

Tangential 90° End Mill with 4-Edge Inserts

MA90



Reliable, Stable, High Quality Machining with Extended Tool Life

Unique tangential 90° end mill design provides a large variety of machining operations

Newly designed inserts with grade PR18 series coating technology
High quality surface finish and excellent wall accuracy

Supports multi-functional machining
such as 3D milling



M-class insert



MA90

Original tangential 90° end mill with economical 4-edge inserts. New grade PR18 Series and unique insert cutting edge design creates high-quality machining with longer tool life

1

The MA90 tangential end mills provide a large variety of machining operations

Challenges

Conventional end mill

- Sudden fractures can cause damage to the holder
- Insert defects preventing use of all four corners

Tangential end mill

- Premature tool wear can quickly deteriorate the surface finish quality
- Poor wall accuracy

SOLUTION

Kyocera's MA90 tangential end mill solves these problems with a unique insert shape and PR18 Series grade technology.

Large web thickness

High rigidity

Peripheral grinding specifications (G-class insert)

Excellent wall accuracy

Special wiper edge

Large relief angle suppresses wear
High-quality surface finish



Reliable tooling brings peace of mind to machinists.



Multifunctional

Supports three-dimensional machining

Unique cutting edge design

Excellent fracture resistance and low cutting force design

Newly developed insert grade

MEGACOAT NANO EX

PR18 Series delivers longer tool life

2

New insert grade PR18 Series provides a significantly longer tool life

Next-generation insert grade for milling

NEW

PR18 Series

Kyocera's Nano Layer Coating Technology

Longer Tool Life with Next-generation Coating for Milling



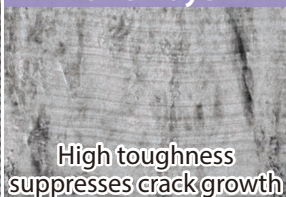
MEGACOAT
NANO EX | Milling |

Double Lamination Technology
Maintains Longer Tool Life

Multi-layer structure with two unique nano layers
Superior abrasion resistance and fracture resistance

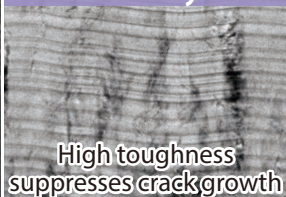
Special Nano Layer x Multilayer Lamination

Nano-Layer



AlCr-based coating
with excellent abrasion resistance

Nano-Layer



AlTi-based coating
with excellent heat resistance

Multi-layering of high-performance nano layers
Increases toughness with suppression of crack growth and optimization of internal stress

CG Image

Extensive lineup of insert grades covers a variety of machining materials and applications

Workpiece material	P Steel					M Stainless steel					K Cast iron				
ISO	01	10	20	30	40	01	10	20	30	40	01	10	20	30	40
Lineup	1st recommendation					1st recommendation					1st recommendation				
	PR1825					PR1835					PR1810				
	Wet					High-speed machining									
	PR1835					CA6535									

H

Hardened material

PR015S (GH)

S

Heat-resistant alloy

CA6535 (PR1835)

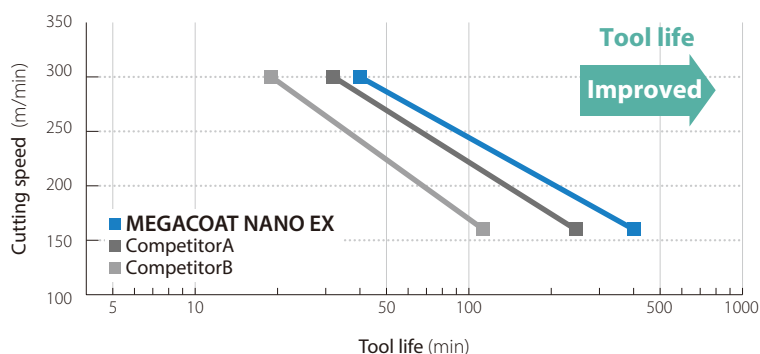
Titanium alloy

PR1835

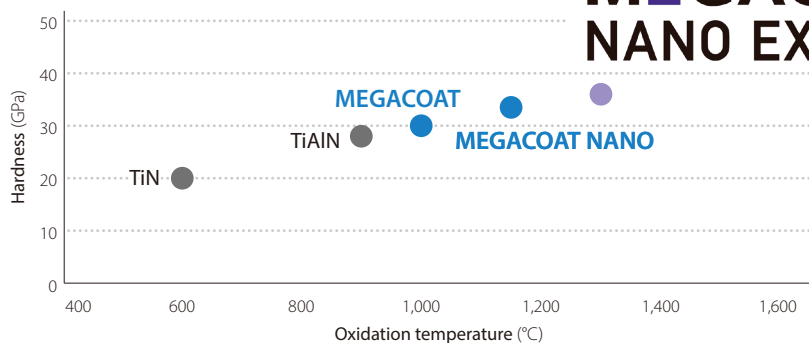
PR1825 Wear resistance comparison (Internal evaluation) V-T graph

Life criteria:
Flank face wear = 0.10 mm

Cutting conditions:
Vc = 160 / 300 m/min
ap × ae = 2.0 × 110 mm, fz = 0.12 mm/t
SCM440 Dry
PNMU1205ANER-GM (MFPN)

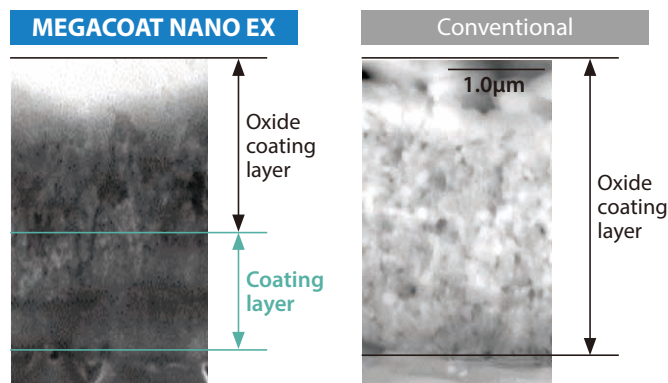


Coating characteristics (Internal evaluation)



Oxidation progression comparison (Internal evaluation)

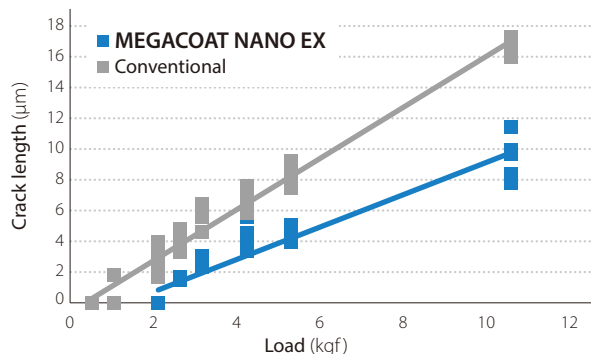
Suppresses oxidation progression with excellent oxidation resistance



*Section after holding at 1,200 degrees for 30 minutes in air

Coating layer toughness evaluation (Internal evaluation)

Excellent coating toughness with small crack length



*Micro-Vickers measurement

3

Achieve reliable results with an insert shape designed for high quality machining and long tool life

