



ME90

Helical Shell Mill for Difficult-to-Machine Materials



Stable, Long-Tool-Life Machining of Titanium Alloys and Other Difficult-to-Machine Materials

High-Rigidity Toolholder Design Minimizes Deflection

Special Arc-Land Geometry for Longer Tool Life

New Grade PM335S Provides Stable Performance in Difficult-to-Machine Materials



Helical Shell Mill for Difficult-to-Machine Materials

ME90

Solves Machining Challenges in Difficult-to-Machine Materials Such as Titanium Alloys

High-Rigidity Holder, Advanced Insert Design, and New Grade Deliver Stable Performance and Long Tool Life

Double-Sided Peripheral Inserts with 8 Cutting Edges Provide Excellent Economy



1 Solving Titanium Alloy Machining Challenges with Stability and Long Tool Life

Titanium Machining Challenges

Unstable Machining

Excessive vibration during machining

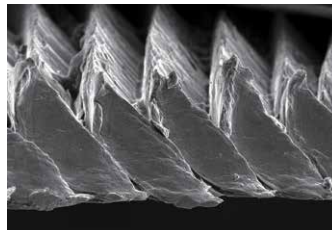
Fluctuating cutting loads can cause cutting-edge chipping and unstable machining



Short Tool Life

Heat concentrated at the cutting edge accelerates wear

Serrated chip formation creates fluctuating cutting loads, increasing the risk of chipping



High-Rigidity Toolholder

High-Rigidity Toolholder Design Minimizes Deflection

Proprietary Insert

Special Arc-Land Geometry for Longer Tool Life

Newly Developed Grade

New Grade PM335S Provides Stable Performance in Difficult-to-Machine Materials



**MEGACOAT
TOUGH**

Bottom Inserts (1st Stage Only)

Positive-Rake, 2-Edge Insert for
Low Cutting Forces

Wide Range of Corner Radii
RE 0.031"–0.250" (0.8–6.35 mm)

H-Class Precision Insert

Reduced Runout for
Stable Tool Life



Peripheral Inserts (2nd Stage or Higher)

