Technical Information **KORLOY**

AEROSPACE INDUSTRY



KORLOY

1
Engine Part

Turbine Case

- Ni-based Superalloy -



Turbine Spool

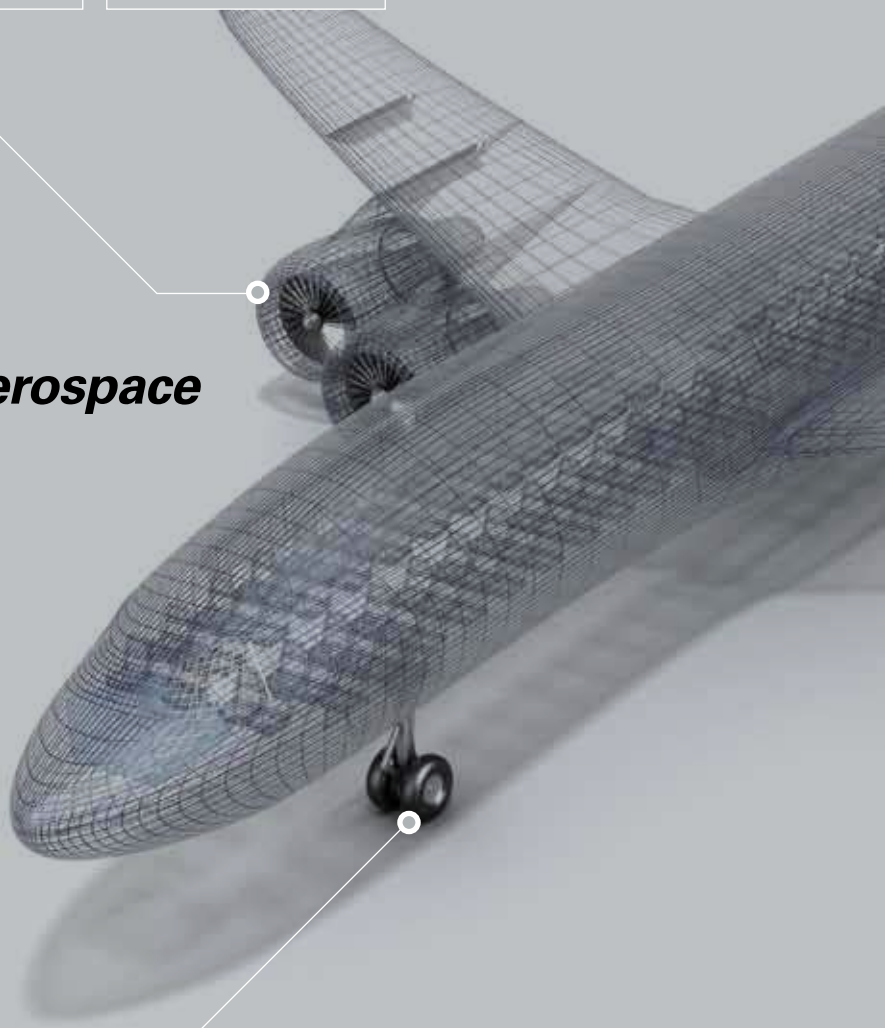
- Ni-based Superalloy -



Turbine Disk

- Ni-based Superalloy -





Parts of Aerospace

2
Landing Part

Landing Gear

- Titanium alloy -



Turbine Shaft

- Ni-based Superalloy -



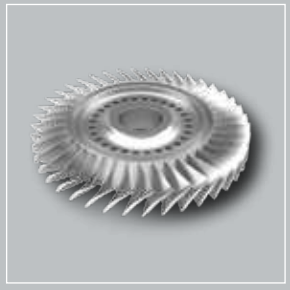
Disk

- Ni-based Superalloy -



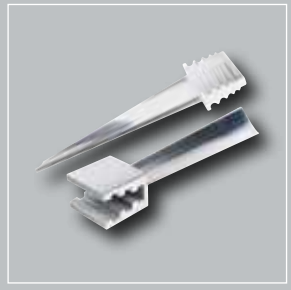
Blisk

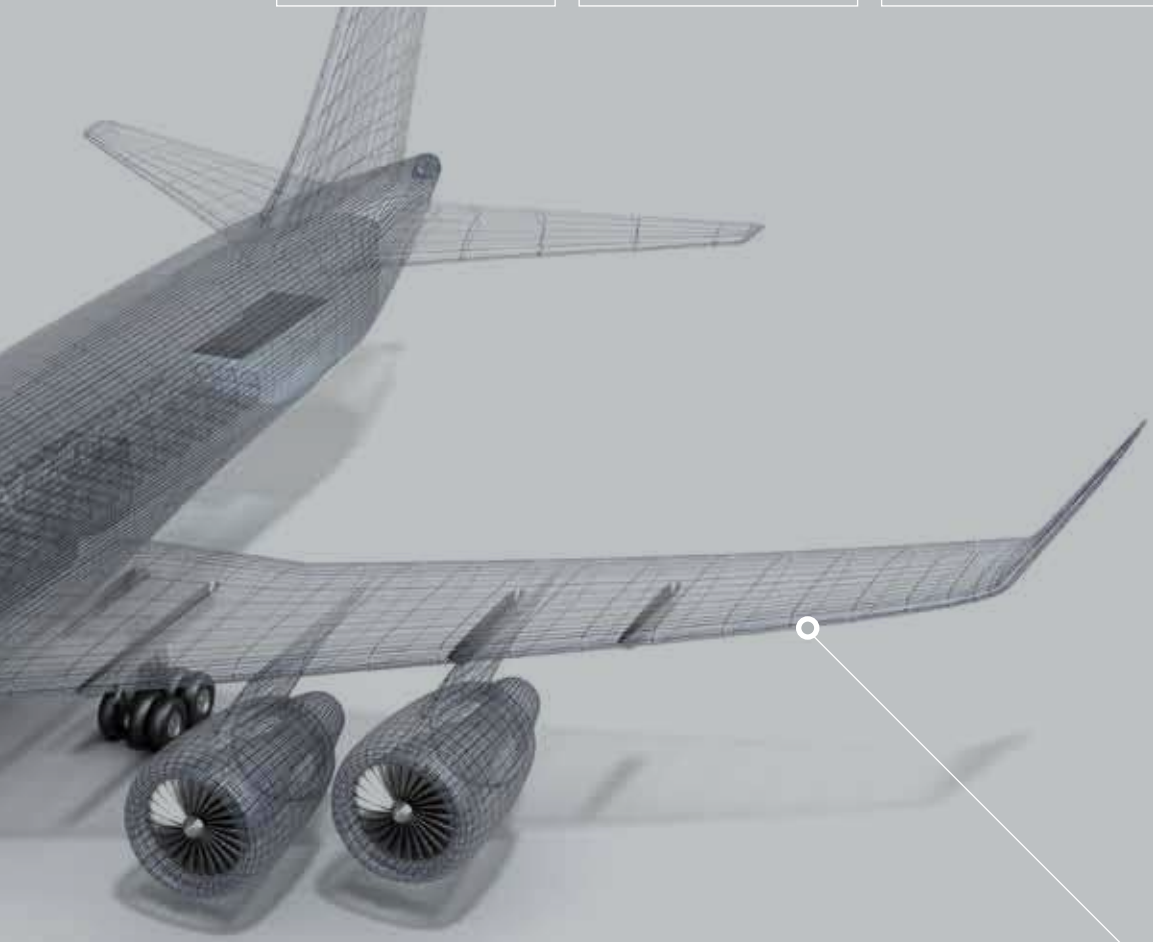
- Ni-based Superalloy -



Turbine Blade

- Titanium alloy -





3 Wing Part

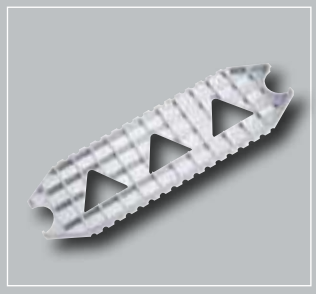
Wing Tail

- Aluminum alloy -



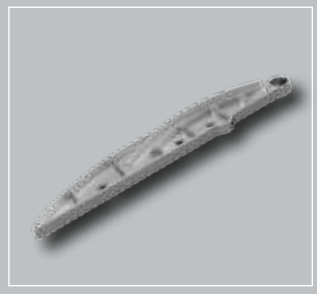
Wing Rib

- Aluminum alloy -



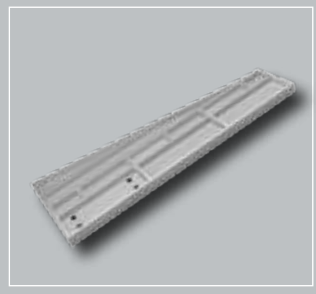
Flap Track

- Titanium alloy -



Wing Tail_CFRP

- Titanium alloy -



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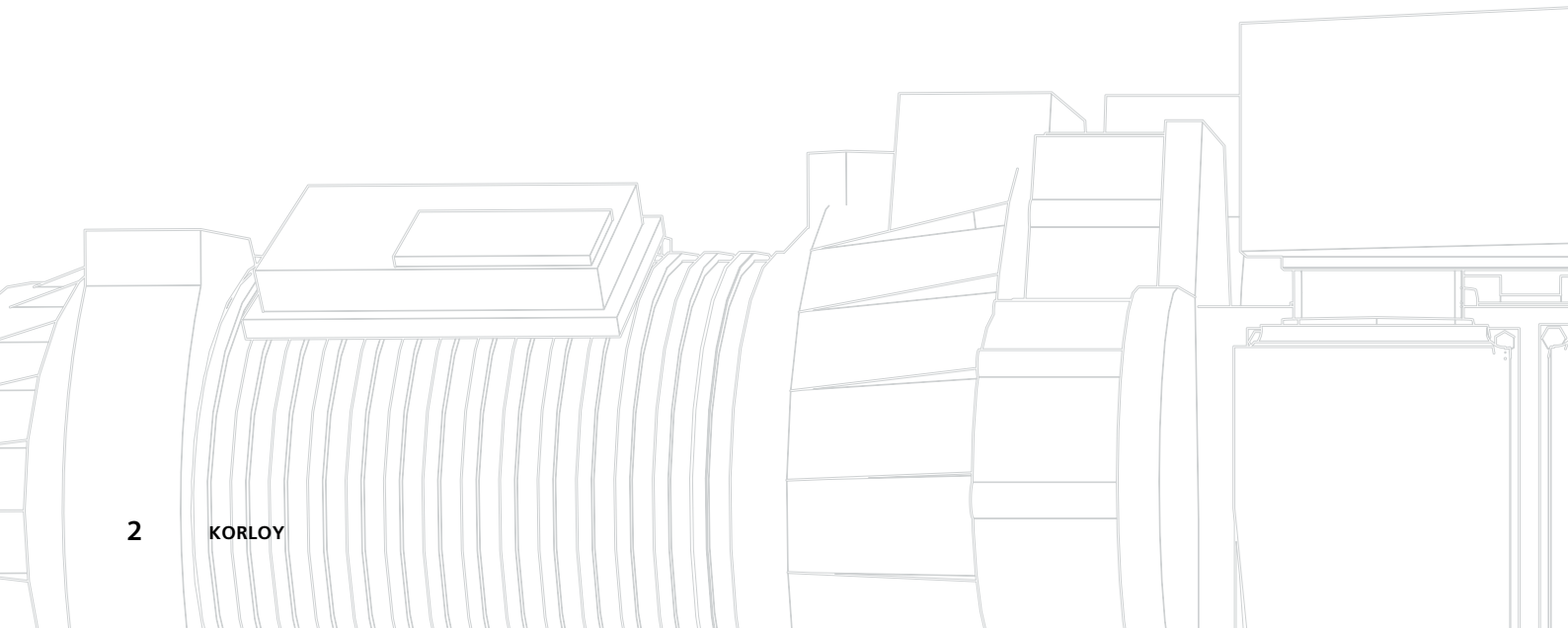

AEROSPACE INDUSTRY

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AEROSPACE INDUSTRY

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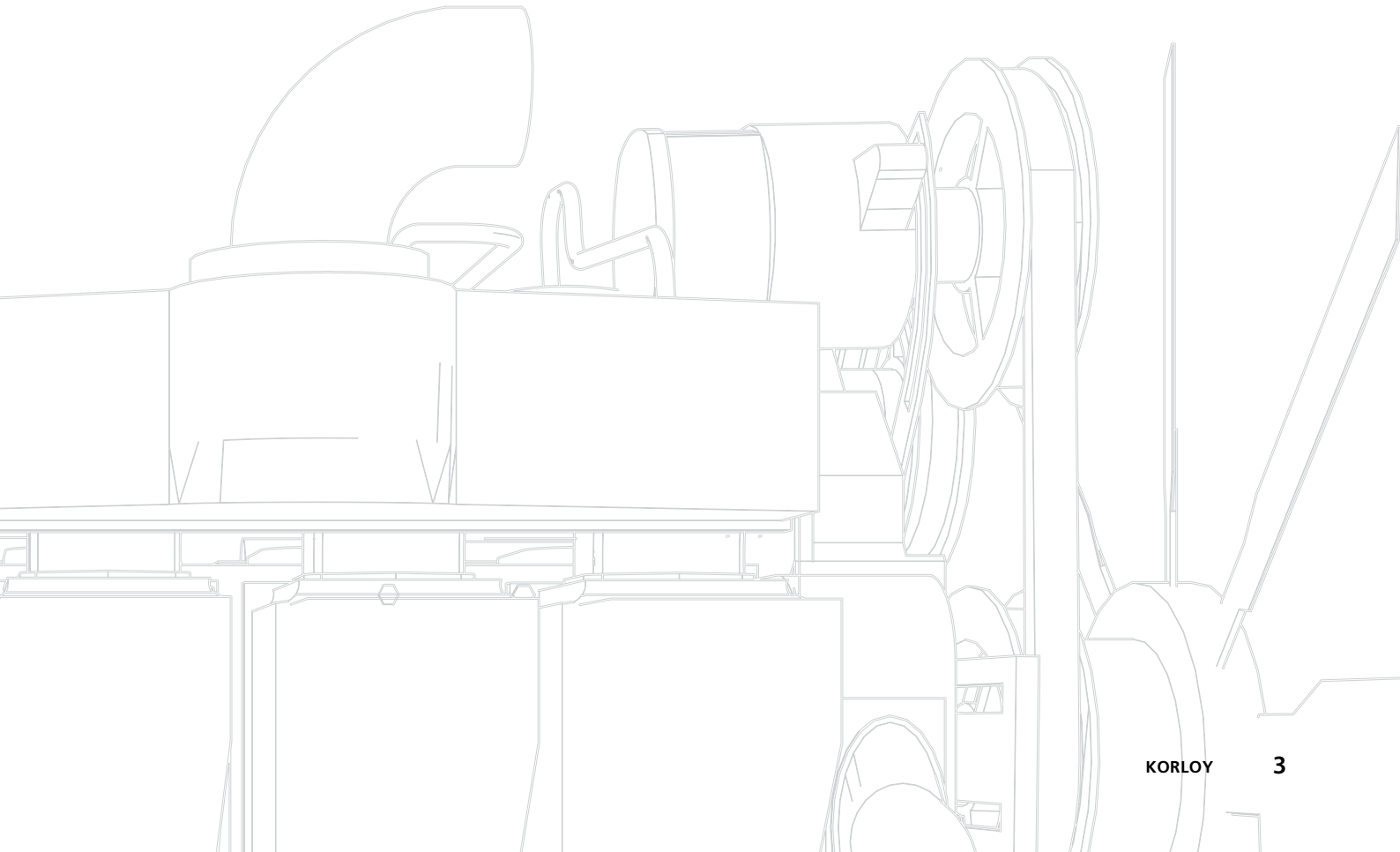




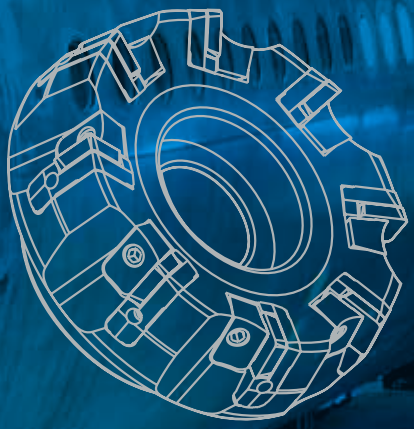
AEROSPACE INDUSTRY

Part 1

AEROSPACE INDUSTRY

Part 1

Aerospace Structural Components and Applicable Tools



1 Engine Part

2 Landing Part

3 Wing Part

01 Alpha Mill

Application: Boss end facing
Insert: **APMT1604PDER-ML**
Holder: **AMCM3063HS**

Application Example: P.32~38
Recommended cutting conditions: P.75~77
Product Details: P.117~123



Aerospace Industry

1 Turbine Case

(Ni-based Superalloy)

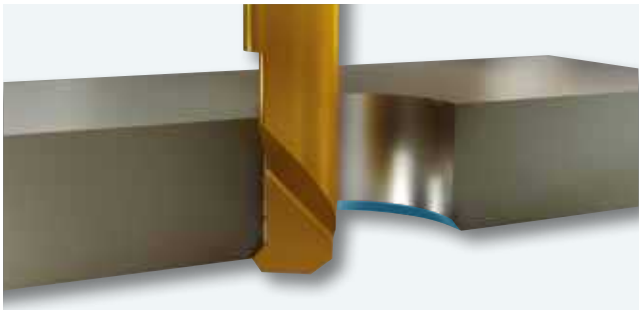




02 Mach Drill Plus

Application: Side face hole making
Drill: **MSDPH080-3S**

Product Details: P.182~186



03 MSB Tool

Application: Small hole chamfering
Insert: **MBFR0620**
Holder: **SL1606**

Product Details: P.109~111



< Single Edge type > *< Twin Edge type >*



04 Solid Endmill

Application: Side face hole making
Endmill: **VFE4100-075**

Recommended cutting conditions: P.89
Product Details: P.197~198

05 KGT Holder

Application: Outside diameter turning for turbine case
Insert: **KGMN400-08-T**
Holder: **KGEHL2525-4-T20**

Application Example: P.41
Recommended cutting conditions: P.68~69
Product Details: P.112~113



< KGMN type >





06 Special Boring Bar

Application: Hole boring
Insert: **TPGT080204L-FW**
Holder: **BT50-MD32F-110**
(FBH3233N+FBB33N)



01 KGT Holder

Application: Spool grooving
Insert: **KGMN400-08-T**
Holder: **KGIVR4032-4**

Recommended cutting conditions: P.68~69
Product Details: P.112~113

Aerospace Industry

2 Turbine Disk / Spool

(Ni-based Superalloy)



02 Solid Endmill

Application: Spool grooving
Endmill: **VFE4100-075**

Application Example: P.41
Recommended cutting conditions: P.89
Product Details: P.197~198

03 Mach Drill Plus

Application: Core hole making
Drill: **MSDPH080-3S**

Product Details: P.182~186

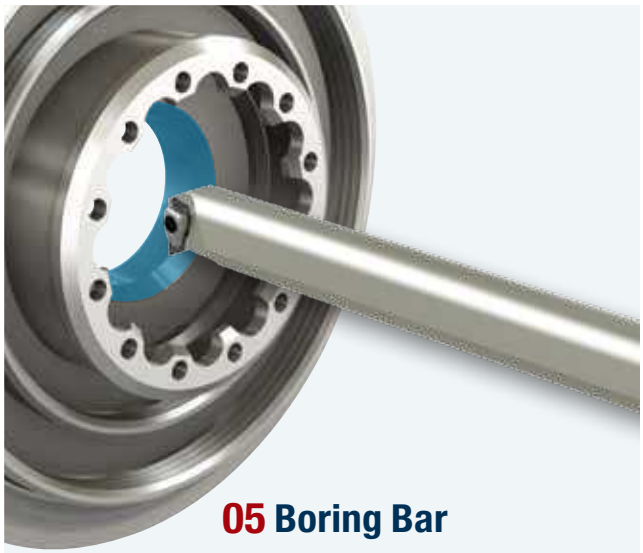




04 KGT Holder

Application: Disk ring seat grooving
Insert: **KGMN400-08-T**
Holder: **KGEHR2525-4-T20**

Recommended cutting conditions: P.68~69
Product Details: P.112~113



05 Boring Bar

Application: Disk inside diameter turning
Insert: **DNMG150608-VP4**
Holder: **S40T-DDUNR-15N**

Recommended cutting conditions: P.71~72
Product Details: P.106~108





06 KGT Holder

Application: Spool grooving
Insert: **KGMN400-04-T**
Holder: **KGFHR425-60/120-T20**

Recommended cutting conditions: P.68~69
Product Details: P.112~113



01 Lever Lock System Holder

Application: Shaft outside diameter turning
Insert: **RNMG1906M0-VP4**
Holder: **PRDNN3232-P19**

Application Example: P.40
Recommended cutting conditions: P.71~72
Product Details: P.94~105

< RNMG type >

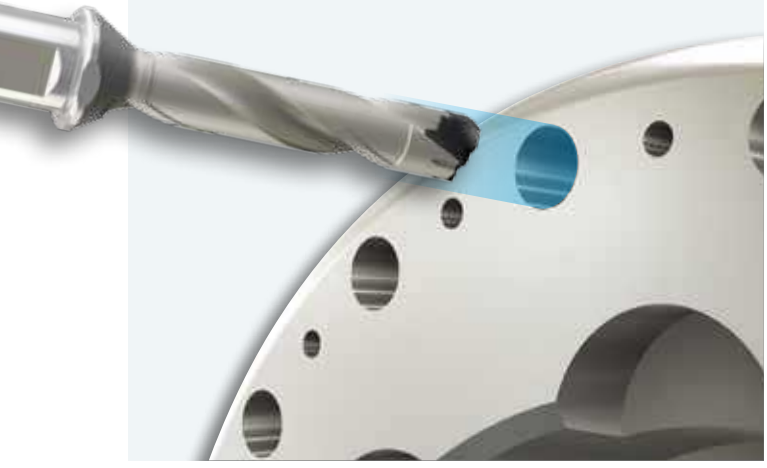
Aerospace Industry

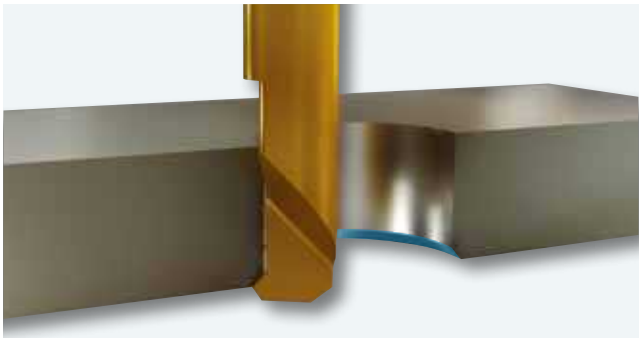
3 Turbine Shaft

(Ni-based Superalloy)

02 Exchangeable Drill

Application: Shaft hole making
Insert: **TPD1200CP**
Holder: **TPDC5D-12016-60**





03 MSB Tool

Application: Small hole chamfering
Insert: **MBFR0620**
Holder: **SL1606**

Product Details: P.109~111



< Single Edge type >



< Twin Edge type >



04 Lever Lock System Holder

Application: Shaft outside diameter turning
Insert: **CNMG190608-VP4**
Holder: **PCLNR3232-P19N**

Recommended cutting conditions: P.71~72
Product Details: P.94~105

05 Straight Reamer

Application: Hole making
Reamer: **TMRS120**





AEROSPACE INDUSTRY



06 Solid Endmill

Application: Shaft hole side milling
Endmill: **VFE4100-075**

Recommended cutting conditions: P.89
Product Details: P.197~198





01 Double Clamp System Holder

Application: Disk outside diameter turning
Insert: **VNMG160408-VP3**
Holder: **DVJNR2525-M16**

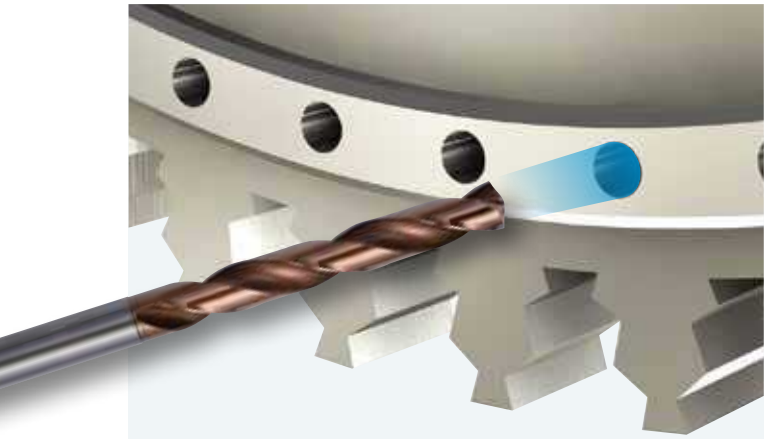
Recommended cutting conditions: P.71~72
Product Details: P.94~105

Aerospace Industry

4

Disk

(Ni-based Superalloy)



02 Mach Drill Plus

Application: Core hole making
Drill: **MSDPH080-3S**

Product Details: P.182~186

03 Boring Bar

Application: Disk inside diameter turning
Insert: **DNMG150608-VP4**
Holder: **S40T-DDUNR-15N**

Recommended cutting conditions: P.71~72
Product Details: P.106~108



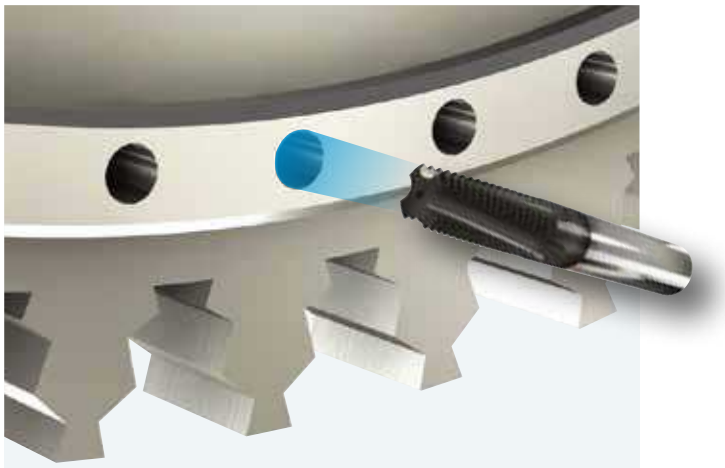


04 Indexable Drill

Application: Disk hole making
Insert: SPMT07T208-PD
XOMT07T205-PD
Holder: K4D-20025-07

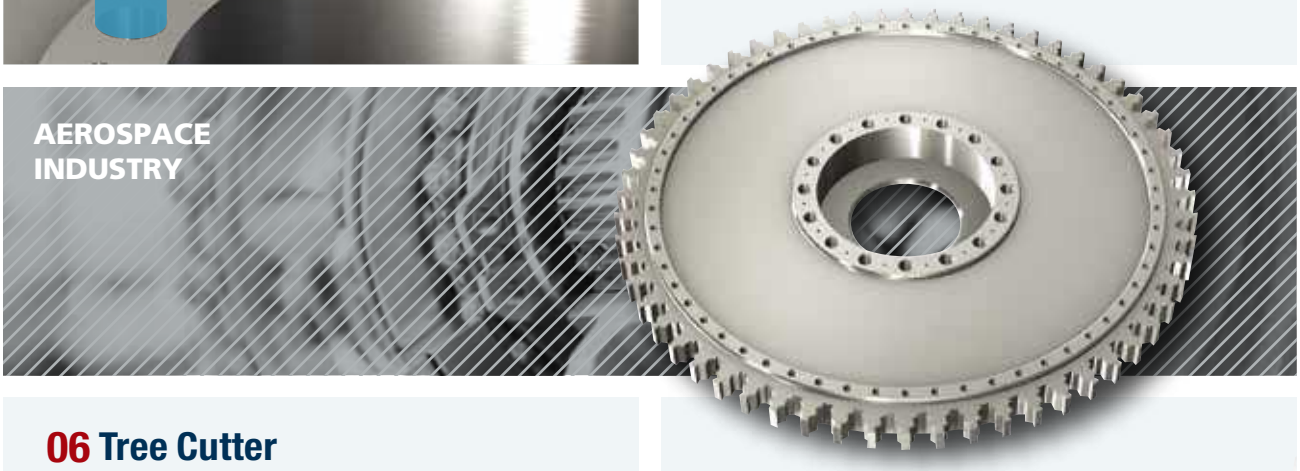
- Application Example: P.39
- Recommended cutting conditions: P.82~85
- Product Details: P.178~181





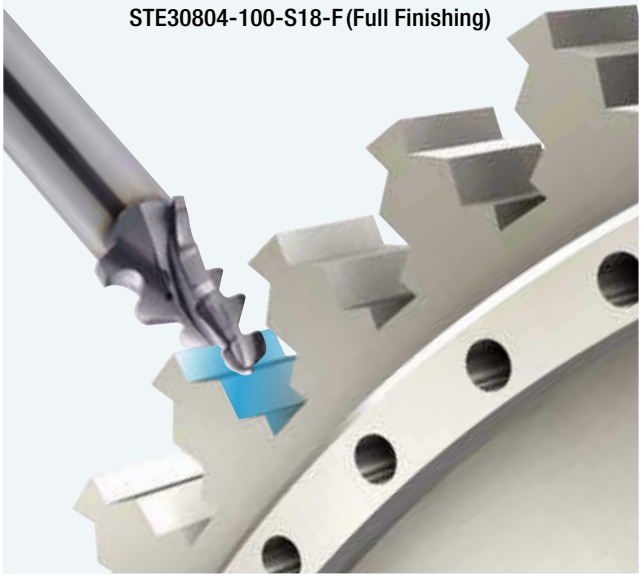
05 TM Solid

Application: Hole making for side face clamping bolt
TM: STMHC10085L20-I1.25ISO



06 Tree Cutter

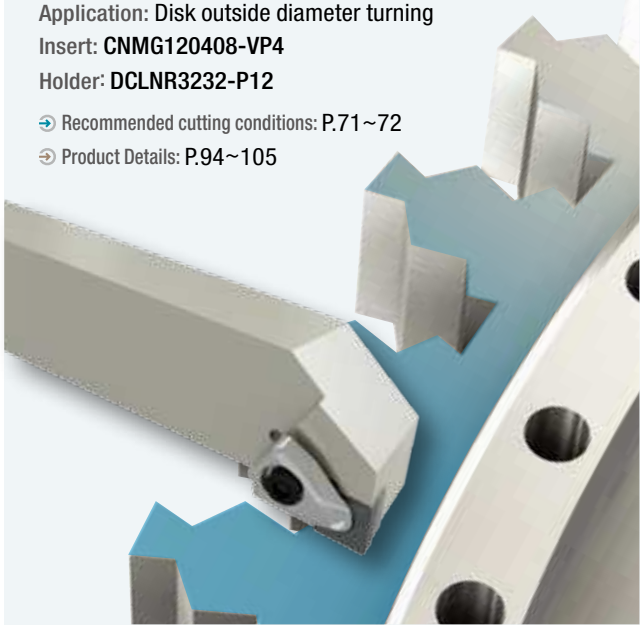
Application: Slotting - Roughing, Semi-Finishing, Finishing
Endmill: STE3040-080-T26S12-R (Taper Roughing)
STE3040-080-S18-R (Semi-Finishing)
STE30804-100-S18-F (Full Finishing)



07 Double Clamp System Holder

Application: Disk outside diameter turning
Insert: CNMG120408-VP4
Holder: DCLNR3232-P12

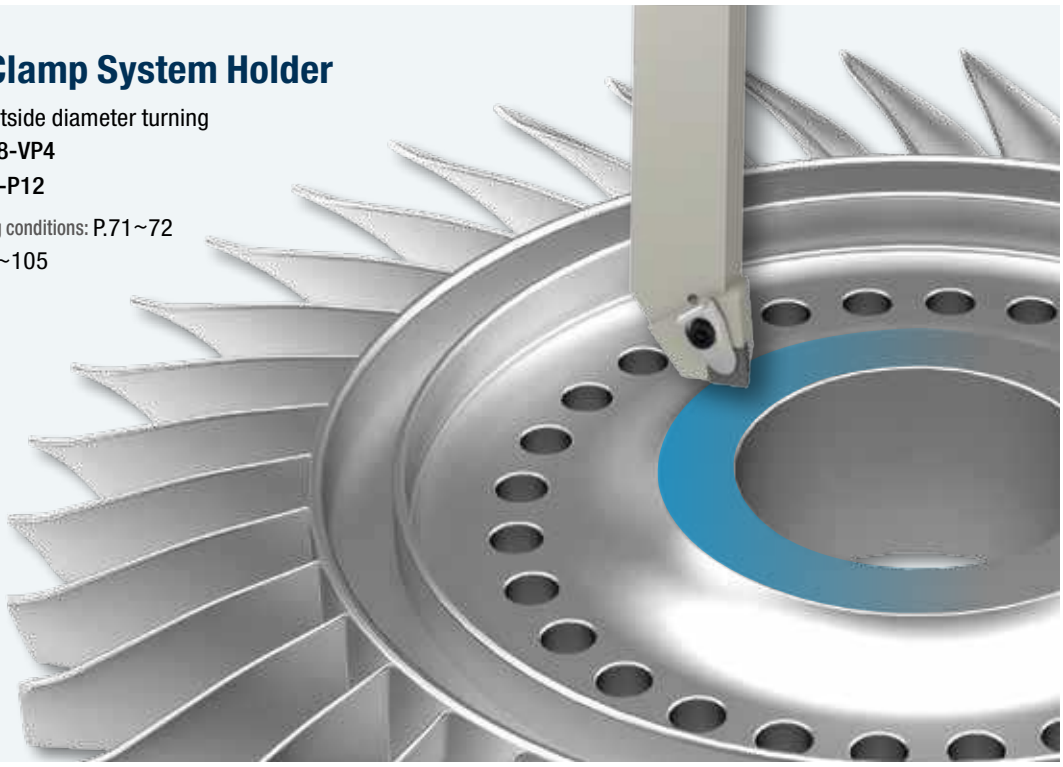
- Recommended cutting conditions: P.71~72
- Product Details: P.94~105



01 Double Clamp System Holder

Application: Blisk outside diameter turning
Insert: **CNMG120408-VP4**
Holder: **DCLNR3232-P12**

Recommended cutting conditions: P.71~72
Product Details: P.94~105



Aerospace Industry

5

Blisk

(Ni-based Superalloy)



02 HFM (High Feed Mill)

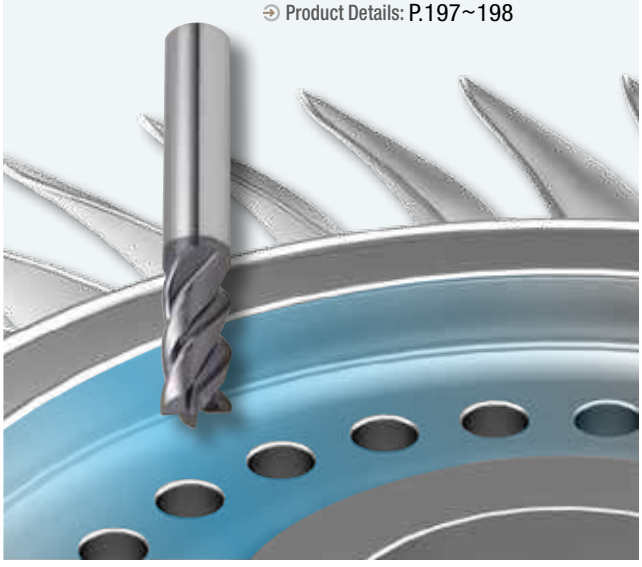
Application: Blisk wing pocket milling
Insert: **LPMT040210R-MF**
Holder: **HFMS1016HR-4S16**

Recommended cutting conditions: P.75~76
Product Details: P.153~156

03 Solid Endmill

Application: Blisk side milling
Endmill: **VFE4100-075**

Recommended cutting conditions: P.89
Product Details: P.197~198

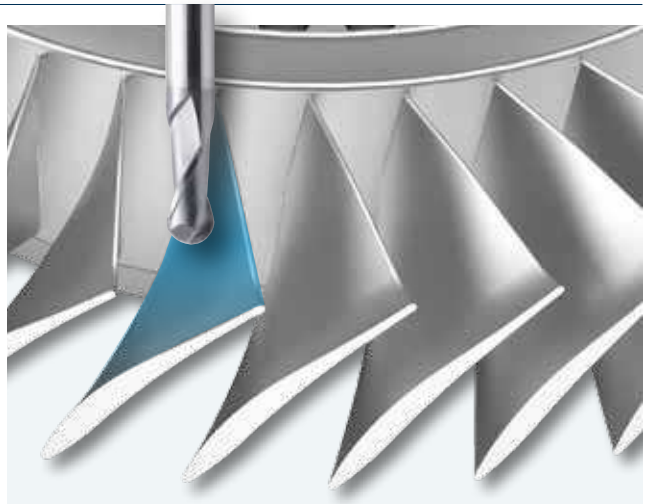




04 Mach Drill Plus

Application: Blisk hole making
Drill: **MSDPH080-3S**

Product Details: P.182~186



05 Solid Ball Endmill

Application: Blisk wing milling
Endmill: **ZBE2100-100**

Recommended cutting conditions: P.88
Product Details: P.199~200





06 KGT Holder

Application: Blisk end facing
Insert: **KGMN400-04-T**
Holder: **KGFHR425-112/200-T20**

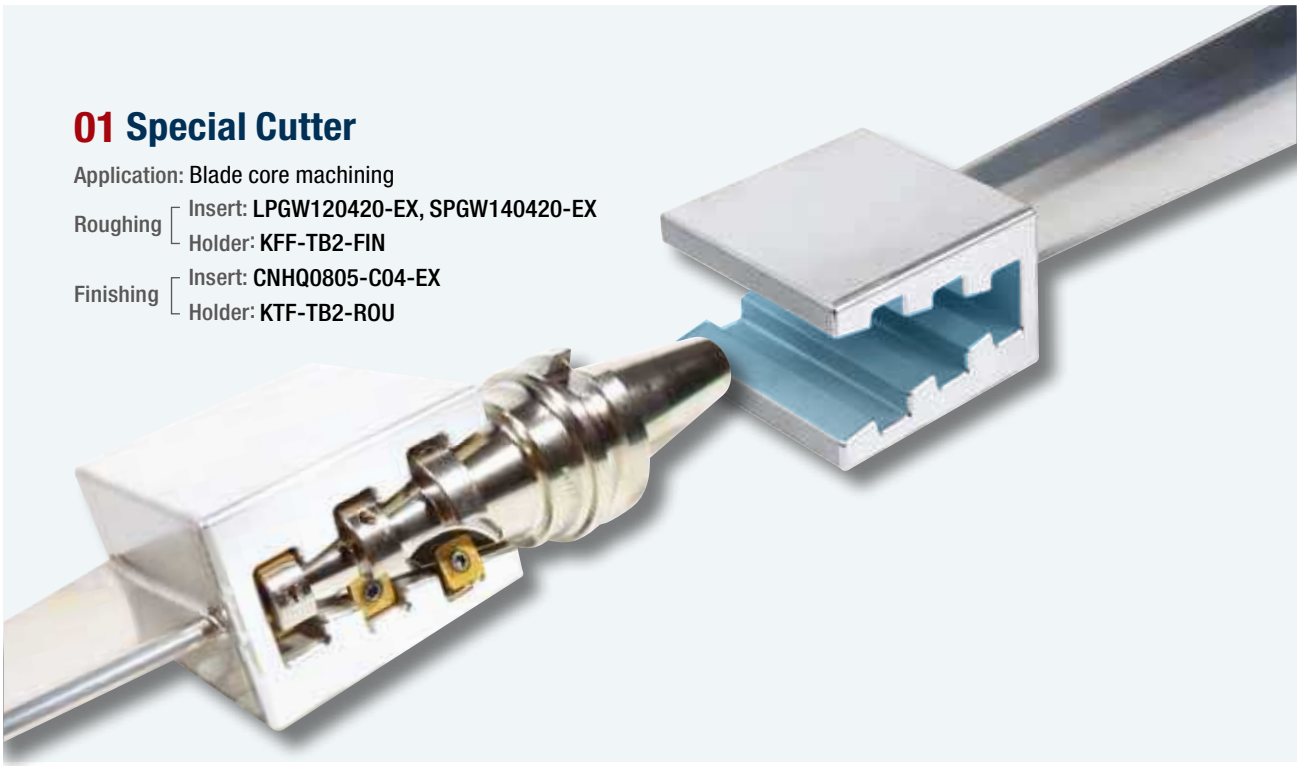
Recommended cutting conditions: P.68~69
Product Details: P.112~113

01 Special Cutter

Application: Blade core machining

Roughing
- Insert: **LPGW120420-EX, SPGW140420-EX**
- Holder: **KFF-TB2-FIN**

Finishing
- Insert: **CNHQ0805-C04-EX**
- Holder: **KTF-TB2-ROU**



Aerospace Industry

6 Turbine Blade

(Titanium alloy)

02 FMR P-Positive

Application: Blade facing

Insert: **RPET1204M0E-ML**

Holder: **FMRS4033HRP-3M32**

- Application Example: P.31
- Recommended cutting conditions: P.73~74
- Product Details: P.138~146

03 Indexable Ball Endmill

Application: Blade facing

Insert: **ZDMT130416R-MM**
SDMT090308R-MM

Holder: **BRE32R-M**

- Recommended cutting conditions: P.73~74
- Product Details: P.157~160



04 Special Cutter

Application: Blade core machining

Roughing
- Insert: LPGW120420-EX, SPGW140420-EX
- Holder: KFF-TB2-FIN

Finishing
- Insert: CNHQ0805-C04-EX
- Holder: KTF-TB2-ROU



05 Mach Drill Plus

Application: Blade core hole making

Drill: MSDPH080-3S

Product Details: P.182~186





06 Solid Ball Endmill

Application: Blade facing

Endmill: ZBE2100-100

Recommended cutting conditions: P.88
Product Details: P.199~200





01 HSK/BT Tooling System

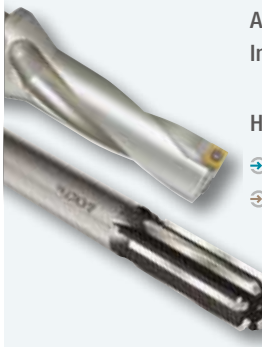
Application: Landing gear side milling
Insert: **APMT1604PDER-ML**
Holder: **BT50-AM3063057-4**

- Application Example: P.47~49
- Recommended cutting conditions: P.73~74
- Product Details: P.117~123

Aerospace Industry

7 Landing Gear

(Titanium alloy)



02 Indexable Drill

Application: Landing gear hole making
Insert: **SPMT040204-PD**
XOMT040204-PD
Holder: **K3D-12020-04**

- Recommended cutting conditions: P.82~85
- Product Details: P.178~181

03 Straight Reamer

Application: Hole making
Reamer: **TMRS120**

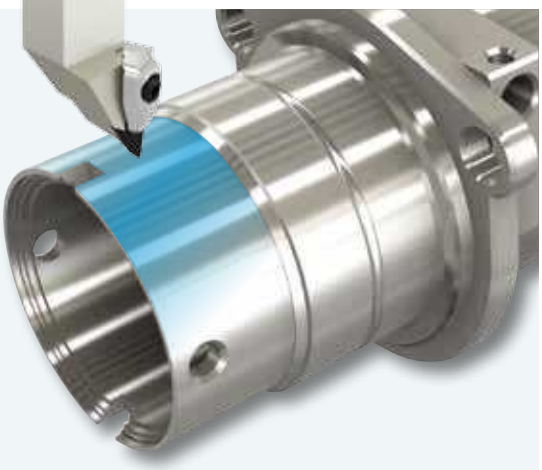




04 Lever Lock System Holder

Application: Landing gear turning
Insert: **CNMG160608-VP3**
Holder: **PCLNR2525-M16**

- Recommended cutting conditions: P.70
- Product Details: P.94~105



05 Double Clamp System Holder

Application: Landing gear turning
Insert: **VNMG160408-VP3**
Holder: **DVJNR2525-M16**

Recommended cutting conditions: P.70
Product Details: P.94~105

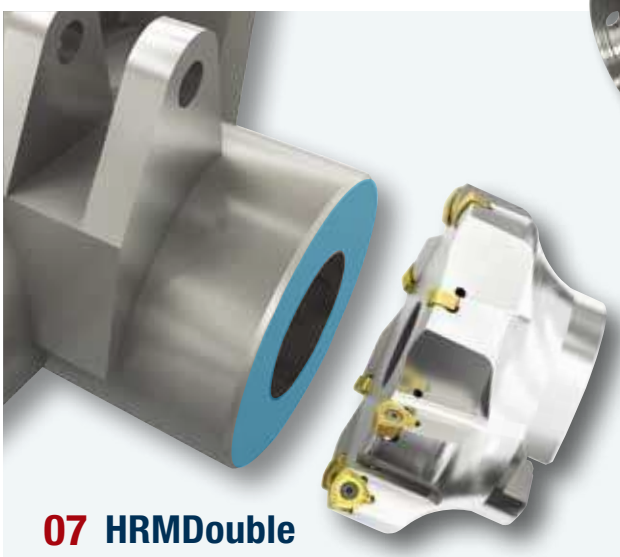
06 Boring bar

Application: Landing gear inside diameter turning
Insert: **CNMG120408-VP3**
Holder: **A32S-PCLNR-12N**

Recommended cutting conditions: P.70
Product Details: P.106~108







07 HRMDouble

Application: Landing gear boss end milling
Insert: **WNMX130520ZNN-ML**
Holder: **HRMDCM13100HR-7**

Recommended cutting conditions: P.73~74
Product Details: P.147~152

08 Special Boring Bar

Application: Hole boring
Insert: **TPGT080204L-FW**
Holder: **BT50-MD32F-110**
(FBH3233N+FBB33N)





01 Brazed Spiral Long Endmill

Application: Wing rib pocket side milling
Endmill: **ZSEAL220**

02 Pro-XL Mill

Application: Ramping & Facing - Roughing
Insert: **LDET650550PPFR-MA**
Holder: **BT50-PXL04090HR-2F**

Aerospace Industry

8

Wing Rib / Tail

(Aluminum alloy)



03 Pro-V Mill

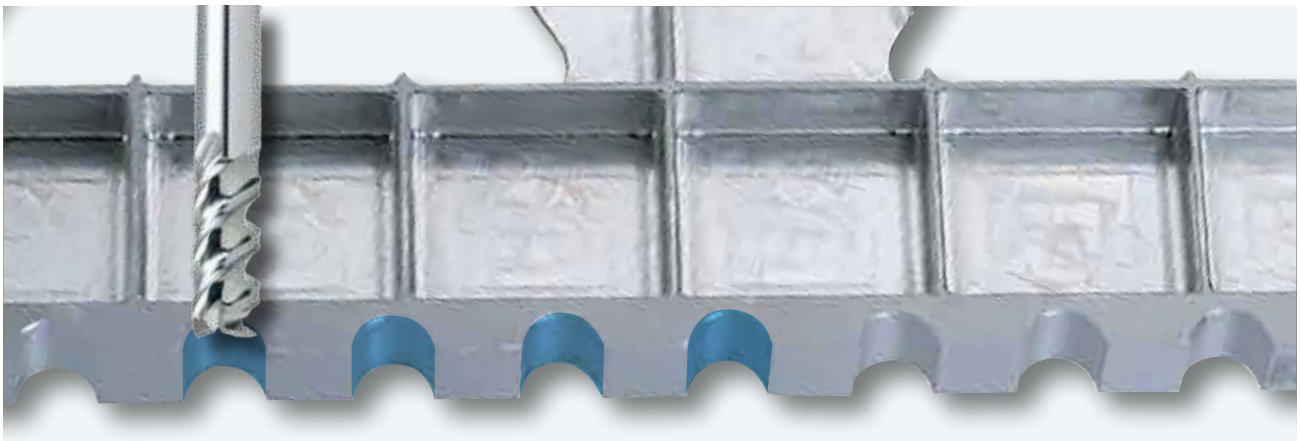
Application: Shouldering - Roughing
Insert: **XDET190508PEFR-MA**
Holder: **PAVCM050R-22-4-XD19-A**



04 Mach Drill Plus

Application: Blisk hole making
Drill: **MSDPH080-3N/ND**

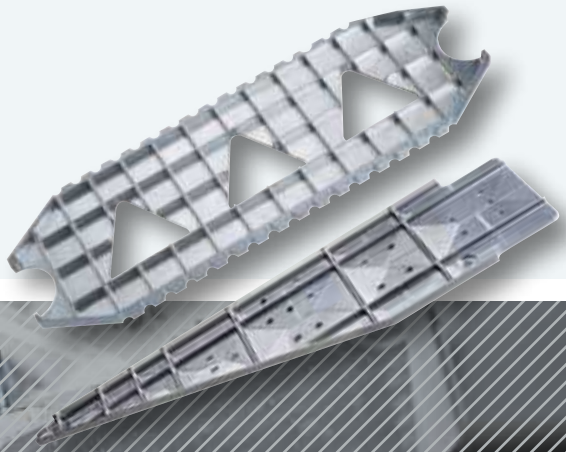
Recommended cutting conditions: P.86~87
Product Details: P.182~186



05 Solid Endmill

Application: Wing rib side face milling
Endmill: **APFE3100-075**

Recommended cutting conditions: P.90
Product Details: P.195~196





06 Solid Endmill

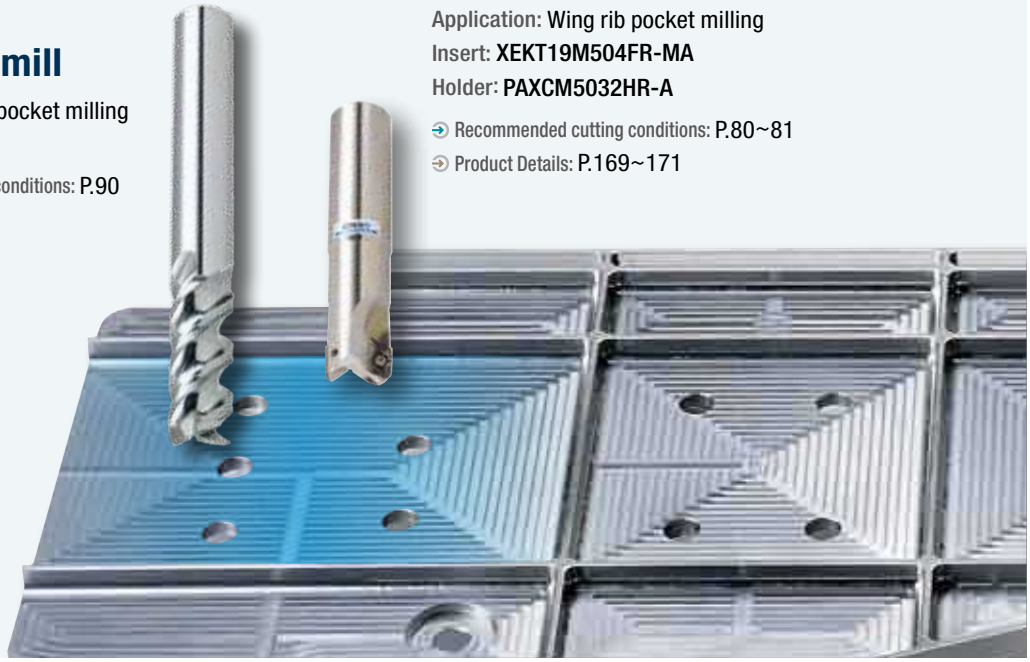
Application: Wing rib pocket milling
Endmill: **SSREA3100**

Recommended cutting conditions: P.90

07 Pro-X Mill

Application: Wing rib pocket milling
Insert: **XEKT19M504FR-MA**
Holder: **PAXCM5032HR-A**

Recommended cutting conditions: P.80~81
Product Details: P.169~171



01 Indexable Drill

Application: Flap track hole making
Insert: **SPMT050204-PD**
XOMT050204-PD
Holder: **K3D-16020-05**

Recommended cutting conditions: P.82~85
Product Details: P.178~181



Aerospace Industry

9 Flap Track

(Titanium alloy)

02 Indexable Drill

Application: Flap track hole making
Insert: **SPMT11T308-PD**
XOMT11T306-PD
Holder: **K3D-30032-11**

Recommended cutting conditions: P.82~85
Product Details: P.178~181

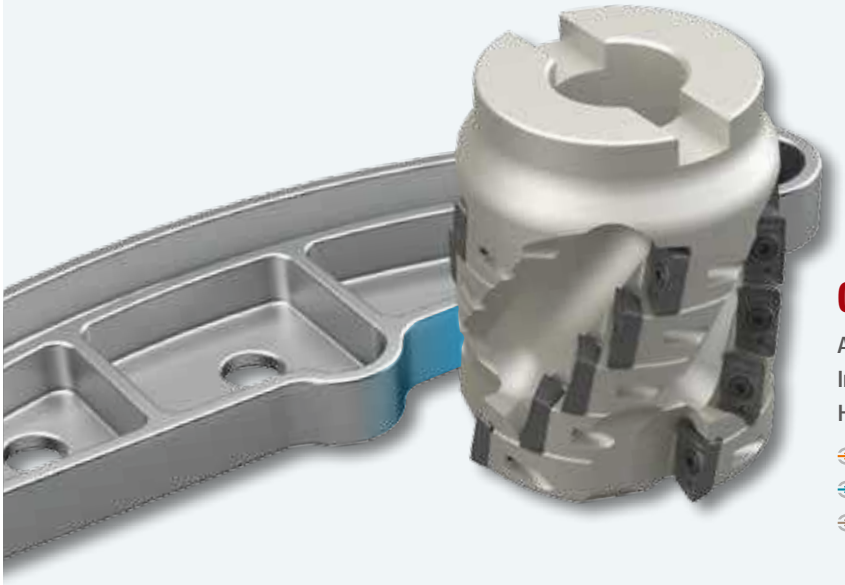


03 Solid Endmill

Application: Flap track pocket milling
Endmill: **VFE4100-075**

Recommended cutting conditions: P.89
Product Details: P.197~198





04 Alpha Mill

Application: Flap track wall side milling
Insert: **APMT1604PDER-ML**
Holder: **AMCM3080M**

- Application Example: P.47~49
- Recommended cutting conditions: P.73~74
- Product Details: P.117~123

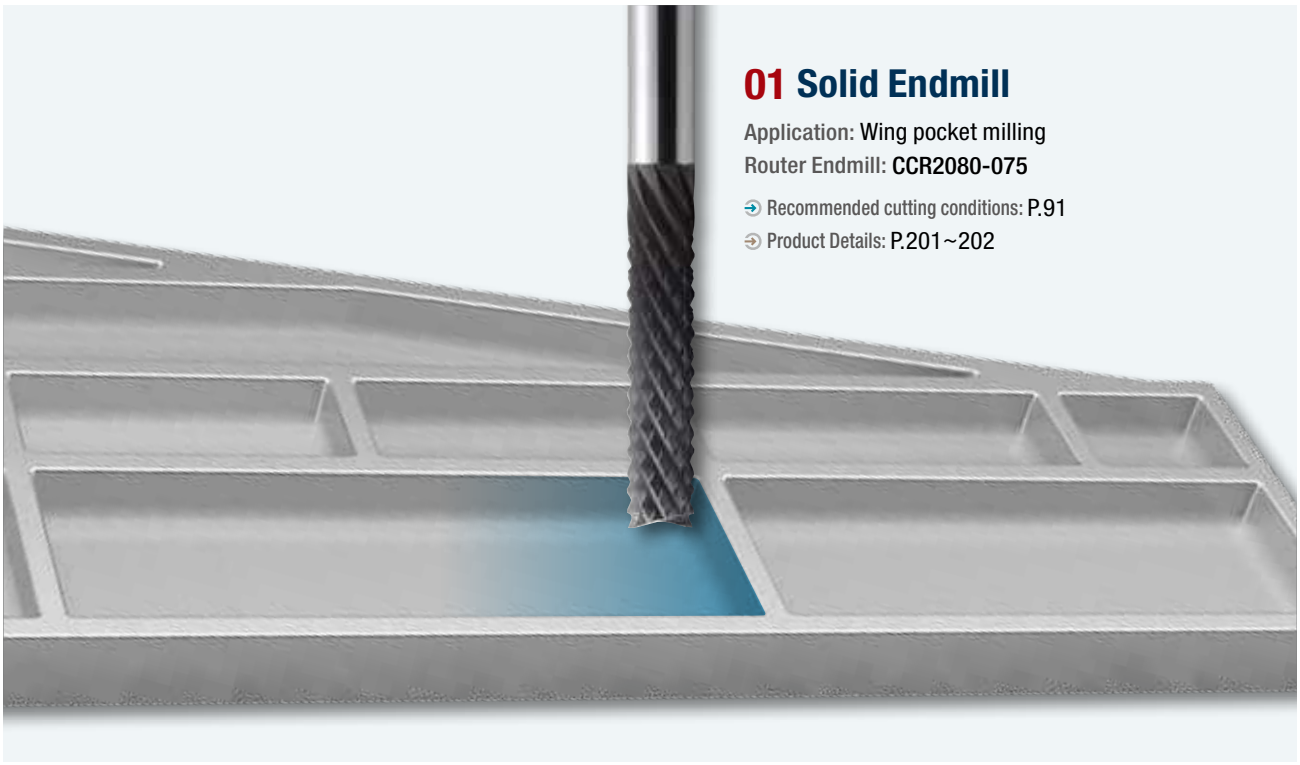


05 Rich Mill

Application: Flap track top facing
Insert: **XNKT080508PNER-ML**
Holder: **RM3PCM4080HR-M**

- Recommended cutting conditions: P.73~74
- Product Details: P.124~126





01 Solid Endmill

Application: Wing pocket milling
Router Endmill: **CCR2080-075**

Recommended cutting conditions: P.91
Product Details: P.201~202

Aerospace Industry

10 CFRP Wing Tail

(Carbon Fiber Reinforced Plastic)



02 Solid Endmill

Application: Wing pocket side milling
Dual-Helix Router Endmill: **CCDR6100-085**

Recommended cutting conditions: P.91
Product Details: P.201~202

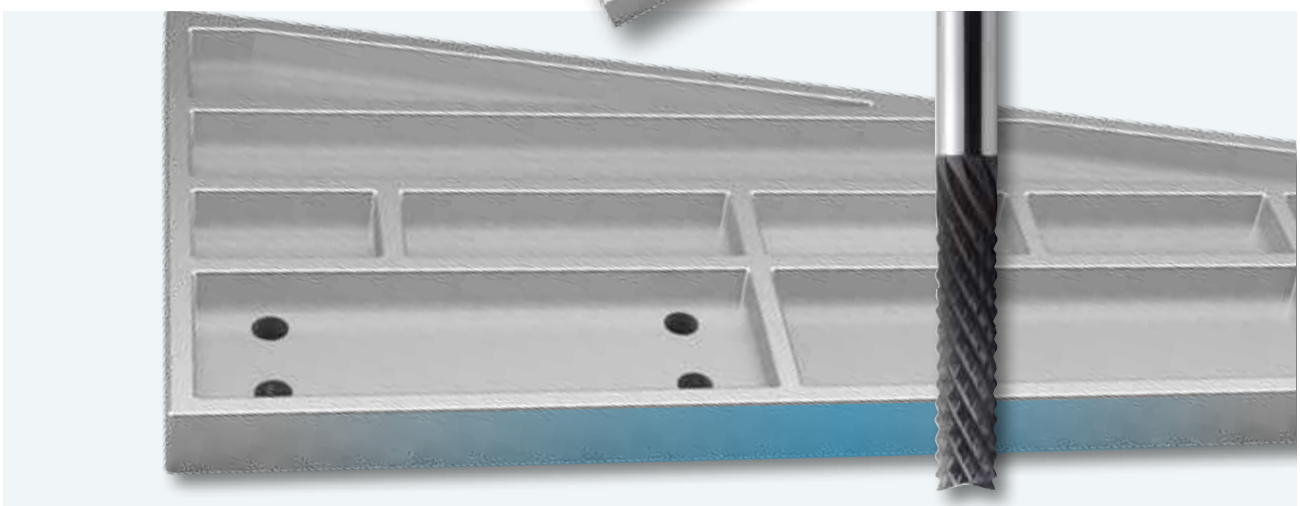


03 Mach Drill Plus

Application: Wing pocket hole making
CFRP Drill: **MSDPH080-3C**

Product Details: P.187~189





04 Solid Endmill

Application: Wing pocket milling
Router Endmill: **CCR2080-075**

Recommended cutting conditions: P.91
Product Details: P.201~202



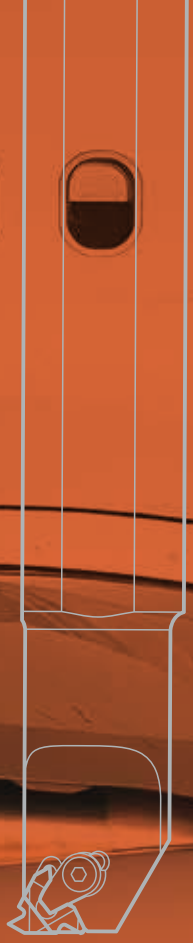
AEROSPACE INDUSTRY

Part 2

AEROSPACE INDUSTRY

Part 2

Application Examples for Each Aerospace Component



1 Application Examples for Engine Parts

2 Application Examples for Wing Parts

3 Application Examples for Landing Gear

4 Application Examples for Heat Resistant Alloy

5 Technical Information for Machining Hard-to-Cut Materials

Part 2

01

Application Examples for Engine Parts

Turbine Case & Turbine Blade



Turbine Case

Alpha Mill

Application: Application: Boss end facing
Insert: **APMT1604PDER-ML**
Holder: **AMCM3063HS**

- Application Example: P.32~38
- Recommended cutting conditions: P.75~77
- Product Details: P.117~123





FMR P-Positive

Application: Blade facing
Insert: **RPET1204M0E-ML**
Holder: **FMRS4033HRP-3M32**

- Application Example: P.31
- Recommended cutting conditions: P.73~74
- Product Details: P.138~146



Turbine Blade

Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.

In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear per depth of cut. Therefore, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.



FMR P-positive

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear per depth of cut. Therefore, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

The high cutting forces and thermal shock from milling Inconel creates excessive wear, chipping, and fracture. We recommend using our PC5300 grade which has excellent wear and thermal resistance.
For shanks type, use the feed rate (fz) under 0.3mm/tooth to make sure stable machining, for its smaller machining diameters often result in chipping.

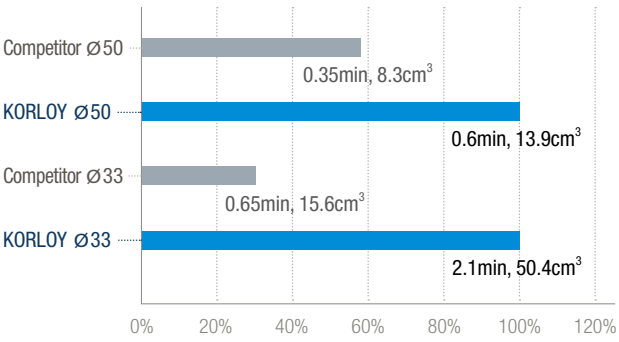
Results of tool wear

M0S1-PC5300	Competitor
	
 After machining 15.6cm^3	 After machining 15.6cm^3

Cutting conditions

		FMRS4033HRP-3L32 (Ø33, 3teeth, 250L)	FMRCM4050HRP-4 (Ø50, 4teeth, 250L)
Applied tool			
Insert		RPMW1204M0S1	RPMW1204M0S1
Grade		PC5300	PC5300
Workpiece		Inconel 718 (HRC38~40)	Inconel 718 (HRC38~40)
Cutting speed		vc = 40 (m/min)	vc = 40 (m/min)
Feed		fz = 0.3 (mm/t)	fz = 0.6 (mm/t)
Depth of cut		ap = 1 (mm), ae = 20 (mm)	ap = 1 (mm), ae = 20 (mm)
Cutting fluid	Type	Wet, Internal + External coolant supply	Wet, Internal + External coolant supply
	Pressure	30bar	30bar
	Concentration	6~8%	6~8%

[Tool life]



FMR P-positive

Work Material

KS - Ti-6Al-4V / JIS - Ti6400 / AISI - UNS-R56400 / DIN - WS 3.7164

Workpiece



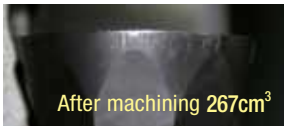
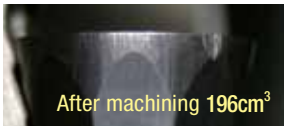
Material Property and Machining Solution

The titanium properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~50m/min, feed rate of 0.3~0.5mm/tooth)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut.Therefore, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

The high cutting forces and thermal shock from milling titanium creates excessive wear, chipping, and fracture. We recommend using our PC5300 grade which has excellent wear and thermal resistance.
RPET-ML shows higher resistance to wear and chipping compared to RPMT-MF. The evaluation results were obtained after gradually increasing the speed from 40m/min to 60m/min, the feed rate from 0.3mm/tooth to 0.5 mm/tooth.

