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

New Corner R Available
R4.0 / R5.0 / R6.0

NEW

Tangential 90° End Mill with 4-Edge Inserts

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

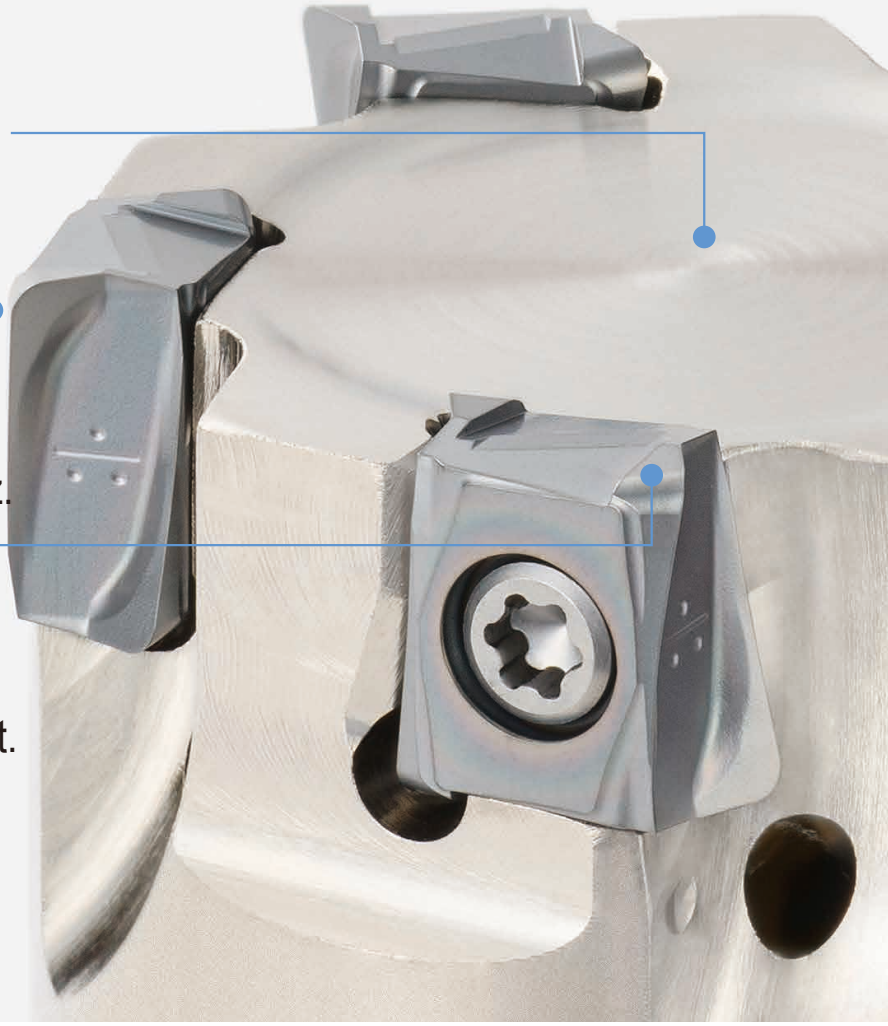
SOLUTION

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

Nagy magvastagság
Kiemelkedő merevséget biztosít.

Külső vágóélek speciális köszörülése
Kiváló falpontosságot eredményez.

Speciális wiper él
Nagy hátszög csökkenti a kopást és kiváló felületi minőséget biztosít.



Reliable tooling brings peace of mind to machinists.

Többfunkciós (G-osztályú) lapka

Háromdimenziós megmunkálást is támogat.

Egyedi vágóél kialakítás

Kiváló törésállóság és alacsony vágóerő

Újonnan kifejlesztett lapkaminőség - PR18 sorozat MEGACOAT NANO EX

Hosszabb szerszáméltartamot garantál.