Unique cutting edge design delivers high fracture resistance and low cutting forces

Special wiper edge and peripheral grinding specifications provide high quality finish and long tool life

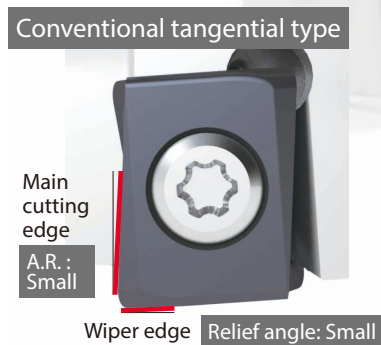
Advantage

Both the A.R. and the relief angle of the wiper edge are large.
Low resistance and excellent surface finish



Unique cutting edge design

Superior fracture resistance and low cutting force



Special wiper edge

Large relief angle: Excellent surface finish and wear suppression
Stepped corners: Designed to prevent seat damage

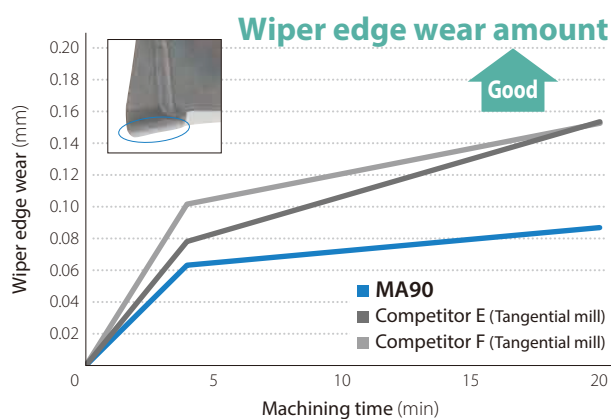
Excellent

Excellent surface finish >>>

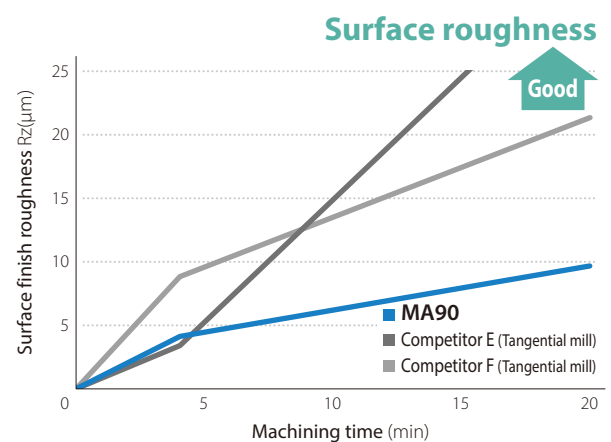
Special wiper edge design suppresses abrasion progress of the edge. Maintains high-quality finished surface

Wear and Surface Finish Comparison (Internal evaluation)

Wiper edge wear



Surface finish roughness (Bottom surface)



Cutting conditions: $V_c = 200$ m/min, $a_p \times a_e = 1 \times 37.5$ mm, $f_z = 0.1/0.12$ mm/t, Dry S50C $\Phi 50$ (6/7 inserts) BT50

Excellent wall accuracy

Excellent

Peripheral grinding specifications(G-class insert)

Unique, sloped, edge shape

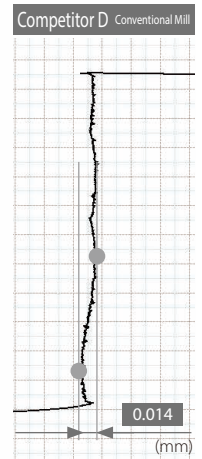
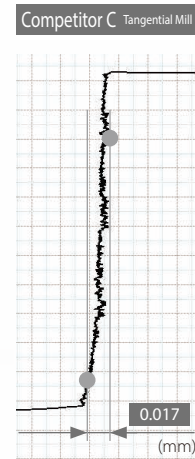
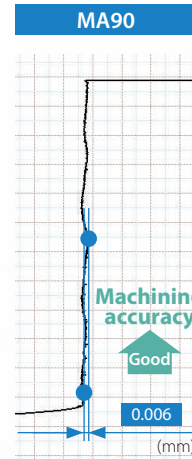
Grounded peripheral provides higher precision



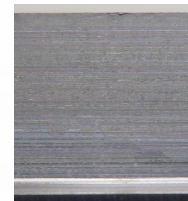
Wall accuracy comparison (Internal evaluation)

Step on the wall

1mm
0.01mm



Wall condition



Cutting conditions: $V_c = 150$ m/min, $a_p \times a_e = 3 \times 5$ mm 4 passes, $f_z = 0.1$ mm/t, Dry S50C Dia.20 (3 inserts) BT50

>>> Long tool life and high-speed machining

Test 1

Even if the main cutting edge is in good condition, the tool reached the end of life due to deterioration of the finished surface.



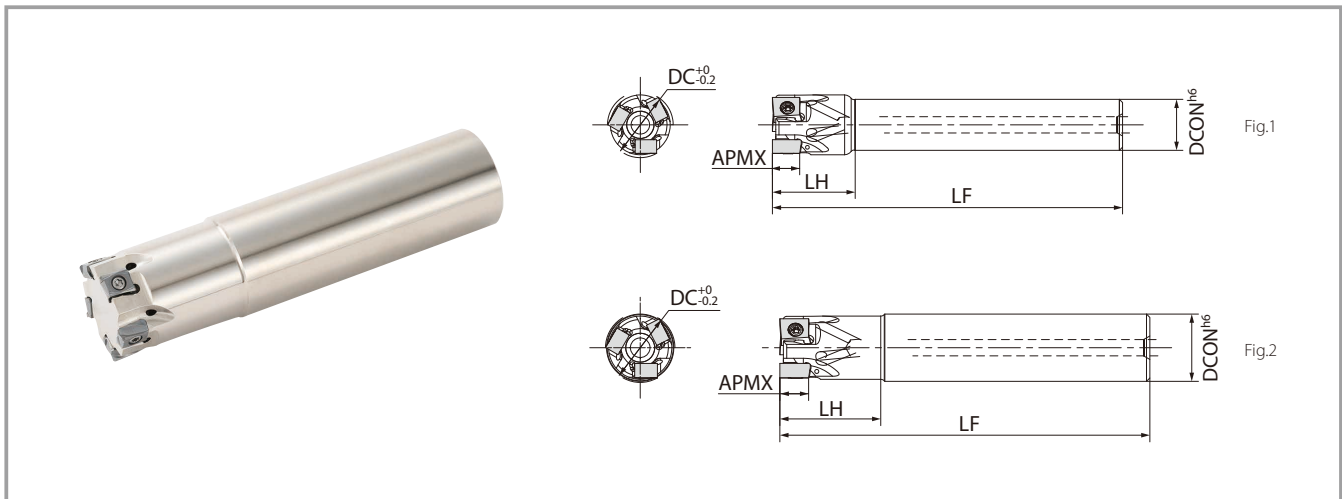
Test 2

Machined with reduced cutting speed because the surface finish deteriorated early.