Double-Sided Insert with 8
Cutting Edges for Excellent
Economy

H-Class Precision Insert

Reduced Runout for Stable
Tool Life

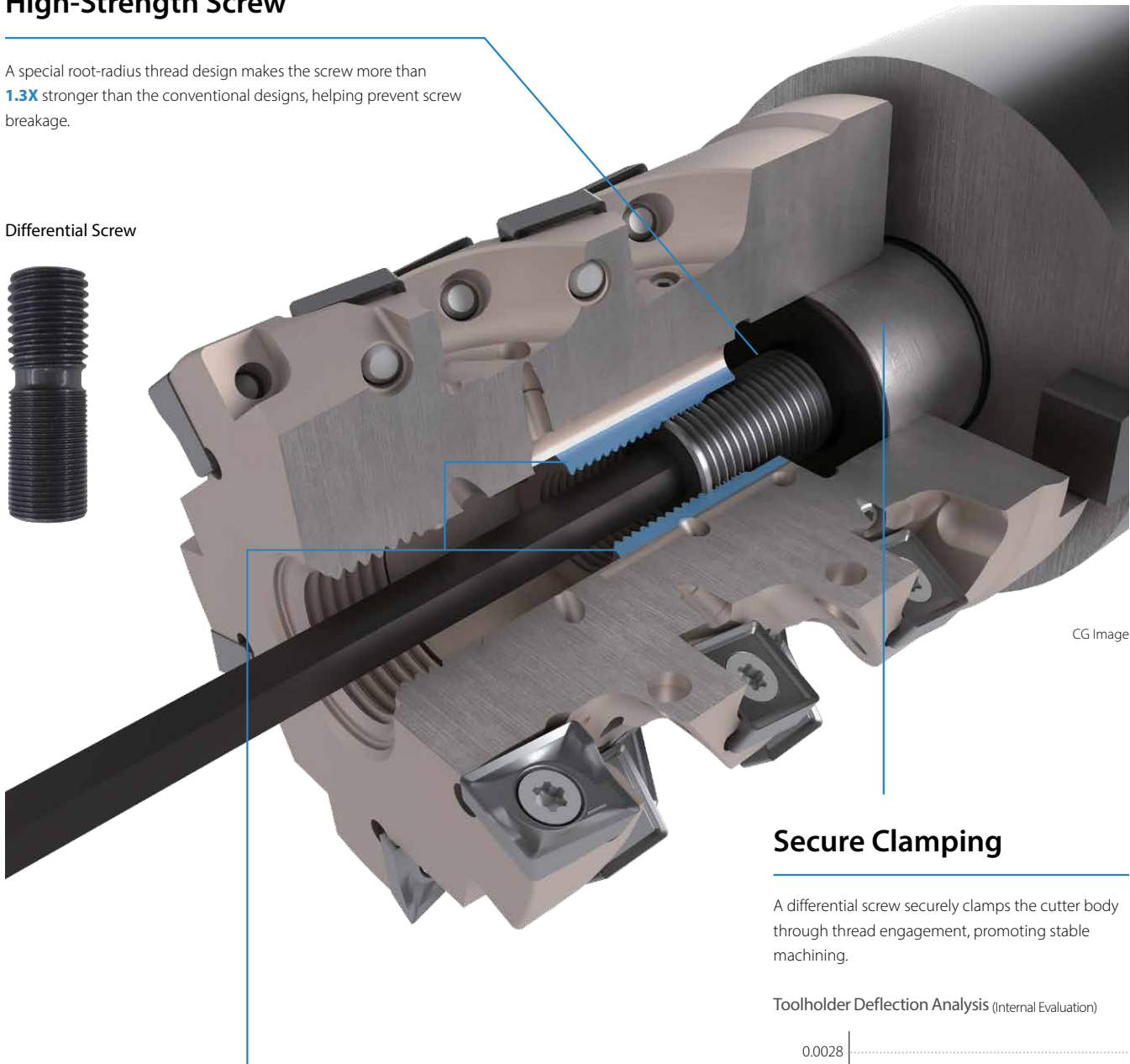


A unique differential-screw clamping design and increased cutter body wall thickness improve rigidity, minimizing deflection and reducing chatter even in long-overhang applications.

High-Strength Screw

A special root-radius thread design makes the screw more than **1.3X** stronger than the conventional designs, helping prevent screw breakage.

Differential Screw



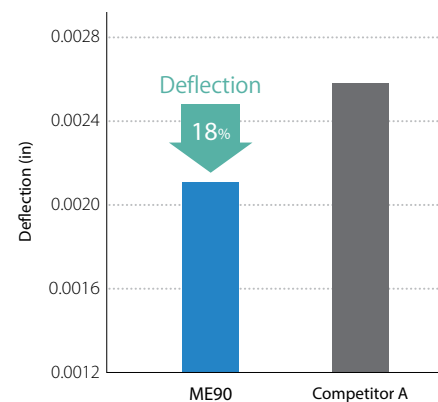
High-Rigidity Toolholder

The differential screw preserves cutter body wall thickness, reducing deflection

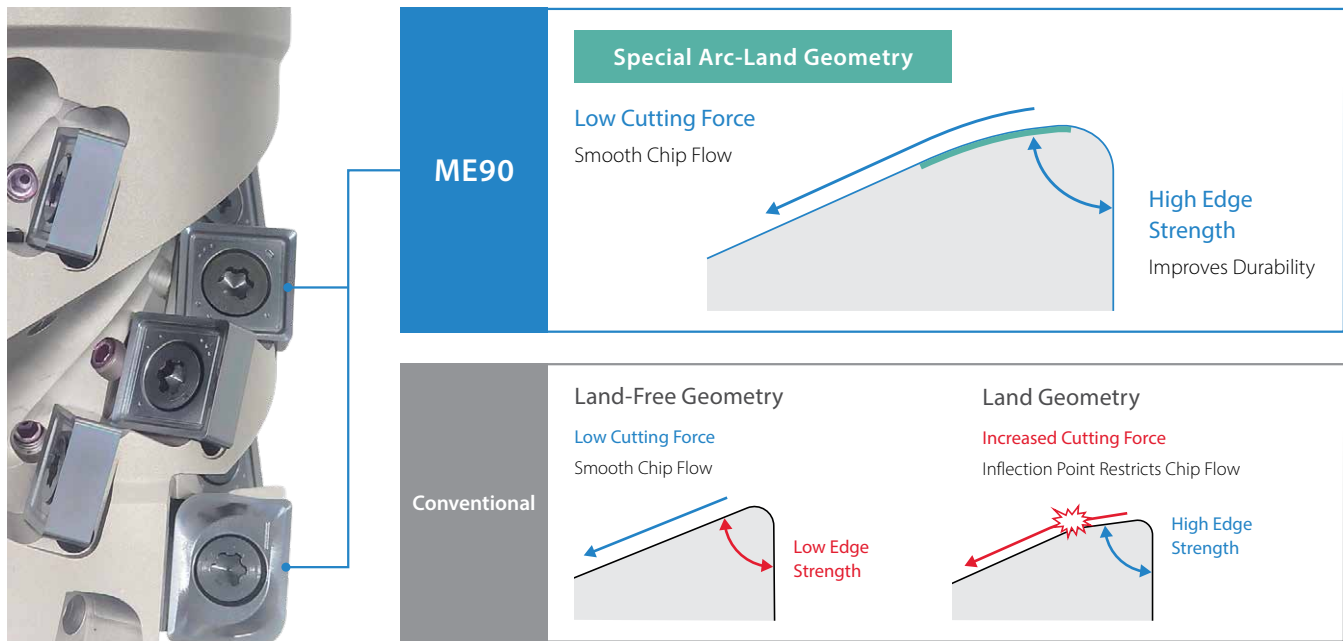
Secure Clamping

A differential screw securely clamps the cutter body through thread engagement, promoting stable machining.

