Tools Selection Guide

BROTECH КОМПЛЕКСНЫЕ РЕШЕНИЯ МЕТАЛЛООБРАБОТКИ

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BROTECH

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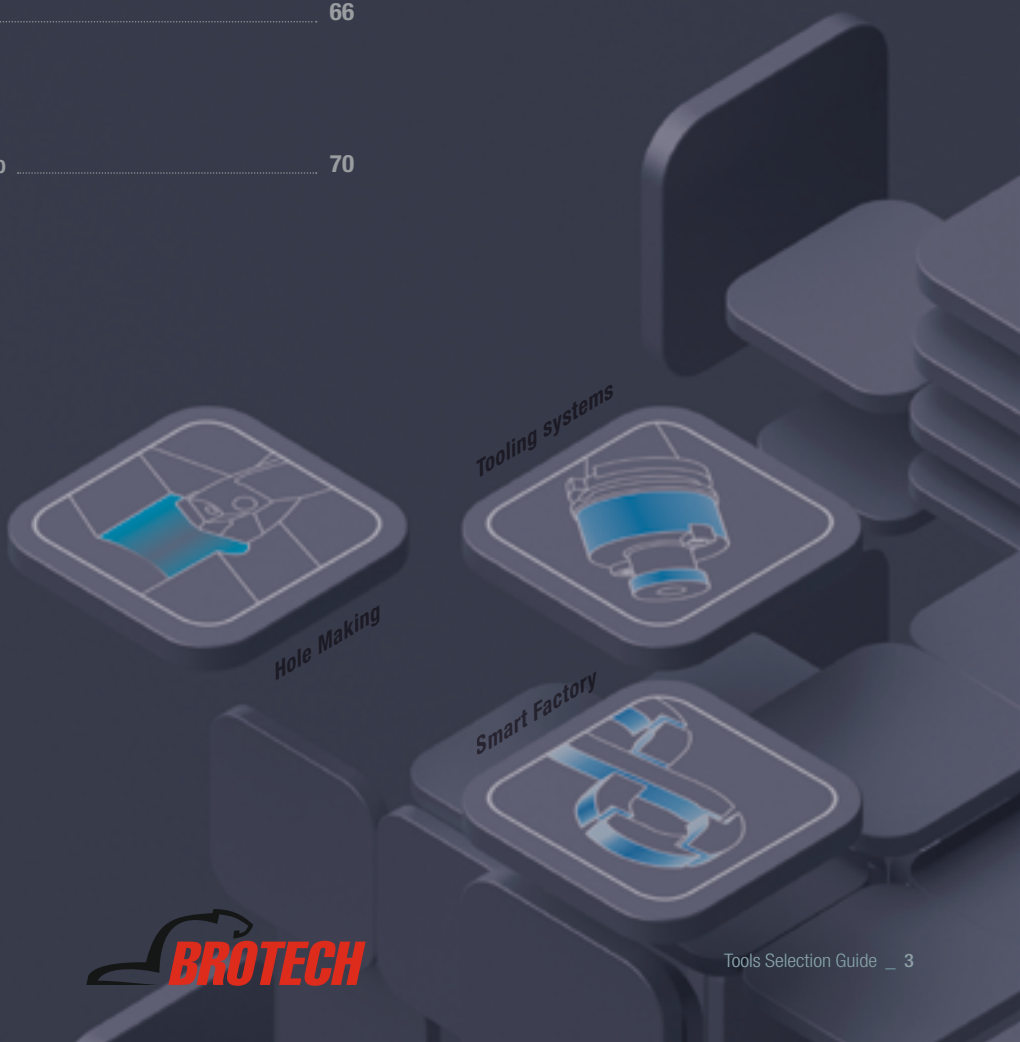
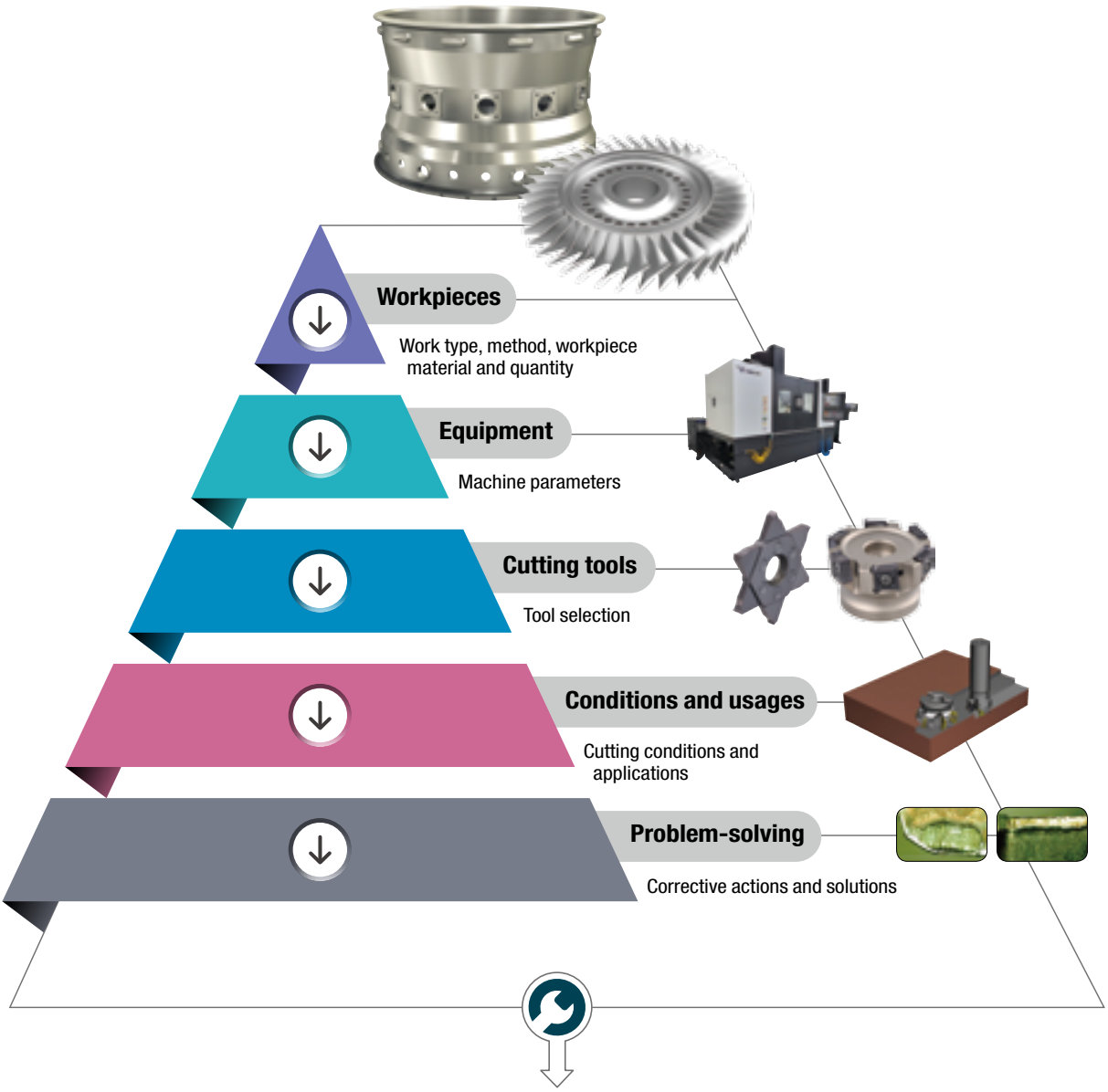


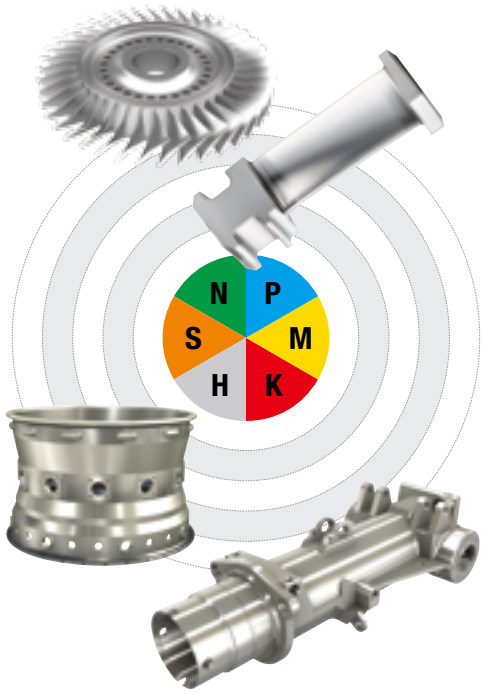
☑ Pre-Checklist for tool selection

Machining operation analysis sequence



- To analyze machining operation, follow the steps above.
- From Cutting tools to Problem-solving, refer to the respective chapters for each tool category.
- For inspection criteria regarding workpieces and equipment, please refer to the detailed documentation on the following page.
- If you have any inquiries or questions, please contact the designated sales office listed on the last page for a detail explanation.

Workpieces



Workpiece materials

Section		Recommendations or Suggestions
Production method	Castings	Select casting-specific material
	Forgings	Select high hardness grade
Chip shape	Sheared chip	Select productivity-enhancing tool (Maximum no. of tooth)
	Built-up chip	Select tool with maximum chip pocket capacity and surface treatment
Hardness	High hardness chip	Select High Grade + Sharp C/B
	Low hardness chip	Select Low Grade + Sharp C/B
Material	Steel	Select Medium C/B + steel specific grade
	STS, HRSA	Select Light C/B + hard-to-cut material specific grade

Workpiece shapes

Section		Recommendations or Suggestions
Surface	Curved surface	Tools for profiling + Tool interference check
	Flat surface	Tools for facing + maximum machining dia. check
Hole	Shallow hole	Select tools with low overhang
	Deep hole	Select tools for deep hole cutting
Side wall	Thin side wall	Select tools with high fastening stability
	Normal side wall	Select general tools for shouldering
Slotting		Select tools suitable for slot shape and size

Workpiece tolerance

Section		Recommendations or Suggestions
Dimensional accuracy	Roughing	Apply cost-effective tools + coating material
	Finishing	Consider applying precision-grade tools + non-coated materials
Surface finish		Consider applying wipers + non-coated materials

Equipment

Equipment

Section		Recommendations or Suggestions
Equipment power	Low horsepower	Select low cutting resistant tools
	High horsepower	Select high-productivity tools
Equipment stability (Model year, condition)	Good	Consider using custom made tools
	Aged	Consider using ISO Tools
Number of axis	General facilities	Consider using ISO Tools
	Multiaxial equipment	Use tools with higher clamping stability
Clamping workpiece	Wrong clamping	Reassess equipment clamping status

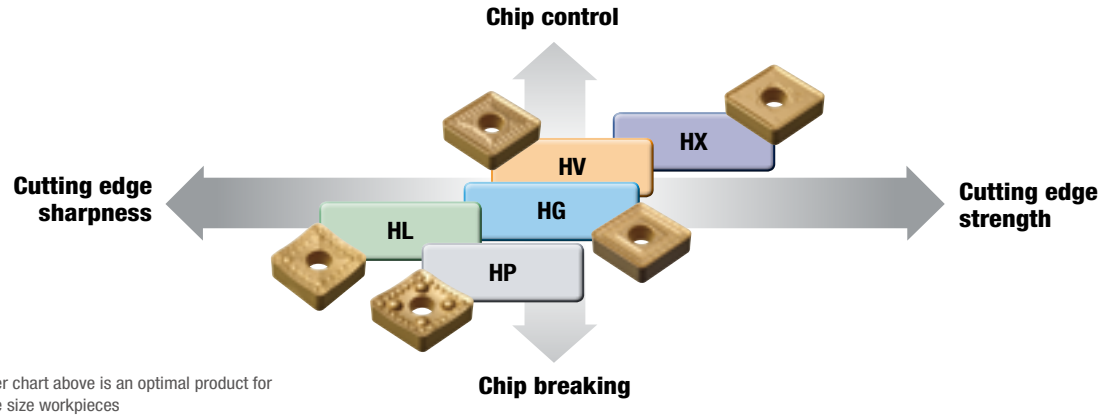
Tooling System

Section		Recommendations or Suggestions
Overhang	Short	Use general tools
	Long	Select low cutting edge angle and Anti-vibration tools
Arbor size	Small (BT30)	Apply compact tools with fewer teeth
	Large (BT50)	Select high-productivity tools, application of multiple teeth
Run-out	Defect	Check spindle condition and reviewing equipment overhaul

Turning

01) Line-up

Heavy inserts (For large size workpieces in wind power, ships, railways, etc. industries)



※ The chip breaker chart above is an optimal product for machining large size workpieces

※ Representative insert: CNMM250924

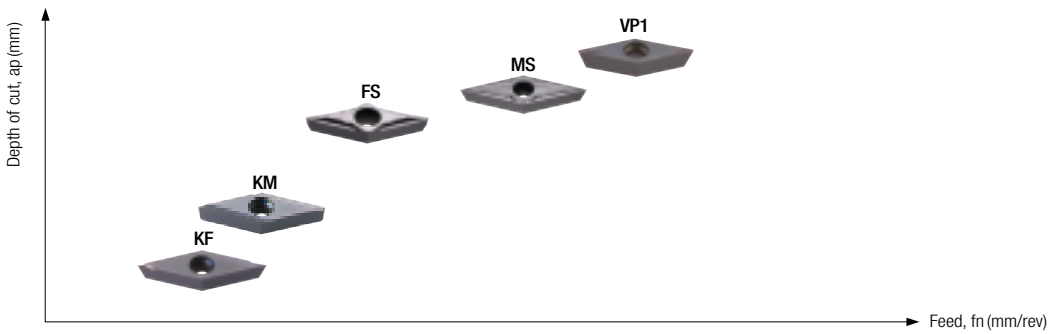
ISO insert (Automobiles, general machinery parts, etc.)

Workpiece	Single- sided insert (Positive)				Double- sided insert (Negative)				
	Finishing	Medium to finishing	Medium cutting	Roughing	Ultra finishing	Finishing	Medium to finishing	Medium cutting	Roughing
P Coating	FP	VL	MP	C25	FP	VL	LP	MP	GR
P Cermet	FP	VL	MP	C25		VL	VB	VQ	GM
M	FP	VL	MP	C25		FM	VP2	MM	RM
K		VL	MP	C25		MP	B25	MK	RK
S	LU	MU	MP			VP1	VP2	VP3	VP4
N	AK		AM	AR				HA	

※ The table represents chip breakers for different workpiece material types, and the chip breaker selection based on chip control or toughness issues, detail information can be found on the back page

※ Representative insert: CNMG120408

Small precision machining inserts Auto Tools (Electronics, electricity, medical components, etc.)



※ The chip breaker table above is Auto Tools products which is for small precision component machining.

Cermet | Coated Cermet | CVD | PVD | 1st Recommended

02) Grade selection guide

Steel Turning

Workpiece	ISO / vc (m/min)	Grade - Recommended cutting speed(m/min)							
		Wear resistance ← • → Toughness							
		P05	P15	P20	P25	P30	P35	P40	P45
P	400	NC3205 (230~480)							
	350		NC3215 (170~420)						
	300			NC5320 (150~370)					
	250				NC3225 (150~370)				
	200					NC3030 (110~260)	NC3235 (100~280)		
	150						PC5300 (100~250)		
	100							PC5400 (80~160)	
	Application	Chip breaker (Recommended cutting conditions)							
		Chip control ← • → Strength of cutting-edges							
	Negative – Roughing							HR (0.3~0.65)	GR (0.3~0.7)
	Negative – Medium cutting					VM (0.2~0.4)	MP (0.2~0.45)	HM (0.25~0.5)	
	Negative – Medium to finish cutting			VC (0.10~0.32)	LP (0.12~0.35)	CP (0.12~0.38)			
	Negative – Finishing		VB (0.1~0.28)	VF (0.1~0.3)					
	Negative – Ultra finishing	FP (0.05~0.25)	VL (0.08~0.27)						
	Negative – wiper						VW (0.15~0.50)	LW (0.25~0.70)	
	Positive – Roughing						C25 (0.10~0.30)		
	Positive – Medium cutting				HMP (0.07~0.23)	MP (0.08~0.25)			
	Positive – Finishing	FP (0.02~0.10)	VL (0.05~0.12)	VF (0.06~0.16)					

※ The recommended cutting speed above is based on SM45C carbon steel.
※ Recommended cutting conditions may vary depending on the workpiece materials

Steel Turning (Heavy)

* Inscribed circle, 19 or greater

Workpiece	ISO / vc (m/min)	Grade - Recommended cutting speed(m/min)					
		Wear resistance ← • → Toughness					
		P05	P15	P20	P25	P35	P40
P	130	NC3205 (115~150)					
	120		NC515H (110~135)				
	110			NC520H (100~125)			
	100				NC525H (90~115)		
	80					NC3235 (70~105)	
	40						NCM535 (60~95)
	Application	Chip breaker (Recommended cutting conditions)					
		Chip control ← • → Strength of cutting-edges					
	Negative – Roughing						HX (0.6~1.5)
	Negative – Medium cutting				HG (0.4~1.2)	HV (0.5~1.4)	
	Negative – Medium to finish cutting		HP (0.4~1.0)	HL (0.4~1.1)			
	Negative – Finishing	HD (0.35~0.8)					

Workpiece	Workpiece materials	ISO (DIN)	AISI (ASTM)	Cutting conditions (Cutting speed for each material was adjusted based on the reference values set at 100%)		
				Cutting speed (m/min)	Feed	Depth of cut
Carbon steel	C=0.10~0.25%	C22	1020	105%	100% (Standard)	100% (Standard)
	C=0.25~0.55%	C45	1045	100% (Standard)		
	C=0.55~0.80%	C55	1055	90%		
Alloy steel	Unhardened	42CrMo4	4140(H)	86%	90%	
	Hardened	42CrMo4	4140(H)	78%		
	High Manganese (12~14% Mn)	22Mn6	(A128, B-2)	65%		

※ The first and second recommended classifications are divided into NC3200 grade for smaller than ISO19, and heavy grade for ISO19 and above.
※ The first and second recommendations are connected via QR codes, providing detailed information on chip breaker lineups.
※ The lineup of recommended grades provides cutting speed information, while the chip breaker lineup provides recommended feed rates and entry conditions.

Cermet | Coated Cermet | CVD | PVD | 1st Recommended

02) Grade selection guide

Steel Turning (Cermet)

Workpiece	ISO / vc (m/min)		Grade - Recommended cutting speed(m/min)					
			Wear resistance ← • → Toughness					
			P05	P10	P15	P20	P25	P30
P	300			CC1015 (200~400)				
	270				CC1025 (180~350)			
	250				CN1500 (150~250)			
	220						CN2500 (130~300)	
	Application		Chip breaker (Recommended cutting conditions)					
			Chip control ← • → Strength of cutting-edges					
	Negative	Roughing						GM (0.3~0.65)
		Medium cutting			VQ (0.2~0.4)	VM (0.2~0.45)	HM (0.25~0.5)	
		Medium to finish cutting		VB (0.12~0.35)	CP (0.12~0.38)			
		Finishing		VL (0.08~0.27)				
		Ultra finishing	FP (0.05~0.25)					
	Positive	Roughing						C25 (0.10~0.30)
		Medium cutting				HMP (0.07~0.23)	MP (0.08~0.25)	
		Finishing	FP (0.02~0.10)	VL (0.05~0.12)	VF (0.06~0.16)			

※ The recommended cutting speed above is based on SM45C carbon steel.
※ Recommended cutting conditions may vary depending on the workpiece materials

Workpiece	Workpiece materials	ISO (DIN)	AISI (ASTM)	Cutting conditions (Cutting speed for each material was adjusted based on the reference values set at 100%)		
				Cutting speed (m/min)	Feed	Depth of cut
Carbon steel	C=0.10~0.25%	C22	1020	105%	100% (Standard)	100% (Standard)
	C=0.25~0.55%	C45	1045	100% (Standard)		
	C=0.55~0.80%	C55	1055	90%		
Alloy steel	Unhardened	42CrMo4	4140(H)	86%	90%	
	Hardened	42CrMo4	4140(H)	78%		
Sintered ferrous alloy	Fe - Cu - C (C=0.2~1.0%)	[JIS, SMF4030]	-	70%	70%	

Cermet | Coated Cermet | CVD | PVD | 1st Recommended

02) Grade selection guide

Stainless steel Turning

Workpiece	ISO	Grade - Recommended cutting speed(m/min)							
		Wear resistance ← • → Toughness							
	vc (m/min)	M05	M10	M15	M20	M25	M30	M35	M40
M	250			NC9115 (220~260)					
	200		PC8105 (115~235)			NC9125 (190~230)		NC3235 (180~220)	
	150			PC8110 (105~225)	PC8115 (100~215)	PC5300 (90~190)		NC9135 (160~200)	
	125						PC9035 (75~175) PC9030 (80~180)		
	100							PC5400 (60~160)	
	Application	Chip breaker (Recommended cutting conditions)							
		Chip control ← • → Strength of cutting-edges							
	Negative – Roughing						RM (0.25~0.55)		
	Negative – Medium cutting			MP (0.2~0.45)	MM (0.2~0.50)				
	Negative – Medium to finish cutting		VP2 (0.1~0.4)						
	Negative – Finishing	FM (0.1~0.3)							
	Positive – Roughing						C25 (0.10~0.30)		
	Positive – Medium cutting			HMP (0.07~0.23)	MP (0.08~0.25)				
	Positive – Finishing	FP (0.02~0.10)	VL (0.05~0.12)						

※ Recommended cutting speed above is for austenitic stainless steel STS304

※ Recommended cutting conditions may vary depending on the workpiece materials

Cast iron Turning

Workpiece	ISO	Grade - Recommended cutting speed(m/min)					
		Wear resistance ← • → Toughness					
	vc (m/min)	K05	K10	K15	K20	K25	K30
K	500	NC6310 (300~500)					
	400			NC6315 (200~400)			
	300				NC5320 (150~330)		
	200					NC5330 (110~270)	
	150			PC8110 (95~180)		PC5300 (75~140)	
	100						PC5400 (65~120)
	Application	Chip breaker (Recommended cutting conditions)					
		Chip control ← • → Strength of cutting-edges					
	Negative – Roughing				VR (0.25~0.65)	RK (0.25~0.7)	MA (0.3~0.7)
	Negative – Medium cutting		MK (0.2~0.5)	B25 (0.25~0.55)			
	Negative – Medium to finish cutting	MP (0.1~0.45)					
	Positive – Roughing				C25 (0.10~0.30)		
	Positive – Medium to finish cutting		MP (0.08~0.25)				

※ Recommended cutting speed above is for austenitic stainless steel STS304

※ Recommended cutting conditions may vary depending on the workpiece materials

Workpiece	ISO (DIN)	AISI (ASTM)	Cutting conditions (Cutting speed for each material was adjusted based on the reference values set at 100%)		
			Cutting speed (m/min)	Feed	Depth of cut
Austenitic	(X5CrNi 18-10)	304	100% (Standard)	100% (Standard)	100% (Standard)
	(X5CrNiMo17-12-2)	316	100%		
Ferritic, martensitic	-	-	110%	90%	
	(X12Cr13)	410	105%		
	(X6Cr17)	430	100%		
Precipitation series	(X5CrNiCuNb 16-4)	S17400	70%	80%	
Duplex	(X2CrNiMoN22-5-3)	S31803	45%	70%	

※ For large cutting materials (ø300 and above), CVD grades are recommended, while for small cutting materials (ø150 and below), PVD grades are recommended.

Workpiece	ISO (DIN)	AISI (ASTM)	Cutting conditions (Cutting speed for each material was adjusted based on the reference values set at 100%)		
			Cutting speed (m/min)	Feed	Depth of cut
Gray cast iron	250	(A48,class35)	100% (Standard)	100% (Standard)	100% (Standard)
	350	(A48,class50)	95%		
Ductile iron	400-18	(60-40-18)	94%	90%	
	500-7	(65-45-12)	90%		
	600-3	(80-55-06)	85%		
	700-2	(100-70-03)	82%		

※ The recommended cutting speed above is based on GC250 gray cast iron.