Edge condition and finished surface

		MA90	Competitor E Tangential	Competitor F Tangential
Wiper edge	After 3.8 min			
	After 6.5 min			
Main cutting edge		Abrasion progress: Small Good	Wear progress: Large Good	Wear progress: Large Good
Finished surface	After 13.1 min	Good 8.0 μ mRz (1.3 μ mRa)	Cloudy finish 20.6 μ mRz (2.2 μ mRa)	Surface finish deteriorating 14.9 μ mRz (3.0 μ mRa)
Results		Main cutting edge: Good Wiper edge wear: Small wear Good finished surface and can continue to use	Main cutting edge: Good Wiper edge wear: Progressive Worse finished surface	Main cutting edge: Good Wiper edge wear: Progressive Worse finished surface


Toolholder Dimensions 09 Size (LO..09 ...)

Description			Stock	Number of Inserts	Dimensions (mm)					Coolant hole	Shape	Weight	Maximum number of revolutions (min ⁻¹)
					DC	DCON	LF	LH	APMX				
Standard shank	MA90 -	16S12-09T2C	●	2	16	12	100	23	8	Yes	Fig.1	0.1	29,500
		18S16-09T2C	●		18	16							110
		20S16-09T2C	●		20		110	26				0.2	
		20S16-09T3C	●	22		120							29
		22S20-09T3C	●		25		130	32				0.9	
		25S20-09T3C	●	28		150							50
		25S20-09T4C	●		30		120	40				0.9	
		28S25-09T3C	●	32		130							40
		30S25-09T4C	●		35		150	50				0.9	
		32S25-09T4C	●	40		120							40
		32S25-09T5C	●		50		120	40				0.9	
		35S32-09T4C	●	5		120							40
		35S32-09T5C	●		5		120	40				0.9	
		40S32-09T4C	●	4		120							40
		40S32-09T6C	●		6		120	40				0.9	
		50S32-09T5C	●	5		120							40
50S32-09T7C	●	7	120		40		0.9	17,000					
Same size shank	MA90 -			16S16-09T2C		●		2	16	16	100	26	8
		20S20-09T2C	●	20	20	110	30		0.2	26,600			
		20S20-09T3C	●	3	25	25	120	32	0.4	23,900			
		25S25-09T3C	●		32	32	130	40		0.7	21,200		
		25S25-09T4C	●	4	32	32	130	40	0.7		21,200		
		32S32-09T4C	●		5	32	32	130		40	0.7	21,200	
		32S32-09T5C	●	32		32	130	40	0.7	21,200			
Long shank	MA90 -	20S18-09T2CL	●	2	20	18	150	30		8	Yes	Fig.1	0.3
		20S20-09T2CL	●			20		40	Fig.2			0.6	
		25S25-09T2CL	●		25	25	170	50					1.1
		32S32-09T2CL	●		32	32	200	65	1.1			21,200	

Maximum number of revolutions

Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on Page 15-16.

Do not use the end mill or cutter at the maximum revolution or higher since the centrifugal force may cause chips and parts to scatter even under no load.

● : Standard Stock

Toolholder Dimensions 12 Size (LO..12 ...)

Description			Stock	Number of Inserts	Dimensions (mm)					Coolant hole	Shape	Weight	Maximum number of revolutions (min ⁻¹)
					DC	DCON	LF	LH	APMX				
Standard shank	MA90 -	25S20-12T2C	●	2	25	20	120	29	12	Yes	Fig.1	0.3	18,300
		28S25-12T2C	●		28	25						130	32
		30S25-12T2C	●	30	0.5		16,800						
		30S25-12T3C	●					3					
		32S25-12T2C	●	2	35		14,600						
		32S25-12T3C	●	3		40		13,100					
		35S32-12T3C	●		4		50					0.8	
		40S32-12T3C	●	6		32		150					50
		40S32-12T4C	●		3		120					40	
		50S32-12T4C	●	4		120		40					
		50S32-12T6C	●		6		32					150	50
Same size shank	MA90 -	25S25-12T2C	●	2	25	25		120	32	12	Yes		
		32S32-12T2C	●		32	32	130	40	0.7			16,300	
		32S32-12T3C	●	3									
Long shank	MA90 -	25S25-12T2CL	●	2	25	25	170	50	12	Yes	Fig.2	0.6	18,300
		32S32-12T2CL	●		32	32	200	65				1.1	16,300

Maximum number of revolutions

Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on Page 15-16.

Do not use the end mill or cutter at the maximum revolution or higher since the centrifugal force may cause chips and parts to scatter even under no load.

● : Standard Stock

Parts / Applicable Inserts

Description			Clamp screw	Wrench	Anti-seizure compound
					
09 Size (LO..09...)	End Mill	MA90-16...-09...	SB-44865UTRP Tightening torque for clamping insert 1.2 N·m	DTPM-8	P-37
		MA90-18...-09...			
		MA90-20~50...-09...	SB-44880UTRP Tightening torque for clamping insert 1.2 N·m	DTPM-8	
12 Size (LO..12...)	End Mill	MA90-...-12...	SB-40104TRP Tightening torque for clamping insert 3.5 N/m	DTPM-15	P-37

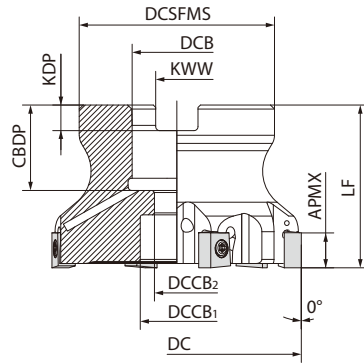


Fig.1

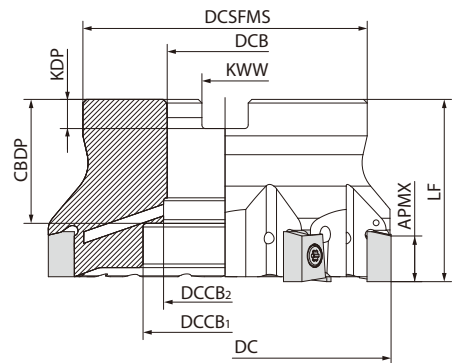


Fig.2

Toolholder dimensions 09 size (LO..09...)

Description		Stock	Number of Inserts	Dimensions (mm)										Coolant hole	Shape	Weight (kg)	Maximum number of revolutions (min ⁻¹)
				DC	DCSFMS	DCB	DCCB ₁	DCCB ₂	LF	CBDP	KDP	KWW	APMX				
Metric Spec	MA90 - 040R-09T4C-M	●	4	40	38	16	15	9	40	19	5.6	8.4	8	Yes	Fig.1	0.2	26,600
	040R-09T6C-M	●	6													0.4	23,900
	050R-09T5C-M	●	5	50	48	22	18	11	40	21	6.3	10.4	8	Yes	Fig.1	0.5	21,200
	050R-09T7C-M	●	7													0.4	
	063R-09T6C-M	●	6	63	48	22	18	11	40	21	6.3	10.4	8	Yes	Fig.1	0.5	21,200
	063R-09T9C-M	●	9													0.4	

Maximum number of revolutions

● : Standard Stock

Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on Page 15-16.

Do not use the end mill or cutter at the maximum revolution or higher since the centrifugal force may cause chips and parts to scatter even under no load.

Toolholder dimensions 12 size (LO..12...)