Toolholder Deflection Analysis (Internal Evaluation)

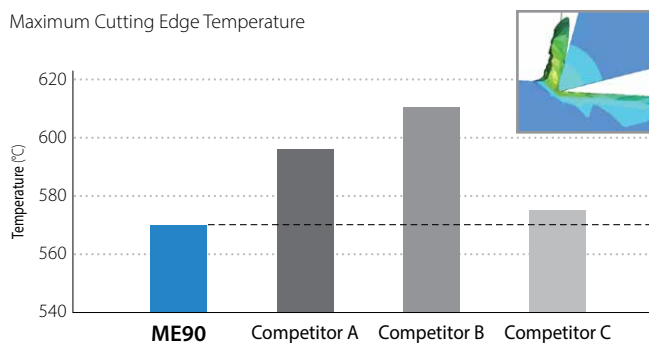


Newly developed arc-land geometry provides an optimal balance of low cutting forces and cutting-edge strength.

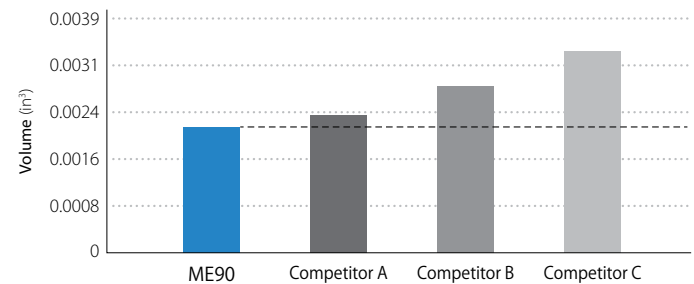


Simulation Results (Internal Evaluation)

Maximum Cutting Edge Temperature

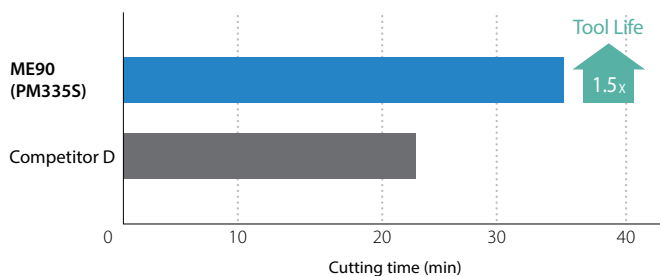


High-Stress Region Volume at the Cutting Edge



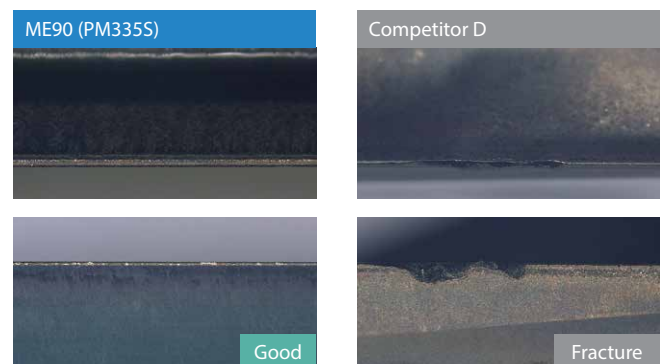
ME90 reduces cutting-edge temperature and stress, providing excellent wear and chipping resistance.

Tool Life Comparison (Internal Evaluation)



$V_c = 100 \text{ sfm}$ ($n = 120 \text{ rpm}$), $ap \times ae = 1.575'' \times 0.787''$, $fz = 0.004 \text{ ipt}$
Wet Ti-5553 ø80mm BT50

After 22.8 min Machining



4

New Grade PM335S for Stable Machining of Difficult-to-Machine Materials

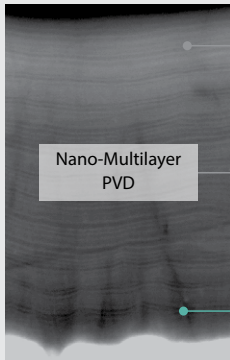
High-adhesion, high-toughness coating improves chipping resistance.