2 New insert grade PR18 Series provides a significantly longer tool life

Next-generation insert grade for milling

NEW

PR18 Series

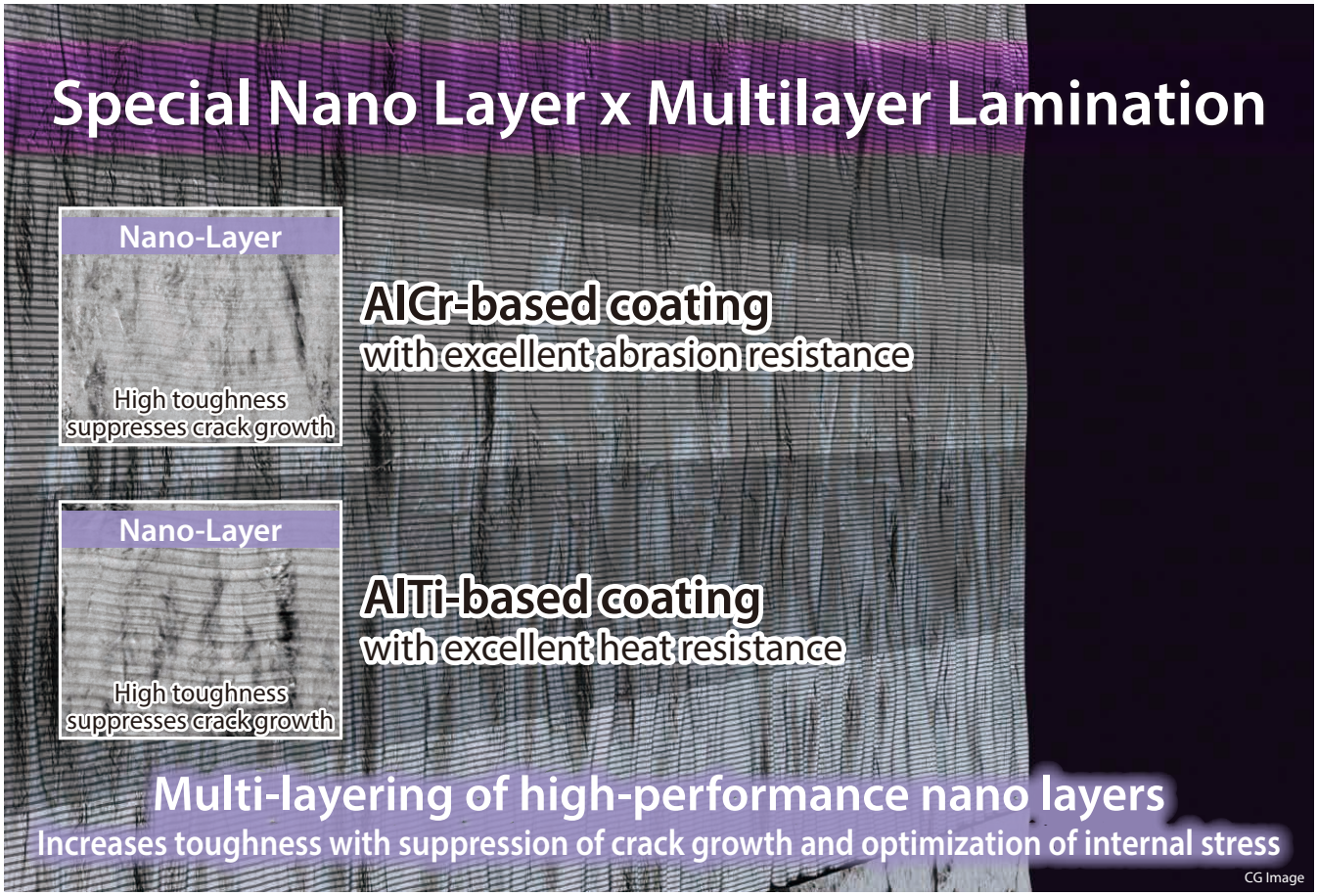
Kyocera's Nano Layer Coating Technology

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



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

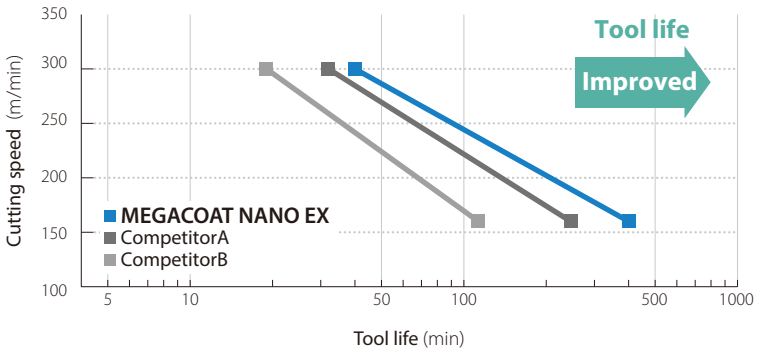
Workpiece material	P Steel					M Stainless steel					K Cast iron				
ISO	01	10	20	30	40	01	10	20	30	40	01	10	20	30	40
Lineup		1st recommendation PR1825					1st recommendation PR1835					1st recommendation PR1810			
		Wet PR1835					High-speed machining CA6535								

H Hardened material	PR015S (GH)	S Heat-resistant alloy	CA6535 (PR1835)	Titanium alloy	PR1835

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

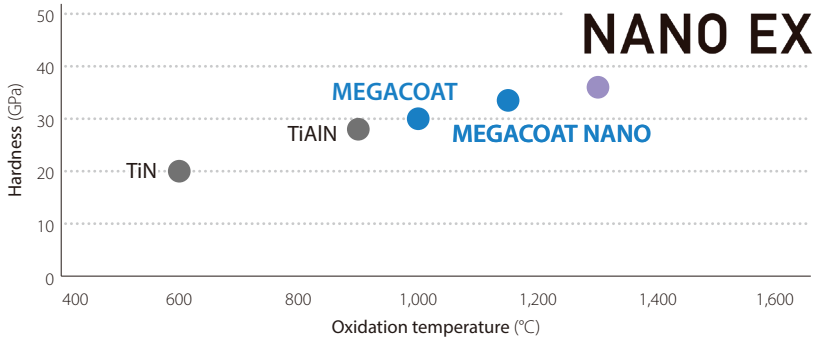
Life criteria:
Flank face wear = 0.10 mm