※ Recommended cutting conditions may vary depending on the workpiece materials

Cemented carbide | Diamond coating | Cermet | Coated Cermet | CVD | PVD | DLC coating | 1st Recommended

02) Grade selection guide

Heat resisting alloy Turning

Workpiece	ISO / vc (m/min)	Application		Grade - Recommended cutting speed(m/min)						
				Wear resistance ← • → Toughness						
				S05	S10	S15	S20	S25	S30	S35
S	60			PC8105 (40~80)						
	55				PC8110 (35~75)					
	50					PC8115 (30~70)				
	45						PC5300 (30~60)			
	40					NC9125 (20~60)		PC9035 (25~55)	NC9135 (20~60)	
	35								PC5400 (25~50)	
		Chip breaker (Recommended cutting conditions)								
		Chip control ← • → Strength of cutting-edges								
		Negative	Roughing					VP4 (0.15~0.45)		
			Medium cutting				VP3 (0.12~0.42)			
			Medium to finish cutting			VP2 (0.1~0.4)				
			Finishing	VP1 (0.07~0.2)	FM (0.1~0.3)					
		Positive	Medium cutting				MU (0.07~0.23)	MP (0.08~0.25)		
			Medium to finish cutting	LU (0.03~0.08)	VP1 (0.04~0.10)	VL (0.05~0.12)				

Aluminium Turning

Workpiece	ISO / vc (m/min)	Application		Grade - Recommended cutting speed(m/min)				
				Wear resistance ← • → Toughness				
				N05	N10	N15	N20	N25
N	1200			ND3000/ ND2100 (160~1200)				
	800				PD1005 (160~800)			
	600					PD1010 (160~450)		
	300						H01 (160~300)	
	200							H05 (60~220)
		Chip breaker (Recommended cutting conditions)						
		Chip control ← • → Strength of cutting-edges						
		Negative	Medium cutting			HA (0.1~0.5)		
		Positive	Roughing			AR (0.05~0.5)		
			Medium cutting		AM (0.04~0.45)			
			Finishing	AK (0.03~0.4)				

Workpiece	ISO (DIN)	AISI (ASTM)	Cutting conditions (Cutting speed for each material was adjusted based on the reference values set at 100%)		
			Cutting speed (m/min)	Feed	Depth of cut
Ti alloy	Ti-6Al-4V	Ti-6Al-4V	110%	110%	100% (Standard)
Ni series	(NiCr22Mo9Nb)	(B443)	100% (Standard)	100% (Standard)	
	(NiCr19Fe19Nb5Mo3)	(B637)			
Co series	Stellite	Stellite	85%	90%	
Fe series	-	Inconel909			

※ The recommended cutting speed above is based on Inconel 718, a nickel-based alloy.
※ Recommended cutting conditions may vary depending on the workpiece materials

Workpiece	ISO (DIN)	AISI (ASTM)	Cutting conditions (Cutting speed for each material was adjusted based on the reference values set at 100%)		
			Cutting speed (m/min)	Feed	Depth of cut
Graphite	Graphite	-	110%	100% (Standard)	100% (Standard)
Al alloy	G9GK0-ALLi7Mg (GD-AlSi10Mg) (GD-AlSi9Cu3)	-	100% (Standard)	90%	
Composite materials	CFRP	-	90%		

※ The recommended cutting speed above is based on A6061S Al forged alloy.
※ Recommended cutting conditions may vary depending on the workpiece materials

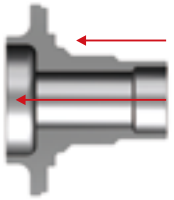
03) Useful cutting tip

Section	Contents

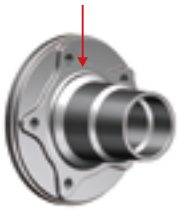
Hub
Continuous cutting/
interrupted cutting

1st recommendation
: NC5320

INFO



Internal/ External cutting, etc.
(Continuous cutting)
: NC3215



External fins
(Low interrupted cutting)
: NC5320

(Heavy interrupted cutting)
: NC3225

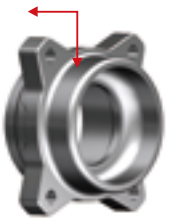
Wear resistance

1st recommendation

Toughness

Difference in tool life based on the presence or absence of cutting fluid

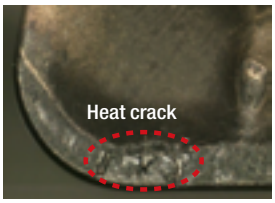
Recommendation for dry machining at high interrupted cutting

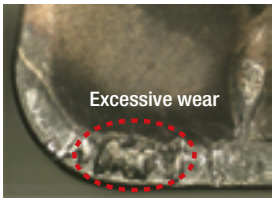


Interrupted and wet cutting

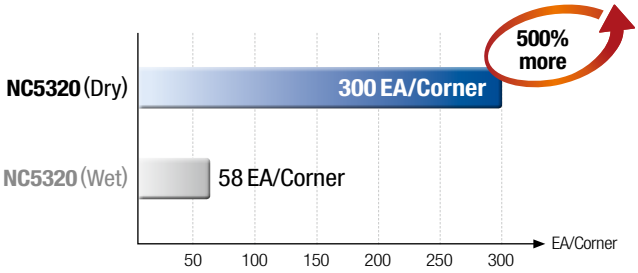
Rapid heating and rapid cooling cycles on cutting tools

Excessive wear by heat impact

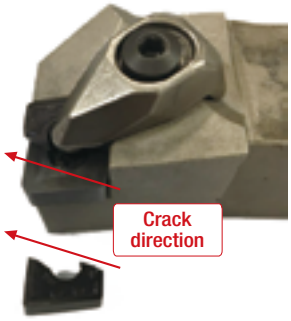
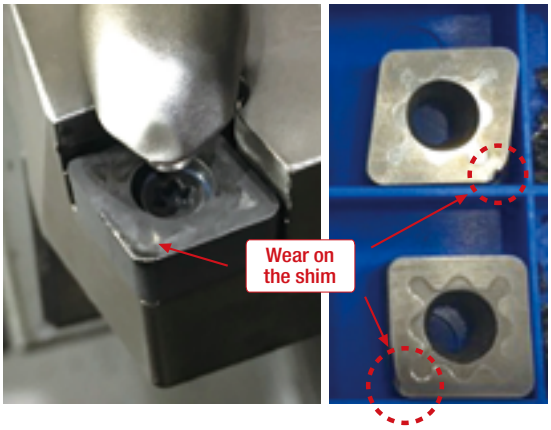
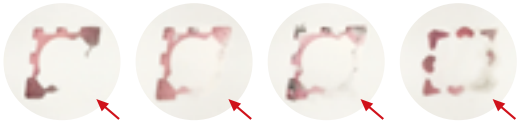
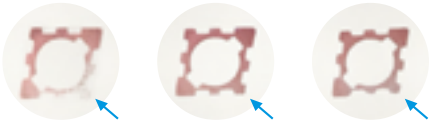
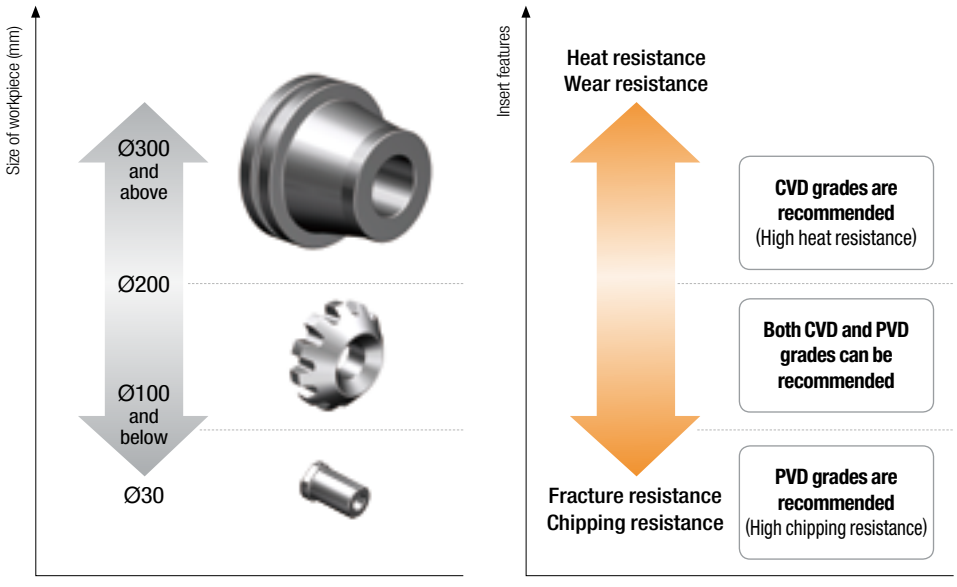




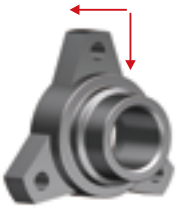
Workpiece use	Hub bearing
Workpiece	S55CR
Cutting conditions	vc (m/min) = 250~270 fn (mm/rev) = 0.2~0.35 ap (mm) = 1



03) Useful cutting tip

Section	Contents
Insert fracture/ defect issues during heavy interrupted machining Holder shim replacement	**1) Sudden insert fracture**  **2) Cause of fracture** (excessive wear on shim)  **3) Analysis of fracture causes** (clamping force) **Contact area comparison between worn shim and normal shim** **Worn shim - Unstable clamping**  - Not able to clamp 100% - Occurrence of unstable fastening **Normal shim - Stable clamping**  - Ensures contact area and improving fastening stability after shim replacement - More than 95% fully secure fastening state
In stainless steel cutting, the application areas of CVD and PVD coatings For large workpieces (Ø300 and above) : CVD coating is preferred. For small workpieces (Ø100 and below) : PVD coating is preferred.	

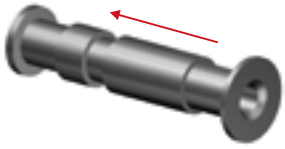
03) Useful cutting tip - Cermet

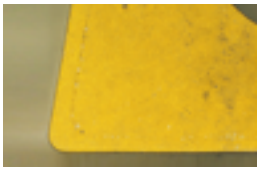
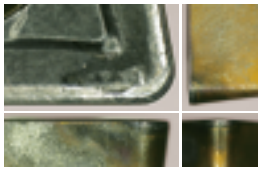
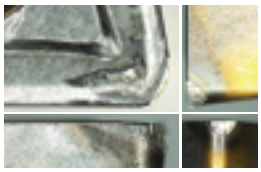
Section	Contents
Automotive and machinery components (carbon steel and alloy steel - continuous machining on external and internal diameter) 1st recommendation For continuous cutting : CC1015 1st recommendation For interrupted cutting : CN2500	 External diameter (Continuous cutting) : CC1015 External diameter (Continuous cutting) : CN1500  Slotting / External diameter (Interrupted cutting) : CC1025 / CN2500 Wear resistance 1st recommendation Toughness
Automotive components (sintered alloy-interrupted cutting) 1st recommendation : CC1015 CN1500 2nd recommendation : CC1025 CN2500 INFO	 Facing / External diameter (Continuous cutting) : CC1015 / CN1500 Facing / External diameter (Interrupted cutting) : CC1025 / CN2500 1st recommendation Toughness

Section	TPMT110304	SCMT09T308	SNMG120408	VNMG160408
Cutting speed vc (m/min)	250	200	100 ~ 150	150 ~ 180
RPM n (rpm)	1,650 ~ 2,500	1,650 ~ 2,500	1,650 ~ 2,500	1,650 ~ 2,500
Feed fn (mm/rev)	0.08 ~ 0.12	0.08 ~ 0.12	0.2 ~ 0.25	0.12 ~ 0.3
Depth of cut ap (mm)	0.2	0.4	0.5 ~ 2.0	0.2 ~ 0.4
Diameter and length of workpiece	Smaller than 100mm	Smaller than 100mm	Smaller than 100mm	Smaller than 100mm
Coolant	Wet	Wet	Wet	Wet

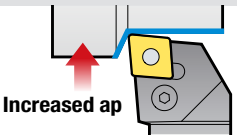
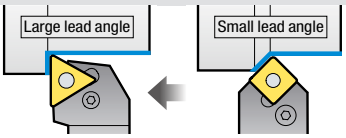
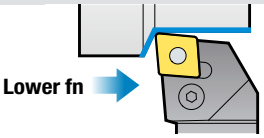
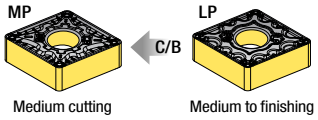
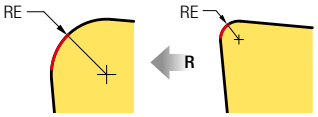
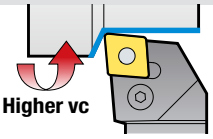
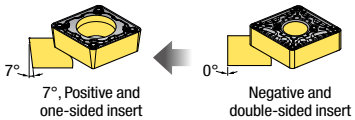
- Representative inserts used in sintered alloy components
  - TPMT110304-MP - SCMT09T308-HMP - TCMT110204-B25
  - SNMG120408-VQ - VNMG160408-VF - VBMT160404-MP
- To minimize the variation in tool life when machining sintered alloy components, the primary recommendation is to use medium-rough to medium chip breakers.

03) Useful cutting tip - Heavy cutting

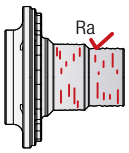
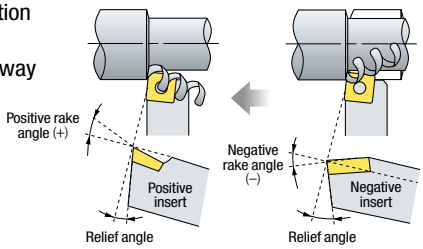
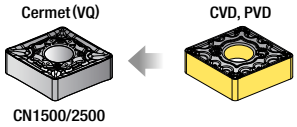
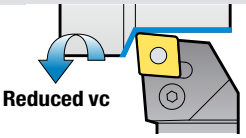
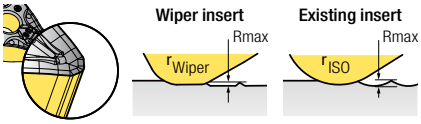
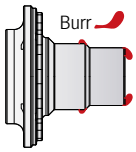
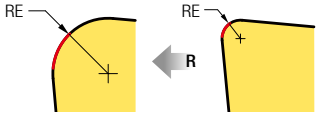
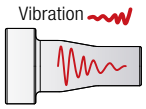
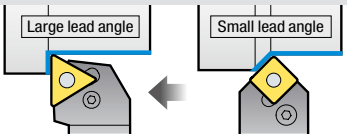
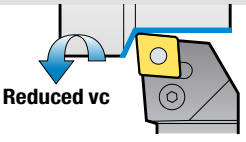
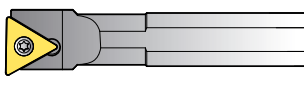
Section	Contents
1st recommended chip breaker for heavy cutting 1st recommended chip breaker for vertical machining : **HV** 1st recommended chip breaker for horizontal machining : **HG**	**1) In vertical cutting of a flange**  Facing/external diameter cutting (vertical direction of holders) : 1st recommended **HV** **2) In horizontal cutting of a shaft**  External diameter cutting (horizontal direction of holders) : 1st recommended **HG** **[Chip breaker features]** Rigidity of cutting edge Wear resistance
Cases of insert damage caused by screw issues and solutions Recommended to use genuine screws and holders	• Checking the screw head protrusion → Suspecting the insert attachment condition → Verifying the screw size   Damaged holder  Genuine screw  Fracture or counterfeit screw

Section	Contents	
Undamaged holder + genuine screw	 Stable clamping	 Normal wear
Damaged holder + counterfeit screw	 Wear phenomenon (vibrations)	 Abnormal wear/ fracture

04 Troubles in cutting and solutions

Troubles	Factors	Solutions
Chip jamming Chips do not break, so the long chip tangled around the tools or a workpiece 	→ Selected a wrong chip breaker for the application area	→ Select an appropriate chip breaker matches the cutting conditions that Refer to the tool selection guide p. 7
	→ Too low feed	→ Increased feed 
	→ Low depth of cut	→ Increased depth of cut 
	→ Too large nose radius	→ Select smaller nose radius 
	→ Improper lead angle	→ Select a holder with large lead angle or shape 
Excessive chip fragmentation The excessive formation of very short chips due to high cutting forces, leading to shortened tool life and tool damage 	→ Too high feed	→ Decreased feed 
		→ Select a chip breaker designed for higher feed 
	→ Too small nose radius	→ Select larger nose radius 
Built-up-edge/ welding The simultaneous occurrence of burrs and chipping, causing accumulated burrs to detach along with the insert material, resulting in damage 	→ Low speed	→ Optimize the cutting speed 
	→ Low feed	→ Optimize the feed 
	→ Negative insert shape	→ Select a positive shape 

04) Troubles in cutting and solutions

Troubles	Factors	Solutions
Surface roughness defect Rough surface finish and fail to meet the tolerance requirements 	→ Leaving marks on the surface as chips break towards the workpiece	→ Choose a chip evacuation configuration that discharges chips far away 
	→ Rough surface due to notch wear	→ Select a cermet grade 
		→ Reduce cutting speed 
	→ High feed and too small cutting radius	→ Select a wiper insert or larger nose radius → Lower feed 
Burr formation The formation of burrs at the end of cutting when the cutting edge deviates from the workpiece 	→ Dull cutting edge	→ Use a sharp insert 
	→ Notch wear on the part of depth of cut	→ Select larger nose radius 
Vibration Tool scratched the workpiece due to chattering 	→ Improper lead angle	→ Use larger lead angle 
	→ Too large nose radius	→ Select smaller nose radius 
	→ Excessive front wear of the cutting edge	→ Reduce cutting speed or select a better wear resistance grade 
	→ Vibration caused by excessive overhang during steel boring bar usage	→ Use carbide boring bar which has better rigidity than steel boring bar and minimizes vibration during deep machining 

Grooving

01 Line-up

Tool-specific cutting width, depth of cut, and recommended machining by tool

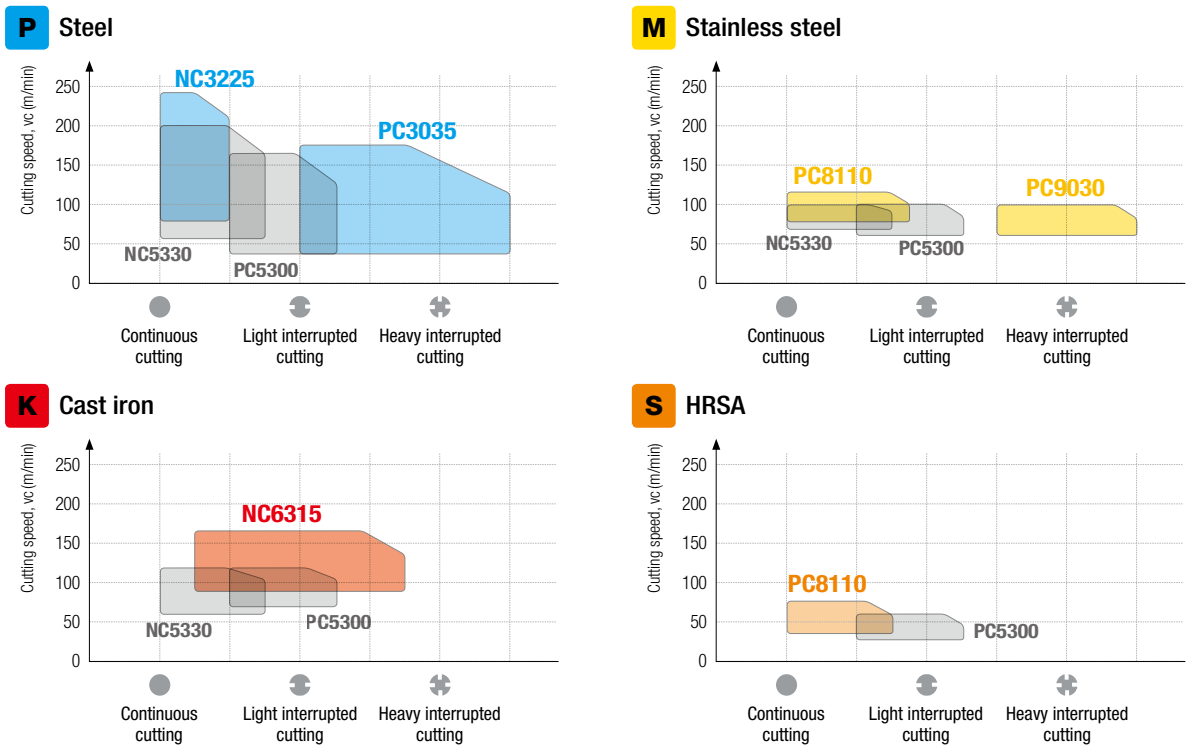
Division	Tools	No. of corners	Recommended cutting conditions															INFO Link
			For external machining							For external machining						Face grooving		
			Grooving	Parting	Turning	Back turning	Copying	Reliefing	Threading	Grooving	Boring	Back Boring	Copying	Reliefing	Threading	Grooving	Turning	
Basic	**Saw Man-X** 	1	○	○														INFO
			• Tool for external diameter cutting, deep hole cutting • For high speed and high feed															
Basic	**Saw Man** 	1	○	○														–
			• Tool for external diameter cutting, deep hole cutting															
Precision (Cutting edge sharpness)	**Fine Tools** 	1								○	○		○		○			–
			• For precision boring of internal diameters up to 16															
Precision (Cutting edge sharpness)	**Auto Tools** (MSB Plus) 	1								○	○				○	○		INFO
			• For premium precision boring of internal diameters up to 10 • Internal coolant, precision clamping															
Precision (Cutting edge sharpness)	**Auto Tools** (MSB) 	1, 2								○	○	○	○		○	○		INFO
			• For precision boring of internal diameters up to 10															
Precision (Cutting edge sharpness)	**K-Notch** 	2	○	○	○		○											INFO
			• For precision external machining															
Basic, Precision (C/B type)	**KGT** 	1, 2	○	○	○		○	○		○	○		○	○		○	○	INFO
			• For multi-functional machining of external, internal, and face															
Basic, Precision (C/B type)	**MGT** 	2	○	○	○		○	○		○	○		○	○		○	○	INFO
			• Multi-functional tool capable of various operations such as external diameter, inner diameter, cross-section, and more															
Basic	**MGT Plus** 	2	○	○	○		○	○		○	○		○	○		○	○	INFO
			• Multi-functional tool capable of various operations such as external diameter, inner diameter, cross-section, and more • Inserts compatible with MGT Holders															
Precision (Cutting edge sharpness)	**Auto Tools** (Blade) 	2	○	○	○	○			○									INFO
			• Tool for external diameter machining on automatic lathes. • Small-sized parting off operations with a diameter of Ø16 or less															
Precision (Cutting edge sharpness)	**Auto Tools** (Multi utility) 	2	○	○	○	○			○									INFO
			• Tool for external diameter machining on automatic lathes • Capable to apply various inserts for multiple purposes onto a single holder															
Precision (Cutting edge sharpness, C/B type)	**TB** 	3	○	○	○		○											INFO
			• Cutting tool for external diameter • 3 corner grooving															
Precision (Cutting edge sharpness, C/B type)	**Hexa Blade** 	6	○	○	○													INFO
			• Tool for external diameter machining • Economical 6-corner groove machining															

02) Grade selection guide

Features

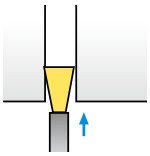
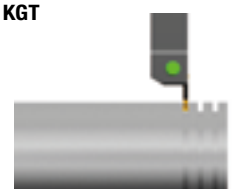
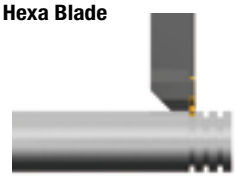
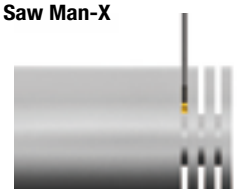
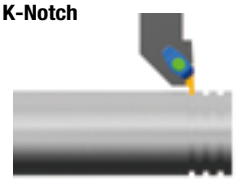
Grade		Recommended workpiece	ISO Grade: Wear resistance ← → Toughness (5 10 15 20 25 30 35 40 45)	Features
CVD	NC3225	P	P20~25	• Steel, mild steel general purpose grade
	NC5330	P	P30~35	• Universal grade • Stable in high speed machining
		M	M25~35	
		K	K15~25	
		S	S15~25	
	NC6315	K	K10~20	• Gray cast iron general purpose machining
PVD	PC3035	P	P30~40	• Exclusive for steel grooving and parting
	PC5300	P	P30~40	• Universal grade • Good wear resistance and interrupted cutting
		M	M20~30	
		K	K20~25	
		S	S15~25	
	PC8110	M	M10~20	• Machining heat resistant alloy and stainless steel at high speed
		S	S5~15	
	PC9030	M	M25~35	• Medium to roughing for Stainless steel
Carbide	H01	N	N10~20	• Non-ferrous metal

Application range

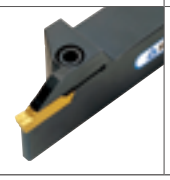


03) Tool selection guide

External Grooving and Turning

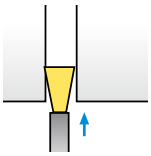
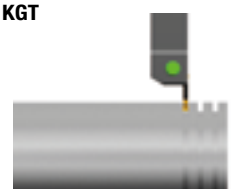
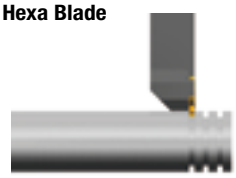
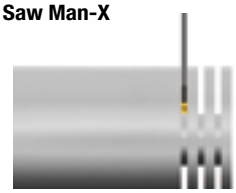
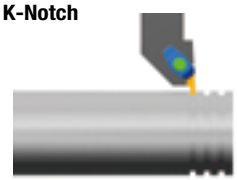
Usage	Processing type and Recommended tool			
	General external diameter grooving (CDX 36 mm and below)	Shallow external diameter grooving (CDX 4 mm and below)	Deep external diameter grooving (CDX 36 mm over)	Precision external diameter grooving (CWTOL: ±0.025)
	KGT 	Hexa Blade 	Saw Man-X 	K-Notch 

