Helical End Mill for Difficult-to-Machine Materials

ME90

NEW



Stable, long tool life machining of difficult-to-machine materials such as titanium alloys

New high-rigidity toolholder design minimizes deflection

Special arc land geometry for longer tool life

Stable machining with PM335S, a new grade for difficult-to-machine materials



Helical End Mill for Difficult-to-Machine Materials

ME90

Addresses the challenges of machining difficult-to-machine materials such as titanium alloys. Proprietary high-rigidity holder, advanced insert design, and new grade delivers stable performance and long tool life.
Double-sided inserts with 8 cutting edges provide excellent economy.

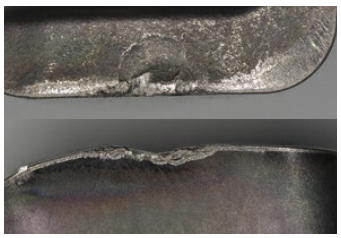
1 Solving titanium alloy machining challenges with stable performance and long tool life

Titanium machining challenges

Unstable machining

Excessive vibration during machining

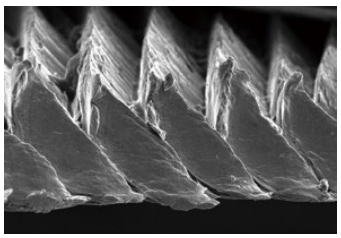
Cutting-edge chipping caused by fluctuating loads can lead to unstable machining



Short tool life

Heat concentrates at the cutting edge, accelerating wear

Serrated chip formation causes fluctuating cutting loads and increases the risk of chipping



High-rigidity toolholder	New high-rigidity holder design minimizes deflection
Proprietary insert	Special arc land geometry for extended tool life
Newly developed grade	Stable machining with PM335S, a new grade for difficult-to-machine materials

MEGACOAT TOUGH

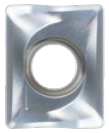
Bottom inserts (1st stage only)

Positive-rake insert with 2 cutting edges for low cutting forces

Available in a wide range of corner radii (RE0.8–RE6.35)

H-class precision insert

Reduced runout ensures stable tool life



Peripheral inserts (2nd stage or above)

Double-sided insert with 8 cutting edges for high cost efficiency

H-class precision insert

Reduced runout ensures stable tool life





2 New high-rigidity toolholder design minimizes deflection

A unique differential screw clamping design and increased holder wall thickness improve rigidity. Minimizes deflection and resists chatter, even in long-overhang applications.

High-strength screw

Increased screw strength with a special root-radius thread design

More than **1.3×** greater tensile strength than conventional designs

Helps prevent screw breakage

Differential screw



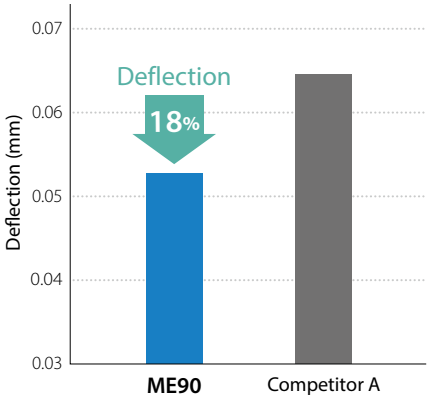
CG Image

Secure insert clamping

Differential screw securely clamps the holder through thread engagement

Promotes stable machining

Toolholder deflection analysis (Internal evaluation)



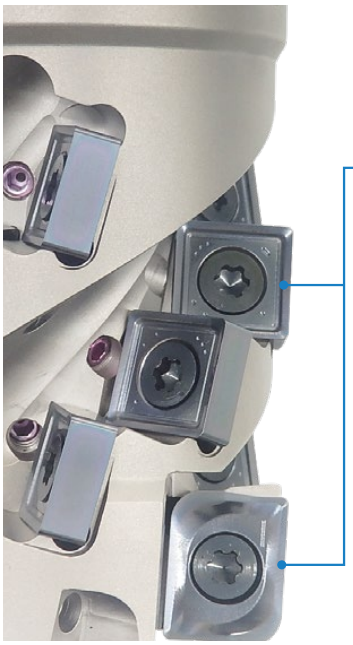
High-rigidity toolholder

Differential screw ensures sufficient holder wall thickness

Suppresses deflection

3 Special arc land geometry for extended tool life

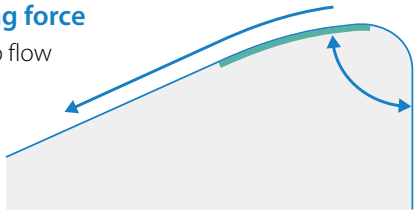
Newly developed special arc land geometry
Achieves the optimal balance between low cutting force and cutting edge strength