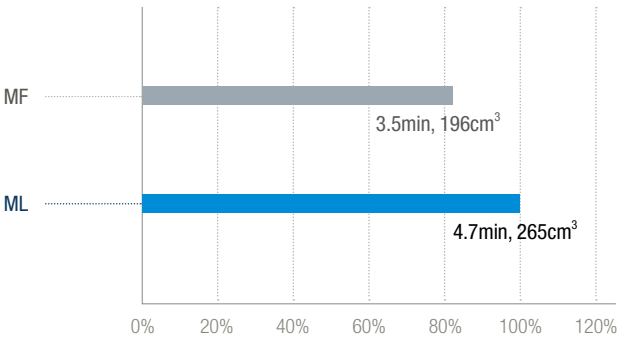
Results of tool wear

RPET-ML	RPMT-MF
	
 After machining 267cm^3	 After machining 196cm^3

Cutting conditions

Applied tool		**FMRCM4050HRP-5** (Ø50, 5teeth)
Insert		RPMT1204M0E-MF, RPET1204M0E-ML
Grade		PC5300
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Ti-6Al-4V (HRC45~47)
Cutting speed		vc = 60 (m/min)
Feed		fz = 0.5 (mm/t)
Depth of cut		ap = 1.7 (mm), ae = 35 (mm)
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]

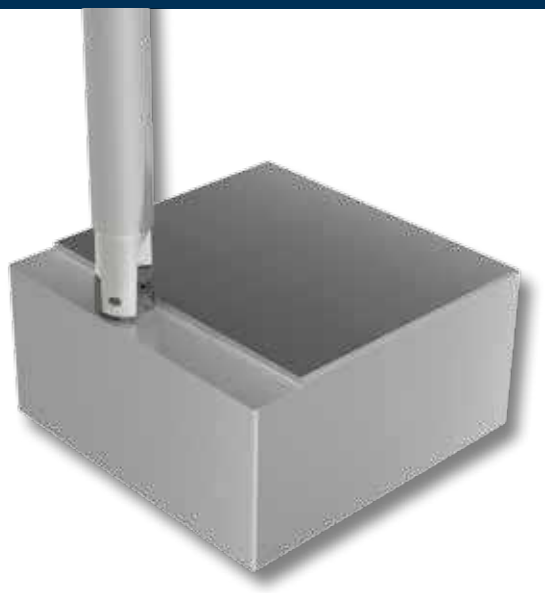


Alpha Mill

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

Shouldering Inconel at high depth of cuts over ae = 0.3D accompanies excessive wear, chipping and fracture due to high cutting force and thermal shock caused during machining. We recommend our MM chip breaker combined with our PC5300 grade.

Results of tool wear

MM-PC5300



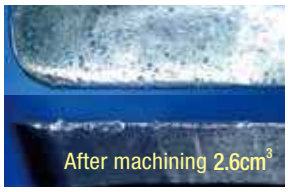
MM-PC5400



ML-PC5300



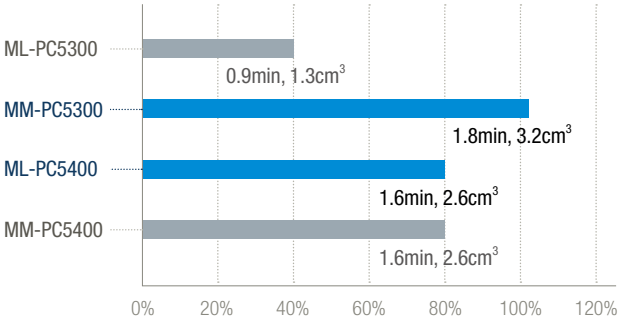
ML-PC5400



Cutting conditions

Applied tool		AMS2016HS
Insert		APMT11T3PDER-ML APMT11T3PDSR-MM
Grade		PC5300, PC5400
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 60 (m/min) High speed
Feed		fz = 0.06 (mm/t)
Depth of cut		ap = 2.0 (mm), ae = 5.0 (mm) High depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]

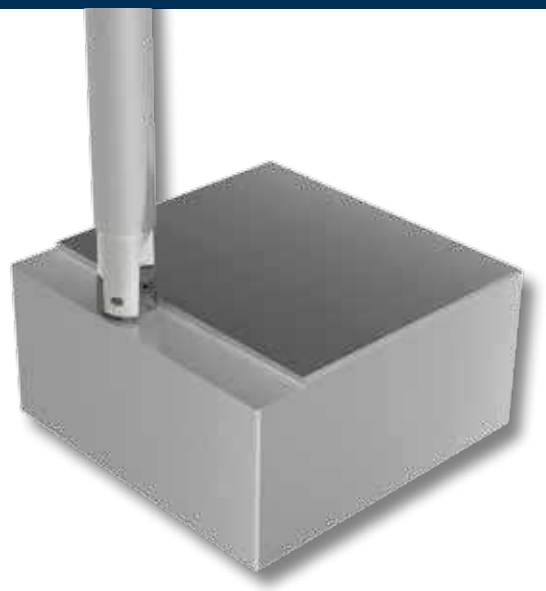


Alpha Mill

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

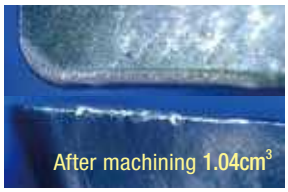
Shouldering Inconel at low depth of cuts under ae = 0.3D accompanies excessive wear, chipping and fracture due to high cutting force and thermal shock caused during machining. We recommend our MM chip breaker combined with our PC5300 grade. Or the combination of the high rake chip breaker ML and the tough grade PC5400 would be another option.

Results of tool wear

MM-PC5300



MM-PC5400



ML-PC5300



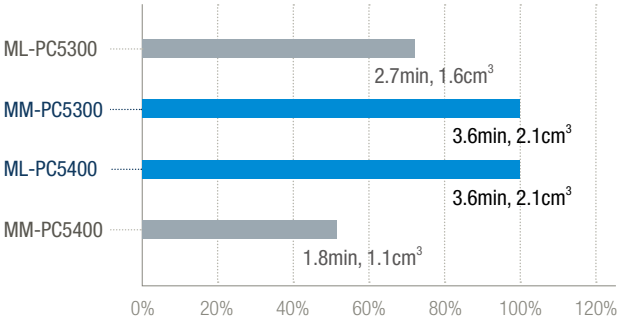
ML-PC5400



Cutting conditions

Applied tool		AMS2016HS
Insert		APMT11T3PDER-ML APMT11T3PDSR-MM
Grade		PC5300, PC5400
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 60 (m/min) High speed
Feed		fz = 0.06 (mm/t)
Depth of cut		ap = 2.0 (mm), ae = 5.0 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]

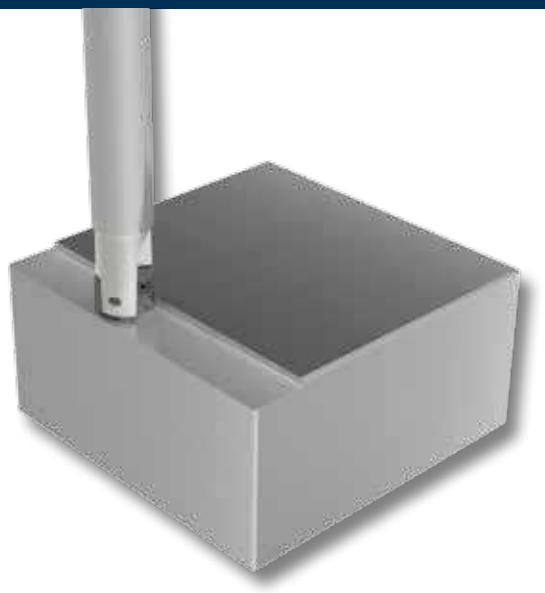


Alpha Mill

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



Material Property and Machining Solution

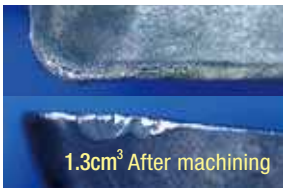
The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

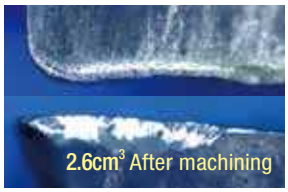
Shouldering Inconel at low speeds and high depth of cuts over ae = 0.3D accompanies less wear but frequent chipping and fracture due to built-up edge, thermal shock and work hardening. We recommend the high rake chip breaker ML + the tough grade PC5400.

Results of tool wear

MM-PC5300



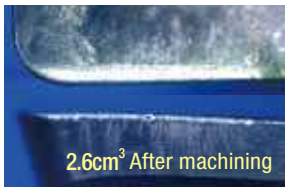
MM-PC5400



ML-PC5300



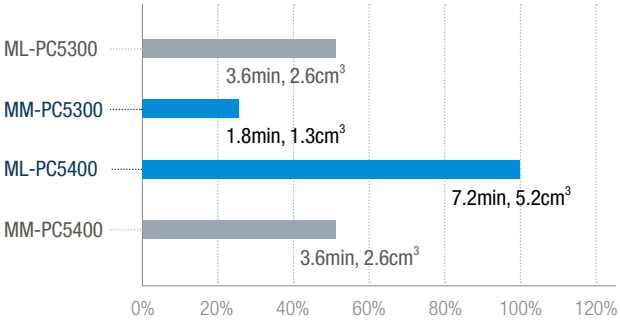
ML-PC5400



Cutting conditions

Applied tool		AMS2016HS
Insert		APMT11T3PDER-ML APMT11T3PDSR-MM
Grade		PC5300, PC5400
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Inconel 718 (H_RC38~40)
Cutting speed		vc = 30 (m/min) Low speed
Feed		fz = 0.06 (mm/t)
Depth of cut		ap = 2.0 (mm), ae = 5.0 (mm) High depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]

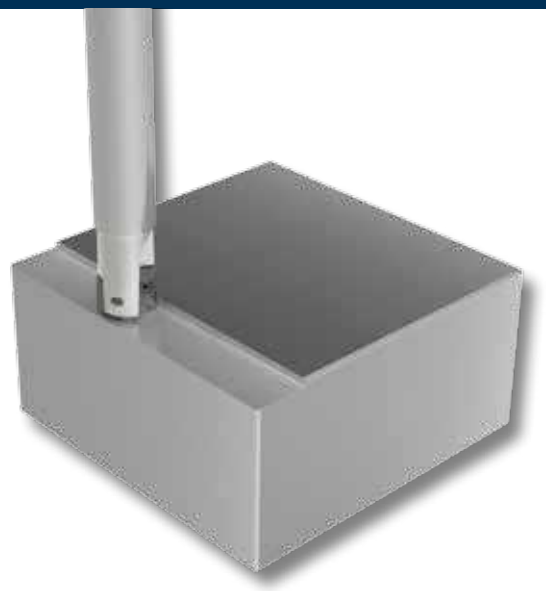


Alpha Mill

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

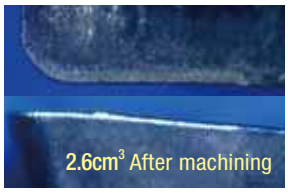
Shouldering Inconel at low speeds and low depth of cuts under ae = 0.3D accompanies less wear but frequent chipping and fracture due to built-up edge, work hardening and interruptions. We recommend the high rake chip breaker ML + the tough grade PC5400.

Results of tool wear

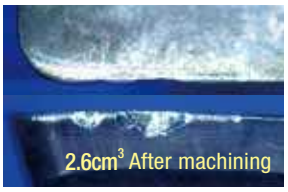
MM-PC5300



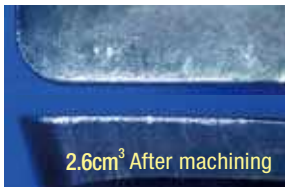
MM-PC5400



ML-PC5300



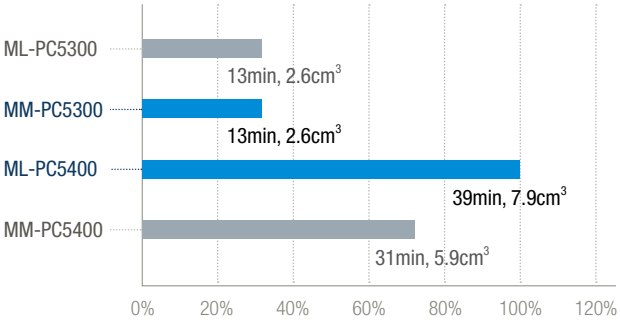
ML-PC5400



Cutting conditions

Applied tool		AMS2016HS
Insert		APMT11T3PDER-ML APMT11T3PDSR-MM
Grade		PC5300, PC5400
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 30 (m/min) Low speed
Feed		fz = 0.06 (mm/t)
Depth of cut		ap = 2.0 (mm), ae = 2.0 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



Alpha Mill

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

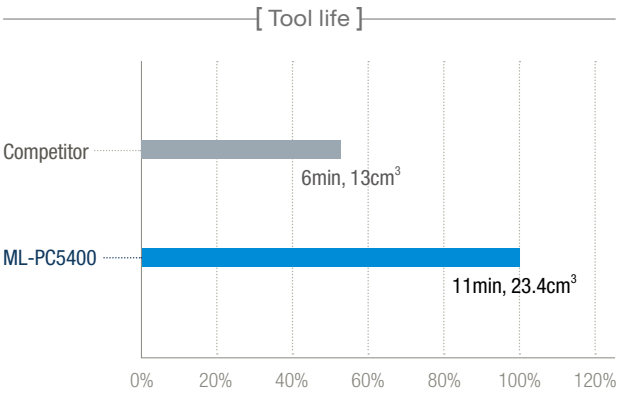
Shouldering Inconel at high speeds and low depth of cuts under ae = 0.3D accompanies excessive wear, chipping and fracture due to high cutting force and interruptions. We recommend the high rake chip breaker ML + the tough grade PC5400.

Results of tool wear

ML-PC5400	Competitor
	
 After machining 13cm^3	 After machining 13cm^3

Cutting conditions

Applied tool		AMS2016HS
Insert		APMT1604PDER-ML
Grade		PC5400
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 60 (m/min) High speed
Feed		fz = 0.06 (mm/t)
Depth of cut		ap = 10.0 (mm), ae = 2.0 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%



Alpha Mill

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



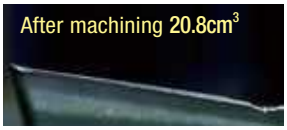
Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

Shouldering Inconel at low speeds and low depth of cuts under ae = 0.3D accompanies less wear but frequent chipping and fracture due to built-up edge, work hardening and interruptions. We recommend the high rake chip breaker ML + the tough grade PC5400.

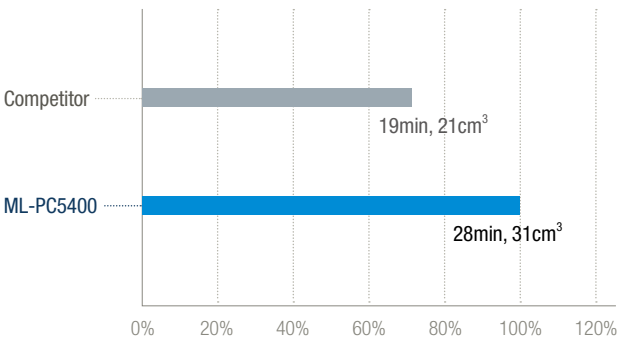
Results of tool wear

ML-PC5400	Competitor
	
	

Cutting conditions

Applied tool		AMS2016HS
Insert		APMT1604PDER-ML
Grade		PC5400
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 30 (m/min) Low speed
Feed		fz = 0.06 (mm/t)
Depth of cut		ap =10.0 (mm), ae = 2.0 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



Alpha Mill

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



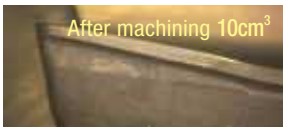
Material Property and Machining Solution

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 30~60m/min)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

Evaluation

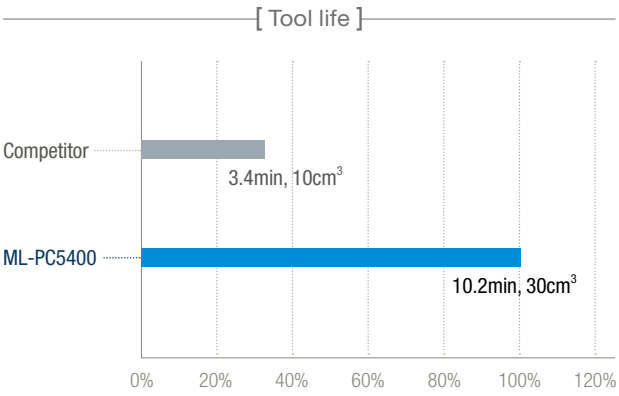
Shouldering Inconel at medium speeds and low depth of cuts under ae = 0.3D accompanies less wear but frequent chipping and fracture due to built-up edge, work hardening and interruptions. We recommend the high rake chip breaker ML + the tough grade PC5400.

Results of tool wear

ML-PC5400	Competitor
	
	

Cutting conditions

Applied tool		AMS3032HS
Insert		APMT1604PDER-ML
Grade		PC5400
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 50 (m/min) Medium speed
Feed		fz = 0.1 (mm/t)
Depth of cut		ap = 10.0 (mm), ae = 2.0 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%



King Drill

Work Material

KS - Ti-6Al-4V / JIS - Ti6400 / AISI - UNS-R56400 / DIN - WS 3.7164

Workpiece



Material Property and Machining Solution

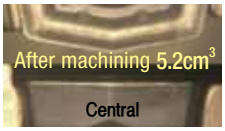
The titanium properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.
(Recommended cutting speed of 40~80m/min, feed rate of 0.06~0.12mm/rev)

Evaluation

Drilling titanium alloy at high speeds over 80m/min accompanies excessive wear, chipping and fracture due to cutting loads. We recommend lowering cutting speed and combine the LD chip breaker which controls chips well at low speed, with the PC5335 grade which has lubricative coatings.

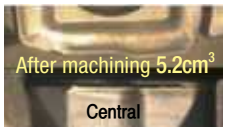
Results of tool wear

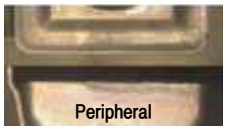
LD-PC5335





Competitor

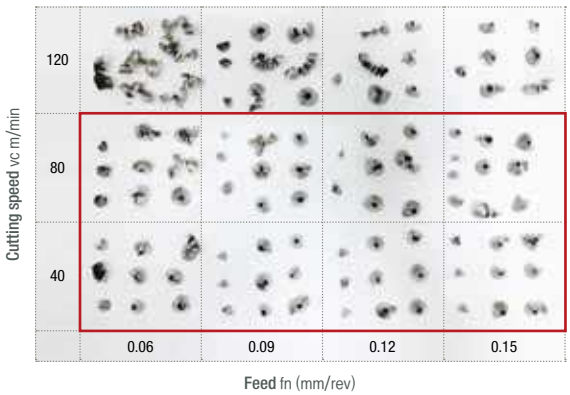


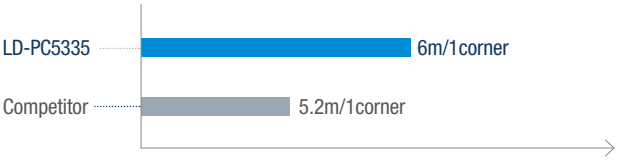


Cutting conditions

Applied tool		K3D20025-07
Insert		SPMT07T208-LD XOMT07T205-LD
Grade		PC5335
Workpiece		Ti-6Al-4V (HRC45~47)
Cutting speed		vc = 60 (m/min)
Feed		fn = 0.06 (mm/rev)
Depth of cut		ap = 50 (mm)
Cutting fluid	Type	Wet, Internal coolant supply
	Pressure	30bar
	Concentration	6~8%

LD chip breaker Chip map





ISO Turning VP Chip Breaker

Work Material

KS - / JIS - / AISI - / DIN - Ti829 (Ti-5.5Al-3.5Sn-3Zr-1Nb-0.25Mo-0.3Si)

Workpiece



Material Property and Machining Solution

Titanium alloy is a highly reactive chemical substance that causes built-up edges in metal cutting, leading to repetitive cutting or a rapidly increased machining load. Therefore, it is necessary to use chip breakers specialized for titanium machining. Its low thermal conductivity and tendency towards work hardening often trigger excessive wear, plastic deformation and notch wear. Additionally, its low elasticity is blamed for springbacks or deflection of workpieces, and vibrations accordingly cause edge chipping or tool breakage. Machining uneven surfaces or roughing at high depth of cuts causes cutting loads, vibrations, excessive wear from chattering, chipping and tool breakage. It is necessary to use a highly wear resistant and tough grade.

Evaluation

Turning Ti829 disk for an aircraft engine at high depth of cut (4.5mm) and high feed (0.4mm/rev) causes topical high temp cutting heat on edges, welding and cutting overload. And this leads to excessive wear, chipping and fracture. We recommend combining the high rake VP3 chip breaker which shows smooth chip flow and low cutting resistance, with the PC5300 grade which has balanced wear resistance and toughness.

Results of tool wear

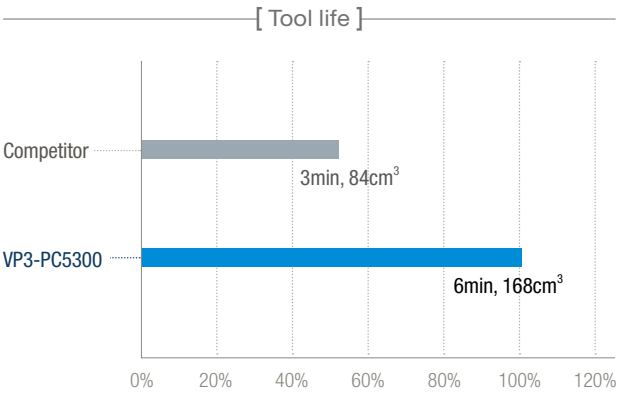
VP3-PC5300 | Competitor





Cutting conditions

Applied tool		**Turning holder**
Insert		RNMG190600-VP3
Grade		PC5300
Workpiece		Ti829 (HRC45~47)
Cutting speed		vc = 35~40 (m/min)
Feed		fn = 0.4 (mm/rev)
Depth of cut		ap = 2~4.5 (mm)
Cutting fluid	Type	Wet
	Pressure	10bar
	Concentration	6~8%



KGT

Work Material

KS - Inconel718 / JIS - NCF718 / AISI - UNS-N07718 / DIN - NiCr19FeNbMo

Workpiece



Material Property and Machining Solution

Inconel causes high cutting force and heat on cutting edges during operation, due to its properties of high strength at high temperature and low heat conductivity. Chip breakers which can minimize cutting loads and provide stable chip evacuation are essential to grooving Inconel.
It is also important to select proper grades and cutting speeds depending on the size of workpieces and cutting intervals. (Recommended cutting speed of 20~60m/min)

Evaluation

Grooving an Inconel workpiece at depth of cut of 4mm, which is 300Ø wide and 5mm thick, accompanies excessive wear on rake and relief surfaces of insert due to high cutting force and heat concentration on edges. This results from the 3-face contact, the feature of grooving applications. We recommend combining the T chip breaker featuring sharp cutting edges and improved chip control, with the PC8110 grade of excessive wear and thermal resistance.

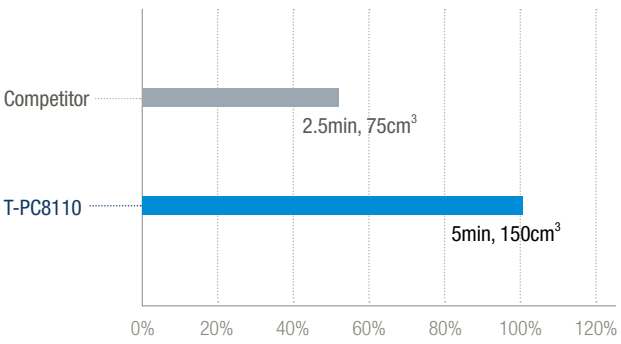
Results of tool wear

KGMN400-08-T PC8110	Competitor
	

Cutting conditions

Applied tool		KGEHR2525-4-T15
Insert		KGMN400-08-T
Grade		PC8110
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 60 (m/min)
Feed		fn = 0.1 (mm/rev)
Depth of cut		ap = 5.0 (mm)
Cutting fluid	Type	Wet
	Pressure	10bar
	Concentration	6~8%

[Tool life]



Part 2

02

Application Examples for Wing Parts

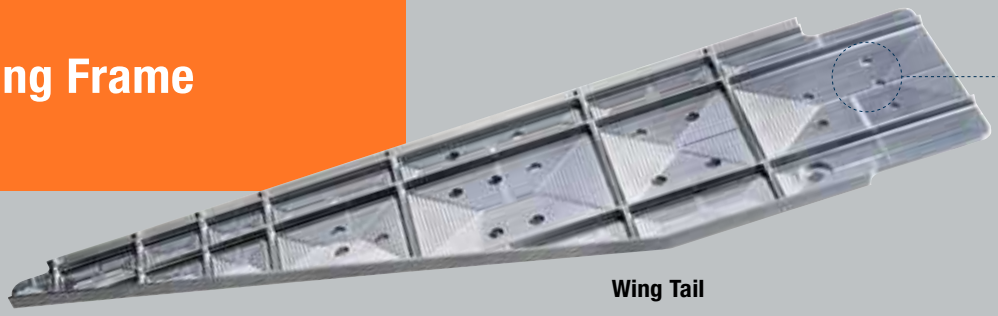
Wing Frame



Pro-X Mill

Application: Wing rib pocket milling
Insert: **XEKT19M504FR-MA**
Holder: **PAXCM5032HR-A**

Recommended cutting conditions: P.80~81
Product Details: P.169~171



Wing Tail

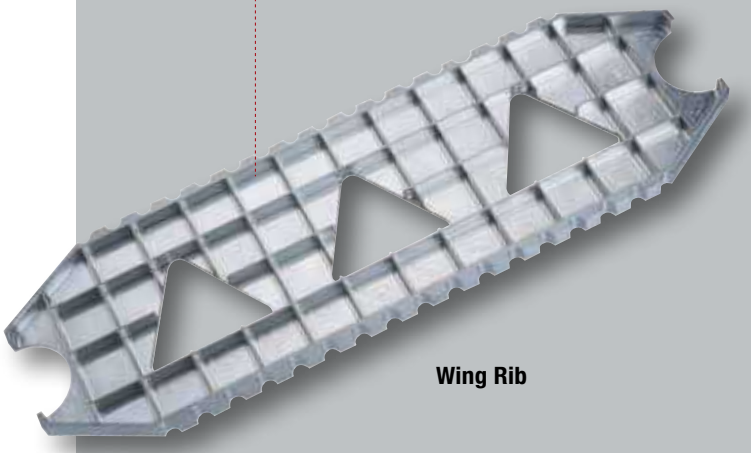


Brazed Spiral Long Endmill

Application: Wing rib pocket side milling
Endmill: **ZSEAL220**

Material Property and Machining Solution

Aluminum Alloy demonstrates elongation and welding at high temperatures causing built up edges, shortened tool life and breakage. Very high cutting speeds are needed to prevent the formation of built up edges. These high speeds require tooling with strong clamping force.



Wing Rib

Pro-L Mill & Alpha Mill APMT-MA

Work Material

KS - A6061P / JIS - A6061 / ANSI - A430.0 / DIN – GD-AlSi12

Workpiece



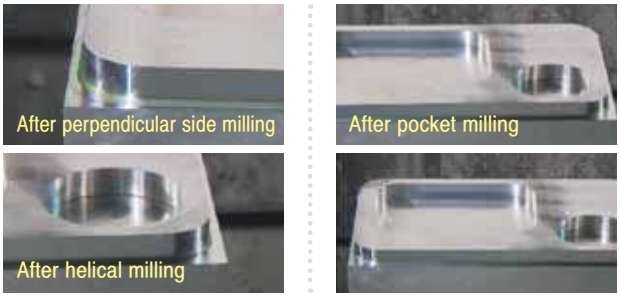
Material Property and Machining Solution

Aluminum Alloy demonstrates elongation and welding at high temperatures causing built up edges, shortened tool life and breakage. Very high cutting speeds are needed to prevent the formation of built up edges. These high speeds require tooling with strong clamping force.

Evaluation

Shouldering and pocket milling of aluminum frequently accompany built-up edges, early chipping and fracture at high speeds and high depth of cuts over 2/3rd of cutting edges, due to high temperature, high cutting force and unstable clamping. We recommend combining the sharp-edged MA chip breaker for aluminum, with the lubricative H01 grade. With the MA and H01, Pro-L Mill enables stable machining even at high speeds and high depth of cuts thanks to its reinforced clamping force with two screw-ons.

Surface roughness of each application



Cutting conditions

Applied tool		Pocket milling: **AMS3032HS** (Ø32) Perpendicular side milling: **PALS040HR-3S32** (Ø40)
Insert		Pocket milling: **APMT1604PDFR-MA** Perpendicular side milling: **LXET2504PEFR-40-MA**
Grade		H01
Workpiece		A6061P (HB170~195)
Cutting speed		Pocket milling: vc = 700 (m/min) Perpendicular side milling: vc = 800 (m/min)
Feed		Pocket milling: fz = 0.3 (mm/t) Perpendicular side milling: fz = 0.06 (mm/t)
Depth of cut		Pocket milling: ap = 15 (mm), ae = 3 (mm) Perpendicular side milling: ap = 20 (mm), ae = 5 (mm)
Cutting fluid	Type	Wet, Internal coolant supply
	Pressure	30bar
	Concentration	6~8%

Roughing	Medium cutting	Finishing
		
Alpha Mill APMT-MA 06~18mm	Pro-X XEKT-MA 19~25mm	Pro-L LXET-MA 25~34mm

Pro-L Mill

Work Material

KS - A6061P / JIS - A6061 / ANSI - A430.0 / DIN – GD-AlSi12

Workpiece



Material Property and Machining Solution

Aluminum Alloy demonstrates elongation and welding at high temperatures causing built up edges, shortened tool life and breakage. Very high cutting speeds are needed to prevent the formation of built up edges. These high speeds **require tooling with strong clamping force.**

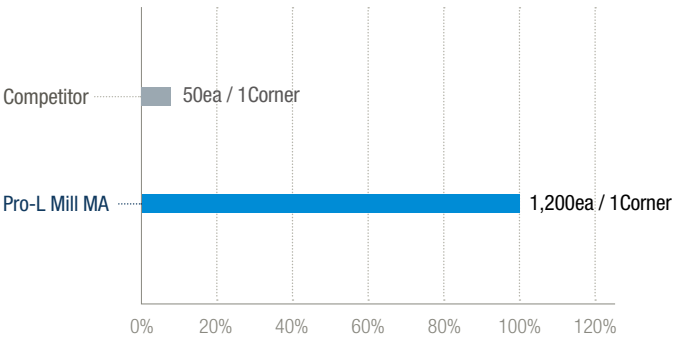
Evaluation

Shouldering aluminum frequently accompany built-up edges, early chipping and fracture at high speeds and high depth of cuts over 2/3rd of cutting edges, due to high temperature, high cutting force and unstable clamping. We recommend combining the sharp-edged MA chip breaker for aluminum, with the lubricative H01 grade. With the MA and H01, Pro-L Mill enables stable machining even at high speeds and high depth of cuts thanks to its reinforced clamping force with two screw-ons.

Cutting conditions

Applied tool		**PALS050HR-3S32** (Ø50)
Insert		LXET340532PEFR-50-MA
Grade		H01
Workpiece		A6061P (HB170~195)
Cutting speed		vc = 1,000 (m/min)
Feed		fz = 0.1 (mm/t)
Depth of cut		ap = 30 (mm), ae = 5 (mm)
Cutting fluid	Type	Wet, Internal coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



Alpha Mill APMT–MA

Work Material

KS - AC4CH / JIS - AC4CH / ANSI – A356.0 / DIN - GB-Al Si 7Mg

Workpiece



Material Property and Machining Solution

Aluminum Alloy demonstrates elongation and welding at high temperatures causing built up edges, shortened tool life and breakage. Very high cutting speeds are needed to prevent the formation of built up edges. These high speeds **require tooling with strong clamping force.**

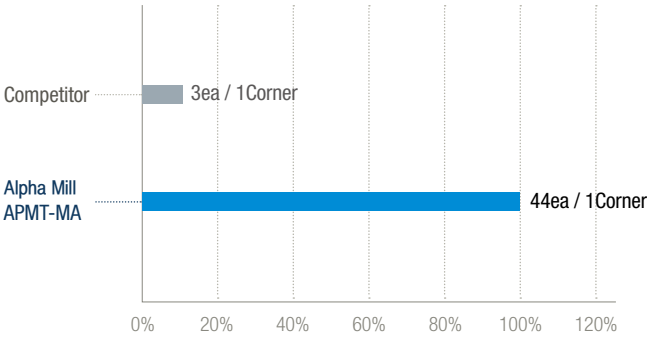
Evaluation

Multi-edge shouldering of aluminum frequently accompanies built-up edges, early chipping and fracture due to the long flute length and large contact areas between a workpiece and an insert as well as the high temperature and high cutting force. We recommend combining the sharp-edged MA chip breaker for aluminum, with the lubricative H01 grade.

Cutting conditions

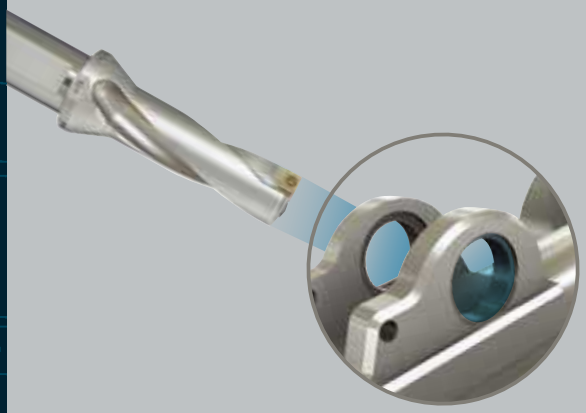
Applied tool		**AMS2032M** (∅32)
Insert		APMT1604PDFR-MA
Grade		H01
Workpiece		AC4CH / A6061P (HB55~80)
Cutting speed		vc = 350 (m/min)
Feed		fz = 0.258 (mm/t)
Depth of cut		ap = 15 (mm), ae = 3 (mm)
Cutting fluid	Type	Wet, Internal coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



Part 2
03
Application Examples for Landing Gear

Landing Gear



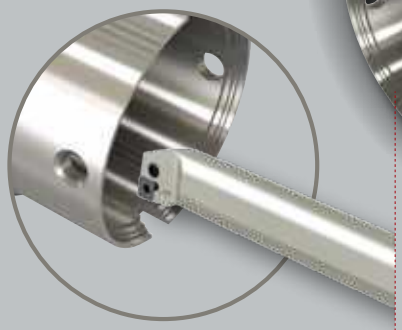
Indexable Drill

Application: Landing gear hole making
Insert: **SPMT040204-PD**
XOMT040204-PD
Holder: **K3D-12020-04**

Recommended cutting conditions: P.82~85
Product Details: P.178~181



Landing Gear



Boring bar

Application: Landing gear inside diameter turning
Insert: **CNMG120408-VP3**
Holder: **A32S-PCLNR-12N**

Recommended cutting conditions: P.70
Product Details: P.106~108

>> Material Property and Machining Solution

Titanium alloy has low heat conductivity, creating heat concentration on inserts when machining. This creates built up edges, rapid tool wear, and breakage. Machining titanium alloy requires lower cutting speeds. (Recommended cutting speed of 40~80m/min, feed rate of 0.06~0.12mm/rev)

Alpha Mill

Work Material

KS - Ti-6Al-4V / JIS - Ti6400 / AISI - UNS-R56400 / DIN - WS 3.7164

Workpiece



Material Property and Machining Solution

Titanium alloy is a highly reactive that causes built-up edges in metal cutting, leading to repetitive cutting or a rapidly increased machining load. Chip breakers specialized for titanium machining are necessary - ML for milling, VP for turning. Titanium alloys low thermal conductivity and tendency towards work hardening often trigger excessive wear, plastic deformation and notch wear. Additionally, its low elasticity is blamed for springbacks or deflection of workpieces, and vibrations cause edge chipping or tool breakage.
(Recommended cutting speed of 30~60m/min)

Evaluation

Rough shouldering of titanium alloy at high depth of cut (ap=50mm, ae=10mm) with a multi-edge cutter accompanies complex problems such as built-up edges, cutting overloads and chipping, due to its low thermal conductivity. Titanium alloy exhibits severe wear and fracture around the lower parts of cutting edges where cutting loads are significantly concentrated in roughing.
We recommend combining the ML chip breaker specialized for titanium, with the PC5300 grade of excellent wear and thermal resistance.

Results of tool wear

ML-PC5300



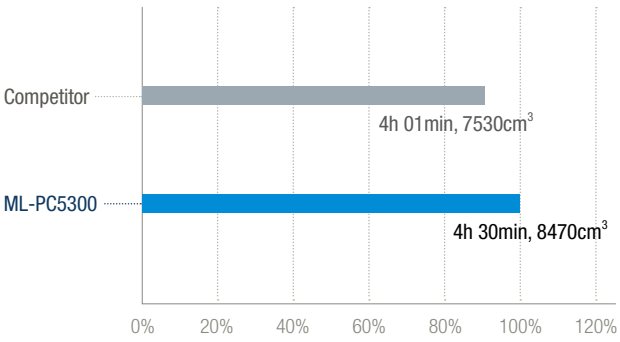
Competitor



Cutting conditions

Applied tool		BT50-AM3063057-4 (Multi edge)
Insert		APMT1604PDER-ML
Grade		PC5300
Machining center		MAZAK NEXUS6800-11
Workpiece		Ti-6Al-4V (HRC45~47)
Cutting speed		vc = 40 (m/min) Medium speed
Feed		fz = 0.1 (mm/t)
Depth of cut		ap = 50.0 (mm) High depth of cut, ae = 10.0 (mm)
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]

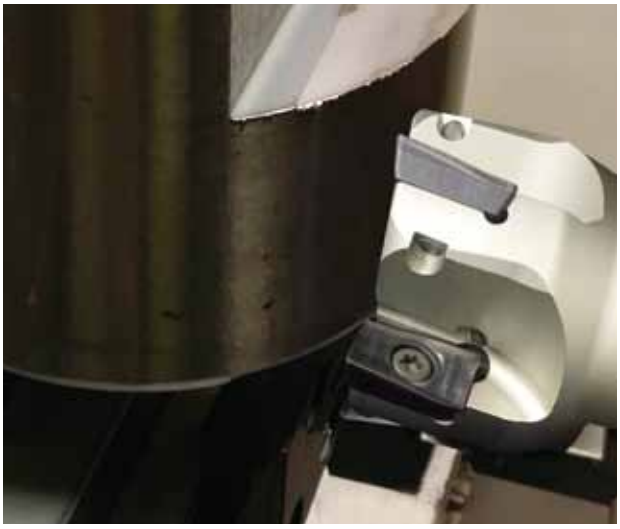


Alpha Mill

Work Material

KS - Ti-6Al-4V / JIS - Ti6400 / AISI - UNS-R56400 / DIN - WS 3.7164

Workpiece



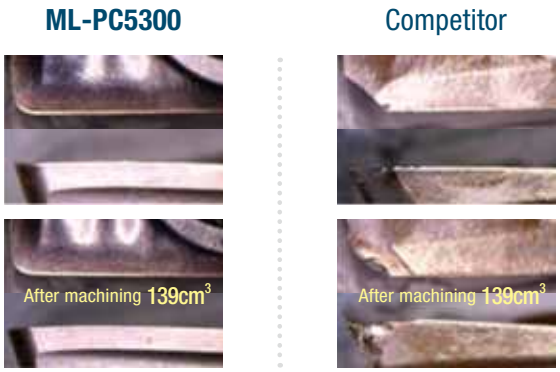
Material Property and Machining Solution

Titanium alloy is a highly reactive material that causes built-up edges in metal cutting, leading to repetitive cutting or a rapidly increased machining load. Chip breakers specialized for titanium machining are necessary - ML for milling, VP for turning. Titanium alloys low thermal conductivity and tendency towards work hardening often trigger excessive wear, plastic deformation and notch wear. Additionally, its low elasticity is blamed for springbacks or deformation of workpieces, and vibrations cause edge chipping or tool breakage. (Recommended cutting speed of 30~60m/min)

Evaluation

Rough shouldering of titanium alloy at medium speed and low depth of cut (ap=5.0mm, ae=10.0mm) with a Ø63 cutter accompanies complex problems such as built-up edges, cutting overloads and chipping, due to its low thermal conductivity. Titanium alloy exhibits severe wear and fracture around the lower parts of cutting edges where cutting loads are significantly concentrated in roughing.
We recommend combining the ML chip breaker specialized for titanium, with the PC5300 grade of excellent wear and thermal resistance.

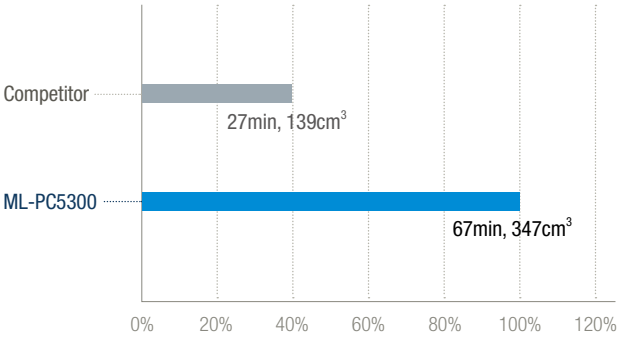
Surface roughness of each application



Cutting conditions

Applied tool		AMC3063HS
Insert		APMT1604PDER-ML
Grade		PC5300
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Titanium alloy (Ti-6Al-4V)
Cutting speed		vc = 40 (m/min) Medium speed
Feed		fz = 0.1 (mm/t)
Depth of cut		ap = 5.0 (mm), ae = 10.0 (mm)
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]

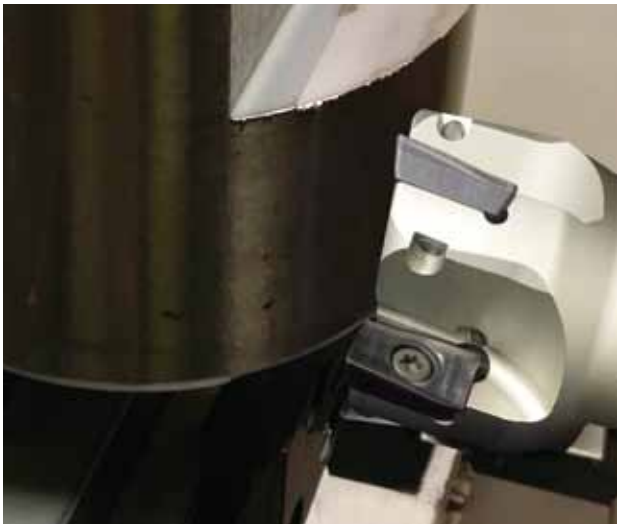


Alpha Mill

Work Material

KS - Ti-6Al-4V / JIS - Ti6400 / AISI - UNS-R56400 / DIN - WS 3.7164

Workpiece



Material Property and Machining Solution

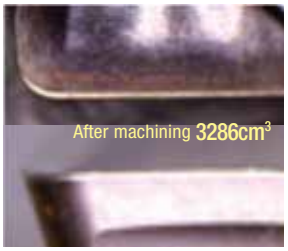
Titanium alloy is a highly reactive material that causes built-up edges in metal cutting, leading to repetitive cutting or a rapidly increased machining load. Chip breakers specialized for titanium machining are necessary - ML for milling, VP for turning. Titanium alloys low thermal conductivity and tendency towards work hardening often trigger excessive wear, plastic deformation and notch wear. Additionally, its low elasticity is blamed for springbacks or deflection of workpieces, and vibrations cause edge chipping or tool breakage. (Recommended cutting speed of 30~60m/min)

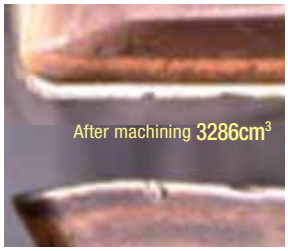
Evaluation

Rough shouldering of titanium alloy at medium speed and high depth of cut (ap=15.0mm, ae=30.0mm) with a Ø63 cutter accompanies complex problems such as built-up edges, cutting overloads and chipping, due to its low thermal conductivity. Titanium alloy exhibits severe wear and fracture around the lower parts of cutting edges where cutting loads are significantly concentrated in roughing.
We recommend combining the ML chip breaker specialized for titanium, with the PC5300 grade of excellent wear and thermal resistance.

Results of tool wear

ML-PC5300 | Competitor

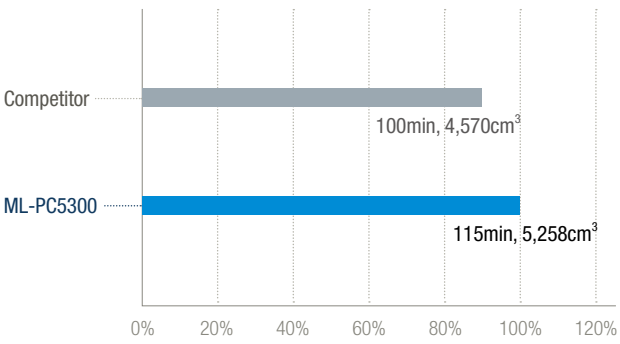




Cutting conditions

Applied tool		AMC3063HS
Insert		APMT1604PDER-ML
Grade		PC5300
Machining center		HYUNDAI WIA VC750M, BT50
Workpiece		Ti-6Al-4V (HRC45~47)
Cutting speed		vc = 40 (m/min) Medium speed
Feed		fz = 0.1 (mm/t)
Depth of cut		ap = 15.0 (mm), ae = 30.0 (mm) High depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



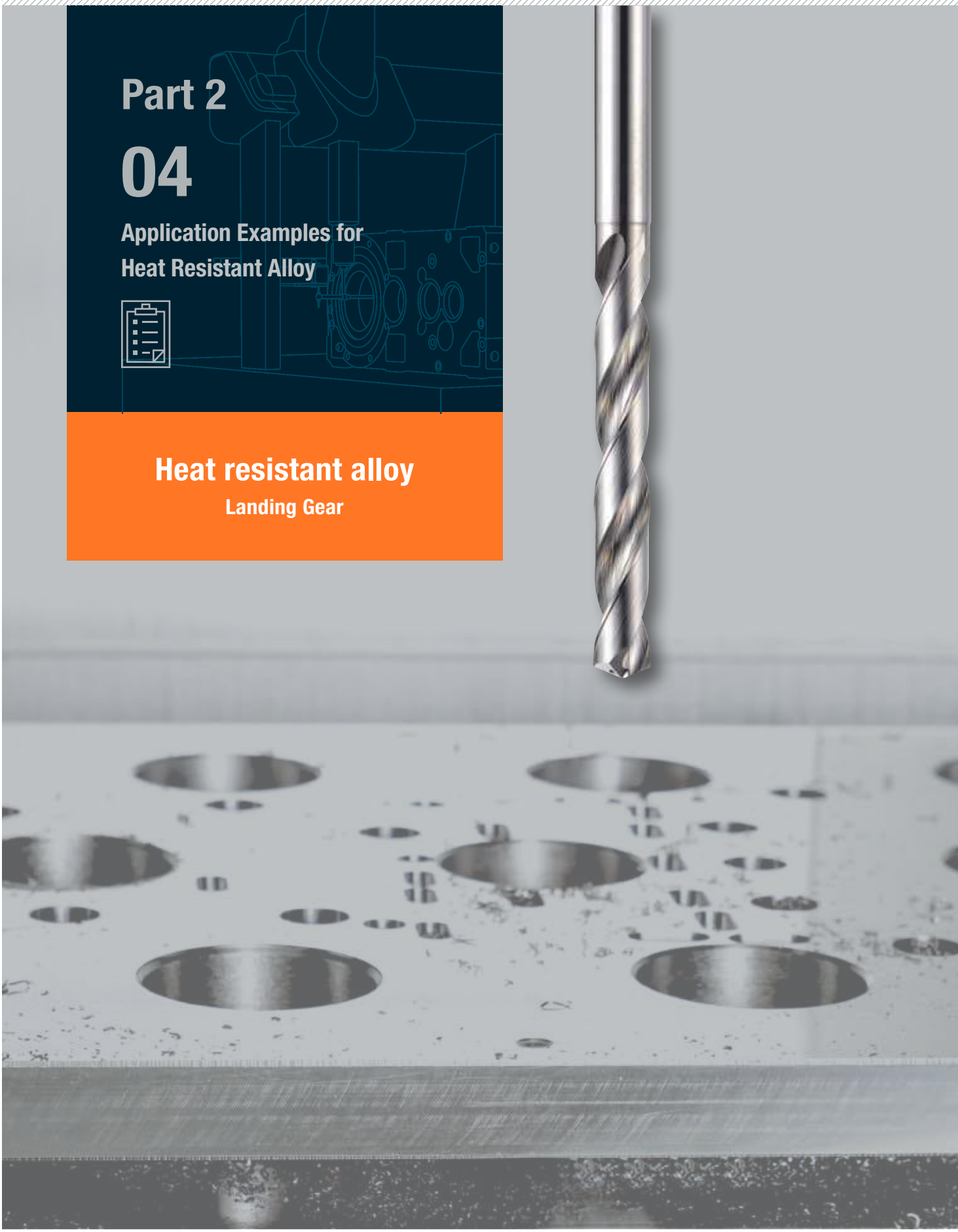
Part 2

04

Application Examples for Heat Resistant Alloy

Heat resistant alloy

Landing Gear



FMR P-Positive

Work Material

KS - A286/ JIS - / AISI - UNS-S66286/ DIN - X6 NiCrTiMo 26-15

Workpiece



Material Property and Machining Solution

Machining Incoloy (A286) will have excessive wear, chipping and fracture it is a hard-to-cut nickel-chromium alloy which involves severe thermal shock, work hardening and welding chips during operation. Therefore, cutting velocity should be decreased. (Recommended cutting speed of 40~60m/min) To prevent tool breakage when facing hard-to-cut materials at low to medium depth of cuts, you must use tools with reinforced clamping like FMR-P as well as chip breakers which reduce cutting loads. (e.g. In an evaluation test using Rich Mill with PC5300-MM, sudden tool breakage arose due to large cutting loads and led to a premature end of tool life.) Also, PVD grades are recommended to keep inserts from being damaged by chipping or breakage.

Evaluation

Machining Incoloy (A286) will have excessive wear, chipping and fracture due to thermal shock, work hardening and welding chips. We recommend combining the **high lake chip breaker MF,** with the **PC5400 grade of excellent toughness and resistance to chipping and slipping.**

Results of tool wear

MF-PC5400
After machining 10pcs



Normal wear

Competitor
After machining 8pcs

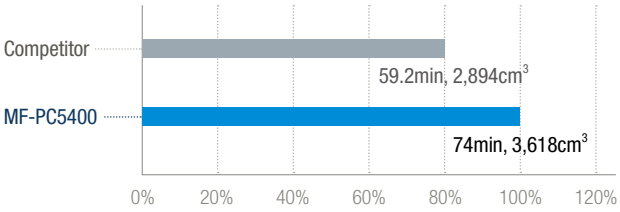


Chipping

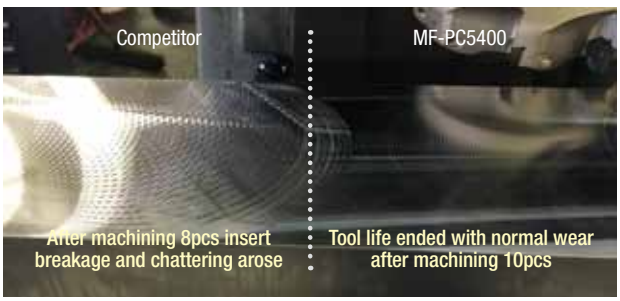
Cutting conditions

Applied tool		**FMRCA6800RP-8** (FMR-P)
Insert		RPMT2007M0E-MF
Grade		PC5400
Workpiece		A286 (Incoloy)
Cutting speed		vc = 60 (m/min)
Feed		fz = 0.4 (mm/t)
Depth of cut		ap = 1.3 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



Surface finish after machining



ISO Turning

Work Material

KS - SNCM439 / JIS - SNCM439 / AISI - SAE4340 / DIN - 1.6511

Workpiece

MM-PC5300



Excellent surface finish / Satisfactory result

Sudden tool breakage arose in interruptions

Competitor



Material Property and Machining Solution

Machining 4340 (SNCM439) will have built-up edge, excessive wear, chipping and tool breakage because it is a nickel-chrome-molybdenum alloy steel which is heat-treated and high hardened.

Therefore, cutting velocity should be decreased lower than general steels. (Recommended cutting speed of 100~150m/min) Turning outside diameters with high interruptions (e.g. around holes) or machining cross sections frequently involves sudden tool breakage. We recommend our MM chip breaker which provides excellent chip breaking and high toughness. Also, PVD grades are recommended to keep inserts from being damaged at high interruptions or low speeds or low depth of cuts.

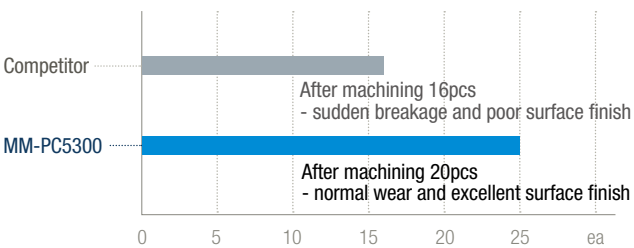
Evaluation

To prevent excessive wear, chipping and tool breakage when machining 4340 (SNCM439) at low speeds and depth of cuts, and high interruptions, We recommend combining the **MM chip breaker for medium cutting of steels,** with the **PC5300 grade of excellent toughness and resistance to chipping and wear.**

Cutting conditions

Applied tool		ISO Turning I/S
Insert		CNMG432-MM
Grade		PC5300
Workpiece		4340 Steel + Heat treatment (LOAD CELL ROD END)
Cutting speed		vc = 103 (m/min)
Feed		fn = 0.127 (mm/rev)
Depth of cut		ap = 1.3 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



ISO Turning

Work Material

KS - Monel400 / JIS - Monel400 / AISI - SAE4730G / DIN - 2.4360

Workpiece

ISO Turning VP3-PC8115



Material Property and Machining Solution

Monel is a nickel-copper alloy and creates excessive wear, chipping and tool breakage due to its properties of high hardness and welding. Additionally, its cutting pattern is similar to that of steels and hard-to-cut materials. Therefore, cutting velocity should be adjusted lower than general steels, higher than hard-to-cut materials. (Recommended cutting speed of 100~150m/min) Turning outside diameters continuously or machining cross sections frequently involves sudden tool breakage. We recommend using the high rake and tough chip breaker VP3 for hard-to-cut materials. Also, the PC8115 grade is first recommended, and then the CVD grade NC3225 or NC3120. (In case of workpieces of Monel, Sandvik GC4325 is occasionally used.)

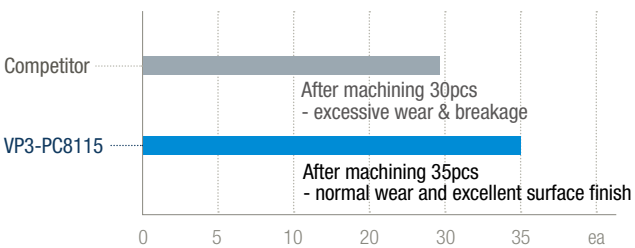
Evaluation

To prevent excessive wear, chipping and tool breakage when machining Monel at low speeds and depth of cuts, and high interruptions, We recommend combining the **high rake chip breaker VP3 for medium cutting of hard-to-cut materials,** with the **PC81150 grade of excellent resistance to chipping and wear.** Otherwise make the- The CVD P25 grade NC3225 or NC3120 can be another option.

Cutting conditions

Applied tool		ISO Turning I/S
Insert		CNMG432-VP3
Grade		PC8115
Workpiece		MONEL + Heat treatment
Cutting speed		vc = 103 (m/min)
Feed		fn = 0.127 (mm/rev)
Depth of cut		ap = 1.3 (mm) Low depth of cut
Cutting fluid	Type	Wet, Internal + External coolant supply
	Pressure	10bar
	Concentration	6~8%

[Tool life]



FMR P-Positive

Work Material

KS - S31803 (F51) / JIS- / AISI - S31803 / DIN - X2CrNiMoN22-5-3

Workpiece



Material Property and Machining Solution

Duralumin (Ni & Cr Base) is a stainless steel-type material with properties of strong corrosion resistance and yield strength as well as high mechanical strength. It demonstrates similar cutting patterns to hard-to-cut materials, it is required to apply cutting fluids and maintain low cutting speeds to prevent high heat concentration and improve tool life.
In case workpiece hardness is higher than HRC30, cutting velocity should be decreased to extend tool life. (Recommended cutting speed of 50~80m/min, feed rate of 0.3~0.5mm/t, depth of cut less than 0.5mm, wet)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Therefore, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting speed, feed rate, etc.

Evaluation

Machining Duralumin at high speeds over 80m/min will have excessive wear, chipping and fracture due to high cutting force and thermal shock. In this test, none-chip breaker types showed excellent performance for large-sized MCT (BT50) by improving resistance to chipping. **MF & MM chip breakers exhibited premature termination of tool life due to wear and chipping.**

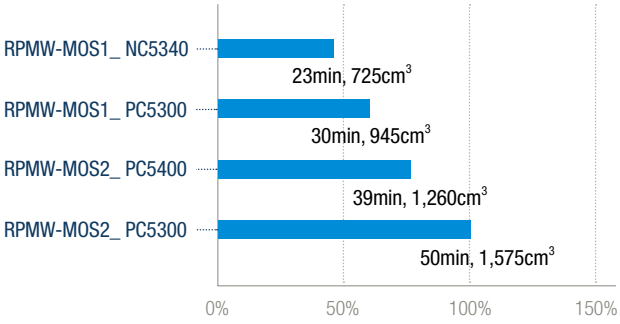
Results of tool wear

RPMW-M0S2 PC5300	RPMW-M0S2 PC5400	RPMW-M0S1 PC5300	RPMW-M0S1 PC5340
			
50min	39min	30min	23min

Cutting conditions

Applied tool		**FMRCM4063HRP-6** (Ø63, 6teeth)
Insert		RPMW1204M0S1, RPMW1204M0S2
Grade		PC5300, PC5400, NC5340
Machining center		HWACHUN SIRIUS-1750/ 12K, BT50
Workpiece		Duralumin (S31803, F51, HRC26)
Cutting speed		vc = 69 (m/min)
Feed		fz = 0.48 (mm/t)
Depth of cut		ap = 0.5 (mm)
Cutting fluid	Type	Wet, External coolant supply
	Pressure	30bar
	Concentration	6~8%

[Tool life]



FMR P-Positive

Work Material

KS - S31803 (F51) / JIS- / AISI - S31803 / DIN - X2CrNiMoN22-5-3

Workpiece



Material Property and Machining Solution

Duralumin (Ni & Cr Base) is a stainless steel-type material with properties of strong corrosion resistance and yield strength as well as high mechanical strength. It demonstrates similar cutting patterns to hard-to-cut materials, it is required to apply cutting fluids and maintain low cutting speeds to prevent high heat concentration and improve tool life. In case workpiece hardness is higher than HRC30, cutting velocity should be decreased to extend tool life. (Recommended cutting speed of 50~80m/min, feed rate of 0.3~0.5mm/t, depth of cut less than 0.5mm, wet)
In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Therefore, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting speed, feed rate, etc.

Evaluation

In this test, non-chip breaker types were unable to machine the small-sized MCT (BT40) due to vibrations and cutting loads, while they showed excellent performance for the large-sized MCT (BT40) in the previous test. After lowering cutting conditions (ap) to determine the best chip breaker, the combination of **MM-PC5300 showed the longest tool life** while the MF-PC5300 exhibited premature chipping due to lack of rigidity.

Results of tool wear

RPMT-MF_PC5400



Premature chipping

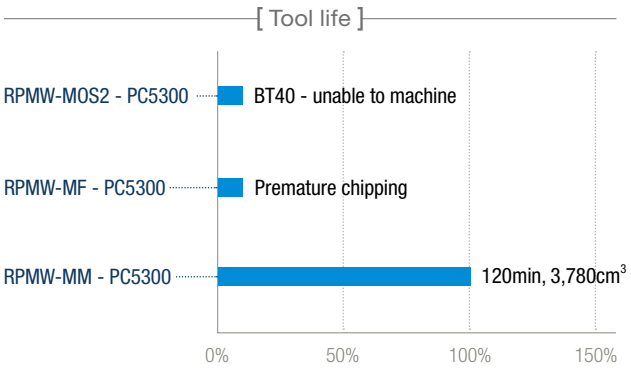
RPMT-MM_PC5400



120min

Cutting conditions

Applied tool		**FMRCM4063HRP-6** (Ø63, 6teeth) Internal Coolant
Insert		RPMT1204M0E-MF, RPMT1204M0S-MM
Grade		PC5300, PC5400, NC5340
Machining center		HWACHUN VESTA-1000/ 10K, BT40
Workpiece		Duralumin (S31803, F51, HRC26)
Cutting speed		vc = 69 (m/min)
Feed		fz = 0.48 (mm/t)
Depth of cut		ap = 0.3 (mm)
Cutting fluid	Type	Wet, External coolant supply
	Pressure	30bar
	Concentration	6~8%



Part 2

05

Technical Information for Machining Hard-to-Cut Materials



5 - 1 Turning Application of Inconel

5 - 2 Turning Application of Titanium

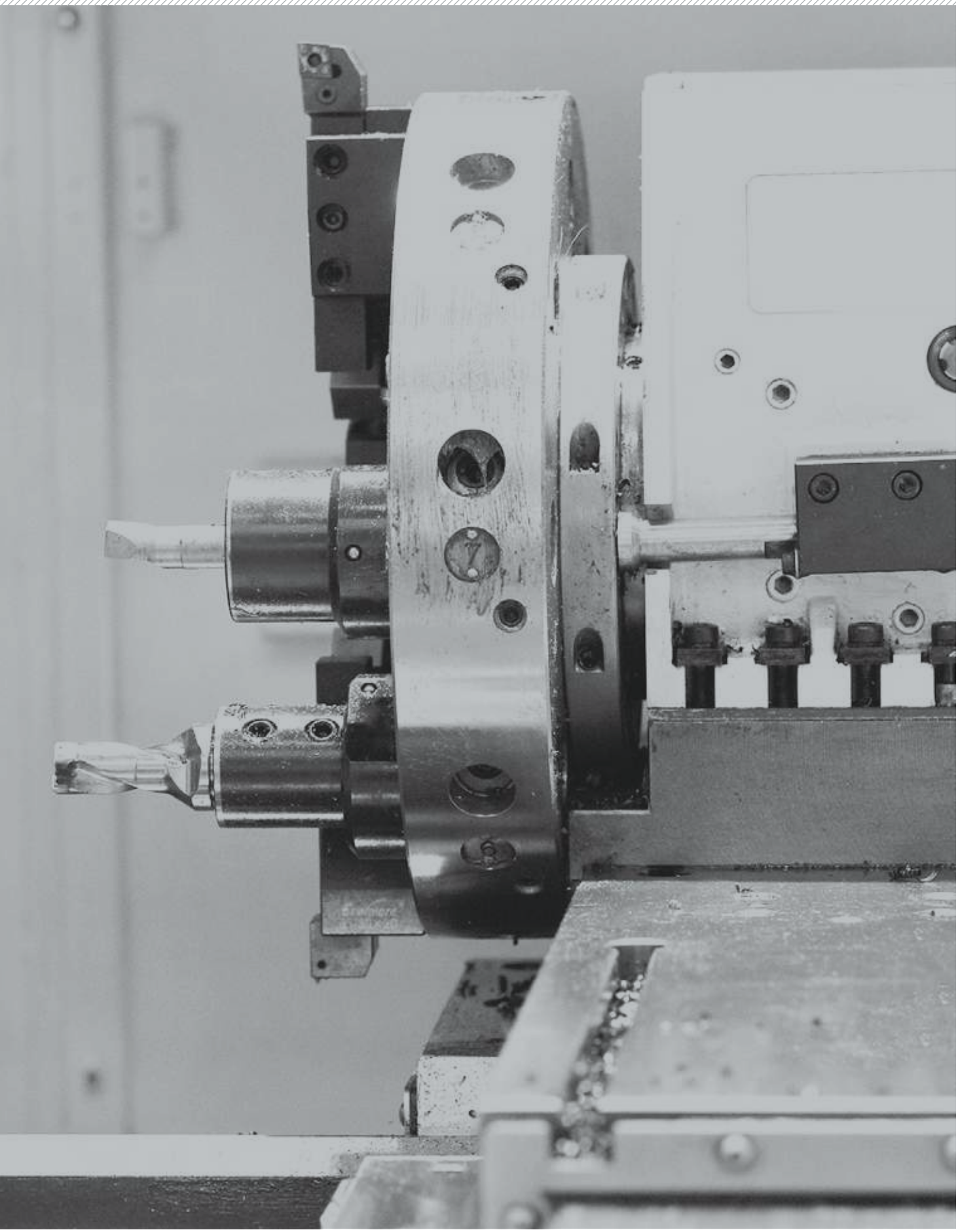
5 - 3 M / S Type Chip Breaker Line-up

M / S Type Grade Line-up

5 - 4 Chip Breaker & Grade Comparison for Heat Resistant Alloy

5 - 5 Milling Application of Inconel

5 - 6 Milling Application of Titanium



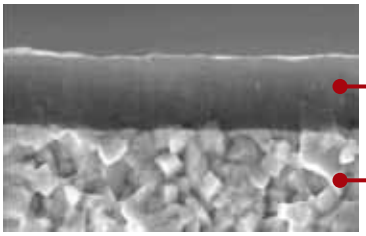
Inconel Turning

Features of Inconel

The Inconel properties of high strength at high temperature, with low heat conductivity, creates high cutting forces and temperatures on inserts, requiring reduced cutting velocities.