*CWTOL : Cutting width tolerance

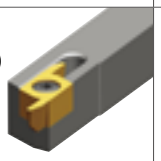
Tools	No. of corners	shank size (mm)	Width of cutting edge (CW, mm) 2 4 6 8 / Max. Depth of cut (CDX, mm) 5 10 20 60	Recommended inserts by workpiece material P	M	K	S	N
Saw Man-X KSPH 	1	16 20 25	2 – 6 38	KSP-N PC3035 	KSP-S PC8110 	KSP-N PC5300 	KSP-S PC8110 	-
Saw Man-X KSEHR 	1	20 25	2 – 6 25	KSP-N PC3035 	KSP-S PC8110 	KSP-N PC5300 	KSP-S PC8110 	-
Saw Man SPH SPH-S 	1	16 20 25	3 – 5 35	SP PC5300 	SP PC5300 	SP PC5300 	-	SP A30 
K-Notch KNSR 	2	10 12 16, 20 25, 32	0.79 – 6.35 6.35	KNG PC5300 	KNGP PC8110 	KNG PC5300 	KNGP PC8110 	-
KGT KGEHR 	1, 2	12 16 20 25,32	1.5 – 8 36	KGMN-T PC5300 	KGMN-TL PC5300 	KGMN-R PC5300 	KGMN-TL SPC810 	KGGN-A H01 
MGT MGEHR 	2	16 20 25 32	1.5 – 8 32	MGMN-M PC5300 	MGMN-L PC5300 	MGMN-M PC5300 	-	MGGN-A H01 
MGT Plus MGEHR 	2	16 20 25 32	1.5 – 8 32	PGMN-MM PC3035 	PGMN-MM PC9030 	PGMN-MM PC5300 	-	-

03 Tool selection guide

External Grooving and Turning

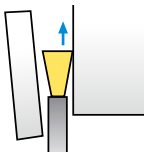
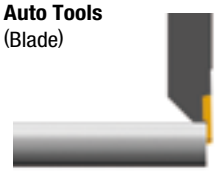
Usage	Processing type and Recommended tool			
	General external diameter grooving (CDX 36 mm and below)	Shallow external diameter grooving (CDX 4 mm and below)	Deep external diameter grooving (CDX 36 mm over)	Precision external diameter grooving (CWTOL: ±0.025)
	KGT 	Hexa Blade 	Saw Man-X 	K-Notch 

*CWTOL : Cutting width tolerance

Tools	No. of corners	shank size (mm)	Width of cutting edge (CW, mm) 2 4 6 8 / Max. Depth of cut (CDX, mm) 5 10 20 60	Recommended inserts by workpiece material				
				P	M	K	S	N
Auto Tools (Blade) **SBHR** 	2	10 12 16	0.5 – 2.5 7.5	SBGR PC5300 	SBGR PC8110 	SBGR PC5300 	SBGR PC8110 	-
Auto Tools (Multi utility) **SXGNR** 	2	10 12 16 20	1 – 3 9	-	SGR PC9030 	-	-	-
TB TBH 3/4 	3	20 25	1.25 – 4.5 5	TB4-M PC5300 	TB3/4 PC5300 	TB4-M PC5300 	-	-
TB TBH 5 	3	10 12 16 20, 25	0.5 – 3.18 6.5	TB5-M PC5300 	TB5-P PC5300 	TB5-M PC5300 	-	-
Hexa Blade HBEHR -27 	6	16 20 25	1.78 – 4 5	HB27-M PC5300 	HB27-M PC5300 	HB27-M PC5300 	-	-
Hexa Blade HBEHR -19 	6	12 16 20	0.5 – 3.18 4	HB19-M PC5300 	B19-M PC8110 	HB19-M PC5300 	HB19-M PC8110 	-

03) Tool selection guide

External Parting

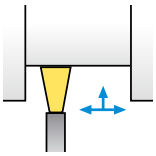
Usage	Processing type and Recommended tool			
	General external diameter parting off (CUTDIA Ø70 and below)	Shallow external diameter parting off (CUTDIA Ø16 and below)	Deep external diameter parting off (CUTDIA Ø70 over Ø120 and below)	Pipe external diameter parting off (CUTDIA Ø120 and below)
	**Saw Man-X** 	**Auto Tools** (Blade) 	**Saw Man-X** 	**Saw Man-X** 

Tools	No. of corners	shank size (mm)	Width of cutting edge (CW, mm) 2 4 6 8 / Max. Depth of cut (CDX, mm) 5 10 20 60	Recommended inserts by workpiece material P	M	K	S	N
Saw Man-X KSPB 	1	26 32	2 6 60	KSP-D-N PC3035 	KSP-D-N PC8110 	KSP-D-N PC5300 	KSP-D-N PC8110 	-
Saw Man SPB SPB-S 	1	26 32 52.6	2 6 60	SP-R/L PC5300 	SP-R/L PC5300 	SP-R/L PC5300 	-	SP-R/L A30 
Auto Tools (KGT) **KGEHR -D00A/B** 	1, 2	10 12 16	2 3 16	KGMR-RP PC5300 	KGMR-LP PC5300 	KGMR-RP PC5300 	KGMN-TL SPC810 	KGGN-A H01 
KGT KGTB 	1, 2	26 32	1.5 8 60	KGMR-RP PC5300 	KGMR-LP PC5300 	KGMR-RP PC5300 	KGMN-TL SPC810 	KGGN-A H01 
Auto Tools (MGT) **MGEHR -X00A** 	2	10 12 16	1.5 2.5 12.5	MGMN-M PC5300 	MGMN-M PC5300 	MGMN-M PC5300 	-	MGGN-A H01 
Auto Tools (MGT Plus) **MGEHR -X00A** 	2	10 12 16	1.5 2.5 12.5	PGMN-MM PC3035 	PGMN-MM PC9030 	PGMN-MM PC5300 	-	-
Auto Tools (Blade) **SBHR** 	2	10 12 16	0.7 2 7.5	SBCR PC5300 	SBCR PC8110 	SBCR PC5300 	SBCR PC8110	-
Auto Tools (Multi utility) **SXGNR**	2	10 12 16 20	1 3 9	-	SCR PC9030	-	-	-
TB TBH 5	3	10 12 16 20, 25	1 2 6.5	TB5-DR PC5300	TB5-DR PC5300	TB5-DR PC5300	-	-

03 Tool selection guide

External Back Turning

Usage	Processing type and Recommended tool
	General external back turning

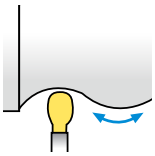
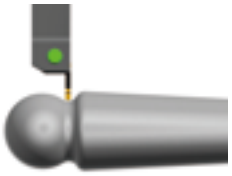


Auto Tools
(Blade)

Tools	No. of corners	shank size (mm)	Max. Depth of cut (APMX, mm) 2 4 6 8 / Major cutting edge angle (KRINS, °) 5 10 20 60	Recommended inserts by workpiece material				
				P	M	K	S	N
Auto Tools (Blade) **SBHR** 	2	10 12 16	4 59	SBBR PC5300 	SBBR PC8110 	SBBR PC5300 	SBBR PC8110 	-
Auto Tools (Multi utility) **SXGNR** 	2	10 12 16 20	5.5 70	-	SBR PC9030 	-	-	-

03) Tool selection guide

External Copying and Relief

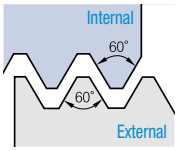
Usage	Processing type and Recommended tool	
	General external diameter machining	General external diameter relief (CDX = 3.3 mm)
	KGT 	KGT 

Tools	No. of corners	shank size (mm)	Width of cutting edge (CW, mm) 2 4 6 8 / Max. Depth of cut (CDX, mm) 5 10 20 60	Recommended inserts by workpiece material				
				P	M	K	S	N
K-Notch KNSR 	2	10 12 16, 20 25, 32	1.57 6.35 6.35	KNR PC5300 	KNRP PC8110 	KNR PC5300 	KNRP PC8110 	-
KGT KGEHR 	2	12 16 20 25 32	2 8 36	KRMN-C PC5300 	KRGN-CM PC5300 	KRMN-C PC5300 	KRGN-CM SPC810 	KRGN-A H01 
KGT KGEUR 	2	16 20 25	3 8 3.3	KRMN-C PC5300 	KRGN-CM PC5300 	KRMN-C PC5300 	KRGN-CM SPC810 	KRGN-A H01 
MGT MGEHR 	2	16 20 25 32	2 8 32	MRMN-M PC5300 	MRMN-M PC5300 	MRMN-M PC5300 	-	MRGN-A H01 
MGT MGEUR 	2	20 25	3 8 5	MRMN-M PC5300 	MRMN-M PC5300 	MRMN-M PC5300 	-	MRGN-A H01 
MGT Plus MGEUR 	2	20 25	3 8 5	PRMN-RM PC3035 	PRMN-RM PC9030 	PRMN-RM PC5300 	-	-
TB TBH 5 	3	16 20 25	1.57 3 6.5	TB5-P PC5300 	TB5-P PC5300 	TB5-P PC5300 	TB5-P PC5300 	-

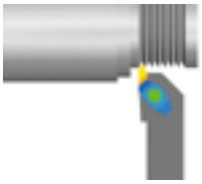
03 Tool selection guide

External Threading

Usage	Processing type and Recommended tool
	General external thread



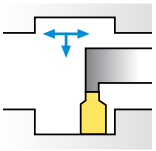
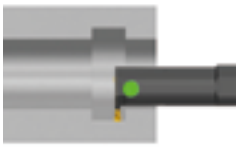
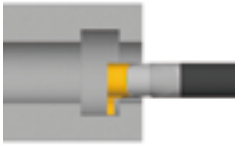
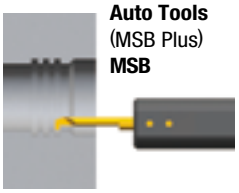
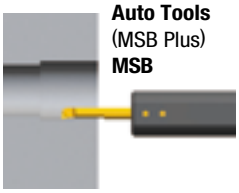
K-Notch



Tools	No. of corners	shank size (mm)	Profile X-direction distance (PDX, mm) 2 4 6 8 / Thread angle (°) 5 10 20 60	Recommended inserts by workpiece material				
				P	M	K	S	N
K-Notch **KNSR** 	2	10 12 16, 20 25, 32	3.25 60	KNT PC5300 	KNT PC8110 	KNT PC5300 	KNT PC8110 	-
Auto Tools (Blade) **SBHR** 	2	10 12 16	1.59 60	SBTR PC5300 	SBTR PC8110 	SBTR PC5300 	SBTR PC8110 	-
Auto Tools (Multi utility) **SXGNR** 	2	10 12 16 20	1.6 60	-	STR PC9030 	-	-	-

03) Tool selection guide

Internal Grooving and Boring

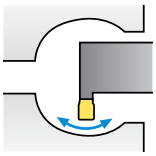
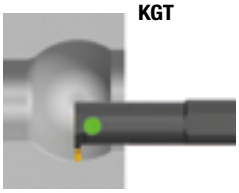
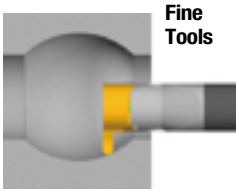
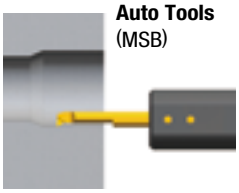
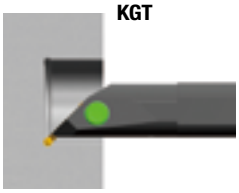
Usage	Processing type and Recommended tool			
	General internal grooving, boring (DMIN Ø20 mm)	Small internal grooving, boring (DMIN Ø8 ~ Ø16 mm)	Micro internal grooving (DMIN Ø3.2 ~ Ø10.2 mm)	Micro internal boring (DMIN Ø3.2~10.2 mm)
	**KGT** 	**Fine Tools** 	**Auto Tools** (MSB Plus) **MSB** 	**Auto Tools** (MSB Plus) **MSB** 

*DMIN : Minimum bore diameter

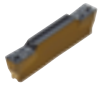
Tools	No. of corners	Min. Cutting dia (Ø)	Width of cutting edge (CW, mm) 2 4 6 8 / Max. Depth of cut (CDX, mm) 5 10 20 60	Recommended inserts by workpiece material P	M	K	S	N
Fine Tools **NFTIH** 	1	8 11 14 16	0.75 4.02 4.6	NFTG PC5300 	NFTG PC5300 	NFTG PC5300 	-	-
Auto Tools (MSB Plus) **MBCR** (Boring) 	1	1.0	0.5	MBCR PC3030T 	MBCR PC3030T 	MBCR PC3030T 	-	-
Auto Tools (MSB Plus) **MGSR** (Grooving) 	1	7.2	0.6 2 2.5	MGSR PC3030T 	MGSR PC3030T 	MGSR PC3030T 	-	-
Auto Tools (MSB) **MGR** (Square) 	1, 2	3.2	1 3 3.5	MGR PC30M 	MGR PC30M 	MGR PC30M 	-	-
Auto Tools (MSB) **MGRR** (Round) 	1, 2	3.2	1 4.5 5	MGRR PC30M 	MGRR PC30M 	MGRR PC30M 	-	-
Auto Tools (MSB) **MBR** (Boring) 	1, 2	3.2	0.8	MBR PC53M 	MBR PC53M 	MBR PC53M 	-	-
Auto Tools (MSB) **MBBR** (Back Boring) 	1, 2	3.2	1.5 2 1.9	MBBR PC53M 	MBBR PC53M 	MBBR PC53M 	-	-
KGT **KGIVR** 	2	20 25 32 40, 45	1.5 8 8.5	KGMI-T PC5300 	KGMI-T PC5300 	KGMI-T PC5300 	-	-
MGT **MGIVR** 	2	20 25 29,31 37,45	1.5 8 10.2	MGMN-M PC5300 	MGMN-M PC5300 	MGMN-M PC5300	-	-
MGT Plus **MGIVR**	2	20 25 29,31 37,45	2 8 10.2	PGMN-MM PC3035	PGMN-MM PC9030	PGMN-MM PC5300	-	-

03 Tool selection guide

Internal Copying and Relief

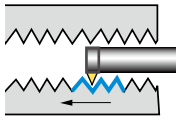
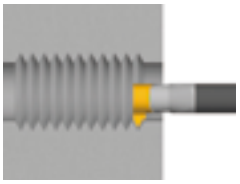
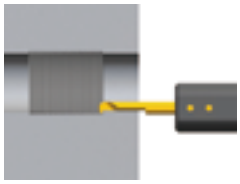
Usage	Processing type and Recommended tool			
	General internal copying (DMIN Ø20mm)	Small internal copying (DMIN Ø8 ~ Ø16mm)	Micro internal copying (DMIN Ø4.2 ~ Ø6.2mm)	General internal relief (DMIN Ø35mm)
	 KGT	 Fine Tools	 Auto Tools (MSB)	 KGT

*DMIN : Minimum bore diameter

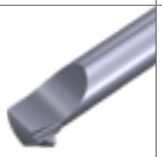
Tools	No. of corners	Min. Cutting dia (Ø)	Width of cutting edge (CW, mm) 2 4 6 8 / Max. Depth of cut (CDX, mm) 5 10 20 60	Recommended inserts by workpiece material				
				P	M	K	S	N
Fine Tools NFTIH 	1	8 11 14 16	0.75 4.02 4.6	NFTF PC5300 	NFTF PC5300 	NFTF PC5300 	-	-
Auto Tools (MSB) MBCR (Copying) 	1, 2	4.2	1 3 3.5	MBCR PC30M 	MBCR PC30M 	MBCR PC30M 	-	-
KGT KGIVR 	2	20 25 32 40, 45	1.5 8 8.5	KRMN-C PC5300 	KRGN-CM PC5300 	KRMN-C PC5300 	KRGN-CM UPC810 	KRGN-A H01 
KGT KGIUR 	2	35 40 50	1.5 8 10.2	KRMN-C PC5300 	KRGN-CM PC5300 	KRMN-C PC5300 	KRGN-CM UPC810 	KRGN-A H01 
MGT MGIVR 	2	20 25 29, 31 37, 45	2 8 10.2	MRMN-M PC5300 	MRMN-M PC5300 	MRMN-M PC5300 	-	MRGN-A H01 
MGT MGIUR 	2	35 40 50	3 8 8	MRMN-M PC5300 	MRMN-M PC5300 	MRMN-M PC5300 	-	MRGN-A H01 
MGT Plus MGIVR 	2	20 25 29, 31 37, 45	2 8 10.2	PRMN-RM PC3035 	MRMN-RM PC9030 	MRMN-RM PC5300 	-	-
MGT Plus MGIUR 	2	35 40 50	3 8 8	PRMN-RM PC3035	MRMN-RM PC9030	MRMN-RM PC5300	-	-

03) Tool selection guide

Internal Threading

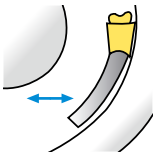
Usage	Processing type and Recommended tool	
	General internal thread (DMIN Ø8 ~ Ø16 mm)	Micro internal thread (DMIN Ø3.3 ~ Ø6.2 mm)
	**Fine Tools** 	**Auto Tools** (MSB) 

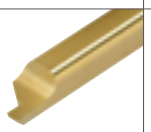
*DMIN : Minimum bore diameter

Tools	No. of corners	Min. Cutting dia (Ø)	Profile X-direction distance (PDX, mm) 1 2 3 4 / Thread angle (°) 5 10 20 60	Recommended inserts by workpiece material				
				P	M	K	S	N
Fine Tools **NFTIH** 	1	8 11 14 16	1.8 60	NFTT PC5300 	NFTT PC5300 	NFTT PC5300 	-	-
Auto Tools (MSB Plus) **MTHR** (Threading) 	1	0.73	0.9 60	MTHR PC3030T 	MTHR PC3030T 	MTHR PC3030T 	-	-
Auto Tools (MSB) **MTR** (Threading) 	1, 2	3.3	1.59 60	MTR PC30M 	MTR PC30M 	MTR PC30M 	-	-

03 Tool selection guide

Face Grooving and Turning

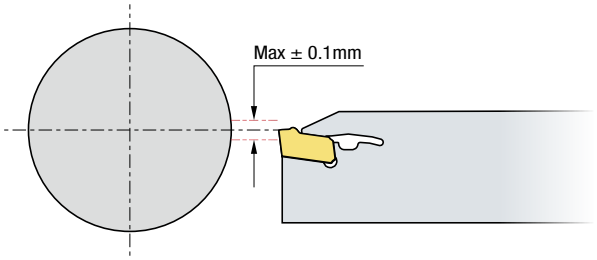
Usage	Processing type and Recommended tool
	General face grooving, turning
	KGT 

Tools	No. of corners	shank size (mm)	Width of cutting edge (CW, mm) 2 4 6 8 / Max. Depth of cut (CDX, mm) 5 10 20 60	Recommended inserts by workpiece material P	M	K	S	N
Auto Tools (MSB Plus) **MFGR** 	1	-	1 3.18 / 6	MFGR PC3030T 	MFGR PC3030T 	MFGR PC3030T 	-	-
Auto Tools (MSB) **MGFR** 	1, 2	-	1 4.5 / 8	MGFR PC30M 	MGFR PC30M 	MGFR PC30M 	-	-
KGT **KGEVR-T00** 	1, 2	16 20 25	1.5 8 / 8	KGMN-T PC5300 	KGMN-TL PC5300 	KGMN-R PC5300 	KGMN-TL SPC810 	KGGN-A H01 
KGT **KGFHR** 	1, 2	25	3 6 / 25	KGMN-T PC5300 	KGMN-TL PC5300 	KGMN-R PC5300 	KGMN-TL SPC810 	KGGN-A H01 
KGT **KGFVR** 	1, 2	20 25	3 6 / 20	KGMN-T PC5300 	KGMN-TL PC5300 	KGMN-R PC5300 	KGMN-TL SPC810 	KGGN-A H01 
MGT **MGFHR** (CW=3) 	2	25	3 / 15	MFMN-M NC5330 	MFMN-M PC5300 	MFMN-M NC5330 	-	-
MGT **MGFHR** (CW=4) 	2	25	4 / 15	MGMN-M PC5300 	MGMN-L PC5300 	MGMN-M PC5300 	-	MGGN-A H01 
MGT **MGFVR** (CW=3) 	2	25	3 / 15	MFMN-M NC5330 	MFMN-M PC5300 	MFMN-M NC5330	-	-
MGT **MGFVR** (CW=4)	2	25	4 / 15	MGMN-M PC5300	MGMN-L PC5300	MGMN-M PC5300	-	MGGN-A H01

04) Useful cutting tip

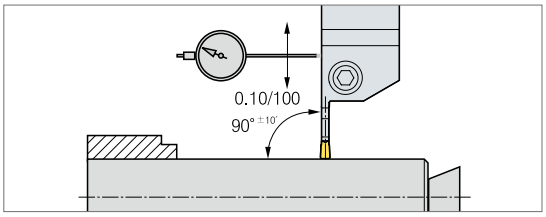
Insert cutting edge height setting

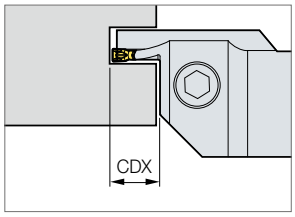
- The insert cutting edge height needs to be set within ±0.1mm from the workpiece center.
- It is recommended to machine as close as possible to the chuck in order to reduce vibration

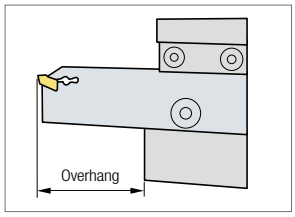


Holder setting method

- To minimize and suppress vibration, the position of the insert's cutting edge should be accurately installed to be parallel or perpendicular to the machining axis.
- The shortest CDX holder should be selected based on the machining depth of the workpiece material being machined.
- Overhang should be set as short as possible for optimal usage.

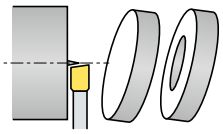




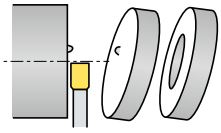


Recommended lead angles for different workpiece types' parting off

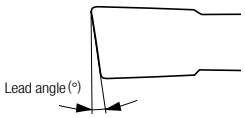
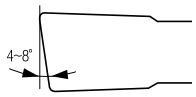
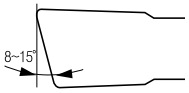
- It is possible to minimize chip (PIP) and burr formation by choosing a proper lead angled insert.
- If there is minimal chip and burr formation, it is recommended to use inserts without a positive lead angle.



Hand-type insert



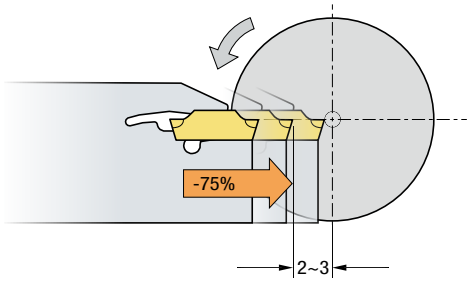
Insert without hand

Applicable workpieces per insert's lead angle	Lead angle 0° (N-type)	Lead angle 4°~ 8°	Lead angle 8°~ 15°
			
• 4° - Hollow (pipe) • 6° - Pipe and solid bar • 8° - Solid bar • 15° - Solid bar with small diameter	• For parting off solid bar shaped workpiece • Center stub can be occurred after parting off • Prevents deflection of the parting off direction during machining • Optimized for deep cutting depth machining	• For parting off solid bar shaped workpiece, reduce center stub • For machining applications with hollow bar inserts to minimize burr formation	• For parting off hollow bars with thin cross-sectional thickness • For parting off small diameter workpieces to minimize burr and center stub

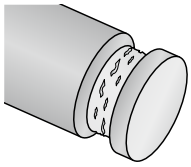
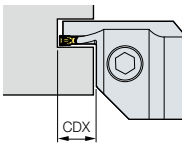
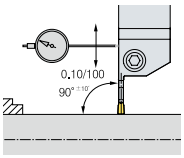
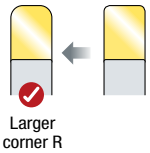
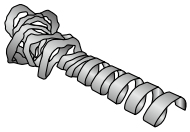
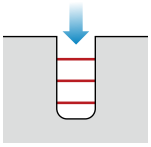
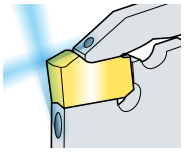
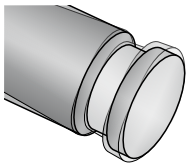
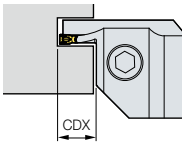
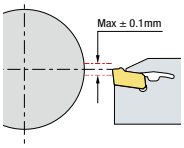
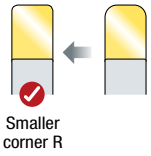
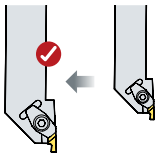
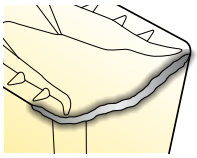
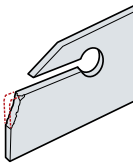
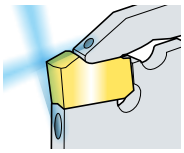
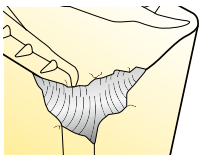
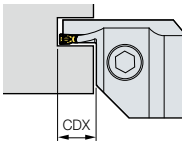
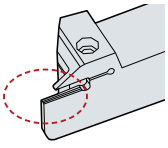
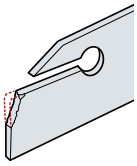
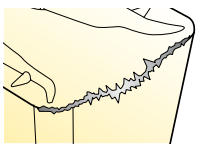
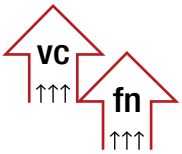
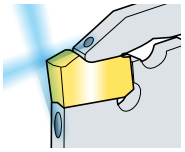
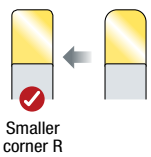
※ Applicable inserts : MGMR/L-□□-Lead angle-PS/PT, KGMR/L-□□-Lead angle-LP/RP

Reducing feed before parting off the center of workpiece

- Tool breakage can be occurred if the tools approaches the workpiece's center with high feed while parting off
- It is necessary to always reduce feed by 75% at a position 2~3mm ahead of the center.
- Lower feed near the center reduces cutting load and decreases the risk of tool breakage.