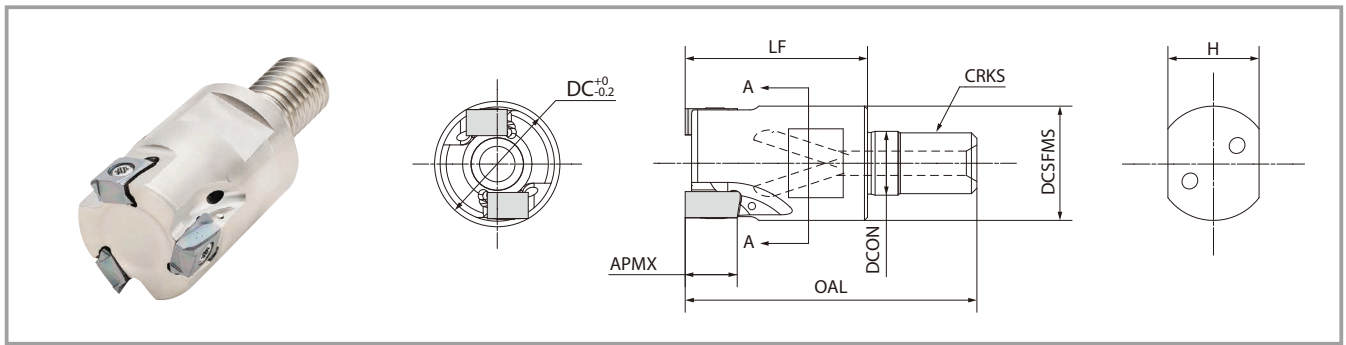
Description		Stock	Number of Inserts	Dimensions (mm)										Coolant hole	Shape	Weight (kg)	Maximum number of revolutions (min ⁻¹)
				DC	DCSFMS	DCB	DCCB ₁	DCCB ₂	LF	CBDP	KDP	KWW	APMX				
Metric Spec	MA90 - 040R-12T3C-M	●	3	40	38	16	14	9	40	19	5.6	8.4	12	Yes	Fig.1	0.2	14,600
	040R-12T4C-M	●	4													0.3	13,100
	050R-12T4C-M	●	5	50	48	22	18	11	40	21	6.3	10.4	12	Yes	Fig.1	0.4	11,700
	050R-12T6C-M	●	6													1.2	10,400
	063R-12T6C-M	●	6	63	48	22	18	11	40	21	6.3	10.4	12	Yes	Fig.1	0.4	11,700
	063R-12T8C-M	●	8													1.2	10,400
	080R-12T7C-M	●	7	80	70	27	20	13	50	24	7	12.4	12	Yes	Fig.1	1.5	9,300
	080R-12T10C-M	●	10													2.5	8,300
	100R-12T9C-M	●	9	100	78	32	45	-	50	30	8	14.4	12	Yes	Fig.2	1.5	9,300
	100R-12T13C-M	●	13													2.5	8,300
	125R-12T12C-M	●	12	125	89	40	55	-	63	33	9	16.4	12	Yes	Fig.2	2.5	8,300
	125R-12T16C-M	●	16													2.6	8,300

Maximum number of revolutions

● : Standard Stock

Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on Page 15-16.

Do not use the end mill or cutter at the maximum revolution or higher since the centrifugal force may cause chips and parts to scatter even under no load.


Toolholder dimensions 09 size (LO..09...)

Description		Stock	Number of Inserts	Dimensions (mm)							Coolant hole	Maximum number of revolutions (min ⁻¹)	
				DC	DCSFMS	DCON	OAL	LF	CRKS	H			APMX
MA90 -	20M10-09T2C	●	2	20	18.8	10.5	48	30	M10×P1.5	15	8	Yes	19,000
	20M10-09T3C	●	3										
	25M12-09T3C	●	25	23	12.5	56	35	M12×P1.75	19	17,000			
	25M12-09T4C	●											4
	32M16-09T4C	●	32	30	17	62	40	M16×P2.0	24	15,100			
	32M16-09T5C	●											5

● : Standard Stock

Toolholder dimensions 12 size (LO..12...)

Description		Stock	Number of Inserts	Dimensions (mm)							Coolant hole	Maximum number of revolutions (min ⁻¹)	
				DC	DCSFMS	DCON	OAL	LF	CRKS	H			APMX
MA90 -	25M12-12T2C	●	2	25	23	12.5	56	35	M12×P1.75	19	12	Yes	18,300
	32M16-12T2C	●	32	30	17	62	40	M16×P2.0	24	16,300			
	32M16-12T3C	●											

Maximum number of revolutions

Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on Page 15-16.

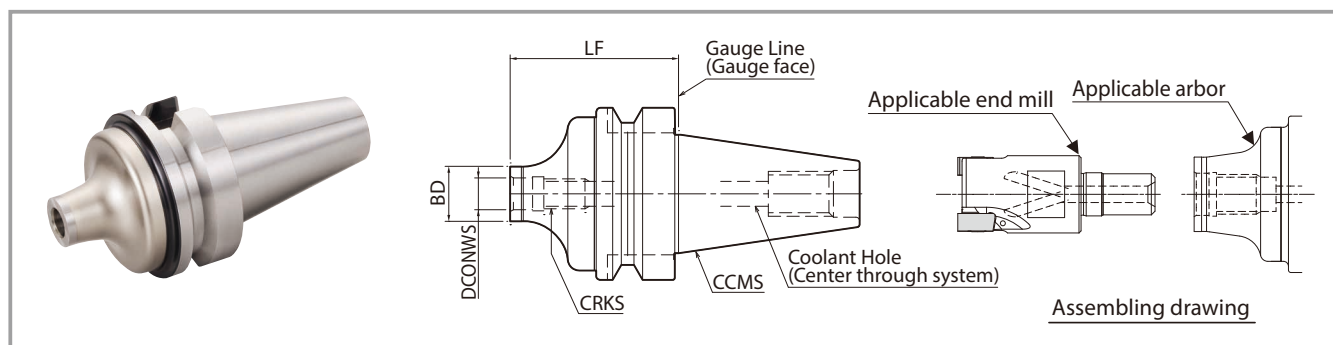
Do not use the end mill or cutter at the maximum revolution or higher since the centrifugal force may cause chips and parts to scatter even under no load.

● : Standard Stock

Parts / Applicable Inserts

Description			Clamp screw	Wrench	Anti-seizure compound	Arbor bolt
						
09 Size (LO..09...)	Modular	MA90-16...-09...	SB-44865UTRP	DTPM-8	P-37	-
		MA90-18...-09...	Tightening torque for clamping insert 1.2 N•m			-
		MA90-20~50...-09...				-
	Face Mill	MA90-040R-09...	SB-44880UTRP	DTPM-8		HH8×25
		MA90-050R-09...	Tightening torque for clamping insert 1.2 N•m			HH10×30
		MA90-063R-09...				
12 Size (LO..12...)	Modular	MA90-...-12...			P-37	-
	Face Mill	MA90-040R-12...-M				HH8×25
		MA90-050R-12...-M				HH10×30
		MA90-063R-12...-M				
		MA90-080R-12...-M				HH12×35
		MA90-100R-12...-M				-
		MA90-125R-12...-M				
		MA90-080R-12...				HH12×35
		MA90-100R-12...				
		MA90-125R-12...				