Maintains high strength even at elevated cutting temperatures.

Combined with a tough carbide substrate, PM335S delivers stable machining and long tool life in difficult-to-machine materials, including titanium alloys.



Coating



Uses AlCrN for excellent adhesion resistance.

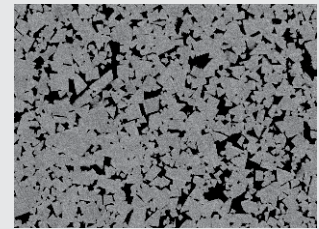
AlTiN-Based / AlCrN Nano-Multilayer Coating

High hot hardness through the addition of high-melting-point elements
Optimized compressive stress improves coating toughness

Special Interface Layer

Enhanced coating adhesion reduces the risk of delamination
(Critical load increased by 15%)

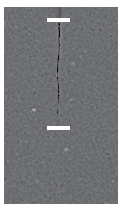
Carbide Substrate



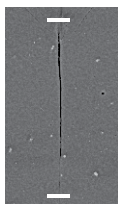
Uses a high-toughness carbide substrate for excellent fracture and wear resistance.

Coating Fracture Toughness Comparison (Internal Evaluation)

The nano-multilayer structure and optimized residual stress suppress crack propagation.



PM335S
Coating



Conventional
Coating

Test Conditions
Equipment: Vickers Hardness Tester
Load: 25 kgf
Temperature: Room Temperature

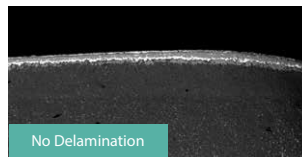
Fracture Toughness

1.5x

Coating Delamination Comparison (Internal Evaluation)

A special interface layer improves adhesion between the carbide substrate and coating.

With Interface Layer



No Delamination

Without Interface Layer



Coating Delamination

Cutting Conditions: $V_c = 200$ sfm, $a_p \times a_e = 0.030'' \times 0.394''$, $f_z = 0.031$ ipt, Coolant, Ti-6Al-4V (Pocketing)
Coating Test Performed on MFH-Max ($\varnothing 25$ mm)

Case Study



Cutting Conditions: $V_c = 150$ sfm, $a_p \times a_e = 2.165'' \times 1.181''$, $f_z = 0.004$ ipt, Coolant, Ti-6Al-4V, $\varnothing 80$ mm, BT50

Cutting Time

ME90
PM335S

46min/edge

Competitor A

23min/edge

Tool life

2x

Video

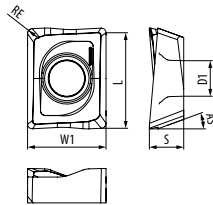
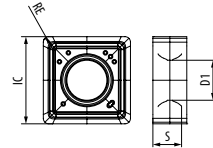


Competitor inserts experienced sudden chipping due to chip packing.

ME90 (PM335S) maintained a stable cutting edge and continued machining for more than twice as long.

(User Evaluation)