05 Troubles in cutting and solutions

Troubles	Factors	Solutions			
		Checkpoint 1	Checkpoint 2	Checkpoint 3	Checkpoint 4
Bad surface finish 	Chattering and wrong tool setting	Use a short CDX holder 	Tool setup at 90° 	Use larger Nose R 	Change to another chip breaker Refer to the tool selection guide p. 7
Bad chip control 	Setting improper cutting condition and chip breaker	Increase the feed within recommended cutting conditions 	Machining multiple times with divided cutting depth 	Increase coolant amount and pressure (Recommended inner coolant) 	Change to another chip breaker Refer to the tool selection guide p. 7
Vibration 	Long overhang, wrong setting of holder and lack of holder rigidity	Use a short CDX holder 	Check the center height ±0.1mm from the insert's cutting edge 	Use smaller Nose R 	Use a bigger shank 
Short tool life 	Selecting improper grade and chip breaker, lower clamping force of holder	Select a proper grade depending on workpiece materials 	Don't use any damaged holders 	Increase coolant amount and pressure (Recommended inner coolant) 	Change to another chip breaker Refer to the tool selection guide p. 7
Fracture of insert 	Putting excessive power when clamping an insert, damaged holder and too long overhang	Use a short CDX holder 	Use the provided wrench (prohibited to use a pipe as an extension) 	Remove all debris from the clamping part (chips, coolant oil and etc.) 	Don't use any damaged holders 
Built-up edge 	Setting improper cutting condition and chip breaker, lack of coolant	Increase the cutting speed and feed within recommended cutting conditions 	Increase coolant amount and pressure (Recommended inner coolant) 	Use smaller Nose R 	Change to another chip breaker Refer to the tool selection guide p. 7

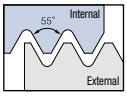
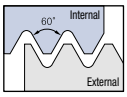
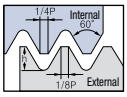
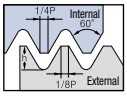
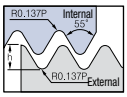
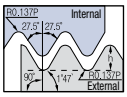
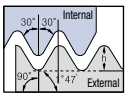
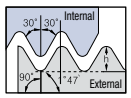
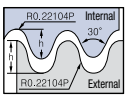
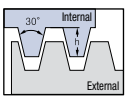
Threading

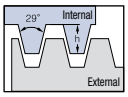
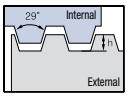
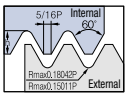
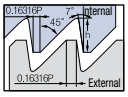
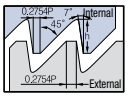
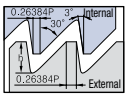
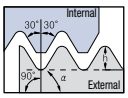
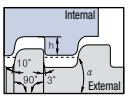
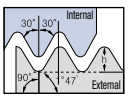
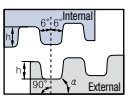
01 Line-up

Grade

Thread for turning						Thread for milling			Solid		
PVD											
PC3030T		PC9070T	PC5300 (M class thread)			PC9570T			PC9070M		
P	K	M	P	M	K	P	M	K	P	M	K

Turning line-up

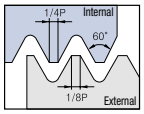
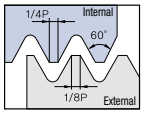
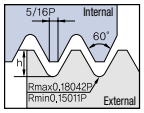
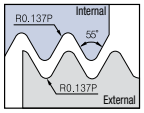
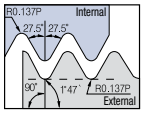
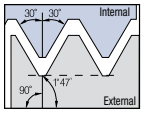
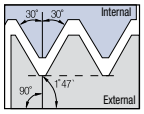
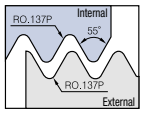
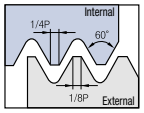
Division	Appli-cation	Geometries	Unit	Grinding	M-type	U-type
Partial profile (55°)	General threading		TP	0.5~6.0	0.5~5.0	0.5~3.0
			TPI	48~4	48~5	48~8
Partial profile (60°)	General threading		TP	0.5~6.0	0.5~5.0	0.5~3.0
			TPI	48~4	48~5	48~8
ISO metric	General industry		TP	0.35~6.0	1.0~3.0	1.5~2.0
			TPI	-	-	-
American UN (UN, UNC)	General industry		TP	-	-	-
			TPI	72~4	-	-
Withworth (BSW, BSF)	Industrial pipe		TP	-	-	-
			TPI	72~4	19~11	14~11
British standard pipe (BSPT)	Gas and water pipe (55°)		TP	-	-	-
			TPI	28~11	-	-
National pipe (NPT)	Gas and water pipe		TP	-	-	-
			TPI	27~8	-	-
National pipe (NPTF) _Dryseal	Gas and water pipe		TP	-	-	-
			TPI	27~8	–	-
Round DIN405 (RD)	Fire-fighting and food industry		TP	-	-	-
			TPI	10~4	-	-
Trapez DIN103 (TR)	Power transfer		TP	1.5~6.0	-	-
			TPI	-	-	-

Division	Appli-cation	Geometries	Unit	Grinding	M-type	U-type
American ACME (ACME)	Power transfer (feed screw)		TP	-	-	-
			TPI	16~4	-	-
Stub ACME (STACME)	Power transfer (thin shape)		TP	-	-	-
			TPI	16~3	-	-
UNJ	Aero-space industry		TP	-	-	-
			TPI	48~4	-	-
American buttress (ABUT)	One direction		TP	-	-	-
			TPI	20~6	-	-
British buttress (BBUT)	One direction		TP	-	-	-
			TPI	16~8	-	-
Metric buttress (SAGE)	One direction (DIN513)		TP	2.0~4.0	-	-
			TPI	-	-	-
API	Oil and gas industry		TP	-	-	-
			TPI	6~4	-	-
API buttress casing (BUT)	Oil and gas industry (tube, casing)		TP	-	-	-
			TPI	5	-	-
API round casing (APIRD)	Oil and gas industry		TP	-	-	-
			TPI	10~8	-	-
Extreme line casing (EL)	Oil and gas industry (tube, casing)		TP	-	-	-
			TPI	6~5	-	-

※ **Unit** : TP(mm), TP(tpi)

01) Line-up

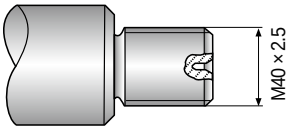
Milling line-up

Division	Appli-cation	Geometries	Unit	Indexable	Internal coolant Helical	Internal coolant Helical, drill/chamfer	Deep drilling	External coolant Helical	External coolant straight
									
ISO metric	General industry		TP	0.5~6.0	0.5~3.0	1.0~1.75	0.25~2.5	0.5~3.0	0.5~6.0
American UN (UN, UNC)	General industry		TPI	32~4	32~8	-	80~1	32~8	-
UNJ	Aerospace industry		TPI	24~11	32~13	-	32~13	-	-
Withworth (BSW, BSF)	Industrial pipe		TPI	28~4	26~11	-	-	-	-
British standard pipe (BSPT)	Gas and water pipe (55°)		TPI	19~11	28~11	-	-	28~11	28~11
National pipe (NPT)	Gas and water pipe		TPI	18~8	27~8	-	-	27~8	27~8
National pipe (NPTF) _Dryseal	Gas and water pipe		TPI	14~8	27~8	-	-	27~8	27~8
BSP (G)	General industry		TPI	-	28~11	-	-	28~11	28~11
MJ	General industry		TP	-	-	-	0.5~2.0	-	-

※ **Unit** : TP(mm), TP(tpi)

02) Tool selection guide - Thread Turning

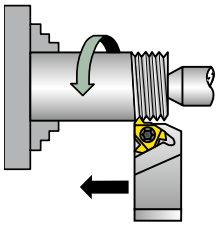
Thread turning steps



Application

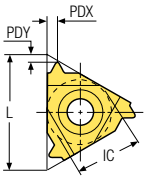
- **Thread** : External right hand ISO metric M40 × 2.5
- **Material** : 4140 (25 HRC)

1 Choose the thread turning method



Use a right hand threading insert with a right hand external threading holder as threading direction is towards the chuck.

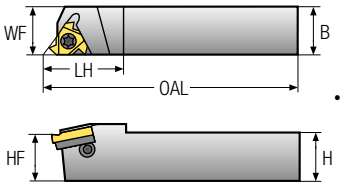
2 Choose the insert size



- **Chosen insert** : ER16-2.5 ISO

Insert size	Pitch	Ordering code	Shim	Tool holder
IC	**mm**	**RH** (Right Hand)	**RH** (Right Hand)	
9.525	2.5	ER16-2.5ISO	ATE16	ERH□□-16

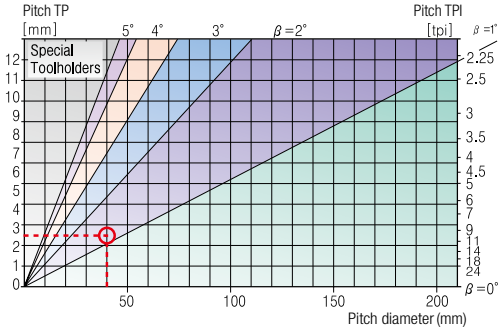
3 Choose the tool holder



- **Chosen tool holder** : ERH25–16

Insert size	Ordering code	Dimensions (mm)				
IC	**RH** (Right Hand)	**H= HF**	**B**	**WF**	**OAL**	**LH**
9.525	ERH25-16	25	25	25	153.6	30

4 Determine the helix angle



- From the table, using a pitch of 2.5 mm (10 tpi) and a workpiece diameter of 40 mm (1.57"), we find the helix angle to be 1.5°

5 Choose the correct shim

Helix angle		1.5°
Insert size	**IC**	9.525
	L	16
Shim designation		ATE16

6 Choose the carbide grade and cutting speed

- **Carbide grade chosen** : PC3030T
- **Cutting speed** : 140m/min

Workpiece			HB	**vc** (m/min)
				PC3030T
P	**Low alloy steel** (alloying elements ≤ 5%)	Non-hardened	180	85~145
		Hardened	275	75~140
		Hardened	350	70~135

7 Determine the number of passes

- **Carbide grade chosen** : PC3030T
- **Cutting speed** : 140m/min

Pitch	mm	1.50	1.75	2.00	2.50	3.00	3.50	4.00
	tpi	16	14	12	10	8	7	6
No.of passes		6~10	7~12	7~12	8~14	9~16	10~18	11~18

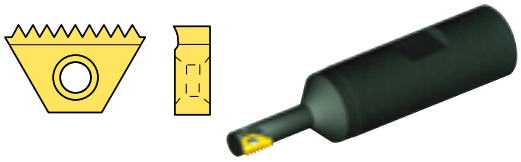
8 Summary

Thread type	ISO M40 × 2.5 External right hand
1. Feed direction	Towards the chuck
2. Insert and grade	ER16–2.5ISO, PC3030T
3. Tool holder	ERH25–16
4. Helix angle	1.5°
5. Shim	ATE16
6. Cutting speed	140 m/min
7. Number of passes	10

02) Tool selection guide - Thread Milling

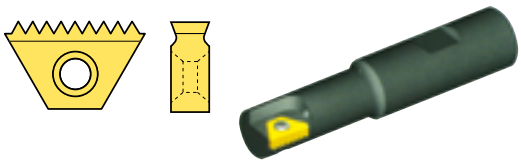
The right tool for the job

Small diameter type



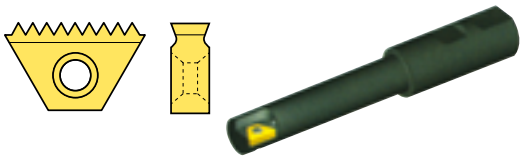
- **Tool holder** : TMSR • **Insert** : TM (L = 10.4 mm)
- For small bore diameters down to 9.5 mm

Standard type



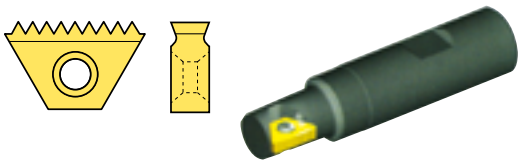
- **Tool holder** : TMSR • **Insert** : TM2
- For standard length threads

Long type



- **Tool holder** : TMSR • **Insert** : TM2
- Long shank thread milling

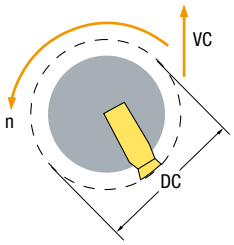
Tapered type



- **Tool holder** : TMSR • **Insert** : TM2 (BSPT, NPT, NPTF)
- Taper thread millings

Preparing for the thread milling operation

(Calculation of rotational velocity and feed at the cutting edge)



$$n = \frac{vc \times 1000}{\pi \times DC}$$

$$vc = \frac{n \times \pi \times DC}{1000}$$

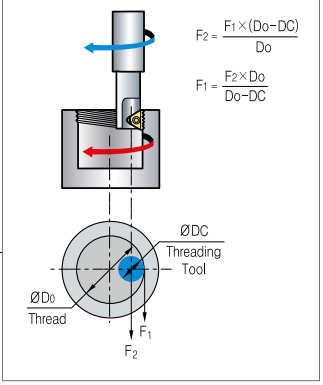
$$F_1 = n \times z \times fn$$

- n – Rotational Velocity (min^{-1})
- vc – Cutting Speed (m/min)
- DC – Tool holder Cutting Dia. (mm)
- F_1 – Real Feed rate at the Cutting Edges (mm/min)
- z – No. of Cutting Edges
- fn – Feed per Tooth per Rotation (mm/rev)

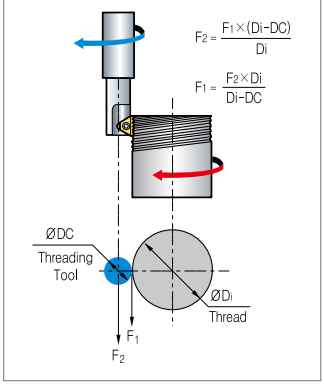
(Calculation of feed rates at the tool center line)

- Feed rate from the center-line of the tools is required for most of the CNC machine's programming. When dealing with linear tool movement, the feed rate at the cutting edge and the center line are identical, but with a milling tool, this is not the case. The value can be defined relatively by the feed rate at the cutting edge and the feed rate at the tool's center-line.

Internal thread



External thread



(Grades and applications)

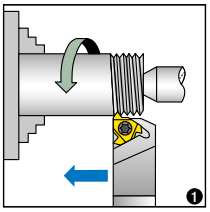
- **Grade** : PC9570T
- **Application** : First Choice for steel and cast iron A tough sub-micron substrate with TiCN coating Provides good fracture toughness and excellent wear resistance

03) Useful cutting tip - Thread Turning

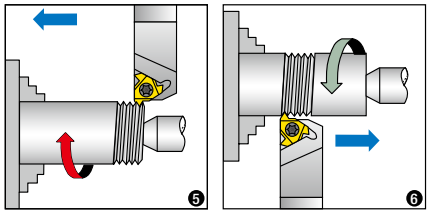
Thread turning method

Thread	Inserts & Tool holder	Rotation	Feed direction	Helix method	Drawing no.
Right Hand External	EX RH	Counter clockwise	Towards chuck	Regular	❶
	EX LH	Clockwise	Outwards chuck	Reversed	❷
Right Hand Internal	EX RH	Counter clockwise	Towards chuck	Regular	❸
	IN LH	Clockwise	Outwards chuck	Reversed	❹
Left Hand External	EX LH	Clockwise	Towards chuck	Regular	❺
	EX RH	Counter clockwise	Outwards chuck	Reversed	❻
Left Hand Internal	IN LH	Clockwise	Towards chuck	Regular	❼
	IN RH	Counter clockwise	Outwards chuck	Reversed	❽

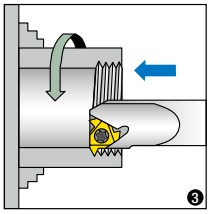
External RH thread



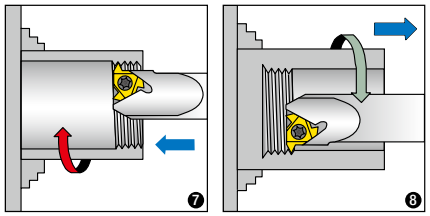
External LH thread



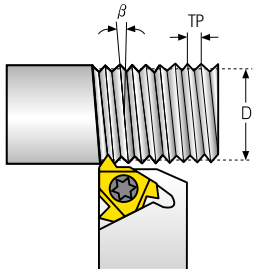
Internal RH thread



Internal LH thread



Calculating the helix angle (β)



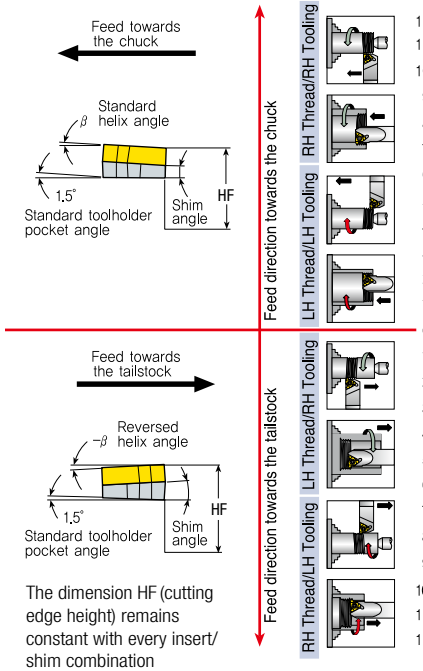
- The helix angle is calculated by the following formula

$$\beta = \tan^{-1}\frac{TP \times N}{\pi \times D}$$

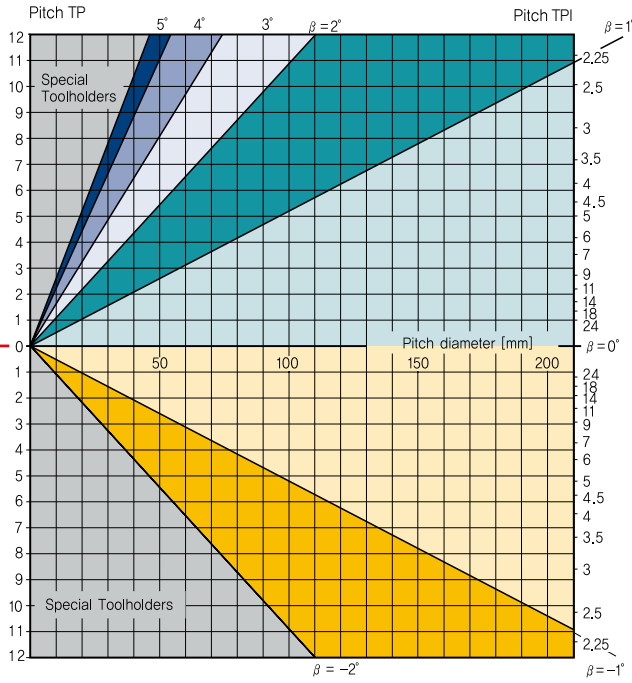
β : Helix angle (°)
P : Pitch (mm)
N : No. of starts
D : Pitch diameter (mm)
Lead = TP × N

- The helix angle can also be found from the diagram below

(Helix angle diagram)



The dimension HF (cutting edge height) remains constant with every insert/shim combination

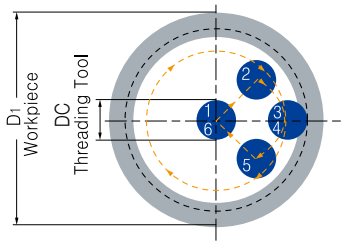


03) Useful cutting tip - Thread Milling

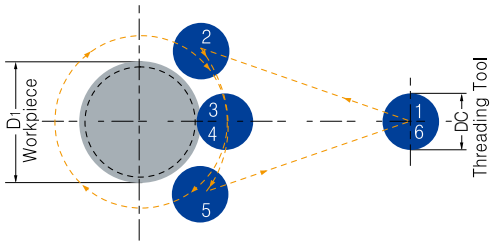
Tangential Arc Approach

- With this method, the tool enters and exits the workpiece smoothly. No marks are left on the workpiece and there is no vibration, even with harder materials. Although it requires slightly more complex programming than the radial approach (see below), this is the method recommended for machining at the highest quality threads

Internal thread



External thread



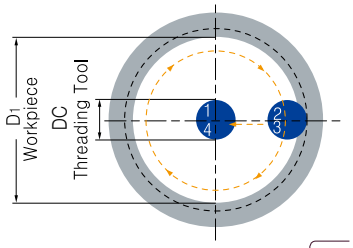
1-2 : Rapid approach
2-3 : Tool entry along tangential arc, with simultaneous feed along z-axis
3-4 : Helical movement during one full orbit (360°)
4-5 : Tool exit along tangential arc, with continuing feed along z-axis
5-6 : Rapid return

Radial Approach

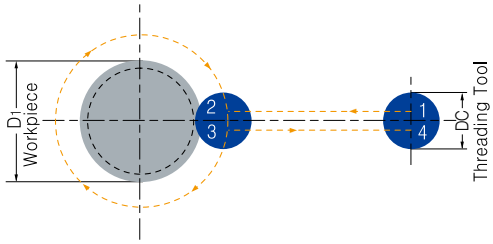
- It is the simplest method and there are two properties to consider:
  ① a small vertical mark may be lift at the entry (and exit) point. This is of no significance to the thread itself
  ② when using this method with very hard materials, there may be a tendency of the tool to vibrate as it approaches the full cutting depth

Note : Radial feed during entry to the full profile depth should only be 1/3 of the subsequent circular feed

Internal thread



External thread

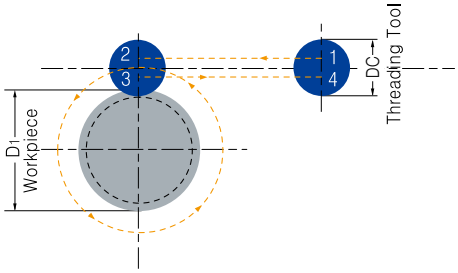


1-2 : Radial entry
2-3 : Helical movement during one full orbit (360°)
3-4 : Radial exit

Tangential Line Approach

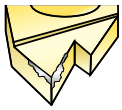
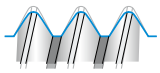
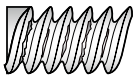
- This method is very simple, and has all of the advantages of the tangential arc method However, it is applicable only with external threads

External thread

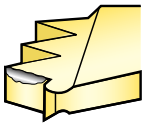
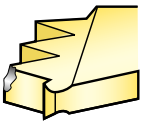
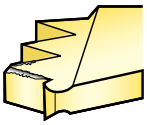
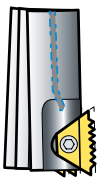
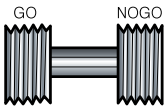


1-2 : Radial entry with simultaneous feed along z axis
2-3 : Helical movement during one full orbit (360°)
3-4 : Radial exit

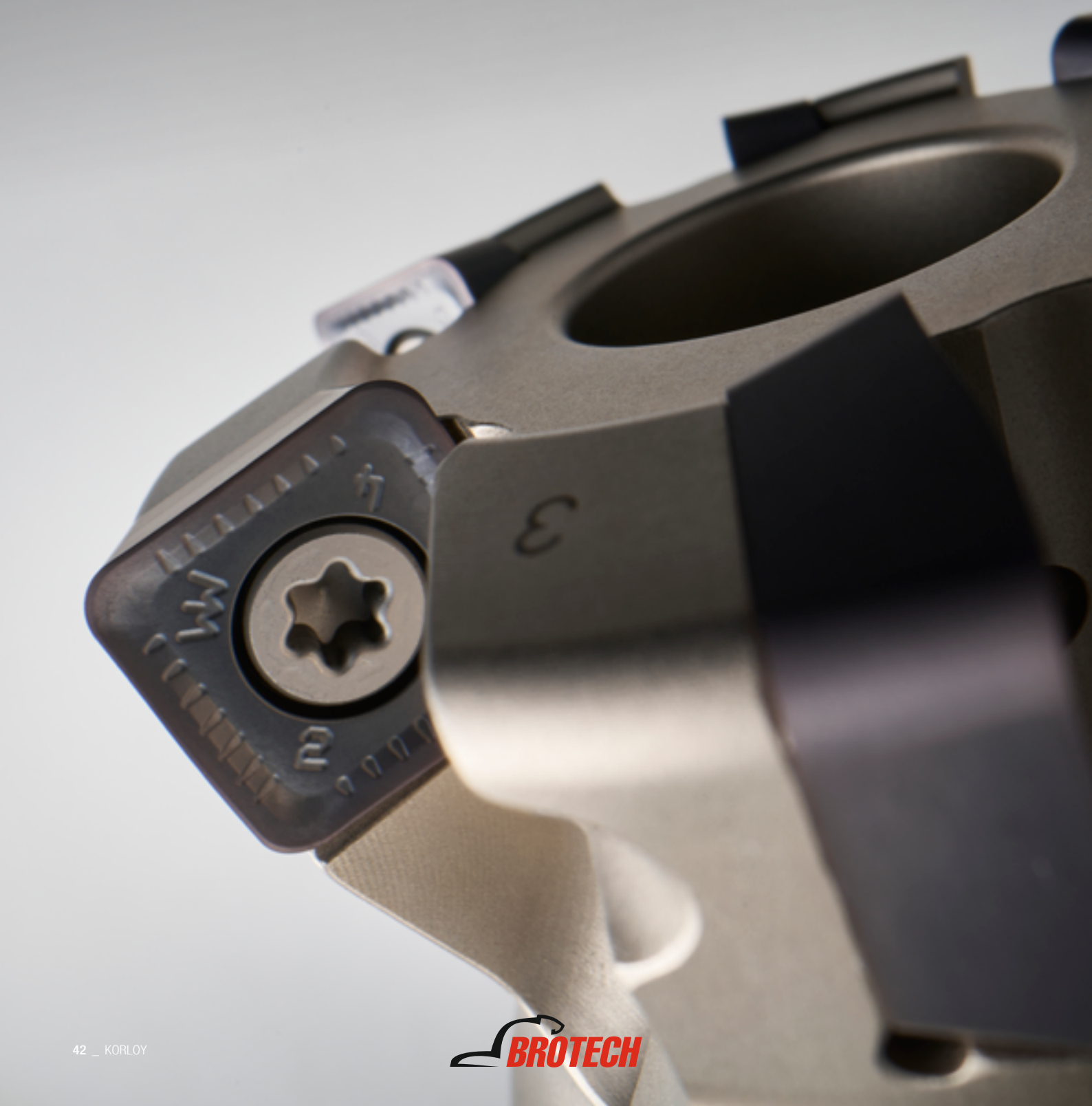
04) Troubles in cutting and solutions - Thread Turning