BT Arbor for Modular (for exchangeable head/two face contact)



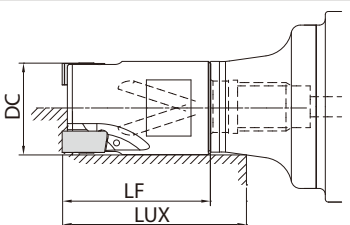
Dimensions

Description		Stock	Dimensions (mm)				Coolant hole	Arbor (Two-face clamping)	Applicable End Mill (Head)
			LF	BD	DCONWS	CRKS		CCMS	
BT30K-	M10-45	●	45	18.7	10.5	M10×P1.5	Yes	BT30	MA90-...M10-..
	M12-45	●	45	23	12.5	M12×P1.75			MA90-...M12-..
BT40K-	M10-60	●	60	18.7	10.5	M10×P1.5	Yes	BT40	MA90-...M10-..
	M12-55	●	55	23	12.5	M12×P1.75			MA90-...M12-..
	M16-65	●	65	30	17	M16×P2.0			MA90-...M16-..

● : Standard Stock

BT Arbor for Modular (for exchangeable head/two face contact)

Actual End Mill Depth



Arbor description	Applicable End Mill (Head)			Actual End Mill Depth(mm)
	Description	Cutting Dia. (mm)	Dimensions (mm)	
		DC	LF	
BT30K- M10-45	MA90-20M10-...	20	30	36.8
	MA90-25M12-...	25	35	42.8
BT40K- M10-60	MA90-20M10-...	20	30	38.7
	MA90-25M12-...	25	35	44.6
	MA90-32M16-...	32	40	51.2



Tangential Cutter

Feel safe! Feel great!

Usage Classification		P	Carbon steel/Alloy steel						★	☆				Applicable toolholder	
			Mold Steel						★	☆					
★ : 1st recommendation ☆ : 2nd recommendation		M Stainless steel	Austenitic							★	☆			★	
			Martensitic							☆					
			Precipitation hardening system							★					
		K	Gray cast iron								★				
			Ductile cast iron								★				
		S	Heat-resistant alloys							☆				★	
			Titanium alloy							★					
				H	Hardened material (50HRC)									★	
Shape		Description	No. of edges	Dimensions (mm)						MEGACOAT (PVD coating)				CVD Coating	
				W1	S	D1	INSL	BS	RE	PR1825	PR1835	PR1810	PR0155	CA6535	
	General Purpose (G-class)	LOGU 090404ER-GM	4	4.3	6.77	3.33	8.89	1.29	0.4	●	●	●	—	●	MA90- ...-09-..
		090408ER-GM								●	●	●	—	●	
		090412ER-GM								●	●	●	—	●	
		090416ER-GM								●	●	●	—	●	
	Low Cutting Force (G-class)	LOGU 090404ER-SM	4	4.3	6.77	3.33	8.89	1.29	0.4	●	●	—	—	●	
		090408ER-SM								●	●	—	—	●	
		090412ER-SM								●	●	—	—	●	
		090416ER-SM								●	●	—	—	●	
	Tough Edge (G-class)	LOGU 090408ER-GH		4.3	6.71	3.33	8.89	0.90	0.8	●	●	●	●	—	

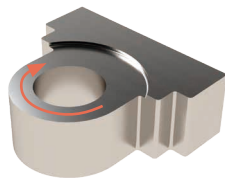
Unmarked : GM
△ : SM
□ : GH

● : Standard Stock

Case Studies

Brake parts FCD500

Vc = 135 m/min
n = 535 min⁻¹
ap x ae = 3.4 x 25 mm
fz = 0.15 mm/t
Vf = 560 mm/min
Wet
MA90-080R-12T7C-M
LOGU120616ER-GM (PR1810)



Number of Workpieces

MA90
(7 inserts)

1,000 pcs

Tool life
x1.6

Competitor G
(7 inserts)

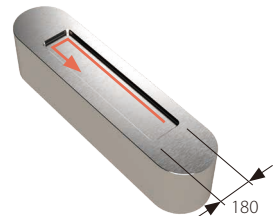
600 pcs

MA90 showed good cutting edge condition and stable machining. Achieved 1.6 times longer tool life.

(User evaluation)

Mold parts Stainless steel

Vc = 125 m/min
n = 1,600 min⁻¹
ap x ae = 1.0 x 25 mm
fz = 0.12 mm/t
Vf = 570 mm/min
Dry
MA90-25S20-09T3C
LOGU090408ER-GM (PR1835)



Machining efficiency

MA90
(3 inserts)

Q = 14.5 cc/min

Machining efficiency
x1.5

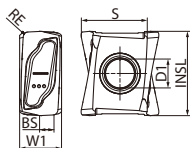
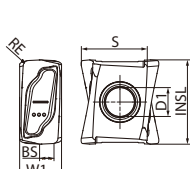
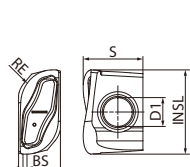
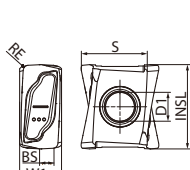
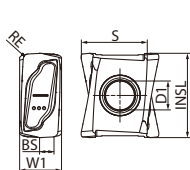
Competitor H
(3 inserts)

Q = 9.5 cc/min

MA90 showed 1.5 times higher machining efficiency than its competitors. Improved tool life (3 to 4 pcs)

(User evaluation)

Applicable Insert 12 Size

Usage Classification		P	Carbon steel/Alloy steel						★	☆				Applicable toolholder
			Mold Steel						★	☆				
★ : 1st recommendation ☆ : 2nd recommendation		M Stainless steel	Austenitic							★	☆			
			Martensitic							☆			★	
			Precipitation hardening system							★				
		K	Gray cast iron								★			
			Ductile cast iron								★			
		S		Heat-resistant alloys							☆			
Titanium alloy							★							
H		Hardened material (50HRC)									★			
Shape		Description	No. of edges	Dimensions (mm)						MEGACOAT (PVD coating)				
				W1	S	D1	INSL	BS	RE	PR1825	PR1835	PR1810	PR015S	CA6535
NEW  General Purpose (M-class)	 Unmarked : GM	LOMU 120604ER-GM	4	6.6	4.55	13.19		2.50	0.4	●	●	●	-	●
		120608ER-GM						2.14	0.8	●	●	●	-	●
		120612ER-GM						1.79	1.2	●	●	●	-	●
		120616ER-GM						1.44	1.6	●	●	●	-	●
		120620ER-GM						1.08	2.0	●	●	●	-	●
		120624ER-GM						0.72	2.4	●	●	●	-	●
		120630ER-GM						0.20	3.0	●	●	●	-	●
		 General Purpose (G-class)					 Unmarked : GM	LOGU 120604ER-GM	4	6.6	4.55	13.28		2.50
120608ER-GM			2.14	0.8	●	●		●					-	●
120612ER-GM			1.79	1.2	●	●		●					-	●
120616ER-GM			1.44	1.6	●	●		●					-	●
120620ER-GM			1.08	2.0	●	●		●					-	●
120624ER-GM			0.72	2.4	●	●		●					-	●
120630ER-GM			0.20	3.0	●	●		●					-	●
 Single-sided General Purpose (G-class)	 Unmarked : GM		LOGT 120640ER-GM	2	6.6	4.55		13.28						1.69
		120650ER-GM					0.63		5.0	●	●	●	-	●
		120660ER-GM					0.37		6.0	●	●	●	-	●
 Low Cutting Force (G-class)	 △ : SM	LOGU 120604ER-SM	4	6.6	4.55	13.28		2.50	0.4	●	●	-	-	●
		120608ER-SM						2.14	0.8	●	●	-	-	●
		120612ER-SM						1.79	1.2	●	●	-	-	●
		120616ER-SM						1.44	1.6	●	●	-	-	●
		120620ER-SM						1.08	2.0	●	●	-	-	●
		120624ER-SM						0.72	2.4	●	●	-	-	●
		120630ER-SM						0.20	3.0	●	●	-	-	●
		 Tough Edge (G-class)					 □ : GH	LOGU 120608ER-GH	4	6.6	10.16	4.55	13.25	2.26