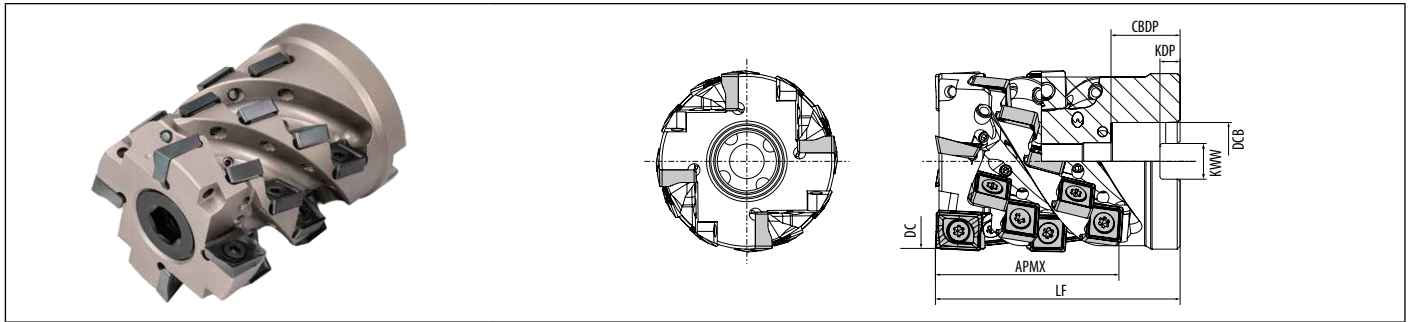
Applicable Inserts

Usage Classification ★ : Roughing / 1st Choice ☆ : Roughing / 2nd Choice (Hardness 40HRC or under)		Carbon Steel / Alloy Steel			★	P							
		Mold and Die Steel											
		Austenitic Stainless Steel			★	M							
		Martensitic Stainless Steel			★								
		Precipitation Hardened Stainless Steel			★								
		Gray Cast Iron				K							
		Nodular Cast Iron											
		Heat-Resistant Alloy		★	☆	S							
		Titanium Alloy		★	☆								
		Hardened Materials (> 40 HRC)				H							
Insert	Part Number	No. of Edges	Dimensions (mm)							Carbide		Applicable Toolholder ➡ Page 8-9	
			IC	S	D1	RE	L	W1	AS	PVD			
										PM335S	PR1835		
 Bottom Insert		LNHT 150508ER-GM	2	-	5.6	5.8	0.8	15.5	12.7	20	●	●	ME90-...C ME90-...CL ME90-...C-M ME90-...C-F
		150516ER-GM	2				1.6				●	●	
		150520ER-GM	2				2.0				●	●	
		150530ER-GM	2				3.0	●			●		
		150532ER-GM	2				3.2	15.6			●	●	
		150540ER-GM	2				4.0	●			●		
		150550ER-GM	2				5.0	15.7			●	●	
		150560ER-GM	2				6.0	15.8			●	●	
		150564ER-GM	2				6.35	●			●		
 Peripheral Insert		SNHU 120408ER-GM	8	12.7	4.2	5.8	0.8	-	-	-	●	●	ME90-...C ME90-...CL ME90-...C-M ME90-...C-B ME90-...C-F

Recommended Cutting Conditions ➡ Page 10

● : Standard Item

LNHT & SNHU Inserts are
sold in 10-piece boxes



Toolholder Dimensions

Unit	Part Number		Std. Item	No. of Inserts	No. of Flutes	No. of Stages	Dimensions						A.R. Max. (°)	R.R. Max. (°)	Coolant Hole	Weight (kg)	Max RPM	Applicable Inserts		
							DC	DCB	LF	CBDP	KDP	KWW						APMX	1st Stage	2nd Stage or Higher
Inch	Standard	ME90- 2000R15T3H5C	●	15	3	5	2.000	0.750	3.000	0.750	0.187	0.313	2.087	+15	-17	Yes*	0.6	7,800	LNHT1505..	SNHU1204..
		2500R15T4H6C	●	24	4	6	2.500	1.000	3.465	1.063	0.236	0.382	2.480		-16		1.1	7,000		
		3000R15T5H7C	●	35	5	7	3.000	1.250	3.976	1.063	0.315	0.516	2.835		-15		1.9	6,400		
	Long Length	ME90- 2000R15T3H7CL	●	21	3	7	2.000	0.750	3.740	0.750	0.187	0.313	2.874		-17		0.7	7,800		
		2500R15T4H8CL	●	32	4	8	2.500	1.000	4.134	1.063	0.236	0.382	3.228		-16		1.2	7,000		
		3000R15T5H10CL	●	50	5	10	3.000	1.250	4.724	1.063	0.315	0.516	3.976		-15		2.1	6,400		
mm	Standard	ME90- 050R-15T3H5C-M	●	15	3	5	50	22	75	21	6.3	10.4	53	+15	-17	Yes*	0.5	7,900	LNHT1505..	SNHU1204..
		063R-15T4H6C-M	●	24	4	6	63	27	85	24	7	12.4	63		-16		1.0	7,000		
		080R-15T5H7C-M	●	35	5	7	80	32	100	30	8	14.4	72		-15		2.2	6,200		
	Long Length	ME90- 050R-15T3H7CL-M	●	21	3	7	50	22	95	21	6.3	10.4	73		-17		0.6	7,900		
		063R-15T4H8CL-M	●	32	4	8	63	27	105	24	7	12.4	82		-16		1.1	7,000		
		080R15T5H10CL-M	●	50	5	10	80	32	120	30	8	14.4	101		-15		2.4	6,200		

For inserts with a corner radius (RE) ≥ 4.0 mm, toolholder modification is required. (See Page 12 for details.)

● : Standard Item

Maximum RPM

Set the spindle speed within the recommended cutting speed range for each workpiece material. Do not operate the cutter at or above the maximum spindle speed. Even under no-load conditions, centrifugal force may cause inserts or components to be ejected, creating a hazardous condition.