Problem		Possible cause	Solution
	**Increased flank wear**	Too high cutting speed	Reduce cutting speed/use coated insert
		Too low depth of cut / Too many passes	Increase the depth of cut per pass
		Unsuitable carbide grade	Use a coated carbide grade
		Insufficient coolant oil	Increase coolant flow rate
	**Uneven cutting edge wear**	Incorrect helix angle	Choose the correct shim
		Wrong infeed method	Use the alternating flank infeed method
	**Extreme plastic deformation**	Too deep depth of cut	Decrease depth of cut/ increase number of passes
		Insufficient coolant	Increase coolant flow rate
		Too high cutting speed	Reduce cutting speed
		Unsuitable carbide grade	Use a tougher carbide
		Too small nose radius	Use an insert with a larger radius, if possible
	**Cutting edge breakage**	Too deep depth of cut	Decrease depth of cut/ increase number of passes
		Extreme plastic deformation	Use a tougher carbide
		Insufficient coolant oil	Increase flow rate and/ or correct flow direction
		Unsuitable carbide grade	Use a tougher carbide
		Instability	Check stability of the system
	**Built-up edge**	Incorrect cutting speed	Change the cutting speed
		Unsuitable carbide grade	Use a coated carbide
	**Thread profile is too shallow**	Tool's height is not matched with the workpiece's axial height	Change tool's height
		Thread's crest is not properly shaped	Recheck the workpiece diameter
		Worn insert	Change the insert's cutting edge immediately
	**Poor surface quality**	Too low cutting speed	Increase cutting speed
		Wrong shim	Choose correct shim
		Flank infeed method is not appropriate	Use the alternate flank or radial infeed method

04) Troubles in cutting and solutions - Thread Milling

Problem		Possible cause	Solution
	**Excessive flank wear**	Too high cutting speed	Reduce cutting speed/use coated insert
		Chip is too thin	Increase feed rate
		Insufficient coolant	Increase coolant flow rate
	**Excessive chipping**	Chip is too thick	Reduce feed rate/Use the tangential arc method Increase RPM
		Vibration	Check stability
	**Built up edge**	Incorrect cutting speed	Change cutting speed
		Unsuitable carbide grade	Use a coated carbide grade
	**Chatter/ vibration**	Feed rate is too high	Reduce the feed.
		Profile is too deep	Execute two passes, each with increased cutting depth/ Execute two passes, each cutting only half the thread length
		Thread length is too long	Execute two passes, each cutting only half the thread length
	**Insufficient thread accuracy**	Tool deflection	Reduce feed rate/Execute a “zero” cut

Milling



01) Line-up

Machining types	KAPR	APMX (mm) 5 10 15 20 25 30	Cutting -edges	Holder Type	Cutting diameter Range (Ø)	Product name	Designation	Available inserts	INFO Link	Sub Application
Facing	-	RNMX12:3.5mm	8	Shank	32 ~ 63	Rich Mill (RMR)	RMRS		INFO	-
				Cutter	50 ~ 125		RMRC			
		SAGX14:5.5mm SNMX14:5.5mm	8	Cutter	50 ~ 250	Rich Mill (RM8-X)	RMX8AC		INFO	-
	45°	SNM(E)X12:6mm SNM(E)X15:7.5mm	8		50 ~ 400	Rich Mill (RM8)	RM8AC		INFO	-
		ONM(H)X06:4mm ONM(H)X08:5.5mm	16		50 ~ 400	Rich Mill (RM16)	RM16AC		INFO	-
	51°	XNMX06(Flat):4.8mm XNMX06(Helix):3.5mm	14		50 ~ 160	Rich Mill (RM14)	RM14XC		INFO	-
	75°	SNM(E)X12:9mm SNM(E)X15:11mm	8		50 ~ 400	Rich Mill (RM8)	RM8EC		INFO	-
Shouldering	90°	ADKT10:9.5mm ADKT12:11.5mm ADKT17:16.5mm	2	Shank	16 ~ 40	Alpha Mill-X	AMXS		INFO	Facing Slotting Plunge Ramping Helical
				Cutter	40 ~ 125		AMXC			
		TNKT11:8mm TNKT16:11.5mm TNKT20:15.5mm	3	Shank	25 ~ 40	Triple Mill	TPMS		INFO	Facing Slotting Plunge
				Cutter	50 ~ 125		TPMC			
		XNK(C)T06:5.5mm XNK(C)T08:8mm XNK(C)T12:12mm	3	Shank	20 ~ 63	Rich Mill (RM3)	RM3PS		INFO	Facing Slotting Plunge Ramping Helical
				Cutter	40 ~ 125		RM3PC			
		LNM(E)X10:9mm LNM(E)X15:14mm	4	Shank	14 ~ 63	Rich Mill (RM4)	RM4PS		INFO	Facing Slotting Plunge Ramping Helical
				Cutter	40 ~ 160		RM4PC			
		WNGX04:4.3mm WNGX08:8.2mm	6	Shank	20 ~ 50	Rich Mill (RM6)	RM6PS		INFO	Facing Slotting Plunge Ramping Helical
				Cutter	40 ~ 125		RM6PC			
		LNKT08:8mm LNKT14:12.7mm LNKT17:16.5mm	2	Shank	25 ~ 40	Tangen-Pro (TP2P)	TP2PS		INFO	Facing Slotting Plunge
				Cutter	40 ~ 125		TP2PC			

01) Line-up

Machining types	KAPR	APMX (mm) 5 10 15 20 25 30	Cutting -edges	Holder Type	Cutting diameter Range (Ø)	Product name	Designation	Available inserts	INFO Link	Sub Application
Shouldering	90°	LNGX13:12mm	4	Shank	25 ~ 40	Tangen-Pro (TP4P)	TP4PS		INFO	Facing Slotting Plunge
				Cutter	40 ~ 125		TP4PC			
		SOKX14:11mm	8	Shank	32 ~ 40	Tangen-Pro (TP8P)	TP8PS		INFO	
				Cutter	50 ~ 125		TP8PC			
High feed machining	10°	SQMT12:1.5mm SQMT14:2.0mm	4	Shank	32 ~ 40	HQM	HQMS		INFO	Facing Shouldering Profile Ramping Helical
				Cutter	50 ~ 100		HQMC			
	-	LNMX04:0.5mm LNMX06:1mm LNMX10:1.5mm	4	Shank	16 ~ 42	HFMD	HFMDS		INFO	
				Cutter	32 ~ 100		HFMDC			
	13°	LPMT04 / LPM(E)W04:0.5mm	2	Shank	8 ~ 21	HFM	HFMS		INFO	
				Cutter						
	14°	WNMX06:1mm WNMX09:1.5mm WNMX13:2mm WNMX16:2.5mm	6	Shank	16 ~ 63	HRMD	HRMDS		INFO	
				Cutter	40 ~ 315		HRMDC			
	15°	WDKT08:1mm WDKT10:1.5mm WDKT13:2mm WDKT15:2.5mm	3	Shank	20 ~ 63	HRM	HRMS		-	
				Cutter	50 ~ 160		HRMC			
Aluminum cutting	90°	LXET25:25mm LXET34:34mm	2	Shank	32 ~ 63	Pro-L Mill	PALS		-	Facing Slotting Plunge Ramping Helical
				Cutter	63		PALC			
		XEKT19:17mm XEKT25:23mm	2	Shank	20 ~ 40	Pro-X Mill	PAXS		INFO	
				Cutter	40 ~ 125		PAXC			
		XDET19:17mm	2	Shank	25 ~ 40	Pro-V Mill	PAVS		INFO	
				Cutter	40 ~ 125		PAVC			
		VDKT11:8mm VDKT22:15mm	2	Shank	12 ~ 40	Pro-A Mill	PAS		INFO	
				Cutter	40 ~ 100		PAC			

02) Grade selection guide

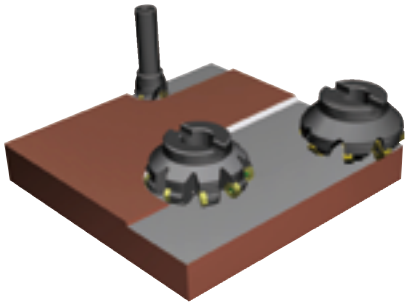
Machining types	Type	Product	Machining Features	Application range					
				P	M	K	S	H	N
				MM/MF	ML/MM	MF/MM	ML/MM	MM/MF	MA
Facing	General flat surface milling	RM8 RM8-X RM14 RM16 RMR	High speed Continuous Low speed Interrupted	NCM535 PC3700 PC5300 PC5535 PC5400	NC5330 PC5300 PC5535 PC9530 PC5400 PC9540	PC6100 NCM535 PC5300 PC5535 PC5400	PC5300 PC5535 PC5400 PC9540	-	H01
	High rigidity flat surface milling	Mill Max Heavy Power Buster	High speed Continuous Low speed Interrupted	NCM535 PC3700 PC5300	PC5300	NCM535 PC5300	PC5300	-	-
	Finishing with wiper	RM8 RM16	High speed Continuous Low speed Interrupted	PC3700 PC5300	PC5300	PC6100	PC5300	-	-
Shouldering	Perpendicularity and flat surface milling	Alpha Mill-X Alpha Mill RM3 RM4 Triple Mill RM6	High speed Continuous Low speed Interrupted	NCM535 PC3700 PC5300 PC5535 PC5400	NC5330 PC5300 PC5535 PC9530 PC5400 PC9540	PC6100 NCM535 PC5300 PC5535 PC5400	PC5300 PC5535 PC5400 PC9540	PC2505 PC2510	H01 H05
	Perpendicular milling on a thin wall	TP4P TP2P TP8P RM4 RM6	High speed Continuous Low speed Interrupted	NCM535 PC3700 PC5300 PC5535 PC5400	NC5330 PC5300 PC5535 PC9530 PC5400 PC9540	PC6100 NCM535 PC5300 PC5535 PC5400	PC5300 PC5535 PC5400 PC9540	PC2505 PC2510	H01
	Edge cutting-peripheral milling	Mono - Tool Alpha Mill Multi - Edge	High speed Continuous Low speed Interrupted	NCM535 PC3700 PC5300 PC5535 PC5400	NC5330 PC5300 PC5535 PC9530 PC5400 PC9540	PC6100 NCM535 PC5300 PC5535 PC5400	PC5300 PC5535 PC5400 PC9540	PC2505 PC2510	H01
High feed machining		HQM HRMD HRM HFMD HFM	High speed Continuous Low speed Interrupted	PC3700 PC5300 PC5535 PC5400	PC5300 PC5535 PC9530 PC5400 PC9540	PC5300 PC5535 PC5400	PC5300 PC5535 PC5400 PC9540	PC2505 PC2510	H01
Aluminum cutting		Pro-L Mill Pro-X Mill Pro-V Mill Pro-A Mill	High speed Continuous Low speed Interrupted	-	-	-	-	-	H01 H05 PD1005 PD1010

Chip Breaker selection

MA	ML	MF	MM
Aluminum	Hard-to-cut materials	Light cutting	General cutting
Sharp cutting edge type	Low cutting resistance type	Low cutting resistance type	Strengthened edge
			

03 Tool selection guide - Facing

General flat surface milling



1st Recommended

RM8 8 corners

RM8A

Wide line-up and most general use

To increase the cost-efficiency and productivity

RM16 16 corners

High efficiency with the maximum no. of corners (16 corners)

Low jig stability

RM14 14 corners

KAPR 51°
(14 corners)

To increase the cutting performance high speed and high feed

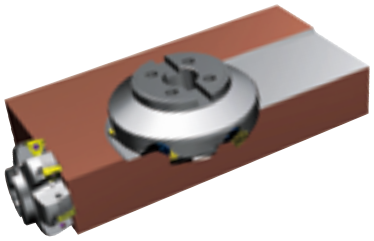
RM8-X 8 corners

High Helix
Sharp cutting edge

Need more corners

Item	Cutting load	Max. Depth of cut	Cutting quality	Versatility	Cost-effectiveness	No. of corners
RM8-X	★★★★★	★★★★★	★★★★	★★★	★★★★	★★★
RM8	★★★	★★★★	★★★★★	★★★★	★★★★	★★★
RM14	★★★★	★★★	★★★★	★★★★★	★★★★★	★★★★
RM16	★★★	★★★	★★★	★★	★★★★	★★★★★
RMR	★★★★★	★★★★	★★★	★★★	★★★	★★★

High rigidity flat surface milling



1st Recommended

Mill Max Heavy 4 corners

High rigidity milling tool

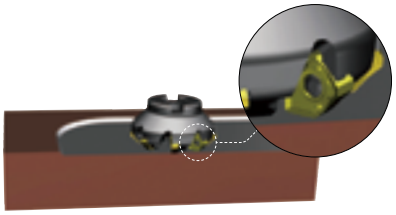
Increased cutting performance, high speed and high feed

Power Buster 6 corners

Improving processability with serrated cutting edges

Item	Cutting load	Max. Depth of cut	Cutting quality	Versatility	Cost-effectiveness	No. of corners
Mill Max Heavy	★★★	★★★	★★★★★	★★★	★★★★	★★★
Power Buster	★★★★★	★★★★★	★★★	★★★★★	★★★★	★★★★★

Finishing with wiper



1st Recommended

RM8 8 corners

RM8A

Wide line-up and most general use

Need more corners

RM16 16 corners

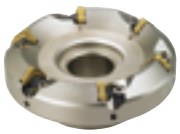
High efficiency with the maximum no. of corners (16 corners)

Item	Cutting load	Max. Depth of cut	Cutting quality	Versatility	Cost-effectiveness	No. of corners
RM8	★★★	★★★★★	★★★★★	★★★★	★★★★	★★★
RM16	★★★	★★★★	★★★	★★★	★★★★	★★★★★

03) Tool selection guide - Facing

General flat surface milling

★ 1st recommended ☆ 2nd recommended ○ Available

System	Rich Mill - RM8A/E/Q									Rich Mill - RM8A/E/Q									Rich Mill - RM8-X							
																										
KAPR	45º ~ 88º									45º ~ 88º									45º							
APMX	6 ~ 11.5									6 ~ 11.5									5.5							
DC	50 ~ 400									80 ~ 315									50 ~ 125							
ISO	P		M		K		S		N	P		M		K		S		N	P		M		K		S	
Chip breaker	MM	MF	MM	ML	MM	MF	MM	ML	MA	MM	MF	MM	ML	MM	MF	MM	ML	MA	MM	ML	MM	ML	MM	ML	MM	ML
PC6100					★	☆								★	☆								★			
PC3700	★	○								★	☆								★							
PC5300	☆	○	○	☆	○	○	○	☆											☆		○	☆	☆	○	○	☆
PC5535	○	○	○		○	○	○																			
PC9530			○																							
PC5400	○	○	○	○	○	○	○	○																		
PC9540			★				★														○	★			○	★
NC5330	○		○		○		○																			
NCM535	○	○			○	○																				
H01									★																	
H05																										

★ 1st recommended ☆ 2nd recommended ○ Available

System	Rich Mill - RM14				Rich Mill - RM16								Rich Mill - RMR							
																				
KAPR	51º				45º								-							
APMX	3.5				4 ~ 5.5								3.5							
DC	80 ~ 315				80 ~ 400								32 ~ 125							
ISO	M		K		P		M	K		S		N	P		M		K		S	
Chip breaker	N	XNR	N	XNR	MM	MF	MM	MM	MF	MM	ML	MA	MM	ML	MM	ML	MM	ML	MM	ML
PC6100			○	○				★	☆								★	○		
PC3700					★	○							★							
PC5300	○	○	○	○	☆	○	☆	○	○	○	☆		☆	○	○	○	☆	○	○	○
PC5535	○	○	○	○	○	○	○	○	○	○										
PC9530							○													
PC5400	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○
PC9540	☆	★					★			★					☆	★				
NC5330																				
NCM535	○	○	☆	★	○	○		○	○											
H01												★								
H05																				

03) Tool selection guide - Facing

High rigidity flat surface milling

★ 1st recommended ☆ 2nd recommended ○ Available

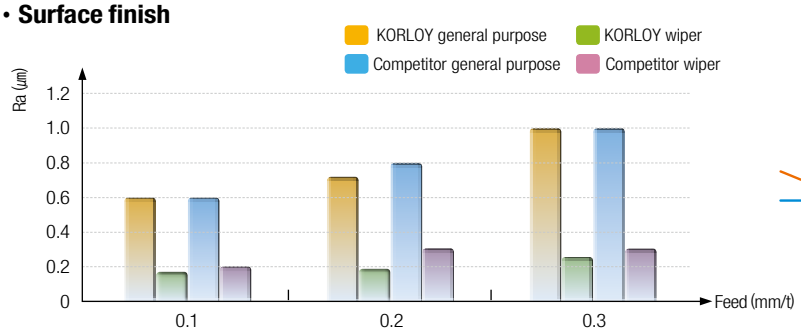
System	Mill Max - Heavy			Power Buster - PBP		Power Buster - PBA		Power Buster - PBZ	
									
KAPR	55º			90º		45º		80º	
APMX	14.5			20		12		18	
DC	125 ~ 315			80 ~ 315		80 ~ 315		80 ~ 315	
ISO	P	M	K	P	K	P	K	P	K
Chip breaker	MM	MM	MM	NM	NM	NM	NM	NM	NM
PC3700	★					★		★	
PC5300	☆	★	☆			☆	★	☆	★
PC9530									
PC5400						○	○	○	○
NCM535	○	○	★			○	☆	○	☆

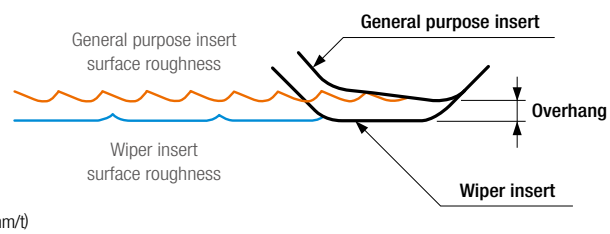
Finishing with wiper

★ 1st recommended ☆ 2nd recommended ○ Available

System	Rich Mill - RM8A				Rich Mill - RM16			
								
KAPR	45º				45º			
APMX	7.5				4 ~ 5.5			
DC	50 ~ 400				80 ~ 400			
ISO	P	M	K	S	P	M	K	S
Chip breaker	W	W	W	W	W	W	W	W
PC6100			★				★	
PC3700	★							
PC9530						○		
PC5300	○	★	○	★	★	★	○	★

- **Surface finish**

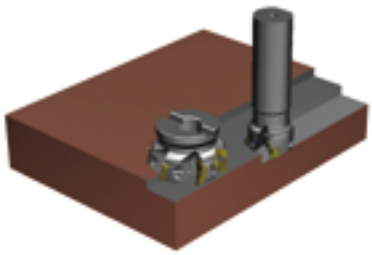


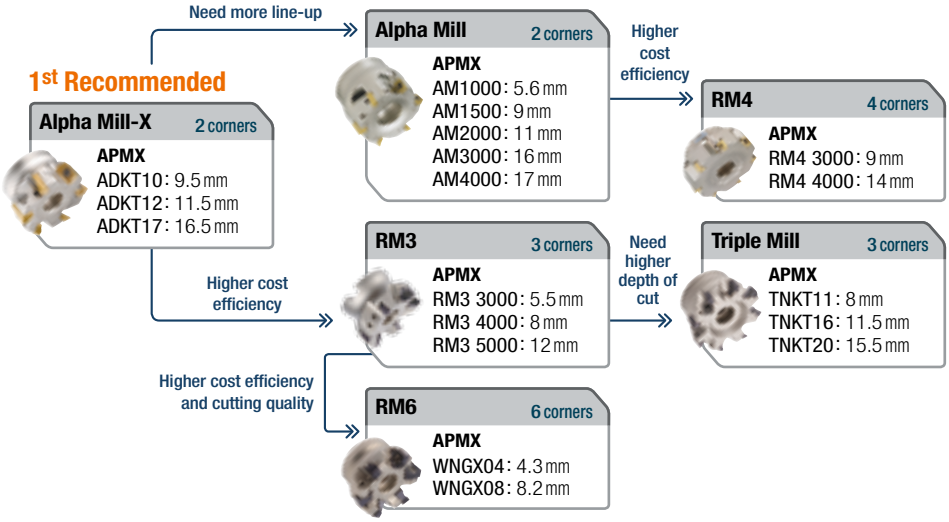


- **Insert** : ONMX080608-MM (General purpose) / ONHX080608-W (Wiper)
- **Grade** : PC3700
- **Material** : SM45C
- **Depth of cut** : vc = 200m/min
- **Cutting depth** : ap = 3.0mm

03) Tool selection guide - Shouldering

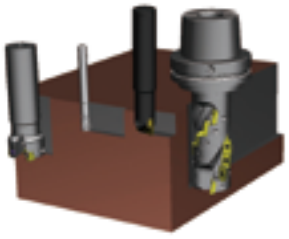
Perpendicularity and flat surface milling

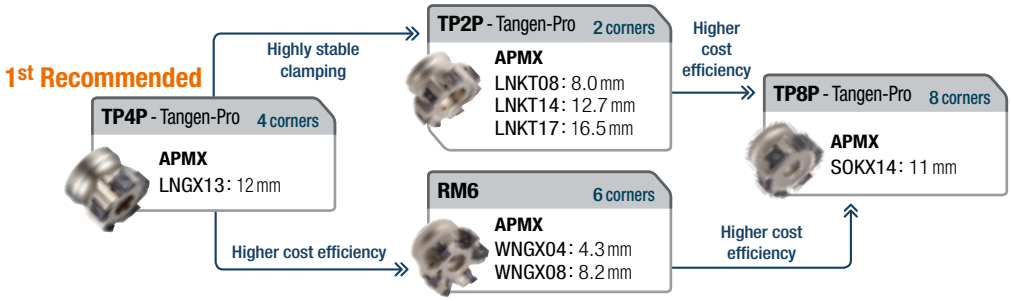




Item	Unit price per corner	No. of corners	Versatility	Cutting load	Max. Depth of cut
RM3	★★★★★	★★½	★★★★	★★★★	★★★
RM4	★★★	★★★	★★★	★★★	★★★★
RM6	★★★★	★★★★	★★★★	★★★	★★★
Alpha Mill	★★	★★	★★★★★	★★★½	★★★★★
Alpha Mill-X	★★	★★	★★★★★	★★★★★	★★★★★
Triple Mill	★★★	★★½	★★	★★★★★	★★★★
TP8P	★★	★★★★★	★★	★★★★	★★★★

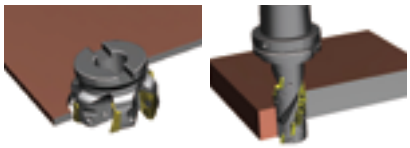
Perpendicular milling on a thin wall

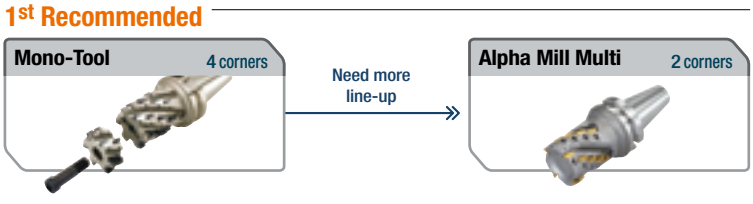




Item	Stable clamping	No. of corners	Surface roughness	Line-up	Max. Depth of cut
TP2P	★★★★★	★★	★★★★★	★★★	★★★★★
TP4P	★★★★	★★★	★★★	★★★★	★★★★
TP8P	★★★★	★★★★★	★★★	★★	★★★
RM6	★★★	★★★★	★★★★½	★★★★★	★★

Edge cutting- peripheral milling





Item	No. of corners	Cutting stability	Max. Depth of cut	Surface roughness	Line-up
Mono-Tool	★★	★★★★★	★★★★★	★★★★★	★★★
Alpha Mill	★★	★★★	★★★★★	★★★	★★★★★