PC8100 Series - PVD Coated Inserts for Turning Heat Resistant Alloy

PC8105 / PC8110 / PC8115



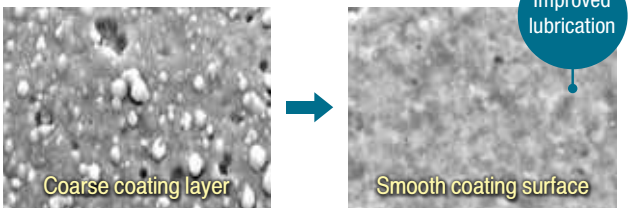
Coating layers providing high temp high hardness, strong oxidation resistance, and excellent surface finish

Ultra fine substrate of excellent resistance to chipping and wear

- Extends tool life by smoothly evacuating heated chips when machining heat resistant alloy
- Extends tool life by keeping the hardness even at high temperatures thanks to excellent oxidation resistance

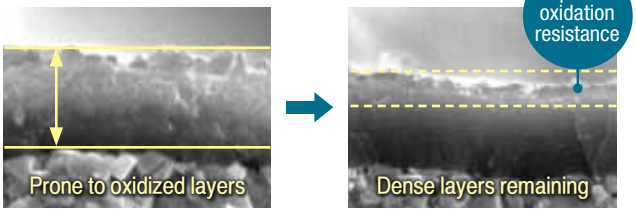
ISO Grade	Grade	Features	Application
S05	PC8105	Excellent wear resistance in continuous cutting / finishing	Continuous cutting / finishing of heat resistant alloy or STS
S10	PC8110	Excellent wear resistance in continuous cutting / medium to finish cutting	Medium to finish cutting of heat resistant alloy or STS
S15	PC8115	Excellent resistance to wear and chipping under various cutting conditions	From roughing to Medium and finish cutting of heat resistant alloy or STS

Smooth coating surface



<Existing coating> <PC8100 Series>

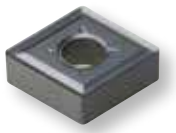
Coating layers with excellent oxidation resistance at high temperatures (After heat treatment at 900℃)



<Existing coating> <PC8100 Series>

Features of Inconel

ISO Grade	Grade	Features	Application
VP3	Medium to finish cutting	**High-positive blade design (Wide land)** → Performs stable chip control at high depth of cuts by improving machinability in continuous cutting of Inconel	Continuous cutting
VP4	Rough to medium cutting	**High-positive blade design (Reinforced cutting edges)** → Provides stable tool life by reducing cutting heat and wear when machining super heat resistant alloy → Prevents notch wear when roughing uneven surfaces	Continuous or light interrupted cutting



VP3

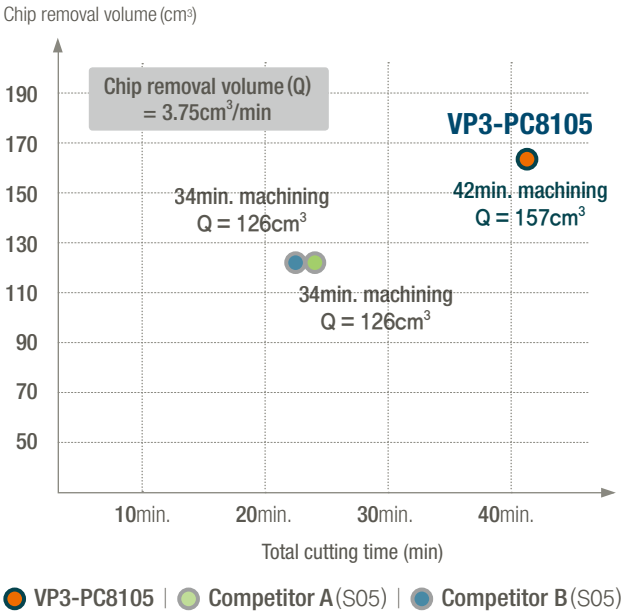




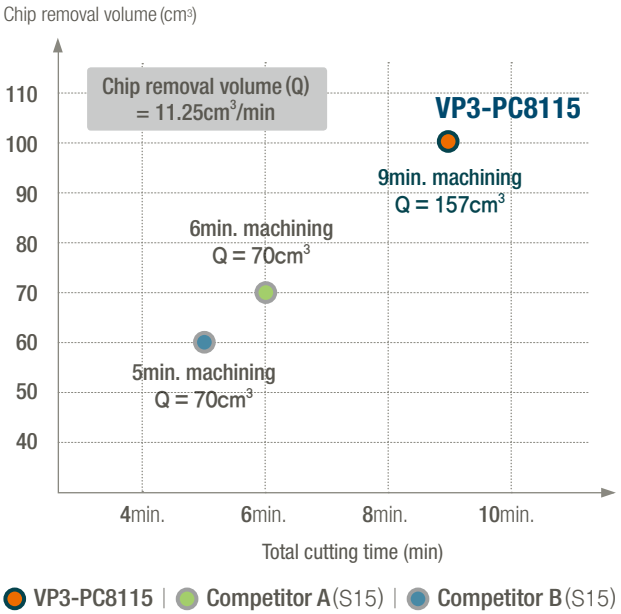
VP4



Application Examples of Inconel



VP3-PC8105 | Competitor A(S05) | Competitor B(S05)



VP3-PC8115 | Competitor A(S15) | Competitor B(S15)

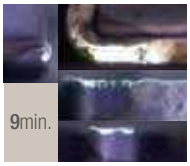
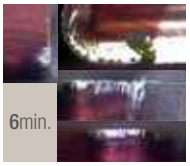
Results of tool wear

VP3-PC8105	Competitor A	Competitor B
		
34min.	34min.	34min.

Cutting conditions

Applied tool		PCLNR2525-M12
Insert		CNMG120408-VP3
Grade		PC8105
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 50 (m/min)
Feed		fn = 0.15 (mm/rev)
Depth of cut		ap = 0.5 (mm)
Cutting fluid	Type	wet
	Pressure	10bar
	Concentration	6~8%

Results of tool wear

VP3-PC8115	Competitor A	Competitor B
		
9min.	5min.	6min.

Cutting conditions

Applied tool		PCLNR2525-M12
Insert		CNMG120408-VP3
Grade		PC8115
Workpiece		Inconel 718 (HRC38~40)
Cutting speed		vc = 50 (m/min)
Feed		fn = 0.15 (mm/rev)
Depth of cut		ap = 1.5 (mm)
Cutting fluid	Type	wet
	Pressure	10bar
	Concentration	6~8%

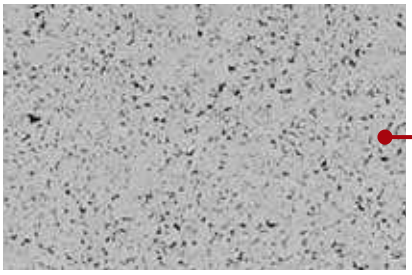
Titanium Turning

Features of Inconel

Titanium alloy is a highly reactive material that causes built-up edges in metal cutting, leading to repetitive cutting or a rapidly increased machining load. Its low thermal conductivity and tendency towards work hardening often trigger excessive wear, plastic deformation and notch wear. Additionally, its low elasticity is blamed for springbacks or deflection of workpieces, and vibrations accordingly cause edge chipping or tool breakage. Therefore, it is important to find a balanced combination of grades and chip breakers specialized for titanium machining.

Turning Grades for Titanium

H01 / H05 / PC5300



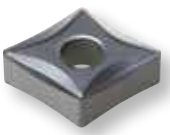
Ultra fine substrate of excellent resistance to chipping and wear

- Extends tool life by smoothly evacuating heated chips when machining titanium alloy
- Extends tool life by inhibiting built-up edge and tool breakage when machining titanium alloy

ISO Grade	Grade	Features	Application
T05	H01	Excellent wear resistance thanks to sharp edges in continuous cutting / finishing	Continuous cutting
T15	H05	1st recommended grade for various cutting conditions	Continuous cutting
T25	PC5300	Excellent resistance to damage in interrupted cutting / roughing	Continuous or light interrupted cutting

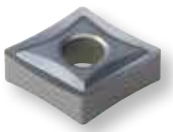
VP Series for Titanium Turning

ISO Grade	Grade	Features	Application
VP1	Finishing	**High-positive blade design** → Extends tool life by reducing contact areas between flank surface and chips, and minimizing cutting heat	Continuous cutting
VP2	Medium to finish cutting	**High-positive blade design with side rake angle** → Performs stable chip control at varying depth of cuts by improving machinability	Continuous cutting
VP3	Rough to medium cutting	**High-positive blade design (Wide land)** → Performs stable chip control at high depth of cuts by improving machinability in continuous cutting of Inconel	Continuous or light interrupted cutting



VP1





VP2

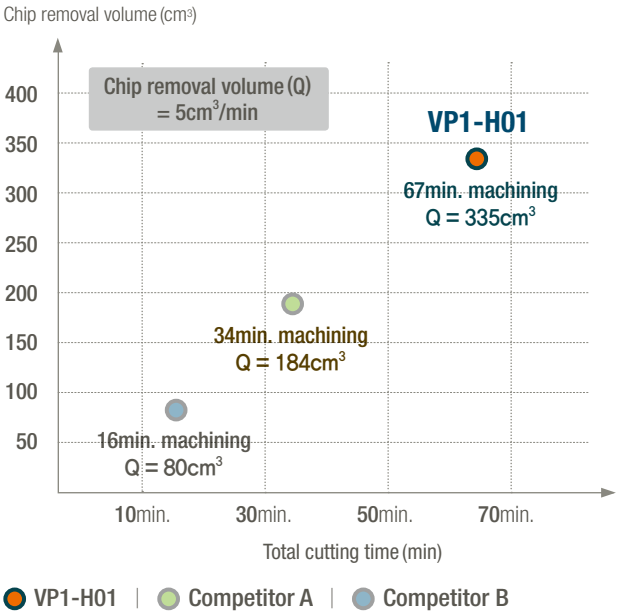


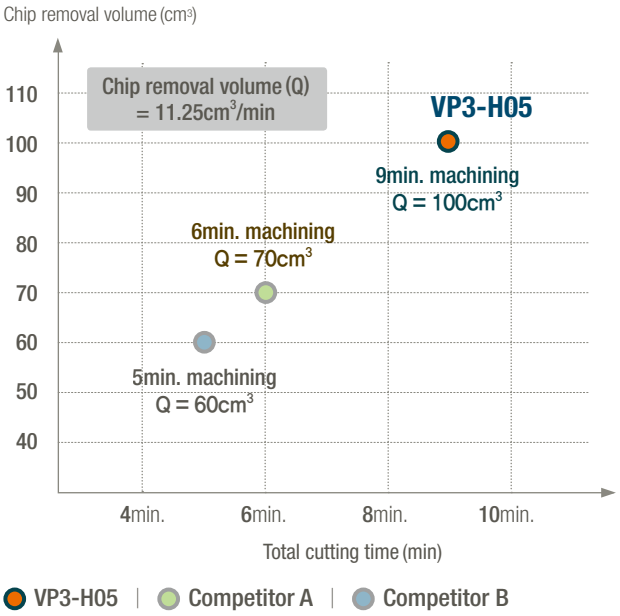


VP3

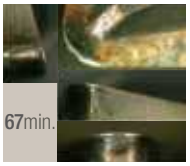


Application Examples of Titanium





Results of tool wear

VP1-H01	Competitor A	Competitor B
		
67min.	34min.	16min.

Cutting conditions

Applied tool		PCLNR2525-M12
Insert		CNMG120408-VP1
Grade		H01
Workpiece		Ti-6Al-4V (HRC45~47)
Cutting speed		vc = 100 (m/min)
Feed		fn = 0.1 (mm/rev)
Depth of cut		ap = 0.5 (mm)
Cutting fluid	Type	wet
	Pressure	10bar
	Concentration	6~8%

Results of tool wear

VP3-H05	Competitor A	Competitor B
		
9min.	6min.	5min.

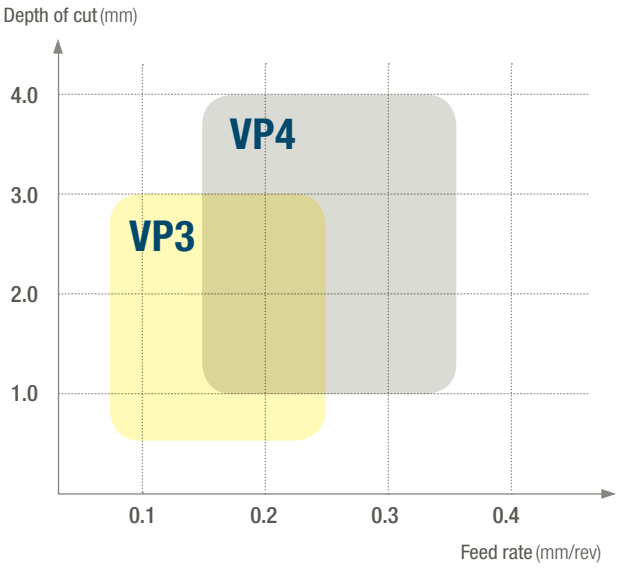
Cutting conditions

Applied tool		PCLNR2525-M12
Insert		CNMG120408-VP3
Grade		H05
Workpiece		Ti-6Al-4V (HRC45~47)
Cutting speed		vc = 80 (m/min)
Feed		fn = 0.2 (mm/rev)
Depth of cut		ap = 2.0 (mm)
Cutting fluid	Type	wet
	Pressure	10bar
	Concentration	6~8%

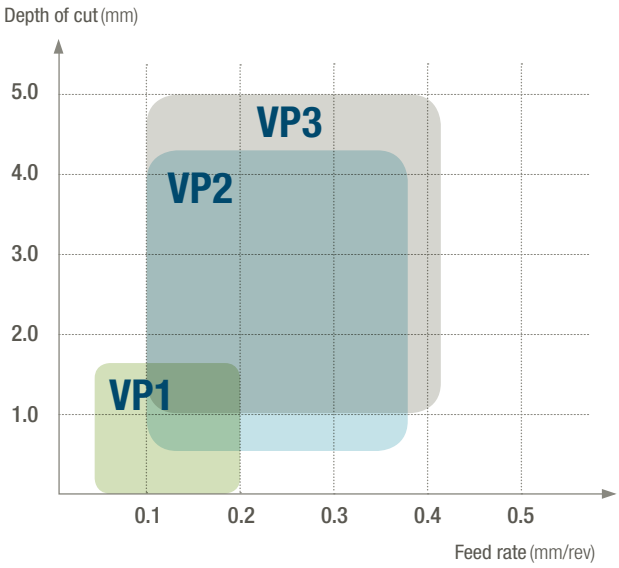
M, S Type Chip Breaker Line-up

For Inconel / Titanium

Inconel 718

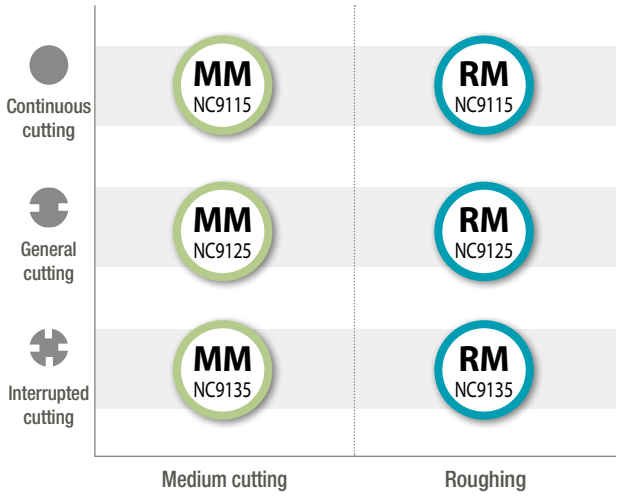


Titanium

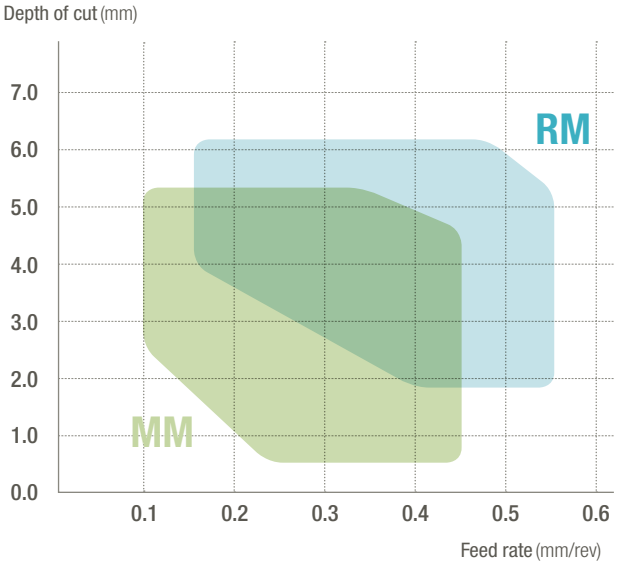


For Stainless Steel

Application Range



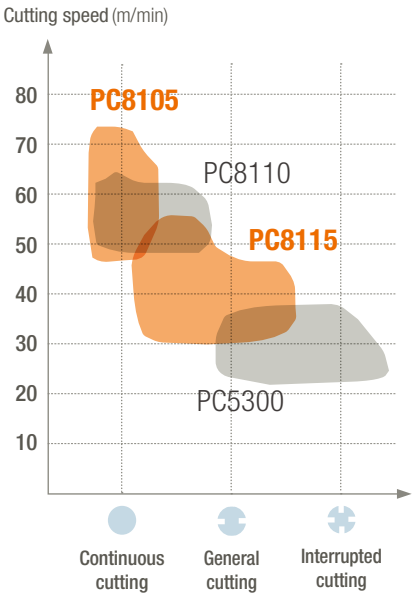
Recommended Cutting Range

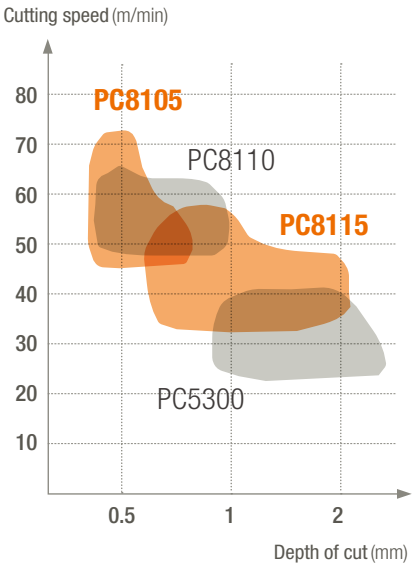


M, S Type Grade Line-up

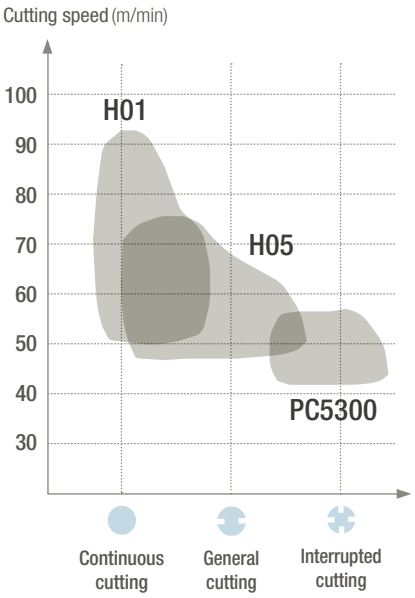
For Inconel

Inconel 718



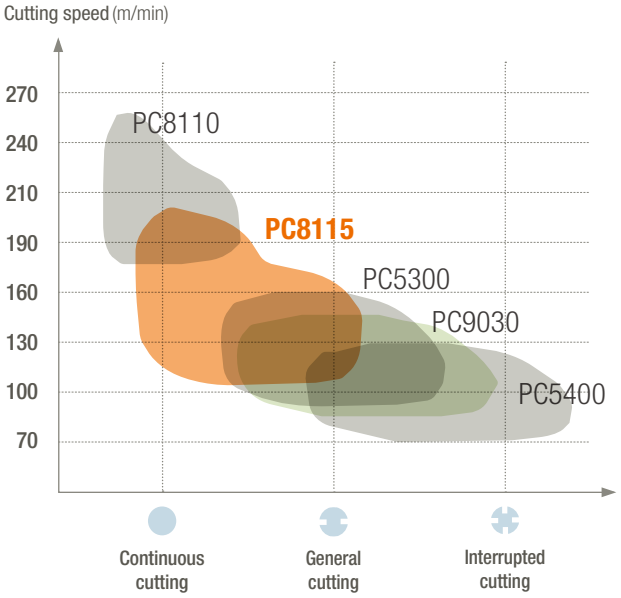


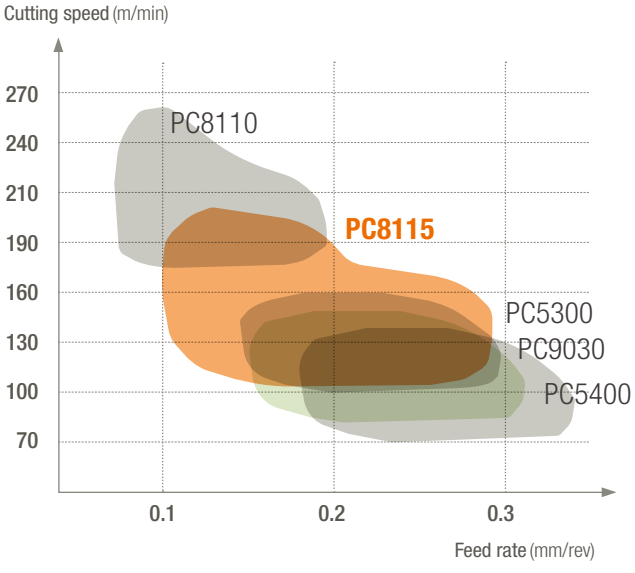
Titanium



For Stainless Steel

Recommended Cutting Range





Chip Breaker & Grade Comparison for Heat Resistant Alloy

Turning Grade Comparison for Heat Resistant Alloy & STS

Workpiece \ Maker	Korloy	Sandvik	MMC	ISCAR	Kyocera	TaeguTec	Seco	Walter
S05	PC8105	S05F	MP9005 VP05RT	IC808	PR1305	TT5080	TS2000	WSM10
S10	PC8110	GC1105	VP10RT	IC907	PR1310			
S15	PC8115	GC1115	MP9015	-	-			
S25	PC5300	GC1125 GC2025	VP15TF VP20MF	IC908	PR1125 PR1325	TT9030 TT9080	CP500 TS2500	WSM20
S35	PC5400	GC2035	MP7035	IC328	PR660	TT8020 TT8080	TM4000 F40M	WSM30

Turning Grade Comparison for Titanium Alloy

Workpiece \ Maker	Korloy	Sandvik	MMC	ISCAR	Kyocera	TaeguTec	Seco	Walter
T05	H01	GC1115						
T15	H05	H13A	MT9015	IC20	-	TT5080	THR	WS10
T25	PC5300	GC1125	VP15TF VP20MF	IC908	PR1125 PR1325	TT9030 TT9080	CP500 TS2500	WSM20

Turning Grade Comparison for Heat Resistant Alloy

Workpiece \ Maker	Korloy	Sandvik	MMC	ISCAR	Kyocera	TaeguTec	Seco	Walter
R	VP4	SMR	RS	TF	MS	ET	MF4	NRT, NRS
M	VP3	SM	MS	VL	MU	EM	M1	NMT, NMS
L	VP2	- NGP	MJ	PP	TK	ML	MF1	-
F	VP1	SF	LS	-	MQ	EA	-	NFT

Inconel Milling

Features of Inconel Alloy

Inconel causes high cutting force and heat on cutting edges during operation, due to its properties of high strength at high temperature and low heat conductivity. Therefore, cutting velocity should be decreased as cutting tools go worn out. In addition, thermal shock and work hardening accompany chipping, breakage, or notch wear depending on depth of cut. Consequently, it is important to select the best combination of chip beakers and grades for your cutting conditions such as cutting velocity, cutting length, etc.

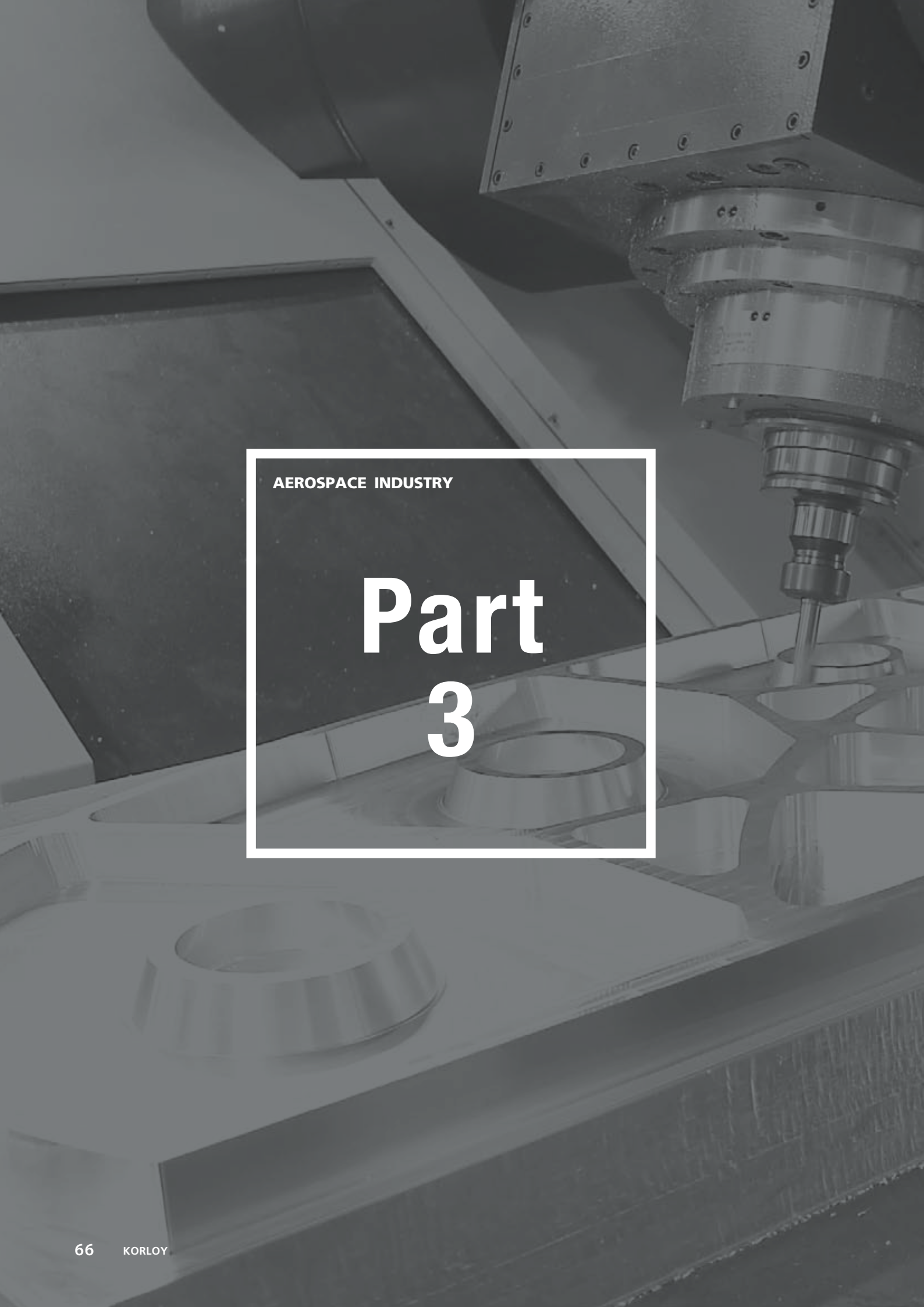
- In Inconel milling, ML chip breaker is highly recommended for its excellent chip control, strong welding resistance and cutting edges, and low cutting loads. For a grade, PC5300 provides exceptional resistance to chipping and wear.
- Recommended cutting speed of 30~50m/min (40 for best result), feed of 0.1~0.6mm/t (For best result, consult the recommended cutting conditions for each application)
- Please make sure to use cutting fluids with the concentration of maximum 10~12%, the pressure over 30 bar (Double the pressure will increase tool life about 1.5 times). It is recommended to apply enough fluids both inside and outside the tool.

Titanium Milling

Features of Titanium Alloy

Titanium alloy is a highly reactive material that causes built-up edges in metal cutting, leading to repetitive cutting or a rapidly increased machining load. Its low thermal conductivity and tendency towards work hardening often trigger excessive wear, plastic deformation and notch wear. Additionally, its low elasticity is blamed for springbacks or deflection of workpieces, and vibrations accordingly cause edge chipping or tool breakage. Therefore, it is important to find a balanced combination of grades and chip breakers specialized for titanium machining.

- In Inconel milling, ML chip breaker is highly recommended for its excellent chip control, strong welding resistance and cutting edges, and low cutting loads. For a grade, PC5300 provides exceptional resistance to chipping and wear.
- Recommended cutting speed of 30~70m/min, feed of 0.1~1.2mm/t (For best result, consult the recommended cutting conditions for each application)
- Please make sure to use cutting fluids with the concentration of maximum 10~12%, the pressure over 30 bar (Double the pressure will increase tool life about 1.5 times). It is recommended to apply enough fluids both inside and outside the tool.



AEROSPACE INDUSTRY

Part 3

AEROSPACE INDUSTRY

Part 3

Recommended Cutting Conditions for Each Aerospace Component



1 Recommended Cutting Conditions for Turning

2 Recommended Cutting Conditions for Milling

3 Recommended Cutting Conditions for Hole Making

4 Recommended Cutting Conditions for Endmilling

Landing Gear

Ti-6Al-4V (HRC35~40)

KGT

□□□□□ □□□□	□□	□□□□□□ □□□□□□□	Rose □	□□□□□□□□□□□□□□ vc	fn	ap	□□□□□ Type		Pressure	Concentration	□□□□ □□ □□□□□□	□□□□
				m/min sfm	mm/rev ipr	mm inch	Internal	External	bar	%	cm^3/min $inch^3$/min	
Copying	A	H05	KRGN200 KRGN300	under 1.5	40 (32 ~ 56)	0.10 (0.04 ~ 0.16)	under 0.8 (0.08 ~ 2.4)	○	○	10	6~8	3.1	112~113
					131 (105 ~ 184)	0.004 (0.002 ~ 0.006)	under 0.031 (0.003 ~ 0.094)	○	○	10	6~8	0.016	
			KRGN400 KRGN500 KRGN600	over 2.0	50 (40 ~ 70)	0.12 (0.05 ~ 0.2)	under 1.0 (0.1 ~ 3.0)	○	○	10	6~8	6.0	
					164 (131 ~ 230)	0.005 (0.002 ~ 0.008)	under 0.039 (0.004 ~ 0.118)	○	○	10	6~8	0.031	
Light Cutting	A	H05	KGGN200 KGGN300 KGGN400	under 0.2	40 (32 ~ 56)	0.08 (0.04 ~ 0.12)	under 4.0 (0.8 ~ 16.0)	○	○	10	6~8	12.8	112~113
					131 (105 ~ 184)	0.003 (0.002 ~ 0.005)	under 0.157 (0.031 ~ 0.630)	○	○	10	6~8	0.065	
			KGGN500 KGGN600	over 0.4	50 (40 ~ 70)	0.1 (0.05 ~ 0.15)	under 5.0 (1.0 ~ 20.0)	○	○	10	6~8	25.0	
					164 (131 ~ 230)	0.004 (0.002 ~ 0.006)	under 0.197 (0.039 ~ 0.787)	○	○	10	6~8	0.127	
Medium Cutting	T	H05	KGMN200 KGMN300 KGMN400	under 0.2	40 (32 ~ 56)	0.08 (0.04 ~ 0.12)	under 4.0 (0.8 ~ 16.0)	○	○	10	6~8	12.8	112~113
					131 (105 ~ 184)	0.003 (0.002 ~ 0.005)	under 0.157 (0.031 ~ 0.630)	○	○	10	6~8	0.065	
			KGMN500 KGMN600 KGMN800	over 0.4	50 (40 ~ 70)	0.1 (0.05 ~ 0.15)	under 5.0 (1.0 ~ 20.0)	○	○	10	6~8	25.0	
					164 (131 ~ 230)	0.004 (0.002 ~ 0.006)	under 0.197 (0.039 ~ 0.787)	○	○	10	6~8	0.127	
Rough Cutting	R	H05	KGMN200 KGMN300 KGMN400	under 0.2	40 (32 ~ 56)	0.10 (0.04 ~ 0.16)	under 4.0 (0.8 ~ 16.0)	○	○	10	6~8	15.4	112~113
					131 (105 ~ 184)	0.004 (0.002 ~ 0.006)	under 0.157 (0.031 ~ 0.630)	○	○	10	6~8	0.078	
			KGMN500 KGMN600 KGMN800	over 0.3	50 (40 ~ 70)	0.12 (0.05 ~ 0.2)	under 5.0 (1.0 ~ 20.0)	○	○	10	6~8	30.0	
					164 (131 ~ 230)	0.005 (0.002 ~ 0.008)	under 0.197 (0.039 ~ 0.787)	○	○	10	6~8	0.153	

1. Cutting conditions – If you are using a different grade, the cutting conditions may differ. (10% faster for H01, 10% slower for PC5300)

2. Tool life – To ensure the most satisfactory tool life, stay within the cutting conditions above.

3. Concentration of coolant – Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure – 1) Coolant pressure of over 30 bar is recommended. 2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply – It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate – Please consult the table above.

Engine Housing
INCONEL718 (HRC40~45)

KGT

				Rose	vc	fn	ap	Type		Pressure	Concentration		
					m/min sfm	mm/rev ipr	mm inch	Internal	External	bar	%	cm^3/min $inch^3$/min	
Copying	C	PC8110	KRMN200 KRMN300	under 1.5	32 (24 ~ 48)	0.10 (0.04 ~ 0.16)	under 0.8 (0.08 ~ 2.4)	○	○	10	6~8	2.5	112~113
					105 (79 ~ 157)	0.004 (0.002 ~ 0.006)	under 0.031 (0.003~0.094)	○	○	10	6~8	0.012	
			KRMN400 KRMN500 KRMN600	over 2.0	40 (30 ~ 60)	0.12 (0.05 ~ 0.2)	under 1.0 (0.1 ~ 3.0)	○	○	10	6~8	4.8	
					131 (98 ~ 197)	0.005 (0.002 ~ 0.008)	under 0.039 (0.004~0.118)	○	○	10	6~8	0.024	
Medium Cutting	T	PC8110	KGMN200 KGMN300 KGMN400	under 0.2	32 (24 ~ 48)	0.08 (0.04 ~ 0.12)	under 4.0 (0.8 ~ 16.0)	○	○	10	6~8	10.2	112~113
					105 (79 ~ 157)	0.003 (0.002 ~ 0.005)	under 0.157 (0.031~0.630)	○	○	10	6~8	0.052	
			KGMN500 KGMN600 KGMN800	over 0.4	40 (30 ~ 60)	0.1 (0.05 ~ 0.15)	under 5.0 (1.0 ~ 20.0)	○	○	10	6~8	20.0	
					131 (98 ~ 197)	0.004 (0.002 ~ 0.006)	under 0.197 (0.039~0.787)	○	○	10	6~8	0.102	
Rough Cutting	R	PC8110	KGMN200 KGMN300 KGMN400	under 0.2	32 (24 ~ 48)	0.10 (0.04 ~ 0.16)	under 4.0 (0.8 ~ 16.0)	○	○	10	6~8	12.3	112~113
					105 (79 ~ 157)	0.004 (0.002 ~ 0.006)	under 0.157 (0.031~0.630)	○	○	10	6~8	0.062	
			KGMN500 KGMN600 KGMN800	over 0.3	40 (30 ~ 60)	0.12 (0.05 ~ 0.2)	under 5.0 (1.0 ~ 20.0)	○	○	10	6~8	24.0	
					131 (98 ~ 197)	0.005 (0.002 ~ 0.008)	under 0.197 (0.039~0.787)	○	○	10	6~8	0.122	

1. Cutting conditions – If you are using a different grade, the cutting conditions may differ.
(10% faster for H01, 10% slower for PC5300)

2. Tool life – To ensure the most satisfactory tool life, stay within the cutting conditions above.

3. Concentration of coolant – Coolant concentration of max. 10~12% is recommended.
The above data was gained at the concentration of 6~8%.

4. Coolant pressure – 1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply – It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate – Please consult the table above.

Landing Gear

Ti-6Al-4V (HRC35~40)

VP Series for ISO Turning

				Rose	vc	fn	ap	Type		Pressure	Concentration			
					m/min sfm	mm/rev ipr	mm inch	Internal	External	bar	%	cm³/min inch³/min		
Light Cutting	VP1	H05	CNMG12 SNMG12 WNMG08	under 04	40 (32 ~ 56)	0.12 (0.056~ 0.16)	under 0.8 (0.08 ~ 1.2)	○	○	10	6~8	3.8	97~99	
					131 (105 ~ 184)	0.005 (0.002~0.006)	under 0.031 (0.003~0.047)	○	○	10	6~8	0.020		
				over 08	50 (40 ~ 70)	0.15 (0.07 ~ 0.2)	under 1.0 (0.1 ~ 1.5)	○	○	10	6~8	7.5		
					164 (131 ~ 230)	0.006 (0.003~0.008)	under 0.039 (0.004~0.059)	○	○	10	6~8	0.038		
			DNMG15	under 04	40 (32 ~ 56)	0.12 (0.056~ 0.16)	under 0.8 (0.08 ~ 1.2)	○	○	10	6~8	3.8	97~99	
					131 (105 ~ 184)	0.005 (0.002~0.006)	under 0.031 (0.003~0.047)	○	○	10	6~8	0.020		
				over 08	50 (40 ~ 70)	0.15 (0.07 ~ 0.2)	under 1.0 (0.1 ~ 1.5)	○	○	10	6~8	7.5		
					164 (131 ~ 230)	0.006 (0.003~0.008)	under 0.039 (0.004~0.059)	○	○	10	6~8	0.038		
			VNMG16 TNMG16	under 04	32 (24 ~ 48)	0.14 (0.04 ~0.144)	under 0.64 (0.06 ~ 1.04)	○	○	10	6~8	2.9	97~99	
					105 (79 ~ 157)	0.006 (0.002~0.006)	under 0.025 (0.003~0.041)	○	○	10	6~8	0.015		
				over 08	40 (30 ~ 60)	0.18 (0.05 ~ 0.18)	under 0.8 (0.08 ~ 1.3)	○	○	10	6~8	5.8		
					131 (98 ~ 197)	0.007 (0.002~0.007)	under 0.031 (0.003~0.051)	○	○	10	6~8	0.029		
Medium to Light Cutting	VP2	H05	CNMG12 SNMG12 WNMG08	under 04	40 (32 ~ 56)	0.16 (0.08 ~ 0.32)	under 1.44 (0.4 ~ 2.8)	○	○	10	6~8	9.2	97~99	
					131 (105 ~ 184)	0.006 (0.003~0.013)	under 0.057 (0.016~0.110)	○	○	10	6~8	0.047		
				over 08	50 (40 ~ 70)	0.2 (0.1 ~ 0.4)	under 1.8 (0.5 ~ 3.5)	○	○	10	6~8	18.0		
					164 (131 ~ 230)	0.008 (0.004~0.016)	under 0.071 (0.020~0.138)	○	○	10	6~8	0.092		
			DNMG15	under 04	40 (32 ~ 56)	0.16 (0.08 ~ 0.32)	under 1.44 (0.4 ~ 2.8)	○	○	10	6~8	9.2	97~99	
					131 (105 ~ 184)	0.006 (0.003~0.013)	under 0.057 (0.016~0.110)	○	○	10	6~8	0.047		
				over 08	50 (40 ~ 70)	0.2 (0.1 ~ 0.4)	under 1.8 (0.5 ~ 3.5)	○	○	10	6~8	18.0		
					164 (131 ~ 230)	0.008 (0.004~0.016)	under 0.071 (0.020~0.138)	○	○	10	6~8	0.092		
			VNMG16 TNMG16	under 04	32 (24 ~ 48)	0.14 (0.064~ 0.28)	under 1.2 (0.24 ~ 2.4)	○	○	10	6~8	5.5	97~99	
					105 (79 ~ 157)	0.006 (0.003~0.011)	under 0.047 (0.009~0.094)	○	○	10	6~8	0.028		
				over 08	40 (30 ~ 60)	0.18 (0.08 ~ 0.35)	under 1.5 (0.3 ~ 3.0)	○	○	10	6~8	10.8		
					131 (98 ~ 197)	0.007 (0.003~0.014)	under 0.059 (0.012~0.118)	○	○	10	6~8	0.055		
Rough to Medium Cutting	VP3	H05	CNMG12 SNMG12 WNMG08	under 04	40 (32 ~ 56)	0.20 (0.08 ~ 0.32)	under 1.6 (0.4 ~ 3.6)	○	○	10	6~8	12.8	97~99	
					131 (105 ~ 184)	0.008 (0.003~0.013)	under 0.063 (0.016~0.142)	○	○	10	6~8	0.065		
				over 08	50 (40 ~ 70)	0.25 (0.1 ~ 0.4)	under 2.0 (0.5 ~ 4.5)	○	○	10	6~8	25.0		
					164 (131 ~ 230)	0.010 (0.004~0.016)	under 0.079 (0.020~0.177)	○	○	10	6~8	0.127		
			DNMG15	under 04	40 (32 ~ 56)	0.20 (0.08 ~ 0.32)	under 1.6 (0.4 ~ 3.6)	○	○	10	6~8	12.8	97~99	
					131 (105 ~ 184)	0.008 (0.003~0.013)	under 0.063 (0.016~0.142)	○	○	10	6~8	0.065		
				over 08	50 (40 ~ 70)	0.25 (0.1 ~ 0.4)	under 2.0 (0.5 ~ 4.5)	○	○	10	6~8	25.0		
					164 (131 ~ 230)	0.010 (0.004~0.016)	under 0.079 (0.020~0.177)	○	○	10	6~8	0.127		
			VNMG16 TNMG16	under 04	32 (24 ~ 48)	0.16 (0.064~ 0.28)	under 1.2 (0.32 ~ 3.2)	○	○	10	6~8	6.1	97~99	
					105 (79 ~ 157)	0.006 (0.003~0.011)	under 0.047 (0.013~0.126)	○	○	10	6~8	0.031		
				over 08	40 (30 ~ 60)	0.2 (0.08 ~ 0.35)	under 1.5 (0.4 ~ 4.0)	○	○	10	6~8	12.0		
					131 (98 ~ 197)	0.008 (0.003~0.014)	under 0.059 (0.016~0.157)	○	○	10	6~8	0.061		
			RNMG19	-	50 (40 ~ 70)	0.8 (0.5 ~ 1.2)	under 4.5 (3.0 ~ 8.0)	○	○	10	6~8	180.0	99	
					164 (131 ~ 230)	0.008 (0.003~0.014)	under 0.059 (0.016~0.157)	○	○	10	6~8	0.076		

1. Cutting conditions – The cutting conditions above are based on the inscribed circle of 12.
(If the inscribed circle is over 15, you can increase both the feed and depth of cut 10%)

2. Tool life – To ensure the most satisfactory tool life, stay within the cutting conditions above.

3. Concentration of coolant – Coolant concentration of max. 10~12% is recommended.
The above data was gained at the concentration of 6~8%.

4. Coolant pressure – 1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply – It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate – Please consult the table above.

Engine Housing
INCONEL718(HRC40~44)

VP Series for ISO Turning

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					vc	fn	ap	Type		Pressure	Concentration		
					m/min sfm	mm/rev ipr	mm inch	Internal	External	bar	%	cm³/min inch³/min	
Medium to Light Cutting	VP3	PC8110	CNMG12 SNMG12 WNMG08	under 04	32 (24 ~ 48)	0.20 (0.08 ~ 0.32)	under 1.6 (0.4 ~ 3.6)	O	O	10	6~8	10.2	97~99
					105 (79 ~157)	0.008 (0.003~0.013)	under 0.063 (0.016~0.142)	O	O	10	6~8	0.052	
				over 08	40 (30 ~ 60)	0.25 (0.1 ~ 0.4)	under 2.0 (0.5 ~ 4.5)	O	O	10	6~8	20.0	
					131 (98 ~197)	0.010 (0.004~0.016)	under 0.079 (0.020~0.177)	O	O	10	6~8	0.102	
			DNMG15	under 04	32 (24 ~ 48)	0.20 (0.08 ~ 0.32)	under 1.6 (0.4 ~ 3.6)	O	O	10	6~8	10.2	97~99
					105 (79 ~157)	0.008 (0.003~0.013)	under 0.063 (0.016~0.142)	O	O	10	6~8	0.052	
				over 08	40 (30 ~ 60)	0.25 (0.1 ~ 0.4)	under 2.0 (0.5 ~ 4.5)	O	O	10	6~8	20.0	
					131 (98 ~197)	0.010 (0.004~0.016)	under 0.079 (0.020~0.177)	O	O	10	6~8	0.102	
			VNMG16 TNMG16	under 04	28 (20 ~ 44)	0.16 (0.064~ 0.28)	under 1.2 (0.32 ~ 3.2)	O	O	10	6~8	5.4	97~99
					92 (66 ~144)	0.006 (0.003~0.011)	under 0.047 (0.013~0.126)	O	O	10	6~8	0.027	
				over 08	35 (25 ~ 55)	0.2 (0.08 ~ 0.35)	under 1.5 (0.4 ~ 4.0)	O	O	10	6~8	10.5	
					115 (82 ~180)	0.008 (0.003~0.014)	under 0.059 (0.016~0.157)	O	O	10	6~8	0.053	
			RNMG19	-	40 (30 ~ 60)	0.8 (0.5 ~ 1.2)	under 4.5 (3.0 ~ 8.0)	O	O	10	6~8	144.0	99
					115 (82 ~180)	0.008 (0.003~0.014)	under 0.059 (0.016~0.157)	O	O	10	6~8	0.053	
Rough to Medium Cutting	VP4	PC8110	CNMG12 SNMG12 WNMG08	under 04	32 (24 ~ 48)	0.24 (0.12 ~ 0.36)	under 2.0 (0.8 ~ 4.0)	O	O	10	6~8	10.2	97~99
					105 (79 ~157)	0.009 (0.005~0.014)	under 0.079 (0.031~0.157)	O	O	10	6~8	0.052	
				over 08	40 (30 ~ 60)	0.3 (0.15 ~ 0.45)	under 2.5 (1.0 ~ 5.0)	O	O	10	6~8	20.0	
					131 (98 ~197)	0.012 (0.006~0.018)	under 0.098 (0.039~0.197)	O	O	10	6~8	0.102	
			DNMG15	under 04	32 (24 ~ 48)	0.24 (0.12 ~ 0.36)	under 2.0 (0.8 ~ 4.0)	O	O	10	6~8	10.2	97~99
					105 (79 ~157)	0.009 (0.005~0.014)	under 0.079 (0.031~0.157)	O	O	10	6~8	0.052	
				over 08	40 (30 ~ 60)	0.3 (0.15 ~ 0.45)	under 2.5 (1.0 ~ 5.0)	O	O	10	6~8	20.0	
					131 (98 ~197)	0.012 (0.006~0.018)	under 0.098 (0.039~0.197)	O	O	10	6~8	0.102	

VP Series for ISO Turning

				Rose									
					vc	fn	ap	Type		Pressure	Concentration		
					m/min sfm	mm/rev ipr	mm inch	Internal	External	bar	%	cm³/min inch³/min	
Rough to Medium Cutting	VP4	PC8110	VNMG16 TNMG16	under 04	28 (20 ~ 44)	0.20 (0.096~ 0.32)	under 1.6 (0.64 ~ 3.6)	O	O	10	6~8	5.4	97~99
					92 (66 ~144)	0.008 (0.004~0.013)	under 0.063 (0.025~0.142)	O	O	10	6~8	0.027	
				over 08	35 (25 ~ 55)	0.25 (0.12 ~ 0.4)	under 2.0 (0.8 ~ 4.5)	O	O	10	6~8	10.5	
					115 (82 ~180)	0.010 (0.005~0.016)	under 0.079 (0.031~0.177)	O	O	10	6~8	0.053	
			RNMG19	-	40 (30 ~ 60)	1.0 (0.6 ~ 1.4)	under 5.0 (4.0 ~ 10.0)	O	O	10	6~8	144.0	99
					115 (82 ~180)	0.010 (0.005~0.016)	under 0.079 (0.031~0.177)	O	O	10	6~8	0.053	

1. Cutting conditions – If you are using a different grade, the cutting conditions may differ.
(10% faster for H01, 10% slower for PC5300)

2. Tool life – To ensure the most satisfactory tool life, stay within the cutting conditions above.

3. Concentration of coolant – Coolant concentration of max. 10~12% is recommended.
The above data was gained at the concentration of 6~8%.

4. Coolant pressure – 1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply – It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate – Please consult the table above.

Landing Gear / Engine Housing

Ti-6Al-4V (HRC35~40) / INCONEL718 (HRC40~45)

MST Tools

				Rose									
					vc	fn	ap	Type		Pressure	Concentration		
					m/min sfm	mm/rev ipr	mm inch	Internal	External	bar	%	cm³/min inch³/min	
Cham -fering	Single edges	PC30M	MBFR000	-	40 (30 ~ 60)	0.05 (0.01 ~ 0.1)	under 0.5 (0.1 ~ 1.0)	O	O	10	6~8	1.0	
					131 (98 ~ 197)	0.002 (0.000~0.004)	under 0.020 (0.004~0.039)	O	O	10	6~8	0.005	
	twin edges	PC30M	MBFR000-1	-	40 (30 ~ 60)	0.05 (0.01 ~ 0.1)	under 0.5 (0.1 ~ 1.0)	O	O	10	6~8	1.0	
					131 (98 ~ 197)	0.002 (0.000~0.004)	under 0.020 (0.004~0.039)	O	O	10	6~8	0.005	

1. Cutting conditions – The cutting conditions above are based on the shank diameter of Ø6. If you are using a shank diameter over Ø8, you can increase the feed rate 20%.

2. Tool life – To ensure the most satisfactory tool life, stay within the cutting conditions above.

3. Concentration of coolant – Coolant concentration of max. 10~12% is recommended.
The above data was gained at the concentration of 6~8%.

4. Coolant pressure – 1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply – It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate – Please consult the table above.

Landing Gear / Engine Blisk / Engine Casing / Wing Flap Track

Ti-6Al-4V (HRC35~40)

Facing (FMR, HFM, FMA, RM8, RM16, HRMD)

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			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm^3/min $inch^3$/min	
FMR	RPET0803M0E-ML	PC5300	50 (40 ~ 70)	0.4 (0.5 ~ 0.3)	under 0.7	under 0.3D	○	○	30	6~8	2.7	138~146
			164 (131 ~ 230)	0.016 (0.020 ~ 0.012)	under 0.028	under 0.012D	○	○	30	6~8	0.006	
	RPET10T3M0E-ML	PC5300	50 (40 ~ 70)	0.4 (0.5 ~ 0.3)	under 0.9	under 0.4D	○	○	30	6~8	4.6	
			164 (131 ~ 230)	0.016 (0.020 ~ 0.012)	under 0.035	under 0.016D	○	○	30	6~8	0.011	
	RPET1204M0E-ML	PC5300	50 (40 ~ 70)	0.4 (0.5 ~ 0.3)	under 1.0	under 0.5D	○	○	30	6~8	15.9	
			164 (131 ~ 230)	0.016 (0.020 ~ 0.012)	under 0.039	under 0.020D	○	○	30	6~8	0.038	
	RPET1606M0E-ML	PC5300	50 (40 ~ 70)	0.4 (0.5 ~ 0.3)	under 1.2	under 0.6D	○	○	30	6~8	27.5	
			164 (131 ~ 230)	0.016 (0.020 ~ 0.012)	under 0.047	under 0.024D	○	○	30	6~8	0.066	
	RPET2007M0E-ML	PC5300	50 (40 ~ 70)	0.4 (0.5 ~ 0.3)	under 1.5	under 0.7D	○	○	30	6~8	33.4	
			164 (131 ~ 230)	0.016 (0.020 ~ 0.012)	under 0.059	under 0.028D	○	○	30	6~8	0.080	
HFM	LPMT040210R-MF LPMT040220R-MF	PC5300	40 (30 ~ 50)	0.9 (0.4 ~ 1.2)	under 0.5	under 0.5D	○	○	30	6~8	11.5	153~156
			131 (98 ~ 164)	0.035 (0.016 ~ 0.047)	under 0.020	under 0.020D	○	○	30	6~8	0.028	
FMA	SEEW0903AGTN	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	114.1	-
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.157	under 0.028D	○	○	30	6~8	0.274	
	SEEW14M4AGTN	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	85.6	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.157	under 0.028D	○	○	30	6~8	0.206	
RM8	SNEX1206ANN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 6.0	under 0.3D	○	○	30	6~8	27.5	131~134
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.236	under 0.012D	○	○	30	6~8	0.066	
	SNEX1206ENN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 9.0	under 0.3D	○	○	30	6~8	28.9	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.354	under 0.012D	○	○	30	6~8	0.069	
	SNEX1206QNN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 11.5	under 0.3D	○	○	30	6~8	52.7	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.453	under 0.012D	○	○	30	6~8	0.127	
	SNEX1507ANN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 7.5	under 0.3D	○	○	30	6~8	20.6	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.295	under 0.012D	○	○	30	6~8	0.050	
	SNEX1507ENN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 11.0	under 0.3D	○	○	30	6~8	30.3	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.433	under 0.012D	○	○	30	6~8	0.073	
RM16	ONHX060608-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 4.0	under 0.3D	○	○	30	6~8	11.0	135~137
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.157	under 0.012D	○	○	30	6~8	0.026	
	ONHX080608-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 5.5	under 0.3D	○	○	30	6~8	15.1	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.217	under 0.012D	○	○	30	6~8	0.036	
HRMD	WNMX060312ZNN-ML	PC5300	40 (30 ~ 50)	0.3 (0.4 ~ 0.1)	under 1.0	under 0.3D	○	○	30	6~8	4.6	147~152
			131 (98 ~ 164)	0.012 (0.016 ~ 0.004)	under 0.039	under 0.012D	○	○	30	6~8	0.011	
	WNMX09T316ZNN-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.1)	under 1.5	under 0.3D	○	○	30	6~8	16.0	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.004)	under 0.059	under 0.012D	○	○	30	6~8	0.039	
	WNMX130520ZNN-ML	PC5300	40 (30 ~ 50)	0.5 (0.6 ~ 0.1)	under 2.0	under 0.3D	○	○	30	6~8	22.9	
			131 (98 ~ 164)	0.020 (0.024 ~ 0.004)	under 0.079	under 0.012D	○	○	30	6~8	0.055	

Facing (FMR, HFM, FMA, RM8, RM16, HRMD)

			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm³/min inch³/min	
HRMD	WNMX160720ZNN-ML	PC5300	40 (30 ~ 50)	0.6 (0.7 ~ 0.1)	under 2.5	under 0.3D	○	○	30	6~8	28.6	147~152
			131 (98 ~ 164)	0.024 (0.028 ~ 0.004)	under 0.098	under 0.012D	○	○	30	6~8	0.069	

Copy Milling (GBE)

GBE	ZPET080M-MM ZPET080S-MM	PC5300	40 (30 ~ 50)	0.3 (0.4 ~ 0.2)	under 8.0	under 0.1D	○	○	30	6~8	6.1	157~160
			131 (98 ~ 164)	0.012 (0.016 ~ 0.008)	under 0.315	under 0.004D	○	○	30	6~8	0.015	
	ZPET100M-MM ZPET100S-MM	PC5300	40 (30 ~ 50)	0.3 (0.4 ~ 0.2)	under 10.0	under 0.1D	○	○	30	6~8	7.6	
			131 (98 ~ 164)	0.012 (0.016 ~ 0.008)	under 0.394	under 0.004D	○	○	30	6~8	0.018	
	ZPET125M-MM ZPET125S-MM	PC5300	40 (30 ~ 50)	0.3 (0.4 ~ 0.2)	under 13.0	under 0.1D	○	○	30	6~8	9.9	
			131 (98 ~ 164)	0.012 (0.016 ~ 0.008)	under 0.512	under 0.004D	○	○	30	6~8	0.024	
	ZPET160M-MM ZPET160S-MM	PC5300	40 (30 ~ 50)	0.3 (0.4 ~ 0.2)	under 16.0	under 0.1D	○	○	30	6~8	12.2	
			131 (98 ~ 164)	0.012 (0.016 ~ 0.008)	under 0.630	under 0.004D	○	○	30	6~8	0.029	

Shouldering (RM3, Pro-L, Alpha Mill)

RM3	XNKT080508PNER-ML	PC5300	40 (30 ~ 50)	0.15 (0.2 ~ 0.1)	under 8.0	under 0.3D	○	○	30	6~8	27.5	124~126
			131 (98 ~ 164)	0.006 (0.008 ~ 0.004)	under 0.315	under 0.012D	○	○	30	6~8	0.066	
	XNKT060405PNER-ML	PC5300	40 (30 ~ 50)	0.15 (0.2 ~ 0.1)	under 5.5	under 0.3D	○	○	30	6~8	25.2	
			131 (98 ~ 164)	0.006 (0.008 ~ 0.004)	under 0.217	under 0.012D	○	○	30	6~8	0.061	
Pro-L	LXET2504PEER-40-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 25.0	under 0.3D	○	○	30	6~8	28.6	172~174
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.984	under 0.012D	○	○	30	6~8	0.069	
	LXET3405PEER-63-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 34.0	under 0.3D	○	○	30	6~8	51.9	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 1.339	under 0.012D	○	○	30	6~8	0.125	
Alpha Mill	APMT0903PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 5.6	under 0.3D	○	○	30	6~8	10.7	117~123
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.220	under 0.012D	○	○	30	6~8	0.026	
	APMT11T3PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 9.0	under 0.3D	○	○	30	6~8	13.8	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.354	under 0.012D	○	○	30	6~8	0.033	
	APMT1604PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 11.0	under 0.3D	○	○	30	6~8	12.6	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.433	under 0.012D	○	○	30	6~8	0.030	
	APMT1806PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 17.0	under 0.3D	○	○	30	6~8	19.5	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.669	under 0.012D	○	○	30	6~8	0.047	

Slotting (Wind Mill)

Wind Mill	SNHT□□□□□□R/L-WX	PC5300	40 (30 ~ 50)	0.2 (0.3 ~ 0.1)	under 1.0	under 0.15D	○	○	30	6~8	6.1	163~165
			131 (98 ~ 164)	0.008 (0.012 ~ 0.004)	under 0.039	under 0.006D	○	○	30	6~8	0.015	

1. Cutting conditions

1) It is recommended to use the minimum feed per tooth when using the maximum cutting speed.
2) When the feed per tooth increases, lower the cutting speed. (e.g.) fz: 0.3 → 0.4, vc 40 → 30)

2. Tool life

- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Concentration of coolant

- Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure

1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply

- It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate

1) For the FMR, RPET08 Ø17 (2 teeth), RPET10 Ø26 (2 teeth), RPET12 Ø50 (5 teeth), RPET16 Ø80 (6 teeth), RPET20 Ø80 (5 teeth) were used.
2) For the HFM, LPMT04 Ø16 (4 teeth) were used.
3) For the GBE, ZPET080 Ø16 (2 teeth), ZPET100 Ø20 (2 teeth), ZPET125 Ø25 (2 teeth), ZPET160 Ø32 (2 teeth) were used.
4) For the FMA, SEEW09 Ø63 (8 teeth), SEEW14 Ø63 (6 teeth) were used.
5) For the RM3, XNKT06 Ø63 (8 teeth), XNKT08 Ø63 (6 teeth) were used.
6) For the RM8, SNEX1206ANN Ø80 (10 teeth), SNEX1206ENN Ø80 (7 teeth), SNEX1206QNN Ø80 (10 teeth), SNEX15 Ø80 (6 teeth) were used.
7) For the RM16,ONHX Ø80 (6 teeth) were used.
8) For the HRMD, WNMX06 Ø32 (4 teeth), WNMX09 Ø80 (7 teeth), WNMX13 Ø80 (6 teeth), WNMX16 Ø80 (5 teeth) were used.
9) For the Pro-L, LXET25 Ø40 (3 teeth), LXET34 Ø63 (4 teeth) were used.
10) For the Alpha Mill, APMT09 Ø32 (5 teeth), APMT11 Ø32 (4 teeth), APMT16 Ø32 (3 teeth), APMT18 Ø32 (3 teeth) were used.
11) For the Wind Mill, SNHT Ø160 (16 teeth) were used.