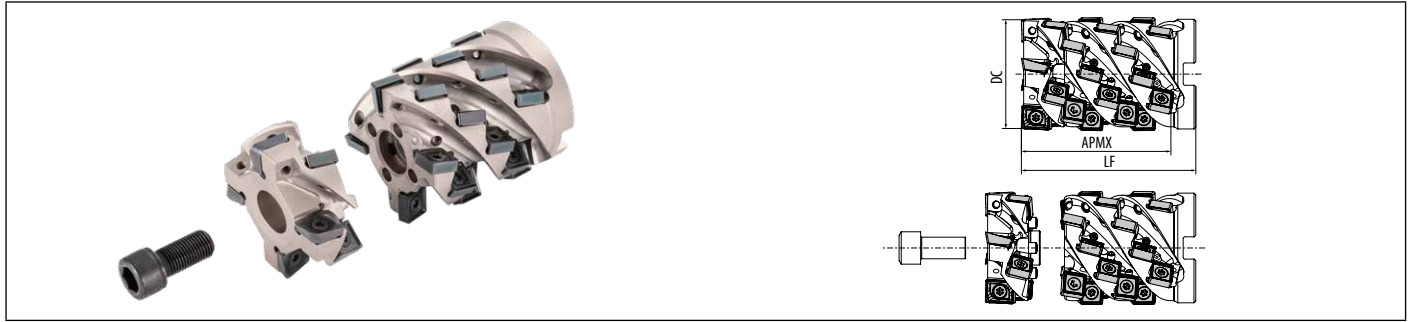
***For through-coolant applications, use a face-through coolant arbor.** The differential mounting screw does not accommodate through-coolant passages.

Spare Parts

Part Number			Arbor Bolt (Differential Screw)	Arbor Wrench (for Differential Screw)	Clamp Screw	Wrench	Mounting Bolt	Coolant Nozzle
								
Shell Mill	Inch	ME90-2000R**	W3/8X49 Torque 15N·m	SB-50100TRP Torque 4.5N·m	TTP-20	HZ10X12	HS4X4-H10	
		ME90-2500R**	W1/2X64 Torque 20N·m			HZ22X15		
		ME90-3000R**	W5/8X60 Torque 28N·m			HZ22X15		
	mm	ME90-050R**	W10X38 Torque 15N·m			HH8X10		
		ME90-063R**	W12X52 Torque 20N·m			HZ22X15		
		ME90-080R**	W16X48 Torque 28N·m			HZ22X15		
Exchangeable Head	Inch	ME90-2500R**-B	W1/2X64 Torque 20N·m			HH12X30EF		
		ME90-3000R**-B	W5/8X60 Torque 28N·m			HH16X30EF		
	mm	ME90-063R**-B	W12X52 Torque 20N·m			HH12X25F		
		ME90-080R**-B	W16X48 Torque 28N·m			HH16X30EF		

ME90 | Exchangeable Head

Base Unit + Front Piece



Toolholder Dimensions

Unit	Base Unit + Front Piece	No. of Inserts	No. of Flutes	No. of Stages	Dimensions		
					DC	LF	APMX
Inch	ME90-2500R...-B + ME90-2500R...-F	32	4	8	2.500	4.134	3.228
	ME90-3000R...-B + ME90-3000R...-F	50	5	10	3.000	4.764	3.976
mm	ME90-063R...-B + ME90-063R...-F	32	4	8	63	97	82
	ME90-080R...-B + ME90-080R...-F	50	5	10	80	120	101

Base Unit



Toolholder Dimensions

Unit	Part Number	Std. Item	No. of Inserts	No. of Flutes	No. of Stages	Dimensions						A.R. Max. (°)	R.R. Max. (°)	Coolant Hole	Weight (kg)	Max RPM	Applicable Inserts
						DC	DCB	LF	CBDP	KDP	KWW						
Inch	ME90-2500R12T4H6C-B	●	24	4	6	2.500	1.000	3.228	1.063	0.236	0.382	+15	-16	Yes*	1.0	7,000	SNHU1204..
	3000R12T5H8C-B	●	40	5	8	3.000	1.250	3.819	1.063	0.315	0.516		-15		1.7	6,400	
mm	ME90-063R-12T4H6C-B	●	24	4	6	63	27	74	24	7	12.4	+15	-16	Yes*	0.7	7,000	SNHU1204..
	080R-12T5H8C-B	●	40	5	8	80	32	97	30	8	14.4		-15		1.9	6,200	

● : Standard Item

Front Piece



Toolholder Dimensions

Unit	Part Number	Std. Item	No. of Inserts	No. of Flutes	No. of Stages	Dimensions				A.R. Max. (°)	R.R. Max. (°)	Coolant Hole	Weight (kg)	Max RPM	Applicable Inserts	
						DC	LF	LH	DCON						1st Stage	2nd Stage or Higher
Inch	ME90-2500R15T4H2C-F	●	8	4	2	2.500	1.201	0.945	0.748	+15	-16	Yes*	0.3	7,000	LNHT1505..	SNHU1204..
	3000R15T5H2C-F	●	10	5	2	3.000	1.260	0.945	1.063		-15		0.4	6,400		
mm	ME90-063R-15T4H2C-F	●	8	4	2	63	30.5	24	19	+15	-16	Yes*	0.2	7,000	LNHT1505..	SNHU1204..
	080R-15T5H2C-F	●	10	5	2	80	32	24	27		-15		0.4	6,200		

For inserts with a corner radius (RE) ≥ 4.0 mm, toolholder modification is required. (See [Page 12](#) for details.)