● : Standard Stock

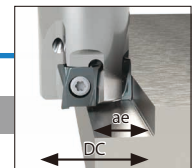
Recommended cutting conditions ★1st recommendation ☆2nd recommendation

() : When using M-class inserts

Insert Shape	Workpiece Material	Toolholder Description and Feed rate (fz: mm/t)				Recommended Insert Grade (Cutting speed Vc: m/min)				
		09 Size (LOGU09...)		12 Size (LOGU12...)		MEGACOAT NANO EX			MEGACOAT HARD	CVD coating
		MA90-16~ MA90-18	MA90-20~MA90-50 MA90-040~MA90-063	MA90-25~ MA90-30	MA90-32~MA90-50 MA90-040~MA90-125	PR1825	PR1835	PR1810	PR015S	CA6535
General GM	Carbon steel (SxxC)	0.05 - 0.1 - 0.14	0.05 - 0.1 - 0.16	0.05 - 0.1 - 0.18 (0.14)	0.06 - 0.15 - 0.23 (0.21)	★ 120 - 180 - 250	☆ 120 - 180 - 250	-	-	-
	Alloy steel (SCM, etc.)	0.05 - 0.08 - 0.12	0.05 - 0.1 - 0.14	0.05 - 0.1 - 0.16 (0.13)	0.06 - 0.13 - 0.2 (0.18)	★ 100 - 160 - 220	☆ 100 - 160 - 220	-	-	-
	Mold steel (SKD, etc.)	0.05 - 0.08 - 0.1	0.05 - 0.1 - 0.12	0.05 - 0.1 - 0.14 (0.13)	0.06 - 0.12 - 0.18 (0.16)	★ 80 - 140 - 180	☆ 80 - 140 - 180	-	-	-
	Austenitic stainless steel (SUS 304, etc.)	0.05 - 0.08 - 0.1	0.05 - 0.1 - 0.12	0.05 - 0.1 - 0.14 (0.13)	0.06 - 0.12 - 0.18 (0.16)	☆ 100 - 160 - 200	★ 100 - 160 - 200	-	-	-
	Martensitic stainless steel (SUS 403, etc.)	0.05 - 0.08 - 0.1	0.05 - 0.1 - 0.12	0.05 - 0.1 - 0.14 (0.13)	0.06 - 0.12 - 0.18 (0.16)	-	☆ 150 - 200 - 250	-	-	★ 180 - 240 - 300
	Precipitation hardened stainless steel (SUS 630, etc.)	0.05 - 0.08 - 0.1	0.05 - 0.1 - 0.12	0.05 - 0.1 - 0.14 (0.13)	0.06 - 0.12 - 0.18 (0.16)	-	★ 90 - 120 - 150	-	-	-
	Grey cast iron (FC)	0.05 - 0.1 - 0.14	0.05 - 0.1 - 0.16	0.05 - 0.1 - 0.18 (0.16)	0.06 - 0.15 - 0.23 (0.21)	-	-	☆ 120 - 180 - 250	-	-
	Ductile cast iron (FCD)	0.05 - 0.08 - 0.1	0.05 - 0.1 - 0.12	0.05 - 0.1 - 0.14 (0.13)	0.06 - 0.12 - 0.18 (0.16)	-	-	☆ 100 - 150 - 200	-	-
	Ni-based heat resistant alloys	0.05 - 0.06 - 0.08	0.05 - 0.08 - 0.1	0.05 - 0.08 - 0.12 (0.11)	0.06 - 0.1 - 0.15 (0.14)	-	☆ 20 - 30 - 50	-	-	★ 20 - 30 - 50
	Titanium alloy (Ti -6Al -4 V)	0.05 - 0.08 - 0.1	0.05 - 0.09 - 0.12	0.05 - 0.09 - 0.12 (0.11)	0.06 - 0.1 - 0.15 (0.14)	-	☆ 30 - 50 - 70	-	-	-

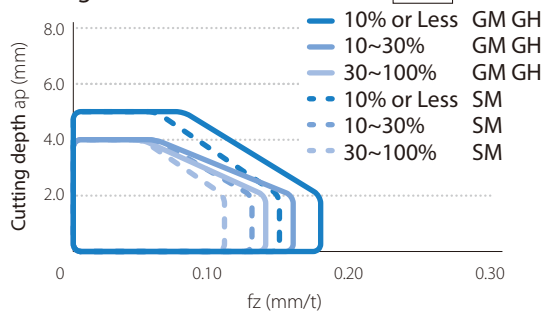
The number in bold font is recommended starting conditions. Adjust the cutting speed and the feed rate within the above conditions according to the actual machining situation. Machining with coolant is recommended for Ni-base heat-resistant alloys and titanium alloys. When choosing wet machining for other workpieces, reduce the cutting speed to 70% or less. Face milling does not recommend slotting or pocketing. We recommend setting the ae to 75% or less. We recommend the small number insert type for ae of 30% or more. Working above recommended conditions or long-term use can damage the screws. It is recommended to replace the screws regularly. Ramping and Helical milling are not recommended if the corner R is R4.0/R5.0/R6.0.

Cutting Performance

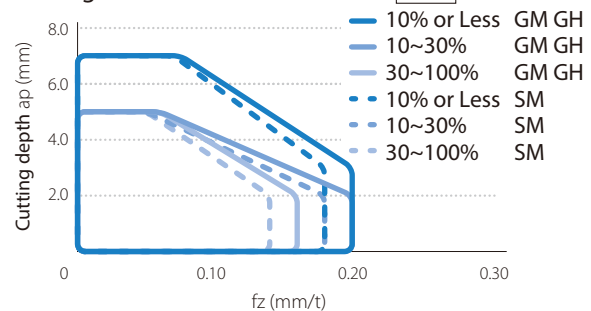


09 Size (LOGU09...) Machining for Steel (Dry)

Cutting Dia. DC : $\phi 16 \sim \phi 18$



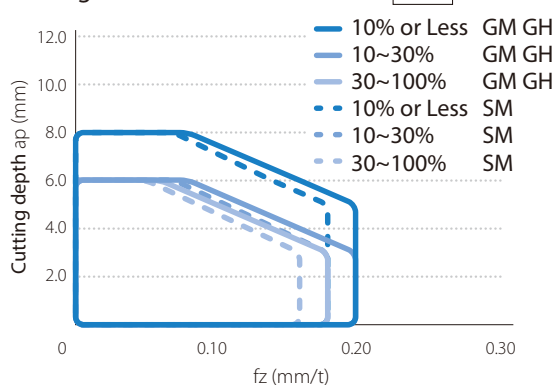
Cutting Dia. DC : $\phi 20 \sim \phi 63$