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



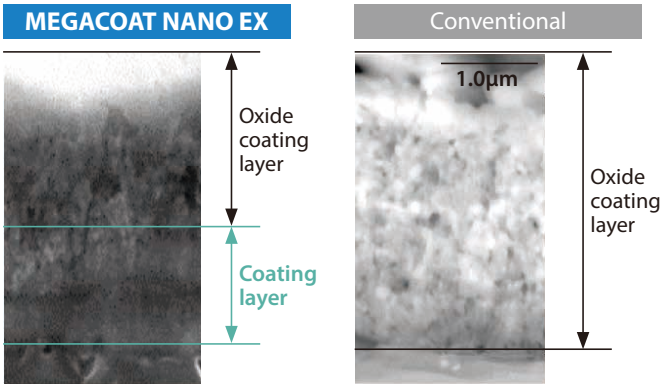
Coating characteristics (Internal evaluation)

MEGACOAT NANO EX | Milling



Oxidation progression comparison (Internal evaluation)

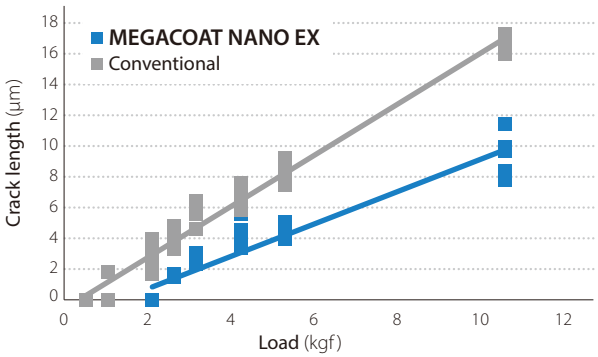
Suppresses oxidation progression with excellent oxidation resistance



*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

MA90

Conventional tangential type

Unique cutting edge design

Superior fracture resistance and low cutting force

Special wiper edge

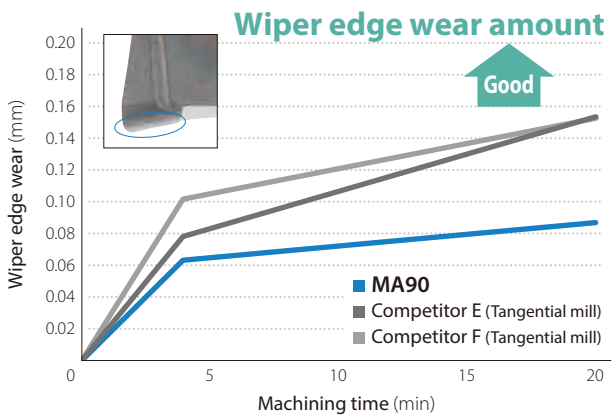
Large relief angle: Excellent surface finish and wear suppression
Stepped corners: Designed to prevent seat damage

Excellent Excellent surface finish ›››

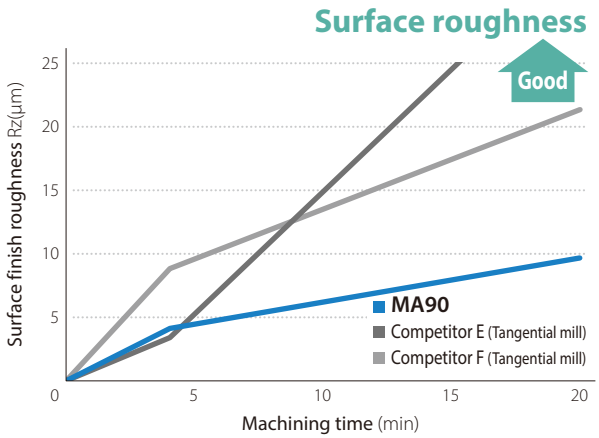
Special wiper edge design suppresses abrasion progress of the edge. Maintains high-quality finished surface

Wear and Surface Finish Comparison (Internal evaluation)

Wiper edge wear



Surface finish roughness (Bottom surface)



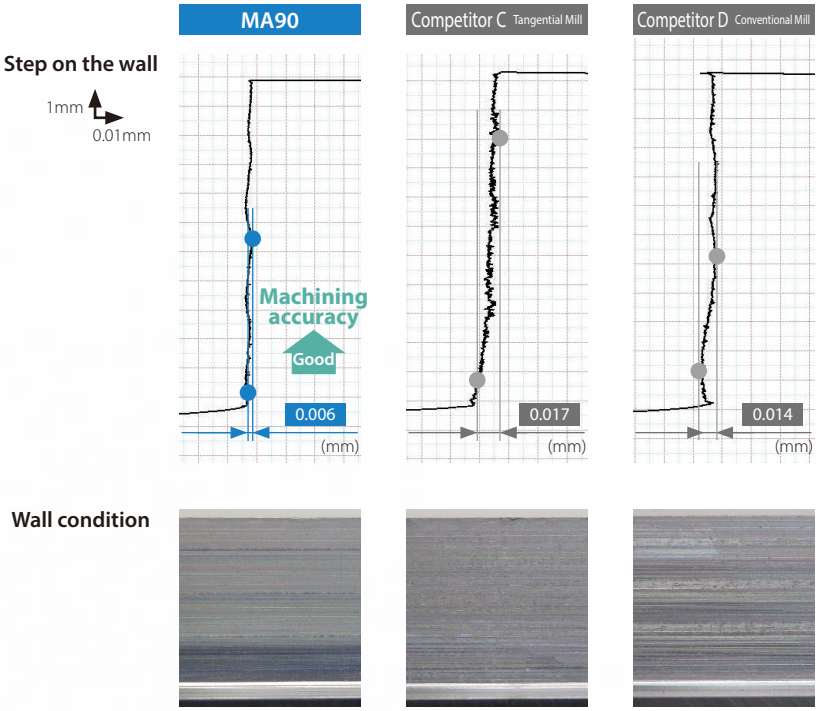
Cutting conditions: Vc = 200 m/min, ap x ae = 1 x 37.5 mm, fz = 0.1/0.12 mm/t, Dry S50C Φ50 (6/7 inserts) BT50