ME90

Special arc land geometry

Low cutting force
Smooth chip flow

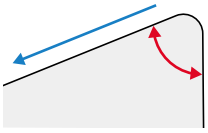


High strength
Ensures cutting edge durability

Conventional

Land-free geometry

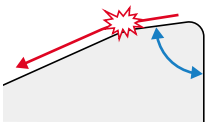
Low cutting force
Smooth chip flow



Low strength
Low cutting edge strength

Land geometry

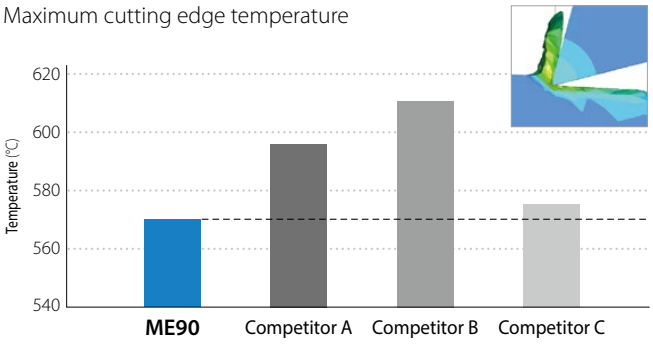
Increased cutting force
The inflection point restricts chip flow



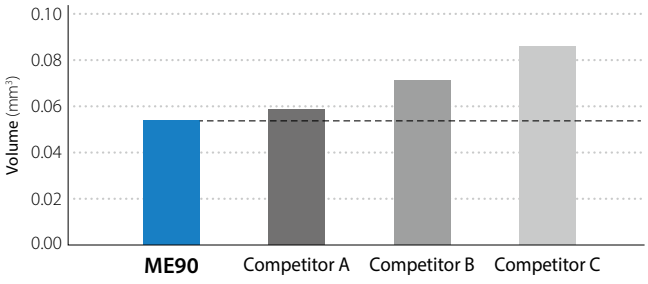
High strength
Ensures cutting edge strength

Simulation results (Internal evaluation)

Maximum cutting edge temperature

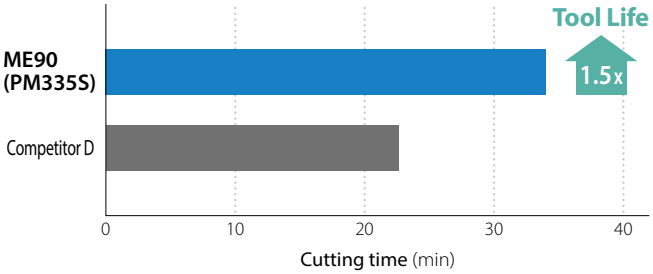


High-stress region volume at the cutting edge



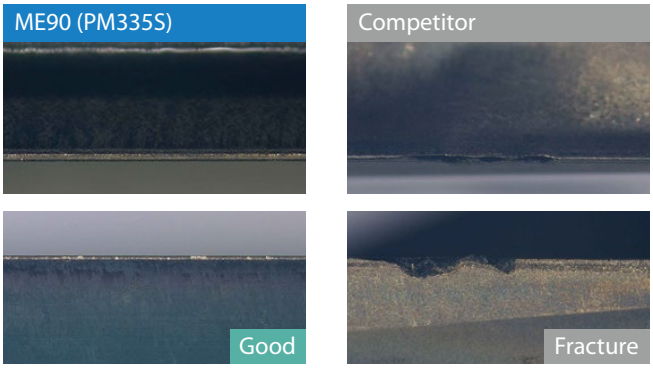
ME90 achieves both lower cutting edge temperature and stress, providing excellent wear resistance and chipping resistance.