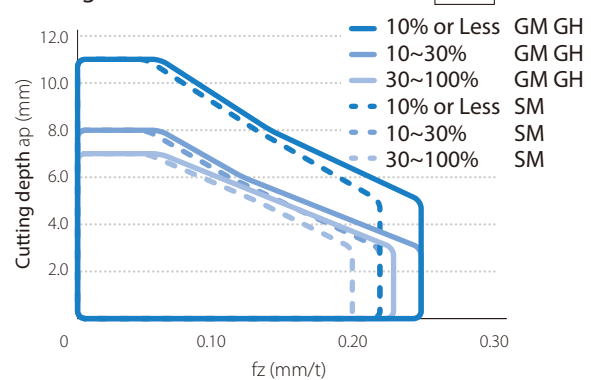
For other workpiece material, set ap and fz appropriately for each ae.

12 Size (LOGU12...) Machining for Steel (Dry)

Cutting Dia. DC : $\phi 25 \sim \phi 30$



Cutting Dia. DC : $\phi 32 \sim \phi 125$



For other workpiece material, set ap and fz appropriately for each ae.

Recommended cutting conditions ★1st recommendation ☆2nd recommendation

Insert Shape	Workpiece Material	Toolholder Description and Feed rate (fz: mm/t)				Recommended Insert Grade (Cutting speed Vc: m/min)				
		09 Size (LO..09...)		12 Size (LO..12...)		MEGACOAT NANO EX			MEGACOAT HARD	CVD coating
		MA90-16~ MA90-18	MA90-20~MA90-50 MA90-040~MA90-063	MA90-25~ MA90-30	MA90-32~MA90-50 MA90-040~MA90-125	PR1825	PR1835	PR1810	PR015S	CA6535
Low Cutting Force SM	Carbon steel (SxxC)	0.05 – 0.08 – 0.11	0.05 – 0.1 – 0.14	0.05 – 0.1 – 0.14	0.06 – 0.1 – 0.18	★ 120 – 180 – 250	☆ 120 – 180 – 250	–	–	–
	Alloy steel (SCM, etc.)	0.05 – 0.07 – 0.1	0.05 – 0.08 – 0.12	0.05 – 0.08 – 0.12	0.06 – 0.1 – 0.14	★ 100 – 160 – 220	☆ 100 – 160 – 220	–	–	–
	Mold steel (SKD, etc.)	0.05 – 0.07 – 0.1	0.05 – 0.08 – 0.1	0.05 – 0.08 – 0.12	0.06 – 0.1 – 0.14	★ 80 – 140 – 180	☆ 80 – 140 – 180	–	–	–
	Austenitic stainless steel (SUS304, etc.)	0.05 – 0.08 – 0.11	0.05 – 0.08 – 0.12	0.05 – 0.08 – 0.12	0.06 – 0.1 – 0.14	☆ 100 – 160 – 200	★ 100 – 160 – 200	–	–	–
	Martensitic stainless steel (SUS403, etc.)	0.05 – 0.08 – 0.11	0.05 – 0.08 – 0.12	0.05 – 0.08 – 0.12	0.06 – 0.1 – 0.14	–	☆ 150 – 200 – 250	–	–	★ 180 – 240 – 300
	Precipitation hardened stainless steel (SUS630, etc.)	0.05 – 0.08 – 0.11	0.05 – 0.08 – 0.12	0.05 – 0.08 – 0.12	0.06 – 0.1 – 0.14	–	★ 90 – 120 – 150	–	–	–
	Ni-based heat resistant alloys	0.05 – 0.06 – 0.08	0.05 – 0.08 – 0.1	0.05 – 0.08 – 0.1	0.06 – 0.08 – 0.12	–	☆ 20 – 30 – 50	–	–	★ 20 – 30 – 50
	Titanium alloy (Ti-6 Al-4V)	0.05 – 0.08 – 0.1	0.05 – 0.08 – 0.12	0.05 – 0.08 – 0.12	0.06 – 0.09 – 0.12	–	★ 30 – 50 – 70	–	–	–
Tough Edge GH	Carbon steel (SxxC)	0.05 – 0.1 – 0.14	0.05 – 0.1 – 0.16	0.05 – 0.1 – 0.18	0.06 – 0.15 – 0.23	★ 120 – 180 – 250	☆ 120 – 180 – 250	–	–	–
	Alloy steel (SCM, etc.)	0.05 – 0.08 – 0.12	0.05 – 0.1 – 0.14	0.05 – 0.1 – 0.16	0.06 – 0.13 – 0.2	★ 100 – 160 – 220	☆ 100 – 160 – 220	–	–	–
	Mold steel (SKD, etc.)	0.05 – 0.08 – 0.1	0.05 – 0.1 – 0.12	0.05 – 0.1 – 0.14	0.06 – 0.12 – 0.18	★ 80 – 140 – 180	☆ 80 – 140 – 180	–	–	–
	Austenitic stainless steel (SUS304, etc.)	0.05 – 0.08 – 0.1	0.05 – 0.1 – 0.12	0.05 – 0.1 – 0.14	0.06 – 0.12 – 0.18	☆ 100 – 160 – 200	☆ 100 – 160 – 200	–	–	–
	Martensitic stainless steel (SUS403, etc.)	0.05 – 0.08 – 0.1	0.05 – 0.1 – 0.12	0.05 – 0.1 – 0.14	0.06 – 0.12 – 0.18	–	☆ 150 – 200 – 250	–	–	–
	Precipitation hardened stainless steel (SUS630, etc.)	0.05 – 0.08 – 0.1	0.05 – 0.1 – 0.12	0.05 – 0.1 – 0.14	0.06 – 0.12 – 0.18	–	☆ 90 – 120 – 150	–	–	–
	Grey cast iron (FC)	0.05 – 0.1 – 0.14	0.05 – 0.1 – 0.16	0.05 – 0.1 – 0.18	0.06 – 0.15 – 0.23	–	–	★ 120 – 180 – 250	–	–
	Ductile cast iron (FCD) 0	0.05 – 0.08 – 0.1	0.05 – 0.1 – 0.12	0.05 – 0.1 – 0.14	0.06 – 0.12 – 0.18	–	–	★ 100 – 150 – 200	–	–
	Ni-based heat resistant alloys	0.05 – 0.06 – 0.08	0.05 – 0.08 – 0.1	0.05 – 0.08 – 0.12	0.06 – 0.1 – 0.15	–	☆ 20 – 30 – 50	–	–	–
	Titanium alloy (Ti-6 Al-4V)	0.05 – 0.08 – 0.1	0.05 – 0.09 – 0.12	0.05 – 0.09 – 0.12	0.06 – 0.1 – 0.15	–	☆ 30 – 50 – 70	–	–	–
	Hardened material (50HRC)	0.05 – 0.07 – 0.1	0.05 – 0.07 – 0.1	0.05 – 0.07 – 0.1	0.05 – 0.07 – 0.1	–	–	–	★ 60 – 80 – 100	–

The number in bold font is recommended starting conditions. Adjust the cutting speed and the feed rate within the above conditions according to the actual machining situation.