Excellent wall accuracy　Excellent

Peripheral grinding specifications

Unique, sloped, edge shape
Grounded peripheral provides higher precision

Wall accuracy comparison (Internal evaluation)



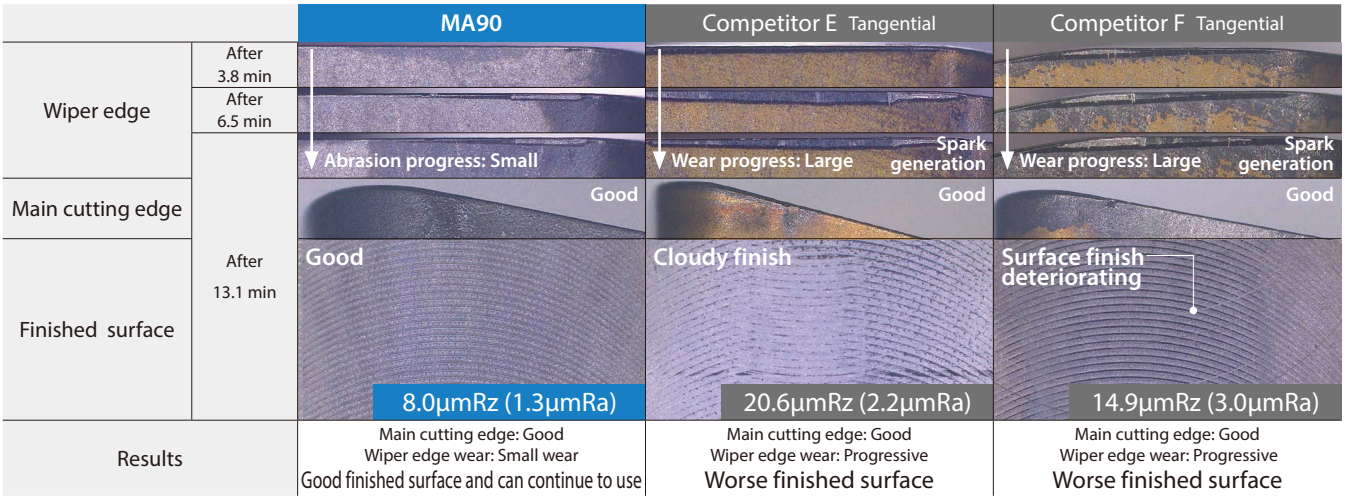
Cutting conditions: Vc = 150 m/min, ap x ae = 3 x 5 mm 4 passes, fz = 0.1 mm/t, Dry S50C Dia.20 (3 inserts) BT50

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. — MA90 ✓

Test 2 Machined with reduced cutting speed because the surface finish deteriorated early. — MA90 ✓

Edge condition and finished surface



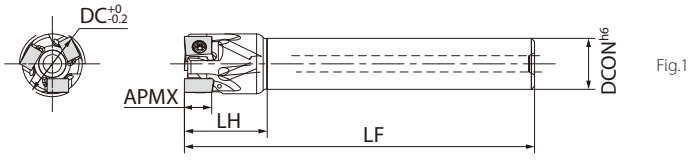


Fig.1

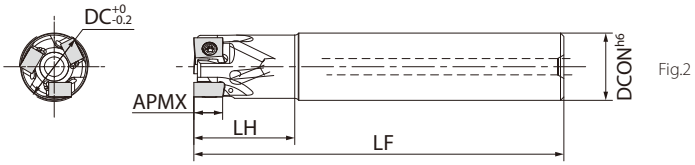


Fig.2

Toolholder Dimensions 09 Size (LOGU09 ...)

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							27,900
		20S16-09T2C	●		20		110	26				0.2	26,600
		20S16-09T3C	●	3									
		22S20-09T3C	●		22	20							25,400
		25S20-09T3C	●		25		120	29				0.3	23,900
		25S20-09T4C	●	4									
		28S25-09T3C	●	3	28	25							22,600
		30S25-09T4C	●	4	30		130	32				0.5	21,900
		32S25-09T4C	●		32								21,200
		32S25-09T5C	●	5									
		35S32-09T4C	●	4	35	32	150	50				0.9	20,300
		35S32-09T5C	●	5									
		40S32-09T4C	●	4	40							1.0	19,000
		40S32-09T6C	●	6									
		50S32-09T5C	●	5	50		120	40				0.9	17,000
		50S32-09T7C	●	7									
Same size shank	MA90 -	16S16-09T2C	●	2	16	16	100	26	8	Yes	Fig.2	0.1	29,500
		20S20-09T2C	●		20	20	110	30				0.2	26,600
		20S20-09T3C	●	3									
		25S25-09T3C	●		25	25	120	32				0.4	23,900
		25S25-09T4C	●	4									
		32S32-09T4C	●		32	32	130	40				0.7	21,200
		32S32-09T5C	●	5									
Long shank	MA90 -	20S18-09T2CL	●	2	20	18	150	30	8	Yes	Fig.1	0.3	26,600
		20S20-09T2CL	●			20		40			Fig.2		
		25S25-09T2CL	●		25	25	170	50				0.6	23,900
		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 13.
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 (LOGU12 ...)