Tool life comparison (Internal evaluation)



Vc = 30 m/min (n = 120 min^{-1}), ap × ae = 40×20 mm, fz = 0.1 mm/t
Wet Ti-5553 ø80 BT50

After 22.8 min machining



4 New grade PM335S for stable machining of difficult-to-machine materials

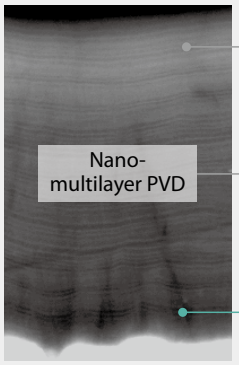
High-adhesion, high-toughness coating improves resistance to chipping

Maintains high strength even at elevated cutting temperatures

Combined with a high-toughness carbide substrate, PM335S delivers stable machining and extended tool life in difficult-to-machine materials, including titanium alloys



Coating



MEGACOAT TOUGH

Utilizes AlCrN with superior resistance to adhesion

AlTiN-based / AlCrN nano-multilayer coating

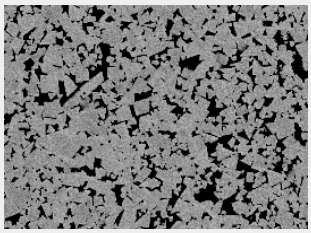
High hot hardness through high-melting-point element addition

Optimized compressive stress improves coating toughness

Special interface layer

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

Carbide substrate

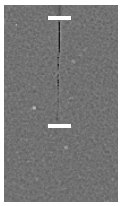


Utilizes a high-toughness carbide substrate

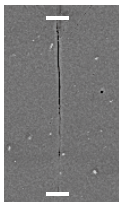
Delivers excellent fracture and wear resistance

Coating fracture toughness comparison (Internal evaluation)

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



PM335S Coating



Conventional Coating

Test Conditions

Equipment: Vickers hardness tester
Load: 25 kgf
Temperature: Room temperature

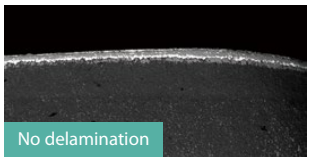
Fracture toughness

1.5x

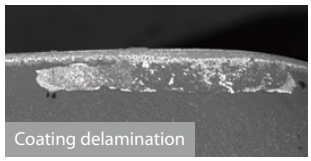
Coating delamination comparison (Internal evaluation)

Special interface layer improves adhesion between the carbide substrate and the coating.

With interface layer



Without interface layer



Vc = 60 m/min, ap × ae = 0.75 × 10 mm, fz = 0.8 mm/t, Wet Ti-6Al-4V (Pocketing) MFH Boost (ø25)

Case studies



Vc = 45 m/min, ap × ae = 55 × 30 mm, fz = 0.1 mm/t, Wet Ti-6Al-4V ø80 BT50

Cutting time

ME90 PM335S	**46**min/edge	Tool life 2x
Competitor A	**23**min/edge	

Video

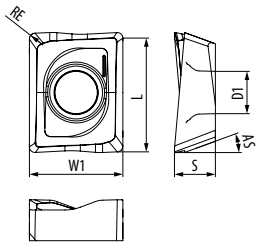
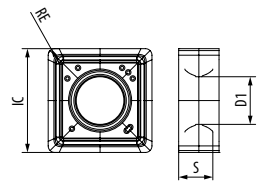
Competitor inserts experienced sudden chipping caused by chip packing.

ME90 (PM335S) maintained a stable cutting edge and continued machining even after twice the cutting time.

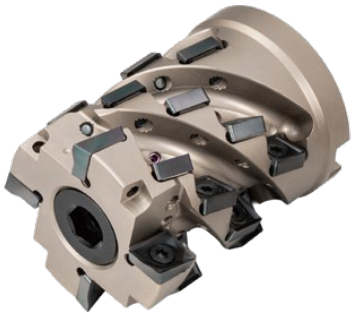
(User evaluation)