Engine Housing / Engine Disk
INCONEL718 (HRC40~45)

Facing (FMR, HFM, FMA, RM8, RM16, HRMD)

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			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm³/min inch³/min	
FMR	RPET0803M0E-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 0.5	under 0.3D	○	○	30	6~8	1.5	138~146
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.020	under 0.012D	○	○	30	6~8	0.004	
	RPET10T3M0E-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 0.9	under 0.4D	○	○	30	6~8	3.7	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.035	under 0.016D	○	○	30	6~8	0.009	
	RPET1204M0E-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 1.0	under 0.5D	○	○	30	6~8	12.7	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.039	under 0.020D	○	○	30	6~8	0.031	
	RPET1606M0E-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 1.2	under 0.6D	○	○	30	6~8	22.0	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.047	under 0.024D	○	○	30	6~8	0.053	
	RPET2007M0E-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 1.5	under 0.7D	○	○	30	6~8	26.7	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.059	0.028D	○	○	30	6~8	0.064	
HFM	LPMT040210R-MF LPMT040220R-MF	PC5300	40 (30 ~ 45)	0.5 (0.4 ~ 0.6)	under 0.5	under 0.5D	○	○	30	6~8	6.4	153~156
			131 (98 ~ 148)	0.020 (0.016 ~ 0.024)	0.020	0.020D	○	○	30	6~8	0.015	

Facing (FMR, HFM, FMA, RM8, RM16, HRMD)

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			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm³/min inch³/min	
FMA	SEEW0903AGTN	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	114.1	-
			131 (98 ~ 164)	0.016 (0.020~0.012)	under 0.157	under 0.028D	○	○	30	6~8	0.274	
	SEEW14M4AGTN	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	114.1	
			131 (98 ~ 164)	0.016 (0.020~0.012)	under 0.157	under 0.028D	○	○	30	6~8	0.274	
RM8	SNEX1206ANN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 6.0	under 0.3D	○	○	30	6~8	27.5	131~134
			131 (98 ~ 164)	0.005 (0.006~0.004)	under 0.236	under 0.012D	○	○	30	6~8	0.066	
	SNEX1206ENN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 9.0	under 0.3D	○	○	30	6~8	28.9	
			131 (98 ~ 164)	0.005 (0.006~0.004)	0.354	under 0.012D	○	○	30	6~8	0.069	
	SNEX1206QNN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 11.5	under 0.3D	○	○	30	6~8	52.7	
			131 (98 ~ 164)	0.005 (0.006~0.004)	under 0.453	under 0.012D	○	○	30	6~8	0.127	
	SNEX1507ANN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 7.5	under 0.3D	○	○	30	6~8	20.6	
			131 (98 ~ 164)	0.005 (0.006~0.004)	under 0.295	under 0.012D	○	○	30	6~8	0.050	
	SNEX1507ENN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 11.0	under 0.3D	○	○	30	6~8	30.3	
			131 (98 ~ 164)	0.005 (0.006~0.004)	under 0.433	under 0.012D	○	○	30	6~8	0.073	
RM16	OHX060608-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 4.0	under 0.3D	○	○	30	6~8	11.0	135~137
			131 (98 ~ 164)	0.005 (0.006~0.004)	under 0.157	under 0.012D	○	○	30	6~8	0.026	
	OHX080608-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 5.5	under 0.3D	○	○	30	6~8	15.1	
			131 (98 ~ 164)	0.005 (0.006~0.004)	under 0.217	under 0.012D	○	○	30	6~8	0.036	
HRMD	WNMX060312ZNN-ML	PC5300	40 (30 ~ 50)	0.3 (0.4 ~ 0.1)	under 1.0	under 0.3D	○	○	30	6~8	4.6	147~152
			131 (98 ~ 164)	0.012 (0.016~0.004)	under 0.039	under 0.012D	○	○	30	6~8	0.011	
	WNMX09T316ZNN-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.1)	under 1.5	under 0.3D	○	○	30	6~8	16.0	
			131 (98 ~ 164)	0.016 (0.020~0.004)	under 0.059	under 0.012D	○	○	30	6~8	0.039	
	WNMX130520ZNN-ML	PC5300	40 (30 ~ 50)	0.5 (0.6 ~ 0.1)	under 2.0	under 0.3D	○	○	30	6~8	22.9	
			131 (98 ~ 164)	0.020 (0.024~0.004)	under 0.079	0.012D	○	○	30	6~8	0.055	
	WNMX160720ZNN-ML	PC5300	40 (30 ~ 50)	0.6 (0.7 ~ 0.1)	under 2.5	under 0.3D	○	○	30	6~8	28.6	
			131 (98 ~ 164)	0.024 (0.028~0.004)	under 0.098	under 0.012D	○	○	30	6~8	0.069	

Copy Milling (GBE)

GBE	ZPET080M-MM ZPET080S-MM	PC5300	38 (30 ~ 45)	0.2 (0.1 ~ 0.3)	under 8	under 0.1D	○	○	30	6~8	3.9	157~160
			125 (98 ~ 148)	0.008 (0.004~0.012)	under 0.315	under 0.004D	○	○	30	6~8	0.009	
	ZPET100M-MM ZPET100S-MM	PC5300	38 (30 ~ 45)	0.2 (0.1 ~ 0.3)	under 10	under 0.1D	○	○	30	6~8	4.8	
			125 (98 ~ 148)	0.008 (0.004~0.012)	under 0.394	under 0.004D	○	○	30	6~8	0.012	
	ZPET125M-MM ZPET125S-MM	PC5300	38 (30 ~ 45)	0.2 (0.1 ~ 0.3)	under 13	under 0.1D	○	○	30	6~8	6.0	
			125 (98 ~ 148)	0.008 (0.004~0.012)	under 0.492	under 0.004D	○	○	30	6~8	0.015	
	ZPET160M-MM ZPET160S-MM	PC5300	38 (30 ~ 45)	0.2 (0.1 ~ 0.3)	under 16	under 0.1D	○	○	30	6~8	7.7	
			125 (98 ~ 148)	0.008 (0.004~0.012)	under 0.630	under 0.004D	○	○	30	6~8	0.019	

Shouldering (RM3, Pro-L, Alpha Mill)

RM3	XNKT080508PNER-ML	PC5300	40 (30 ~ 50)	0.15 (0.2 ~ 0.1)	under 8.0	under 0.3D	○	○	30	6~8	27.5	124~126
			131 (98 ~ 164)	0.006 (0.008~0.004)	under 0.315	under 0.012D	○	○	30	6~8	0.066	

Shouldering (RM3, Pro-L, Alpha Mill)

			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm³/min inch³/min	
RM3	XNKT060405PNER-ML	PC5300	40 (30 ~ 50)	0.15 (0.2 ~ 0.1)	under 5.5	under 0.3D	○	○	30	6~8	25.2	124~126
			131 (98 ~164)	0.006 (0.008~0.004)	under 0.217	under 0.012D	○	○	30	6~8	0.061	
Pro-L	LXET2504PEER-40-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 25.0	under 0.3D	○	○	30	6~8	28.6	172~174
			131 (98 ~164)	0.004 (0.006~0.002)	under 0.984	under 0.012D	○	○	30	6~8	0.069	
	LXET3405PEER-63-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 34.0	under 0.3D	○	○	30	6~8	51.9	
			131 (98 ~164)	0.004 (0.006~0.002)	under 1.339	under 0.012D	○	○	30	6~8	0.125	
Alpha Mill	APMT0903PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 5.6	under 0.3D	○	○	30	6~8	10.7	117~123
			131 (98 ~164)	0.004 (0.006~0.002)	under 0.220	under 0.012D	○	○	30	6~8	0.026	
	APMT11T3PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 9.0	under 0.3D	○	○	30	6~8	13.8	
			131 (98 ~164)	0.004 (0.006~0.002)	under 0.354	under 0.012D	○	○	30	6~8	0.033	
	APMT1604PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 11.0	under 0.3D	○	○	30	6~8	12.6	
			131 (98 ~164)	0.004 (0.006~0.002)	under 0.433	under 0.012D	○	○	30	6~8	0.030	
	APMT1806PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 17.0	under 0.3D	○	○	30	6~8	19.5	
			131 (98 ~164)	0.004 (0.006~0.002)	under 0.669	under 0.012D	○	○	30	6~8	0.047	

1. Cutting conditions

1) It is recommended to use the minimum feed per tooth when using the maximum cutting speed.
2) When the feed per tooth increases, lower the cutting speed. (e.g.) fz: 0.3 → 0.4, vc 40 → 30)

2. Tool life

- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Concentration of coolant

- Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure

1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply

- It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate

1) For the FMR, RPET08 Ø17 (2 teeth), RPET10 Ø26 (2 teeth), RPET12 Ø50 (5 teeth), RPET16 Ø80 (6 teeth), RPET20 Ø80 (5 teeth) were used.
2) For the HFM, LPMT04 Ø16 (4 teeth) were used.
3) For the GBE, ZPET080 Ø16 (2 teeth), ZPET100 Ø20 (2 teeth), ZPET125 Ø25 (2 teeth), ZPET160 Ø32 (2 teeth) were used.
4) For the FMA, SEEW09 Ø63 (8 teeth), SEEW14 Ø63 (6 teeth) were used.
5) For the RM3, XNKT06 Ø63 (8 teeth), XNKT08 Ø63 (6 teeth) were used.
6) For the RM8, SNEX1206ANN Ø80 (10 teeth), SNEX1206ENN Ø80 (7 teeth), SNEX1206QNN Ø80 (10 teeth), SNEX15 Ø80 (6 teeth) were used.
7) For the RM16,ONHX Ø80 (6 teeth) were used.
8) For the HRMD, WNMX06 Ø32 (4 teeth), WNMX09 Ø80 (7 teeth), WNMX13 Ø80 (6 teeth), WNMX16 Ø80 (5 teeth) were used.
9) For the Pro-L, LXET25 Ø40 (3 teeth), LXET34 Ø63 (4 teeth) were used.
10) For the Alpha Mill, APMT09 Ø32 (5 teeth), APMT11 Ø32 (4 teeth), APMT16 Ø32 (3 teeth), APMT18 Ø32 (3 teeth) were used.
11) For the Wind Mill, SNHT Ø160 (16 teeth) were used.

Air Frame / Engine Mount

Ti-6Al-4V (HRC35~40)

Facing (FMA, RM8, RM16, HRMD)

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			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm³/min inch³/min	
FMA	SEEW0903AGTN	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	114.1	-
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.157	under 0.028D	○	○	30	6~8	0.274	
	SEEW14M4AGTN	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	114.1	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.012)	under 0.157	under 0.028D	○	○	30	6~8	0.274	
RM8	SNEX1206ANN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 6.0	under 0.3D	○	○	30	6~8	27.5	131~134
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.236	under 0.012D	○	○	30	6~8	0.066	
	SNEX1206ENN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 9.0	under 0.3D	○	○	30	6~8	28.9	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.354	under 0.012D	○	○	30	6~8	0.069	
	SNEX1206QNN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 11.5	under 0.3D	○	○	30	6~8	52.7	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.453	under 0.012D	○	○	30	6~8	0.127	
	SNEX1507ANN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 7.5	under 0.3D	○	○	30	6~8	20.6	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.295	under 0.012D	○	○	30	6~8	0.050	
	SNEX1507ENN-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 11.0	under 0.3D	○	○	30	6~8	30.3	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.433	under 0.012D	○	○	30	6~8	0.073	
RM16	OHX060608-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 4.0	under 0.3D	○	○	30	6~8	11.0	135~137
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.157	under 0.012D	○	○	30	6~8	0.026	
	OHX080608-ML	PC5300	40 (30 ~ 50)	0.12 (0.15 ~ 0.1)	under 5.5	under 0.3D	○	○	30	6~8	15.1	
			131 (98 ~ 164)	0.005 (0.006 ~ 0.004)	under 0.217	under 0.012D	○	○	30	6~8	0.036	
HRMD	WNMX060312ZNN-ML	PC5300	40 (30 ~ 50)	0.3 (0.4 ~ 0.1)	under 1.0	under 0.3D	○	○	30	6~8	4.6	147~152
			131 (98 ~ 164)	0.012 (0.016 ~ 0.004)	under 0.039	under 0.012D	○	○	30	6~8	0.011	
	WNMX09T316ZNN-ML	PC5300	40 (30 ~ 50)	0.4 (0.5 ~ 0.1)	under 1.5	under 0.3D	○	○	30	6~8	16.0	
			131 (98 ~ 164)	0.016 (0.020 ~ 0.004)	under 0.059	under 0.012D	○	○	30	6~8	0.039	
	WNMX130520ZNN-ML	PC5300	40 (30 ~ 50)	0.5 (0.6 ~ 0.1)	under 2.0	under 0.3D	○	○	30	6~8	22.9	
			131 (98 ~ 164)	0.020 (0.024 ~ 0.004)	under 0.079	under 0.012D	○	○	30	6~8	0.055	
	WNMX160720ZNN-ML	PC5300	40 (30 ~ 50)	0.6 (0.7 ~ 0.1)	under 2.5	under 0.3D	○	○	30	6~8	28.6	
			131 (98 ~ 164)	0.024 (0.028 ~ 0.004)	under 0.098	under 0.012D	○	○	30	6~8	0.069	

Shouldering (RM3, Pro-L, Alpha Mill)

RM3	XNKT080508PNER-ML	PC5300	40 (30 ~ 50)	0.15 (0.2 ~ 0.1)	under 8.0	under 0.3D	○	○	30	6~8	27.5	124~126
			131 (98 ~ 164)	0.006 (0.008 ~ 0.004)	under 0.315	under 0.012D	○	○	30	6~8	0.066	
	XNKT060405PNER-ML	PC5300	40 (30 ~ 50)	0.15 (0.2 ~ 0.1)	under 5.5	under 0.3D	○	○	30	6~8	25.2	
			131 (98 ~ 164)	0.006 (0.008 ~ 0.004)	under 0.217	under 0.012D	○	○	30	6~8	0.061	
Pro-L	LXET2504PEER-40-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 25.0	under 0.3D	○	○	30	6~8	28.6	172~174
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.984	under 0.012D	○	○	30	6~8	0.069	
	LXET340508PEER-63-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 34.0	under 0.3D	○	○	30	6~8	51.9	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 1.339	under 0.012D	○	○	30	6~8	0.125	

Shouldering (RM3, Pro-L, Alpha Mill)

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			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm³/min inch³/min	
Alpha Mill	APMT0903PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 5.6	under 0.3D	○	○	30	6~8	10.7	117~123
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.220	under 0.012D	○	○	30	6~8	0.026	
	APMT11T3PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 9.0	under 0.3D	○	○	30	6~8	13.8	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.354	under 0.012D	○	○	30	6~8	0.033	
	APMT1604PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 11.0	under 0.3D	○	○	30	6~8	12.6	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.433	under 0.012D	○	○	30	6~8	0.030	
	APMT1806PDER-ML	PC5300	40 (30 ~ 50)	0.1 (0.15 ~ 0.05)	under 17.0	under 0.3D	○	○	30	6~8	19.5	
			131 (98 ~ 164)	0.004 (0.006 ~ 0.002)	under 0.669	under 0.012D	○	○	30	6~8	0.047	

1. Cutting conditions

1) It is recommended to use the minimum feed per tooth when using the maximum cutting speed.
2) When the feed per tooth increases, lower the cutting speed. (e.g.) fz: 0.3 → 0.4, vc 40 → 30)

2. Tool life

- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Concentration of coolant

- Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure

1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply

- It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate

1) For the FMA, SEEW09 Ø63 (8 teeth), SEEW14 Ø63 (6 teeth) were used.
2) For the RM3, XNKT06 Ø63 (8 teeth), XNKT08 Ø63 (6 teeth) were used.
3) For the RM8, SNEX1206ANN Ø80 (10 teeth), SNEX1206ENN Ø80 (7 teeth), SNEX1206QNN Ø80 (10 teeth), SNEX15 Ø80 (6 teeth) were used.
4) For the RM16,ONHX Ø80 (6 teeth) were used.
5) For the HRMD, WNMX06 Ø32 (4 teeth), WNMX09 Ø80 (7 teeth), WNMX13 Ø80 (6 teeth), WNMX16 Ø80 (5 teeth) were used.
6) For the Pro-L, LXET25 Ø40 (3 teeth), LXET34 Ø63(4 teeth) were used.
7) For the Alpha Mill, APMT09 Ø32 (5 teeth), APMT11 Ø32 (4 teeth), APMT16 Ø32 (3 teeth), APMT18 Ø32 (3 teeth) were used.

Air Frame / RIB SPAR
Aluminum

Facing (FMA, RM8, RM16)

			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm^3/min $inch^3/min$	
FMA	SEET0903AGFN-MA	H01	600 (300 ~ 800)	0.5 (0.6 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	2139.0	-
			1969 (984 ~2625)	0.020 (0.024~0.012)	under 0.157	under 0.028D	○	○	30	6~8	5.139	
	SEET14M4AGFN-MA	H01	600 (300 ~ 800)	0.5 (0.6 ~ 0.3)	under 4.0	under 0.7D	○	○	30	6~8	1604.3	
			1969 (984 ~2625)	0.020 (0.024~0.012)	under 0.157	under 0.028D	○	○	30	6~8	3.854	
RM8	SNEX1206ANN-MA	H01	1000 (500 ~1200)	0.4 (0.5 ~ 0.1)	under 6.0	under 0.3D	○	○	30	6~8	2291.8	131~134
			3281 (1640~3937)	0.016 (0.020~0.004)	under 0.236	under 0.012D	○	○	30	6~8	5.506	
	SNEX1206ENN-MA	H01	1000 (500 ~1200)	0.4 (0.5 ~ 0.1)	under 9.0	under 0.3D	○	○	30	6~8	2406.4	
			3281 (1640~3937)	0.016 (0.020~0.004)	under 0.354	under 0.012D	○	○	30	6~8	5.781	
	SNEX1206QNN-MA	H01	1000 (500 ~1200)	0.4 (0.5 ~ 0.1)	under 11.5	under 0.3D	○	○	30	6~8	4392.7	
			3281 (1640~3937)	0.016 (0.020~0.004)	under 0.453	0.012D	○	○	30	6~8	10.553	
RM16	OHX060608-MA	H01	600 (300 ~ 800)	0.5 (0.6 ~ 0.3)	under 6.0	under 0.3D	○	○	30	6~8	1031.3	135~137
			1969 (984 ~2625)	0.020 (0.024~0.012)	under 0.236	under 0.012D	○	○	30	6~8	2.478	
	OHX080608-MA	H01	1000 (500 ~1200)	0.4 (0.5 ~ 0.1)	under 6.0	under 0.3D	○	○	30	6~8	1375.1	
			3281 (1640~3937)	0.016 (0.020~0.004)	under 0.236	under 0.012D	○	○	30	6~8	3.304	

Shouldering (RM3, RM4, Alpha Mill, Pro-A, Pro-X, Pro-L)

RM3	XNCT080508PNFR-MA	H01	1000 (500 ~1200)	0.4 (0.5 ~ 0.1)	under 8.0	under 0.3D	○	○	30	6~8	1833.5	124~126
			3281 (1640~3937)	0.016 (0.020~0.004)	under 0.315	under 0.012D	○	○	30	6~8	4.405	
RM4	LNEX100605PNR-MA	H01	600 (300 ~ 800)	0.5 (0.6 ~ 0.3)	under 10.0	under 0.3D	○	○	30	6~8	2578.3	127~130
			1969 (984 ~2625)	0.020 (0.024~0.012)	under 0.394	under 0.012D	○	○	30	6~8	6.194	
	LNEX151008PNR-MA	H01	1000 (500 ~1200)	0.4 (0.5 ~ 0.1)	under 15.0	under 0.3D	○	○	30	6~8	3437.7	
			3281 (1640~3937)	0.016 (0.020~0.004)	under 0.591	under 0.012D	○	○	30	6~8	8.259	
Pro-L	LXET2504PEFR-40-ML	H01	1000 (400 ~1000)	0.2 (0.3 ~ 0.15)	under 6.0	under 0.3D	○	○	30	6~8	343.8	172~174
			3281 (1312~3281)	0.008 (0.012~0.006)	under 0.236	under 0.012D	○	○	30	6~8	0.826	
	LXET3405PEFR-63-ML	H01	600 (300 ~ 800)	0.2 (0.3 ~ 0.15)	under 6.0	under 0.3D	○	○	30	6~8	275.0	
			1969 (984 ~2625)	0.008 (0.012~0.006)	under 0.236	under 0.012D	○	○	30	6~8	0.661	
Alpha Mill	APMT0602PDFR-MA	H01	1000 (400 ~1000)	0.2 (0.3 ~ 0.15)	under 5.6	under 0.3D	○	○	30	6~8	855.6	117~123
			3281 (1312~3281)	0.008 (0.012~0.006)	under 0.220	under 0.012D	○	○	30	6~8	2.056	
	APMT0903PDFR-MA	H01	1000 (400 ~1000)	0.2 (0.3 ~ 0.15)	under 9.0	under 0.3D	○	○	30	6~8	859.4	
			3281 (1312~3281)	0.008 (0.012~0.006)	under 0.354	under 0.012D	○	○	30	6~8	2.065	
	APMT11T3PDFR-MA	H01	1000 (400 ~1000)	0.2 (0.3 ~ 0.15)	under 11.0	under 0.3D	○	○	30	6~8	840.3	
			3281 (1312~3281)	0.008 (0.012~0.006)	under 0.433	under 0.012D	○	○	30	6~8	2.019	
	APMT1604PDFR-MA	H01	1000 (400 ~1000)	0.2 (0.3 ~ 0.15)	under 16.0	under 0.3D	○	○	30	6~8	916.7	
			3281 (1312~3281)	0.008 (0.012~0.006)	under 0.630	under 0.012D	○	○	30	6~8	2.202	
	APMT1806PDFR-MA	H01	1000 (400 ~1000)	0.2 (0.3 ~ 0.15)	under 17.0	under 0.3D	○	○	30	6~8	974.0	
			3281 (1312~3281)	0.008 (0.012~0.006)	under 0.669	under 0.012D	○	○	30	6~8	2.340	

Shouldering (RM3, RM4, Alpha Mill, Pro-A, Pro-X, Pro-L)

			vc	fz	ap	ae	Type		Pressure	Concentration		
			m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm^3/min $inch^3$/min	
Pro-X	XEKT19M508FR-MA	H01	1000 (200 ~1200)	0.25 (0.3 ~ 0.15)	under 17.0	under 0.3D	O	O	30	6~8	2029.2	169~171
			3281 (656 ~3937)	0.010 (0.012 ~ 0.006)	under 0.669	under 0.012D	O	O	30	6~8	4.875	
	XEKT250608FR-MA	H01	800 (200 ~1000)	0.2 (0.25 ~ 0.15)	under 23.0	under 0.3D	O	O	30	6~8	1054.2	
			2625 (656 ~3281)	0.008 (0.010 ~ 0.006)	under 0.906	under 0.012D	O	O	30	6~8	2.533	
Pro-A	VDKT11T210N-MA	H01	800 (200 ~1000)	0.2 (0.25 ~ 0.15)	under 8.0	under 0.3D	O	O	30	6~8	244.5	166~168
			2625 (656 ~3281)	0.008 (0.010 ~ 0.006)	under 0.315	under 0.012D	O	O	30	6~8	0.587	
	VDKT220530N-MA	H01	800 (200 ~1000)	0.2 (0.25 ~ 0.15)	under 15.0	under 0.3D	O	O	30	6~8	458.4	
			2625 (656 ~3281)	0.008 (0.010 ~ 0.006)	under 0.591	under 0.012D	O	O	30	6~8	1.101	

1. Cutting conditions

1) It is recommended to use the minimum feed per tooth when using the maximum cutting speed.
2) When the feed per tooth increases, lower the cutting speed. (e.g.) fz: 0.3 → 0.4, vc 40 → 30)

2. Tool life

- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Concentration of coolant

- Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure

1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply

- It is recommended to apply enough fluids both inside and outside the tool.

6. Chip removal rate

1) For the FMA, SEET09 Ø63 (8 teeth), SEET14 Ø63 (6 teeth) were used.
2) For the RM3, XNCT08 Ø63 (6 teeth) were used.
3) For the RM4, LXEX10 Ø63 (9 teeth), LXEX15 Ø63 (6 teeth) were used.
4) For the RM8, SNEX1206ANN Ø80 (10 teeth), SNEX1206ENN Ø80 (7 teeth), SNEX1206QNN Ø80 (10 teeth) were used.
5) For the RM16,ONHX Ø80 (6 teeth) were used.
6) For the Pro-L, LXET25 Ø40 (3 teeth), LXET34 Ø63 (4 teeth) were used.
7) For the Alpha Mill, APMT06 Ø32 (8 teeth), APMT09 Ø32 (5 teeth), APMT11 Ø32 (4 teeth), APMT16 Ø32 (3 teeth), APMT18 Ø32 (3 teeth) were used.
8) For the Pro-X Mill, XEKT19 Ø63 (5 teeth), XEKT25 Ø63 (3 teeth) were used.
9) For the Pro-A Mill, VDKT11 Ø16 (2 teeth), VDKT22 Ø32 (2 teeth) were used.

Landing Gear

Ti-6Al-4V (HRC35~40)

KING DRILL

							vc	fn					
							m/min	mm/rev	Type		Pressure	Concentration	
			Central	Peripheral	mm		sfm	ipt	Internal	External	bar	%	
KING DRILL	PD	4	PC5300	PC5300	12.0 ~ 13.5	2D	70 (40 ~ 80)	0.06 (0.07 ~ 0.05)	○	○	30	6~8	178~181
					0.47 ~ 0.53	2D	230 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
					12.0 ~ 13.5	3D	60 (40 ~ 80)	0.06 (0.07 ~ 0.05)	○	○	30	6~8	
					0.47 ~ 0.53	3D	197 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
					12.0 ~ 13.5	4D	50 (40 ~ 80)	0.04 (0.05 ~ 0.03)	○	○	30	6~8	
					0.47 ~ 0.53	4D	164 (131 ~ 262)	0.002 (0.002~0.001)	○	○	30	6~8	
					12.0 ~ 13.5	5D	50 (40 ~ 80)	0.04 (0.05 ~ 0.03)	○	○	30	6~8	
					0.47 ~ 0.53	5D	164 (131 ~ 262)	0.002 (0.002~0.001)	○	○	30	6~8	
	PD	5	PC5300	PC5300	13.6 ~ 16.0	2D	70 (40 ~ 80)	0.06 (0.07 ~ 0.05)	○	○	30	6~8	178~181
					0.54 ~ 0.63	2D	230 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
					13.6 ~ 16.0	3D	60 (40 ~ 80)	0.06 (0.07 ~ 0.05)	○	○	30	6~8	
					0.54 ~ 0.63	3D	197 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
					13.6 ~ 16.0	4D	50 (40 ~ 80)	0.04 (0.05 ~ 0.03)	○	○	30	6~8	
					0.54 ~ 0.63	4D	164 (131 ~ 262)	0.002 (0.002~0.001)	○	○	30	6~8	
					13.6 ~ 16.0	5D	50 (40 ~ 80)	0.04 (0.05 ~ 0.03)	○	○	30	6~8	
					0.54 ~ 0.63	5D	164 (131 ~ 262)	0.002 (0.002~0.001)	○	○	30	6~8	
	LD	6	PC5335	PC5335	16.1 ~ 19.5	2D	70 (40 ~ 80)	0.08 (0.1 ~ 0.06)	○	○	30	6~8	178~181
					0.63 ~ 0.77	2D	230 (131 ~ 262)	0.003 (0.004~0.002)	○	○	30	6~8	
					16.1 ~ 19.5	3D	60 (40 ~ 80)	0.08 (0.1 ~ 0.06)	○	○	30	6~8	
					0.63 ~ 0.77	3D	197 (131 ~ 262)	0.003 (0.004~0.002)	○	○	30	6~8	
					16.1 ~ 19.5	4D	50 (40 ~ 80)	0.05 (0.07 ~ 0.04)	○	○	30	6~8	
					0.63 ~ 0.77	4D	164 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
					16.1 ~ 19.5	5D	50 (40 ~ 80)	0.05 (0.07 ~ 0.04)	○	○	30	6~8	
					0.63 ~ 0.77	5D	164 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
	LD	7	PC5335	PC5335	19.6 ~ 23.5	2D	70 (40 ~ 80)	0.08 (0.1 ~ 0.06)	○	○	30	6~8	178~181
					0.77 ~ 0.93	2D	230 (131 ~ 262)	0.003 (0.004~0.002)	○	○	30	6~8	
					19.6 ~ 23.5	3D	60 (40 ~ 80)	0.08 (0.1 ~ 0.06)	○	○	30	6~8	
					0.77 ~ 0.93	3D	197 (131 ~ 262)	0.003 (0.004~0.002)	○	○	30	6~8	
					19.6 ~ 23.5	4D	50 (40 ~ 80)	0.06 (0.07 ~ 0.04)	○	○	30	6~8	
					0.77 ~ 0.93	4D	164 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
					19.6 ~ 23.5	5D	50 (40 ~ 80)	0.06 (0.07 ~ 0.04)	○	○	30	6~8	
					0.77 ~ 0.93	5D	164 (131 ~ 262)	0.002 (0.003~0.002)	○	○	30	6~8	
	LD	9	PC5335	PC5335	23.6 ~ 29.5	2D	70 (40 ~ 80)	0.08 (0.1 ~ 0.06)	○	○	30	6~8	178~181
					0.93 ~ 1.16	2D	230 (131 ~ 262)	0.003 (0.004~0.002)	○	○	30	6~8	
					23.6 ~ 29.5	3D	60 (40 ~ 80)	0.08 (0.1 ~ 0.06)	○	○	30	6~8	
					0.93 ~ 1.16	3D	197 (131 ~ 262)	0.003 (0.004~0.002)	○	○	30	6~8	

KING DRILL

							vc	fn					
			Central	Peripheral	mm / inch		m/min / sfm	mm/rev / ipt	Type Internal	Type External	Pressure bar	Concentration %	
KING DRILL	LD	9	PC5335	PC5335	23.6 ~ 29.5	4D	50 (40 ~ 80)	0.06 (0.08 ~ 0.04)	O	O	30	6~8	178~181
					0.93 ~ 1.16	4D	164 (131 ~ 262)	0.002 (0.003~0.002)	O	O	30	6~8	
					23.6 ~ 29.5	5D	50 (40 ~ 80)	0.06 (0.08 ~ 0.04)	O	O	30	6~8	
					0.93 ~ 1.16	5D	164 (131 ~ 262)	0.002 (0.003~0.002)	O	O	30	6~8	
	LD	11	PC5335	PC5335	29.6 ~ 35.5	2D	70 (40 ~ 80)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.17 ~ 1.40	2D	230 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					29.6 ~ 35.5	3D	60 (40 ~ 80)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	
					1.17 ~ 1.40	3D	197 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					29.6 ~ 35.5	4D	50 (40 ~ 80)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.17 ~ 1.40	4D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	
					29.6 ~ 35.5	5D	50 (40 ~ 80)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.17 ~ 1.40	5D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	
	LD	13	PC5335	PC5335	35.6 ~ 42.5	2D	70 (40 ~ 80)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.40 ~ 1.67	2D	230 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					35.6 ~ 42.5	3D	60 (40 ~ 80)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	
					1.40 ~ 1.67	3D	197 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					35.6 ~ 42.5	4D	50 (40 ~ 80)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.40 ~ 1.67	4D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	
					35.6 ~ 42.5	5D	50 (40 ~ 80)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.40 ~ 1.67	5D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	
	LD	15	PC5335	PC5335	42.6 ~ 50.5	2D	70 (40 ~ 80)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.68 ~ 1.99	2D	230 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					42.6 ~ 50.5	3D	60 (40 ~ 80)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	
					1.68 ~ 1.99	3D	197 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					42.6 ~ 50.5	4D	50 (40 ~ 80)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.68 ~ 1.99	4D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	
					42.6 ~ 50.5	5D	50 (40 ~ 80)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.68 ~ 1.99	5D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	
	LD	18	PC5335	PC5335	50.6 ~ 60.5	2D	70 (40 ~ 80)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.99 ~ 2.38	2D	230 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					50.6 ~ 60.5	3D	60 (40 ~ 80)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	
					1.99 ~ 2.38	3D	197 (131 ~ 262)	0.004 (0.005~0.003)	O	O	30	6~8	
					50.6 ~ 60.5	4D	50 (40 ~ 80)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.99 ~ 2.38	4D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	
					50.6 ~ 60.5	5D	50 (40 ~ 80)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.99 ~ 2.38	5D	164 (131 ~ 262)	0.003 (0.004~0.002)	O	O	30	6~8	

*cf) If you increase the cutting speed, please decrease the feed rate.

Landing Gear

Ti-6Al-4V (HRC35~40)

KING DRILL

Product name	C/B	IC	Grade		Machining dia.(Ø) mm / inch	Aspect ratio L/D	Cutting conditions vc m/min / sfm	Cutting conditions fn mm/rev / ipt	Coolant Type Internal	Coolant Type External	Coolant Pressure bar	Coolant Concentration %	Page
			Central	Peripheral									
KING DRILL	PD	4	PC5300	PC8115	12.0 ~ 13.5	2D	80 (50 ~ 90)	0.06 (0.07 ~ 0.05)	O	O	30	6~8	178~181
					0.47 ~ 0.53	2D	262 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
					12.0 ~ 13.5	3D	70 (50 ~ 90)	0.06 (0.07 ~ 0.05)	O	O	30	6~8	
					0.47 ~ 0.53	3D	230 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
					12.0 ~ 13.5	4D	60 (50 ~ 90)	0.04 (0.05 ~ 0.03)	O	O	30	6~8	
					0.47 ~ 0.53	4D	197 (164 ~ 295)	0.002 (0.002~0.001)	O	O	30	6~8	
					12.0 ~ 13.5	5D	60 (50 ~ 90)	0.04 (0.05 ~ 0.03)	O	O	30	6~8	
					0.47 ~ 0.53	5D	197 (164 ~ 295)	0.002 (0.002~0.001)	O	O	30	6~8	
	PD	5	PC5300	PC8115	13.6 ~ 16.0	2D	80 (50 ~ 90)	0.06 (0.07 ~ 0.05)	O	O	30	6~8	178~181
					0.54 ~ 0.63	2D	262 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
					13.6 ~ 16.0	3D	70 (50 ~ 90)	0.06 (0.07 ~ 0.05)	O	O	30	6~8	
					0.54 ~ 0.63	3D	230 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
					13.6 ~ 16.0	4D	60 (50 ~ 90)	0.04 (0.05 ~ 0.03)	O	O	30	6~8	
					0.54 ~ 0.63	4D	197 (164 ~ 295)	0.002 (0.002~0.001)	O	O	30	6~8	
					13.6 ~ 16.0	5D	60 (50 ~ 90)	0.04 (0.05 ~ 0.03)	O	O	30	6~8	
					0.54 ~ 0.63	5D	197 (164 ~ 295)	0.002 (0.002~0.001)	O	O	30	6~8	
	LD	6	PC5335	PC8115	16.1 ~ 19.5	2D	80 (50 ~ 90)	0.08 (0.1 ~ 0.06)	O	O	30	6~8	178~181
					0.63 ~ 0.77	2D	262 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					16.1 ~ 19.5	3D	70 (50 ~ 90)	0.08 (0.1 ~ 0.06)	O	O	30	6~8	
					0.63 ~ 0.77	3D	230 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					16.1 ~ 19.5	4D	60 (50 ~ 90)	0.05 (0.07 ~ 0.04)	O	O	30	6~8	
					0.63 ~ 0.77	4D	197 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
					16.1 ~ 19.5	5D	60 (50 ~ 90)	0.05 (0.07 ~ 0.04)	O	O	30	6~8	
					0.63 ~ 0.77	5D	197 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
	LD	7	PC5335	PC8115	19.6 ~ 23.5	2D	80 (50 ~ 90)	0.08 (0.1 ~ 0.06)	O	O	30	6~8	178~181
					0.77 ~ 0.93	2D	262 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					19.6 ~ 23.5	3D	70 (50 ~ 90)	0.08 (0.1 ~ 0.06)	O	O	30	6~8	
					0.77 ~ 0.93	3D	230 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					19.6 ~ 23.5	4D	60 (50 ~ 90)	0.06 (0.07 ~ 0.04)	O	O	30	6~8	
					0.77 ~ 0.93	4D	197 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
					19.6 ~ 23.5	5D	60 (50 ~ 90)	0.06 (0.07 ~ 0.04)	O	O	30	6~8	
					0.77 ~ 0.93	5D	197 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
	LD	9	PC5335	PC8115	23.6 ~ 29.5	2D	80 (50 ~ 90)	0.08 (0.1 ~ 0.06)	O	O	30	6~8	178~181
					0.93 ~ 1.16	2D	262 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					23.6 ~ 29.5	3D	70 (50 ~ 90)	0.08 (0.1 ~ 0.06)	O	O	30	6~8	
					0.93 ~ 1.16	3D	230 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	

KING DRILL

							vc	fn	Type		Pressure	Concentration	
			Central	Peripheral	mm inch		m/min sfm	mm/rev ipt	Internal	External	bar	%	
KING DRILL	LD	9	PC5335	PC8115	23.6 ~ 29.5	4D	60 (50 ~ 90)	0.06 (0.08 ~ 0.04)	O	O	30	6~8	178~181
					0.93 ~ 1.16	4D	197 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
					23.6 ~ 29.5	5D	60 (50 ~ 90)	0.06 (0.08 ~ 0.04)	O	O	30	6~8	
					0.93 ~ 1.16	5D	197 (164 ~ 295)	0.002 (0.003~0.002)	O	O	30	6~8	
	LD	11	PC5335	PC8115	29.6 ~ 35.5	2D	80 (50 ~ 90)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.17 ~ 1.40	2D	262 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					29.6 ~ 35.5	3D	70 (50 ~ 90)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	
					1.17 ~ 1.40	3D	230 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					29.6 ~ 35.5	4D	60 (50 ~ 90)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.17 ~ 1.40	4D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					29.6 ~ 35.5	5D	60 (50 ~ 90)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.17 ~ 1.40	5D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
	LD	13	PC5335	PC8115	35.6 ~ 42.5	2D	80 (50 ~ 90)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.40 ~ 1.67	2D	262 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					35.6 ~ 42.5	3D	70 (50 ~ 90)	0.09 (0.12 ~ 0.07)	O	O	30	6~8	
					1.40 ~ 1.67	3D	230 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					35.6 ~ 42.5	4D	60 (50 ~ 90)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.40 ~ 1.67	4D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					35.6 ~ 42.5	5D	60 (50 ~ 90)	0.07 (0.09 ~ 0.05)	O	O	30	6~8	
					1.40 ~ 1.67	5D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
	LD	15	PC5335	PC8115	42.6 ~ 50.5	2D	80 (50 ~ 90)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.68 ~ 1.99	2D	262 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					42.6 ~ 50.5	3D	70 (50 ~ 90)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	
					1.68 ~ 1.99	3D	230 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					42.6 ~ 50.5	4D	60 (50 ~ 90)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.68 ~ 1.99	4D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					42.6 ~ 50.5	5D	60 (50 ~ 90)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.68 ~ 1.99	5D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
	LD	18	PC5335	PC8115	50.6 ~ 60.5	2D	80 (50 ~ 90)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	178~181
					1.99 ~ 2.38	2D	262 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					50.6 ~ 60.5	3D	70 (50 ~ 90)	0.1 (0.12 ~ 0.07)	O	O	30	6~8	
					1.99 ~ 2.38	3D	230 (164 ~ 295)	0.004 (0.005~0.003)	O	O	30	6~8	
					50.6 ~ 60.5	4D	60 (50 ~ 90)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.99 ~ 2.38	4D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	
					50.6 ~ 60.5	5D	60 (50 ~ 90)	0.07 (0.1 ~ 0.05)	O	O	30	6~8	
					1.99 ~ 2.38	5D	197 (164 ~ 295)	0.003 (0.004~0.002)	O	O	30	6~8	

Wing Rib
Aluminum Alloy

MSDP

□□□□□□□ □□□ □	□ □□□□□□□□	□ □□□□□□□□□□□□□□□□ □ mm inch	□□□□□□□□□□□□ □□□	□□□□□□□□□□□□□□□□□□□□ vc m/min sfm	fn mm/rev ipt	□ □□□□□ Type Internal	Type External	Pressure bar	Concentration %	□□□□
MSDP	N	2.5 ~ 4.0	3D	90 (60 ~ 100)	0.3 (0.35 ~ 0.2)	O	O	30	6~8	182~186
		0.10 ~ 0.16	3D	295 (197 ~ 328)	0.012 (0.014 ~ 0.008)	O	O	30	6~8	
		2.5 ~ 4.0	5D	80 (60 ~ 100)	0.27 (0.35 ~ 0.2)	O	O	30	6~8	
		0.10 ~ 0.16	5D	262 (197 ~ 328)	0.011 (0.014 ~ 0.008)	O	O	30	6~8	
		2.5 ~ 4.0	7D	70 (60 ~ 100)	0.22 (0.35 ~ 0.2)	O	O	30	6~8	
		0.10 ~ 0.16	7D	230 (197 ~ 328)	0.009 (0.014 ~ 0.008)	O	O	30	6~8	
		4.1 ~ 10.0	3D	100 (80 ~ 110)	0.35 (0.4 ~ 0.3)	O	O	30	6~8	
		0.16 ~ 0.39	3D	328 (262 ~ 361)	0.014 (0.016 ~ 0.012)	O	O	30	6~8	
		4.1 ~ 10.0	5D	90 (80 ~ 110)	0.32 (0.4 ~ 0.3)	O	O	30	6~8	
		0.16 ~ 0.39	5D	295 (262 ~ 361)	0.013 (0.016 ~ 0.012)	O	O	30	6~8	
		4.1 ~ 10.0	7D	80 (80 ~ 110)	0.3 (0.4 ~ 0.3)	O	O	30	6~8	
		0.16 ~ 0.39	7D	262 (262 ~ 361)	0.012 (0.016 ~ 0.012)	O	O	30	6~8	
		10.1 ~ 16.0	3D	120 (100 ~ 120)	0.35 (0.4 ~ 0.3)	O	O	30	6~8	
		0.40 ~ 0.63	3D	394 (328 ~ 394)	0.014 (0.016 ~ 0.012)	O	O	30	6~8	
		10.1 ~ 16.0	5D	110 (100 ~ 120)	0.32 (0.4 ~ 0.3)	O	O	30	6~8	
		0.40 ~ 0.63	5D	361 (328 ~ 394)	0.013 (0.016 ~ 0.012)	O	O	30	6~8	
		10.1 ~ 16.0	7D	100 (100 ~ 120)	0.3 (0.4 ~ 0.3)	O	O	30	6~8	
		0.40 ~ 0.63	7D	328 (328 ~ 394)	0.012 (0.016 ~ 0.012)	O	O	30	6~8	
		16.1 ~ 20.0	3D	120 (100 ~ 120)	0.4 (0.45 ~ 0.35)	O	O	30	6~8	
		0.63 ~ 0.79	3D	394 (328 ~ 394)	0.016 (0.018 ~ 0.014)	O	O	30	6~8	
		16.1 ~ 20.0	5D	110 (100 ~ 120)	0.38 (0.45 ~ 0.35)	O	O	30	6~8	
		0.63 ~ 0.79	5D	361 (328 ~ 394)	0.015 (0.018 ~ 0.014)	O	O	30	6~8	
		16.1 ~ 20.0	7D	100 (100 ~ 120)	0.35 (0.45 ~ 0.35)	O	O	30	6~8	
		0.63 ~ 0.79	7D	328 (328 ~ 394)	0.014 (0.018 ~ 0.014)	O	O	30	6~8	

Wing Rib
Aluminum Alloy

MSDP

				vc	fn	Type	Pressure	Concentration	
		mm inch		m/min sfm	mm/rev ipt	Internal / External	bar	%	
MSDP	ND	2.5 ~ 4.0	3D	150 (100 ~ 160)	0.22 (0.3 ~ 0.1)	O O	30	6~8	182~186
		0.10 ~ 0.16	3D	492 (328 ~ 525)	0.009 (0.012 ~ 0.004)	O O	30	6~8	
		2.5 ~ 4.0	5D	140 (100 ~ 160)	0.2 (0.3 ~ 0.1)	O O	30	6~8	
		0.10 ~ 0.16	5D	459 (328 ~ 525)	0.008 (0.012 ~ 0.004)	O O	30	6~8	
		2.5 ~ 4.0	7D	130 (100 ~ 160)	0.18 (0.3 ~ 0.1)	O O	30	6~8	
		0.10 ~ 0.16	7D	427 (328 ~ 525)	0.007 (0.012 ~ 0.004)	O O	30	6~8	
		4.1 ~ 10.0	3D	170 (110 ~ 180)	0.28 (0.35 ~ 0.15)	O O	30	6~8	
		0.16 ~ 0.39	3D	558 (361 ~ 591)	0.011 (0.014 ~ 0.006)	O O	30	6~8	
		4.1 ~ 10.0	5D	155 (110 ~ 180)	0.25 (0.35 ~ 0.15)	O O	30	6~8	
		0.16 ~ 0.39	5D	509 (361 ~ 591)	0.010 (0.014 ~ 0.006)	O O	30	6~8	
		4.1 ~ 10.0	7D	140 (110 ~ 180)	0.22 (0.35 ~ 0.15)	O O	30	6~8	
		0.16 ~ 0.39	7D	459 (361 ~ 591)	0.009 (0.014 ~ 0.006)	O O	30	6~8	
		10.1 ~ 16.0	3D	170 (110 ~ 180)	0.28 (0.35 ~ 0.15)	O O	30	6~8	
		0.40 ~ 0.63	3D	558 (361 ~ 591)	0.011 (0.014 ~ 0.006)	O O	30	6~8	
		10.1 ~ 16.0	5D	155 (110 ~ 180)	0.25 (0.35 ~ 0.15)	O O	30	6~8	
		0.40 ~ 0.63	5D	509 (361 ~ 591)	0.010 (0.014 ~ 0.006)	O O	30	6~8	
		10.1 ~ 16.0	7D	140 (110 ~ 180)	0.22 (0.35 ~ 0.15)	O O	30	6~8	
		0.40 ~ 0.63	7D	459 (361 ~ 591)	0.009 (0.014 ~ 0.006)	O O	30	6~8	
		16.1 ~ 20.0	3D	180 (120 ~ 200)	0.33 (0.4 ~ 0.2)	O O	30	6~8	
		0.63 ~ 0.79	3D	591 (394 ~ 656)	0.013 (0.016 ~ 0.008)	O O	30	6~8	
		16.1 ~ 20.0	5D	170 (120 ~ 200)	0.3 (0.4 ~ 0.2)	O O	30	6~8	
		0.63 ~ 0.79	5D	558 (394 ~ 656)	0.012 (0.016 ~ 0.008)	O O	30	6~8	
		16.1 ~ 20.0	7D	160 (120 ~ 200)	0.27 (0.4 ~ 0.2)	O O	30	6~8	
		0.63 ~ 0.79	7D	525 (394 ~ 656)	0.011 (0.016 ~ 0.008)	O O	30	6~8	

Landing Gear
Ti-6Al-4V (HRC35~40)

Shouldering (Z Endmill)

								Type		Pressure	Concentration		
		mm inch	flutes	vc m/min sfm	fz mm/t ipt	ap mm inch	ae mm inch	Internal	External	bar	%	cm^3/min $inch^3$/min	
ZFE4	PC315E	3	4	60 (40 ~ 70)	0.02 (0.01 ~ 0.02)	under 1.5D	under 0.1D	-	O	30	6~8	0.2	199~200
		0.118	4	198 (131~230)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.000	
		4	4	60 (40 ~ 70)	0.03 (0.01 ~ 0.02)	under 1.5D	under 0.1D	-	O	30	6~8	0.3	
		0.157	4	198 (131~230)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.001	
		5	4	60 (40 ~ 70)	0.03 (0.01 ~ 0.03)	under 1.5D	under 0.1D	-	O	30	6~8	0.4	
		0.197	4	196 (131~230)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.001	
		6	4	60 (40 ~ 70)	0.04 (0.01 ~ 0.03)	under 1.5D	under 0.1D	-	O	30	6~8	0.5	
		0.236	4	198 (131~230)	0.002 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.001	
ZFE4	PC315E	8	4	60 (40 ~ 70)	0.06 (0.02 ~ 0.04)	under 1.5D	under 0.1D	-	O	30	6~8	0.6	199~200
		0.315	4	198 (131~230)	0.002 (0.001~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.002	
		10	4	60 (40 ~ 70)	0.07 (0.03 ~ 0.05)	under 1.5D	under 0.1D	-	O	30	6~8	0.8	
		0.394	4	196 (131~230)	0.003 (0.001~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.002	
		12	4	60 (40 ~ 70)	0.07 (0.04 ~ 0.06)	under 1.5D	under 0.1D	-	O	30	6~8	0.8	
		0.472	4	198 (131~230)	0.003 (0.002~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.002	
		16	4	60 (40 ~ 70)	0.08 (0.05 ~ 0.07)	under 1.5D	under 0.1D	-	O	30	6~8	0.9	
		0.630	4	198 (131~230)	0.003 (0.002~0.003)	under 0.059	under 0.004D	-	O	30	6~8	0.002	

1. Cutting conditions

- It is recommended to use the minimum feed per tooth when using the maximum cutting speed. Please lower the feed rate 60% when you use 2-flute tools.
- If you increase the feed rate, please decrease the cutting speed.

2. Tool life

- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Concentration of coolant

- Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure

1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply

- It is recommended to apply enough fluids both inside and outside the tool.

Engine Housing
INCONEL718 (HRC40~45)

Shouldering (V Endmill)

				vc	fz	ap	ae	Type		Pressure	Concentration		
		mm inch	flutes	m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm^3/min $inch^3$/min	
VFE4	PC215F	3	4	30 (40 ~ 70)	0.01 (0.01 ~ 0.02)	under 1.5D	under 0.1D	-	O	30	6~8	0.1	197~198
		0.118	4	99 (131~230)	0.000 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.000	
		4	4	30 (40 ~ 70)	0.02 (0.01 ~ 0.02)	under 1.5D	under 0.1D	-	O	30	6~8	0.1	
		0.157	4	99 (131~230)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.000	
		5	4	30 (40 ~ 70)	0.02 (0.01 ~ 0.03)	under 1.5D	under 0.1D	-	O	30	6~8	0.1	
		0.197	4	98 (131~230)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.000	
		6	4	30 (40 ~ 70)	0.03 (0.01 ~ 0.03)	under 1.5D	under 0.1D	-	O	30	6~8	0.1	
		0.236	4	99 (131~230)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.000	
VFE4	PC215F	8	4	30 (40 ~ 70)	0.04 (0.02 ~ 0.04)	under 1.5D	under 0.1D	-	O	30	6~8	0.2	197~198
		0.315	4	99 (131~230)	0.001 (0.001~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.000	
		10	4	30 (40 ~ 70)	0.04 (0.03 ~ 0.05)	under 1.5D	under 0.1D	-	O	30	6~8	0.2	
		0.394	4	99 (131~230)	0.002 (0.001~0.002)	under 0.059	0.004D	-	O	30	6~8	0.001	
		12	4	30 (40 ~ 70)	0.05 (0.04 ~ 0.06)	under 1.5D	under 0.1D	-	O	30	6~8	0.3	
		0.472	4	99 (131~230)	0.002 (0.002~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.001	
		16	4	30 (40 ~ 70)	0.05 (0.05 ~ 0.07)	under 1.5D	under 0.1D	-	O	30	6~8	0.3	
		0.630	4	99 (131~230)	0.002 (0.002~0.003)	under 0.059	under 0.004D	-	O	30	6~8	0.001	

1. Cutting conditions

- It is recommended to use the minimum feed per tooth when using the maximum cutting speed. Please lower the feed rate 60% when you use 2-flute tools.
- If you increase the feed rate, please decrease the cutting speed.

2. Tool life

- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Concentration of coolant

- Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure

1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply

- It is recommended to apply enough fluids both inside and outside the tool.

Air Frame
Aluminum Alloy

Shouldering (A+ Endmill)

				vc	fz	ap	ae	Type		Pressure	Concentration		
		mm inch	flutes	m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm³/min inch³/min	
AFE4	H05S	3	4	301 (250~ 350)	0.01 (0.01 ~ 0.02)	under 1.5D	under 0.1D	-	O	30	6~8	0.5	195~196
		0.118	4	989 (820~ 1148)	0.000 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.001	
		4	4	301 (250~ 350)	0.01 (0.01 ~ 0.02)	under 1.5D	under 0.1D	-	O	30	6~8	0.7	
		0.157	4	989 (820~ 1148)	0.000 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.002	
		5	4	298 (250~ 350)	0.02 (0.01 ~ 0.03)	under 1.5D	under 0.1D	-	O	30	6~8	1.0	
		0.197	4	979 (820~ 1148)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.002	
		6	4	301 (250~ 350)	0.02 (0.01 ~ 0.03)	under 1.5D	under 0.1D	-	O	30	6~8	1.4	
		0.236	4	989 (820~ 1148)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	O	30	6~8	0.003	
AFE4	H05S	8	4	301 (250~ 350)	0.03 (0.02 ~ 0.04)	under 1.5D	under 0.1D	-	O	30	6~8	1.8	195~196
		0.315	4	989 (820~ 1148)	0.001 (0.001~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.004	
		10	4	298 (250~ 350)	0.04 (0.03 ~ 0.05)	under 1.5D	under 0.1D	-	O	30	6~8	2.3	
		0.394	4	979 (820~ 1148)	0.002 (0.001~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.005	
		12	4	301 (250~ 350)	0.05 (0.04 ~ 0.06)	under 1.5D	under 0.1D	-	O	30	6~8	2.7	
		0.472	4	989 (820~ 1148)	0.002 (0.002~0.002)	under 0.059	under 0.004D	-	O	30	6~8	0.007	
		16	4	301 (250~ 350)	0.06 (0.05 ~ 0.07)	under 1.5D	under 0.1D	-	O	30	6~8	3.6	
		0.630	4	989 (820~ 1148)	0.002 (0.002~0.003)	under 0.059	under 0.004D	-	O	30	6~8	0.009	

1. Cutting conditions

- It is recommended to use the minimum feed per tooth when using the maximum cutting speed. Please lower the feed rate 60% when you use 2-flute tools.
- If you increase the feed rate, please decrease the cutting speed.

2. Tool life

- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Concentration of coolant

- Coolant concentration of max. 10~12% is recommended. The above data was gained at the concentration of 6~8%.

4. Coolant pressure

1) Coolant pressure of over 30 bar is recommended.
2) If you double the coolant pressure, tool life could be up to 1.5 times longer.

5. Coolant supply

- It is recommended to apply enough fluids both inside and outside the tool.

Air Frame
Composite Router Endmill

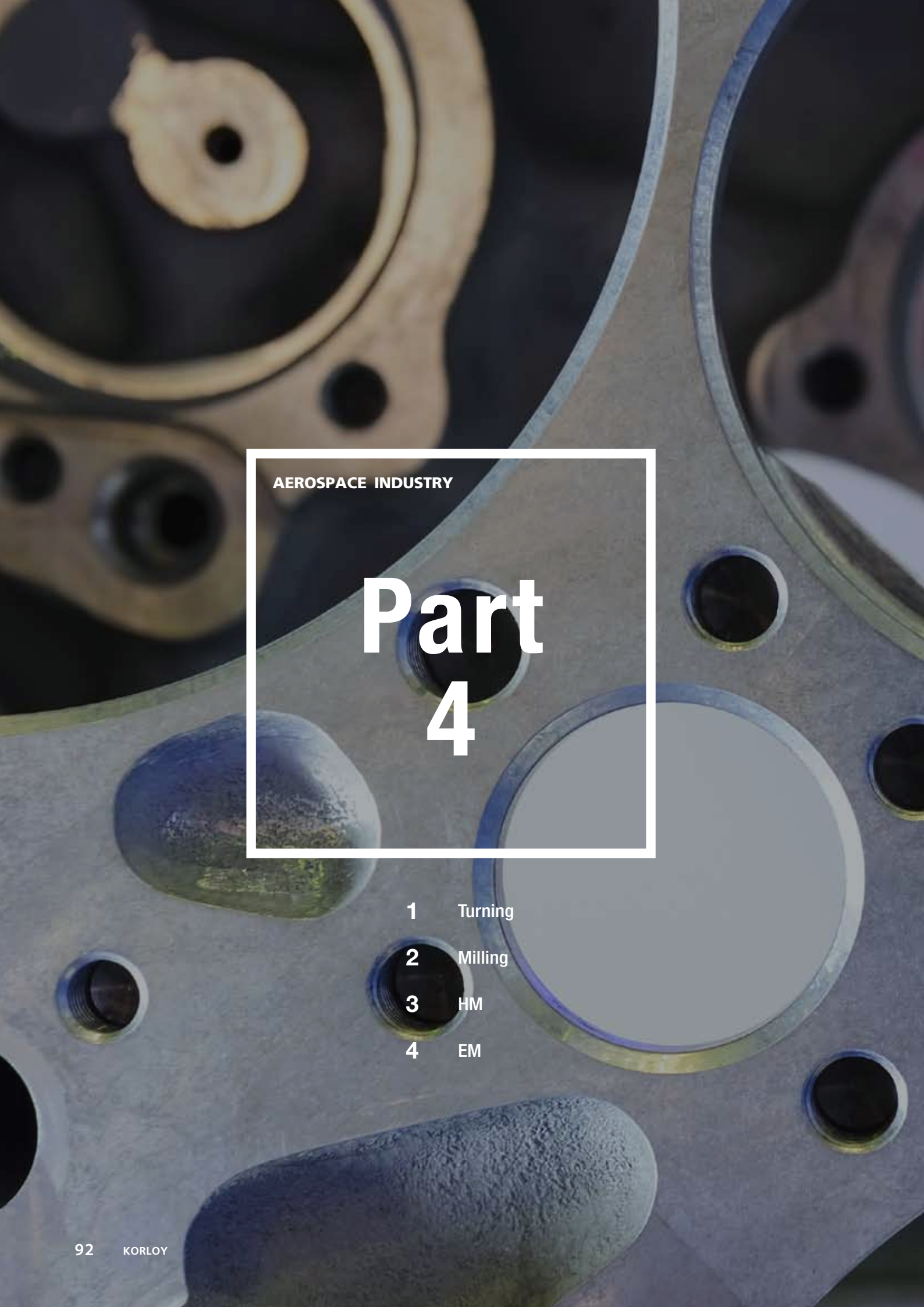
Shouldering (Composite Router Endmill)

				vc	fz	ap	ae	Type		Pressure	Concentration		
		mm inch	flutes	m/min sfm	mm/t ipt	mm inch	mm inch	Internal	External	bar	%	cm^3/min $inch^3$/min	
CCR060	ND2110	6	2	151 (100~200)	0.05 (0.04 ~ 0.06)	under 1.5D	under 0.1D	-	-	-	-	3.6	201~202
		0.236	2	494 (328~656)	0.002 (0.002~0.002)	under 0.059	under 0.004D	-	-	-	-	0.009	
CCR080		8	2	151 (100~200)	0.06 (0.05 ~ 0.07)	under 1.5D	under 0.1D	-	-	-	-	5.0	
		0.315	2	494 (328~656)	0.002 (0.002~0.003)	under 0.059	under 0.004D	-	-	-	-	0.012	
CCR100		10	2	151 (100~200)	0.07 (0.06 ~ 0.08)	under 1.5D	under 0.1D	-	-	-	-	6.3	
		0.394	2	494 (328~656)	0.003 (0.002~0.003)	under 0.059	under 0.004D	-	-	-	-	0.015	
CCR120		12	2	151 (100~200)	0.08 (0.07 ~ 0.09)	under 1.5D	under 0.1D	-	-	-	-	6.5	
		0.472	2	494 (328~656)	0.003 (0.003~0.004)	under 0.059	under 0.004D	-	-	-	-	0.016	
CCDR060	ND2110	6	4	151 (100~200)	0.02 (0.01 ~ 0.03)	under 1.5D	under 0.1D	-	-	-	-	0.5	201~202
		0.236	4	494 (328~656)	0.001 (0.000~0.001)	under 0.059	under 0.004D	-	-	-	-	0.001	
CCDR080		8	6	151 (100~200)	0.03 (0.02 ~ 0.04)	under 1.5D	under 0.1D	-	-	-	-	1.1	
		0.315	6	494 (328~656)	0.001 (0.001~0.002)	under 0.059	under 0.004D	-	-	-	-	0.003	
CCDR100		10	6	151 (100~200)	0.03 (0.02 ~ 0.04)	under 1.5D	under 0.1D	-	-	-	-	1.2	
		0.394	6	494 (328~656)	0.001 (0.001~0.002)	under 0.059	under 0.004D	-	-	-	-	0.003	
CCDR120		12	6	151 (100~200)	0.03 (0.02 ~ 0.04)	under 1.5D	under 0.1D	-	-	-	-	1.5	
		0.472	6	494 (328~656)	0.001 (0.001~0.002)	under 0.059	under 0.004D	-	-	-	-	0.004	

1. Cutting conditions
- It is recommended to use the minimum feed per tooth when using the maximum cutting speed.
- If you increase the feed rate, please decrease the cutting speed.

2. Tool life
- To ensure the most satisfactory tool life, stay within the cutting conditions above. If you change cutting speeds or feed rates from the above conditions, it may shorten tool life up to 20%.