Description			Stock	Number of Inserts	Dimensions (mm) DC	DCON	LF	LH	APMX	Coolant hole	Shape	Weight	Maximum number of revolutions (min^{-1})
Standard shank	MA90 -	25S20-12T2C	●	2	25	20	120	29	12	Yes	Fig.1	0.3	18,300
		28S25-12T2C	●		28	25						0.4	17,300
		30S25-12T2C	●		30		130	32				0.5	16,800
		30S25-12T3C	●	3									
		32S25-12T2C	●	2	32								16,300
		32S25-12T3C	●	3									
		35S32-12T3C	●		35	32	150	50				0.9	15,600
		40S32-12T3C	●		40								14,600
		40S32-12T4C	●	4									
		50S32-12T4C	●		50		120	40					13,100
		50S32-12T6C	●	6								0.8	
Same size shank	MA90 -	25S25-12T2C	●	2	25	25	120	32	12	Yes	Fig.2	0.4	18,300
		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 13.

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 (LOGU09...)	End Mill 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 (LOGU12...)	End Mill Modular	MA90-...-12...	SB-40104TRP	DTPM-15	P-37	-
	Face Mill	MA90-040R-12...-M	Tightening torque for clamping insert 3.5 N/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...				

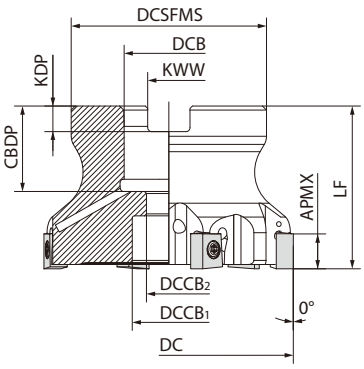


Fig.1

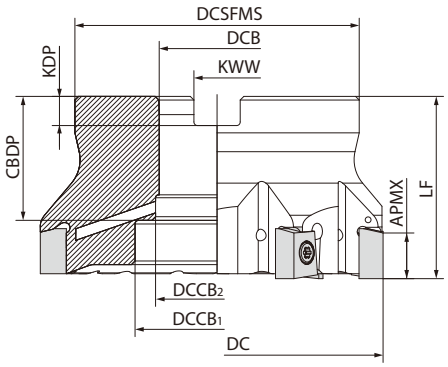


Fig.2

Toolholder dimensions 09 size (LOGU09...)

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														
		050R-09T5C-M	●	5	50	48	22	18	11		21	6.3	10.4				0.4	23,900
		050R-09T7C-M	●	7														
		063R-09T6C-M	●	6	63												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 13.
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 (LOGU12...)

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														
		050R-12T4C-M	●		50	48	22	18	11		21	6.3	10.4				0.3	13,100
		050R-12T6C-M	●	6														
		063R-12T6C-M	●		63												0.4	11,700
		063R-12T8C-M	●	8														
		080R-12T7C-M	●	7	80	70	27	20	13	50	24	7	12.4				1.2	10,400
		080R-12T10C-M	●	10														
		100R-12T9C-M	●	9	100	78	32	45	-		30	8	14.4			Fig.2	1.5	9,300
		100R-12T13C-M	●	13														
		125R-12T12C-M	●	12	125	89	40	55		63	33	9	16.4				2.5	8,300
		125R-12T16C-M	●	16														
Bore Dia. Inch Spec	MA90 -	080R-12T7C	●	7	80	70	25.4	20	13	50	27	6	9.5	12	Yes	Fig.1	1.2	10,400
		080R-12T10C	●	10														
		100R-12T9C	●	9	100	78	31.75	45	-		34	8	12.7			Fig.2	1.5	9,300
		100R-12T13C	●	13														
		125R-12T12C	●	12	125	89	38.1	55		63	38	10	15.9				2.6	8,300
		125R-12T16C	●	16														