● : Standard Item

Maximum RPM

Set the spindle speed within the recommended cutting speed range for each workpiece material. Do not operate the cutter at or above the maximum spindle speed. Even under no-load conditions, centrifugal force may cause inserts or components to be ejected, creating a hazardous condition.

*For through-coolant applications, use a face-through coolant arbor. The differential mounting screw does not accommodate through-coolant passages.

Recommended Cutting Conditions ★ 1st Recommendation ☆ 2nd Recommendation

Chipbreaker	Workpiece Material	Feed Rate (fz: ipt)	Recommended Insert Grade (Vc: sfm)	
			MEGACOAT TOUGH	MEGACOAT NANO EX
			PM335S	PR1835
GM	Titanium Alloy	0.003 ~ 0.004 ~ 0.006	★ 100 ~ 130 ~ 200	☆ 100 ~ 130 ~ 200
	Heat-Resistant Alloy	0.002 ~ 0.003 ~ 0.004	★ 70 ~ 100 ~ 130	☆ 70 ~ 100 ~ 130
	Carbon Steel	0.003 ~ 0.004 ~ 0.006	-	★ 260 ~ 390 ~ 490
	Alloy Steel	0.003 ~ 0.004 ~ 0.006	-	★ 260 ~ 390 ~ 490
	Austenitic Stainless Steel	0.003 ~ 0.004 ~ 0.006	-	★ 200 ~ 330 ~ 430
	Martensitic Stainless Steel	0.003 ~ 0.004 ~ 0.006	-	★ 200 ~ 330 ~ 430
	Precipitation Hardened Stainless Steel	0.003 ~ 0.004 ~ 0.006	-	★ 160 ~ 260 ~ 330

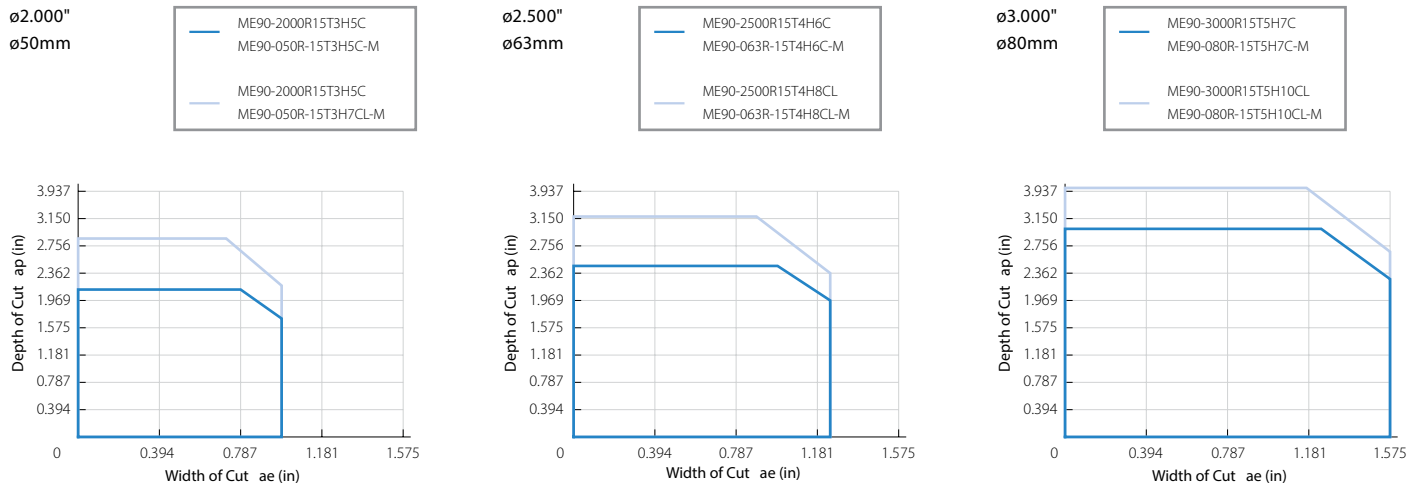
Bold values indicate the recommended starting conditions. Adjust cutting speed and feed rate within the specified ranges based on actual machining conditions.