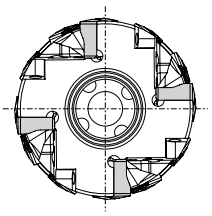
Applicable Inserts

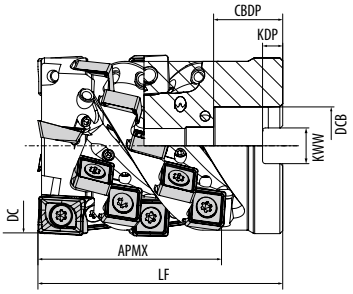
Usage Classification					
★ : Roughing / 1st Choice ☆ : Roughing / 2nd Choice ■ : Finishing / 1st Choice □ : Finishing / 2nd Choice (For hardened materials ≤ 40 HRC)	P	Carbon steel / Alloy steel		★
		Mold steel		
	M	Austenitic stainless steel		★
		Martensitic stainless steel		★
		Precipitation hardened stainless steel		★
	K	Gray cast iron		
		Nodular cast iron		
	N	Non-ferrous metal		
	S	Heat-resistant alloy (Ni-based heat-resistant alloy)	★	☆
		Titanium alloys	★	☆
	H	Hardened materials		

Insert		Description	Dimensions (mm)							Carbide	
			IC	S	D1	RE	L	W1	AS	PM335S	PR1835
 Bottom insert		LNHT150508ER-GM	-	5.6	5.8	0.8	15.5	12.7	20	●	●
		LNHT150516ER-GM				1.6				●	●
		LNHT150520ER-GM				2.0				●	●
		LNHT150530ER-GM				3.0	15.6			●	●
		LNHT150532ER-GM				3.2				●	●
		LNHT150540ER-GM				4.0				●	●
		LNHT150550ER-GM				5.0	15.7			●	●
		LNHT150560ER-GM				6.0	15.8			●	●
		LNHT150564ER-GM				6.35				●	●
 Peripheral insert		SNHU120408ER-GM	12.7	4.2	5.8	0.8	-	-	-	●	●

● : Standard item







Toolholder dimensions

Description			Availability	No. of Inserts	No. of Insert Rows	No. of Stages	Dimensions (mm)							Rake Angle		Coolant Hole	Weight (kg)	Max. revolution (min-1)	Applicable Inserts	
							DC	DCB	LF	CBDP	KDP	KWW	APMX	A.R. (°)	R.R. (°)				1st stage	2nd stage or above
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 type	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 corner radius (RE) ≥ 4.0 mm, modifications to the toolholder are required. (See page 11 for details.)

● : Standard item

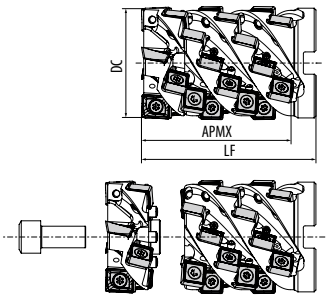
Maximum number of revolutions
Set the spindle speed within the recommended cutting speed range for each workpiece material.
Do not operate the cutter at or above the maximum number of revolutions.
Even under no-load conditions, centrifugal force may cause inserts or components to be ejected, resulting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

Spare parts

Description		Arbor bolt (differential screw)	Arbor wrench (for differential screw)	Clamp screw	Wrench	Mounting bolt	Coolant nozzle
							
Shell mill	ME90-050R**	W10X38	TW-5	SB-50100TRP	TTP-20	HH8X10	HS4X4-H10
		Torque 15N·m		Torque 4.5N·m			
	ME90-063R**	W12X52	TW-6			HZ22X15	
		Torque 20N·m					
	ME90-080R**	W16X48	TW-8				
		Torque 28N·m					
Exchangeable head type	ME90-063R**-B	W12X52	TW-6			HH12X25F	
		Torque 20N·m					
	ME90-080R**-B	W16X48	TW-8			HH16X30EF	
		Torque 28N·m					

Exchangeable head type (Base unit + front piece)



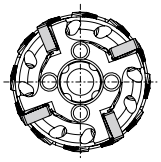


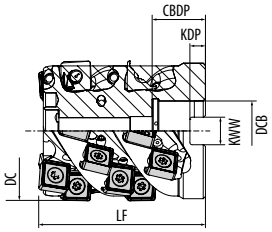
Assembly dimensions

Base unit + front piece	No. of Inserts	No. of Insert rows	No. of Stages	Dimensions (mm)		
				DC	LF	APMX
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