Maximum number of revolutions

● : Standard Stock

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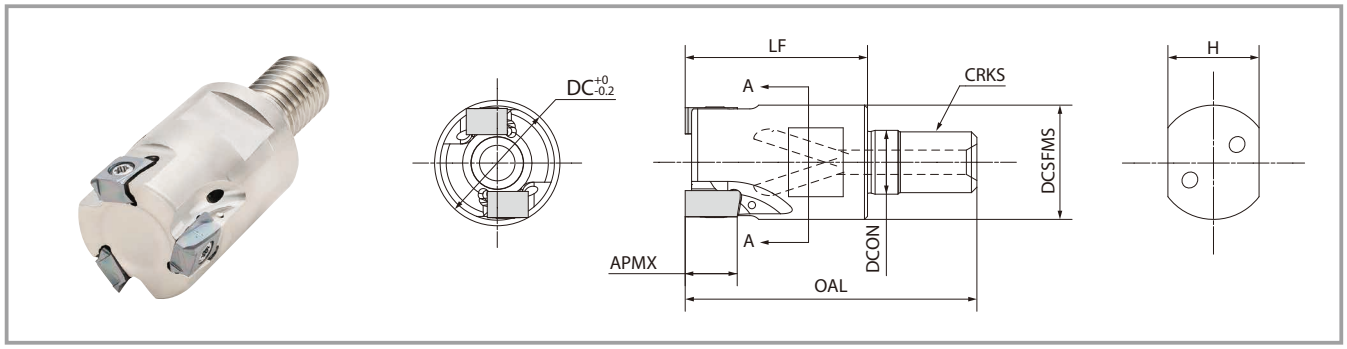


Toolholder dimensions 09 size (LOGU09...)

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

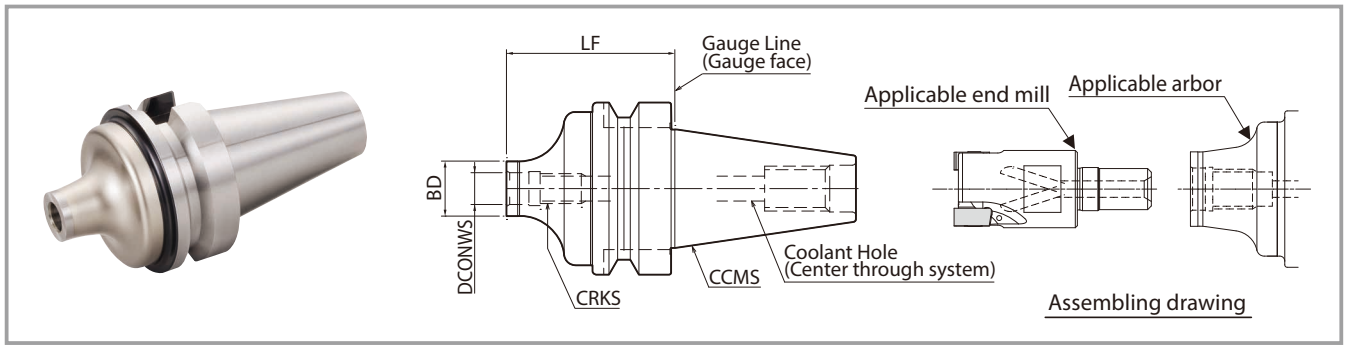
Toolholder dimensions 12 size (LOGU12...)

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	●	3										

●: Standard Stock

Maximum number of revolutions
Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on Page 13.
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.

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



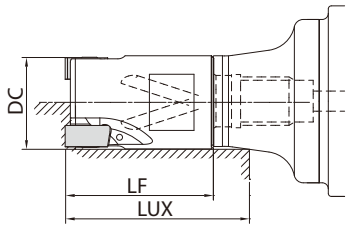
Dimensions

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

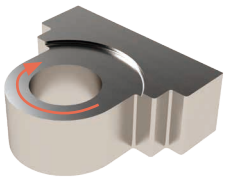


Arbor description		Applicable End Mill (Head)			Actual End Mill Depth(mm)
		Description	Cutting Dia. (mm)	Dimensions (mm)	LUX
			DC	LF	
BT30K-	M10-45	MA90-20M10-...	20	30	36.8
	M12-45	MA90-25M12-...	25	35	42.8
BT40K-	M10-60	MA90-20M10-...	20	30	38.7
	M12-55	MA90-25M12-...	25	35	44.6
	M16-65	MA90-32M16-...	32	40	51.2

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**

Competitor G (7 inserts) **600 pcs**

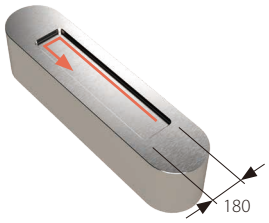
Tool life x1.6

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**

Competitor H (3 inserts) **Q = 9.5 cc/min**

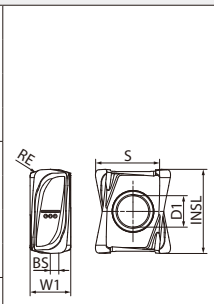
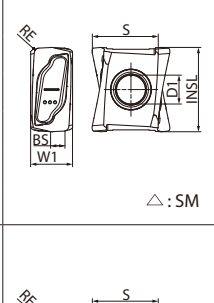
x1.5 Machining efficiency

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

(User evaluation)

Applicable Insert

Usage Classification									Applicable toolholder
★ : 1st recommendation ☆ : 2nd recommendation	P	Carbon steel/Alloy steel	★	☆					
		Mold Steel	★	☆					
	M Stainless steel	Austenitic		★	☆				
		Martensitic		☆				★	
		Precipitation hardening system		★					
	K	Gray cast iron			★				
		Ductile cast iron			★				
	S	Heat-resistant alloys		☆				★	
		Titanium alloy		★					
	H	Hardened material				★			