3. Coolant supply
- Air Coolant



AEROSPACE INDUSTRY

Part 4

1 Turning

2 Milling

3 HM

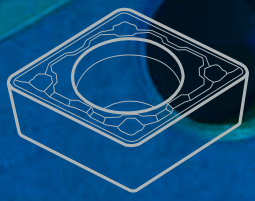
4 EM

AEROSPACE INDUSTRY

Part 4 - 1

Turning





1 Turning Tool

2 Code System

3 Product Features

4 Designation (Digest ver.)

Turning Insert Code System (ISO)

C	N	M	G
1	2	3	4
Insert Shape	Relief Angle	Tolerance	Cross Section Type

1 Insert Shape

C N M G 12 04 08 - MM



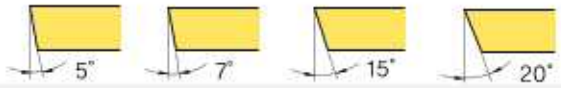
C D E K L



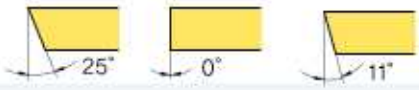
R S T V W

2 Relief Angle

C N M G 12 04 08 - MM



B C D E

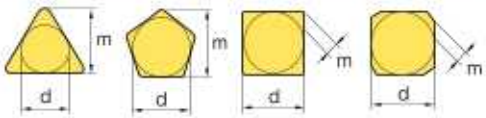


F N P Special type O

3 Tolerance

C N M G 12 04 08 - MM

d: Inscribed circle
t: Thickness
m: Refer to figure



(mm)

Class	d	m	t
A	± 0.025	± 0.005	± 0.025
C	± 0.025	± 0.013	± 0.025
H	± 0.013	± 0.013	± 0.025
E	± 0.025	± 0.025	± 0.025
G	± 0.025	± 0.025	± 0.13
J *	± 0.05 ~ ± 0.15	± 0.005	± 0.025
K *	± 0.05 ~ ± 0.15	± 0.013	± 0.025
L *	± 0.05 ~ ± 0.15	± 0.025	± 0.025
M *	± 0.05 ~ ± 0.15	± 0.08 ~ ± 0.20	± 0.13
N *	± 0.05 ~ ± 0.15	± 0.08 ~ ± 0.18	± 0.025
U *	± 0.08 ~ ± 0.25	± 0.13 ~ ± 0.38	± 0.13

* Sides are based on unground insert

Tolerance on C,E,H,M,O,P,R,S,T,W Insert Shape (Exceptional case)

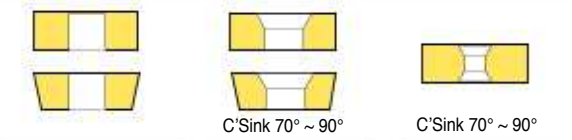
d	Tolerance on d		Tolerance on m	
	J, K, L, M, N	U	M, N	U
6.35	± 0.05	± 0.08	± 0.08	± 0.13
9.525	± 0.05	± 0.08	± 0.08	± 0.13
12.7	± 0.08	± 0.13	± 0.13	± 0.20
15.875	± 0.10	± 0.18	± 0.15	± 0.27
19.05	± 0.10	± 0.18	± 0.15	± 0.27
25.4	± 0.13	± 0.25	± 0.18	± 0.38

Tolerance on D Insert Shape (Exceptional case)

d	Tolerance on d	Tolerance on m
6.35	±0.05	±0.11
9.525	±0.05	±0.11
12.7	±0.08	±0.15
15.875	±0.10	±0.18
19.05	±0.10	±0.18

4 Cross Section Type

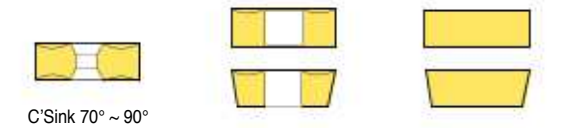
C N M G 12 04 08 - MM



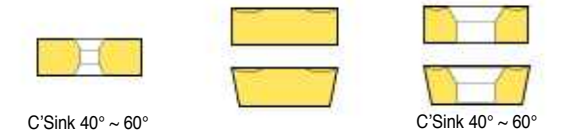
A B C



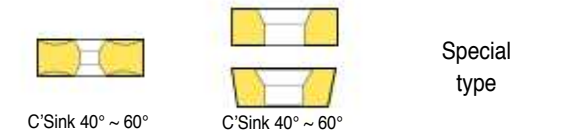
F G H



J M N



Q R T



U W Special type X

12 04 08 - MM

5	6	7	8
Cutting Edge Length, Diameter of Inscribed Circle	Height of Cutting Edge	Nose Radius (Nose R)	Chip Breaker for Turning

5 Cutting Edge Length, Diameter of Inscribed Circle

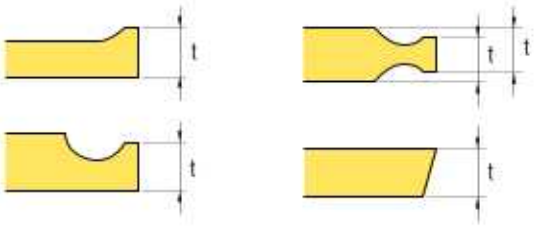
C N M G **12** 04 08 - MM

Symbol							Inch	IC
								
Metric								d (mm)
03	04	03	06	03	-	02	1.2 (5)	3.97
04	05	04	08	04	08	S3	1.5 (6)	4.76
05	06	05	09	05	09	03	1.8 (7)	5.56
-	-	-	-	06	-	-	-	6.00
06	07	06	11	06	11	04	2	6.35
08	09	07	13	07	13	05	2.5	7.94
-	-	-	-	08	-	-	-	8.00
09	11	09	16	09	16	06	3	9.525
-	-	-	-	10	-	-	-	10.00
11	13	11	19	11	19	07	3.5	11.11
-	-	-	-	12	-	-	-	12.00
12	15	12	22	12	22	08	4	12.70
14	17	14	24	14	24	09	4.5	14.29
16	19	15	27	15	27	10	5	15.875
-	-	-	-	16	-	-	-	16.00
17	21	17	30	17	30	11	5.5	17.46
19	23	19	33	19	33	13	6	19.05
-	-	-	-	20	-	-	-	20.00
22	27	22	38	22	38	15	7	22.225
-	-	-	-	25	-	-	-	25.00
25	31	25	44	25	44	17	8	25.40
32	38	31	54	31	54	21	10	31.75
-	-	-	-	32	-	-	-	32.00

( ) Symbol for small size insert

6 Height of Cutting Edge

C N M G 12 **04** 08 - MM

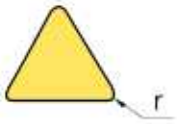


Symbol		Height of Cutting Edge (t)	
Metric	Inch	mm	Inch
01	1 (2)	1.59	1/16
T0	1.125	1.79	9/128
T1	1.2	1.98	5/64
02	1.5 (3)	2.38	3/32
T2	1.75	2.78	7/64
03	2	3.18	1/8
T3	2.5	3.97	5/32
04	3	4.76	3/16
05	3.5	5.56	7/32
06	4	6.35	1/4
07	5	7.94	5/16
09	6	9.52	3/8
11	7	11.11	7/16
12	8	12.70	1/2

( ) Symbol for small size insert

7 Nose Radius (Nose R)

C N M G 12 04 **08** - MM



Symbol		Corner Radius	
Metric	Inch	Metric	Inch
01	0	0.1	0.004
02	0.5	0.2	0.008
04	1	0.4	1/64
08	2	0.8	1/32
12	3	1.2	3/64
16	4	1.6	1/16
20	5	2.0	5/64
24	6	2.4	3/32
28	7	2.8	7/64
32	8	3.2	1/8
00	-	Round insert (Inch)	
M0	-	Round insert (Metric)	

8 Chip Breaker for Turning

C N M G 12 04 08 - **MM**

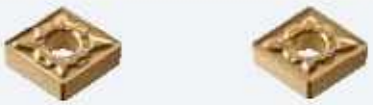
Negative Insert Chip Breaker



VP1 VP2



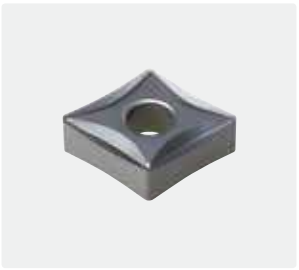
VP3 VP4



MM RM

VP Chip Breaker

Negative Type

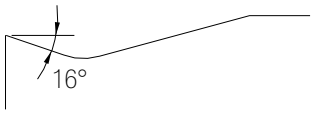


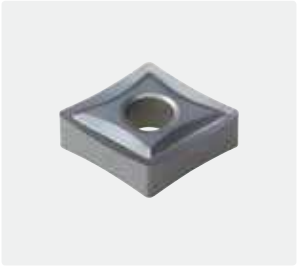
VP1 (For finishing) ⟶ High-positive blade design

Extends tool life by reducing contact areas between flank surface and chips, and minimizing cutting heat

Recommended cutting condition

• fn = 0.05~0.20mm/rev • ap = 0.1~1.5mm





VP2 (For medium to finish cutting) ⟶ High-positive blade design with side rake angle

Performs stable chip control at varying depth of cuts by improving machinability

Recommended cutting condition

• fn = 0.05~0.40mm/rev • ap = 0.5~4.0mm





VP3 (For medium cutting) ⟶ High-positive blade design with wide land

Performs stable chip control and machinability at high depth of cuts

Recommended cutting condition

• fn = 0.10~0.45mm/rev • ap = 1.0~4.5mm





VP4 (For roughing Inconel) ⟶ High hardened cutting edges with highly resistant rake angle

Prevents notch wear when roughing Inconel by reinforcing the toughness of its cutting edges

Recommended cutting condition

• fn = 0.15~0.35mm/rev • ap = 1.0~4.5mm



Positive Type



VP1 (For finishing Inconel) ⟶ Sharp cutting edges with improved rigidity

Performs stable chip control and satisfactory tool life when machining super-heat resistant alloy which remains extremely hard at high temperatures

Recommended cutting condition

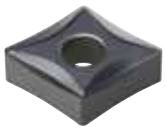
• fn = 0.2~0.35mm/rev • ap = 1.0~4.0mm



Turning Inserts

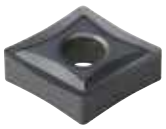
C-Type

CNGG-VP1



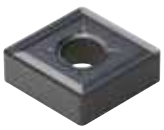
120400
120402
120404
120408

CNMG-VP2



120404
120408

CNMG-VP3



120404
120408
120412

CNMG-VP4



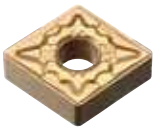
120408
120412
190608
190612

CCGT-VP1



060201
060202
060204
09T301
09T302
09T304

CNMG-MM



090308
120404
120408
120412
120416
160608
160612
160616
190608
190612
190616

CNMG-RM



120404
120408
120412
120416
160608
160612
160616
190608
190612
190616
250924

D-Type

DNGG-VP1



150404
150408
150604
150608

DNMG-VP2



150404
150408
150604
150608

DNMG-VP3



150404
150408
150412
150604
150608
150612

DNMG-VP4



150408
150412
150608
150612

DCGT-VP1



070201
070202
070204
11T301
11T302
11T304

DNMG-MM



110408
150404
150408
150412
150604
150608
150612

DNMG-RM

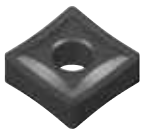


150404
150408
150412
150604
150608
150612

Turning Inserts

S-Type

SNMG-VP2



120404
120408
120412
120416

SNMG-VP3



120404
120408
120412
120416
150612
190616

SNMG-VP4



120408
120412
150612
190608
190612
190616

SNMG-MM



090308
120404
120408
120412
150612
190608
190612

SNMG-RM



120404
120408
120412
120416
150612
190608
190612
250924

T-Type

TNMG-VP2



160404
160408
160412
220404
220408

TNMG-VP3



160404
160408
160412

TNMG-VP4



160408
160412

TNMG-MM



160404
160408
160412
160416
220404
220408
220412

TNMG-RM



160404
160408
160412
220408
220412

Turning Inserts

V-Type

VNMG-VP3

160404
160408



VNMG-HS

160404
160408
160412



VCGT-VP1

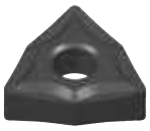
110301
110302
110304



W-Type

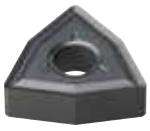
WNMG-VP2

080404
080408
080412



WNMG-VP3

080404
080408
080412



WNMG-VP4

080408
080412



WNMG-MM

060408
060412
080404
080408
080412



WNMG-RM

060404
060408
060412
080404
080408
080412



R-Type

RNMG-VP3

190600



RNMG-VP4

190600

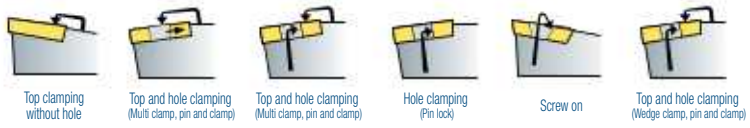


External tool Holder Code System (ISO)

P	S	K	N	R	25	25	-	M	12
1	2	3	4	5	6	7		8	9
Clamping Method of Insert	Insert Shape	Holder Style	Clearance Angle of Insert	Hand	Height of Shank	Width of Shank		Length of Holder	Length of Insert Cutting Edge

1 Clamping Method of Insert

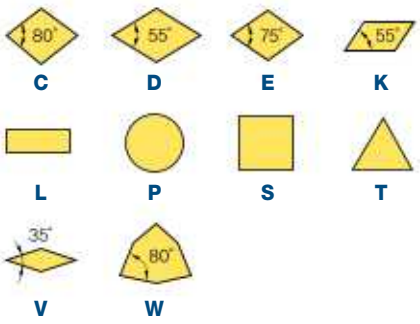
P S K N R 25 25 - M 12



Top clamping without hole	Top and hole clamping (Multi clamp, pin and clamp)	Top and hole clamping (Multi clamp, pin and clamp)	Hole clamping (Pin lock)	Screw on	Top and hole clamping (Wedge clamp, pin and clamp)
C	D	M	P	S	W

2

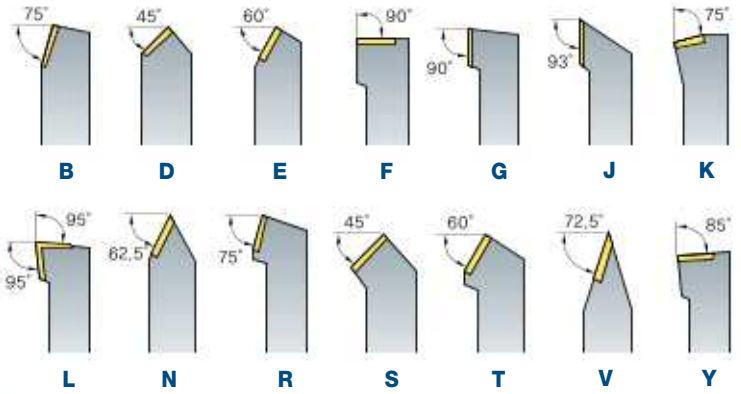
P S K N R 25 25 - M 12



C D E K L P S T V W

3 Holder Style

P S K N R 25 25 - M 12

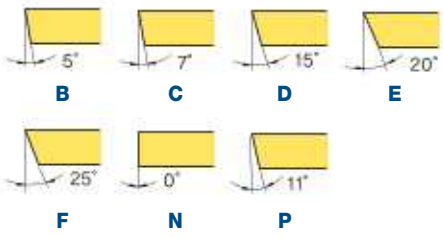


B D E F G J K

L N R S T V Y

4 Clearance Angle of Insert

P S K N R 25 25 - M 12

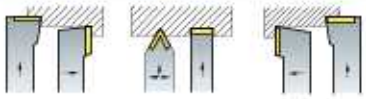


B C D E

F N P

5 Hand

P S K N R 25 25 - M 12



L N R

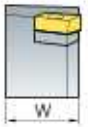
6 Height of Shank

P S K N R 25 25 - M 12



7 Width of Shank

P S K N R 25 25 - M 12



8 Length of Holder

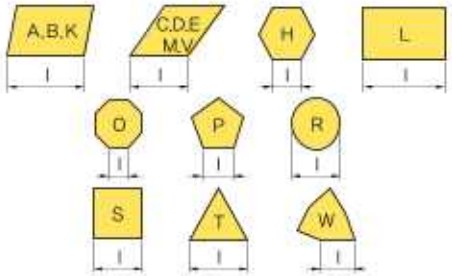
P S K N R 25 25 - M 12



A - 32	H - 100	Q - 180	X-Special Item
B - 40	J - 110	R - 200	
C - 50	K - 125	S - 250	
D - 60	L - 140	T - 300	
E - 70	M - 150	U - 350	
F - 80	N - 160	V - 400	
G - 90	P - 170	W - 450	

9 Length of Insert Cutting Edge

P S K N R 25 25 - M 12



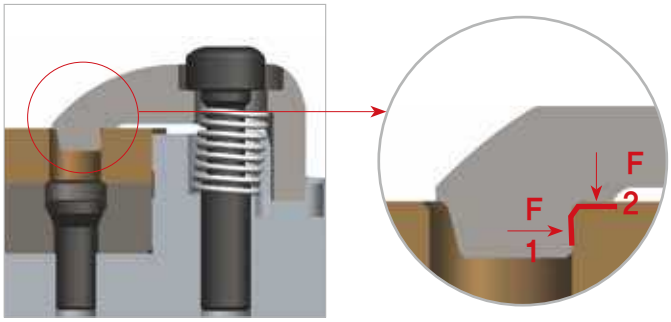
Features of Double Clamp / Lever Lock System

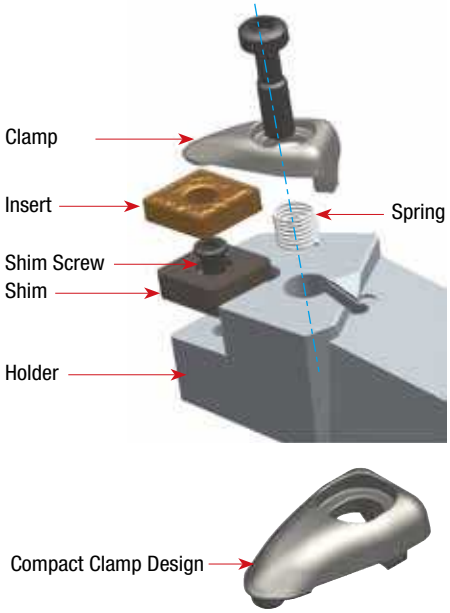
Features

Double Clamp System

Stable clamping with double clamp system

- Simple and powerful clamping system operated by only a single clamp screw
- The powerful double-clamping system (upper and internal) is suitable for machining in very tough cutting conditions
- The holder offers precision due to the special design in the rear of the clamp
- Compact and optimized design for avoiding chip interference with a powerful clamp

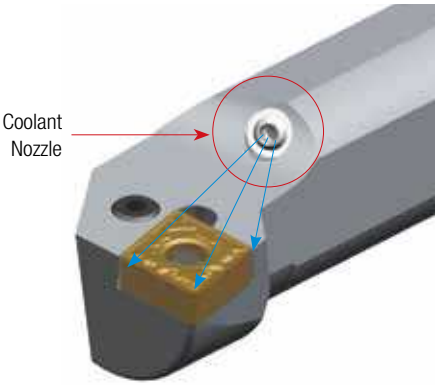


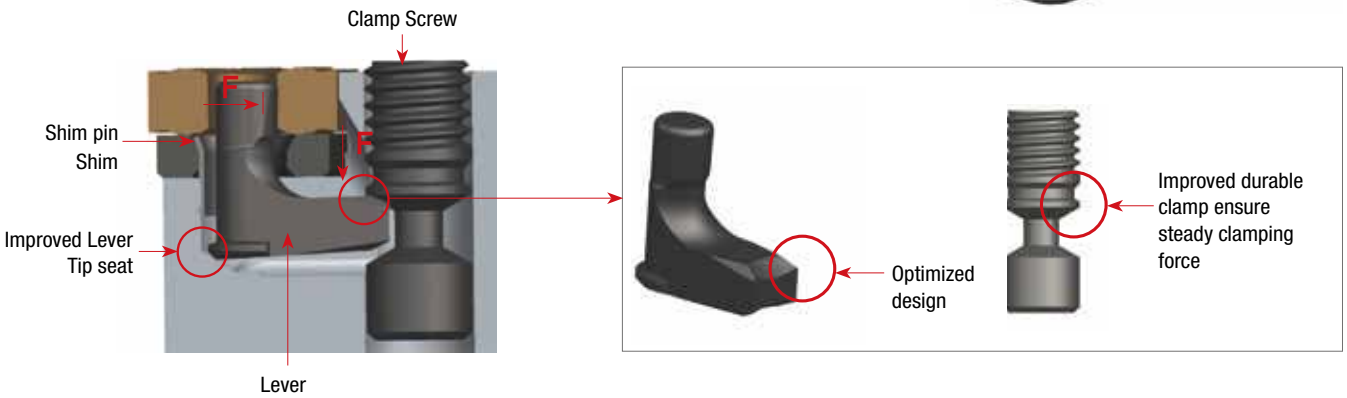


Lever Lock System

Stable clamping with double clamp system

- The holder offers precision due to the special design due to the improved Lever tip seat
- The durability of parts has been improved
- Superior tool life due to powerful clamping system and optimized design of part.
- Part designation on holder body makes it easy to check the right part description for each product
- Adjustable coolant nozzle gives the option to change the direction of the coolant to optimize chip control and improve tool life





Turning Tool Holders

Double Clamp System

DCBNR/L



2020-K12
2525-M12
3225-P12
2525-M16
3232-P16
3232-P19
4040-S19

DCKNR/L



2020-K12
2525-M12
3225-P12
3232-P16
4040-S16

DCLNR/L



2020-K09 3225-P16
2525-M09 3232-P16
2020-K12 2525-M19
2525-M12 3225-P19
3225-P12 3232-P19
3232-P12 4040-S19
2525-M16

DDJNR/L



2020-K11 2525-M15-3
2525-M11 3232-P15-3
3225-P11
3232-P11
2020-K15
2525-M15
3225-P15
3232-P15
2020-K15-3

DSBNR/L



2020-K09 3232-P19
2525-M09 4040-S19
2020-K12
2525-M12
3225-P12
3232-P12
2525-M15
3225-P15
3232-P15

DSDNN



2020-K09
2020-K12
2525-M12
3225-P12
3232-P12
2525-M15
3232-P15
3232-P19
4040-S19

DSKNR/L



2020-K09
2020-K12
2525-M12
3232-P12
3232-P15
3232-P19
4040-S19

DSSNR/L



2020-K09
2020-K12
2525-M12
3225-P12
3232-P12
2525-M15
3232-P15
3232-P19
4040-S19

DTFNR/L



2020-K16
2525-M16
3232-P16
2525-M22
3225-P22
3232-P22

DTGNR/L



2020-K16
2525-M16
3232-P16
2525-M22
3225-P22
3232-P22

DVJNR/L



2020-K16
2525-M16
3232-P16

DVVNN



2020-K16
2525-M16
3232-P16

DWLNR/L



2020-K06
2525-M06
2020-K08
2525-M08

Turning Tool Holders

Lever Lock System

PCBNR/L



New Type

2020-K12N
2525-M12N
3225-P12N
2525-M16N
3232-P16N

PCKNR/L



New Type

2020-K12N
2525-M12N
3225-P12N
3232-P16N
4040-S16N

PCLNR/L



New Type

1616-H09N
2020-K09N
2525-M09N
1616-H12N
2020-K12N
2525-M12N
3225-P12N
3232-P12N
2525-M16N
3232-P16N

PDJNR/L



New Type

1616-H11N
2020-K11N
2525-M11N
2020-K15N
2525-M15N
3225-P15N
3232-P15N
2020-K15-3N
2525-M15-3N
3232-P15-3N

PDNNR/L



New Type

2020-K15N
2525-M15N
3232-P15N
2525-M15-3N
3232-P15-3N

PSBNR/L



New Type

1616-H09N
2020-K09N
2020-K12N
2525-M12N
3225-P12N
3232-P12N
2525-M15N
3232-P15N

PSDNN



New Type

1616-H09N
2020-K12N
2525-M12N
3225-P12N
3232-P12N
2525-M15N
3232-P15N
3225-P12N

PSKNR/L



New Type

1616-H09N
2020-K09N
2020-K12N
2525-M12N
3232-P12N
2525-M15N
3232-P15N

PSSNR/L



New Type

1616-H09N
2020-K12N
2525-M12N
3225-P12N
3232-P12N
2525-M15N
3232-P15N

PTFNR/L



New Type

1616-H16N
2020-K16N
2525-M16N
2525-M22N
3232-P22N
3232-P27N
4040-S27N

Turning Tool Holders

Lever Lock System

PTGNR/L



New Type

1616-H16N	3232-P16N	3232-P27N
2020-K16N	2525-M22N	4040-S27N
2525-M16N	3232-P22N	

PTTNR/L



New Type

1616-H16N	2525-M16N
2020-K16N	2525-M22N

PWLNR/L



New Type

1616-H06N	2525-M06N	2525-M08N
2020-K06N	2020-K08N	

PRNNN



New Type

3232-P19

Turning Tool Holders

Screw on System

SCACR/L



1010-E06 1212-F09

SCLCR/L



0808-D06 1212-F09 2020-K09
1010-E06 1616-H09

SDACR/L



1010-E07 1212-F11 1616-H11

SDJCR/L



1010-E07 1212-F07 1616-H07

SDNCN



1010-E07 1212-H11 2020-K11
1212-F07 1616-H11

SVJVR/L



1212-F11 1616-H16 3225-P16
1616-H11 2020-K16 3232-P16
2020-K11 2525-M16

SVJCR/L



1212-F11 1616-H11 2020-K11

SVVCN



1212-F11 1616-H11 2020-K11

Boring Bar Code System (ISO)

S 12 M - S T F P R - 11

1	2	3	4	5	6	7	8	9
Type of Bar	Bar Diameter	Bar Length	Method of Mounting Insert	Insert Shape	Lead Angle of Boring Bar	Relief Angle of Insert	Hand of Bar	Length of Cutting Edge

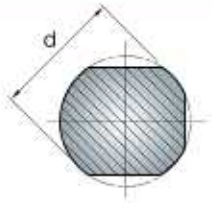
1 Type of Bar

S 12 M - S T F P R - 11

- **A:** Steel with coolant hole
- **E:** Carbide bar with fixed Steel head and coolant hole
- **C:** Carbide shank
- **S:** Steel shank
- **X:** Special type

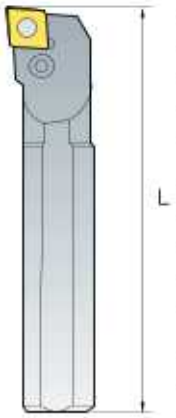
2 Bar Diameter

S 12 M - S T F P R - 11



3 Bar Length

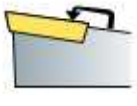
S 12 M - S T F P R - 11

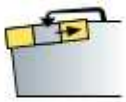


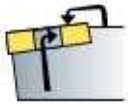
length (L)	(mm)
H	100
J	110
K	125
M	150
N	160
Q	180
R	200
S	250
T	300
U	350
V	400
W	450
Y	500

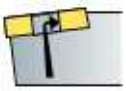
4 Method of Mounting Insert

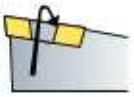
S 12 M - S T F P R - 11


Top clamping
C


Top and hole clamping
D

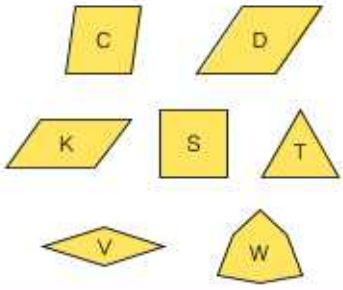

Top and hole clamping
M


Hole clamping
P


Screw on
S

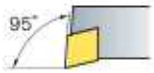
5 Insert Shape

S 12 M - S T F P R - 11



6 Lead Angle of Boring Bar

S 12 M - S T F P R - 11



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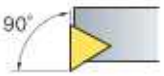

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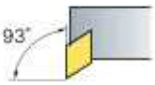
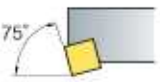
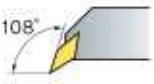


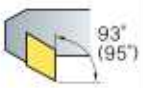
U



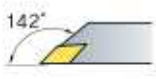
K



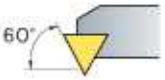
Q



Z



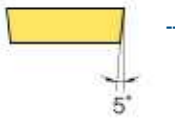
J



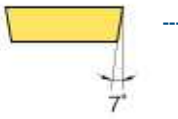
W

7 Relief Angle of Insert

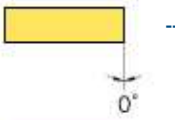
S 12 M - S T F P R - 11



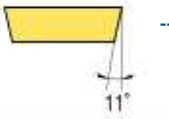
-------- **B**



-------- **C**



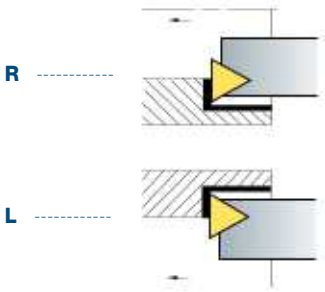
-------- **N**



-------- **P**

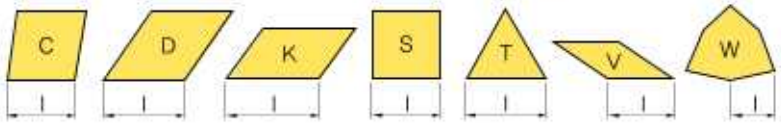
8 Hand of Bar

S 12 M - S T F P R - 11



9 Length of Cutting Edge

S 12 M - S T F P R - 11



Boring Bars

Double Clamp System

DCLNR/L



A25R-DCLNR/L-09
A25R-DCLNR/L-12
A32S-DCLNR/L-12
A40T-DCLNR/L-12
A50U-DCLNR/L-16

DDUNR/L



A40T-DDUNR/L-15
A50U-DDUNR/L-15
A40T-DDUNR/L-15-3
A50U-DDUNR/L-15-3

DSKNR/L



A25R-DSKNR/L-09
A25R-DSKNR/L-12
A32S-DSKNR/L-12
A40T-DSKNR/L-12

DTFNR/L



A25R-DTFNR/L-16
A32S-DTFNR/L-16
A40T-DTFNR/L-22
A50U-DTFNR/L-22

DWLNR/L



A25R-DWLNR/L-06
A32S-DWLNR/L-06
A40T-DWLNR/L-06
A25R-DWLNR/L-08
A32S-DWLNR/L-08
A40T-DWLNR/L-08
A50U-DWLNR/L-08

Lever Lock System

PCLNR/L



New Type

S16R-PCLNR/L-09N
S20S-PCLNR/L-09N
S25R-PCLNR/L-09N
S25R-PCLNR/L-12N
S32S-PCLNR/L-12N
S40T-PCLNR/L-12N
S50U-PCLNR/L-12N
S50U-PCLNR/L-19N
A16R-PCLNR/L-09N
A20S-PCLNR/L-09N
A25R-PCLNR/L-09N
A25R-PCLNR/L-12N
A32S-PCLNR/L-12N
A40T-PCLNR/L-12N
A50U-PCLNR/L-12N
A50U-PCLNR/L-19N

PDSNR/L



New Type

S32S-PDSNR/L-15N
S40T-PDSNR/L-15N
S32S-PDSNR/L-15-3N
S40T-PDSNR/L-15-3N
A32S-PDSNR/L-15N
A40T-PDSNR/L-15N
A32S-PDSNR/L-15-3N
A40T-PDSNR/L-15-3N

PDUNR/L



New Type

S20S-PDUNR/L-11N
S25R-PDUNR/L-11N
S32S-PDUNR/L-11N
S32S-PDUNR/L-15N
S40T-PDUNR/L-15N
S50U-PDUNR/L-15N
S32S-PDUNR/L-15-3N
S40T-PDUNR/L-15-3N
A20S-PDUNR/L-11N
A25R-PDUNR/L-11N
A32S-PDUNR/L-11N
A32S-PDUNR/L-15N
A40T-PDUNR/L-15N
A50U-PDUNR/L-15N
A32S-PDUNR/L-15-3N
A40T-PDUNR/L-15-3N

PSKNR/L



New Type

S25R-PSKNR/L-12N
S32S-PSKNR/L-12N
S40T-PSKNR/L-12N
A25R-PSKNR/L-12N
A32S-PSKNR/L-12N
A40T-PSKNR/L-12N

PTFNR/L



New Type

S25R-PTFNR/L-16N
S32S-PTFNR/L-16N
S40T-PTFNR/L-16N
A25R-PTFNR/L-16N
A32S-PTFNR/L-16N
A40T-PTFNR/L-16N

PWLNR/L



New Type

S20S-PWLNR/L-06N
S25R-PWLNR/L-06N
S32S-PWLNR/L-06N
S25R-PWLNR/L-08N
S32S-PWLNR/L-08N

Boring Bars

Screw on System

SCLCR/L



S08K-SCLCR/L-06
S10K-SCLCR/L-06
S10M-SCLCR/L-06
S12M-SCLCR/L-06
S16R-SCLCR/L-06
S12M-SCLCR/L-09
S16R-SCLCR/L-09
S20S-SCLCR/L-09
A08F-SCLCR/L-06
A10H-SCLCR/L-06
A12K-SCLCR/L-06
A12K-SCLCR/L-09
A16M-SCLCR/L-09
A20Q-SCLCR/L-09
A25R-SCLCR/L-09

SCLPR/L



S10M-SCLPR/L-08
S12M-SCLPR/L-08
S16N-SCLPR/L-09
S16R-SCLPR/L-09
S20N-SCLPR/L-09
A10H-SCLPR/L-08
A12K-SCLPR/L-08
A16M-SCLPR/L-09
A20Q-SCLPR/L-09

SDQCR/L



S10M-SDQCR/L-07
S12M-SDQCR/L-07
S16R-SDQCR/L-07
S16R-SDQCR/L-11
S20S-SDQCR/L-11
S25R-SDQCR/L-11
A10H-SDQCR/L-07
A12K-SDQCR/L-07
A16M-SDQCR/L-11
A20Q-SDQCR/L-11
A25R-SDQCR/L-11

SDUCR/L



S10M-SDUCR/L-07
S12M-SDUCR/L-07
S16R-SDUCR/L-07
S16R-SDUCR/L-11
S20S-SDUCR/L-11
S25R-SDUCR/L-11
S32S-SDUCR/L-11
A10H-SDUCR/L-07
A12K-SDUCR/L-07
A16M-SDUCR/L-07
A20Q-SDUCR/L-11
A25R-SDUCR/L-11

SDZCR/L



S16R-SDZCR/L-07
S20S-SDZCR/L-07
S25R-SDZCR/L-11
S32S-SDZCR/L-11
S40T-SDZCR/L-11
A25R-SDZCR/L-11
A32S-SDZCR/L-11

SVQCR/L



S16R-SVQCR/L-11
S20S-SVQCR/L-11
S25R-SVQCR/L-11

SVUCR/L



S16R-SVUCR/L-11
S20S-SVUCR/L-11
S25T-SVUCR/L-11

MSB Tool

Code System



Type
M: Micro

Application
B : Boring
BC: Copying
BB: Back Boring
BF: Chamfering
G : Square Grooving
GR: Round Grooving
GF: Face Grooving
T : Threading

Hand
R: Right
L: Left

Shank Dia.
03: 3.0
04: 4.0
06: 6.0
08: 8.0
10: 10.0

Max. aspect ratio
10: 10.0
15: 15.0
20: 20.0
25: 25.0
35: 35.0

Machining size

Boring		No Code	
Copying		Width of Groove	
Threading		60°	55°
		Pitch	tpi
◇	F	0.25~1.0	72~24
	A	0.5~1.5	48~16
	AG	0.5~3.0	48~8

Cutting edge
1: Single ended
None: Double ended

Features

- High hardness grade guarantees longer tool life.
- Various kinds of machining (Fitting, Valve, Medical parts, Automobile component and Semiconductor equipment) are available.
- Various types of MSB tools (Boring, Grooving, Threading)

MSB tool code system

Types		Application		Designation
01	Boring	Boring		MBR/L○○☆☆
02		Copying		MBCR/L○○☆☆
03		Back Boring		MBBR/L○○☆☆
04		Chamfering		MBFR/L○○☆☆
05	Grooving	Square Grooving		MGR/L○○☆☆–□□
06		Round Grooving		MGRR/L○○☆☆–□□
07		Face Grooving		MGFR/L○○00–□□
08	Threading	Partial	60°	MTR/L○○☆☆–◇60
			55°	MTR/L○○☆☆–◇55

Details

Marks	○○	Shank Dia.			
	☆☆	Max. depth of boring			
	□□	Width of groove			
	◇	Pitch / tpi	F	0.25~1.0	72~24
			A	0.5~1.5	48~16
			AG	0.5~3.0	48~8

MSB Tool

MSB

MBR



Twin		Single	
0310	0620	0310-1	0620-1
0315	0810	0315-1	0810-1
0410	0820	0410-1	0820-1
0415	0830	0415-1	0830-1
0420	1015	0420-1	1015-1
0610	1025	0610-1	1025-1
0615	1035	0615-1	1035-1

MBCR



Twin		Single	
0410	0610	0410-1	0610-1
0415	0615	0415-1	0615-1
0420	0620	0420-1	0620-1

MBBR



Twin		Single	
0310	0420	0310-1	0420-1
0315	0610	0315-1	0610-1
0410	0615	0410-1	0615-1
0415	0620	0415-1	0620-1

MBFR



Twin		Single	
0410	0610	0410-1	0610-1
0415	0615	0415-1	0615-1
0420	0620	0420-1	0620-1

MGR



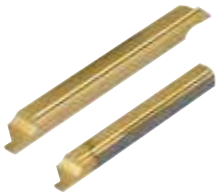
Twin		Single	
0310-1.0	0620-1.5	0310-1.0-1	0620-1.5-1
0315-1.0	0610-2.0	0315-1.0-1	0610-2.0-1
0310-1.5	0620-2.0	0310-1.5-1	0620-2.0-1
0315-1.5	0610-2.5	0315-1.5-1	0610-2.5-1
0410-1.0	0620-2.5	0410-1.0-1	0620-2.5-1
0420-1.0	0820-1.5	0420-1.0-1	0820-1.5-1
0410-1.5	0820-2.0	0410-1.5-1	0820-2.0-1
0420-1.5	0820-2.5	0420-1.5-1	0820-2.5-1
0410-2.0	0820-3.0	0410-2.0-1	0820-3.0-1
0420-2.0	1025-1.5	0420-2.0-1	1025-1.5-1
0610-1.0	1025-2.0	0610-1.0-1	1025-2.0-1
0620-1.0	1025-2.5	0620-1.0-1	1025-2.5-1
0610-1.5	1025-3.0	0610-1.5-1	1025-3.0-1

MGRR



Twin		Single	
0310-0.8	0610-2.0	0310-0.8-1	0610-2.0-1
0315-0.8	0620-2.0	0315-0.8-1	0620-2.0-1
0410-1.0	0820-1.0	0410-1.0-1	0820-1.0-1
0420-1.0	0820-1.5	0420-1.0-1	0820-1.5-1
0610-1.0	0820-2.0	0610-1.0-1	0820-2.0-1
0620-1.0	1025-1.0	0620-1.0-1	1025-1.0-1
0610-1.5	1025-1.5	0610-1.5-1	1025-1.5-1
0620-1.5	1025-2.0	0620-1.5-1	1025-2.0-1

MGFR



Twin		Single	
0400-1.0	0800-2.0	0400-1.0-1	0800-2.0-1
0400-1.5	1000-2.0	0400-1.5-1	1000-2.0-1
0600-1.0	1000-2.5	0600-1.0-1	1000-2.5-1
0600-1.5	1000-3.0	0600-1.5-1	1000-3.0-1
0600-2.0	1000-3.5	0600-2.0-1	1000-3.5-1
0800-1.0	1000-4.0	0800-1.0-1	1000-4.0-1
0800-1.5	1000-4.5	0800-1.5-1	1000-4.5-1

MBCR



Twin		Single	
0315-F60	0315-F55	0315-F60-1	0315-F55-1
0415-F60	0415-F55	0415-F60-1	0415-F55-1
0615-A60	0615-A55	0615-A60-1	0615-A55-1

SLEEVE

Sleeve

SL



SL1603
SL1604
SL1605
SL1606
SL1607
SL2008
SL2010

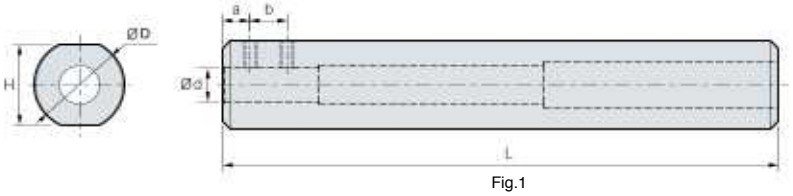


Fig.1

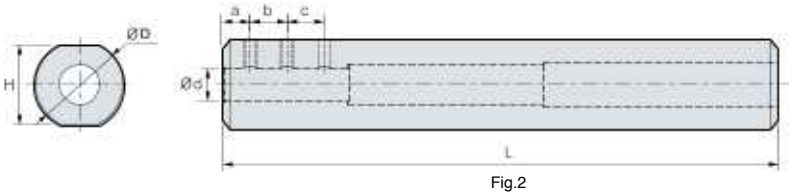


Fig.2

SL (SLEEVE)

(mm)

Designation	d	a	b	c	D	H	L	Screw	Wrench	Fig.
SL1603	3	5	-	-	16	14	100	M3	HW15L	1
SL1604	4	5	6	-	16	14	100	M4	HW20L	
SL1605	5	5	8	-	16	14	100	M4	HW20L	
SL1606	6	5	6	6	16	14	100	M4	HW20L	2
SL1607	7	5	6	8	16	14	100	M4	HW20L	
SL2008	8	5	10	10	20	18	100	M4	HW20L	2
SL2010	10	5	10	10	20	18	100	M5	HW20L	

※ Fine tolerance and surface roughness

KGT

Insert Code System

KG M N 300 - 04 – T

SYSTEM	Tolerance	Hand	Width of cutting edge	Nose Radius	Chip Breaker
KG SYSTEM (KORLOY Grooving)	M class G class	**N**: Neutral **R**: Right **L**: Left **I**: Internal	2.0~8.0mm	0.2mm 0.3mm 0.4mm 0.8mm	L / R / T / C / LP / RP / B

Holder type Code System

KG E H R/L 2525 - 3 T20

SYSTEM	Working Style	Holder Style	Hand	Shank standard	Cutting Width	Maximum Depth
KG SYSTEM (KORLOY Grooving)	**E**: External Process **I**: Internal Process	**H**: Horizontal **V**: Vertical **U**: Undercut	**R**: Right **L**: Left	Height 25m Width25mm (For Internal machining: Minimum diameter for machining)	2.0~8.0mm	8~36mm

Features

- Double-sided inserts of KGT series reduces machining cost.
- Strong clamping system ensures stable and accurate machining.
- New grade and new technology provide superior tool life.
- Various tooling solutions of the KGT series improve productivity.
- The foreside and clearance face of the KGT insert having cutting edges are optimal for grooving, parting-off, turning and facing with reducing processing time.
- Three-dimensional chip breaker ensures excellent chip control in various applications.
- The KGT inserts with various chip breakers are available for wide application range.
- Special cutting edges are available for quotation.

KGT line up

Application

	Parting	Grooving	Turning	Copying	Special
medium and large, interrupted cutting	 Rough Parting	 Rough Grooving	 Turning-Multi Grooving	 Copying	 Blank
small, continuous cutting	 Light Parting	 Light Grooving	 T (KGMI) Internal Grooving		

▸ Lead angle applied to LP & RP chip breakers - only for parting off

▸ B chip breaker can be customized (contact required in advance)

KGT Insert

KGMN-R



150-015
200-02
300-02
400-03
500-03
600-03
800-04

Width: 1.5~8.0mm

KGMN-T



150-015
200-02
250-02
300-02
300-04
400-04
400-08
500-04
500-08

Width: 1.5~8.0mm

KGMI-T



200-02
300-04
400-04

Width: 2.0~4.0mm

KRMN-C



200
300
400
500
600
800

Width: 2.0~8.0mm

KGGN-A



200-02
300-02
400-04
500-04
600-04

Width: 1.5~8.0mm

KRGN-A



300
400
500
600
800

Width: 1.5~8.0mm

KGT Holder

KGEHR/L



1616-1.5-T14
2020-1.5-T14
2525-1.5-T14
1212-2-T08
1616-2-T08
2020-2-T08
2525-2-T08
1616-2-T17
2020-2-T17
2525-2-T17
1616-2.5-T17
2020-2.5-T17
2525-2.5-T17
1616-3-T10
2020-3-T10
2525-3-T10
3232-3-T10
1616-3-T13
2020-3-T13
2525-3-T13
1616-3-T20
2020-3-T20
2525-3-T20
3232-3-T20
2525-3-T20
3232-3-T20
2525-3-T25
1616-4-T10
2020-4-T10
2525-4-T10
3232-4-T10
1616-4-T15
1616-3-T20
2020-3-T20
2525-3-T20
3232-3-T20
2525-3-T25
1616-4-T10
2020-4-T10
2525-4-T10
3232-4-T10
1616-4-T15
2020-4-T15
2525-4-T15
1616-4-T20
2020-4-T20
2525-4-T20
3232-4-T20
1616-4-T25
2020-4-T25
2525-4-T25
2020-5-T12
2525-T-T12
2020-5-T15
2525-5-T15
3232-5-T15
2020-5-T20
2525-5-T20
3232-5-T20
2525-5-T32
2020-6-T12
2525-6-T12
2525-6-T15
3232-6-T15
2020-6-T20
2525-6-T20
3232-6-T20
2525-6-T32
2525-8-T16
3232-8-T16
2525-8-T25
3232-8-T25
2525-8-T36
3232-8-T36

KGEVR/L-T00



2020-1.5
2525-1.5
3232-1.5
2020-2
2525-2
3232-2
2020-2.5
2525-2.5
3232-2.5
2020-3
2525-3
3232-3
2020-4
2525-4
3232-4
2020-5
2525-5
3232-5
2020-6
2525-6
3232-6
2525-8
3232-8

KGEUR/L



1616-3
2020-3
2525-3
3232-3
1616-4
2020-4
2525-4
3232-4
2020-5
3232-5
2020-6
3232-6
2525-8
3232-8

KGIVR/L



2016-1.5
2520-1.5
3225-1.5
2516-2
2520-2
3225-2
2516-2.5
2520-2.5
3225-2.5
2520-3
3225-3
4032-3
2520-4
3225-4
4032-4
3222-5
4032-5
3225-6
4032-6
4032-8
4540-8

KGFVR/L



425-44/70-T20
425-60/120-T20
425-112/200-T20

KGFHR/L



325-34/50-T10
325-44/70-T15
325-64/100-T15
425-40/60-T10
425-44/70-T20
425-84/92-T20
425-60/120-T20
425-112/200-T20
525-190/220-T10
625-170/190-T10
625-190/220-T10

KGIUR/L



3520-3
4025-3
5032-3
3520-4
4025-4
5032-4
4025-5
5032-5
4025-6
5032-6
4025-8
5032-8

HSK Tooling System

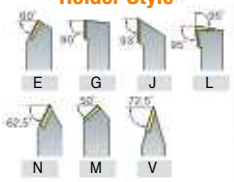
HSK Tooling Code System

H63T D C L N R DX – 12

Taper design & size
ICTM = HSK standard

Clamping Type
D : Double Clamp
M: Multi Clamp
P : Lever Lock
S : Screw On
W: Wedge Clamp

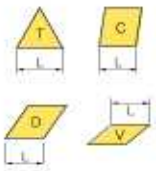
Insert Shape
C : 80° Diamond
D : 55° Diamond
S : 90° Square
T : 60° Triangle
V : 35° Diamond
W: 80° Hexagon

Holder Style


Clearance angle of insert
N = 0°
B = 5°

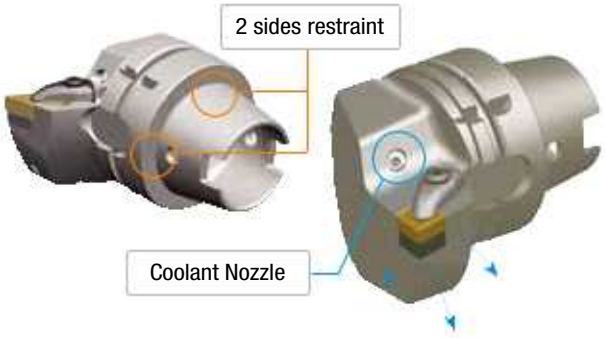
Hand
N: Right
R: Left
L : No Hand

Length of tool holder
DX: 65
H : 100
L : 140

Cutting edge Length


Features

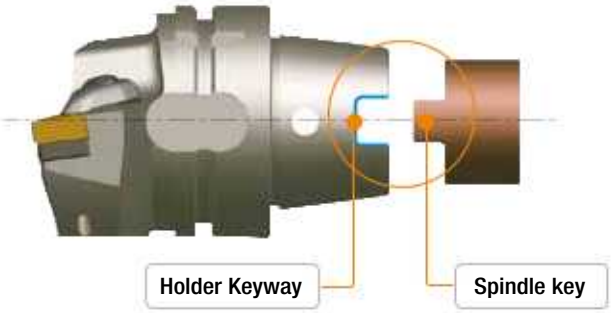
- 2 sides restraint - side and taper part
- Toughness guaranteed for static and dynamic movements
- Precision guaranteed on shaft and repeat directions
- Suitable at high speeds
- Suitable for small work pieces
- Coolant Nozzle is easily adjustable



ICTM
(Interface Committee for Turning Mill)

Interface for Multi-task machines turning tool, which is tooling system based on ICTM standard from 17 major Japanese companies cooperation and is compatible with conventional HSK-A type and common to Multi-task machines and machining centers

Tolerance of Keyway has been improved : HSK-T63



Tolerance comparison (Example)

(mm)

Remarks	Maximum Tolerance	Minimum Tolerance
ICTM STANDARD HSK-T63	0.075	0.035
ISO STANDARD HSK-A63	0.33	0.08

HSK Tool Holder

HSK system

H63T-DCLNR/L



DCLNR/L-DX12

H63T-DCMNN



DCMNN-H12
DCMNN-L12

H63T-DDJNR/L



DDJNR/L-DX15
DDJNR/L-DX15-3

H63T-DDNNN



DDNNN-H15
DDNNN-L15
DDNNN-H15-3
DDNNN-L15-3

H63T-PCLNR/L



PCLNR/L-DX12

H63T-PCMNN



PCMNN-H12
PCMNN-L12

H63T-PDJNR/L



PDJNR/L-DX15
PDJNR/L-DX15-3

H63T-PDNNN



PDNNN-H15
PDNNN-L15
PDNNN-H15-3
PDNNN-L15-3

H63T-PRGCR/L



PRGCR/L-DX12

H63T-PRDCN



PRDCN-H12
PRDCN-L12

H63T-SVPBR/L



SVPBR/L-DX16

H63T-SVVBN



SVVBN-H16
SVVBN-L16

H63T-DCLNR/L



A25K-DCLNR/L-12
A32L-DCLNR/L-12

H63T-EV2525R/L-112



25X25 HOLDER

H63T-EV2525R/L-115



25X25 HOLDER

H63T-EV2525R/L-105-3



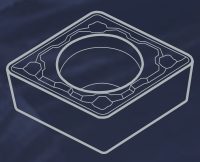
25X25 HOLDER

AEROSPACE INDUSTRY

Part 4 - 2

Milling





1 Alpha Mill

2 Rich Mill (RM3, 4, 8, 16)

3 FMR P-positive

4 FMR D-positive

5 HRM (D)

6 HFM

7 GBE

8 HAVE

9 Wind Mill

10 Pro-A, X, L Mill

11 Aero Mill-Plus

Alpha-Mill (APMT-MA, ML)

Shank type Code system

AM	S	3	032	H	S	–	3	L	32

Product Name
AM: Alpha Mill

Tool type
S: Shank

Inscribed circle of insert
1 : 06type insert
15 : 09type insert
2 : 11type insert
3 : 16type insert
4 : 18type insert

Tool Dia.(ØD)
032: Ø32

Coolant type
Unmarked: None
H: Thru-hole

Type
S : Single edge
SE : Single edge (E:15°)
M : Multi edge
MH: Multi edge helical cutting

No. of tooth
3: 3 teeth

Tool length(L)
S = Standard type
M = Middle type
L = Long type

Tool Dia.(ØD)
032: Ø32

Cutter type Code system

AM	C	(M)	4	100	H	S

Product Name
AM: Alpha Mill

Tool type
C: Cutter

Unit
Unmarked: Inch
M: Metric

Inscribed circle of insert
1 : 06type insert
15 : 09type insert
2 : 11type insert
3 : 16type insert
4 : 18type insert

Tool Dia.(ØD)
100: Ø100

Coolant type
Unmarked: None
H: Thru-hole

Type
S : Single edge
SE : Single edge (E:15°)
M : Multi edge
MH: Multi edge helical cutting

Modular type Code system

AM	M	4	032	H	S	–	M16

Product Name
AM: Alpha Mill

Tool type
M: Modular

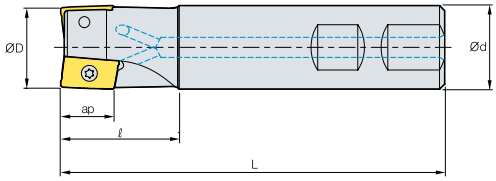
Inscribed circle of insert
1 : 06type insert
15 : 09type insert
2 : 11type insert
3 : 16type insert
4 : 18type insert

Tool Dia.(ØD)
032: Ø32

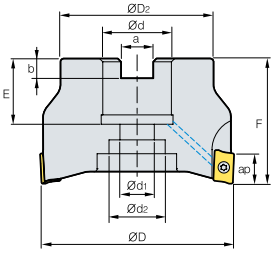
Coolant type
Unmarked: None
H: Thru-hole

Type
S : Single edge
SE : Single edge (E:15°)
M : Multi edge
MH: Multi edge helical cutting

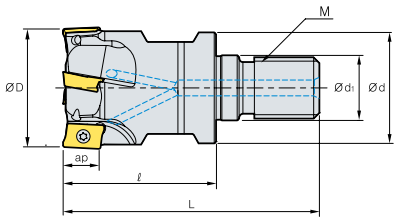
M Dimensions



AMS3032HS - 3L32



AMC (M)4100HS



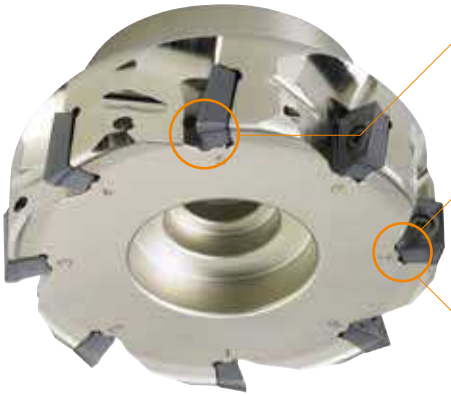
AMM4032HS - M16

Alpha-Mill (APMT-MA, ML)

Features

- Innovative curve cutting edge and chip-breaker design ensures ideal 90 degree cutting and lower cutting resistance
- Various applications are available with multi-functional cutters. (Facing, Slotting, Square shoulder milling etc.)
- Improved insert life time with optimized with each application
- Excellent performance ensured at large depth of cut operations due to strong cutting edge and low cutting resistance

Features



Through coolant system
- Better chip evacuation
- Longer tool life with less heat

Wider chip pocket
- Screw on system for better chip control

Usable with both socket and mounting bolt
(bigger than ∅80)

Lighter weight due to bigger inside diameter
- More convenient, more versatile

Inserts

Chip breaker
- High angle of inclination, increased hardness, and enlarged chip pocket with convex and concave shapes

Concave shape
- Minimum interference for better chip control

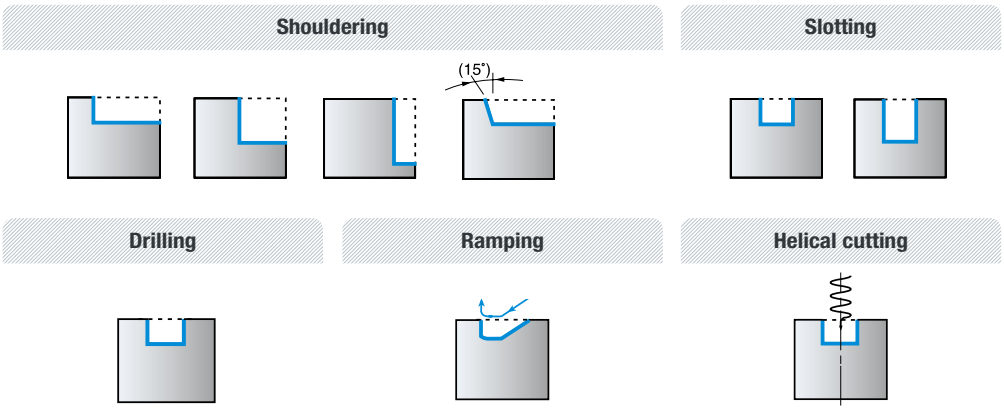


The side
- All positive shaped sides to minimize interference

Main cutting edge
- High rake angle
- Decreasing cutting resistance
- Sharp cutting edge

Alpha-Mill (APMT-MA, ML)

Application example



Features

- **MA** Sharp edge and buffed surface for aluminum machining improve lubrication.
- **ML** Cutting edge and grades for hard-to-cut materials (Ti, STS, Inconel) ensure superb performance in machining.

Features of Chip breakers

Type	Chip breaker	Cutting edge	Features
Al	MA		Optimal cutting edge and buffed surface for aluminum machining ensure high performance in machining.
Hard-to-cut material	ML		Chip breaker with low cutting load is optimal for machining hard-to-cut materials.

Type	Chip breaker	Cutting edge	Features
Light cutting	MF		Chip breaker with low cutting load and harder cutting edge than ML's are optimal for light cutting.
General cutting	MM		Optimal for milling in general ranges

Product constitution

Item description	Type	Nose R	MA	ML
APMT	1000Type	0.4	APMT0602PDFR-MA	-
		0.8	APMT060208PDFR-MA	-
	1500Type	0.4	APMT0903PDFR-MA	APMT0903PDFR-ML
		0.8	APMT090308PDFR-MA	APMT090308PDFR-ML
	2000Type	0.5	APMT11T3PDFR-MA	APMT11T3PDFR-ML
		0.8	APMT11T308PDFR-MA	APMT11T308PDFR-ML
	3000Type	0.4	APMT160404PDFR-MA	APMT160404PDFR-ML
		0.8	APMT1604PDFR-MA	APMT1604PDFR-ML
	4000Type	0.4	APMT180604PDFR-MA	APMT180604PDFR-ML
		0.8	APMT1806PDFR-MA	APMT1806PDFR-ML
		1.2	APMT180612PDFR-MA	APMT180612PDFR-ML
		1.6	APMT180616PDFR-MA	APMT180616PDFR-ML
		2.0	APMT180620PDFR-MA	APMT180620PDFR-ML
		2.4	APMT180624PDFR-MA	APMT180624PDFR-ML
		3.0	APMT180630R-MA	APMT180630R-ML

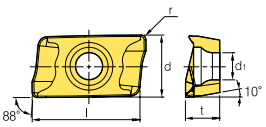
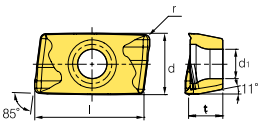
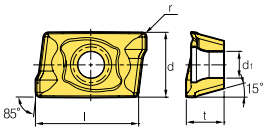
※ The inserts can switch to the APMT type holders.

Alpha-Mill Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting
	Stainless steel	M	✱ General cutting
	Non-ferrous metal	N	✱ Interrupted cutting
	Heat resistant alloy, Titanium alloy	S	

Inserts	Designation	Coated P	Coated P	Coated M	Coated S	Un-coated N	Dimensions (mm) l	d	t	r	d_1	Configuration
		PC3500	PC3600	PC5300	PC5400	H01						
APMT-MA	0602PDFR-MA					●	6	4.24	2.6	0.4	2.0	
	060208PDFR-MA									0.8		
	0903PDFR-MA					●	9.4	6.21	3.6	0.4	2.8	
	090308PDFR-MA						9.4	6.21	3.6	0.8	2.8	
	11T3PDFR-MA					●	11.2	6.467	3.6	0.5	2.9	
	11T308PDFR-MA						11.2	6.467	3.6	0.8	2.9	
	160404PDFR-MA						16.4	9.41	5.76	0.4	4.5	
	1604PDFR-MA					●	16.4	9.41	5.76	0.8	4.5	
	180604PDFR-MA						17.4	10.98	6.35	0.4	4.5	
	1806PDFR-MA					●	17.4	10.98	6.35	0.8	4.5	
	180612PDFR-MA						17.4	10.98	6.35	1.2	4.5	
	180616PDFR-MA						17.4	10.98	6.35	1.6	4.5	
	180620PDFR-MA						17.4	10.98	6.35	2.0	4.5	
	180624PDFR-MA						17.4	10.98	6.35	2.4	4.5	
	180630R-MA						17.4	10.98	6.35	3.0	4.5	
APMT-MF	11T3PDSR-MF	●		●	●		11.2	6.467	3.6	0.5	2.9	
	1604PDSR-MF	●		●	●		16.4	9.41	5.76	0.8	4.5	
	1806PDSR-MF			●	●		17.4	10.98	6.35	0.8	4.5	
	180612PDSR-MF						17.4	10.98	6.35	1.2	4.5	
APMT-ML	0903PDER-ML			●	●		9.4	6.21	3.6	0.4	2.8	
	090308PDER-ML						9.4	6.21	3.6	0.8	2.8	
	11T3PDER-ML			●	●		11.2	6.467	3.6	0.5	2.9	
	11T308PDER-ML						11.2	6.467	3.6	0.8	2.9	
	160404PDER-ML						16.4	9.41	5.76	0.4	4.5	
	1604PDER-ML			●	●		16.4	9.41	5.76	0.8	4.5	
	180604PDER-ML						17.4	10.98	6.35	0.4	4.5	
	1806PDER-ML						17.4	10.98	6.35	0.8	4.5	
	180612PDER-ML			●	●		17.4	10.98	6.35	1.2	4.5	
	180616PDER-ML						17.4	10.98	6.35	1.6	4.5	
	180620PDER-ML						17.4	10.98	6.35	2.0	4.5	
	180624PDER-ML						17.4	10.98	6.35	2.4	4.5	
	180630R-ML						17.4	10.98	6.35	3.0	4.5	
APMT-MM	060202PDSR-MM	●		●	●		6	4.24	2.6	2.6	2.0	
	0602PDSR-MM	●		●	●		6	4.24	2.6	2.6	2.0	
	060208PDSR-MM	●		●	●		6	4.24	2.6	2.6	2.0	
	060212R-MM	●		●	●		6	4.24	2.6	2.6	2.0	
	060216R-MM	●		●	●		6	4.24	2.6	2.6	2.0	
	0903PDSR-MM	●	●	●	●		9.4	6.21	3.6	3.6	2.8	
	090306PDSR-MM						9.4	6.21	3.6	3.6	2.8	
	090308PDSR-MM	●		●	●		9.4	6.21	3.6	3.6	2.8	
	090312R-MM			●	●		9.4	6.21	3.6	3.6	2.8	
	090316R-MM	●		●	●		9.4	6.21	3.6	3.6	2.8	
	090320R-MM	●		●	●		9.2	6.21	3.6	3.6	2.8	
	090331R-MM						9.2	6.21	3.6	3.6	2.8	
	090332R-MM			●	●		9.2	6.21	3.6	3.6	2.8	

Alpha-Mill Insert

Inserts	Designation	Coated P		Coated P M S		Un-coated N	Dimensions (mm) l	d	t	r	d_1	Configuration
		PC3500	PC3600	PC5300	PC5400	H01						
APMT-MM 	11T3PDSR-MM	●	●	●	●		11.2	6.467	3.6	0.5	2.85	
	11T308PDSR-MM	●		●	●		11.2	6.467	3.6	0.8	2.85	
	11T312PDSR-MM	●		●	●		11.2	6.467	3.6	1.2	2.85	
	11T316R-MM	●		●	●		11.0	6.467	3.6	1.6	2.85	
	11T318R-MM						11.0	6.467	3.6	1.8	2.85	
	11T324R-MM	●		●	●		11.0	6.467	3.6	2.4	2.85	
	1604PDSR-MM	●		●	●		16.4	9.41	5.76	0.8	4.5	
	160410PDSR-MM			●	●		16.4	9.41	5.76	1.0	4.5	
	160416PDSR-MM	●		●	●		16.4	9.41	5.76	1.6	4.5	
	160424R-MM	●		●	●		16	9.41	5.76	2.4	4.5	
	160430R-MM			●	●		16	9.41	5.76	3.0	4.5	
	160432R-MM	●		●	●		16	9.41	5.76	3.2	4.5	
	160450R-MM			●	●		16	9.41	5.76	5.0	4.5	
	160464R-MM			●	●		16	9.41	5.76	6.4	4.5	
	1806PDSR-MM	●		●	●		17.4	10.98	6.35	0.8	4.5	
	180612PDSR-MM	●		●	●		17.4	10.98	6.35	1.2	4.5	
	180616PDSR-MM			●	●		17.4	10.98	6.35	1.6	4.5	
	180620PDSR-MM						17.4	10.98	6.35	2.0	4.5	
	180624PDSR-MM	●		●	●		17.4	10.98	6.35	2.4	4.5	
	180630R-MM			●	●		16.7	10.98	6.35	3.0	4.5	
	180632R-MM	●		●	●		16.7	10.98	6.35	3.2	4.5	
	180640R-MM			●	●		16.7	10.98	6.35	4.0	4.5	
	180648R-MM			●	●		16.7	10.98	6.35	4.8	4.5	
	180650R-MM			●	●		16.7	10.98	6.35	5.0	4.5	
	180660R-MM						16.7	10.98	6.35	6.0	4.5	
	180664R-MM			●	●		16.7	10.98	6.35	6.4	4.5	

Alpha-Mill Holder

Shank



AMS

1000type

1010HS
1011HS
1012HS-2
1012HS-2L12
1012HS-3
1014HS-2
1014HS-2L16
1014HS-3
1015HS
1015HS-3L16
1016HS-3
1016HS-3L16
1016HS-4
1017HS
1017HS-3L16
1018HS
1018HS-4L16
1020HS-4
1020HS-4L20
1020HS-5
1021HS
1021HS-4L20
1022HS
1025HS
1026HS
1032HS
1033HS

1500type

15010HS
15010HS-1L16
15012HS
15012HS-1L16
15013HS
15014HS
15014HS-1L16
15016HS
15016HS-2L16
15017HS
15017HS-2L16
15018HS
15018HS-2L16
15019HS
15020HS
15020HS-2L20
15020HS-3
15021HS
15021HS-2L20
15021HS-3
15022HS
15022HS-3L20
15024HS
15024HS-4
15025HS-3S20
15025HS
15025HS-3L25
15025HS-4S20
15025HS-4S25
15028HS
15028HS-4L25
15028HS-5
15030HS
15030HS-4L25
15030HS-5
15032HS
15032HS-4L32
15032HS-5
15035HS
15035HS-6
15040HS-S32
15040HS-5L32
15040HS-6S32
15040HS-S40
15040HS-6S40
15040HS-S42
15040HS-6S42

Alpha-Mill Holder

Shank





AMS

2000type

2010HS	2025HS-3L25
2010HS-1L16	2032HS
2012HS	2032HS-4L32
2012HS-1L16	2040HS
2014HS	2040HS-5L32
2014HS-1L16	2040HS-S40
2016HS	2040HS-S42
2016HS-2L16	2050HS
2018HS	2050HS-S40
2018HS-2L16	2050HS-S42
2020HS	2063HS
2020HS-2L20	2063HS-S40
2022HS	2063HS-S42
2022HS-3L20	
2025HS	

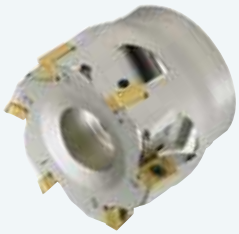
3000type

3025HS	3050HS
3025HS-2M25	3050HS-S40
3025HS-2L25	3050HS-S42
3032HS	3063HS
3032HS-2M32	3063HS-S40
3032HS-2L32	3063HS-S42
3032HS-3M32	
3032HS-3L32	
3040HS	
3040HS-3M32	
3040HS-3L32	
3040HS-4M32	
3040HS-4L32	
3040HS-S40	
3040HS-S42	

4000type

4020HS	4033HS-2L32
4020HS-M	4033HS-3M32
4021HS	4033HS-3L32
4021HS-M	4040HS-3M32
4025HS	4040HS-3L32
4025HS-2M25	4040HS-4M32
4025HS-2L25	4040HS-4L32
4026HS	4040HS-S32
4026HS-2M25	4040HS-S40
4026HS-2L25	4040HS-S42
4032HS	4050HS-S32
4032HS-2M32	4050HS-S40
4032HS-2L32	4050HS-S42
4032HS-3M32	4063HS-S32
4032HS-3L32	4063HS-S40
4033HS	4063HS-S42
4033HS-2M32	

Cutter




AMC(M)

1000type

AMCM	1032HS
	1040HS-16
	1040HS-22
	1050HS
	1063HS

1500type

AMCM	15040HS
	15050HS
	15063HS
AMC (AMCM)	15080HS
	15100HS

2000type

AMCM	2040HS
	2050HS
	2063HS
AMC (AMCM)	2080HS
	2100HS

3000type

AMCM	3040HS
	3050HS
	3063HS
AMC (AMCM)	3080HS
	3100HS

4000type

AMCM	4050HS
	4063HS
AMC (AMCM)	4080HS
	4100HS
	4125HS
	4160S
	4200S

Alpha-Mill Holder

Multi edge





AMC(M)

2000type

AMCM	2050M
AMC (AMCM)	2063M 2080M 2100M

3000type

AMC (AMCM)	3063M 3080M 3100M

4000type

AMC (AMCM)	4063M 4080M 4100M 4125M

AMS

1000type

1016M
1020M
1025M

1500type

15020M
15025M
15032M

2000type

2020M
2025M
2032M
2040M

4000type

4032M
4040M
4050M-S40
4050M

Modular



AMM

1000type

AMM	1012HR-M06 1016HR-M08 1020HR-M10 1025HR-M12 1032HR-M16

1500type

AMM	15010HR-M06 15012HR-M06 15016HR-M08 15020HR-M10 15025HR-M12 15032HR-M16

2000type

AMM	2016HR-M08 2020HR-M10 2025HR-M12 2032HR-M16 2040HR-M16

Rich Mill(RM3)

Shank type Code system

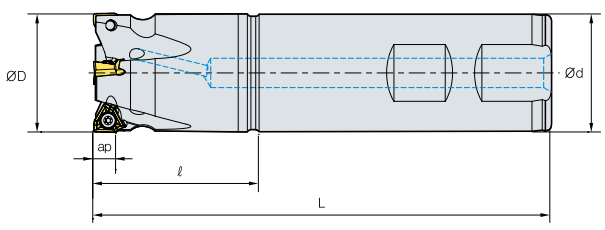
RM3 P S 3 032 H R – 3 L 32

- **Product Name**: RM3
- **Approach angle**: P: 0° / A: 45° / E: 15° / Q: 2°
- **Tool type**: S: Shank
- **Inscribed circle of insert**: 3: 06type insert / 4: 08type insert / 5: 12type insert / 6: 15type insert
- **Tool Dia.(ØD)**: 032: Ø32
- **Coolant type**: Unmarked: None / H: Thru-hole
- **Hand**: R: Right / L: Left
- **No. of tooth**: 3: 3 teeth
- **Tool length(L)**: S = Standard type / M = Middle type / L = Long type
- **Tool Dia.(ØD)**: 032: Ø32

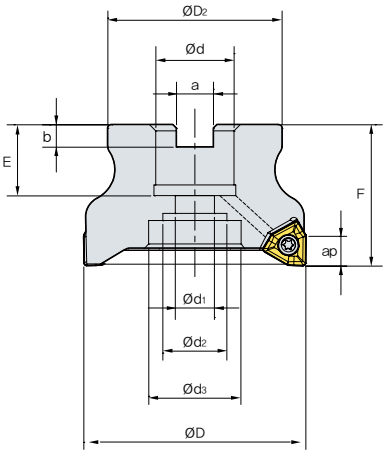
Cutter type Code system

RM3 P C (M) 4 100 H R - M

- **Product Name**: RM3
- **Approach angle**: P: 0°
- **Tool type**: C: Cutter
- **Unit**: Unmarked: Inch / M: Metric
- **Inscribed circle of insert**: 3: 06type insert / 4: 08type insert / 5: 12type insert / 6: 15type insert
- **Tool Dia.(ØD)**: 100: Ø100
- **Coolant type**: Unmarked: None / H: Thru-hole
- **Hand**: R: Right / L: Left
- **Pitch type**: Unmarked: Coarse / M: Close / M: Extra Close



RM3PS3032HR - 3L32



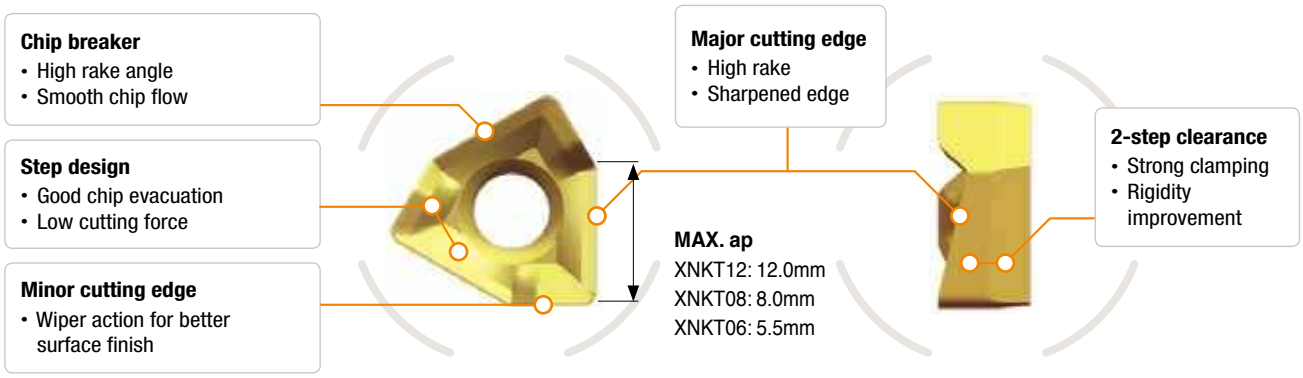
RM3PC (M)4100HR - M

Rich Mill (RM3)

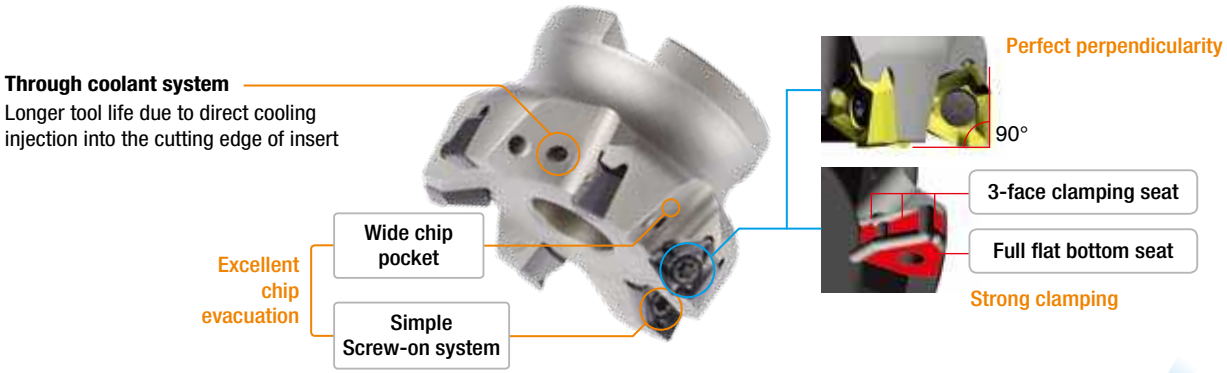
Features

High Quality - True 90 °shouldering operation
High Productivity - Strong thick insert and 3-face clamping ensure stable operation
High Economics - Long tool life due to direct cooling injection

Features of insert

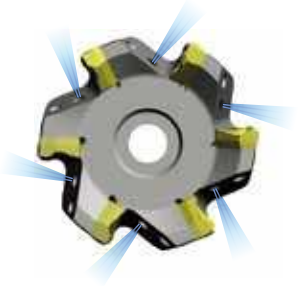


Features of cutter



Through coolant system

- Special through coolant bolt required.
- Effective coolant distribution directly to cutting edge.
- Coolant supporting arbor required.