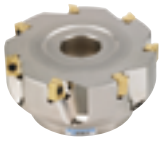
03) Tool selection guide - Shouldering

Perpendicularity and flat surface milling

★ 1st recommended ☆ 2nd recommended ○ Available

System	Alpha Mill-X									Alpha Mill									Rich Mill - RM3									
																												
KAPR	90°									90°									90°									
APMX	9.5 ~ 16.5									5.6 ~ 17									5.5 ~ 12									
DC	16 ~ 125									10 ~ 200									20 ~ 125									
ISO	P		M		K		S		N	P		M		K		S		H	N	P		M		K		S		H	N
Chip breaker	MM	ML	MM	ML	MM	ML	MM	ML	MA	MM	MF	MM	ML	MM	MF	MM	ML	MM	MA	MM	ML	MM	ML	MM	ML	MM	ML	MM	MA
PC6100					★	☆								★	☆									★	☆				
PC2505																		○										○	
PC2510																		★										★	
PC3700	★	○								★	○									★	○								
PC5300	○	○	○	○	○	○	○	○		○	○	○	☆	○	○	○	☆			○	○	○	○	○	○	○	○		
PC5535	☆	○	○	☆	○	○	○	☆		☆	○	○		○	○	○				☆	○	○	☆	○	○	○	☆		
PC9530												○																	
PC5400	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○			○	○	○	○	○	○	○	○		
PC9540			○	★			○	★				★				★						○	★			○	★		
NC5330										○	○	○		○	○	○													
NCM535	○	○			○	○				○				○						○	○			○	○				
H01																			★										★
H05																													

★ 1st recommended ☆ 2nd recommended ○ Available

System	Rich Mill - RM4									Triple Mill									Rich Mill - RM6									
																												
KAPR	90°									90°									90°									
APMX	9 ~ 14									8 ~ 15.5									4.3 ~ 8.2									
DC	14 ~ 160									25 ~ 125									25 ~ 125									
ISO	P		M		K		S		N	P		M		K		S				P		M		K		S		N	
Chip breaker	MM	MF	MM	MF	MM	MF	MM	MF	MA	MM	ML	MM	ML	MM	ML	MM	ML			MM	ML	MM	ML	MM	ML	MM	ML	MA	
PC6100					★	☆								★										★	☆				
PC2505																													
PC2510																													
PC3700	★	○								★	○									★	○								
PC5300	○	○	○		○	○	○	○		○	○	○	○	○	○	○	○			○	○	○	○	○	○	○	○		
PC5535	☆	○	★	☆	○	○	★	☆		☆	○	○	☆	☆	○	○	☆			☆	○	○	☆	○	○	○	☆		
PC9530			○																										
PC5400	○	○	○	○	○	○	○	○												○	○	○	○	○	○	○	○		
PC9540													★				★					○	★			○	★		
NC5330																													
NCM535	○		○		○		○													○	○			○	○				
H01									★																			★	
H05																													

03) Tool selection guide - Shouldering

Perpendicular milling on a thin wall

★ 1st recommended ☆ 2nd recommended ○ Available

System	TP4P - Tangen-Pro									TP8P - Tangen-Pro		Rich Mill - RM4								Rich Mill - RM6								
KAPR	90º									90º		90º								90º								
APMX	12									11		10 ~ 15								4.3 ~ 8.2								
DC	25 ~ 125									32 ~ 125		14 ~ 160								25 ~ 125								
ISO	P		M		K		S		N	P	K	P		M		K		S		N	P		M		K		S		N
Chip breaker	MM	ML	MM	ML	MM	ML	MM	ML	MA	ML	ML	MM	MF	MM	MF	MM	MF	MM	MF	MA	MM	ML	MM	ML	MM	ML	MM	ML	MA
PC6100					★	☆					☆					★	☆								★	☆			
PC3700	★	○								☆		★	○								★	○							
PC5300	☆	○	☆	☆	○	○	☆	★		★	★	☆	○	○	☆	○	○	☆	★		☆	○	○	☆	○	○	☆	★	
PC5535	○	○	★	○	○	○	○	○				○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	
PC5400	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	
PC9540														○	★								○	★					
NC5330												○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	
NCM535												○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	
H01																				★									★
H05									★											☆									☆

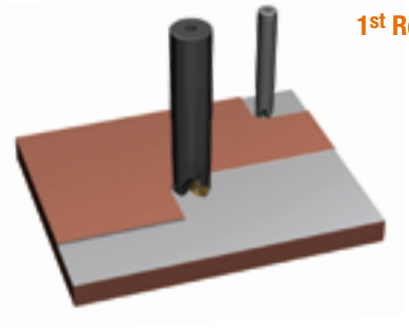
Edge cutting- peripheral milling

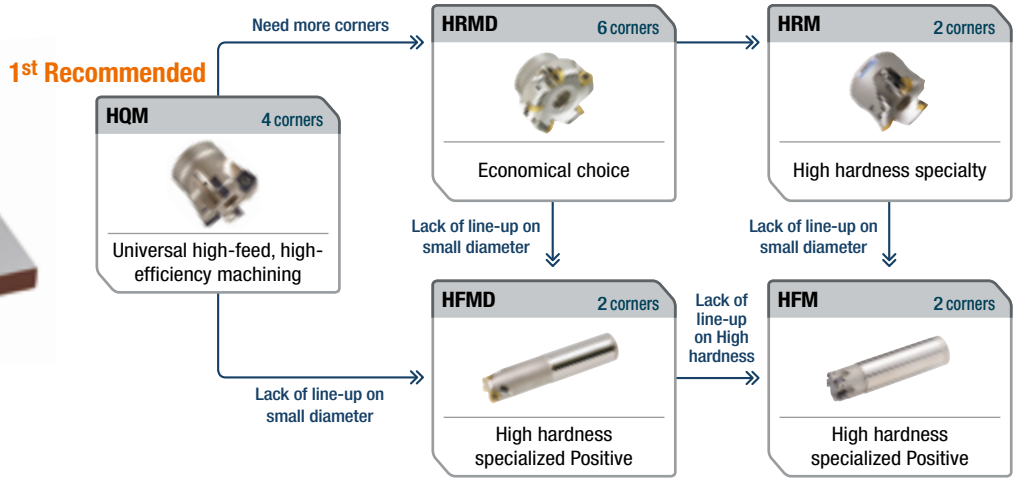
★ 1st recommended ☆ 2nd recommended ○ Available

System	Mono - Tool				Alpha Mill Multi - Edge									
KAPR	90º				90º									
APMX	94 ~ 114				15 ~ 76									
DC	50 ~ 80				16 ~ 100									
Arbor	BT				BT, SK, HSK									
ISO	P		K		P		M		K		S		H	N
Chip breaker	MM		MM		MM	MF	MM	ML	MM	MF	MM	ML	MM	MA
PC6100									★	☆				
PC2505													☆	
PC2510													★	
PC3700	★				★	○								
PC5300	☆		★		☆	○	○	☆	○	○	○	☆		
PC5535					○	○	○	○	○	○	○	○		
PC9530														
PC5400					○	○	○	○	○	○	○	○		
PC9540							○	★			○	★		
NC5330					○	○	○	○	○	○	○	○		
NCM535					○	○			○	○				
H01														★
H05														

03 Tool selection guide - High feed machining

High feed milling





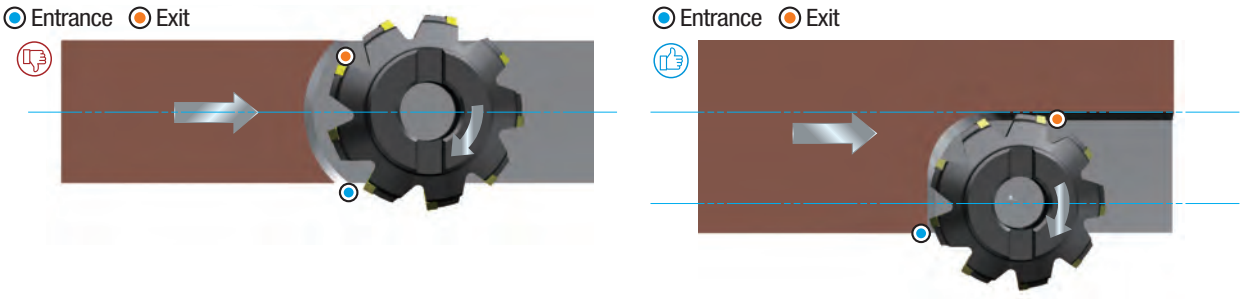
Item	Cost-effectiveness	Cutting resistance	Max. Depth of cut	No. of corners	Min. Cutting dia
HQM	★★★★	★★★★★	★★★★	★★★★	★★
HFMD	★★★	★★★★	★★★	★★★★	★★★★★
HFM	★	★★	★★	★★	★★★★★
HRMD	★★★★★	★★★½	★★★★★	★★★★★	★★★★
HRM	★★	★★	★★★★★	★★★	★★★

★ 1st recommended ☆ 2nd recommended ○ Available

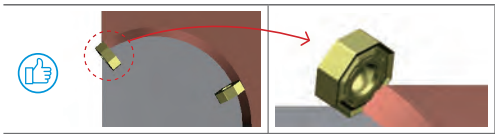
System	HQM										HRMD								HFM									HFMD							
																																			
KAPR	10º										14º								13º									-							
APMX	1.5 ~ 2										1.0 ~ 2.5								0.4 ~ 0.5									0.5 ~ 1.5							
DC	32 ~ 100										16 ~ 315								8 ~ 21									8 ~ 100							
ISO	P		M		K		S		H		P		M		K		S		P		M		K		S		H	P		M		K		S	
Chip breaker	MM	MF	MF	ML	MM	MF	MF	ML	무기호	MM	MM	MF	MM	ML	MM	MF	MM	ML	MF	-	MF	-	MF	-	MF	-	-	MM	MF	MM	ML	MM	MF	MM	ML
PC6100					★	☆									★	☆							★	○									★	☆		
PC3700	★	○									★	○							★	○								★	○						
PC5300	☆	○	○	○	○	○	☆	★	○	○	☆	○	○	☆	○	○	☆	★	☆	○	☆	○	☆	○	☆	★	○	☆	○	○	☆	○	○	☆	★
PC5535											○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PC5400	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PC9530																																			
PC9540			☆	★									○	★							★	○								○	★				
PC2505									○	○																	☆								
PC2510									★	○																	★								

04) Useful cutting Tip

Cutter position : Do not align the cutter center with the center of the workpiece!



Optimal ae Selection : Maximize tool life by selecting the optimal ae!

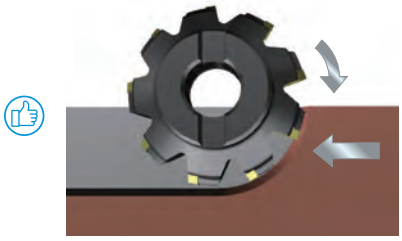


ae > 75% of ØD
- Optimal cutting conditions
- Offset the initial impact along the direction of rotation when entering the cut

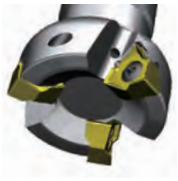
ae < 25% of ØD
- Form positively when entering.
- Absorb the impact during entry by the outermost part of the insert, gradually offset by the tool

ae = 50% of ØD
- Not recommended.
- Very high impact and load on the tool during a tool's entering

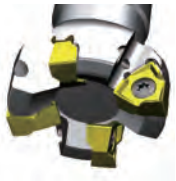
Downward milling : Reduce heat and minimize work hardening tendencies!



Optimal no. of tooth determination : Select the appropriate No. of tooth based on the application!



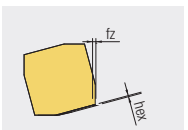
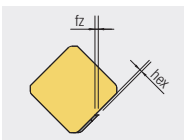
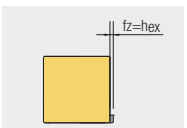
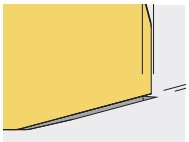
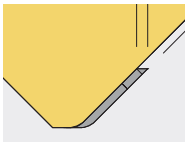
No sign (Coarse)
- Minimal no. of inserts
- Limited stability
- Long overhang
- Small machine/ limited power
- Deep pocket slot machining
- Uneven pitch



M (Close)
- General use
- Proper for multi-variety production
- Small to medium machine
- 1st recommended in general

H (Extra Close)
- Maximal no. of inserts to maximize productivity
- Stable cutting conditions
- Short chip material
- Heat-resistant alloy material

Optimal feed rate determination : Chip thickness varies upon the tool's ccutting edge angle so maximum feed rate also varies.

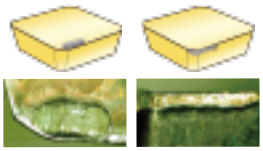
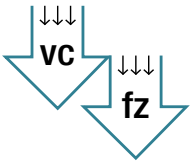
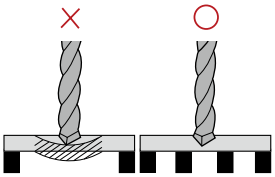
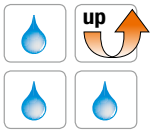
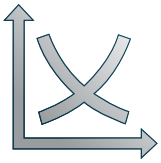
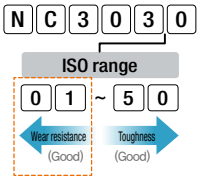
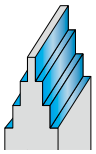
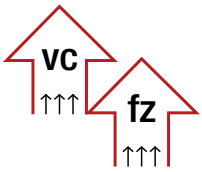
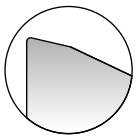
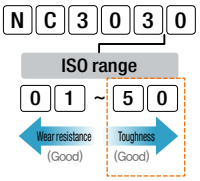
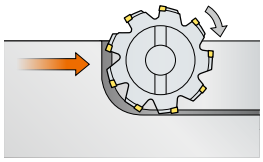
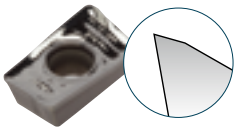
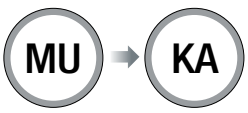
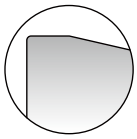
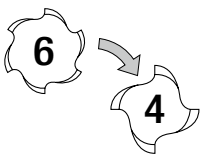
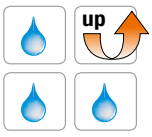
15°	45°	90°
		
		
		
$5.76 \times f_z$	$1.414 \times f_z$	f_z

→ Main formula

$$h_{ex} = f_z * \sin(KAPR)$$

$$f_z = \frac{h_{ex}}{Sin(KAPR)}$$

05 Troubles in cutting and solutions

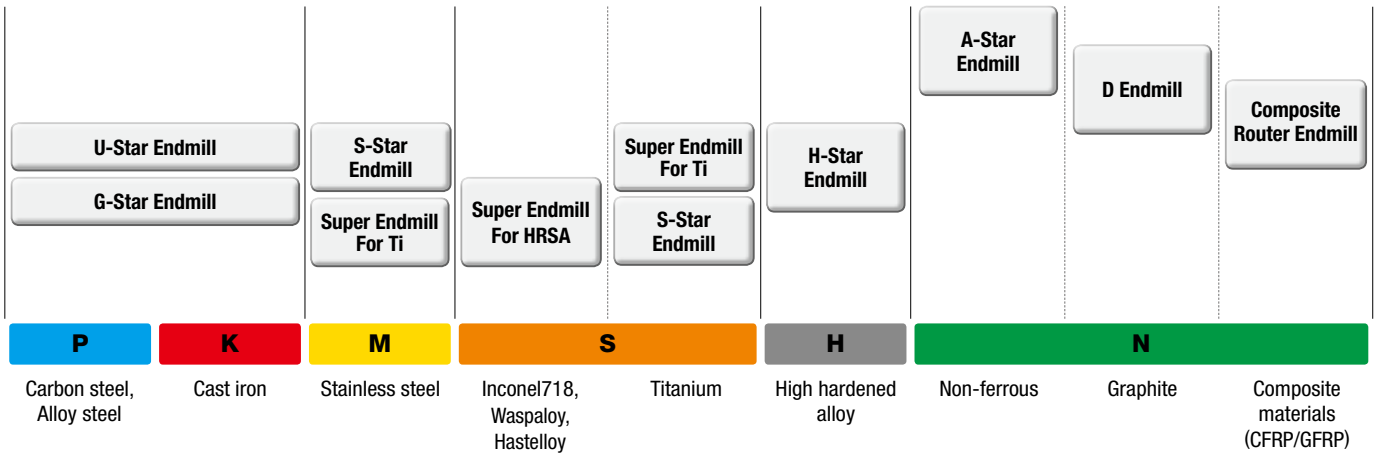
	Excessive wear	Chipping / fracture	Wrong chip evacuation (chip jamming)	Built-up edge / welding
Troubles				
Factors	• Excessive cutting speed/ excessive feed • Dull cutting edge • Low precision of tools	• Excessive feed • Weak jig • Long overhang	• Fracture on the corner • Chipping on the cutting edge and fracture • Re-cutting of chips	• Low cutting speed/ low feed • Negative shape • High adhesiveness material
Solutions	Cutting speed down, feed down 	Accurate clamping of workpiece 	Use more coolant and increase its pressure 	Check the cutting conditions 
	Use higher wear resistance grade 	Feed down 	Multiple pass division of deep machining 	Cutting speed up, feed up 
	Applying C/B for low cutting load 	Use tougher grade 	Upward cutting 	Positive I/S, Using polished inserts 
	Use high precision class inserts (higher tolerance) 	Apply strong cutting edge C/B 	Apply fewer teeth (pitches) 	Use more coolant and increase its pressure 

Endmill

01) Line-up

Workpiece	Use	Product name	Type	No. of tooth	Diameter (mm)	Picture / No. of standard items	Features	INFO Link
H	High hardness (~HRC65)	The Mirror Endmill (PCD)	B	-	0.3~2	6 Items	• Optimal surface finish by PCD ball Endmill with no edge • Nano-level surface finish due to its ultra-fine Endmill	INFO
H	High hardness (~HRC65)	The Mirror Endmill (cBN)	B	2	0.4~2	9 Items	• Higher productivity and surface finish in high speed cutting • Stable tool life and surface from high precision Endmill	INFO
H	High hardness (HRC50~63)	H-Star Endmill	F B R	2~6	1.0~20	3,007 Items	• Suitable for high speed machining of hardened workpieces (HRC50~63) • Improved initial chipping resistance and good wear resistance with optimized edge treatment for high hardness steel cutting	INFO
P K	General (medium hardness) (HRC30~50)	U-Star Endmill	F B R	2~6	0.1~25	4,585 Items	• Suitable for machining medium hardness workpieces (HRC30~50) made of alloy steel, carbon steel, die steel, etc.	INFO
P K	General (~HRC30)	G-Star Endmill	F B R	2~4	1.0~20	456 Items	• For general machining with high performance and high quality • For various workpiece machining (carbon steel, alloy steel, cast iron, pre-hardened, etc.)	INFO
M	Stainless steel	S-Star Endmill	F B R R	2~7	1.0~20	218 Items	• Optimal performance in stainless machining • Enhanced oxidation resistance • Neck application and trochoidal machining	INFO
S	HRSA	Super Endmill	F R	4/6	3.0~20	251 Items	• Endmill for HRSA machining • Optimal for machining of Ni based HRSA such as Inconel, Hastelloy, Waspaloy, etc.	INFO
S	Titanium	Super Endmill	F R	2/4/5	1.0~20	132 Items	• Endmill for titanium and stainless steel cutting • Longer tool life : high toughness substrate and high lubrication coating layer	INFO
N	Non-ferrous metal, Aluminum	A-Star Endmill	F B R	2~3	1.0~20	187 Items	• Effective chip evacuation in high feed machining with U-shape • Double relief angle (Stronger cutting edge hardness)	INFO
N	Composite materials (CFRP, GFRP)	Composite Router Endmill	F	2~8	4.0~12	44 Items	• Router for composite material machining • High performance due to Nano-Crystalline dia-coating	INFO
N	Graphite, Ceramics	D Endmill	F B R	2~4	0.6~12	280 Items	• Longer tool life due to high hardness dia-coating • Applying one-pass grinding and good surface finish	INFO
N	Dental, metal, wax, Zirconia	T Endmill	B	2	0.6~3	214 Items	• Endmill for machining materials for stooping teeth, Zirconia, Titanium, Co-Cr, Wax, PMMA, etc. • Applicable to dental milling machine and various materials for stooping teeth	INFO
N	Copper, Copper alloy	C-Max Endmill	F B R	2	0.5~12	94 Items	• Application of K-Silver Coating(wear resistance, chipping resistance) • Optimal for copper and non-ferrous metal machining	-
For general machining with special function	Roughing	R+ Endmill	R	2~4	5.0~25	204 Items	• Endmill with a shape minimizing cutting load for roughing	INFO

02) Tool selection guide



Tool selection guideline by functions

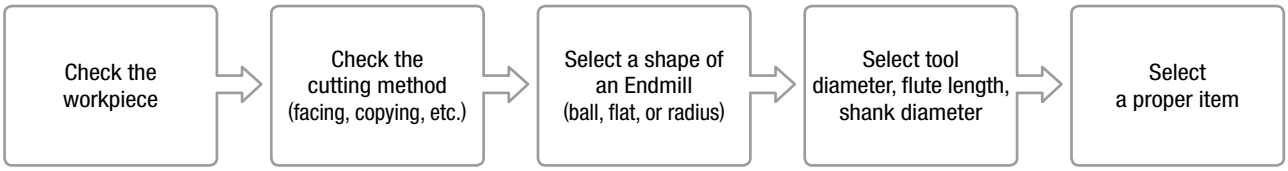
● 1st recommended ◑ 2nd recommended ○ Not recommended

Type	No. of tooth	Precise finishing	Finishing	Roughing	Slotting	Plunging	Copying	Trochoidal milling
Flat/ Radius	2 teeth	○	○	◑	●	●	○	○
	3 teeth	○	◑	◑	●	◑	○	○
	4 teeth	●	●	●	●	○	○	●
	6 teeth or over	●	●	○	○	○	○	●
Ball	2 teeth	○	○	○	●	○	●	○
	4 teeth	○	○	○	◑	○	●	○

※ It is recommended to choose the shortest length tool in every application as possible.
※ Stable machining actualizes long tool life and enhanced surface finish.