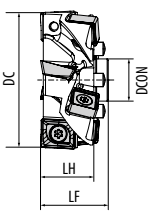
Toolholder dimensions

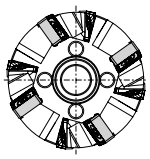
Bore dia.	Description		Availability	No. of Inserts	No. of Insert Rows	No. of Stages	Dimensions (mm)						Rake Angle		Coolant Hole	Weight (kg)	Max. revolution (min-1)	Applicable Inserts
							DC	DCB	LF	CBDP	KDP	KWW	A.R. (°)	R.R. (°)				
Metric	ME90-	063R-12T4H6C-B	●	24	4	6	63	27	74	24	7	12.4	+15	-16	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

Bore dia.	Description		Availability	No. of Inserts	No. of Insert Rows	No. of Stages	Dimensions (mm)				Rake Angle		Coolant Hole	Weight (kg)	Max. revolution (min-1)	Applicable Inserts	
							DC	LF	LH	DCON	A.R. (°)	R.R. (°)				1st stage	2nd stage or above
Metric	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		27		-15		0.4	6,200		

For inserts with corner radius (RE) ≥ 4.0 mm, modifications to the toolholder are required. (See page 11 for details.)

● : Standard item

Maximum number of revolutions

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

Recommended Cutting Conditions ★1st Recommendation ☆2nd Recommendation

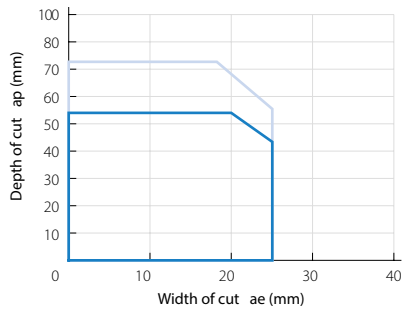
Chipbreaker	Workpiece material	fz (mm/t)	Recommended insert grades	
			MEGACOAT TOUGH	MEGACOAT NANO EX
			PM335S	PR1835
GM	Titanium alloys	0.08 ~ **0.10** ~ 0.15	★ 30 ~ **40** ~ 60	☆ 30 ~ **40** ~ 60
	Ni-based heat-resistant alloys	0.06 ~ **0.08** ~ 0.10	★ 20 ~ **30** ~ 40	☆ 20 ~ **30** ~ 40
	Carbon steel	0.08 ~ **0.10** ~ 0.15	-	★ 80 ~ **120** ~ 150
	Alloy steel	0.08 ~ **0.10** ~ 0.15	-	★ 80 ~ **120** ~ 150
	Austenitic stainless steel	0.08 ~ **0.10** ~ 0.15	-	★ 60 ~ **100** ~ 130
	Martensitic stainless steel	0.08 ~ **0.10** ~ 0.15	-	★ 60 ~ **100** ~ 130
	Precipitation hardened stainless steel	0.08 ~ **0.10** ~ 0.15	-	★ 50 ~ **80** ~ 100

The values in bold are the recommended starting condition. 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.
For long types and modular types, use approximately 80% of the recommended cutting speed.

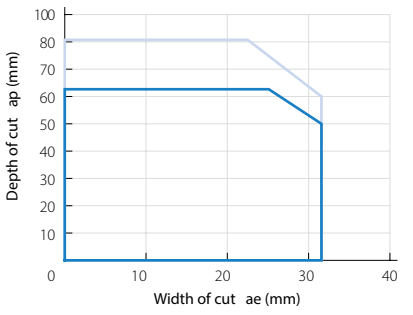
Cutting performance

Shouldering (Vc = 40 m/min, fz = 0.1 mm/t, Wet Ti-6Al-4V BT50)

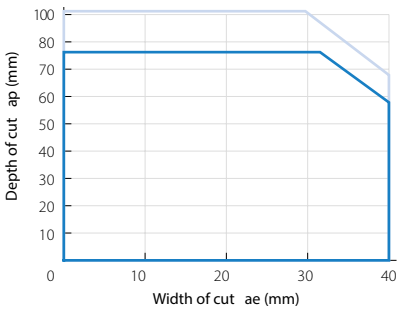
ø50



ø63



ø80



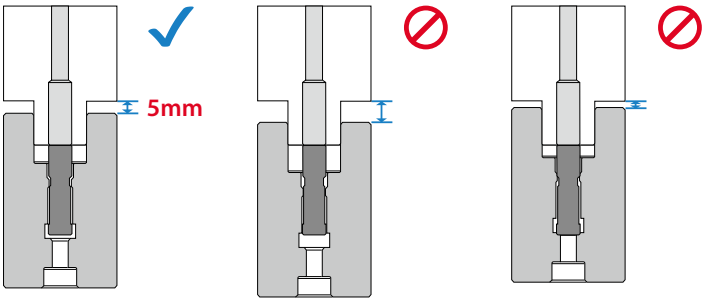
When machining work materials other than titanium alloys, keep the axial depth of cut (ap) or radial width of cut (ae) to 50% or less for the standard type, and 20% or less for the long type.