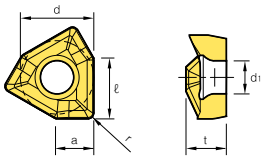
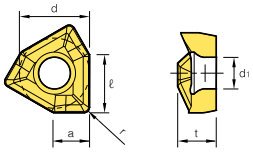
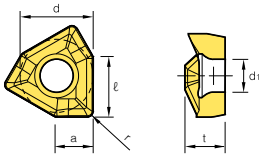


Features of chip breakers

Chip breaker	Insert	Cutting edge	Applications	Features
MA			Aluminum	Superior cutting quality for aluminum due to sharp cutting edge and buffed surface
ML			Light	Superior cutting quality for light and light cutting, difficult-to-cut material machining through the low cutting load of chip breaker
MM			General	Suitable for various cutting due to special shape design for general cutting

RM3 Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting
	Stainless steel	M	⇔ General cutting
	Non-ferrous metal	N	✱ Interrupted cutting
	Heat resistant alloy, Titanium alloy	S	

Inserts	Designation	Coated P	Coated P	Coated M	Coated S	Un-coated N	l	l2	l1	d	t	r	d1	a	Configuration
		PC3500	PC3600	PC5300	PC5400	H01									
XNKT-ML 	060405PNER-ML		●	●	●		5.7	-	-	6.5	4.0	0.5	3.4	1.8	
	080508PNER-ML		●	●	●		8.2	-	-	10.0	5.5	0.8	4.5	2.9	
XNCT-MM 	060405PNSR-MM		●	●	●	●	5.7	-	-	6.5	4.0	0.5	3.4	1.8	
	080508PNSR-MM		●	●	●		8.2	-	-	10.0	5.5	0.8	4.5	2.9	
	080512PNSR-MM						8.2	-	-	10.0	5.5	1.2	4.5	2.9	
	080516PNSR-MM						8.2	-	-	10.0	5.5	1.6	4.5	2.9	
	080520PNSR-MM						8.2	-	-	10.0	5.5	2.0	4.5	2.9	
XNCT-MA 	080508PNFR-MA					●	8.2	-	-	10.0	5.5	0.8	4.5	2.9	

RM3 Holder

Shank



Cutter



RM3PS

3000type

3020HR-2S20	3032HR-3L25
3020HR-2L20	3032HR-4S25
3021HR-2S20	3032HR-4L25
3021HR-2L20	3032HR-4S32
3025HR-3S20	3032HR-4L32
3025HR-3L20	3033HR-3S25
3025HR-3S25	3033HR-3L25
3025HR-3L25	3033HR-4S25
3026HR-2S20	3033HR-4L25
3026HR-2L20	3033HR-4S32
3026HR-3S20	3033HR-4L32
3026HR-3L20	3040HR-4S32
3026HR-2S25	3040HR-4L32
3026HR-2L25	3040HR-5S32
3026HR-3S25	3040HR-5L32
3026HR-3L25	
3032HR-3S25	

4000type

4032HR-3S32	4063HR-5L32
4032HR-3L32	4063HR-5S40
4033HR-3S32	4063HR-5L40
4033HR-3L32	4063HR-6S32
4040HR-3S32	4063HR-6L32
4040HR-3L32	4063HR-6S40
4040HR-4S32	4063HR-6L40
4040HR-4L32	
4050HR-4S32	
4050HR-4L32	
4050HR-4S40	
4050HR-4L40	
4050HR-5S32	
4050HR-5L32	
4050HR-5S40	
4050HR-5L40	
4063HR-5S32	

RM3PC (M)

3000type

RM3PCM	3040HR
	3040HR-M
	3050HR
	3050HR-M
	3063HR
	3063HR-M
RM3PC (RM3PCM)	3080HR
	3080HR-M

4000type

RM3PCM	4040HR
	4040HR-M
	4050HR
	4050HR-M
	4063HR
	4063HR-M
RM3PC (RM3PCM)	4080HR
	4080HR-M
	4100HR
	4100HR-M
	4125HR
	4125HR-M

Rich Mill(RM4)

Shank type Code system

RM4 P S 3 032 H R – 3 L 32

- **Product Name**: RM4
- **Approach angle**: P: 0°
- **Tool type**: S: Shank
- **Inscribed circle of insert**: 3: 10type insert; 4: 15type insert
- **Tool Dia.(ØD)**: 032: Ø32
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **No. of tooth**: 3: 3 teeth
- **Tool length (L)**: S = Standard type; M = Middle type; L = Long type
- **Tool Dia.(ØD)**: 032: Ø32

Cutter type Code system

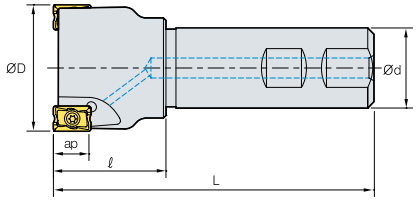
RM4 P C (M) 4 100 H R - M

- **Product Name**: RM4
- **Approach angle**: P: 0°
- **Tool type**: C: Cutter
- **Unit**: Unmarked: Inch; M: Metric
- **Inscribed circle of insert**: 3: 10type insert; 4: 15type insert
- **Tool Dia.(ØD)**: 100: Ø100
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **Pitch type**: Unmarked: Coarse; M: Close; M: Extra Close

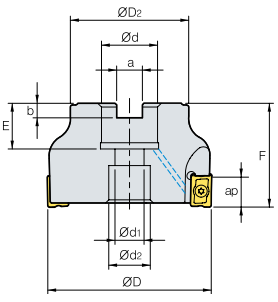
Modular type Code system

RM4 P M 3 032 H R - M16

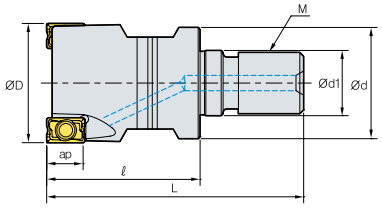
- **Product Name**: RM4
- **Approach angle**: P: 0°
- **Tool type**: M: Modular
- **Inscribed circle of insert**: 3: 10type insert
- **Tool Dia.(ØD)**: 032: Ø32
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **M Dimensions**



RM4PS3032HR - 3L32



RM4PC(M)4100HR - M



RM4PM4032HS - M16

Rich Mill (RM4)

Features

Economical 4 cutting edges by using double-sided insert

- RM4, as a multi-functional milling tool, offers economical 4 cutting edges by using an innovative double-sided insert
- Special designed chip breaker consists of high rake angle and strong cutting edge to decrease the cutting load
- RM4 is multi-functional tool that can cover facing, side cutting, shouldering, slotting, ramping & helical cutting
- Optimal matching of the special cutting edge geometry with variety of new grades provides consistence & long tool life of insert



Features

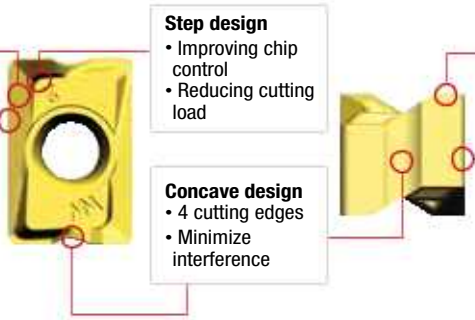
- 4 cutting edges can be used by using double-sided insert
- High rake angle chip breaker and cutting edge provide smooth cutting with a lower cutting load
- Strong negative insert
- High efficiency, economical, multi-functional tool



- Through coolant system Longer tool life due to direct cooling injection into the cutting edge of insert
- Wide chip pocket for better chip evacuation
- Simple screw on system

Inserts

- Double-sided insert using 4cutting edges
- High rake angle chip breaker, cutting edge
- Flexibility of product
- High efficiency, economical, multi-functional tool
- Negative insert has strong cutting edge



Chip breaker
- High rake angle chip breaker
- Improving chip control

Major cutting edge
- High rake angle chip breaker
- Better surface roughness

Step design
- Improving chip control
- Reducing cutting load

Concave design
- 4 cutting edges
- Minimize interference

Minor cutting edge
- Special design of cutting edge to improve surface roughness

Clearance face
- Strong negative face
- Strong cutting edge

Uses



Facing | Shouldering | Slotting | Ramping | Helical cutting

Chip breaker

Insert		Cutting edge	Features
Aluminum, Light machining **MA**			Sharp edge designed to increase productivity and lower cutting force, especially in Aluminum
Light cutting **MF**			Due to low cutting load, it is good for light cutting and difficult-to-cut material.
General cutting **MM**			It is suitable design for general milling.

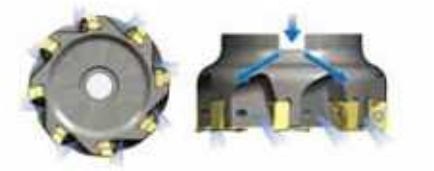
Setting configuration

Insert	Setting angle of insert	Features
		High rake chip breaker & positive setting angle for low cutting load - Improving machinability
		Multi applications for facing, shouldering, slotting, ramping, helical cutting, etc

Rich Mill (RM4)

Through coolant system

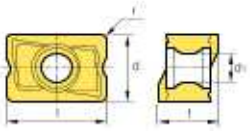
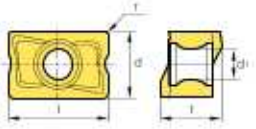
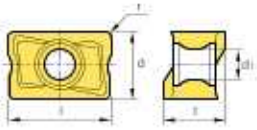
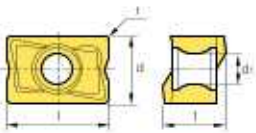
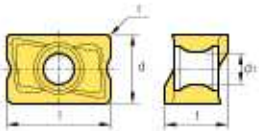
By using an exclusive special coolant bolt (hexagonal socket bolt) powerful cooling & better chip evacuation can be acquired achieved. To get achieve optimal chip control, the direction of coolant injection has been designed to reach to each cutting edge directly. (Through coolant arbor is required.)



Through coolant system for decreasing cutting heat and good chip evacuation

RM4 Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting
	Stainless steel	M	⧓ General cutting
	Non-ferrous metal	N	✖ Interrupted cutting
	Heat resistant alloy, Titanium alloy	S	

Inserts	Designation		Coated P	Coated P	Coated P M S	Coated P M S	Un-coated N	Dimensions (mm) l	d	t	r	d_1	Configuration
			PC3500	PC3600	PC5300	PC5400	H01						
LNM(E)X-MF 	LNMX	100605PNR-MF		●	●	●		10.0	6.5	6.5	0.5	3.5	
		100608PNR-MF		●	●	●		10.0	6.5	6.5	0.8	3.5	
	LNEX	100605PNR-MF			●	●		10.0	6.5	6.5	0.5	3.5	
		100608PNR-MF	●		●	●		10.0	6.5	6.5	0.8	3.5	
LNM(E)X-MF 	LNMX	151004PNR-MF		●	●	●		15.0	10.0	10.0	0.4	4.5	
		151008PNR-MF	●	●	●	●		15.0	10.0	10.0	0.8	4.5	
		151016PNR-MF		●	●	●		15.0	10.0	10.0	1.6	4.5	
	LNEX	151004PNR-MF			●	●		15.0	10.0	10.0	0.4	4.5	
		151008PNR-MF			●	●		15.0	10.0	10.0	0.8	4.5	
		151016PNR-MF			●	●		15.0	10.0	10.0	1.6	4.5	
LNM(E)X-MM 	LNMX	100605PNR-MM	●	●	●	●		10.0	6.5	6.5	0.5	3.5	
		100608PNR-MM	●	●	●	●		10.0	6.5	6.5	0.8	3.5	
		100605PNL-MM	●	●	●	●		10.0	6.5	6.5	0.5	3.5	
	LNEX	100605PNR-MM	●		●	●		10.0	6.5	6.5	0.5	3.5	
		100608PNR-MM			●	●		10.0	6.5	6.5	0.8	3.5	
		100605PNL-MM			●	●		10.0	6.5	6.5	0.5	3.5	
LNM(E)X-MM 	LNMX	151004PNR-MM		●		●		15.0	10.0	10.0	0.4	4.5	
		151008PNR-MM	●	●	●	●		15.0	10.0	10.0	0.8	4.5	
		151016PNR-MM	●	●		●		15.0	10.0	10.0	1.6	4.5	
		151008PNL-MM		●	●	●		15.0	10.0	10.0	0.8	4.5	
	LNEX	151004PNR-MM			●	●		15.0	10.0	10.0	0.4	4.5	
		151008PNR-MM	●		●	●		15.0	10.0	10.0	0.8	4.5	
		151016PNR-MM			●	●		15.0	10.0	10.0	1.6	4.5	
		151008PNL-MM			●	●		15.0	10.0	10.0	0.8	4.5	
LNEX-MA 	LNEX	100605PNR-MA					●	10.0	6.5	6.5	0.5	3.5	
		151004PNR-MA					●	15.0	10.0	10.0	0.4	4.5	
		151008PNR-MA					●	15.0	10.0	10.0	0.8	4.5	

RM4 Holder

Shank

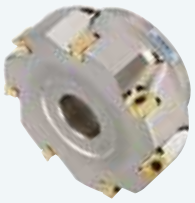


RM4PS

3000type

3014HR-S16	3025HR-S25M	3040HR-S40M	3050HR-S40M
3016HR-S16	3032HR-S32	3040HR-S42	3050HR-S42
3018HR-S16	3032HR-S32M	3040HR-S42M	3050HR-S42M
3020HR-S20	3040HR-S32	3050HR-S32	
3020HR-S20M	3040HR-S32M	3050HR-S32M	
3025HR-S25	3040HR-S40	3050HR-S40	

Cutter



RM4PC (M)

3000type

RM4PCM	3040HR 3040HR-M 3050HR 3050HR-M 3063HR 3063HR-M
RM4PC (RM4PCM)	3080HR 3080HR-M 3100HR 3100HR-M

4000type

RM4PCM	4050HR 4050HR-M 4063HR 4063HR-M
RM4PC (RM4PCM)	4080HR 4080HR-M 4100HR 100HR-M 4125HR 4125HR-M 4160R 4160R-M

Modular



RM4P (M)

3000type

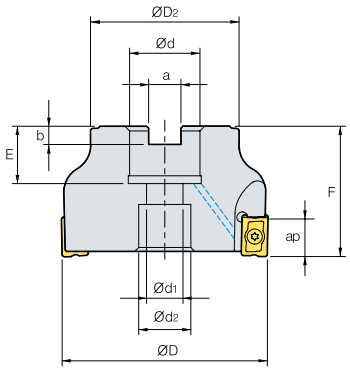
3014HR-M06	3025HR-M12
3016HR-M08	3032HR-M16
3018HR-M08	3040HR-M16
3020HR-M10	3050HR-M16

Rich Mill(RM8)

Cutter type Code system

RM8 A C (M) 4 100 H R - M

- **Product Name**: RM8
- **Approach angle**: **A:** 45° / **E:** 15° / **Q:** 2°
- **Tool type**: **C:** Cutter
- **Unit**: Unmarked: Inch / **M:** Metric
- **Inscribed circle of insert**: **4**: 12type insert / **5**: 15type insert
- **Tool Dia.(ØD)**: 100: Ø100
- **Coolant type**: Unmarked: None / **H**: Thru-hole
- **Hand**: **R**: Right / **L**: Left
- **Pitch type**: Unmarked: Coarse / **M**: Close / **M**: Extra Close



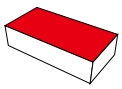
RM8AC (M)4100HR - M

Features

Double sided insert has 8 cutting edges

- Innovative double-sided insert provides 8 cutting edges. It is more economical than a conventional single sided insert.
- The unique geometry and high rake angle of the cutting edge provides an excellent surface finish. Applicable for various workpieces like steel, stainless steel, cast iron, and aluminum
- Combined with the innovative geometry and various grades this tool offers durability and excellent tool life.
- Various pitches and chip breakers can be used in a variety of machining.
- Rich mill can be used for high speed machining and low HP machines

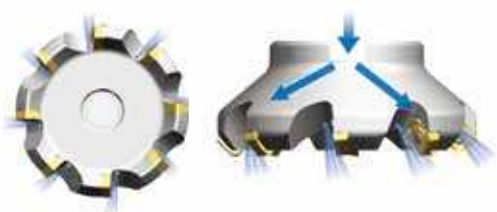




Facing

Through coolant system

Exclusive Special coolant bolt is adapted to get provides better chip evacuation and more powerful cooling. To get optimal chip evacuation, the direction of coolant injection has been designed to reach to each cutting edge directly.



Through coolant system for decreasing cutting heat and good chip evacuation

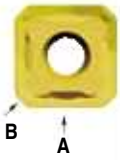
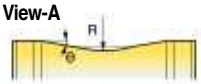
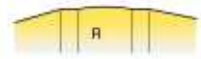
Rich Mill (RM8)

Chip breaker

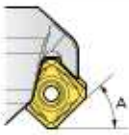
Insert		Cutting edge	Features
For aluminum **MA**			Due to sharp cutting edge and buffed surface, it has good chip flow and welding resistance
Hard-to-cut material **ML**			Chip breaker with low cutting load is optimal for machining hard-to-cut materials.
Light cutting **MF**			Due to low cutting load, it is good for light cutting and difficult-to-cut material

Insert		Cutting edge	Features
General cutting **MM**			It is suitable design for general milling
Wiper **W**			Specialized edge design can be suitable for excellent surface roughness operation

Features of insert

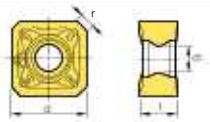
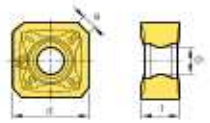
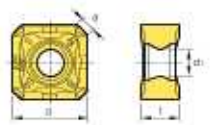
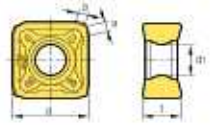
Insert	Cutting edge	Features
	View-A 	High rake chip breaker & positive setting angle for low cutting load
	View-B 	Designed wiper technology in minor cutting edge for improved surface roughness
	Chip breaker 	Low cutting load due to the positive setting and high rake angle chip breaker

Features of cutter

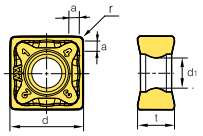
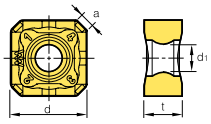
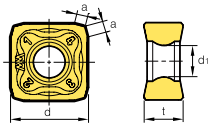
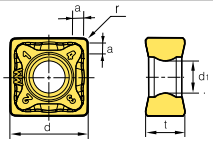
Shape	Cutting edge	Features
		High rake angle makes positive setting angle for low cutting load
		Suitable for facing and chamfering • RM8A A=45° • RM8E A=75° • RM8Q A=88°

RM8 Insert

Workpiece			Machining types: Continuous cutting	General cutting	Interrupted cutting
	Steel	P		●	✖
	Stainless steel	M		●	✖
	Non-ferrous metal	N		●	
	Heat resistant alloy, Titanium alloy	S		●	✖

Inserts	Designation		Coated P	Coated P	Coated M	Coated S	Un-coated N	Dimensions (mm) l	d	t	r	d_1	a	b	Configuration
			PC3500	PC3600	PC5300	PC5400	H01								
SNEX-MA 	SNEX	1206ANN-MA					●	-	12.7	6.35	-	4.5	2.36	-	
		1206ENN-MA					●	-	12.7	6.35	-	5.2	1.82	-	
		1206QNN-MA					●	-	12.7	6.35	-	5.2	1.39	-	
		120612-MA					●	-	12.7	6.35	1.2	5.2	-	-	
SNEX-ML 	SNEX	1206ANN-ML			●	●		-	12.7	6.35	-	4.5	-	-	
		1206ENN-ML			●	●		-	12.7	6.35	-	4.5	2.36	-	
		1206QNN-ML			●	●		-	12.7	6.35	-	4.5	1.82	-	
		120612-ML			●	●		-	12.7	6.35	1.2	4.5	1.39	-	
		1507ANN-ML			●	●		-	15.875	7.94	-	5.6	3.16	-	
		1507ENN-ML			●	●		-	15.875	7.94	-	5.6	2.66	-	
SNM(E)X-MF 	SNMX	1206ANN-MF	●	●	●	●		-	12.7	6.35	-	4.5	2.36	-	
		1507ANN-MF						-	15.875	7.94	-	5.6	3.15	-	
	SNEX	1206ANN-MF	●	●	●	●		-	12.7	6.35	-	4.5	2.36	-	
		1507ANN-MF						-	15.875	7.94	-	5.6	3.15	-	
SNM(E)X-MF 	SNMX	1206ENN-MF	●	●	●	●		-	12.7	6.35	-	4.5	1.82	-	
		1507ENN-MF						-	15.875	7.94	-	5.6	2.66	-	
	SNEX	1206ENN-MF			●	●		-	12.7	6.35	-	4.5	1.82	-	
		1507ENN-MF						-	15.875	7.94	-	5.6	2.66	-	

Rich Mill (RM8)

Inserts	Designation		Coated P		Coated P M S		Un-coated N	Dimensions (mm) l	d	t	r	d1	a	b	Configuration
			PC3500	PC3600	PC5300	PC5400	H01								
SNM(E)X-MF 	SNMX	1206QNN-MF	●	●	●	●		-	12.7	6.35	-	5.2	2.36	-	
		120612-MF		●	●	●		-	12.7	6.35	1.2	5.2	-	-	
	SNEX	1206QNN-MF	●		●	●		-	12.7	6.35	-	5.2	2.36	-	
		120612-MF			●	●		-	12.7	6.35	1.2	5.2	-	-	
SNM(E)X-MM 	SNMX	1206ANN-MM	●	●	●	●		-	12.7	6.35	-	4.5	2.36	-	
		1507ANN-MM						-	15.875	7.94	-	5.6	3.15	-	
	SNEX	1206ANN-MM	●	●	●	●		-	12.7	6.35	-	4.5	2.36	-	
		1507ANN-MM						-	15.875	7.94	-	5.6	3.15	-	
SNM(E)X-MM 	SNMX	1206ENN-MM	●	●	●	●		-	12.7	6.35	-	5.2	1.82	-	
		1507ENN-MM						-	15.875	7.94	-	5.6	2.66	-	
	SNEX	1206ENN-MM		●	●	●		-	12.7	6.35	-	5.2	1.82	-	
		1507ENN-MM						-	15.875	7.94	-	5.6	2.66	-	
SNM(E)X-MM 	SNMX	1206QNN-MM	●	●	●	●		-	12.7	6.35	-	4.5	2.36	-	
		120612-MM	●	●	●	●		-	12.7	6.35	1.2	4.5	-	-	
	SNEX	1206QNN-MM			●	●		-	12.7	6.35	-	4.5	2.36	-	
		120612-MM						-	12.7	6.35	1.2	4.5	-	-	

RM8 Holder

Cutter





RM8AC (M)

4000type

RM8ACM	4050HR-M 4050HR-H 4063HR-M 4063HR-H
RM8AC (RM8ACM)	4080HR 4080HR-M 4080HR-H 4100HR 4100HR-M 4100HR-H 4125HR 4125HR-M 4125HR-H 4160R 4160R-M 4160R-H 4200R-M 4200R-H 4250R-M 4250R-H 4315R 4315R-M 4400R-M

5000type

RM8AC (RM8ACM)	5080HR-M 5100HR-M 5125HR-M 5160R-M 5200R-M 5250R-M 5315R-M 5400R-M

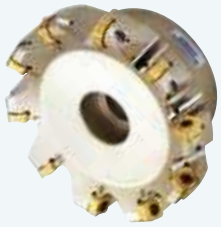
RMH8AC (M)

5000type

RMH8AC (RMH8ACM)	5080HR-M 5100HR-M 5125HR-M 5160R-M 5200R-M 5250R-M 5315R-M 5400R-M

RM8 Holder

Cutter





RM8EC (M)

4000type

RM8ECM	4050HR-M 4063HR-M
RM8EC (RM8ECM)	4080HR 4080HR-M 4100HR 4100HR-M 4125HR 4125HR-M 4160R 4160R-M 4200R-M 4250R-M 4315R-M 4400R-M

5000type

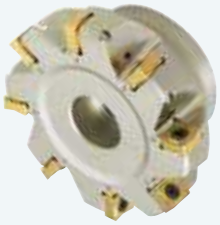
RMH8EC (RMH8ECM)	5080HR-M 5100HR-M 5125HR-M 5160R-M 5200R-M 5250R-M 5315R-M 5400R-M

RMH8EC (M)

4000type

RMH8EC (RMH8ECM)	4080HR-M 4100HR-M 4125HR-M 4160R-M 4200R-M 4250R-M 4315R-M 4400R-M

Cutter





RM8QC (M)

4000type

RM8QCM	4063HR-M 4063HR-H
RM8QC (RM8QCM)	4080HR-M 4080HR-H 4100HR-M 4100HR-H 4125HR-M 4125HR-H 4160R-M 4160R-H 4200R-M 4200R-H

5000type

RM8QC (RM8QCM)	5080HR-M 5100HR-M 5125HR-M 5160R-M 5200R-M 5250R-M 5315R-M 5400R-M

RMH8EC (M)

4000type

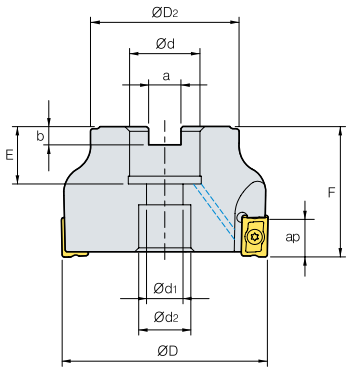
RMH8QC (RMH8QCM)	4080HR-M 4100HR-M 4125HR-M 4160R-M 4200R-M

Rich Mill(RM16)

Cutter type Code system

RM16 A C (M) 4 100 H R - M

- **Product Name**: RM16
- **Approach angle**: A: 45°
- **Tool type**: C: Cutter
- **Unit**: Unmarked: Inch; M: Metric
- **Inscribed circle of insert**: 5: 06type insert; 6: 08type insert
- **Tool Dia.(ØD)**: 100: Ø100
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **Pitch type**: Unmarked: Coarse; M: Close; M: Extra Close



RM16AC(M)4100HR-M

Features

Economical 16 cutting edges

- Economical 16 cutting edges
- Reduces cost in medium cutting
- Wiper insert can be used for good surface roughness
- Optimal matching of the special cutting edge geometry with a variety of new grades provides consistence & consistently longer tool
- When it is used using all16 corners, maximum cutting depth is 5.5mm. When using only but it is used 8 corners, maximum cutting depth is 13mm.
- Wiper insert is placed 0.05mm lower than facing insert in cutter
- When feed is bigger than exceeds the wiper cutting edge length (7mm), 2 wiper inserts are placed in symmetrical positions.



Rich Mill (RM16)

Chip breaker

Insert		Cutting edge	Features
Aluminum Cutting light **MA**			Sharp edge designed to increase productivity and lower cutting force, especially in Aluminum.
Light cutting **MF**			Positive chip breaker reduces cutting load and is recommended for light cutting and difficult to cut materials.
Hard-to-cut material **ML**			Chip breaker design of produces low cutting resistance and ensures better results on difficult-to-cut materials.
General cutting **MM**			Well suited for general milling
Wiper **W**			It has better surface roughness than MM and MF chip breakers.

Instruction for wiper insert

Hand	Correct setting	Incorrect setting			
Right hand					
Decision	○	×	×	×	×
Left hand					
Decision	○	×	×	×	×

Through coolant system

- Well designed chip pocket for better chip flow
- Through coolant system reduces cutting heat and improves chip evacuation



RM16 Insert

Workpiece			Machining types
	Steel	P	
	Stainless steel	M	
	Non-ferrous metal	N	
	Heat resistant alloy, Titanium alloy	S	

● Continuous cutting ⁂ General cutting ✖ Interrupted cutting

Inserts	Designation	Coated P	Coated P	Coated P	Coated M	Coated S	Uncoated N	Dimensions (mm)								Configuration
		PC3500	PC3600	PC5300	PC5400		H01	l	d	t	r	d_1	a	W	g	
ONHX-ML	060608-ML			●	●			6.6	16.0	6.0	0.8	5.6	-	-	-	
	080608-ML			●	●			8.4	20.2	6.0	0.8	5.6	-	-	-	
ONHX-MM	060608-MM			●	●			6.6	16.0	6.0	0.8	5.6	-	-	-	
	080608-MM			●	●			8.4	20.2	6.0	0.8	5.6	-	-	-	
	0606ANN-MM			●	●			6.6	16.0	6.0	0.8	5.6	1.03	-	-	
	0806ANN-MM			●	●			8.4	20.2	6.0	0.8	5.6	1.53	-	-	
ONHX-MA	060608-MA						●	6.6	16.0	6.0	0.8	5.6	-	-	-	
	080608-MA						●	8.4	20.2	6.0	0.8	5.6	-	-	-	
ONHX-W	060608-W			●				6.5	16.0	6.0	0.8	5.6	-	-	-	
	080608-W			●				8.2	20.2	6.0	0.8	5.6	-	-	-	
ONMX-MF	060608-MF		●	●	●			6.6	16.0	6.0	0.8	5.6	-	-	-	
	080608-MF		●	●	●			8.4	20.2	6.0	0.8	5.6	-	-	-	
	0606ANN-MF		●	●	●			6.6	16.0	6.0	0.8	5.6	1.03	-	-	
	0806ANN-MF		●	●	●			8.4	20.2	6.0	0.8	5.6	1.53	-	-	
ONMX-MM	060608-MM	●	●	●	●			6.6	16.0	6.0	0.8	5.6	-	-	-	
	080608-MM	●	●	●	●			8.4	20.2	6.0	0.8	5.6	-	-	-	
	0606ANN-MM	●	●	●	●			6.6	16.0	6.0	0.8	5.6	1.03	-	-	
	0806ANN-MM	●	●	●	●			8.4	20.2	6.0	0.8	5.6	1.53	-	-	

RM16 Holder

Shank



RM16AC(M)

RM16ACM	6063HR-M	**RM16ACM**	8063HR-M
RM16AC (RM16ACM)	6080HR-M 6100HR-M 6125HR-M 6160R-M 6200R-M 6250R-M 6315R-M 6400R-M	**RM16AC (RM16ACM)**	8080HR-M 8100HR-M 8125HR-M 8160R-M 8200R-M 8250R-M 8315R-M 8400R-M

FMR P-Positive

Shank type Code system

FM R S 4 032 H R P - 3 L 32

- **Product Name**: Future-Mill
- **R type Insert**: Round & Rough
- **Tool type**: **S:** Shank
- **Inscribed circle of insert**: **25**: 08type insert; **3**: 10type insert; **4**: 10type insert; **5**: 10type insert; **6**: 10type insert
- **Tool Dia.(ØD)**: 032: Ø32
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **Relief Angle**: P: 11°
- **No. of tooth**: 3: 3 teeth
- **Tool length (L)**: **S** = Standard type; **M** = Middle type; **L** = Long type
- **Tool Dia.(ØD)**: 032: Ø32

Cutter type Code system

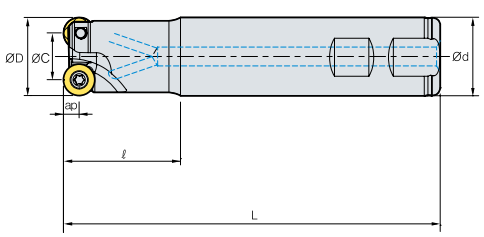
FM R C (M) 4 100 H R P - 7

- **Product Name**: Future-Mill
- **R type Insert**: Round & Rough
- **Tool type**: **C:** Cutter
- **Unit**: Unmarked: Inch; **M:** Metric
- **Inscribed circle of insert**: **3**: 10type insert; **4**: 10type insert; **5**: 10type insert; **6**: 10type insert
- **Tool Dia.(ØD)**: 100: Ø100
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **Relief Angle**: P: 11°
- **No. of tooth**: 3: 3 teeth

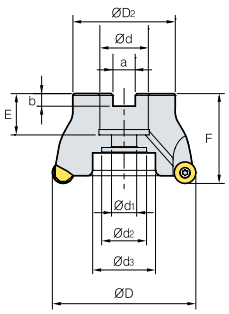
Modular type Code system

FM R M 4 033 H R P - M16

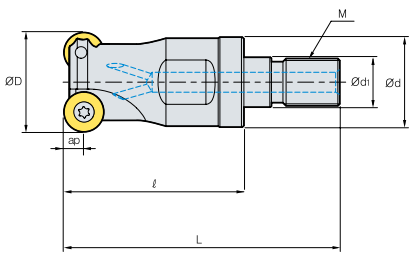
- **Product Name**: Future-Mill
- **R type Insert**: Round & Rough
- **Tool type**: **M:** Modular
- **Inscribed circle of insert**: **25**: 08type insert; **3**: 10type insert; **4**: 10type insert; **5**: 10type insert
- **Tool Dia.(ØD)**: 033: Ø33
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **Relief Angle**: P: 11°
- **M Dimensions**



FMRS4032HRP-3L32



FMRC(M)4100HRP-7



FMRM4033HRP-M16

FMR P - Positive

Features

- Stable clamping system enables stable machining and productivity
- Varied product line-up ensures wide application range
- Optimal shape and grade with high hardness for hard-to-cut material machining



Future Mill series for mold making

FMR P-Positive



- P-positive relief angle (11˚) ensures high rigidity and high machinability in die steel and high-resistant alloy machining.
- Flat clearance face of insert prevents interference and revolution while machining.
- Optimal grades and chip breakers for various workpieces

Chip breaker

- Concave shape ensures wide chip pocket and lowers cutting temperature.

Through-coolant system

- Superb chip evacuation
- Low cutting heat ensures long tool life

Clearance face for preventing rotation

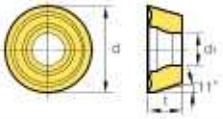
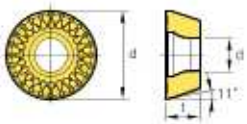
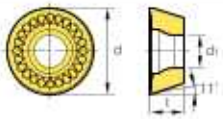
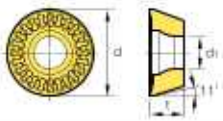
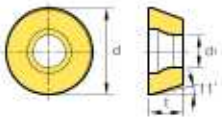
- Prevents rotation in machining.
- Divides corners.
- Prevents interference in high-feed machining.
- Ensures stable clamping.

Usage and features of chip breakers

Chip breaker	Cutting edge	Applications	Features
MA		Aluminum machining	Optimal cutting edge for aluminum machining and buffed surface ensure high machinability.
ML		Titanium & Inconel machining	Excellent results in titanium machining due to a high hardness cutting edge and the chip breaker reduces the cutting load
MF		Fine finishing	Chip breaker for low cutting resistance enables fine finishing.
MM		General machining	Optimal for general machining
None C/B		Super hard material machining	Optimal for high hardness die steel and heat resistant alloy

FMR P - Positive Insert

Workpiece			Machining types		
	Steel	P	● Continuous cutting	❋ General cutting	✖ Interrupted cutting
	Stainless steel	M			
	Non-ferrous metal	N			
	Heat resistant alloy, Titanium alloy	S			

Inserts	Designation	Coated P	Coated P M S	Coated P M S	Uncoated N	Dimensions (mm) l	d	t	r	d_1	a	Configuration
		PC3600	PC5300	PC5400	H01							
RPCT-MA 	10T3M0-MA				●	-	10	3.97	-	4.0	-	
	1204M0-MA				●	-	12	4.76	-	4.5	-	
	1606M0-MA				●	-	16	6.35	-	5.5	-	
	2007M0-MA				●	-	20	7.00	-	7.0	-	
RPET-ML 	0803M0E-ML		●	●		-	8	3.18	-	3.4	-	
	103TM0E-ML		●	●		-	10	3.97	-	4.0	-	
	1204M0E-ML		●	●		-	12	4.76	-	4.5	-	
	1606M0E-ML		●	●		-	16	6.35	-	5.5	-	
	2007M0E-ML		●	●		-	20	7.00	-	7.0	-	
RPMT-MF 	0803M0E-MF	●	●	●		-	8	3.18	-	3.4	-	
	10T3M0E-MF	●	●	●		-	10	3.97	-	4.0	-	
	1204M0E-MF	●	●	●		-	12	4.76	-	4.5	-	
	1606M0E-MF	●	●	●		-	16	6.35	-	5.5	-	
	2007M0E-MF	●	●	●		-	20	7.00	-	7.0	-	
RPMT-MM 	0803M0S-MM	●	●	●		-	8	3.18	-	3.4	-	
	10T3M0S-MM	●	●	●		-	10	3.97	-	4.0	-	
	1204M0S-MM	●	●	●		-	12	4.76	-	4.5	-	
	1606M0S-MM	●	●	●		-	16	6.35	-	5.5	-	
	2007M0S-MM	●	●	●		-	20	7.00	-	7.0	-	
RPMW 	0803M0E1	●	●	●		-	8	3.18	-	3.4	-	
	10T3M0E1	●	●	●		-	10	3.97	-	4.0	-	
	1204M0S1	●	●	●		-	12	4.76	-	4.5	-	
	1204M0S2		●	●		-	12	4.76	-	4.5	-	
	1606M0S1	●	●	●		-	16	6.35	-	5.5	-	
	2007M0S1	●	●	●		-	20	7.00	-	7.0	-	

FMR P - Positive Holder

Shank



FMRS

2000type

2517HRP-2S16
2517HRP-2M16
2517HRP-2L16
2518HRP-2M16
2518HRP-2L16
2520HRP-3S20
2520HRP-3M20
2520HRP-3L20
2521HRP-3S20
2521HRP-3M20
2521HRP-3L20
2525HRP-4S25
2525HRP-4M25
2525HRP-4L25
2526HRP-4S25
2526HRP-4L25

3000type

3025HRP-2M20
3025HRP-2S25
3025HRP-2M25
3025HRP-2L25
3026HRP-2L25
3032HRP-3S32
3032HRP-3L32
3032HRP-4S32
3032HRP-4L25
3033HRP-4S32
3033HRP-4M32
3033HRP-4L32

4000type

4025HRP-2S25
4026HRP-2L25
4032HRP-2L25
4032HRP-2S32
4032HRP-2L32
4032HRP-3S32
4032HRP-3M32
4033HRP-3M32
4033HRP-3L32
4040HRP-3S32
4040HRP-3M32
4040HRP-4S32
4040HRP-4M32
4040HRP-4L32
4050HRP-4M32
4050HRP-4M40
4050HRP-4M42

5000type

5040HRP-2M32
5040HRP-2L32
5050HRP-3M40
5050HRP-3L40

6000type

6050HRP-3S32
6050HRP-3M32
6050HRP-3S40
6050HRP-3M40

FMR P - Positive Holder

Cutter



FMRC (M)

3000type

FMRCM	3040HRP-5 3050HRP-6 3052HRP-6 3063HRP-6 3063HRP-7 3066HRP-7

4000type

FMRCM	4050HRP-4 4050HRP-5 4052HRP-5 4063HRP-5 4063HRP-6 4066HRP-6
FMRC (FMRCM)	4080HRP-6 4080HRP-7 4100HRP-7

5000type

FMRCM	5063HRP-4 5063HRP-5 5066HRP-5
FMRC (FMRCM)	5080HRP-5 5080HRP-6 5100HRP-6 5125HRP-7 5125HRP-8 5160RP-8

6000type

FMRCM	6063HRP-4
FMRC (FMRCM)	6080HRP-5 6100HRP-5 6100HRP-6 6125HRP-5 6125HRP-7 6160RP-6 6160RP-8 6200RP-8 6250RP-9

Modular



FMRM

2500type

FMRM	2517HRP-M08 2521HRP-M10 2526HRP-M12 2533HRP-M16 2540HRP-M16

3000type

FMRM	3026HRP-M12 3033HRP-M16 3035HRP-M16 3040HRP-M16 3042HRP-M16

4000type

FMRM	4026HRP-M12 4033HRP-M16 4035HRP-M16 4040HRP-M16 4042HRP-M16

5000type

FMRM	5040HRP-M16 5042HRP-M16

FMR D-Positive

Shank type Code system

FM R S 3 021 H R D - M (2)

- **Product Name**: Future-Mill
- **Rtype Insert**: Round & Rough
- **Tool type**: **S:** Shank
- **Inscribed circle of insert**:
  - **10**: 05type insert
  - **15**: 06type insert
  - **20**: 07type insert
  - **25**: 08type insert
  - **30**: 10type insert
  - **40**: 12type insert
  - **50**: 16type insert
  - **60**: 20type insert
- **Tool Dia.(ØD)**: 021: Ø21
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **Relief Angle**: D: 15°
- **Tool length(L)**: **S** = Standard type; **M** = Middle type; **L** = Long type
- **No. of tooth**

Cutter type Code system

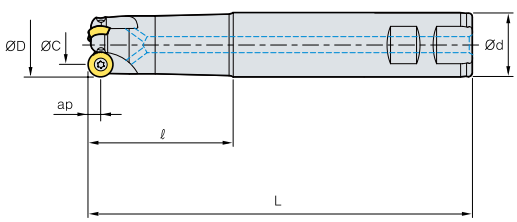
FM R C (M) 4 063 H R D - H

- **Product Name**: Future-Mill
- **Rtype Insert**: Round & Rough
- **Tool type**: **C:** Cutter
- **Unit**: Unmarked: Inch; **M:** Metric
- **Inscribed circle of insert**:
  - **10**: 05type insert
  - **15**: 06type insert
  - **20**: 07type insert
  - **25**: 08type insert
  - **30**: 10type insert
  - **40**: 12type insert
  - **50**: 16type insert
  - **60**: 20type insert
- **Tool Dia.(ØD)**: 063: Ø63
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **Relief Angle**: D: 15°
- **No. of tooth**: **None** = Coarse; **M** = Standard; **H** = Fine

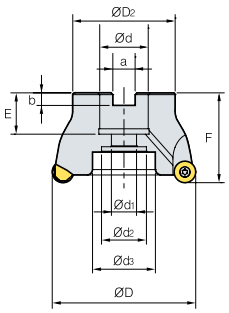
Modular type Code system

FM R M 2 520 H R D - M16

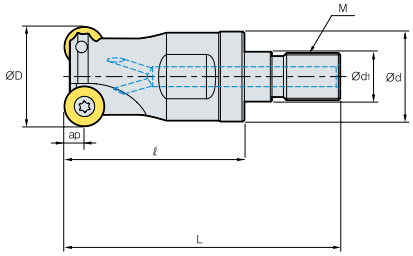
- **Product Name**: Future-Mill
- **Rtype Insert**: Round & Rough
- **Tool type**: **M:** Modular
- **Inscribed circle of insert**:
  - **10**: 05type insert
  - **15**: 06type insert
  - **20**: 07type insert
  - **25**: 08type insert
  - **30**: 10type insert
  - **40**: 12type insert
  - **50**: 16type insert
  - **60**: 20type insert
- **Tool Dia.(ØD)**: 033: Ø33
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **Relief Angle**: D: 15°
- **M Dimensions**



FMRS3021HRD - M (2)



FMRC (M)4063HRD - H



FMRM2520HRD - M16

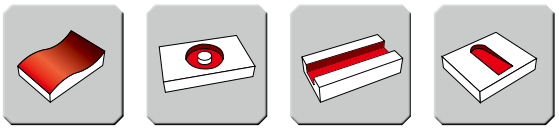
FMR D - Positive

Features

- Wide coverage for medium to roughing, general steel to high hardness mold materials.
- 2 step insert shape provides strong clamping.
- 4-8 available cutting edges available per insert. (Inscribed circle 05, 06, 07, 08, 10, 12, 16, 20)
- Uneven flute spacing prevents vibration in high speed applications and provides more stable machining.
- Precise design of the insert seat prevents insert chatter.
- Special design of the insert seat prevents movement and chatter of insert.
- Easy to change cutting edge due to the rotation-prevention design of the insert.

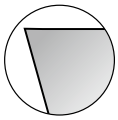
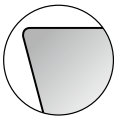
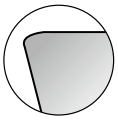


Machining examples



Copying | Helical | Slotting & Side cutting | Ramping

FMR Insert cutting edge shape

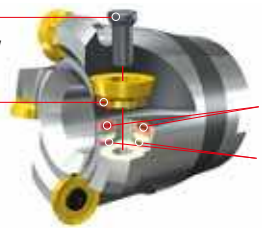
Designation	RDHW□□□□M0F	RDHW□□□□M0E	RDHW□□□□M0S
Cutting edge shape (G calss)			

Chip breakers

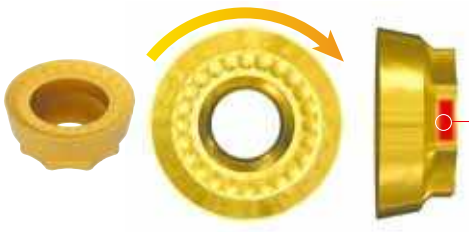
Chip breakers			Cutter edge	Features
Finishing	MF			Low cutting resistance chip breaker design guarantees long tool life good performance at finishing and difficult-to-cut material machining
Medium	MM			Suitable for general milling at wide application range
Aluminum	MA			Sharp cutting edge and buffed top face for aluminum machining prevent welding and control chip flow

Clamping system

- Insert Clamp Screw
- Clamping side of insert



- Supporting part of insert
- Rotate prevention design of insert seat part

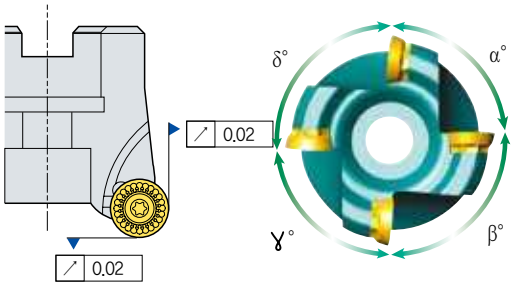


Rotate prevention design of insert seat part

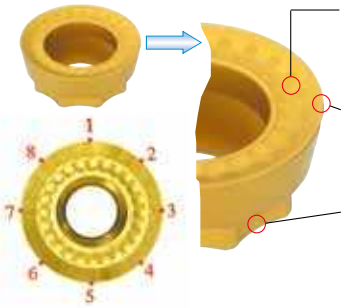
FMR □ 3000 type FMR □ 4000 type	FMR □ 5000 type FMR □ 6000 type

RDKT10T3M0 - □□ RDKT1204M0 - □□	RDKT1605M0 - MM RDKT2006M0 - MM

FMR D - Positive



Good surface finish due to the precise design of insert seat part of cutter	Uneven flute spacing prevents vibration at high speed application and provides stable machining



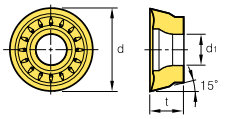
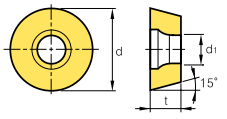
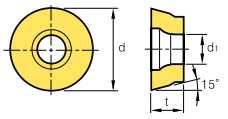
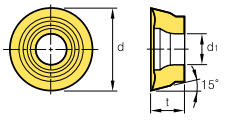
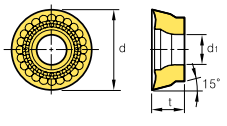
4-8 cutting edge available per insert

- **Special chip breaker for low cutting load**
  Minimized heat generation due to smooth chip flow
- **Smooth cutting edge preparation Inclined land angle**
  Low cutting load and better surface roughness
- **Facial contact through curved face**
  Prevent rotation at high speed cutting Stable and tight clamping of insert. Accurate stable insert positioning.

FMR D - Positive Insert

Workpiece			Machining types		
	Steel	P	●	✱	✱
	Stainless steel	M	✱	✱	✱
	Non-ferrous metal	N			●
	Heat resistant alloy, Titanium alloy	S	✱		✱

● Continuous cutting ● General cutting ✱ Interrupted cutting

Inserts	Designation	Coated P	Coated P M S	Coated P M S	Coated P M S	Uncoated N	Dimensions (mm) l	d	t	r	d1	a	Cutter width	Configuration
		PC3500	PC3545	PC9530	PC5300	H01								
RDCT-MA 	**10T3M0-MA**					●	-	10	3.97	-	3.85	-	-	
	1204M0-MA						-	12	4.76	-	4.5	-	-	
RDHW 	**0501M0F**						-	5	1.59	-	2.3	-	-	
	0501M0E						-	5	1.59	-	2.3	-	-	
	0501M0S						-	5	1.59	-	2.3	-	-	
	06T1M0F						-	6	1.98	-	2.5	-	-	
	06T1M0E			●			-	6	1.98	-	2.5	-	-	
	06T1M0S						-	6	1.98	-	2.5	-	-	
	0702M0F						-	7	2.38	-	2.8	-	-	
	0702M0E			●			-	7	2.38	-	2.8	-	-	
	0702M0S						-	7	2.38	-	2.8	-	-	
	0803M0F						-	8	3.18	-	3.4	-	-	
	0803M0E			●			-	8	3.18	-	3.4	-	-	
	0803M0S						-	8	3.18	-	3.4	-	-	
RDHW 	**1605M0F**						-	16	5.56	-	5.5	-	-	
	1605M0E						-	16	5.56	-	5.5	-	-	
	1605M0S						-	16	5.56	-	5.5	-	-	
	2006M0F						-	20	6.35	-	5.5	-	-	
	2006M0E						-	20	6.35	-	5.5	-	-	
	2006M0S						-	20	6.35	-	5.5	-	-	
RDKT-MF 	**10T3M0-MF**		●	●	●		-	10	3.97	-	3.85	-	-	
	1204M0-MF	●	●	●	●		-	12	4.76	-	4.5	-	-	
	1605M0-MF						-	16	5.56	-	5.5	-	-	
RDKT-ML 	**1605M0-ML**						-	16	5.56	-	5.5	-	-	

FMR D - Positive Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting
	Stainless steel	M	◖ General cutting
	Non-ferrous metal	N	✱ Interrupted cutting
	Heat resistant alloy, Titanium alloy	S	

Inserts	Designation	Coated P	Coated P M S			Un-coated N	Dimensions (mm)						Configuration
		PC3500	PC3545	PC9530	PC5300	H01	l	d	t	r	d_1	a	
RDKT-MM	**10T3M0-MM**	●	●	●	●		-	10	3.97	-	3.85	-	
	1204M0-MM	●	●	●	●		-	12	4.76	-	4.5	-	
	1605M0-MM	●	●				-	16	5.56	-	5.5	-	
	2006M0-MM	●	●				-	20	6.35	-	5.5	-	
RDKW	**0501M0E**	●					-	5	1.59	-	2.3	-	
	06T1M0E	●					-	6	1.98	-	2.5	-	
	0702M0E	●					-	7	2.38	-	2.8	-	
	0803M0E	●					-	8	3.18	-	3.4	-	

FMR D - Positive Holder

Shank



FMRS

1000type

1008HRD-M
1008HRD-L
1010HRD-M
1010HRD-L
1012HRD-M
1012HRD-L
1015HRD-M
1015HRD-L

1500type

1510HRD-M
1510HRD-L
1512HRD-M
1512HRD-L
1516HRD-M
1516HRD-L
1520HRD-M
1520HRD-L

2000type

2015HRD-S
2015HRD-M
2015HRD-L
2020HRD-S
2020HRD-M
2020HRD-L

2500type

2516HRD-S
2516HRD-M
2516HRD-L
2520HRD-S
2520HRD-M
2520HRD-L
2525HRD-S
2525HRD-M
2525HRD-L

3000type

3021HRD-M
3021HRD-M2
3021HRD-L
3021HRD-L2
3025HRD-S
3025HRD-M
3025HRD-L
3026HRD-M
3026HRD-L
3032HRD-S
3032HRD-M
3032HRD-L
3040HRD-S
3040HRD-M
3040HRD-L

4000type

4032HRD-S
4032HRD-M
4032HRD-L
4033HRD-S
4033HRD-M
4033HRD-L
4040HRD-S
4040HRD-M
4040HRD-L
4040HRD-S40
4040HRD-M40
4040HRD-L40
4040HRD-S42
4040HRD-M42
4040HRD-L42
4050HRD-S
4050HRD-M
4050HRD-L
4050HRD-S40
4050HRD-M40
4050HRD-L40

5000type

5040HRD-S
5040HRD-M
5040HRD-L
5040HRD-S40
5040HRD-M40
5040HRD-L40
5040HRD-S42
5040HRD-M42
5040HRD-L42
5050HRD-S40
5050HRD-M40
5050HRD-L40
5050HRD-S
5050HRD-M
5050HRD-L
5063HRD-S40
5063HRD-M40
5063HRD-L40
5063HRD-S
5063HRD-M
5063HRD-L

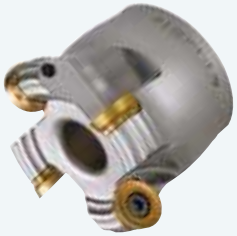
6000type

6050HRD-S40
6050HRD-S42
6050HRD-M40
6050HRD-M42
6050HRD-L40
6050HRD-L42
6063HRD-S40
6063HRD-S42
6063HRD-M40
6063HRD-M42
6063HRD-L40
6063HRD-L42

FMR D - Positive Holder

Cutter





FMRC (M)

3000type	
FMRCM	3040HRD 3040HRD-H 3050HRD 3050HRD-H 3063HRD 3063HRD-H
FMRCM (FMRCM)	3080HRD 3080HRD-H 3100HRD 3100HRD-H

4000type	
FMRCM	4050HRD 4063HRD 4063HRD-M
FMRCM (FMRCM)	4080HRD 4080HRD-M 4100HRD 4100HRD-M 4125HRD 4125HRD-M

FMRC (M)

5000type	
FMRCM	5050HRD 5063HRD 5063HRD-H
FMRCM (FMRCM)	5080HRD 5080HRD-H 5100HRD 5100HRD-H 5125HRD 5125HRD-H

6000type	
FMRCM	6063HRD 6063HRD-M
FMRCM (FMRCM)	6080HRD 6080HRD-M 6100HRD 6100HRD-M 6125HRD 6125HRD-M 6160RD 6160RD-M

Modular





FMRM

1000type	
FMRM	1008HRD-M06 1010HRD-M06 1012HRD-M06 1015HRD-M08 1510HRD-M06 1512HRD-M06 1516HRD-M08 1520HRD-M10

2000type	
FMRM	2015HRD-M08 2020HRD-M10 2516HRD-M08 2520HRD-M10 2525HRD-M12

FMRM

3000type	
FMRM	3021HRD-M10 3025HRD-M12 3032HRD-M16 3042HRD-M16

4000type	
FMRM	4025HRD-M12 4032HRD-M16 4040HRD-M16 4042HRD-M16

5000type	
FMRM	5040HRD-M16

HRMDouble

Shank type Code system

HRM D S 09 32 H R - 2 S 32

- **Product Name**: High Removal Milling
- **Double Sided Insert**
- **Tool type**: S: Shank
- **Inscribed circle of insert**: 6: 06type insert; 9: 09type insert; 13: 13type insert
- **Tool Dia.(ØD)**: 32: Ø32
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **No. of tooth**: 2: 2teeth
- **Tool length (L)**: S = Standard type; M = Middle type; L = Long type
- **Tool Dia.(ØD)**: 32: Ø32

Cutter type Code system

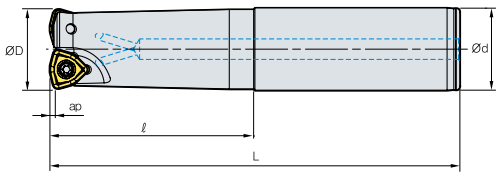
HRM D C (M) 13 063 H R - 5

- **Product Name**: High Removal Milling
- **Double Sided Insert**
- **Tool type**: C: Cutter
- **Unit**: Unmarked: Inch; M: Metric
- **Inscribed circle of insert**: 9: 09type insert; 13: 13type insert; 16: 16type insert
- **Tool Dia.(ØD)**: 63: Ø63
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **No. of tooth**: 5: 5teeth

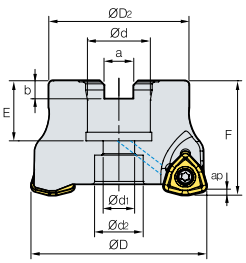
Modular type Code system

HRM D M 13 35 H R - M16

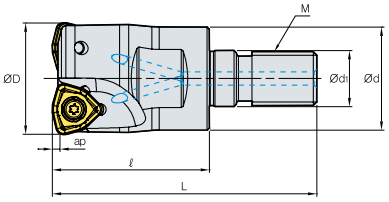
- **Product Name**: High Removal Milling
- **Double Sided Insert**
- **Tool type**: M: Modular
- **Inscribed circle of insert**: 6: 06type insert; 9: 09type insert; 13: 13type insert
- **Tool Dia.(ØD)**: 35: Ø35
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **M Dimensions**



HRMDS0932HR - 2S32



HRMDC (M)13063HR - 5



HRMDM1335HR - M16

HRMDouble

Features

- The HRMDouble is more economical with 6 cutting edges compared to the HRM tool with positive inserts with 3 edges.
- High rake angle cutting edge and chip breaker reduce cutting loads.
- Negative geometry design increases rigidity of cutting edge and doubles the number of cutting edges.
- Simple screw on system provides stable support and stronger clamping force.
- Unique insert design specifically for high feed and multifunctional machining.
- The HRMDouble insert with symmetrical cutting edge is applicable for both R and L hand machining.