Machining with coolant is recommended for Ni-based heat-resistant alloys and titanium alloys. When using coolant for other workpiece materials, reduce the cutting speed to 70% or less of the recommended condition.

For long length and exchangeable head types, use approximately 80% of the recommended cutting speed.

Cutting Performance

Shouldering (Vc = 130 sfm, fz = 0.004 ipt, Wet, Ti-6Al-4V, BT50)



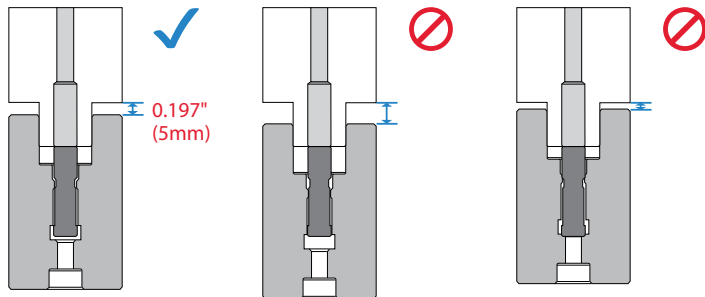
When machining materials other than titanium alloys, limit the axial depth of cut (ap) and/or radial width of cut (ae) to 50% or less of the recommended condition for standard types and 20% or less for long types.

Slotting

Workpiece Material	Machining Operation	ap / ae (in)		Feed Rate fz (ipt)	Cutting Speed Vc (sfm)
		ap	ae		
Titanium Alloy	Slotting	~0.5DC	1DC	0.002 ~ 0.003 ~ 0.004	100 ~ 130 ~ 160

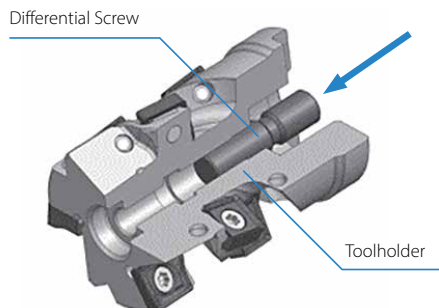
Toolholder Clamping Method

Maintain **0.197" (5mm)** clearance between the cutter body and arbor before tightening.



1. Thread the differential screw into the cutter body until seated.

2. Place the TTP-20 shaft ($\varnothing 0.197$ ") between body and arbor as a spacer.



Insert Clamp Wrench
TTP-20 (20IP)



Arbor Wrench (TW-...) for Mounting Cutter

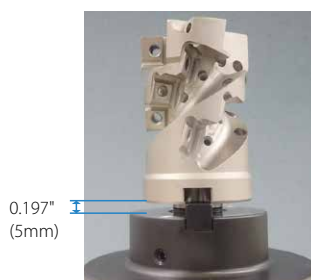


Face-through coolant arbor example

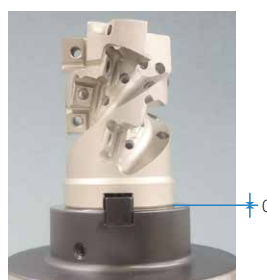
Note: For through-coolant applications, use a face-through coolant arbor.
The differential mounting screw does not accommodate through-coolant passages.

3. Hand-tighten until the body lightly clamps the shaft, then remove it.

4. Tighten with the arbor wrench until the gap closes, to the torque on p.8.



Arbor Wrench (TW-...) for Mounting Cutter



Precautions

How to Replace an Insert

- 1. Completely remove any dust and chips from the insert mounting pocket.
- 2. Apply anti-seize compound to the tapered and threaded portions of the clamp screw.
- 3. Attach the clamp screw to the wrench, then tighten while lightly pressing the insert against the toolholder seating surface.
- 4. Keep the wrench parallel to the clamp screw while tightening.
- 5. Recommended tightening torque: 4.5N·m
- 6. After tightening, confirm that there are no gaps between the insert and the cutter body's support and seating surfaces.



When Using Inserts with a Large Corner Radius (RE ≥ 4.0mm)

When using inserts with a corner radius (RE) of 4.0mm or greater, the cutter body must be modified. Modify the corner of the cutter body using the dimensions shown in the table to the right as a guide.

No modification is required for inserts with a corner radius (RE) of 3.2mm or less.

Insert Corner Radius (RE)	Cutter Body Corner Modification Dimensions (mm)
0.157" (4.00mm)	R2.0
0.197"(5.00mm)	R3.0
0.236" (6.00mm)	R4.0
0.250")6.35mm)	R4.5

An R (radius) modification is recommended for the corners of the cutter body. If chamfering is used instead, take care to avoid overcutting.



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