Shape	Description	No.of edges	Dimensions (mm)						MEGACOAT (PVD coating)				CVD Coating	Applicable toolholder
			W1	S	D1	INSL	BS	RE	PR1825	PR1835	PR1810	PR015S	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			6.71			0.90	0.8	●	●	●	–	●	
	090412ER-GM			6.65			0.49	1.2	●	●	●	–	●	
	090416ER-GM			6.59			0.10	1.6	●	●	●	–	●	
 Low Cutting Force (G-class)	LOGU 090404ER-SM		4.3	6.77	3.33	8.89	1.29	0.4	●	●	–	–	●	
	090408ER-SM			6.71			0.89	0.8	●	●	–	–	●	
	090412ER-SM			6.65			0.49	1.2	●	●	–	–	●	
	090416ER-SM			6.59			0.10	1.6	●	●	–	–	●	
 Tough Edge (G-class)	LOGU 090408ER-GH		4.3	6.71	3.33	8.89	0.90	0.8	●	●	●	●	–	
 Unmarked : GM △ : SM □ : GH														
 General Purpose (G-class)	LOGU 120604ER-GM	4	6.6	10.10	4.55	13.28	2.50	0.4	●	●	●	–	●	MA90-…-12-..
	120608ER-GM			10.04			2.14	0.8	●	●	●	–	●	
	120612ER-GM			9.97			1.79	1.2	●	●	●	–	●	
	120616ER-GM			9.92			1.44	1.6	●	●	●	–	●	
	120620ER-GM			9.85			1.08	2.0	●	●	●	–	●	
	120624ER-GM			9.79			0.72	2.4	●	●	●	–	●	
	120630ER-GM			9.69			0.20	3.0	●	●	●	–	●	
NEW  Single-sided General Purpose (G-class)	LOGT 120640ER-GM	2	6.6	9.56	4.55	13.28	1.69	4.0	●	●	●	–	●	
	120650ER-GM			9.40			0.63	5.0	●	●	●	–	●	
	120660ER-GM			9.24			0.37	6.0	●	●	●	–	●	
 Low Cutting Force (G-class)	LOGU 120604ER-SM	4	6.6	10.10	4.55	13.28	2.50	0.4	●	●	–	–	●	
	120608ER-SM			10.04			2.14	0.8	●	●	–	–	●	
	120612ER-SM			9.97			1.79	1.2	●	●	–	–	●	
	120616ER-SM			9.92			1.44	1.6	●	●	–	–	●	
	120620ER-SM			9.85			1.08	2.0	●	●	–	–	●	
	120624ER-SM			9.79			0.72	2.4	●	●	–	–	●	
	120630ER-SM			9.69			0.20	3.0	●	●	–	–	●	
 Tough Edge (G-class)	LOGU 120608ER-GH	4	6.6	10.16	4.55	13.25	2.26	0.8	●	●	●	●	–	
 △ : SM □ : GH														

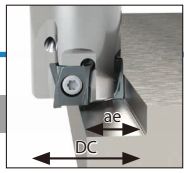
● : Standard Stock

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 (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	0.06 – **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 (SUS 304, 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 (SUS 403, 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	–	–	★ 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	0.06 – **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)	0.05 – **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	–	–	★ 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	0.06 – **0.1** – 0.15	–	☆ 30 – **50** – 70	–	–	–
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	–	–	–

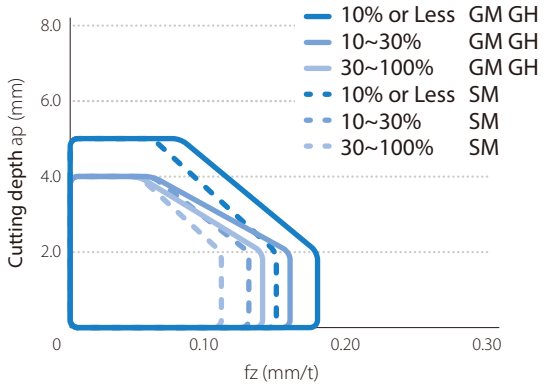
The number in bold font is recommended starting conditions. Adjust the cutting speed and the feed rate within the above conditions according to the actual machining situation.
Machining with coolant is recommended for Ni-base heat-resistant alloys and titanium alloys. When choosing wet machining for 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