Features of Insert

❶ Nose-R

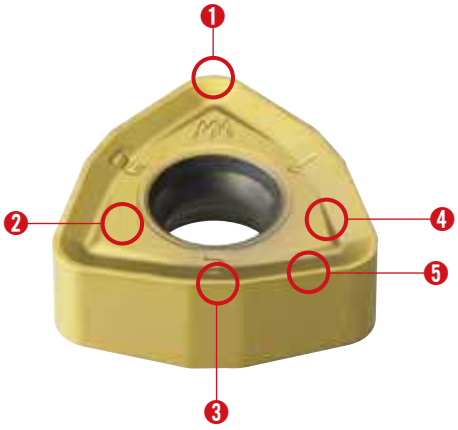
- Security of rigid edge in ramping Pocket machining
- Round edge suitable for high feed rates Insert geometry
- Possible to use R/L type machining

❷ Clamping surface

- Design for stable clamping
- Prevention of friction by chip

❸ Minor cutting edge

- Improvement of surface roughness in high feed machining
- Special design for decreasing thrust force
- Symmetrical insert design for R/L type tool



❹ Chip breaker

- Reduction of cutting load due to high rake angle
- Improvement of chip flow and evacuation in various applications
- Prevention of damage on clamping face of insert

❺ Major cutting edge

- Symmetrical design insert for R/L type tool
- Superior cutting performance due to high rake angle cutting edge
- Low cutting resistance in high feed
- Special design for decreasing thrust force

Features of Cutter

Inner coolant system »

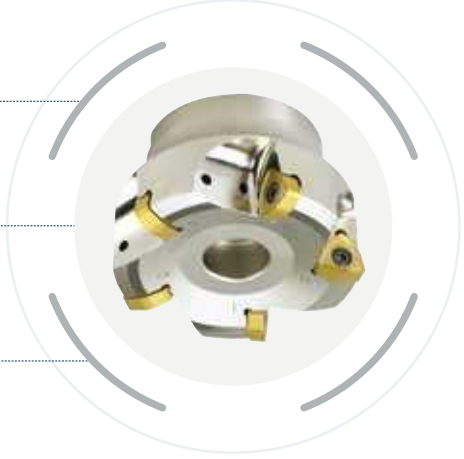
- Improvement of chip control and evacuation
- Longer tool life due to reduced cutting temperature

3-surface constrained system »

- Strong clamping system
- Stable clamping system against different cutting resistances in various machining applications

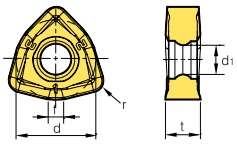
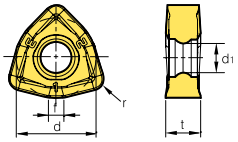
Simple screw on system »

- Strong clamping of screw on system
- Convenient clamping system
- Wide chip pocket for better chip evacuation



HRMDouble Insert

Workpiece			Machining types: ● Continuous cutting ⚙ General cutting ✱ Interrupted cutting
	Steel	P	⚙ ✱ ✱
	Stainless steel	M	✱ ✱
	Non-ferrous metal	N	⚙
	Heat resistant alloy, Titanium alloy	S	✱ ✱

Inserts	Designation	Coated P	Coated P	Coated M	Coated S	Un-coated N	Dimensions (mm) l	l_2	l_1	d	t	r	d_1	a	f	Configuration
		PC3600	PC5300		PC5400	H01										
WNMX-MM 	060312ZNN-MM		●		●	●	-	-	-	6.35	3.18	1.2	2.86	-	1.2	
	09T316ZNN-MM	●	●		●	●	-	-	-	9.525	3.97	1.6	3.6	-	1.7	
	130520ZNN-MM	●	●		●	●	-	-	-	12.7	5.56	2.0	4.7	-	2.5	
	160720ZNN-MM		●		●	●	-	-	-	16.0	7.0	2.0	5.8	-	3.0	
WNMX-MF 	060312ZNN-MF		●		●		-	-	-	6.35	3.18	1.2	2.86	-	1.2	
	09T316ZNN-MF		●		●		-	-	-	9.525	3.97	1.6	3.6	-	1.7	
	130520ZNN-MF		●		●		-	-	-	12.7	5.56	2.0	4.7	-	2.5	
	160720ZNN-MF		●		●		-	-	-	16.0	7.0	2.0	5.8	-	3.0	

HRMDouble Holder

Shank



HRMDS

0616HR-2S16	0621HR-2L20	0925HR-2S25	0933HR-3L32	0940HR-4M40	0950HR-5S32
0616HR-2M16	0625HR-3S25	0925HR-2M25	0935HR-4S32	0940HR-4L40	0950HR-5M32
0616HR-2L16	0625HR-3M25	0925HR-2L25	0935HR-4M32	0940HR-4S42	0950HR-5L32
0617HR-2S16	0625HR-3L25	0926HR-2S25	0935HR-4L32	0940HR-4M42	0950HR-5S40
0617HR-2M16	0626HR-3S25	0926HR-2M25	0940HR-4S32	0940HR-4L42	0950HR-5M40
0617HR-2L16	0626HR-3M25	0926HR-2L25	0940HR-4L32	0950HR-4S32	0950HR-5L40
0618HR-2S16	0626HR-3L25	0930HR-3S32	0940HR-4S40	0950HR-4M32	0950HR-5S42
0618HR-2M16	0632HR-4S32	0930HR-3M32		0950HR-4L32	0950HR-5M42
0618HR-2L16	0632HR-4M32	0930HR-3L32		0950HR-4S40	0950HR-5L42
0620HR-2S20	0632HR-4L32	0932HR-3S32		0950HR-4M40	
0620HR-2M20	0633HR-4S32	0932HR-3M32		0950HR-4L40	
0620HR-2L20	0633HR-4M32	0932HR-3L32		0950HR-4S42	
0621HR-2S20	0633HR-4L32	0933HR-3S32		0950HR-4M42	
0621HR-2M20		0933HR-3M32		0950HR-4L42	

HRMDouble Holder

Shank



HRMDS

1332HR-2S32	1340HR-3L40	1350HR-4M32	1363HR-4S42
1332HR-2M32	1340HR-3S42	1350HR-4L32	1363HR-4M42
1332HR-2L32	1340HR-3M42	1350HR-4S40	1363HR-4L42
1333HR-2S32	1340HR-3L42	1350HR-4M40	1363HR-5S32
1333HR-2M32	1350HR-3S32	1350HR-4L40	1363HR-5M32
1333HR-2L32	1350HR-3M32	1350HR-4S42	1363HR-5L32
1335HR-2S32	1350HR-3L32	1350HR-4M42	1363HR-5S40
1335HR-2M32	1350HR-3S40	1350HR-4L42	1363HR-5M40
1335HR-2L32	1350HR-3M40	1363HR-4S32	1363HR-5L40
1340HR-3S32	1350HR-3L40	1363HR-4M32	1363HR-5S42
1340HR-3M32	1350HR-3S42	1363HR-4L32	1363HR-5M42
1340HR-3L32	1350HR-3M42	1363HR-4S40	1363HR-5L42
1340HR-3S40	1350HR-3L42	1363HR-4M40	
1340HR-3M40	1350HR-4S32	1363HR-4L40	

Cutter



HRMDC(M)

HRMDCM	09040HR-3	**HRMDCM**	13050HR-3	**HRMDC (HRMDCM)**	16080HR-4
	09040HR-4		13050HR-4		16080HR-5
	09050HR-4		13063HR-4		16100HR-5
	09050HR-5		13063HR-5		16100HR-6
	09063HR-5		13080HR-5		16125HR-6
	09063HR-6		13080HR-6		16125HR-7
	09080HR-6		13100HR-6		16160R-7
	09080HR-7		13100HR-7		16160R-8
	09100HR-7		13125HR-7		16200R-8
	09100HR-8		13125HR-8		16200R-10
					16250R-10
HRMDC	09080HR-6	**HRMDC**	13080HR-5		16250R-12
	09080HR-7		13080HR-6		16315R-12
	09080HR-31.75-6		13080HR-31.75-5		16315R-14
	09080HR-31.75-7		13080HR-31.75-6		
	09100HR-7		13100HR-6		
	09100HR-8		13100HR-7		
			13125HR-7		
			13125HR-8		

Modular



HRMDM

HRMDM	0616HR-M08	**HRMDM**	0925HR-M12
	0617HR-M08		0926HR-M12
	0618HR-M08		0930HR-M16
	0620HR-M10		0932HR-M16
	0621HR-M10		0933HR-M16
	0625HR-M12		0935HR-M16
	0626HR-M12		0940HR-M16
	0632HR-M16		
	0633HR-M16	**HRMDM**	1332HR-M16
			1333HR-M16
			1335HR-M16
			1340HR-M16

HRM

Shank type Code system

HRM S 13 32 H R - 2 S 32

- **Product Name**: HRM
- **Tool type**: S: Shank
- **Inscribed circle of insert**: 8: 08type insert; 10: 10type insert; 13: 13type insert; 15: 15type insert
- **Tool Dia.(ØD)**: 32: Ø32
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **No. of tooth**: 3: 3teeth
- **Tool length(L)**: S = Standard type; M = Middle type; L = Long type
- **Tool Dia.(ØD)**: 32: Ø32

Cutter type Code system

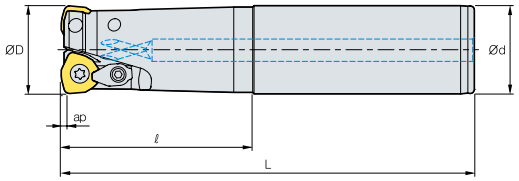
HRM C (M) 1 350 H R - 3

- **Product Name**: HRM
- **Tool type**: C: Cutter
- **Unit**: Unmarked: Inch; M: Metric
- **Inscribed circle of insert**: 8: 08type insert; 10: 10type insert; 13: 13type insert; 15: 15type insert
- **Tool Dia.(ØD)**: 50: Ø50
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **No. of tooth**: 3: 3teeth

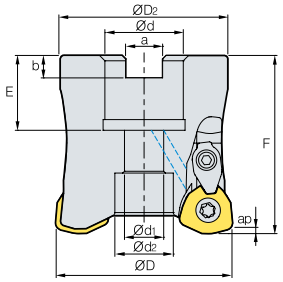
Modular type Code system

HRM M 08 20 H R - M10

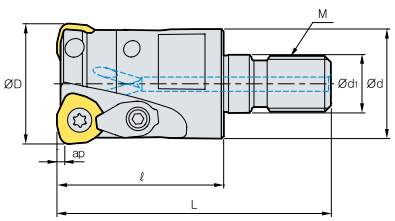
- **Product Name**: HRM
- **Tool type**: M: Modular
- **Inscribed circle of insert**: 8: 08type insert; 10: 10type insert; 13: 13type insert; 15: 15type insert
- **Tool Dia.(ØD)**: 20: Ø20
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **M Dimensions**



HRMS1332HR - 2S32



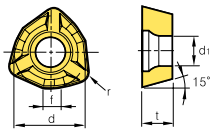
HRMC(M)1350HR - 3



HRMM0820HR - M10

HRM Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting
	Stainless steel	M	⬌ General cutting
	Non-ferrous metal	N	✱ Interrupted cutting
	Heat resistant alloy, Titanium alloy	S	

Inserts	Designation	Coated P	Coated P	Coated M	Coated S	Un-coated N	Dimensions (mm) l	l_2	l_1	d	t	r	d_1	a	f	Configuration
		PC3500	PC5300	PC5400		H01										
WDKT-MH 	**080316ZDSR-MH**	●	●	●			-	-	-	8.0	3.18	1.6	3.3	-	1.8	
	10T320ZDSR-MH	●	●	●			-	-	-	10.0	3.97	2.0	4.3	-	2.3	
	130520ZDSR-MH	●	●	●			-	-	-	13.5	5.56	2.0	5.56	-	3.1	
	150625ZDSR-MH	●	●	●			-	-	-	15.0	6.35	2.5	5.56	-	3.4	

HRM Holder

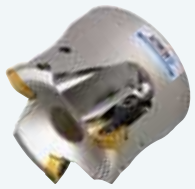
Shank



HRMS

0820HR-2S20	1030HR-2M32	1340HR-3L32	1550HR-3S42
0820HR-2M20	1030HR-2L32	1340HR-3S40	1550HR-3M42
0820HR-2L20	1332HR-2S32	1340HR-3M40	1550HR-3L42
0821HR-2S20	1332HR-2M32	1340HR-3L40	1563HR-4S32
0821HR-2M20	1332HR-2L32	1340HR-3S42	1563HR-4M32
0821HR-2L20	1333HR-2S32	1340HR-3M42	1563HR-4L32
1025HR-2S25	1333HR-2M32	1340HR-3L42	1563HR-4S40
1025HR-2M25	1333HR-2L32	1550HR-3S32	1563HR-4M40
1025HR-2L25	1335HR-2S32	1550HR-3M32	1563HR-4L40
1026HR-2S25	1335HR-2M32	1550HR-3L32	1563HR-4S42
1026HR-2M25	1335HR-2L32	1550HR-3S40	1563HR-4M42
1026HR-2L25	1340HR-3S32	1550HR-3M40	1563HR-4L42
1030HR-2S32	1340HR-3M32	1550HR-3L40	

Cutter



HRMC(M)

HRMC (HRMCM)	13050HR-3
	13050HR-4
	13063HR-4
	13080HR-5
HRMC (HRMCM)	15063HR-3
	15080HR-4
	15100HR-5
	15100HR-6
	15125HR-6
	15160R-7

Modular



HRMM

HRMM	0820HR-M10	**HRMM**	1025HR-M12
	0821HR-M10		1026HR-M12
	0825HR-M12		1030HR-M16
	0826HR-M12		1032HR-M16
	0828HR-M12		1035HR-M16
	0832HR-M16		1040HR-M16
	0833HR-M16		1332HR-M16
	0835HR-M16		1333HR-M16
	0840HR-M16		1335HR-M16
			1340HR-M16

HFM

Shank type Code system

HFM S 1 010 H R - 2 L 10

- **Product Name**: High Feed MILL
- **Tool type**: **S:** Shank
- **Inscribed circle of insert**: **1000**Series: 04type
- **Tool Dia.(ØD)**: 010: Ø10
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **No. of tooth**: 2: 2teeth
- **Tool length(L)**: **S** = Standard type; **M** = Middle type; **L** = Long type
- **Tool Dia.(ØD)**: 10: Ø10

Modular type Code system

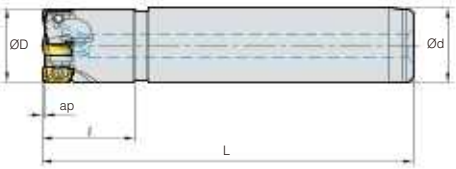
HFM M 1 010 H R - M6

- **Product Name**: High Feed MILL
- **Tool type**: **M:** Modular
- **Inscribed circle of insert**: **1000**Series: 04type
- **Tool Dia.(ØD)**: 010: Ø10
- **Coolant type**: Unmarked: None; **H**: Thru-hole
- **Hand**: **R**: Right; **L**: Left
- **M Dimensions**

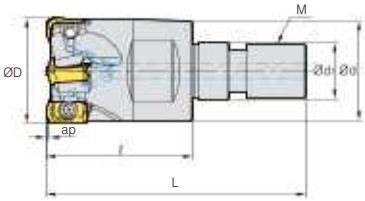
Modular Adaptor Code system

MAT M16 - 120 - S32 S - C

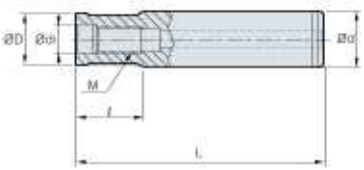
- **Product Name**: Modular Adaptor
- **M Dimensions**
- **Neck length**: 120
- **Tool Dia.(ØD)**: 32: Ø32
- **Neck type**: **T**: Taper; **S**: Straight
- **Adaptor material**: Unmarked: Steel; **C**: Carbide



HFMS1010HR-2L10



HFMM1010HR-M6



MATM16-120-S32S-C

HFM

Features

- High Helix angle on the cutting edge reduces cutting resistance
- The axial rake angle of holder reduces the contact surface on workpiece, reducing wear and vibration and increasing stable stability.
- Improved grades ensure stable tool life. Ultrafine grain substrate and specialized coating layer highly improve anti-chipping and anti-wear.

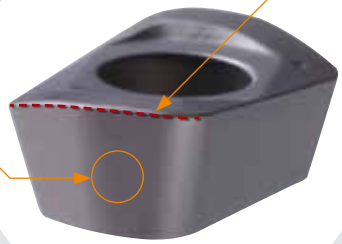


Holder Setup

• To set up the negative axial rake angle, increased chipping resistance

No. of tooth

• Increased Tool life with increased flutes
• HRM(D) Ø20 (2 flutes) ➔ HFM Ø20 (5 flutes)



Relief angle

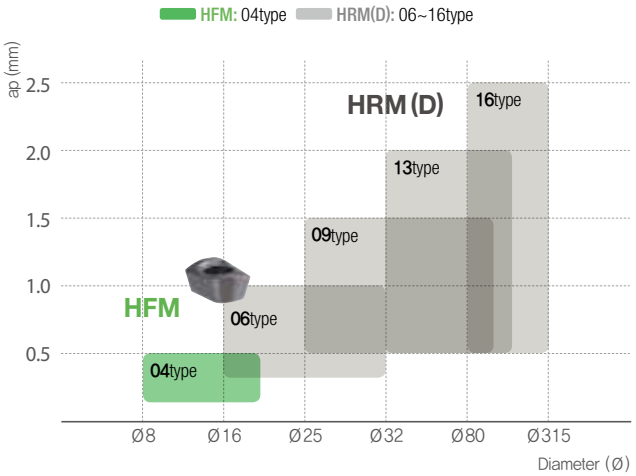
• 11, 13 double relief angle increase rigidity and prevent interference

Major cutting edge

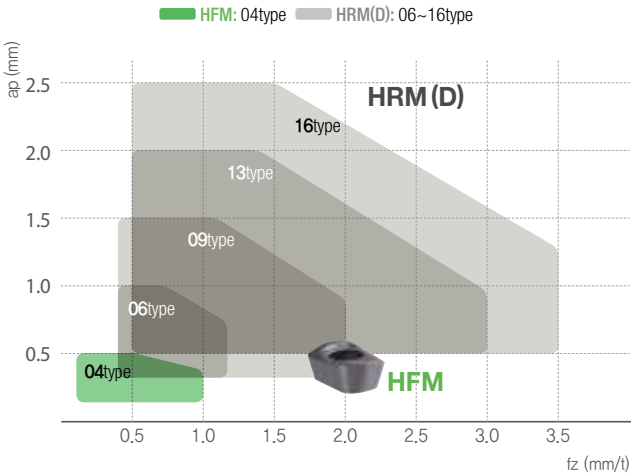
• Apply helix cutting edge
  - Improved sharpness of principle edge
  - Improved toughness of corner edge

Application Area

Application Area (ap & Diameter)



Application Area (ap & fz)



HFM

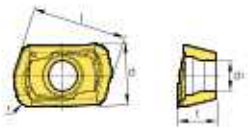
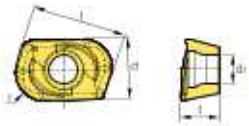
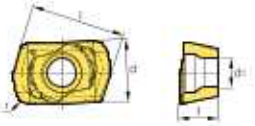
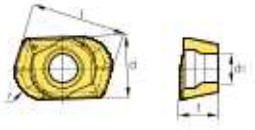
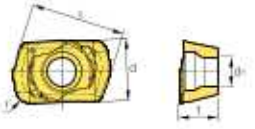
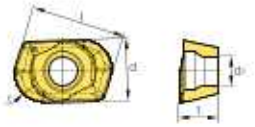
Usage and features of chip breakers

Chip breaker	Cutting edge	Applications	Features
MF		Fine finishing (Titanium & Inconel machining)	Low cutting resistance C/B, suitable for light cutting
MM		Super hard material machining	High toughness shape, suitable for hard die steel cutting

HFM Insert

Workpiece		
	Steel	P
	Stainless steel	M
	Non-ferrous metal	N
	Heat resistant alloy, Titanium alloy	S

Machining types
● Continuous cutting ✱ General cutting ✖ Interrupted cutting

Inserts	Designation	Coated P M S		Dimensions (mm)					Configuration
		PC5300	PC5400	l	d	t	r	d_1	
LPMT Fine finishing	**040210R-MF**	●	●	6.4	4.2	2.6	1.0	2.0	
				LPMT040210R−MF					
	040220R-MF	●	●	6.4	4.2	2.6	2.0	2.0	
				LPMT040220R−MF					
LPMW Super hard material machining	**040210R**	●		6.4	4.2	2.6	1.0	2.0	
	040220R	●		6.4	4.2	2.6	2.0	2.0	
LPEW Super hard material machining	**040210R**	●		6.4	4.2	2.6	1.0	2.0	
	040220R	●		6.4	4.2	2.6	2.0	2.0	

HFM Holder

Shank



Modular



HFMS

1008HR-1S10	1012HR-3S10	1015HR-4S12	1019HR-4S16
1008HR-1M10	1012HR-3M10	1015HR-4M12	1019HR-4M16
1008HR-1L10	1012HR-3L10	1015HR-4L12	1019HR-4L16
1010HR-2S08	1012HR-3S12	1016HR-4S16	1020HR-4S20
1010HR-2M08	1012HR-3M12	1016HR-4M16	1020HR-4M20
1010HR-2L08	1012HR-3L12	1016HR-4L16	1020HR-4L20
1010HR-2S10	1013HR-3S12	1017HR-4S16	1020HR-5S20
1010HR-2M10	1013HR-3M12	1017HR-4M16	1020HR-5M20
1010HR-2L10	1013HR-3L12	1017HR-4L16	1020HR-5L20
1011HR-2S10	1014HR-3S12	1018HR-4S16	1021HR-5S20
1011HR-2M10	1014HR-3M12	1018HR-4M16	1021HR-5M20
1011HR-2L10	1014HR-3L12	1018HR-4L16	1021HR-5L20

HFMM

1008HR-M06	1032HR-M16
1010HR-M06	1033HR-M16
1011HR-M06	
1012HR-M06	
1013HR-M06	
1016HR-M08	
1017HR-M08	
1020HR-M10	
1021HR-M10	
1025HR-M12	
1026HR-M12	
1030HR-M16	

GBE

Holder type Code System

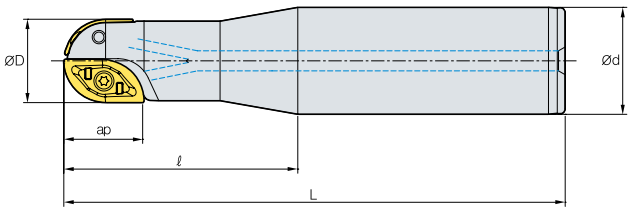
GBE 300 - S 32

- **Product Name**: General Indexable Ball Endmill
- **Machining Dia.(ØD)**: Ø16, Ø18, Ø20, Ø22, Ø25, Ø26, Ø28, Ø30, Ø32, Ø40, Ø50
- **Type**: S: Standard shank; L: Long shank
- **Shank Dia.(ØD)**: 32: Ø32

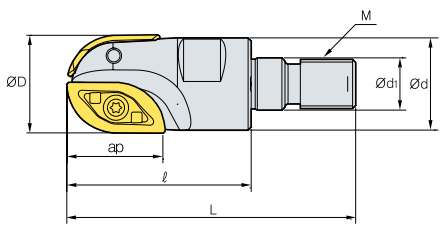
Modular type Code System

GBE M 300 - M16

- **Product Name**: Pro-L Mill
- **Tool type**: M: Modular
- **Tool Dia.(ØD)**: Ø16, Ø18, Ø20, Ø22, Ø25, Ø26, Ø28, Ø30, Ø32, Ø40, Ø50
- **M Dimensions**



GBE300 - S32



GBEM300 - M16

GBE

Features

- Indexable Ball Nose Endmill for Molds in medium & roughing applications
- High hardness grades offer longer tool life
- Precision helical cutting edge
- Through coolant system optimizes cooling and chip evacuation



Internal





Flank support

External





Concave bottom

- Ability to handle high accuracy & large depth of cut applications.
  - Run-out: within 0.05mm
  - R accuracy: within 0.05mm
- Various diameters (Ø16,20,25,30,32,40,50)
- Minimal cutting resistance due to Helical cutting edge
- Anti-rotation of insert due to concave bottom & stable setting by flank support
- Long tool life & better processing due to 2 cutting inserts
- Better tool life with new grade

Multi Edge type | **Single Edge type** | **Modular type**







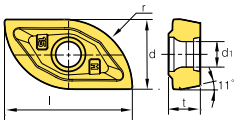


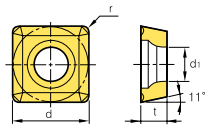
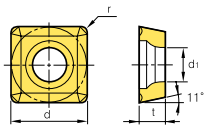
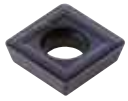
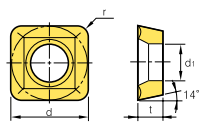
Projection

- Various diameters (Ø16,20,25,30,32,40,50)
- Improved chip treatment with internal coolant (cutting edge portion)
- Long tool life & better processing
- Easy insert setting with projection part to prevent vibration during processing

GBE Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting ⬌ General cutting ✱ Interrupted cutting
	Stainless steel	M	
	Heat resistant alloy, Titanium alloy	S	

Inserts	Designation	Coated				Dimensions (mm)								Configuration
		P		P M S										
		NCM325	PC3500	PC3545	PC5300	l	l_2	l_1	d	t	r	d_1	a	
ZPET-MM  Internal	**080M-MM**					16	-	-	8.0	3.5	8	2.9	-	
	090M-MM					17.7	-	-	7.2	4.3	9	3.4	-	
	100M-MM		●		●	19	-	-	10.4	4.5	10	3.4	-	
	110M-MM					22.2	-	-	11.4	4.8	11	4.5	-	
	125M-MM		●		●	24	-	-	12.9	5.3	12.5	4.5	-	
	130M-MM					25.7	-	-	13.4	5.3	13	4.5	-	
	140M-MM					27.2	-	-	14.3	6.3	14	5.6	-	
	150M-MM		●		●	28	-	-	15.4	7	15	5.6	-	
	160M-MM		●		●	28.5	-	-	16.4	7	16	5.6	-	
	200M-MM		●			38	-	-	20.7	8	20	6.6	-	
	250M-MM					48	-	-	25.9	9.5	25	8.6	-	
ZPET-MM  External	**080S-MM**					15	-	-	6.6	3.1	8	2.9	-	
	090S-MM					15.5	-	-	7.4	3.7	9	3.4	-	
	100S-MM		●		●	15.5	-	-	8.4	3.8	10	3.4	-	
	110S-MM					18.1	-	-	9	4.4	11	4.5	-	
	125S-MM		●		●	20.5	-	-	10.7	4.5	12.5	4.5	-	
	130S-MM					22.2	-	-	11	4.4	13	4.5	-	
	140S-MM					24.1	-	-	11.2	5.7	14	5.6	-	
	150S-MM		●		●	25	-	-	12.4	6.5	15	5.6	-	
	160S-MM		●		●	26	-	-	13.4	6.5	16	5.6	-	
	200S-MM		●			32	-	-	16.7	7	20	6.6	-	
	250S-MM					40	-	-	20.7	8.5	25	8.6	-	

Inserts	Designation	Coated				Dimensions (mm)							Configuration
		P		P M S									
		NCM325	PC3500	PC3545	PC5300	l	d	t	r	d_1	a	b	
SPMT 	**060304**	●				-	6.35	3.18	0.4	2.8	-	-	
SPMT-MM 	**120408-MM**		●	●	●	-	12.7	4.76	0.8	5.6	-	-	
SDMT-MM 	**090308-MM**	●			●	-	9.525	3.18	0.8	4.4	-	-	

GBE Holder

Shank





Modular



GBE (Single Edge)

GBE	160-S20
	160-L20
	180-S20
	180-L20
	200-S25
	200-L25
	220-S25
	220-L25
	250-S32
	250-L32
	260-S32
	260-L32
	280-S32
	280-L32
	300-S32
	300-L32
	320-S32
	320-L32
	400-S42
	400-L42
	500-S42
	500-L42

GBE (Multi Edge)

GBE	200M-S25
	200M-L25
	220M-S25
	220M-L25
	250M-S32
	250M-L32
	260M-S32
	260M-L32
	280M-S32
	280M-L32
	300M-S32
	300M-L32
	320M-S32
	320M-L32
	400M-S42
	400M-L42
	500M-S42
	500M-L42

GBEM

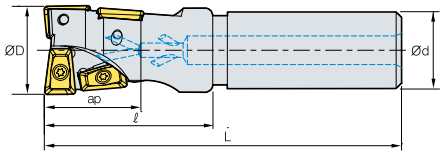
GBEM	160-M08
	200-M10
	250-M12
	300-M16
	320-M16

HAVE

Shank type Code system

HAVE 08 16 H R - S 16 M

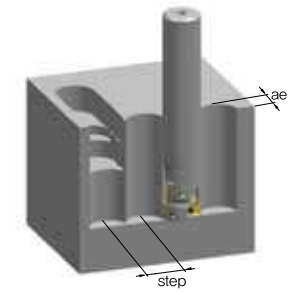
- **Product Name**: Horizontal & Vertical Endmill
- **Inscribed circle of insert**: 8: 08type insert; 10: 10type insert; 13: 13type insert; 16: 16type insert; 18: 18type insert; 20: 20type insert; 25: 25type insert
- **Tool Dia.(ØD)**: 16: Ø16
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **Tool length(L)**: S = Standard type; M = Middle type; L = Long type
- **Tool Dia.(ØD)**: 16: Ø16
- **Shank type**: S: Single; M: Multi



Features

- Tools for Z axis feed plunge machining to cut faster and more effectively in vertical machining
- Machining with whole diameter

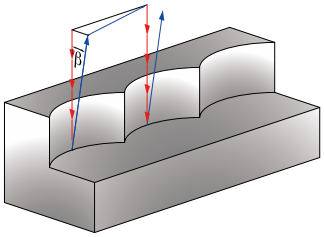
Maximum step in vertical machining



ae	Diameter										
	16	17	20	21	25	26	32	33	35	40	50
	max step (mm)										
1	7.7	8	8.7	8.9	9.7	10	11.1	11.3	11.6	12.4	14
2	10.5	10.9	12	12.3	13.5	13.8	15.4	15.7	16.2	17.4	19.5
3	12.4	12.9	14.2	14.6	16.2	16.6	18.6	18.9	19.5	21	23.7
4	13.8	14.4	16	16.4	18.3	18.7	21.1	21.5	22.2	24	27.1
5	14.8	15.4	17.3	17.8	20	20.4	23.2	23.6	24.4	26.4	30
6	15.4	16.2	18.3	18.9	21.3	21.9	24.9	25.4	26.3	28.5	32.4
7	15.8	16.7	19	19.7	22.4	23	26.4	26.9	28	30.3	34.6
8	16	16.9	19.5	20.3	23.3	24	27.7	28.2	29.3	32	36.6
9	15.8	16.9	19.9	20.7	24	24.7	28.7	29.3	30.5	33.4	38.4
10	15.4	16.7	20	20.9	24.4	25.2	29.6	30.3	31.6	34.6	40
11	14.8	16.2	19.9	20.9	24.8	25.6	30.3	31.1	32.4	35.7	41.4
12	13.8	15.4	19.5	20.7	24.9	25.9	30.9	31.7	33.2	36.6	42.7
13	12.4	14.4	19	20.3	24.9	26	31.4	32.2	33.8	37.4	43.8
14	10.5	12.9	18.3	19.7	24.8	25.9	31.7	32.6	34.2	38.1	44.9
15	7.7	10.9	17.3	18.9	24.4	25.6	31.9	32.8	34.6	38.7	45.8
16	-	8	16	17.8	24	25.2	32	32.9	34.8	39.1	46.6
17	-	-	14.2	16.4	23.3	24.7	31.9	32.9	34.9	39.5	47.3
18	-	-	12	14.6	22.4	24	31.7	32.8	34.9	39.7	48
19	-	-	8.7	12.3	21.3	23	31.4	32.6	34.8	39.9	48.5
20	-	-	-	8.9	20	21.9	30.9	32.2	34.6	40	48.9
21	-	-	-	-	18.3	20.4	30.3	31.7	34.2	39.9	49.3
22	-	-	-	-	16.2	18.7	29.6	31.1	33.8	39.7	49.6
23	-	-	-	-	13.5	16.6	28.7	30.3	33.2	39.5	49.8
24	-	-	-	-	9.7	13.8	27.7	29.3	32.4	39.1	49.9
25	-	-	-	-	-	10	26.4	28.2	31.6	38.7	50

HAVE

Programming in vertical cutting

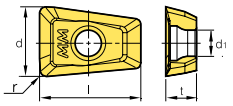


Vertical machining route
Rapid feed
β Angle between tool and Workpiece
(β ≥ 1°)

- Reduce 30% of feed till 3mm machining
- Have the tool be away from the workpiece more than 1°(b) after finishing the machining or when moving the tool to the next step.

HAVE Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting ⇕ General cutting ✱ Interrupted cutting
	Stainless steel	M	✱ ✱
	Heat resistant alloy, Titanium alloy	S	✱ ✱

Inserts	Designation	Coated			Uncoated			Dimensions (mm)								Configuration
		P	P M S		N											
		PC3500	PC5300	PC5400	A30	G10E	H01	l	l_2	l_1	d	t	r	d_1	a	
XPMT-MM	0802ER-MM	●	●					8.5	-	-	5.9	2.38	0.8	-	-	
	1003ER-MM	●	●					10.5	-	-	7.25	3.18	0.8	-	-	
	13T3ER-MM	●	●					13.1	-	-	9	3.97	0.8	-	-	
	1604ER-MM	●	●					16.5	-	-	11.5	4.76	0.8	-	-	
	1805ER-MM	●	●					18	-	-	12.4	5.56	0.8	-	-	
	2006ER-MM	●	●					20.5	-	-	14.1	6.35	0.8	-	-	
	2507ER-MM	●	●					25.5	-	-	17.6	7.94	0.8	-	-	



HAVE Holder

Shank





HAVE (Multi Edge)

HAVE	0816HR-S16M	1632HR-S32M
	0816HR-L16M	1632HR-L32M
	0817HR-S16M	1633HR-S32M
	0817HR-L16M	1633HR-L32M
		1835HR-S32M
	1020HR-S20M	1835HR-L32M
	1020HR-L20M	
	1021HR-S20M	2040HR-S32M
	1021HR-L20M	2040HR-L32M
	1325HR-S25M	2550HR-S42M
	1325HR-L25M	2550HR-L42M
	1326HR-S25M	
	1326HR-L25M	

HAVE (Single Edge)

HAVE	0816HR-S16	1632HR-S32
	0816HR-L16	1632HR-L32
	0817HR-S16	1633HR-S32
	0817HR-L16	1633HR-L32
		1835HR-S32
	1020HR-S20	1835HR-L32
	1020HR-L20	
	1021HR-S20	2040HR-S32
	1021HR-L20	2040HR-L32
	1325HR-S25	2550HR-S42
	1325HR-L25	2550HR-L42
	1326HR-S25	
	1326HR-L25	

Wind Mill

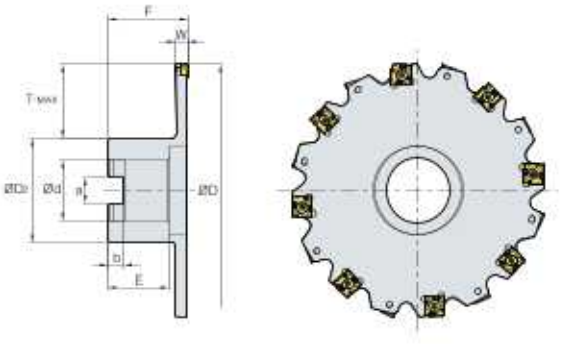
Cutter type Code system

W	FS	P(B)	100	-	T04
Product Name	Insert arrangement	Cutter type	ØD		W
Wind Mill	FS: Full Side HS: Half Side	P: Plane Type B: Boss Type			

Insert Code system

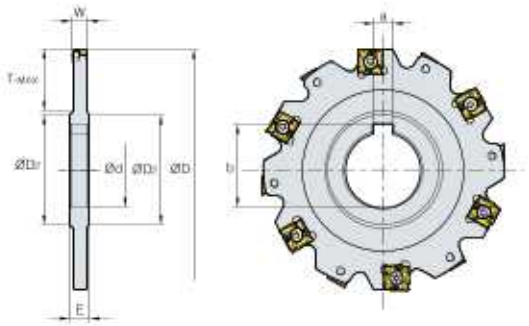
S	N	H	T	12	045	08	R/L	-	WX
Insert shape	Relief angle of major cutting edge	tolerance	Shape of cross section	Ød	Height of cutting edge	Nose R	R/L		Chip breaker

Boss Type



WFSP (B)100 - T04

Plane Type



SNHT1204508R/L - WX

Wind Mill

Features

- Optimal machining for slotting applications
- A unique recess design on the minor cutting edge reduces cutting load and improves tool life
- Special clamping system prevents incorrect clamping and fracture



Item description

Insert



Cutter



WFSP(M) - Plane type



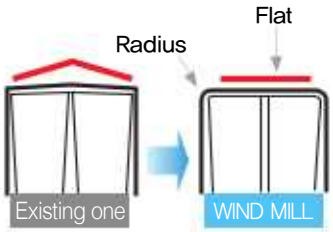
WFSB(M) - Boss type

Features

Ideal geometry for superior surface roughness and extended tool life



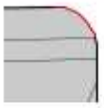
Perpendicular slot



Protruded part on tip seat prevents wrong clamping and fracture



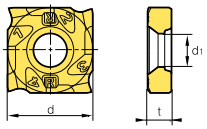
Workpieces with corner radii of varying size and width (R0.2~R2.0)

R0.2	R0.4	R0.6	R0.8	R1.0	R1.2	R1.4	R1.6	R1.8	R2.0
									

Wind Mill Insert

Workpiece			
	Steel	P	✱
	Stainless steel	M	✱
	Heat resistant alloy, Titanium alloy	S	✱

Machining types
● Continuous cutting ◔ General cutting ✱ Interrupted cutting

Inserts	Designation	Coated P M S	Dimensions (mm)							Configuration
		PC5300	l	d	t	r	d_1	a	b	
SNHT-WX 	1102308R/L-WX	●	-	11	2.30	-	4	-	-	
	110308R/L-WX	●	-	11	3.00	-	4	-	-	
	120308R/L-WX		-	12.7	3.25	-	5	-	-	
	1203508R/L-WX	●	-	12.7	3.50	-	5	-	-	
	120408R/L-WX		-	12.7	4.00	-	5	-	-	
	1204508R/L-WX	●	-	12.7	4.54	-	5	-	-	
	120508R/L-WX		-	12.7	5.00	-	5	-	-	
	1205408R/L-WX	●	-	12.7	5.47	-	5	-	-	
	120608R/L-WX		-	12.7	6.00	-	5	-	-	
	1206508R/L-WX		-	12.7	6.50	-	5	-	-	
	120708R/L-WX		-	12.7	7.00	-	5	-	-	
	1207508R/L-WX		-	12.7	7.5	-	5	-	-	

Wind Mill Cutter

Boss type



Plane type



WFSB(M)

WFSBM	080R/L-T04	160R/L-T10
	080R/L-T05	160R/L-T11
	080R/L-T06	160R/L-T12
		160R/L-T13
WFSB (WFSBM)	100R/L-T04	160R/L-T14
	100R/L-T05	
	100R/L-T06	200R/L-T06
	100R/L-T07	200R/L-T07
	100R/L-T08	200R/L-T08
	100R/L-T09	200R/L-T09
	100R/L-T10	200R/L-T10
	125R/L-T04	200R/L-T11
	125R/L-T05	200R/L-T12
	125R/L-T06	200R/L-T13
	125R/L-T07	200R/L-T14
	125R/L-T08	250R/L-T06
	125R/L-T09	250R/L-T07
	125R/L-T10	250R/L-T08
		250R/L-T09
	160R/L-T04	250R/L-T10
	160R/L-T05	250R/L-T11
	160R/L-T06	250R/L-T12
	160R/L-T07	250R/L-T13
	160R/L-T08	250R/L-T14
	160R/L-T09	

WFSP(H)

WFSB (WFSPM)	080-T04	160-T11
	080-T05	160-T12
	080-T06	160-T13
		160-T14
	100-T04	
	100-T05	200-T06
	100-T06	200-T07
	100-T07	200-T08
	100-T08	200-T09
	100-T09	200-T10
	100-T10	200-T11
	125-T04	200-T12
	125-T05	200-T13
	125-T06	200-T14
	125-T07	250-T06
	125-T08	250-T07
	125-T09	250-T08
	125-T10	250-T09
	160-T04	250-T10
	160-T05	250-T11
	160-T06	250-T12
	160-T07	250-T13
	160-T08	250-T14
	160-T09	
	160-T10	

Pro-A Mill

Shank type Code system

PA	S	4	040	H	R	-	S	40

Product Name
Pro-A Mill

Tool type
S: Shank

Inscribed circle of insert
2: 11type insert
4: 22type insert

Tool Dia.(ØD)
040: Ø40

Coolant type
Unmarked: None
H: Thru-hole

Hand
R: Right
L: Left

Tool length(L)
S = Standard type
M = Middle type
L = Long type

Tool Dia.(ØD)
40: Ø40

Cutter type Code system

PA	C	(M)	2	050	H	R

Product Name
Pro-A Mill

Tool type
C: Cutter

Unit
Unmarked: Inch
M: Metric

Inscribed circle of insert
2: 11type insert
4: 22type insert

Tool Dia.(ØD)
050: Ø50

Coolant type
Unmarked: None
H: Thru-hole

Hand
R: Right
L: Left

Modular type Code system

PA	M	2	016	H	R	-	M16

Product Name
Pro-A Mill

Tool type
M: Modular

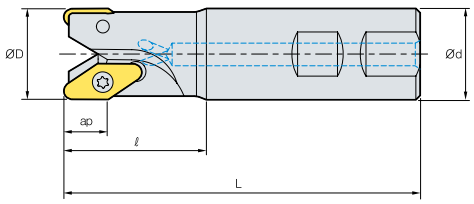
Inscribed circle of insert
2: 11type insert
4: 22type insert

Tool Dia.(ØD)
016: Ø16

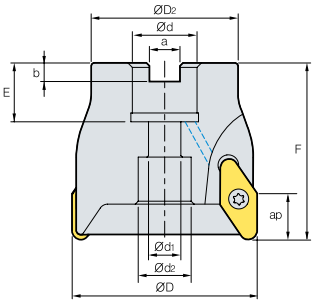
Coolant type
Unmarked: None
H: Thru-hole

Hand
R: Right
L: Left

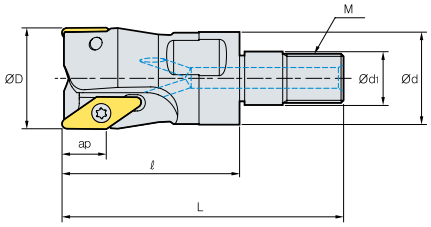
M Dimensions



PAS4040HR - S40



PAC (M)2050HR



PAM2016HR - M08

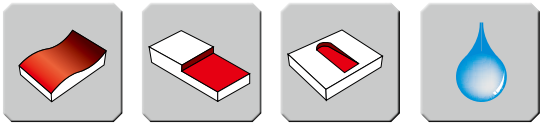
Pro-A Mill

Features

- Buffed top face of insert ensures good chip control and reduces built-up edge
- Small size modular type for aluminum machining
- Various line up of modular system for aluminum machining
- For shouldering, curved surface and ramping
- High rake angle chip breaker ensures excellent surface roughness improved cooling effect, and chip control by through coolant system, even in deep pocket machining



Uses



Copying | Shouldering | Ramping | Through coolant system

Pro-A Mill series

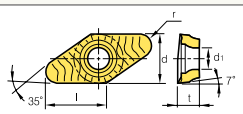
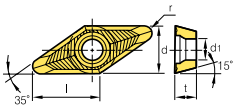
Type	Series	Pro-A Mill	Through coolant system
Application of small-sized Aluminum machining	**Pro-A 2000**	 • Modular: Ø12~Ø42 • Shank : Ø12~Ø42 • Insert : VDKT11T210N-MA VDKT11T220N-MA	O
General application of Aluminum machining	**Pro-A 4000**	 • cutter : Ø40~Ø100 • Shank: Ø32~Ø40 • Insert : VCKT220530N-MA	O

Pro-A Mill Cutter

Workpiece			
	Steel	P	
	Stainless steel	M	
	Cast iron	K	●
	Non-ferrous metal	N	◓
	Heat resistant alloy, Titanium alloy	S	
	Hardened steel	H	

Machining types

● Continuous cutting ◓ General cutting ✱ Interrupted cutting

Inserts	Designation	Uncoated N H01	Dimensions (mm) l	l_2	l_1	d	t	r	d_1	a	f	Configuration
VCKT-MA 	**220530N-MA**		15.6	-	-	12.7	5.56	3.0	5.6	-	-	
VDKT-MA 	**11T210N-MA**	●	8.8	-	-	6.35	2.87	1.0	2.8	-	-	
	11T220N-MA		6.7	-	-	6.35	2.87	2.0	2.8	-	-	

Pro-A Mill Holder

Shank



Cutter



Modular



PAS

2000type

PAS	012HR 2016HR 2016HR-R2.0 2020HR 2020HR-R2.0 2025HR 2032HR 2042HR

4000type

PAS	4032HR 4040HR 4040HR-S40 4040HR-S42

PACM

2000type

PACM	2040HR 2050HR 2063HR
PAC (PACM)	2080HR 2100HR

4000type

PACM	4040HR 4050HR 4063HR
PAC (PACM)	4080HR 4100HR

PAM

2000type

PAM	2012HR-M06 2016HR-M08 2020HR-M10 2025HR-M12 2032HR-M16 2042HR-M16

Pro-X Mill

Shank type Code system

PAX S 5 040 H R - A - S 32

- **Product Name**: Pro-X Mill
- **Tool type**: S: Shank
- **Inscribed circle of insert**: 5: 19type insert; 6: 25type insert
- **Tool Dia.(ØD)**: 040: Ø40
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **I/S Nose-R**: A: under 3.2; B: over 4.0
- **Tool length(L)**: S = Standard type; M = Middle type; L = Long type
- **Tool Dia.(ØD)**: 032: Ø32

Cutter type Code system

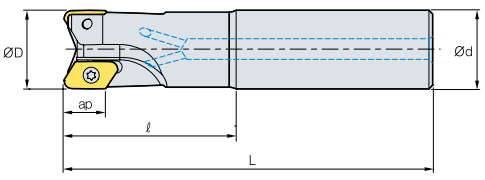
PAX C (M) 5 040 H R - A

- **Product Name**: Pro-X Mill
- **Tool type**: C: Cutter
- **Unit**: Unmarked: Inch; M: Metric
- **Inscribed circle of insert**: 5: 19type insert; 6: 25type insert
- **Tool Dia.(ØD)**: 040: Ø40
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **I/S Nose-R**: A: under 3.2; B: over 4.0

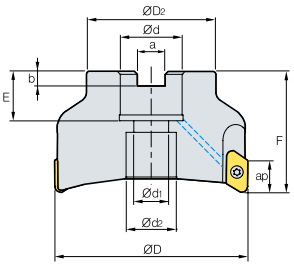
Modular type Code system

PAX M 5 040 H R - A - M16

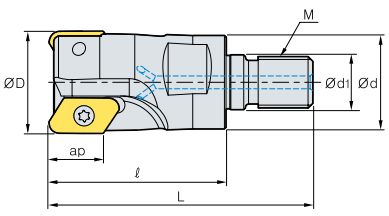
- **Product Name**: Pro-X Mill
- **Tool type**: M: Modular
- **Inscribed circle of insert**: 5: 19type insert; 6: 25type insert
- **Tool Dia.(ØD)**: 040: Ø40
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **I/S Nose-R**: A: under 3.2; B: over 4.0
- **M Dimensions**



PAXS5040HR-A-S32



PAXC(M)5040HR-A



PAXM5040HR-A-M16

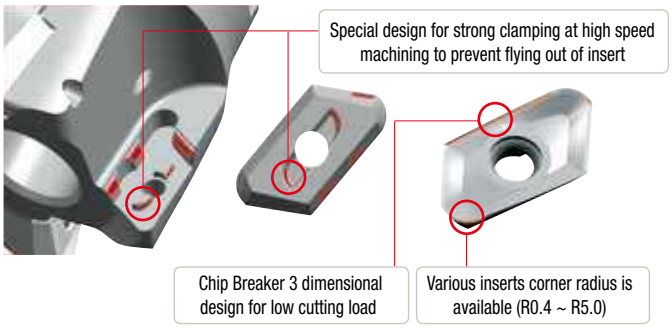
Pro-X Mill

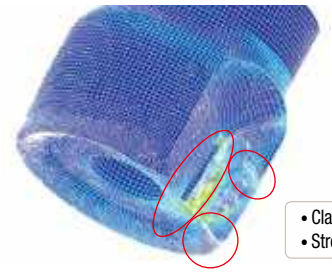
Features

- Strong clamping due to the concave design of insert seat
- Good chip flow and less build up edge achieved with the buffed surface of insert
- High rake angle of insert provides good surface finish and low cutting load
- Specially designed for high speed machining of aluminum
- Suitable for square shouldering and curved surface machining



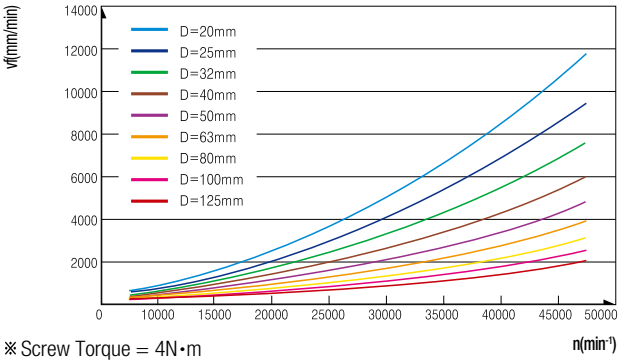
Clamping system for high speed





- Clamping design as per FEM analysis
- Strong clamping of insert

Centrifugal force as per RPM



※ Screw Torque = 4N•m
※ Indexable insert: 6.8g

Marking [• Designation • Max. RPM]



Max. RPM as per cutting diameter

Cutting diameter ØD (mm)	5000type		6000type	
	n (min-1)	vc (m/min)	n (min-1)	vc (m/min)
20	14,000	880	-	-
25	28,000	2,200	10,000	785
32	25,000	2,510	8,900	895
40	22,000	2,760	19,000	2,390
50	20,000	3,140	16,000	2,510
63	18,000	3,560	15,000	2,970
80	16,000	4,020	13,000	3,270
100	14,000	4,400	11,000	3,460
125	13,000	5,100	10,000	3,930

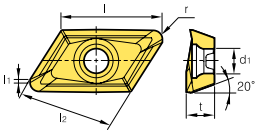
※ In case of actual machining accidental breakage of insert or tool could happen even under the written RPM special cover or door is necessary to prevent damage from broken insert or broken tool

Recommended cutting condition

Workpiece		Cutting Speed vc (m/min)	Feed fz (mm/t)
Aluminum alloy	Rm280 < MPa Rm280 > MPa	1200 1000	0.30 0.25
Copper alloy **Thermo plastic**	Long chipping -	400 350	0.20 0.15
Aluminum alloy	Si <12% Si ≥12%	1000 -	0.25 -
Copper alloy	Short chipping	500	0.20
Magnesium alloy	-	450	0.20
Duroplastics	-	200	0.15

Pro-X Mill Insert

Workpiece			Machining types
	Steel	P	● Continuous cutting
	Stainless steel	M	◓ General cutting
	Non-ferrous metal	N	✱ Interrupted cutting
	Heat resistant alloy, Titanium alloy	S	

Inserts	Designation	Uncoated N HO1	Dimensions (mm) l_1	d	t	r	d_1	a	f	Configuration
XEKT-MA 	19M504FR-MA	●	1.4	-	5	0.4	4.4	-	-	
	19M508FR-MA	●	1.0	-	5	0.8	4.4	-	-	
	19M512FR-MA	●	0.6	-	5	1.2	4.4	-	-	
	19M516FR-MA	●	0.5	-	5	1.6	4.4	-	-	
	19M518FR-MA		0.5	-	5	1.8	4.4	-	-	
	19M520FR-MA	●	0.5	-	5	2.0	4.4	-	-	
	19M530FR-MA	●	0.7	-	5	3.0	4.4	-	-	
	19M532FR-MA	●	0.5	-	5	3.2	4.4	-	-	
	19M540FR-MA	●	0.5	-	5	4.0	4.4	-	-	
	19M550FR-MA	●	0.4	-	5	5.0	4.4	-	-	
	250604FR-MA	●	1.5	-	6.35	0.4	6.0	-	-	
	250608FR-MA	●	1.2	-	6.35	0.8	6.0	-	-	
	250612FR-MA	●	0.8	-	6.35	1.2	6.0	-	-	
	250616FR-MA		0.4	-	6.35	1.6	6.0	-	-	
	250620FR-MA	●	0.5	-	6.35	2.0	6.0	-	-	
	250630FR-MA		0.6	-	6.35	3.0	6.0	-	-	
	250632FR-MA	●	0.4	-	6.35	3.2	6.0	-	-	
	250640FR-MA		1.2	-	6.35	4.0	6.0	-	-	
	250650FR-MA	●	0.4	-	6.35	5.0	6.0	-	-	

Pro-X Mill Holder

Shank 

Cutter 

Modular 

PAXS

5000type

PAXS	5020HR-A,B 5025HR-A,B 5025HR-A,B-L200 5032HR-A,B 5032HR-A,B-L220 5040HR-A,B-S32 5040HR-A,B-L220 5040HR-A,B-S40 5040HR-A,B-S42

6000type

PAXS	6025HR-A,B 6025HR-A,B-L200 6032HR-A,B 6032HR-A,B-L220 6040HR-A,B-S32 6040HR-A,B-L220 6040HR-A,B-S40 6040HR-A,B-S42

PAXC(M)

5000type

PAXCM	5040HR-A,B 5050HR-A,B 5063HR-A,B
PAXC (PAXCM)	5080HR-A,B 5100HR-A,B 5125HR-A,B

6000type

PAXCM	6050HR-A,B 6063HR-A,B
PAXC (PAXCM)	6080HR-A,B 6100HR-A,B 6125HR-A,B

PAXM

5000type

PAXM	5025HR-A,B-M12 5032HR-A,B-M16 5040HR-A,B-M16

※ A type: Insert Nose R 0.4~3.2, B type: Insert Nose R 4.0~5.0

Pro-L Mill

Shank type Code system

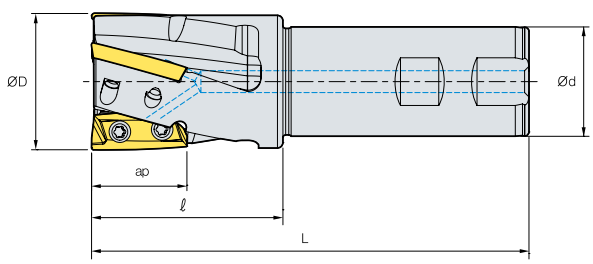
PAL S 050 H R - 3 S 40

- **Product Name**: Pro-L Mill
- **Tool type**: S: Shank
- **Tool Dia.(ØD)**: 050: Ø50
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left
- **No. of tooth**: 3: 3 teeth
- **Tool length(L)**: S = Standard type; M = Middle type; L = Long type
- **Tool Dia.(ØD)**: 040: Ø40

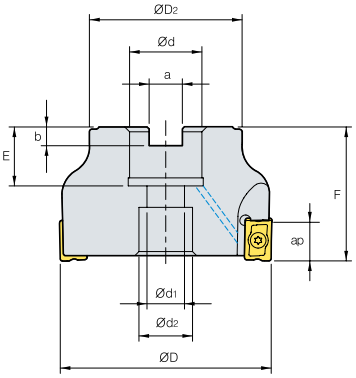
Cutter type Code system

PAL C M 063 H R

- **Product Name**: Pro-L Mill
- **Tool type**: C: Cutter
- **Unit**: Unmarked: Inch; M: Metric
- **Tool Dia.(ØD)**: 063: Ø63
- **Coolant type**: Unmarked: None; H: Thru-hole
- **Hand**: R: Right; L: Left



PALS050HR - 3S40



PALCM063HR

Pro-L mill

Features

- Improved perpendicularity and lower cutting resistance by composition of clearance face and High Helix edge
- Productivity increase due to more than half as much of Depth of Cut comparing to existing product
- Strong clamping design by adaption of double screw on system
- Improved chip flow due to helical type design of chip pocket and application of coolant system



Uses



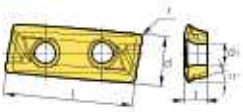
Facing | Shouldering | Slotting | Ramping | Helical cutting

Features

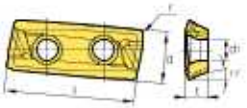
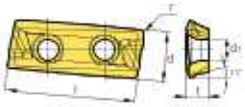


Pro-L Mill Insert

Workpiece			Machining types
Steel	P	● ● ✖ ✖	● Continuous cutting
Stainless steel	M	✖ ✖	● General cutting
Non-ferrous metal	N	●	✖ Interrupted cutting
Heat resistant alloy, Titanium alloy	S	✖ ✖	

Inserts	Designation	Coated P	Coated P	Coated M	Coated S	Un-coated N	Dimensions (mm) l	d	t	r	d_1	Configuration
		PC3500	PC3600	PC5300	PC5400	H01						
LXET-MA 	250404PEFR-32-MA						25	10.775	4.76	0.4	4.5	
	2504PEFR-32-MA						25	10.775	4.76	0.8	4.5	
	250412PEFR-32-MA						25	10.775	4.76	1.2	4.5	
	250416PEFR-32-MA						25	10.775	4.76	1.6	4.5	
	250404PEFR-40-MA						25	10.618	4.76	0.4	4.5	
	2504PEFR-40-MA						25	10.618	4.76	0.8	4.5	
	250412PEFR-40-MA						25	10.618	4.76	1.2	4.5	
	250416PEFR-40-MA						25	10.618	4.76	1.6	4.5	

Pro-L Mill Insert

Inserts	Designation	Coated P		Coated P M S		Un-coated N	Dimensions (mm)					Configuration
		PC3500	PC3600	PC5300	PC5400	H01	l	d	t	r	d_1	
LXET-MA 	**340504PEFR-50-MA**						34	13.765	5.56	0.4	5.56	
	3405PEFR-50-MA						34	13.765	5.56	0.8	5.56	
	340512PEFR-50-MA						34	13.765	5.56	1.2	5.56	
	340516PEFR-50-MA						34	13.765	5.56	1.6	5.56	
	340504PEFR-63-MA						34	13.803	5.56	0.4	5.56	
	3405PEFR-63-MA						34	13.803	5.56	0.8	5.56	
	340512PEFR-63-MA						34	13.803	5.56	1.2	5.56	
	340516PEFR-63-MA						34	13.803	5.56	1.6	5.56	
LXET-ML 	**250404PEER-32-ML**						25	10.775	4.76	0.4	4.5	
	2504PEER-32-ML						25	10.775	4.76	0.8	4.5	
	250412PEER-32-ML						25	10.775	4.76	1.2	4.5	
	250416PEER-32-ML						25	10.775	4.76	1.6	4.5	
	250404PEER-40-ML						25	10.618	4.76	0.4	4.5	
	2504PEER-40-ML						25	10.618	4.76	0.8	4.5	
	250412PEER-40-ML						25	10.618	4.76	1.2	4.5	
	250416PEER-40-ML						25	10.618	4.76	1.6	4.5	
	340504PEER-50-ML						34	13.765	5.56	0.4	5.56	
	3405PEER-50-ML						34	13.765	5.56	0.8	5.56	
	340512PEER-50-ML						34	13.765	5.56	1.2	5.56	
	340516PEER-50-ML						34	13.765	5.56	1.6	5.56	
	340504PEER-63-ML						34	13.803	5.56	0.4	5.56	
	3405PEER-63-ML						34	13.803	5.56	0.8	5.56	
	340512PEER-63-ML						34	13.803	5.56	1.2	5.56	
	340516PEER-63-ML						34	13.803	5.56	1.6	5.56	

Pro-L Mill Holder

Shank





Cutter



PALS (Single Edge)

PALS	032HR-2S20
	032HR-2S25
	032HR-2S32
	040HR-2S32
	040HR-2S40
	040HR-2S42
	040HR-3S32
	040HR-3S40
	040HR-3S42
	050HR-3S32
	050HR-3S40
	050HR-3S42
	063HR-4S32
	063HR-4S40
	063HR-4S42

PALS (Multi Edge)

PALS	063HM-4S32
	063HM-4S40
	063HM-4S42

PALCM

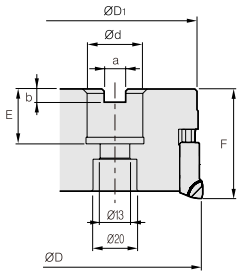
PALCM	063HR

Aero Mill - Plus

Cutter type Code system

A	P	D	(M)	300	R	-	PB	12Z

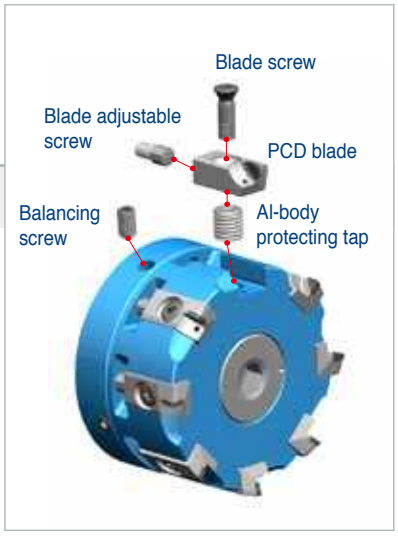
- **A** — Product Name: Aero Mill
- **P** — A.A 90°
- **D** — Relief Angle
- **(M)** — Unit: Unmarked: Inch; **M:** Metric
- **300** — Tool Dia.(ØD): 040: Ø40
- **R** — Hand: **R:** Right; **L:** Left
- **PB** — Aero-Mill Plus blade type
- **12Z** — No. of tooth



APD(M)300R – PB12Z

Features

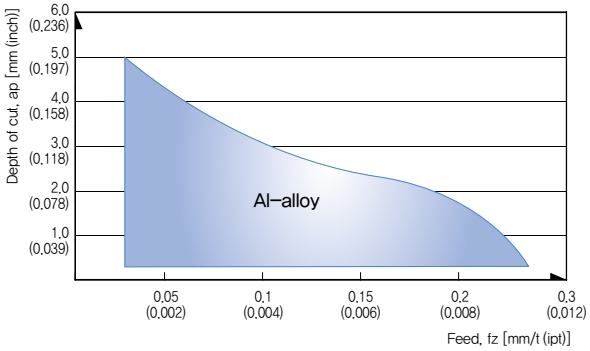
- Improve tool life up to 20% with a coolant system that enables direct spray cooling to cutting blades.
- Enable high feed milling by increasing the number of cutting blades by 20% through a simply structured coupling method for clamps
- Reduce set time up to 40% by applying a spanner adjustment method
- Introduce an aluminum cutter body to provide a superior cutting performance during high speed milling.



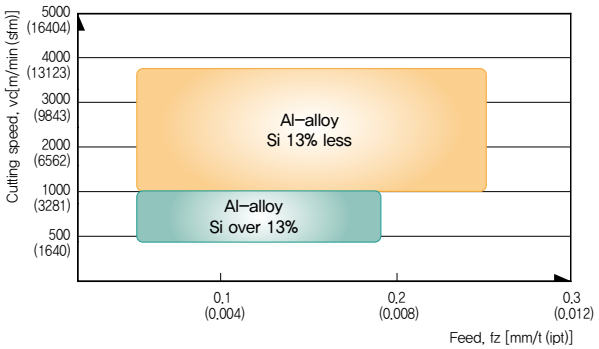
Features of Cutter

- Prevent overload to the spindle bearings through weight reduction of the Aℓ alloy body and enable high-speed processing.
- Provide PCD Blade-dedicated cutter design to offer stable tool life and increase of applied blades.
- Improve the blade life by applying a coolant system that enables direct spray cooling to cutting blades.
- Adopt a clamping method with simple structure without set screw.
- Reduce weight and apply a coolant bolt that is exclusively used for Aero-Mill Plus that applies coolant to remove internal chip.

Application range



Recommended cutting speed



Aero Mill-Plus

Max. RPM

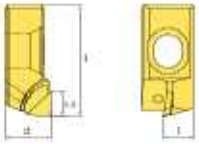
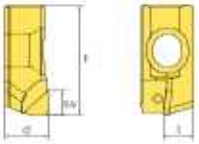
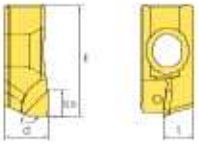
Diameter (mm)	Max. revolution (rpm)
Ø80	20,000
Ø100	18,000
Ø125	16,000
Ø160	13,000
Ø200	10,000
Ø250	8,000
Ø315	7,000

Coolant parts

Diameter (mm)	Type	inch/mm	Designation	Shape	Material	Note
Ø80	Coolant bolt	inch, mm	CB12-AMaP80		Steel	Included
Ø100		inch	CB16-AMP100			
		mm	CB16-AMP100M			
Ø125		inch	CB20-AMP125			
		mm	CB20-AMP125M			
Ø160		inch	CB24-AMP160			
		mm	CB20-AMP125M			
Ø200	Coolant cover	inch, mm	CCV-AMP200		Aluminum	Extra charge
Ø250			CCV-AMP250			
Ø315			CCV-AMP315			

Aero Mill-Plus Insert

Workpiece Non-ferrous metal **N** ● **Machining types** ● Continuous cutting ● General cutting ● Interrupted cutting

Inserts	Designation	Coated P DP150	Dimensions (mm) l	d	t	r	d_1	C	Configuration
BAMPR-XAF 	**BAMPR-XAF**	●	25.5	10.5	7	-	-	-	XAF 
BAMPR-XAW 	**BAMPR-XAW**	●	25.5	10	7	-	-	-	XAW 
BAMPR-XAWR 	**BAMPR-XAWR**		25.5	10	7	-	-	-	XAR 

Aero Mill-Plus Holder

Cutter



APD (M)

APD (APDM)	080R/L-PB6Z 080R/L-PB8Z	**APD (APDM)**	200R/L-PB12Z 250R/L-PB16Z
APD (APDM)	100R/L-PB6Z 100R/L-PB8Z 125R/L-PB8Z 125R/L-PB10Z 160R/L-PB10Z 160R/L-PB12Z	**APD (APDM)**	315R/L-PB18Z

AEROSPACE INDUSTRY

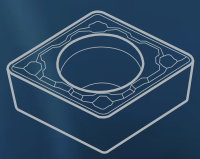
Part 4 - 3

HM

1 King Drill

2 MSD Plus

3 MSD Plus CFRP



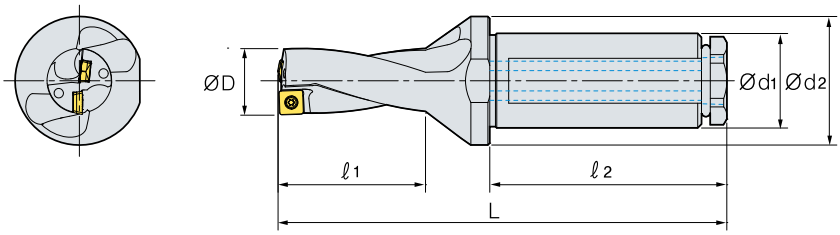


King Drill

King Drill Code system

K **5D** **200** **25** **□** **-** **07**

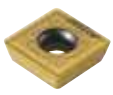
- **K** — KING / KORLOY
- **5D** — Aspect ratio(L/D): 2D, 3D, 4D, 5D
- **200** — Drill Dia.: ØD: 20.0 (One decimal place marked)
- **25** — One decimal place marked: Ø20, Ø25, Ø32, Ø40
- **□** — Shank shape:
  - **No mark**: Flange Shank, Weldone
  - **F1**: Flange Shank, Whistle Notch
  - **F2**: Flange Shank, Without Side Lock
  - **S**: Straight Shank, Weldone
  - **S1**: Straight Shank, Whistle Notch
  - **S2**: Straight Shank, Without Side Lock
  - **M0, M1, M2, M3...:** MT0, MT1, MT2, MT3...
  - **H63, H100**: HSK63, HSK100
  - **B30, B40, B50**: BT30, BT40, BT50
- **07** — Inscribed circle of insert: 04, 05, 06, 07, 09, 11, 13, 15, 18



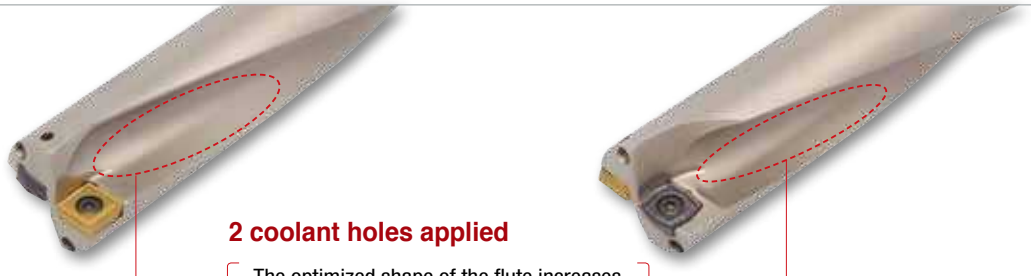
Features

Optimized design of inserts for maximum drilling efficiency

- Excellent cutting performance and chip control due to the optimized geometry and chip breaker of both inserts, central & peripheral.
- Different inserts, optimized for the central and peripheral insert locations in order to maximize cutting tool life.