Slotting

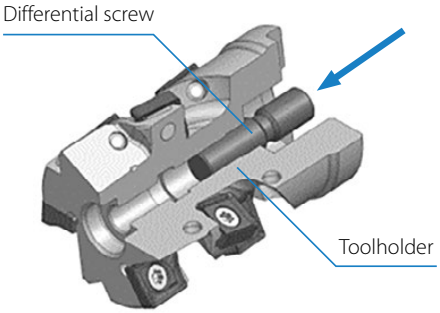
Workpiece material	Machining type	ap / ae (mm)		fz (mm/t)	Vc (m/min)
		ap	ae		
Titanium alloys	Slotting	~0.5DC	1DC	0.06 ~ **0.08** ~ 0.1	30 ~ **40** ~ 50

Holder clamping method

Maintain a **5 mm** clearance between the holder and arbor before tightening.



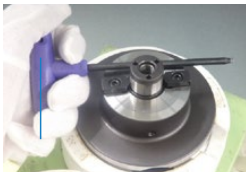
1. Insert the differential screw into the holder, then turn it until it is fully seated.



2. To ensure proper engagement between the holder and the arbor, provide a clearance of approximately 5 mm between the holder and the arbor before tightening the differential screw.

The insert clamping wrench TTP-20 (20IP) has a shaft diameter of ø5 mm.

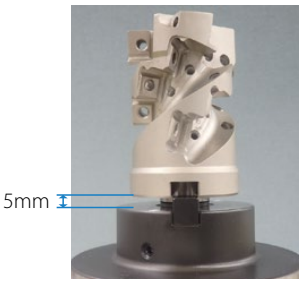
While holding the TTP-20 wrench between the holder and the arbor, tighten the differential screw to maintain the proper clearance.



Insert clamping wrench TTP-20 (20IP)

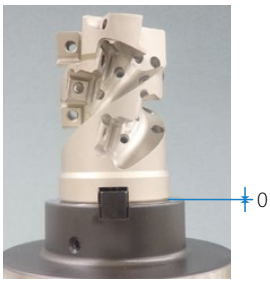


3. As the differential screw is tightened, the TTP-20 wrench becomes clamped between the holder and the arbor, preventing further tightening. At this point, remove the TTP-20 wrench to obtain a 5 mm clearance. Then continue tightening using the hex wrench for cutter mounting.





4. Tighten the differential screw until the clearance is eliminated. Confirm that the holder is securely mounted to the arbor. Refer to the parts list (page 7) for the recommended tightening torque.



Precautions

How to replace an insert



1. Be sure to completely remove dust and chips from the insert mounting pocket.
2. It is recommended to apply an anti-seize compound to the tapered and threaded portions of the clamp screw.
3. Attach the clamp screw to the wrench, then tighten it while lightly pressing the insert against the seating surface of the toolholder.
4. Tighten the wrench in a direction parallel to the clamp screw.
   Recommended tightening torque : 4.5 N·m
5. After tightening, ensure that there are no gaps between the insert seating surface and the holder's support and seating surfaces.

When using inserts with a large corner radius (RE ≥ 4.0)

When using inserts with a corner radius (RE) of 4.0 or greater, additional modification of the cutter body is required.
Modify the corner of the tool body using the dimensions shown in the table on the right as a guide.
(No modification is required for inserts with a corner radius (RE) of 3.2 or less.)

Insert corner radius (RE) (mm)	Tool body corner modification dimensions (mm)
4.00	R2.0
5.00	R3.0
6.00	R4.0
6.35	R4.5

*An R (radius) modification is recommended for the corners of the cutter body.
If chamfering is used, care should be taken to avoid overcutting.

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