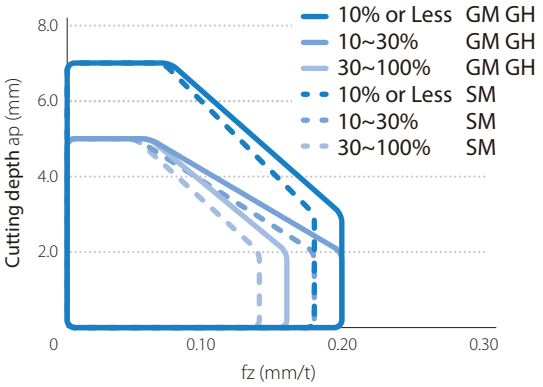


09 Size (LOGU09...) Machining for Steel (Dry)

Cutting Dia. DC : ø16 ~ ø18 ae/DC



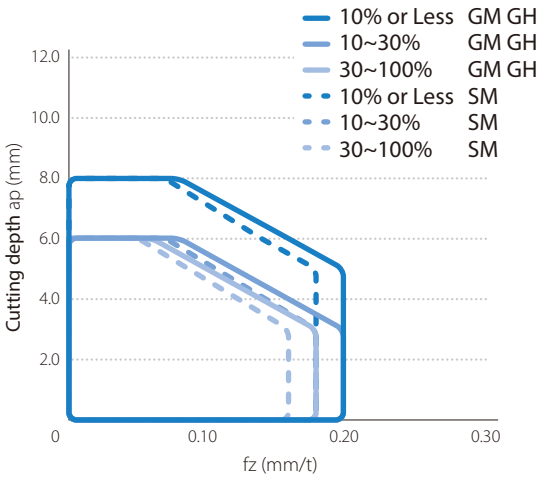
Cutting Dia. DC : ø20 ~ ø63 ae/DC



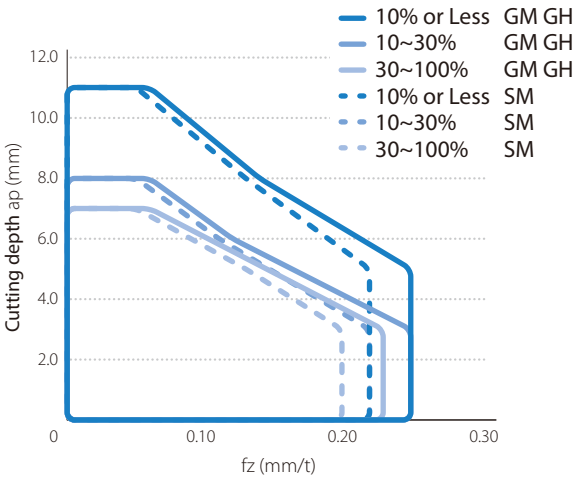
For other workpiece material, set ap and fz appropriately for each ae.

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

Cutting Dia. DC : ø25 ~ ø30 ae/DC



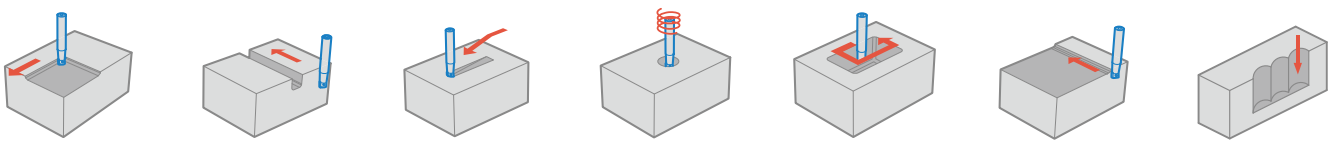
Cutting Dia. DC : ø32 ~ ø125 ae/DC



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

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

Decrease the angle of inclination when the chips extend longer.
Ramping is not recommended if the corner R is R4.0/R5.0/R6.0.

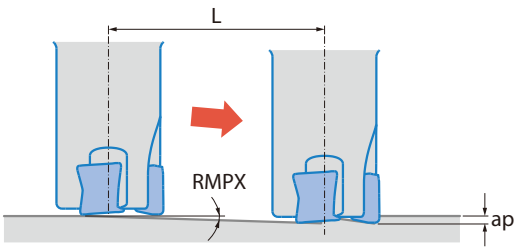
Notes

Ramping Tips

Ramping angle should be under RMPX.
Reduce recommended feed rate by 70%

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

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



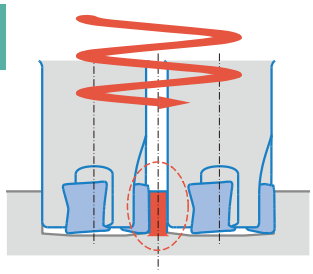
Ramping is not recommended if the corner R is R4.0/R5.0/R6.0.

Helical Milling Tips

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

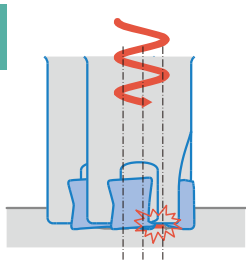
Exceeding max. cutting dia.

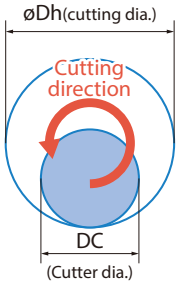
Center core remains after machining



Less than min. cutting dia.

Center core hits holder body





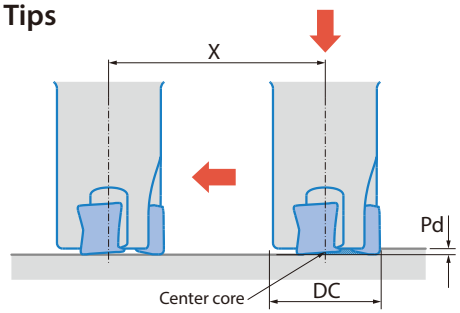
Units: mm

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.

Drilling Tips

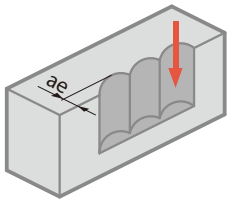


Units: mm

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 = 0.1mm/rev or less when drilling.

Plunging Tips



Available for vertical milling (plunging)
Feed should be set within fz = 0.1 (mm/t) when plunging.

Units: mm

Description	Maximum width of cut (ae)
09 Size (LOGU09...)	2
12 Size (LOGU12...)	3