Chip breaker	PD		LD		ND		RD
Features	- Universal - At medium speed and medium feed		- Superior chip control for machining mild steel and stainless steel - Light cutting(at low ~ medium speed and low feed)		- Sharp cutting edges specialized for aluminum - Excellent chip flow and welding resistance thanks to the buffed surface		- Improved resistance to chipping - Excellent performance in conditions where corner breakages frequently arise
Insert	Peripheral insert	Central insert	Peripheral insert	Central insert	Peripheral insert	Central insert	Central insert
Shape							
Grades for workpiece	NC5330: P, M, K PC3500: P PC5300: P, M, K, S PC6510: K	PC5300: P, M, K, S	PC5335: P, M		H01: N		PC5300: P,M,K,S

King Drill

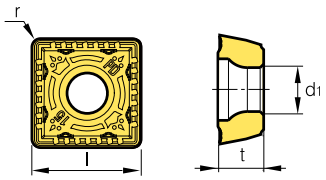
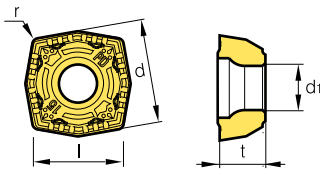


Optimized flute system

2 coolant holes applied

The optimized shape of the flute increases the rigidity of the drill body and improves chip evacuation

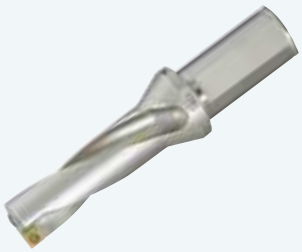
King Drill Insert

Shape		Peripheral insert					Central insert				
											
		Designation	l	t	r	d_1	Designation	l	t	r	d_1
Drill Dia.(Ø)	Ø12.0 ~ Ø13.5	SPM(E)T040204-PD, ND	4.7	2.4	0.4	2.3	XOM(E)T040204-PD, ND	4.9	2.4	0.4	2.3
	Ø14.0 ~ Ø16.0	SPM(E)T050204-PD, ND	5.1	2.4	0.4	2.3	XOM(E)T050204-PD, ND	5.4	2.4	0.4	2.3
	Ø16.5 ~ Ø19.5	SPM(E)T060205-PD, LD, ND	6.2	2.5	0.5	2.5	XOM(E)T060204-PD, LD, ND	6.6	2.5	0.4	2.5
	Ø20.0 ~ Ø23.5	SPM(E)T07T208-PD, LD, ND	7.5	2.8	0.7	2.8	XOM(E)T07T205-PD, LD, ND	7.8	2.8	0.5	2.8
	Ø24.0 ~ Ø29.5	SPM(E)T090308-PD, LD, (ND	9.2	3.3	0.8	3.4	XOM(E)T090305-PD, LD, ND	9.6	3.3	0.5	3.4
	Ø30.0 ~ Ø35.5	SPM(E)T11T308-PD, LD, ND	11	4.0	0.8	4.0	XOM(E)T11T306-PD, LD, ND	11.4	4.0	0.6	4.0
	Ø36.0 ~ Ø42.5	SPM(E)T130410-PD, LD, ND	13	4.5	1.0	4.5	XOM(E)T130406-PD, LD, ND	13.6	4.5	0.6	4.5
	Ø43.0 ~ Ø50.5	SPM(E)T15M510-PD, LD, ND	15.2	5.0	1.0	5.5	XOM(E)T15M508-PD, LD, ND	15.9	5.0	0.8	5.5
	Ø51.0 ~ Ø60.5	SPM(E)T180510-PD, LD, ND	18.2	5.5	1.0	6.0	XOM(E)T180508-PD, LD, ND	18.9	5.5	0.8	0.8

Insert line-up

inscribed circle of insert	LD		PD		ND	
	SPMT	XOMT	SPMT	XOMT	SPET	XOET
	PC5335		PC5300		H01	
	S (Titanium alloy)		S (Inconel)		N (Aluminum alloy)	
04	–	–	●	●	●	●
05	–	–	●	●	●	●
06	●	●	●	●	●	●
07	●	●	●	●	●	●
09	●	●	●	●	●	●
11	●	●	●	●	●	●
13	●	●	●	●	●	●
15	●	●	●	●	●	●
18	●	●	●	●	●	●

King Drill Holder



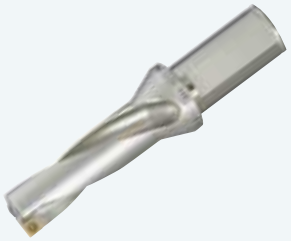
K2D

K2D	12020-04	36040-13
	12520-04	36540-13
	13020-04	37040-13
	13520-04	37540-13
		38040-13
	14020-05	38540-13
	14520-05	39040-13
	15020-05	39540-13
	15520-05	40040-13
	16020-05	40540-13
		41040-13
	16525-06	41540-13
	17025-06	42040-13
	17525-06	42540-13
	18025-06	
	18525-06	43040-15
	19025-06	43540-15
	19525-06	44040-15
		44540-15
	20025-07	45040-15
	20525-07	45540-15
	21025-07	46040-15
	21525-07	46540-15
	22025-07	47040-15
	22525-07	47540-15
	23025-07	48040-15
	23525-07	48540-15
		49040-15
	24032-09	49540-15
	24532-09	50040-15
	25032-09	50540-15
	25532-09	
	26032-09	51040-18
	26532-09	51540-18
	27032-09	52040-18
	27532-09	52540-18
	28032-09	53040-18
	28532-09	53540-18
	29032-09	54040-18
	29532-09	54540-18
		55040-18
	30032-11	55540-18
	30532-11	56040-18
	31032-11	56540-18
	31532-11	57040-18
	32032-11	57540-18
	32532-11	58040-18
	33032-11	58540-18
	33532-11	59040-18
	34032-11	59540-18
	34532-11	60040-18
	35032-11	60540-18
	35532-11	

K3D

K3D	12020-04	36040-13
	12520-04	36540-13
	13020-04	37040-13
	13520-04	37540-13
		38040-13
	14020-05	38540-13
	14520-05	39040-13
	15020-05	39540-13
	15520-05	40040-13
	16020-05	40540-13
		41040-13
	16525-06	41540-13
	17025-06	42040-13
	17525-06	42540-13
	18025-06	
	18525-06	43040-15
	19025-06	43540-15
	19525-06	44040-15
		44540-15
	20025-07	45040-15
	20525-07	45540-15
	21025-07	46040-15
	21525-07	46540-15
	22025-07	47040-15
	22525-07	47540-15
	23025-07	48040-15
	23525-07	48540-15
		49040-15
	24032-09	49540-15
	24532-09	50040-15
	25032-09	50540-15
	25532-09	
	26032-09	51040-18
	26532-09	51540-18
	27032-09	52040-18
	27532-09	52540-18
	28032-09	53040-18
	28532-09	53540-18
	29032-09	54040-18
	29532-09	54540-18
		55040-18
	30032-11	55540-18
	30532-11	56040-18
	31032-11	56540-18
	31532-11	57040-18
	32032-11	57540-18
	32532-11	58040-18
	33032-11	58540-18
	33532-11	59040-18
	34032-11	59540-18
	34532-11	60040-18
	35032-11	60540-18
	35532-11	

King Drill Holder



K4D

K4D	12020-04	36040-13
	12520-04	36540-13
	13020-04	37040-13
	13520-04	37540-13
		38040-13
	14020-05	38540-13
	14520-05	39040-13
	15020-05	39540-13
	15520-05	40040-13
	16020-05	40540-13
		41040-13
	16525-06	41540-13
	17025-06	42040-13
	17525-06	42540-13
	18025-06	
	18525-06	43040-15
	19025-06	43540-15
	19525-06	44040-15
		44540-15
	20025-07	45040-15
	20525-07	45540-15
	21025-07	46040-15
	21525-07	46540-15
	22025-07	47040-15
	22525-07	47540-15
	23025-07	48040-15
	23525-07	48540-15
		49040-15
	24032-09	49540-15
	24532-09	50040-15
	25032-09	50540-15
	25532-09	
	26032-09	51040-18
	26532-09	51540-18
	27032-09	52040-18
	27532-09	52540-18
	28032-09	53040-18
	28532-09	53540-18
	29032-09	54040-18
	29532-09	54540-18
		55040-18
	30032-11	55540-18
	30532-11	56040-18
	31032-11	56540-18
	31532-11	57040-18
	32032-11	57540-18
	32532-11	58040-18
	33032-11	58540-18
	33532-11	59040-18
	34032-11	59540-18
	34532-11	60040-18
	35032-11	60540-18
	35532-11	

K5D

K5D	12020-04	36040-13
	12520-04	36540-13
	13020-04	37040-13
	13520-04	37540-13
		38040-13
	14020-05	38540-13
	14520-05	39040-13
	15020-05	39540-13
	15520-05	40040-13
	16020-05	40540-13
		41040-13
	16525-06	41540-13
	17025-06	42040-13
	17525-06	42540-13
	18025-06	
	18525-06	43040-15
	19025-06	43540-15
	19525-06	44040-15
		44540-15
	20025-07	45040-15
	20525-07	45540-15
	21025-07	46040-15
	21525-07	46540-15
	22025-07	47040-15
	22525-07	47540-15
	23025-07	48040-15
	23525-07	48540-15
		49040-15
	24032-09	49540-15
	24532-09	50040-15
	25032-09	50540-15
	25532-09	
	26032-09	51040-18
	26532-09	51540-18
	27032-09	52040-18
	27532-09	52540-18
	28032-09	53040-18
	28532-09	53540-18
	29032-09	54040-18
	29532-09	54540-18
		55040-18
	30032-11	55540-18
	30532-11	56040-18
	31032-11	56540-18
	31532-11	57040-18
	32032-11	57540-18
	32532-11	58040-18
	33032-11	58540-18
	33532-11	59040-18
	34032-11	59540-18
	34532-11	60040-18
	35032-11	60540-18
	35532-11	

MSD Plus

MSDP Code system

MSDP(H) 040 - 5 N - 100L - 5S

Oil hole
Mach Solid Drill Plus
: MSDP
Mach Solid Drill Plus Oil Hole
: MSDPH

Drill Dia.(ØD)
040 = Ø4.0
(One decimal place marked)

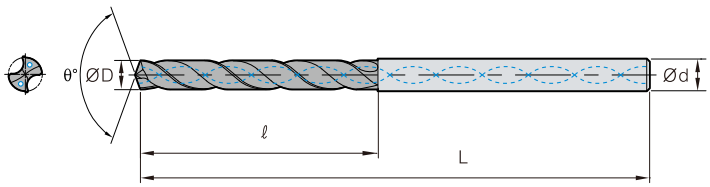
Aspect ratio(L/D)
3, 5, 7

Machining area
N : Aluminum, copper alloy
ND: Aluminum alloys(High speed machining)

Overall length
100L (100mm)

Shank Dia.
5S = Ø5

Special type
FLUTE length 000(000mm)



Central	N	ND
Coated	Uncoated	DLC
Point angle	135˚	140˚
Twist angle	30˚	
Tolerance (Drill dia.)	h7	
Tolerance (Shank dia.)	h6	
Thinning	X type	
Coolant	Through / External	

MSD Plus



MSDP

Designation		D	d	3D		5D		7D	
				ℓ	L	ℓ	L	ℓ	L
MSDP	**010 - ☐ N, ND**	1.0	3.0	6	45	12	66	-	-
	011 - ☐ N, ND	1.1	3.0	7	45	12	66	-	-
	012 - ☐ N, ND	1.2	3.0	8	45	12	66	-	-
	013 - ☐ N, ND	1.3	3.0	8	45	12	66	-	-
	014 - ☐ N, ND	1.4	3.0	9	45	12	66	-	-
	015 - ☐ N, ND	1.5	3.0	9	45	12	66	-	-
	016 - ☐ N, ND	1.6	3.0	10	45	15	66	-	-
	017 - ☐ N, ND	1.7	3.0	10	45	15	66	-	-
	018 - ☐ N, ND	1.8	3.0	11	45	15	66	-	-

MSDP

Designation		D	d	3D		5D		7D	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	019 - ☐ N, ND	1.9	3.0	11	45	15	66	-	-
	020 - ☐ N, ND	2.0	3.0	14	53	20	66	-	-
	021 - ☐ N, ND	2.1	3.0	14	53	20	66	-	-
	022 - ☐ N, ND	2.2	3.0	14	53	20	66	-	-
	023 - ☐ N, ND	2.3	3.0	14	53	20	66	-	-
	024 - ☐ N, ND	2.4	3.0	14	53	20	66	-	-
	025 - ☐ N, ND	2.5	3.0	14	53	20	66	30	70
	026 - ☐ N, ND	2.6	3.0	17	53	20	66	30	70
	027 - ☐ N, ND	2.7	3.0	17	53	20	66	30	70
	028 - ☐ N, ND	2.8	3.0	17	53	20	66	30	70
	029 - ☐ N, ND	2.9	3.0	17	53	20	66	30	70
	030 - ☐ N, ND	3.0	3.0	17	53	20	66	30	70
	031 - ☐ N, ND	3.1	4.0	20	58	28	74	30	70
	032 - ☐ N, ND	3.2	4.0	20	58	28	74	30	70
	033 - ☐ N, ND	3.3	4.0	20	58	28	74	30	70
	034 - ☐ N, ND	3.4	4.0	20	58	28	74	37.5	75
	035 - ☐ N, ND	3.5	4.0	20	58	28	74	37.5	75
	036 - ☐ N, ND	3.6	4.0	22	58	32	74	37.5	75
	037 - ☐ N, ND	3.7	4.0	22	58	32	74	37.5	75
	038 - ☐ N, ND	3.8	4.0	22	58	32	74	37.5	75
	039 - ☐ N, ND	3.9	4.0	22	58	32	74	37.5	75
	040 - ☐ N, ND	4.0	4.0	22	58	32	74	37.5	75
	041 - ☐ N, ND	4.1	5.0	24	62	36	82	37.5	75
	042 - ☐ N, ND	4.2	5.0	24	62	36	82	37.5	75
	043 - ☐ N, ND	4.3	5.0	24	62	36	82	45	85
	044 - ☐ N, ND	4.4	5.0	24	62	36	82	45	85
	045 - ☐ N, ND	4.5	5.0	24	62	36	82	45	85
	046 - ☐ N, ND	4.6	5.0	26	62	38	82	45	85
	047 - ☐ N, ND	4.7	5.0	26	62	38	82	45	85
	048 - ☐ N, ND	4.8	5.0	26	62	38	82	50	90
	049 - ☐ N, ND	4.9	5.0	26	62	38	82	50	90
	050 - ☐ N, ND	5.0	5.0	26	62	38	82	50	90
	051 - ☐ N, ND	5.1	6.0	28	66	44	82	50	90
	052 - ☐ N, ND	5.2	6.0	28	66	44	82	50	90
	053 - ☐ N, ND	5.3	6.0	28	66	44	82	50	90
	054 - ☐ N, ND	5.4	6.0	28	66	44	82	50	90
	055 - ☐ N, ND	5.5	6.0	28	66	44	82	57	97
	056 - ☐ N, ND	5.6	6.0	28	66	44	82	57	97
	057 - ☐ N, ND	5.7	6.0	28	66	44	82	57	97
	058 - ☐ N, ND	5.8	6.0	28	66	44	82	57	97
	059 - ☐ N, ND	5.9	6.0	28	66	44	82	57	97
	060 - ☐ N, ND	6.0	6.0	28	66	44	82	57	97
	061 - ☐ N, ND	6.1	7.0	34	74	50	91	66	106
	062 - ☐ N, ND	6.2	7.0	34	74	50	91	66	106
	063 - ☐ N, ND	6.3	7.0	34	74	50	91	66	106
	064 - ☐ N, ND	6.4	7.0	34	74	50	91	66	106
	065 - ☐ N, ND	6.5	7.0	34	74	50	91	66	106
	066 - ☐ N, ND	6.6	7.0	34	74	50	91	66	106
	067 - ☐ N, ND	6.7	7.0	34	74	50	91	66	106
	068 - ☐ N, ND	6.8	7.0	34	74	50	91	66	106
	069 - ☐ N, ND	6.9	7.0	34	74	50	91	76	116

MSDP

Designation		D	d	3D		5D		7D	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	**070 - ☐ N, ND**	7.0	7.0	34	74	50	91	76	116
	071 - ☐ N, ND	7.1	8.0	41	79	53	91	76	116
	072 - ☐ N, ND	7.2	8.0	41	79	53	91	76	116
	073 - ☐ N, ND	7.3	8.0	41	79	53	91	76	116
	074 - ☐ N, ND	7.4	8.0	41	79	53	91	76	116
	075 - ☐ N, ND	7.5	8.0	41	79	53	91	76	116
	076 - ☐ N, ND	7.6	8.0	41	79	53	91	76	116
	077 - ☐ N, ND	7.7	8.0	41	79	53	91	76	116
	078 - ☐ N, ND	7.8	8.0	41	79	53	91	76	116
	079 - ☐ N, ND	7.9	8.0	41	79	53	91	76	116
	080 - ☐ N, ND	8.0	8.0	43	84	58	98	87	131
	081 - ☐ N, ND	8.1	9.0	43	84	58	98	87	131
	082 - ☐ N, ND	8.2	9.0	43	84	58	98	87	131
	083 - ☐ N, ND	8.3	9.0	43	84	58	98	87	131
	084 - ☐ N, ND	8.4	9.0	43	84	58	98	87	131
	085 - ☐ N, ND	8.5	9.0	43	84	58	98	87	131
	086 - ☐ N, ND	8.6	9.0	43	84	58	98	87	131
	087 - ☐ N, ND	8.7	9.0	43	84	58	98	87	131
	088 - ☐ N, ND	8.8	9.0	43	84	58	98	87	131
	089 - ☐ N, ND	8.9	9.0	43	84	58	98	87	131
	090 - ☐ N, ND	9.0	9.0	43	84	58	98	87	131
	091 - ☐ N, ND	9.1	10.0	47	89	61	105	95	139
	092 - ☐ N, ND	9.2	10.0	47	89	61	105	95	139
	093 - ☐ N, ND	9.3	10.0	47	89	61	105	95	139
	094 - ☐ N, ND	9.4	10.0	47	89	61	105	95	139
	095 - ☐ N, ND	9.5	10.0	47	89	61	105	95	139
	096 - ☐ N, ND	9.6	10.0	47	89	61	105	95	139
	097 - ☐ N, ND	9.7	10.0	47	89	61	105	95	139
	098 - ☐ N, ND	9.8	10.0	47	89	61	105	95	139
	099 - ☐ N, ND	9.9	10.0	47	89	61	105	95	139
	100 - ☐ N, ND	10.0	10.0	47	89	61	105	95	139
	101 - ☐ N, ND	10.1	11.0	55	95	68	114	106	155
	102 - ☐ N, ND	10.2	11.0	55	95	68	114	106	155
	103 - ☐ N, ND	10.3	11.0	55	95	68	114	106	155
	104 - ☐ N, ND	10.4	11.0	55	95	68	114	106	155
	105 - ☐ N, ND	10.5	11.0	55	95	68	114	106	155
	106 - ☐ N, ND	10.6	11.0	55	95	68	114	106	155
	107 - ☐ N, ND	10.7	11.0	55	95	68	114	106	155
	108 - ☐ N, ND	10.8	11.0	55	95	68	114	106	155
	109 - ☐ N, ND	10.9	11.0	55	95	68	114	106	155
	110 - ☐ N, ND	11.0	11.0	55	95	68	114	106	155
	111 - ☐ N, ND	11.1	12.0	55	102	71	120	114	163
	112 - ☐ N, ND	11.2	12.0	55	102	71	120	114	163
	113 - ☐ N, ND	11.3	12.0	55	102	71	120	114	163
	114 - ☐ N, ND	11.4	12.0	55	102	71	120	114	163
	115 - ☐ N, ND	11.5	12.0	55	102	71	120	114	163
	116 - ☐ N, ND	11.6	12.0	55	102	71	120	114	163
	117 - ☐ N, ND	11.7	12.0	55	102	71	120	114	163
	118 - ☐ N, ND	11.8	12.0	55	102	71	120	114	163
	119 - ☐ N, ND	11.9	12.0	55	102	71	120	114	163
	120 - ☐ N, ND	12.0	12.0	55	102	71	120	114	163

MSDP

Designation		D	d	3D		5D		7D	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	121 - ☐ N, ND	12.1	13.0	60	107	77	124	133	182
	122 - ☐ N, ND	12.2	13.0	60	107	77	124	133	182
	123 - ☐ N, ND	12.3	13.0	60	107	77	124	133	182
	124 - ☐ N, ND	12.4	13.0	60	107	77	124	133	182
	125 - ☐ N, ND	12.5	13.0	60	107	77	124	133	182
	126 - ☐ N, ND	12.6	13.0	60	107	77	124	133	182
	127 - ☐ N, ND	12.7	13.0	60	107	77	124	133	182
	128 - ☐ N, ND	12.8	13.0	60	107	77	124	133	182
	129 - ☐ N, ND	12.9	13.0	60	107	77	124	133	182
	130 - ☐ N, ND	13.0	13.0	60	107	77	124	133	182
	131 - ☐ N, ND	13.1	14.0	62	107	80	133	133	182
	132 - ☐ N, ND	13.2	14.0	62	107	80	133	133	182
	133 - ☐ N, ND	13.3	14.0	62	107	80	133	133	182
	134 - ☐ N, ND	13.4	14.0	62	107	80	133	133	182
	135 - ☐ N, ND	13.5	14.0	62	107	80	133	133	182
	136 - ☐ N, ND	13.6	14.0	62	107	80	133	133	182
	137 - ☐ N, ND	13.7	14.0	62	107	80	133	133	182
	138 - ☐ N, ND	13.8	14.0	62	107	80	133	133	182
	139 - ☐ N, ND	13.9	14.0	62	107	80	133	133	182
	140 - ☐ N, ND	14.0	14.0	62	107	80	133	133	182
	141 - ☐ N, ND	14.1	15.0	65	115	85	143	152	204
	142 - ☐ N, ND	14.2	15.0	65	115	85	143	152	204
	143 - ☐ N, ND	14.3	15.0	65	115	85	143	152	204
	144 - ☐ N, ND	14.4	15.0	65	115	85	143	152	204
	145 - ☐ N, ND	14.5	15.0	65	115	85	143	152	204
	146 - ☐ N, ND	14.6	15.0	65	115	85	143	152	204
	147 - ☐ N, ND	14.7	15.0	65	115	85	143	152	204
	148 - ☐ N, ND	14.8	15.0	65	115	85	143	152	204
	149 - ☐ N, ND	14.9	15.0	65	115	85	143	152	204
	150 - ☐ N, ND	15.0	15.0	65	115	85	143	152	204
	151 - ☐ N, ND	15.1	16.0	68	115	88	143	152	204
	152 - ☐ N, ND	15.2	16.0	68	115	88	143	152	204
	153 - ☐ N, ND	15.3	16.0	68	115	88	143	152	204
	154 - ☐ N, ND	15.4	16.0	68	115	88	143	152	204
	155 - ☐ N, ND	15.5	16.0	68	115	88	143	152	204
	156 - ☐ N, ND	15.6	16.0	68	115	88	143	152	204
	157 - ☐ N, ND	15.7	16.0	68	115	88	143	152	204
	158 - ☐ N, ND	15.8	16.0	68	115	88	143	152	204
	159 - ☐ N, ND	15.9	16.0	68	115	88	143	152	204
	160 - ☐ N, ND	16.0	16.0	68	115	88	143	152	204
	161 - ☐ N, ND	16.1	17.0	73	123	93	153	171	223
	162 - ☐ N, ND	16.2	17.0	73	123	93	153	171	223
	163 - ☐ N, ND	16.3	17.0	73	123	93	153	171	223
	164 - ☐ N, ND	16.4	17.0	73	123	93	153	171	223
	165 - ☐ N, ND	16.5	17.0	73	123	93	153	171	223
	166 - ☐ N, ND	16.6	17.0	73	123	93	153	171	223
	167 - ☐ N, ND	16.7	17.0	73	123	93	153	171	223
	168 - ☐ N, ND	16.8	17.0	73	123	93	153	171	223
	169 - ☐ N, ND	16.9	17.0	73	123	93	153	171	223
	170 - ☐ N, ND	17.0	17.0	73	123	93	153	171	223
	171 - ☐ N, ND	17.1	18.0	73	123	98	153	171	223

MSDP

Designation		D	d	3D		5D		7D	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	**172 - ☐ N, ND**	17.2	18.0	73	123	98	153	171	223
	173 - ☐ N, ND	17.3	18.0	73	123	98	153	171	223
	174 - ☐ N, ND	17.4	18.0	73	123	98	153	171	223
	175 - ☐ N, ND	17.5	18.0	73	123	98	153	171	223
	176 - ☐ N, ND	17.6	18.0	73	123	98	153	171	223
	177 - ☐ N, ND	17.7	18.0	73	123	98	153	171	223
	178 - ☐ N, ND	17.8	18.0	73	123	98	153	171	223
	179 - ☐ N, ND	17.9	18.0	73	123	98	153	171	223
	180 - ☐ N, ND	18.0	18.0	73	123	98	153	171	223
	181 - ☐ N, ND	18.1	19.0	79	131	103	153	190	244
	182 - ☐ N, ND	18.2	19.0	79	131	103	153	190	244
	183 - ☐ N, ND	18.3	19.0	79	131	103	153	190	244
	184 - ☐ N, ND	18.4	19.0	79	131	103	153	190	244
	185 - ☐ N, ND	18.5	19.0	79	131	103	153	190	244
	186 - ☐ N, ND	18.6	19.0	79	131	103	153	190	244
	187 - ☐ N, ND	18.7	19.0	79	131	103	153	190	244
	188 - ☐ N, ND	18.8	19.0	79	131	103	153	190	244
	189 - ☐ N, ND	18.9	19.0	79	131	103	153	190	244
	190 - ☐ N, ND	19.0	19.0	79	131	103	153	190	244
	191 - ☐ N, ND	19.1	20.0	79	131	107	153	190	244
	192 - ☐ N, ND	19.2	20.0	79	131	107	153	190	244
	193 - ☐ N, ND	19.3	20.0	79	131	107	153	190	244
	194 - ☐ N, ND	19.4	20.0	79	131	107	153	190	244
	195 - ☐ N, ND	19.5	20.0	79	131	107	153	190	244
	196 - ☐ N, ND	19.6	20.0	79	131	107	153	190	244
	197 - ☐ N, ND	19.7	20.0	79	131	107	153	190	244
	198 - ☐ N, ND	19.8	20.0	79	131	107	153	190	244
	199 - ☐ N, ND	19.9	20.0	79	131	107	153	190	244
	200 - ☐ N, ND	20.0	20.0	79	131	107	153	190	244

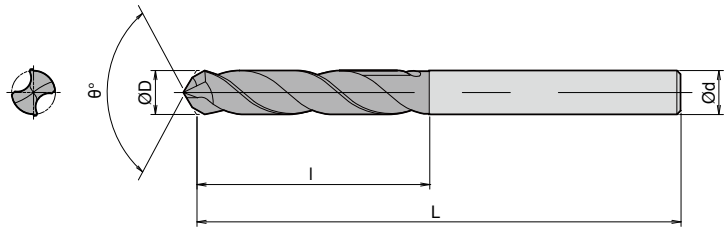
MSD Plus CFRP

MSD Plus CFRP Code system

MSDP 060 - 5 C - 100L - 6S

- **Product Name**: Mach Solid Drill Plus
- **Drill dia.**: 060: Ø6.0 (One decimal place marked)
- **Standard type**: Aspect ratio (L/D)
- **Special type**: FLUTE length 100: 100mm
- **Applications**: C: CFRP
- **Overall length**: 100L: 100mm
- **Shank Dia.(ØD)**: 6S: Ø6

Special type



Specification	C
Grade	ND3000
Tolerance (Drill dia.)	m7
Tolerance (Shank dia.)	h6
Point angle	118°
Twist angle	30°
Thinning	X type
Coolant	External system

CFRP

Features

Improved wear resistance

Excellent wear resistance thanks to the new diamond coated grade ND2110

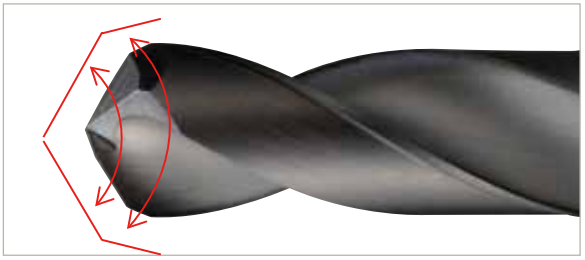
Remarkable quality of holes

Reduced burrs when machining CFRP thanks to high rake cutting edges

Features

- Reduced thrust around corners thanks to the 2-step point angle
- Reduced burrs when drilling CFRP thanks to high rake cutting edges





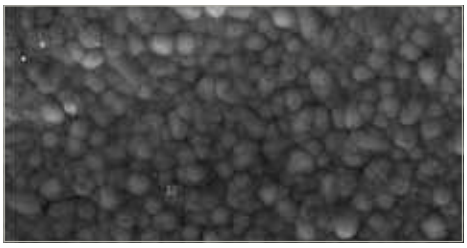
- Fewer burrs
- Longer tool life thanks to improved wear resistance

→ Needs to develop the new grade ND2110

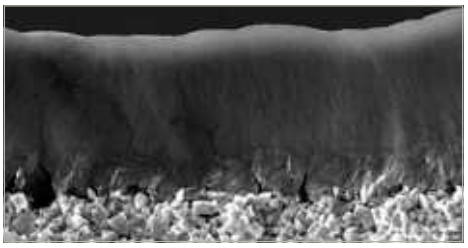
MSD Plus CFRP

Diamond Coating

- Diamond coating specialized in CFRP machining
- Diamond-coated substrate optimized for CFRP cutting



→ High hardness diamond coating maintains well-cut shapes



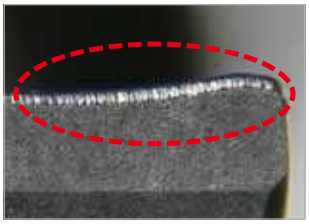
→ Diamond coating's strong grip to the substrate

Improved wear resistance and surface finish by applying high hardness diamond coating of low friction factors

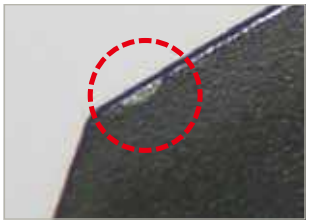
Common Problems

- Wear and flaking on the relief surface due to continuous friction during machining
- Burr creation due to flaking of coated layers and deterioration in surface roughness

1. Wear



2. Flaking



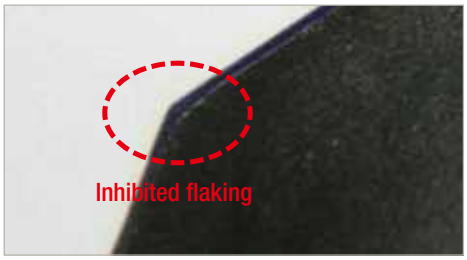
3. Burrs



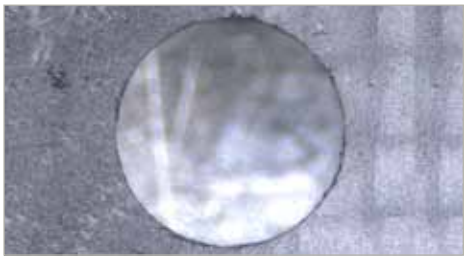
Burrs and deformation of cutting edges caused by wear and flaking

Development Effect

1. Less wear and flaking on the rake surface

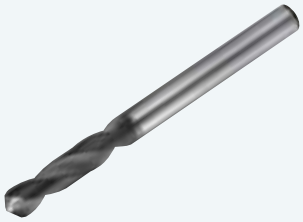


2. Fewer burrs on workpieces



Inhibited burr creation by keeping cutting edges in good shape

MSD Plus CFRP



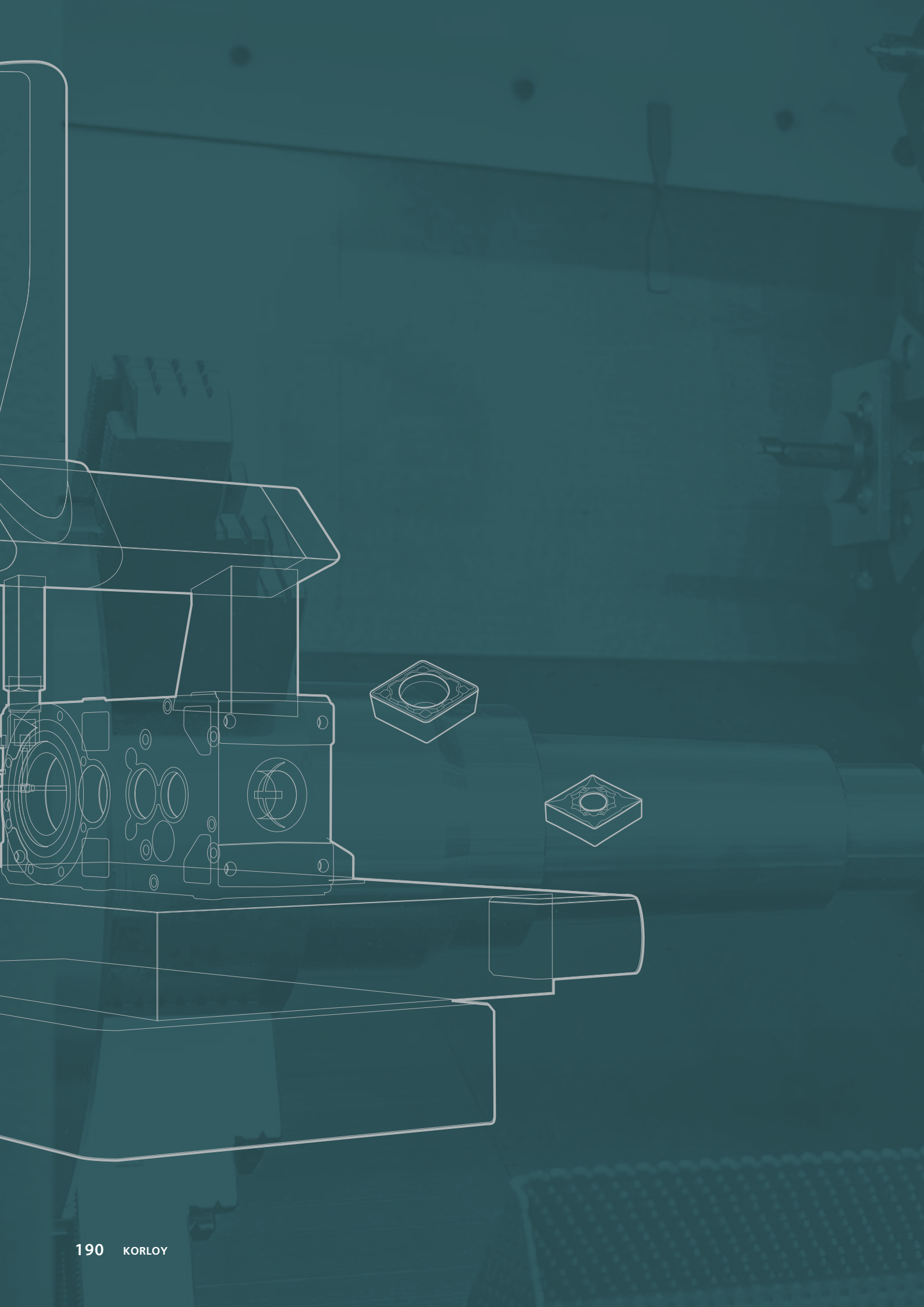
MSDP / MSDPA

(mm)

Designation		D(Metric)	d	5D		
				ℓ	L	
MSDP	030-5C	3	6	28	66	
	040-5C	4	6	36	74	
	050-5C	5	6	44	82	
	060-5C	6	6	44	82	
	070-5C	7	8	53	91	
	080-5C	8	8	53	91	
	090-5C	9	10	61	103	
	100-5C	10	10	61	103	
	110-5C	11	12	71	118	
	120-5C	12	12	71	118	

(inch)

Designation		D		d	5D		
					ℓ	L	
MSDPA	01874-5C	0.187	3/16	0.1874	1.7323	3.2283	
	02500-5C	0.25	1/4	0.2500	2.0866	3.5827	
	03126-5C	0.313	5/16	0.3126	2.0866	3.5827	
	003748-5C	0.375	3/8	0.3748	2.4016	4.0551	
	04374-5C	0.437	7/16	0.4374	2.7953	4.6457	
	05000-5C	0.5	1/2	0.5000	3.0315	4.8819	



AEROSPACE INDUSTRY

Part 4 - 4

EM

1 A+ Endmill

2 V Endmill (for Inconel)

3 Z Endmill (for Titanium)

4 Composite Router Endmill

Endmill Code System

Z	B	E	2	040	-	060	-
①	②	③	④	⑤		⑥	
Series	Type	Endmill	No. of Flutes	Cutting Dia.		Overall Length	

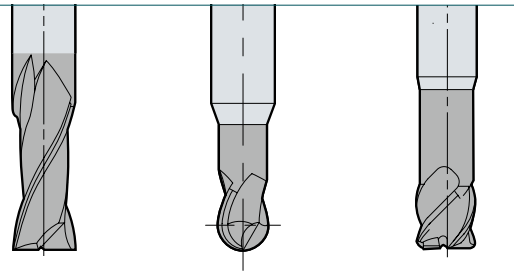
1 Series

Z B E 2 040 - 060 - R T - V N S

Z Endmill (**Z**) A+ Endmill (**AP**) V Endmill (**V**)

2 Type

Z **B** E 2 040 - 060 - R T - V N S



Flat type **F** | Ball type **B** | Radius type **R**

3 Endmill

Z B **E** 2 040 - 060 - R T - V N S

4 No. of Flutes

Z B E **2** 040 - 060 - R T - V N S



2 Flutes — **2**



3 Flutes — **3**



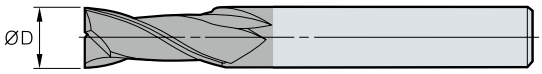
4 Flutes — **4**



6 Flutes — **6**

5 Cutting Dia.

Z B E 2 **040** - 060 - R T - V N S

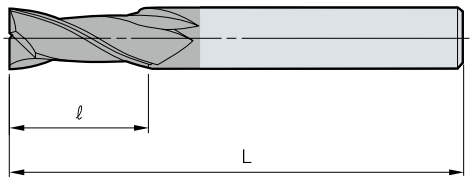


※ ØD: Diameter

Diameter	
ØD	**Notation** (One decimal place marked)
Ø4.0	040
Ø6.0	060
Ø8.0	080
Ø10.0	100

6 Overall Length

Z B E 2 040 - **060** - R T - V N S



※ L(mm): Overall Length

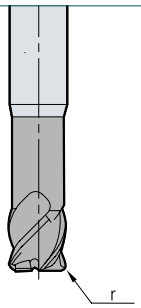
Overall Length	
L (mm)	**Notation**
50	050
80	080
100	100

R02 T00 - V05 N12 S06

7 Corner Radius | 8 Taper Angle | 9 Taper Length | 10 Neck Length | 11 Shank Diameter

7 Corner Radius

Z B E 2 040 - 060 - **R** T - V N S

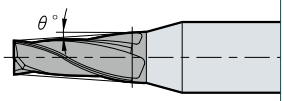


Corner Radius	
R (mm)	Notation (One decimal place marked)
r 0.5	R05
r 1.0	R10
r 1.5	R15
r 2.0	R20

8 Taper Angle

Z B E 2 040 - 060 - R **T** - V N S

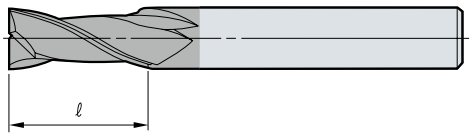
Taper Angle	
T(θ°)	Notation (One decimal place marked)
r1°	T10
1.5°	T15
2°	T20



T(θ°): Taper Angle

9 Taper Length

Z B E 2 040 - 060 - R T - **V** N S

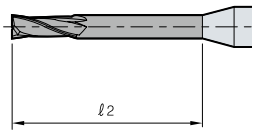


※ ℓ (mm): Neck Length

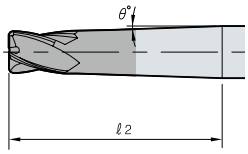
Taper Length	
ℓ (mm)	Notation
4	V40
5	V60
10	V10

10 Neck Length

Z B E 2 040 - 060 - R T - V **N** S



Type 1
Long Neck



Type 2
Taper Long Neck

※ ℓ 2 (mm): Neck Length

Long Neck	
ℓ 2 (mm)	Notation
5	N05
8	N08
10	N10
12	N12

※ T(θ°): Taper Angle

Taper Long Neck	
ℓ 2 + T(θ°)	Notation
5+1°	N0510
8+1.5°	N0815
10+2°	N1020
12+2.5°	N1225

11 Shank Diameter

Z B E 2 040 - 060 - R T - V N **S**

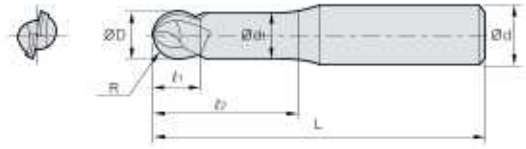


※ Ød: Shank Diameter

Shank Diameter	
Ød	Notation
Ø6	S06
Ø8	S08
Ø10	S10
Ø12	S12
Ø16	S16

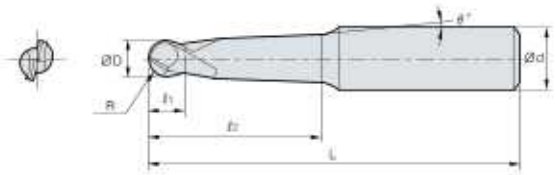
Special Endmill order form





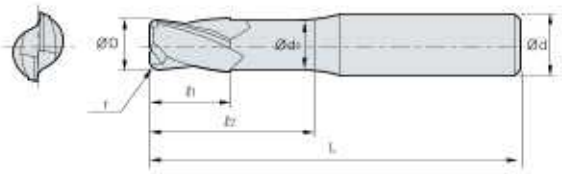
Designation	Flute	R	D	d	d_1	ℓ_1	ℓ_2	L





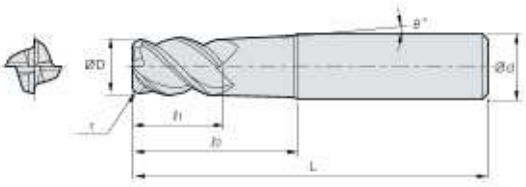
Designation	Flute	R	D	d	ℓ_1	ℓ_2	L	θ°





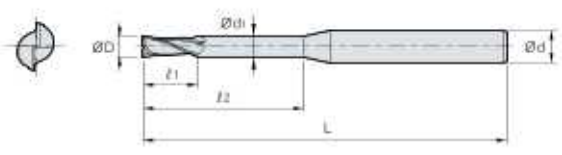
Designation	Flute	D	d	d_1	r	ℓ_1	ℓ_2	L





Designation	Flute	D	r	d	ℓ_1	ℓ_2	L	θ°





Designation	Flute	D	d	d_1	ℓ_1	ℓ_2	L

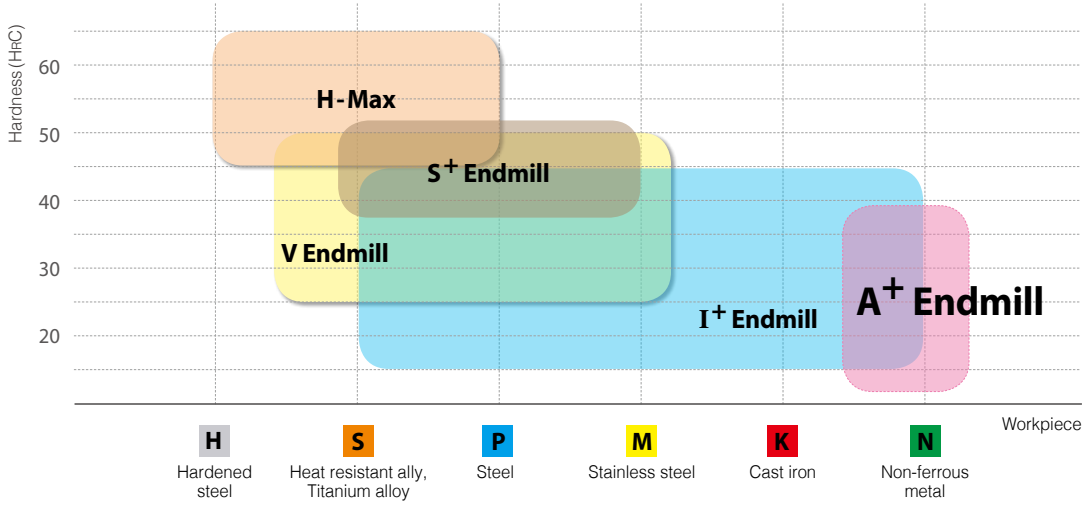
A+ Endmill

Features

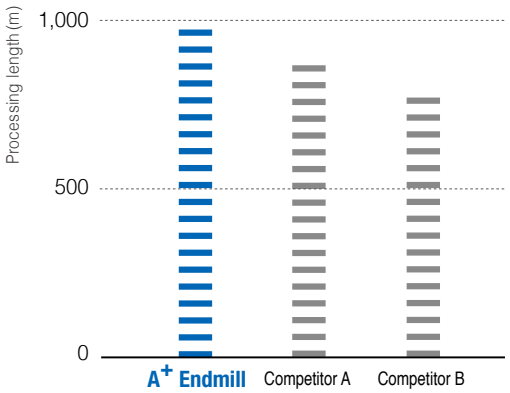
- **Exclusive U-shaped flute**
  - Excellent chip evacuation even in high feed machining
  - U-shaped and buffed flute reduces Built-up edge.
- **Double relief angle**
  - High rigidity cutting edge ensures high productivity.
- **Sharp cutting edge**
  - For both roughing and finishing (Shouldering, slotting and ramping etc.)



Application area



Comparison





A+ Endmill | Competitor A | Competitor B

- **Workpiece** : A7075
- **Cutting condition** : Diameter=Ø8.0, n (min^{-1})=8000, vc (m/min)=200, vf (mm/min)=1200, fz (mm/t)=0.05, ap (mm)=8, ae (mm)=2.0, wet
- **Tool** : APFE3080-060

A+ Endmill



APFE2000 / 3000 (Flat)

APFE	2025-050	**APFE**	3025-050
2	2030-050	3	3030-050
	2040-050		3040-050
	2050-050		3050-050
	2060-050		3060-050
	2080-060		3080-060
	2100-075		3100-075
	2120-075		3120-075
	2160-100		3160-100
	2200-100		3200-100







APLFE2000 / 3000 (Long Flat)

APLFE	2030-060
2	2040-060
	2050-060
	2060-075
	2080-075
	2100-100
	2120-100
	2160-150
	2200-150
APLFE	3030-060
3	3040-060
	3050-060
	3060-075
	3080-075
	3100-100
	3120-100
	3160-150
	3200-150

APBE2000 (Ball)

APBE	2010-050
2	2015-050
	2020-050
	2025-050
	2030-050
	2035-050
	2040-050
	2045-050
	2050-050
	2055-050
	2060-050
	2080-060
	2100-075
	2120-075

APRE3000 (Roughing)

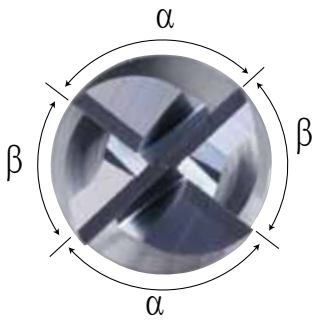
APRE	3040-050
3	3050-050
	3060-050
	3065-060
	3070-060
	3075-060
	3080-060
	3085-075
	3090-075
	3095-075
	3100-075
	3110-075
	3120-075
	3130-075
	3140-075
	3150-075
	3160-100
	3170-100
	3180-100
	3200-100
	3250-105

V Endmill

Features

- Irregular helix angle
- Irregular indexing angle

※ Irregular flute spacing: Decreased vibration

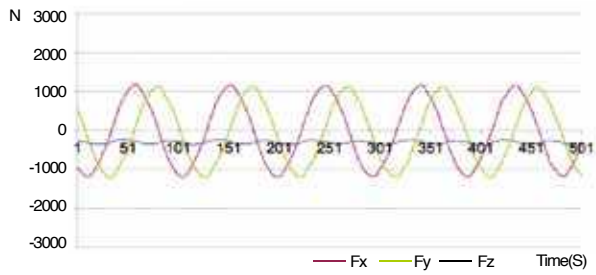




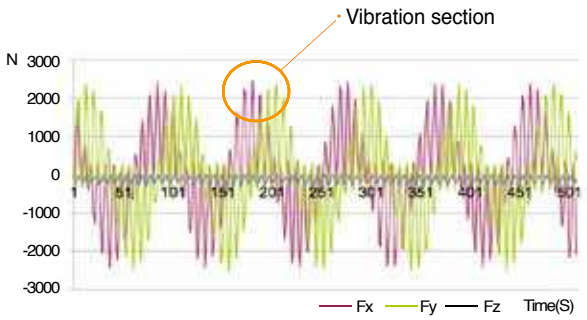
Improved productivity with effective machining due to less vibration

Performance(Vibration test)

V Endmill



Conventional



- **Workpiece** : Alloy steel
- **Cutting condition** : D=Ø8.0, n(min-1)=3183, vc(m/min)=80, vf(mm/min)=713, fz(mm/t)=0.055, ap(mm)=8.0, ae(mm)=8.0, Dry
- **Tool** : V Endmill=VFE4080-060, Conventional Endmill

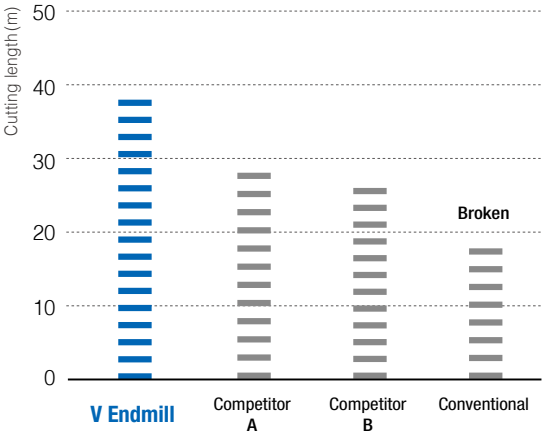
Advantage of V Endmill

Features	Cutting speed(vc)	Feed(vf)	Vibration	Quality
V Endmill	30% up	30% up	Minimize	Excellent

· Higher cutting speed and feed rate increase productivity.
· Less vibration realizes excellent surface finish and higher quality machining.

V Endmill

Performance(Surface finish)



Edge



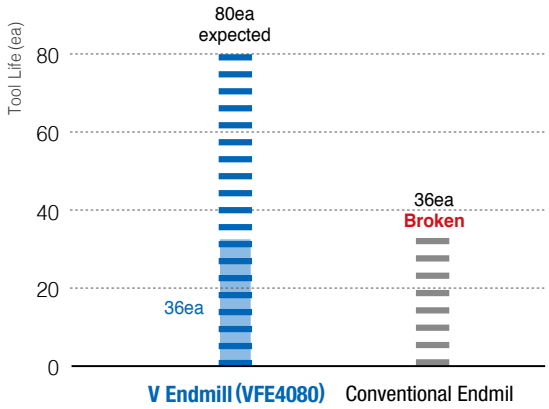
Surface finish



V Endmill	Competitor A Irregular flute spacing Endmill	Competitor B Irregular flute spacing Endmill

- **Workpiece** : Stainless steel
- **Cutting condition** : D=Ø8.0, n(min-1)=3979, vc(m/min)=100, vf(mm/min)=796, fz(mm/t)=0.05, ap(mm)=12, ae(mm)=0.8, Dry
- **Tool** : VFE4080-060

Machining example





V Endmill Conventional

- **Workpiece** : Alloy steel
- **Cutting condition** : D=Ø8.0, n(m/min)=6000, vc(m/min)=150, vf(mm/min)=600, fz(mm/t)=0.025, ap(mm)=7, ae(mm)=0.8, Wet(Water-soluble)
- **Tool** : VFE4080-060

V Endmill

VFE4000(Flat)

VFE 4

4025-045
4030-050
4035-050
4040-050
4050-050
4060-050
4070-060
4080-060
4090-070
4100-075
4120-080
4140-085
4160-090



Z Endmill

Features

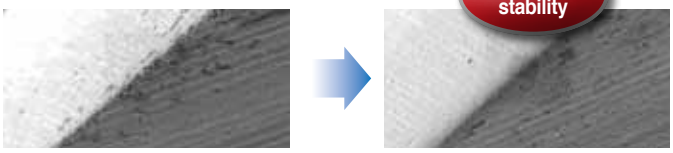
- Endmill for general cutting of various workpieces under H_RC45 (carbon steel, alloy steel, cast iron, pre-hardened steel, etc.)
- New shape and coating improves performance and tool life
- Optimized blade design for less chipping and stable machining

Endmill series for general cutting



Features

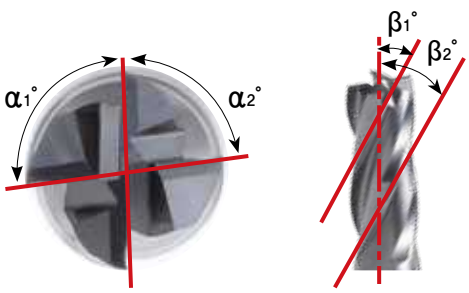
- **New grade(PC315E)**
  Fine substrate and lubricative coating guarantee excellent performance at high speed and high temperature.
- **Special edge treatment**
  Special cutting-edge design was applied for less chipping and longer tool life
- **High accuracy with tolerance-h5**
  High quality production system enables tolerance-h5 throughout the whole series.



before

After special edge treatment

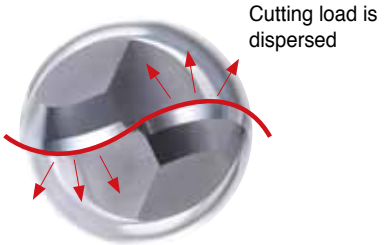
ZFE Series(Flat)



$\alpha_1^\circ \neq \alpha_2^\circ$, $\beta_1^\circ \neq \beta_2^\circ$ Irregular indexing & helix

- Irregular indexing & helix prevent chattering and improve surface

ZFE Series(Ball)



S shape of ball

- The S shape of ball disperses cutting loads
- The tolerance of ball R is under ±0.005mm

Z Endmill



ZFE2000(Flat)

ZFE

2

2010-050-S4	2030-050-S4	2070-060
2010-050-S6	2030-050-S6	2075-060
2012-050-S4	2035-050	2080-070
2012-050-S6	2040-050-S4	2085-070
2015-050-S4	2040-050-S6	2090-070
2015-050-S6	2045-050	2095-070
2020-050-S4	2050-060	2100-075
2020-050-S6	2055-060	2120-080
2025-050-S4	2060-060	2140-100
2025-050-S6	2065-060	2160-100



ZFE4000(Flat)

ZFE

4

4010-050-S4
4010-050-S6
4012-050-S4
4012-050-S6
4015-050-S4
4015-050-S6
4020-050-S4
4020-050-S6
4025-050-S4
4025-050-S6
4030-050-S4
4030-050-S6
4035-050
4040-050-S4
4040-050-S6
4045-050
4050-060
4055-060
4060-060
4065-060
4070-060
4075-060
4080-070
4085-070
4090-070
4095-070
4100-075
4120-080
4140-100
4160-100

ZSFE2000 / 4000(Short Flat)

SFE

2

2010-040-S4
2010-040-S6
2012-040-S4
2012-040-S6
2015-040-S4
2015-040-S6
2020-040-S4
2020-040-S6
2025-040-S4
2025-040-S6
2030-045-S4
2030-045-S6
2040-045-S4
2040-045-S6
2060-050
2080-060
2100-065
2120-070

SFE

4

4010-040-S4
4010-040-S6
4012-040-S4
4012-040-S6
4015-040-S4
4015-040-S6
4020-040-S4
4020-040-S6
4025-040-S4
4025-040-S6
4030-045-S4
4030-045-S6
4040-045-S4
4040-045-S6
4060-050
4080-060
4100-065
4120-070

ZBE2000(Ball)

ZBE

2

2010-050-S4
2010-050-S6
2012-050-S4
2012-050-S6
2015-050-S4
2015-050-S6
2020-050-S4
2020-050-S6
2025-060-S4
2025-060-S6
2030-060-S4
2030-060-S6
2035-070
2040-070-S4
2040-070-S6
2045-080
2050-080
2055-090
2060-090
2065-090
2070-090
2080-100
2085-100
2090-100
2100-100
2120-110

Composite Router Endmill Series

For CFRP / GFRP

Router Endmill Series for Machining Composite Materials(CFRP/GFRP)

Endmills

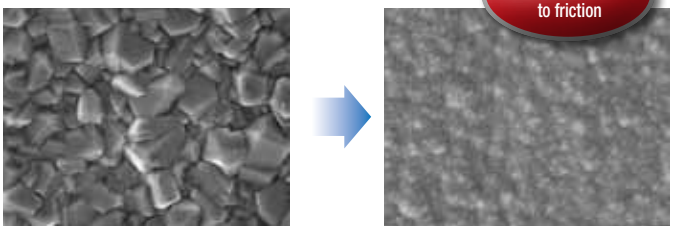
- Router Endmills optimized for Machining Composite Materials(CFRP/GFRP)
- Excellent tool life thanks to nano-crystal diamond coating
- Blade design for reducing flaking and burrs
- Improved productivity through high efficiency machining



Features

Diamond-coated grade ND2110 for machining composite materials

- High hardness diamond coating(over Hv 8,000)
- Nano-diamond coating with excellent resistance to friction and welding
- Improved resistance to flaking thanks by applying the specialized grade for diamond coating



Existing diamond coating

Nano-diamond coating



CCR(Router Endmill)

- Down cut design for low vibrations and cutting force
- Endmill for roughing, profiling, and grooving



CCDR(Dual-Helix Router Endmill)

- Dual helix design to inhibit flaking on upper and lower faces of workpieces
- Endmill for finishing, profiling, and grooving



CCLR(Low-Helix Router Endmill)

- Fewer burrs thanks to the low axial cutting force
- Endmill for finishing, profiling, and blind groove making



CCRR(Reverse-Helix Router Endmill)

- Reverse helix design to inhibit a drift in the workpiece's course
- Endmill for finishing, profiling, and through groove making

Composite Router Endmill Series

For CFRP/GFRP



CCR(Router Endmill)

	Metric		inch
CCR 2	2040-050 2050-050 2060-065 2080-075 2100-085 2120-100	**CCR** 2	202500 202500L 203750 203750L 205000 205000L



CCDR(Dual-Helix Router Endmill)

	Metric		inch
CCDR 4	4060-065 4080-075	**CCDR** 4	402500 402500L
CCDR 6	6100-085 6120-100	**CCDR** 6	603750 603750L 605000 605000L



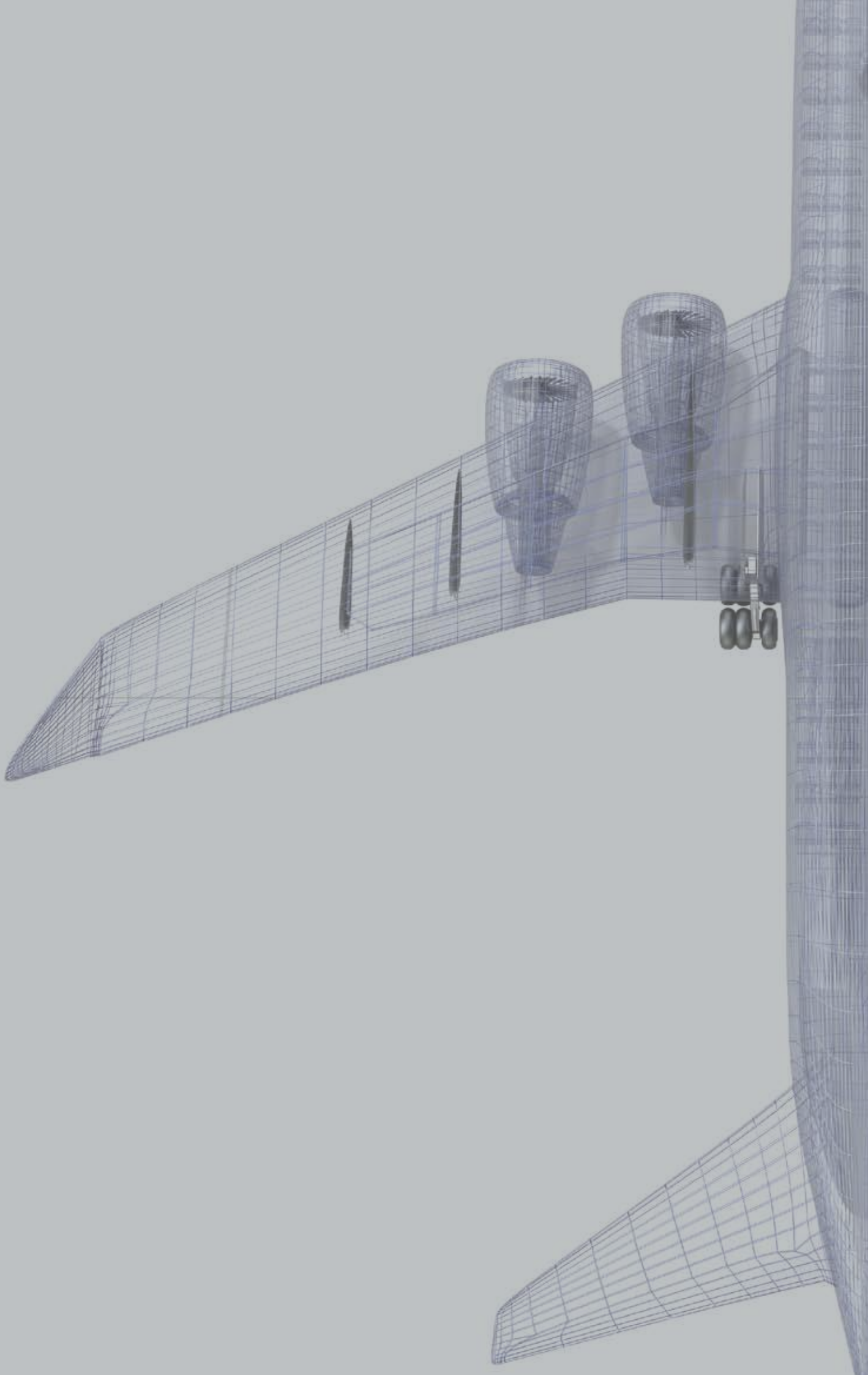
CCLR(Low-Helix Router Endmill)

	Metric		inch
CCLR 4	4040-050 4050-050 4060-065 4080-075 4100-085 4120-100	**CCLR** 4	402500 402500L 403750 403750L 405000 405000L



CCRR(Reverse-Helix Router Endmill)

	Metric		inch
CCRR 6	6060-065 6080-075	**CCRR** 6	602500 602500L
CCRR 8	8100-085 8120-100	**CCRR** 8	803750 803750L 805000 805000L





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