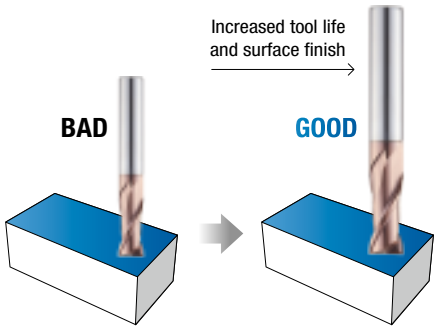
03 Useful cutting Tip

How to select an Endmill

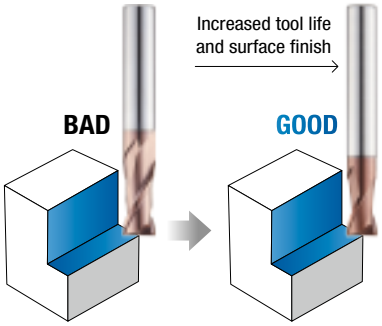


How to use an Endmill

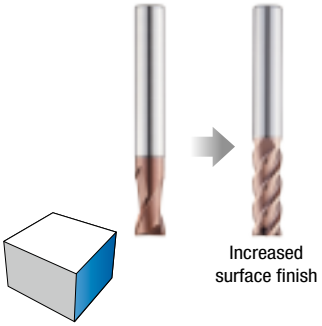
1) Use a larger diameter in case of no issues during machining



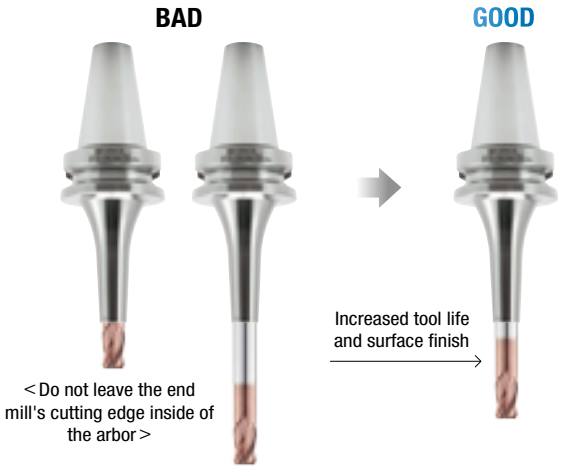
2) Use the shortest available flute length



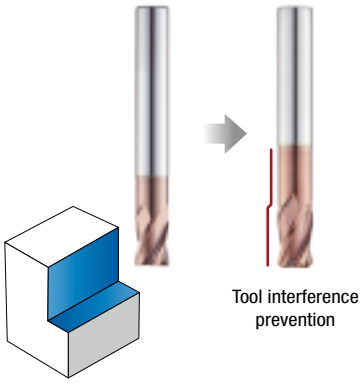
3) Use a tool with more flutes as possible for finishing



4) Maintain a short end mill overhang from arbor



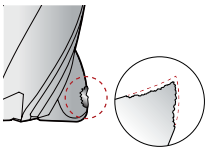
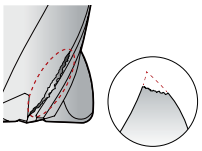
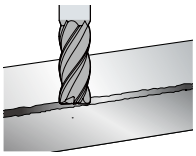
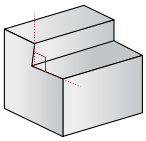
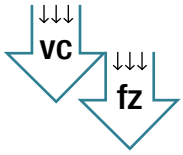
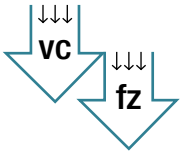
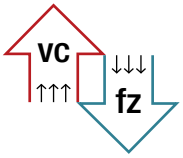
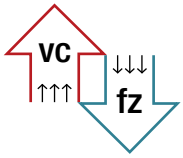
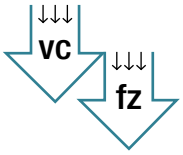
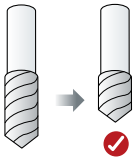
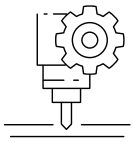
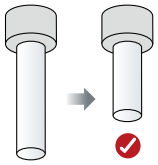
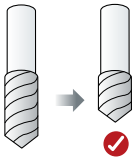
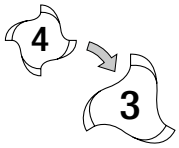
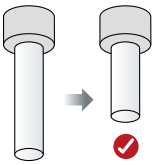
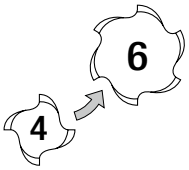
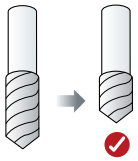
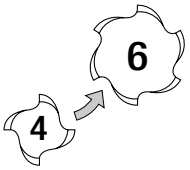
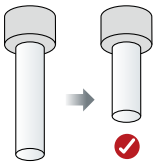
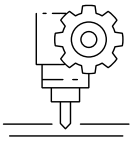
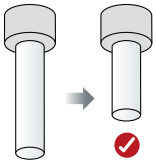
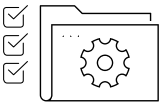
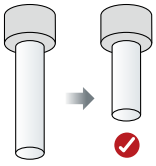
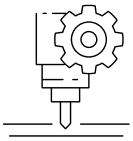
5) Use a necked tool for deep machining depths



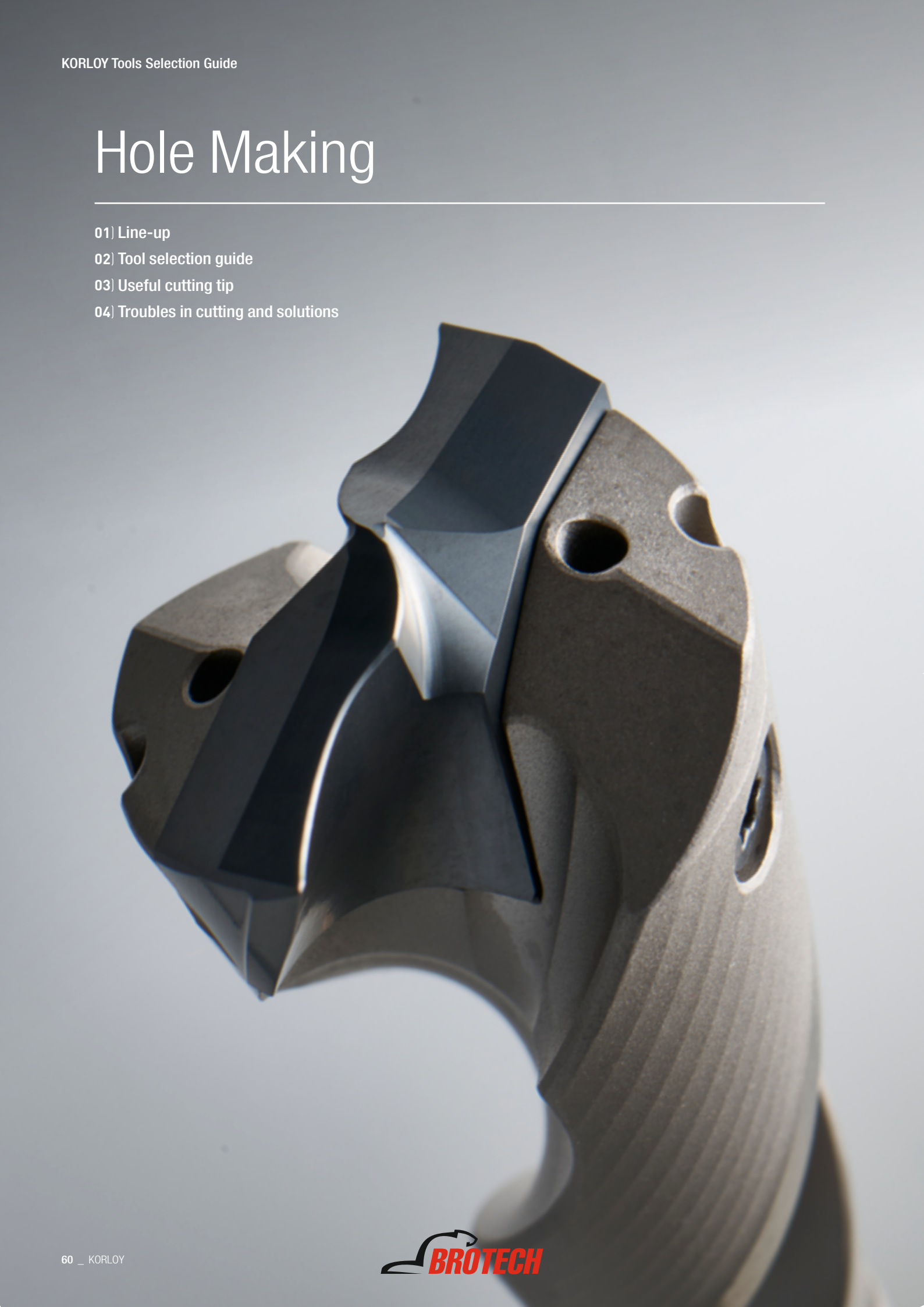
※ In case you already have existing tools in use

Please install the KORLOY KTS app from Play Store or App store and utilize the Solid Tool Converter to select recommended tools. [App Store QR code]

04) Troubles in cutting and solutions

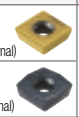
	Chipping on the tool	Excessive wear on the tool	Bad surface finish	Defective dimensional accuracy, perpendicularity	Fracture in while cutting
Trouble					
Factor	• High speed / high feed • Long flute length, overhang	• High speed / high feed • Long overhang	• Vibration • Built-up edge	• Improper cutting conditions • Long flute length, overhang	• Improper cutting conditions • Long overhang
Solution	Cutting speed down, feed down 	Cutting speed down, feed down 	Cutting speed up, feed down 	Cutting speed up, feed down 	Cutting speed down, feed down 
	Use a tool with short flute length 	Check the item (shape and grade) 	Select short overhang 	Use a tool with short flute length 	Enlarge the space for chip flowing (Decrease the no. of tooth) 
	Select short overhang 	Increase the no. of effective tooth 	Use a tool with short flute length 	Increase the no. of effective tooth 	Select short overhang 
	Check the item (shape and grade) 	Select short overhang 	Check the clamping of the facility, arbor and workpiece 	Select short overhang 	Check the item (shape and grade) 

Hole Making



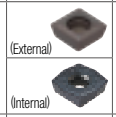
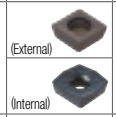
01) Line-up

(**vc** : m/min, **fn** : mm/rev)

Work-piece	Machining type	Tolerance of hole	Drills dia.	Product	Depth of cut	holder		Insert		Grade	Recommended cutting condition		INFO Link
						Picture	Designation	Picture	Designation		vc	fn	
P	Through-hole	-0.15 ~ +0.4	Ø12~Ø60.5 Ø61~Ø100 (Cartridge type)	KING Drill	2D, 3D 4D, 5D		K□D	 (External) (Internal)	SPMT□-PD XOMT□-PD SPMT□-LD XOMT□-LD (For mild steel)	PC3700 PC5335 PC5300 PC5335	120 ~ 170	0.16 ~ 0.06	INFO
	Through-hole	0~+0.1	Ø8~Ø11.9	TPDC Plus Drill (TPDX)	3D, 5D, 8D		TPDX□D		TPD□XP	PC325U	40 ~ 140	0.35 ~ 0.12	INFO
	Through-hole	0~+0.1	Ø10~Ø32.9	1st (recommended) TPDB Plus Drill	3D, 5D, 8D 10D, 12D		TPDB□-P		TPD□B	PC5300	40 ~ 140	0.43 ~ 0.18	INFO
	Through-hole	0~+0.1	Ø33~Ø39.9	1st (recommended) TPDB Plus Drill	3D, 5D, 8D		TPDB□-P		TPD□B-DS	PC5300	50 ~ 140	0.45 ~ 0.2	INFO
	Through-hole	0~+0.1	Ø12~Ø30.9	2nd (recommended) TPDC Plus Drill	1.5D, 3D 5D, 8D 10D, 12D		TPDC□D		TPD□CP	PC5335	50 ~ 140	0.45 ~ 0.2	INFO
	Flat / Blind hole	0~+0.1	Ø12~Ø30.9	1st (recommended) TPDC Plus Drill	1.5D, 3D 5D, 8D 10D, 12D		TPDC□D		TPD□CP-FC	PC5335	50 ~ 110	0.33 ~ 0.18	INFO
	Flat / Blind hole	0~+0.1	Ø14~Ø30.9	2nd (recommended) TPDB Plus Drill	1.5D		TPDB□-F		TPD□B-F	PC5400	40 ~ 100	0.32 ~ 0.2	INFO
	H-Beam, Plate	0~+0.3	Ø14~Ø32.9	TPDB Plus Drill	3D, 4D, 5D, 8D		TPDBP□-H		TPD□BP-H	PC340UL	60 ~ 75	0.3 ~ 0.15	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø2.5~Ø20	MSD Plus	3D, 5D, 7D (Internal coolant)		MSDPH-□P	-	-	PC325U	40 ~ 150	0.4 ~ 0.05	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø1~Ø20	W-Star Drill	5D, 7D (External coolant)		WSDP-□	-	-	PC325W	40 ~ 120	0.32 ~ 0.06	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø3~Ø10	MLD Plus	10D ~ 25D (External coolant, MQL)		MLD□N-□	-	-	PC315G	60 ~ 90	0.25 ~ 0.1	INFO
	Flat / Blind hole	0~+0.1 (Highly precise)	Ø2.5~Ø16	MSFD	2D (External coolant) 3D (Internal coolant)		MSFD(H)□	-	-	PC325U	50 ~ 90	0.2 ~ 0.03	INFO
M	Through-hole	-0.15 ~ +0.4	Ø12~Ø60.5 Ø61~Ø100 (Cartridge type)	1st (recommended) KING Drill	2D, 3D 4D, 5D		K□D	 (External) (Internal)	SPMT□-LD XOMT□-LD (For carbon steel)	PC5335 PC5335	80 ~ 140	0.08 ~ 0.04	INFO
	Through-hole	-0.15 ~ +0.4	Ø12~Ø60.5 Ø61~Ø100 (Cartridge type)	2nd (recommended) KING Drill	2D, 3D 4D, 5D		K□D	 (External) (Internal)	SPMT□-PD XOMT□-PD	PC9540 PC9540	60 ~ 120	0.08 ~ 0.04	INFO
	Through-hole	0~+0.1	Ø12 ~ Ø30.9	2nd (recommended) TPDC Plus Drill	1.5D, 3D 5D, 8D 10D, 12D		TPDC□D		TPD□CM	PC330N	50 ~ 90	0.35 ~ 0.05	INFO

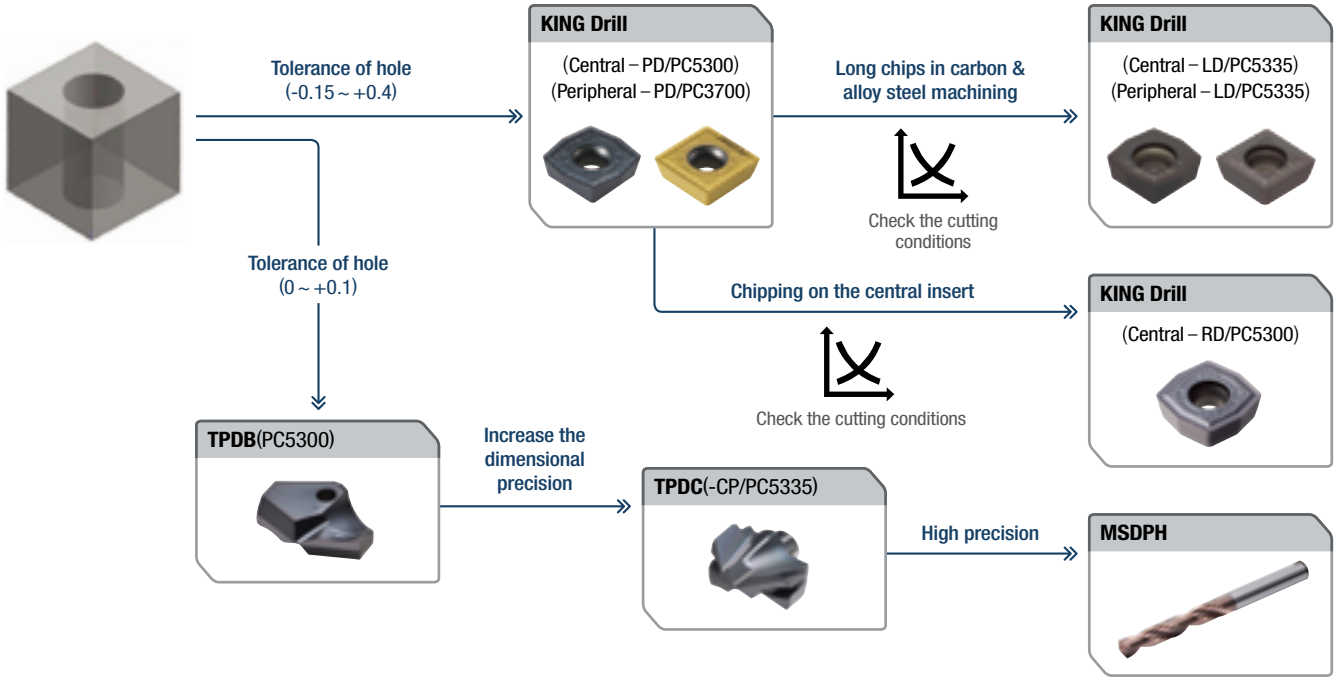
01) Line-up

(**vc**:m/min, **fn**:mm/rev)

Work-piece	Machining type	Tolerance of hole	Drills dia.	Product	Depth of cut	holder		Insert		Grade	Recommended cutting condition		INFO Link
						Picture	Designation	Picture	Designation		vc	fn	
M	Through-hole	0~+0.1	Ø10~Ø32.9	1st (recommended) TPDB Plus Drill	3D, 5D, 8D 10D, 12D		TPDB□-P		TPD□BM	PC340UL	40 ~ 80	0.22 ~ 0.1	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø2.5~Ø20	MSD Plus	3D, 5D, 7D (Internal coolant)		MSDPH-□M	-	-	PC325U	25 ~ 80	0.3 ~ 0.15	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø1~Ø20	W-Star Drill	5D, 7D (External coolant)		WSDP-□	-	-	PC325W	20 ~ 64	0.24 ~ 0.04	INFO
K	Through-hole	-0.15 ~ +0.4	Ø12~Ø60.5 Ø61~Ø100 (Cartridge type)	KING Drill	2D, 3D 4D, 5D		K□D	 (External) (Internal)	SPMT□-PD XOMT□-PD	PC6100 PC5300	100 ~ 250	0.26 ~ 0.04	INFO
	Through-hole	-0.15 ~ +0.4	Ø10~Ø32.9	1st (recommended) TPDB Plus Drill	3D, 5D, 8D 10D, 12D		TPDB□-P		TPD□B	PC5300	100 ~ 140	0.45 ~ 0.18	INFO
	Through-hole	0~+0.1	Ø33~Ø39.9	TPDB Plus Drill	3D, 5D, 8D		TPDB□-P		TPD□B-DS	PC5300	50 ~ 140	0.45 ~ 0.2	INFO
	Through-hole	0~+0.1	Ø12~Ø30.9	2nd (recommended) TPDC Plus Drill	1.5D, 3D 5D, 8D 10D, 12D		TPDC□D		TPD□CP	PC5300	70 ~ 140	0.55 ~ 0.2	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø2.5~Ø20	MSD Plus	3D, 5D, 7D (Internal coolant)		MSDPH-□K	-	-	PC325U	70 ~ 150	0.4 ~ 0.1	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø1~Ø20	W-Star Drill	5D, 7D (External coolant)		WSDP-□	-	-	PC325W	56 ~ 120	0.32 ~ 0.08	INFO
N	Through-hole	-0.15 ~ +0.4	Ø12~Ø60.5 Ø61~Ø100 (Cartridge type)	KING Drill	2D, 3D 4D, 5D		K□D	 (External) (Internal)	SPMT□-ND XOMT□-ND	H01 H01	200 ~ 400	0.25 ~ 0.05	INFO
	Through-hole	0~+0.1	Ø12~Ø30.9	TPDC Plus Drill	1.5D, 3D 5D, 8D 10D, 12D		TPDC□D		TPD□CN	H01	70 ~ 220	0.55 ~ 0.28	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø1~Ø13	SSD-N	- (External coolant)		SSD□□□-N	-	-	H01	65 ~ 120	0.18 ~ 0.05	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø2.5~Ø20	MSD Plus	3D, 5D, 7D (Internal coolant)		MSDPH-□N	-	-	FG2	40 ~ 150	0.4 ~ 0.05	INFO
S	Through-hole	-0.15 ~ +0.4	Ø12~Ø60.5 Ø61~Ø100 (Cartridge type)	KING Drill	2D, 3D 4D, 5D		K□D	 (External) (Internal)	SPMT□-PD XOMT□-PD	PC9540 PC9540	30 ~ 100	0.16 ~ 0.04	INFO
	Through-hole	0~+0.1 (Highly precise)	Ø2.5~Ø20	MSD Plus	3D, 5D (Internal coolant)		MSDPH-□S	-	-	PC325T	20 ~ 50	0.23 ~ 0.045	INFO

02) Tools selection guide

Through-hole machining

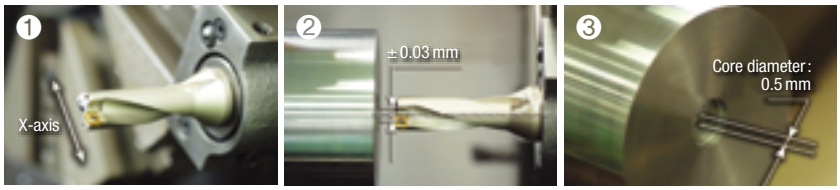


Application products

Machining convex side	Machining concave side	Boring	Ramping	Machining cross holes	Machining overlapped holes
					
KING Drill	KING Drill	KING Drill	KING Drill	KING Drill	KING Drill
TPDB Plus	TPDB Plus	-	TPDB - F	TPDB Plus	TPDB - F
TPDC Plus	TPDC Plus	-	TPDC - FC	TPDC Plus	TPDC - FC
MSDPH	MSDPH	-	MSFD	MSDPH	MSFD
W-Star Drill	W-Star Drill	-	W-Star Drill	W-Star Drill	-

03 Useful cutting Tip

Notice for setting the drill in the lathe



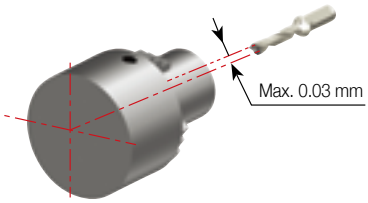
- Set the peripheral insert parallel to the X axis (based on the side lock)
- If the machined core is about 0.5 mm after machining 5 mm, that is the proper setting

※ Please make sure that the location of the side lock could be different depending on manufacturers of machine

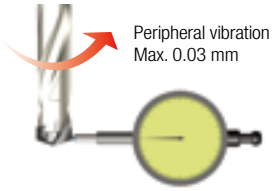
Notice for setting the top solid indexable drill

Use the shortest drill as possible after considering machining depth

[Setting of the horizontal equipment]



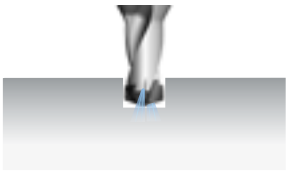
[Setting of the vertical equipment]



How to drill a deep hole (10D/12D)

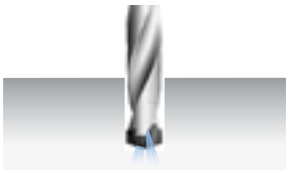
Using a pilot drill (Recommended)

1. Drilling a pilot hole (with a pilot drill)



- Drill a 0.5D pilot hole in 70% lower cutting speed with 1.5D drill or 3D drill

2. Start drilling



- Start drilling in recommended cutting conditions after replacing the drill

Without pilot drill

1. Drilling a pilot hole (without a pilot drill)

- After drill 0.5D with 70% lower cutting speed, stop drilling for 2-3 seconds putting the drill in the hole

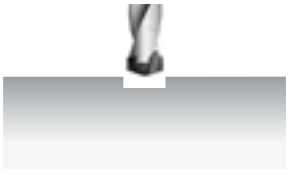
2. Stop drilling

- Stop supplying the coolant and completely take out the drill from the hole. Then, stop drilling for 2-3 seconds

3. Ready to drill

- After putting the drill in the hole to 2-3 mm upper than the bottom of the pilot hole, start supplying the coolant. Then, be ready to start drilling

4. Stop drilling

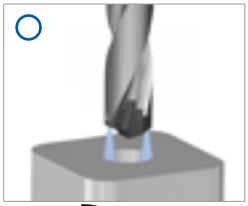


- Start drilling in recommended cutting conditions

Cautions when drilling

- Supply enough coolant to the beginning of the hole
- Minimum pressure of oil coolant : 5 bar
- Minimum flow of coolant : 1.321 gal/min

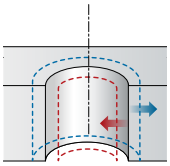
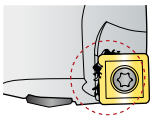
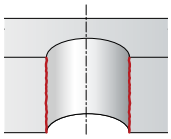
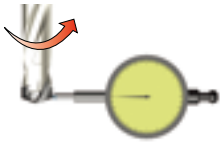
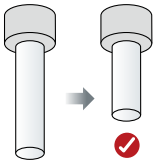
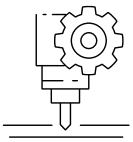
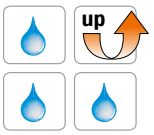
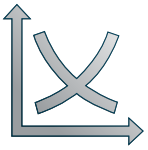
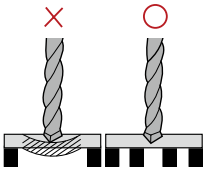
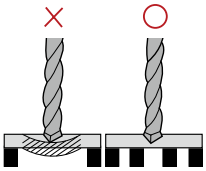
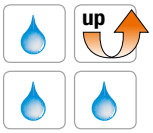
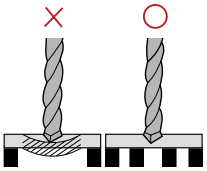
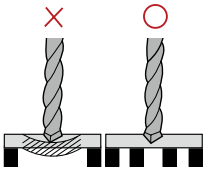
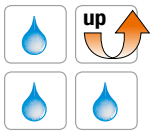
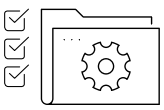
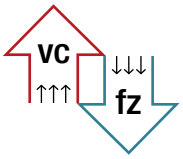
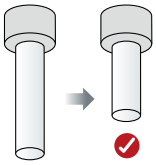
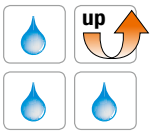
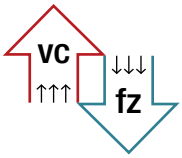
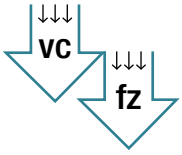
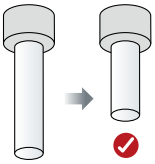
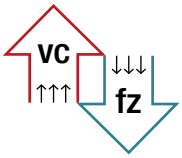
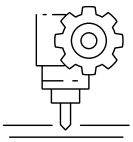
[Internal coolant]



[External coolant]

[Non-dry processing]

04) Troubles in cutting and solutions

	Wrong hole size : Both shrunken or enlarged	**Chattering in cutting**	**Wrong chip evacuation** (chip jamming)	**Bad surface finish of hole**	**Short tool life of insert**
Trouble					
Factor	• Wrong setting • Lack of coolant	• Long overhang • Weak jig	• Fracture of corner • Lack of coolant	• Lack of coolant • Weak jig	• High speed / high feed • Weak jig
Solution	Check the status of drill run-out 	Select short overhang 	Check the item (shape and grade) 	Use more coolant and increase its pressure 	Check the cutting conditions 
	Accurate clamping of workpiece 	Accurate clamping of workpiece 	Use more coolant and increase its pressure 	Accurate clamping of workpiece 	Accurate clamping of workpiece 
	Use more coolant and increase its pressure 	Check the clamping of the facility, arbor and workpiece 	Cutting speed up, feed down 	Select short overhang 	Use more coolant and increase its pressure 
	Cutting speed up, feed down 	Cutting speed down, feed down 	Select short overhang 	Cutting speed up, feed down 	Check the item (shape and grade) 