Machining with coolant is recommended for Ni-base heat-resistant alloys and titanium alloys. When choosing wet machining for other workpieces, reduce the cutting speed to 70% or less.

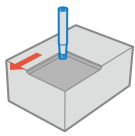
Face milling does not recommend slotting or pocketing. We recommend setting the ae to 75% or less. We recommend the small number insert type for ae of 30% or more.

Working above recommended conditions or long-term use can damage the screws. It is recommended to replace the screws regularly.

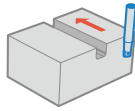
Ramping and Helical milling are not recommended if the corner R is R4.0/R5.0/R6.0.

Notes

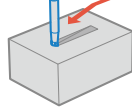
Applications



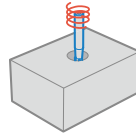
Face Milling & Shouldering



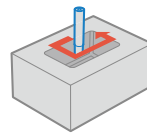
Slotting



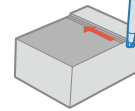
Ramping



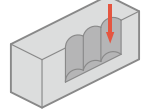
Helical Milling



Pocketing



Contouring



Plunging

Ramping Reference Table

Description	Cutter Diameter DC (mm)	16	20	25	32	40	50
MA... - 09 - ...	Max. Ramping Angle RMPX	1.16°	0.97°	0.64°	0.4°	0.23°	0.11°
	tan RMPX	0.020	0.017	0.011	0.007	0.004	0.002
Description	Cutter Diameter DC (mm)	25	28	30	32	35	40
MA... - 12 - ...	Max. Ramping Angle RMPX	2°	1.7°	1.6°	1.5°	1.2°	1°
	tan RMPX	0.034	0.030	0.027	0.026	0.021	0.017

When using M-class inserts, RMPX (tan RMPX) should be used at 90% in the table above.

Ramping is not recommended if the corner R is R4.0/R5.0/R6.0.

Decrease the angle of inclination when the chips extend longer.

Ramping Tips

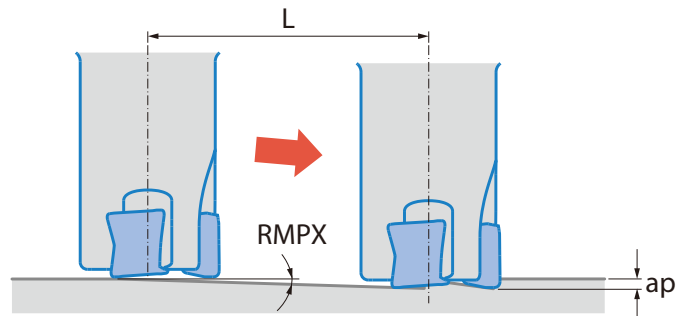
Ramping angle should be under RMPX.

Reduce recommended feed rate by 70%

Formula for Min. Cutting Length (L) at Max. Ramping Angle

$$L = \frac{ap}{\tan RMPX}$$

Ramping is not recommended if the corner R is R4.0/R5.0/R6.0.

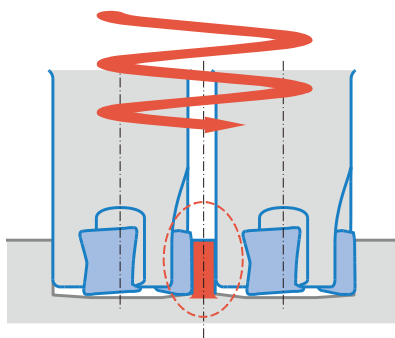


Helical Milling Tips

For Helical milling, use between min. cutting dia. and max. cutting dia.

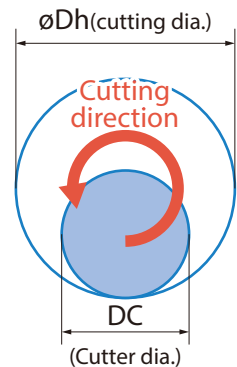
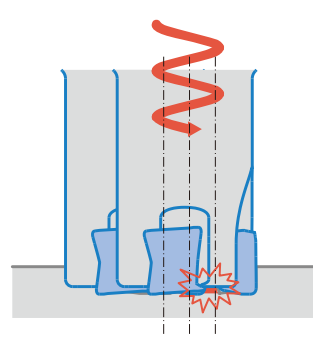
⊘ Exceeding max. cutting dia.

Center core remains after machining



⊘ Less than min. cutting dia.

Center core hits holder body



Units: mm

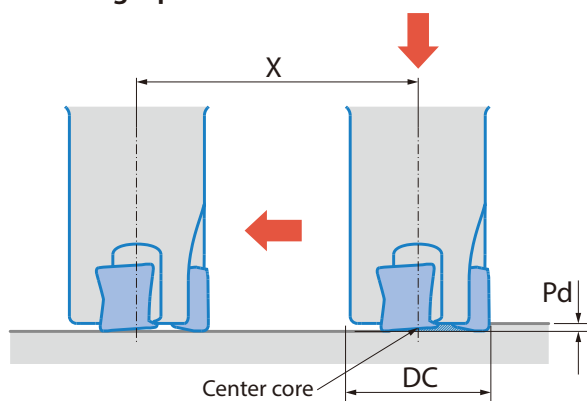
Description	Minimum cutting diameter øDh1	Maximum cutting diameter øDh2
MA... - 09 - ...	2×DC-4	2×DC-2
MA... - 12 - ...	2×DC-6	2×DC-2

Helical milling is not recommended if the corner R is R4.0/R5.0/R6.0.

For helical milling, use between min. cutting dia. and max. cutting dia.. The cutter direction should be counterclockwise (down cut) (see above). Please machining in a safe environment as long chips may be produced.

Notes

■ Drilling Tips



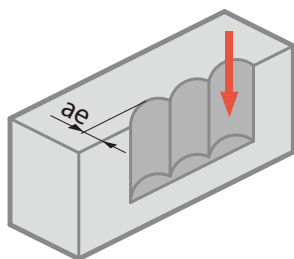
Units: mm

Description	Maximum drilling depth Pd	Min. cutting length X for flat bottom surface
MA... - 09 - ...	0.25	DC-3
MA... - 12 - ...	0.5	DC-5

It is recommended to reduce feed by 25% of recommendation until the center core is removed when traversing after drilling.

Axial feed rate recommendation per revolution is $f = 0.1 \text{ mm/rev}$ or less when drilling.

■ Plunging Tips



Units: mm

Description	Maximum width of cut (ae)
09 Size (LO...09...)	2
12 Size (LO...12...)	3

Available for vertical milling (plunging)

Feed should be set within $f_z = 0.1 \text{ (mm/t)}$ when plunging.

C
Chemical Vapor Deposition
V
D

CVD
TECHNOLOGY



KYOCERA'S COATING WORLD

Achieving Unprecedented Tool Life



P
Physical Vapor Deposition
V
D

MEGACOAT
NANO EX | Milling |

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