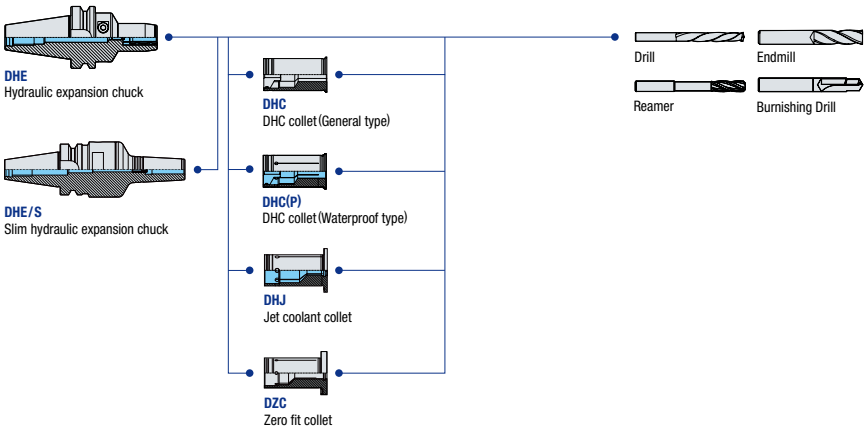
DINOX Map

Division	Milling chuck	Hydraulic expansion chuck	Shrinking chuck
Use	Low to medium speed machining/ general machining	High speed finishing/ precision machining	High speed finishing for narrow and deep shape
Maintaining clamping force	★★★★	★★	★★★
Precision	★★	★★★	★★★★
High speed machining	★	★★★★	★★★★
Easy to use	★★★	★★★★	★★

Hydraulic expansion chuck

DHE

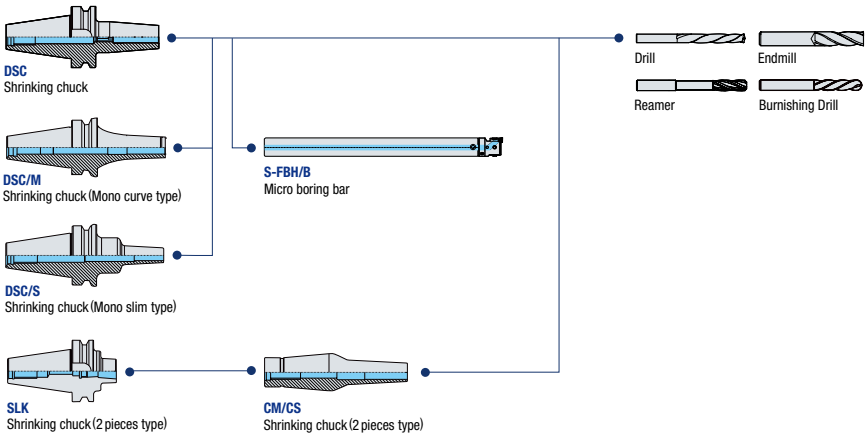
DHE/S



Shrinking chuck

DSC

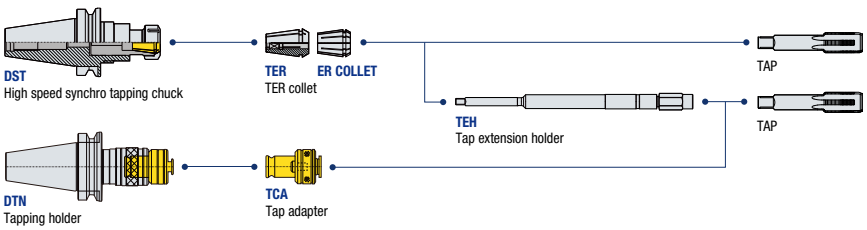
DSC/S



Tapping holder

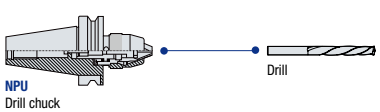
DTN

DST



Drill chuck

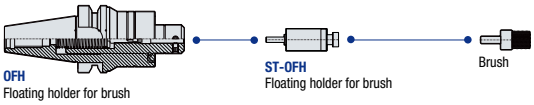
NPU



DINOX Map

Floating holder for brush

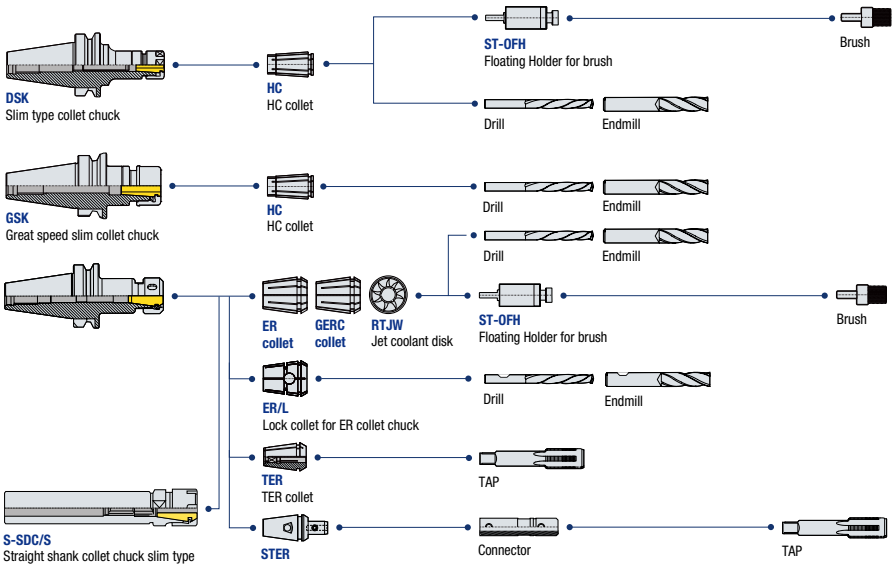
OFH



Collet chuck

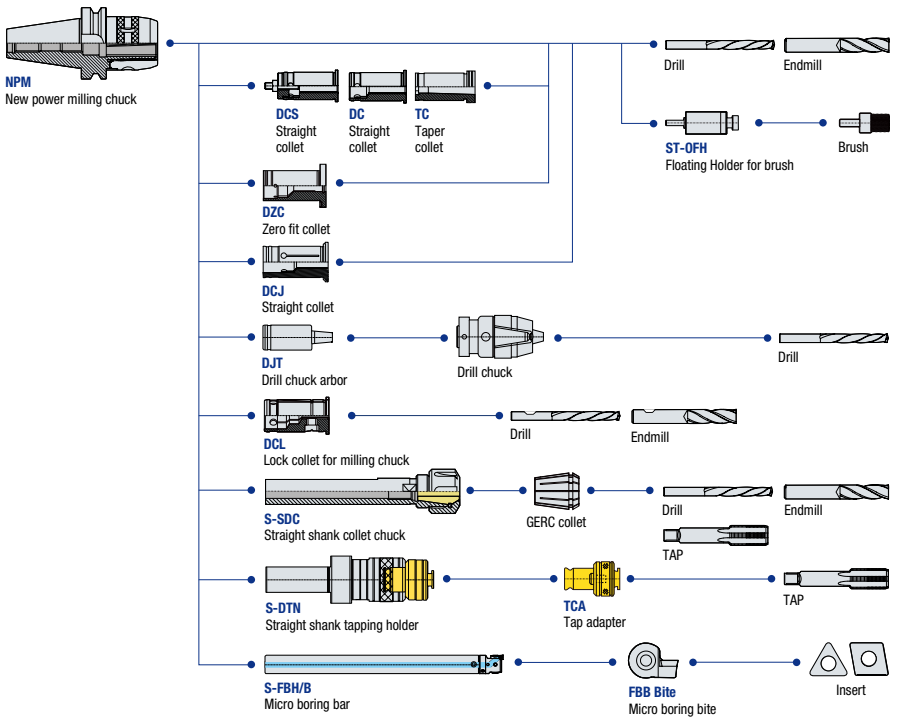
SDC/P

GSK



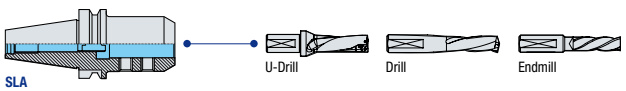
Milling chuck

NPM



Side lock arbor

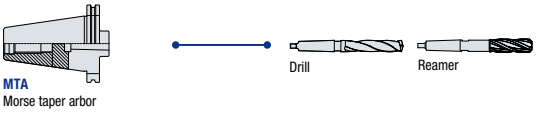
SLA



DINOX Map

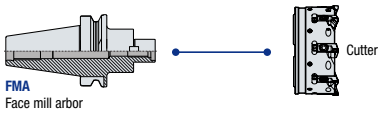
Morse taper arbor

MTA



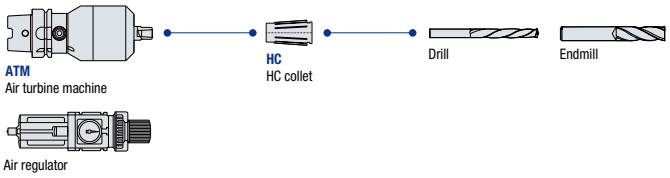
Face mill arbor

FMA



Air spindle

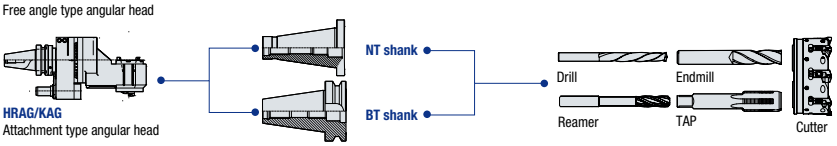
ATM



Angular head

KAH

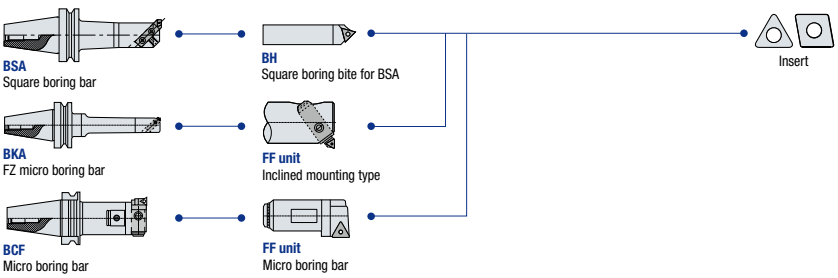
MAH



KAG

Boring series

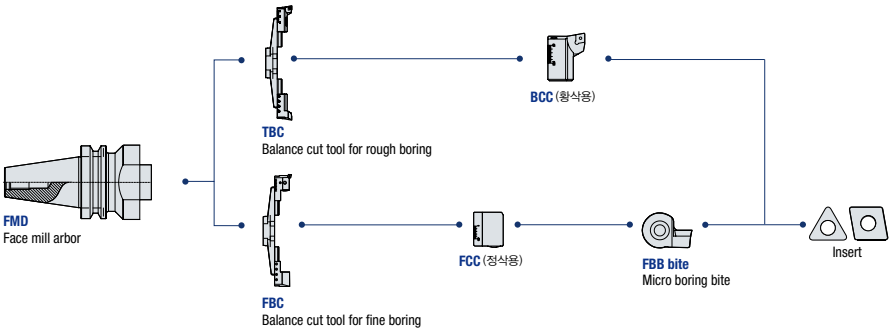
BT-FBH/B



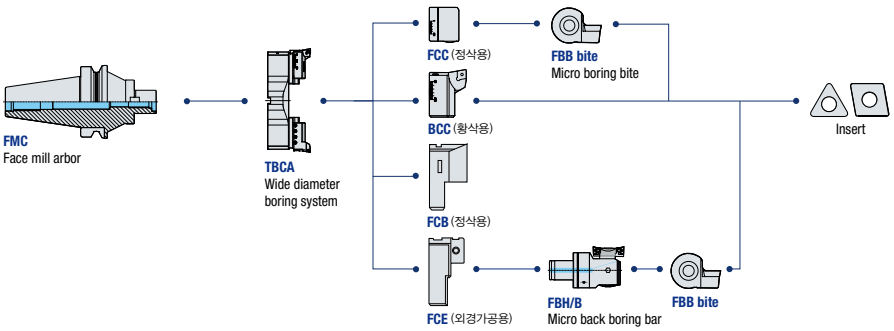
DINOX Map

Boring series

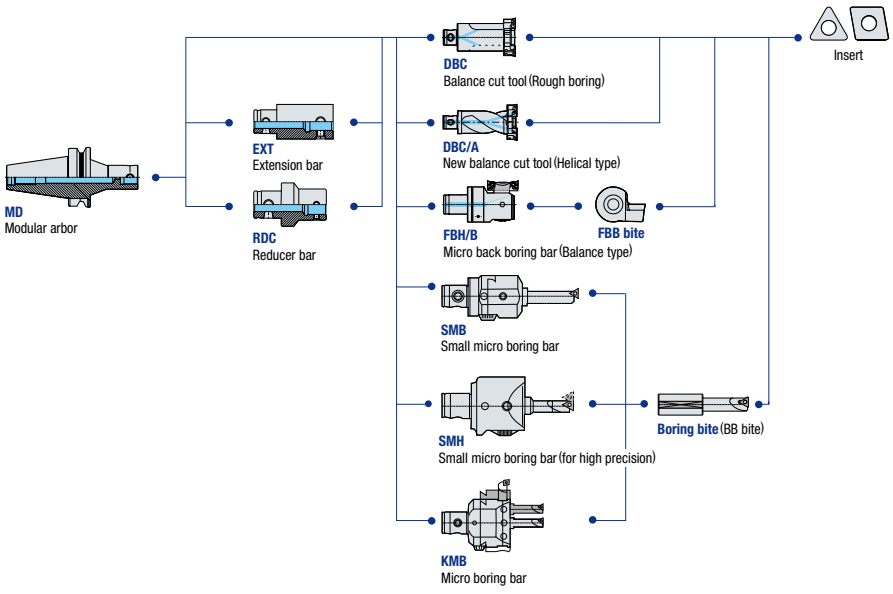
BCF



TBC, FBC

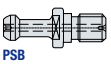


KMB

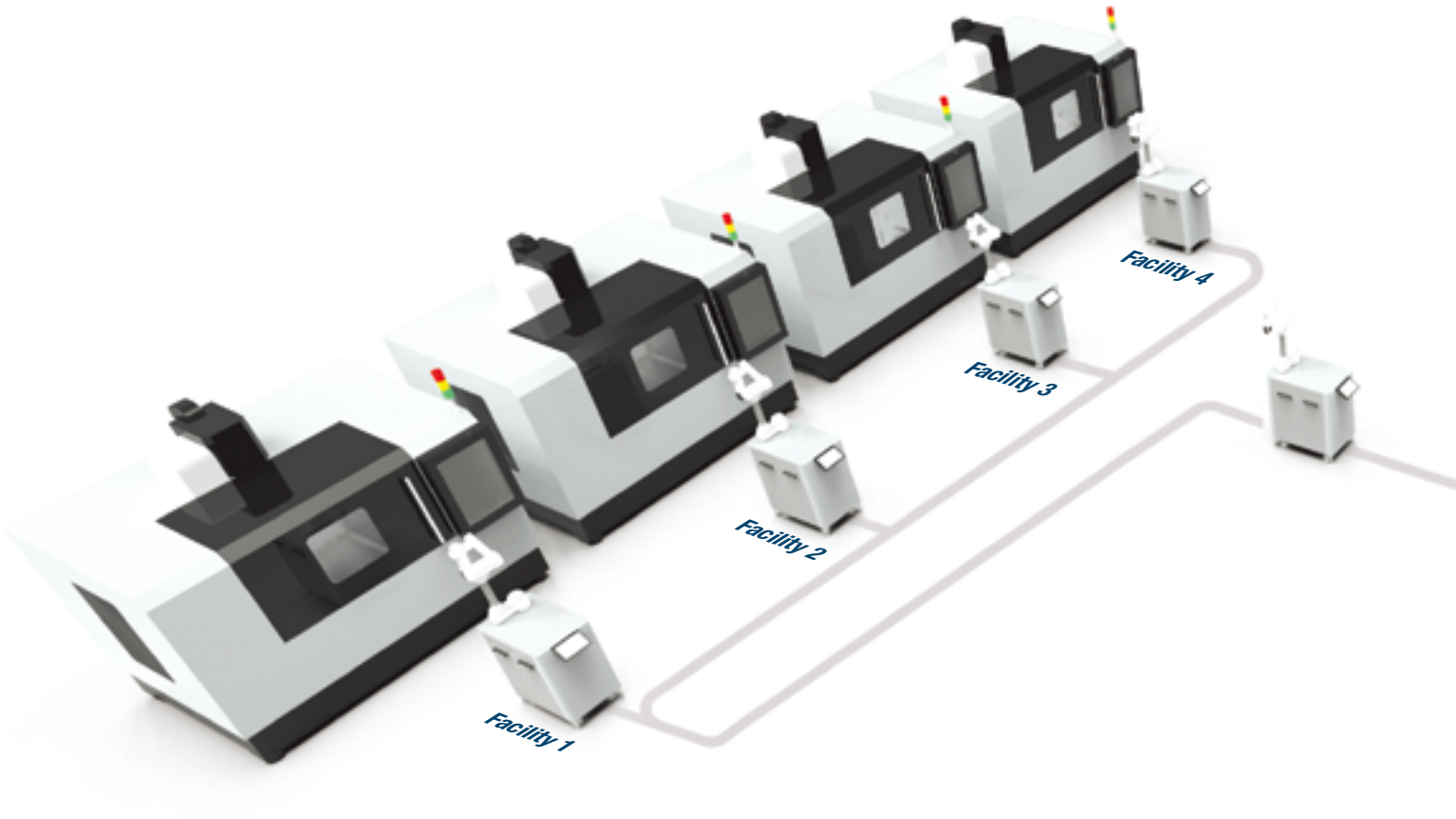


Pull stud bolt

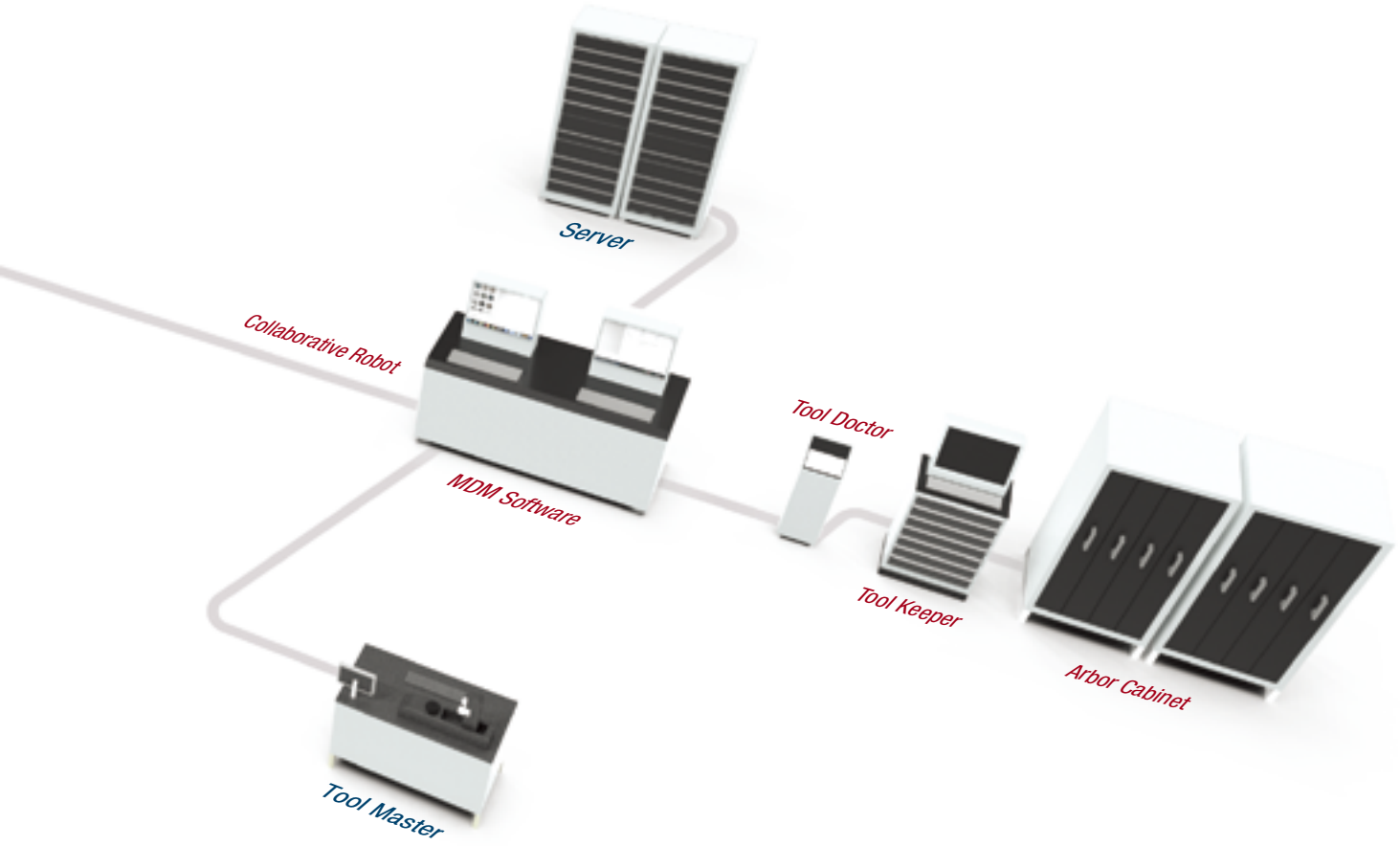
PSB



Smart Factory Solution Map



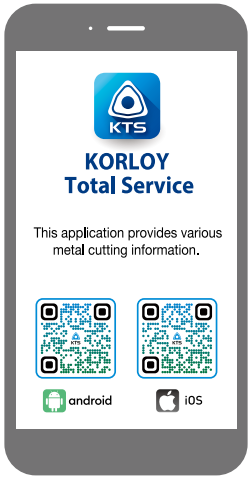
Collaborative Robot	Tool Master (Tool pre-setter)	MDM (Tool management S/W)
• Optimal for repeated work in small place • Effective on works with heavy weight materials	• Measuring the offset of tool length in advance • Reduced tool setting time and downtime	• Managing the tool holder information → Cutting diameter, overall length, storage location • Integrated management of tool, production, CAM, etc.



Tool Doctor (Monitoring system)	Tool Keeper (Tool management equipment)	Arbor Cabinet (Storage box exclusive for Arbors)
• Managing poor quality product manufacturing in mass production → Tool breakage, unprocessed item check, and re-processing • Managing tool life trends	• Managing tool releases day and night • Systemic management of stock and inventory backup order • Transparent tool usage results management	• Enhancing space efficiency and protecting tools (from damage or pollution of tools due to debris of work sites) • Capable for running virtual warehouse with Tool Keeper (Managing position and quantity of tools)

⚠ For the safe metalcutting

- Use safety supplies such as protective gloves to prevent possible injury while touching the edge of tools.
- Use safety glasses or safety cover to hedge possible dangers. Inappropriate usage or excessive cutting condition may lead tool's breakage or even the fragment's scattering.
- Clamp the workpiece tightly enough to prevent its movement while its machining.
- Properly manage the tool change phase because the inordinately used tool can be easily broken under the excessive cutting load or severe wear, and it may threat the operator's safety.
- Use safety cover because chips evacuated during cutting are hot and sharp and may cause burns and cuts. To remove chips safely, stop machining, put on protective gloves, and use a hook or other tools.
- Prepare for fire prevention measures as the use of the non-water soluble cutting oil may cause fire.
- Use safety cover and other safety supplies because the spare parts or the tools can be pulled out due to centrifugal force while high speed machining.



KORLOY

Head Office: Holystar B/D, 326, Seocho-daero, Seocho-gu, Seoul, 06633, Republic of Korea
Tel: +82-2-522-3181 Fax: +82-2-522-3184, +82-2-3474-4744 Web: www.korloy.com E-mail: sales.khq@korloy.com

KORLOY AMERICA
620 Maple Avenue, Torrance, CA 90503, USA
Tel : +1-310-782-3800 / +1-888-711-0001 Fax : +1-310-782-3885
E-mail : sales.kai@korloy.com

KORLOY INDIA
Plot No. 415, Sector 8, IMT Manesar, Gurgaon 122051, Haryana, India
Tel : +91-124-4391790 Fax : +91-124-4050032
E-mail : sales.kip@korloy.com

KORLOY TURKIYE
Ziya Gokalp, Mah. Seyit Onbasi Cad. No:36, 3 Kat,
iC Kapi No : 5 Basaksehir/Istanbul, Turkiye
Tel : +90-212-813-8874 E-mail : sales.ktl@korloy.com

KORLOY RUSSIA
115280, Moscow, vn.ter.g. municipal district Danilovsky,
street Masterkova, house 4, premises 1/2
Tel : +7-495-280-1458 Fax : +7-495-280-1459 E-mail : sales.krc@korloy.com

KORLOY UK
Unit B2, Loades Ecoparc, Blackhorse Road, Exhall CV7 9FW
Tel : +44 7931 085478 E-mail : sales.kul@korloy.com

KORLOY EUROPE
Gablonzer Str. 25-27, 61440 Oberursel, Germany
Tel : +49-6171-27783-0 Fax : +49-6171-27783-59
E-mail : sales.keg@korloy.com

KORLOY BRASIL
Av. Aruana 280, conj.12, WLC, Alphaville, Barueri, CEP06460-010, SP, Brasil
Tel : +55-11-4193-3810 Fax : +55-11-4193-5837
E-mail : sales.kbl@korloy.com

KORLOY CHILE
Av. Providencia 1650, Office 1009, 7500027
Providencia–Santiago, Chile
Tel : +56-229-295-490 E-mail : sales.kcs@korloy.com

KORLOY MEXICO
Avenida de las Ciencias, No. 3015, Interior 406, Juriquilla Santa Fe,
C.P.76230 Querétaro, Mexico
Tel : +52-442-193-3600 E-mail : sales.kml@korloy.com

KORLOY FACTORY INDIA
Plot NO. 415, Sector 8, IMT Manesar, Gurgaon 122051, Haryana, India
Tel : +91-124-4391790 Fax : +91-124-4050032
E-mail : pro.kim@korloy.com

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