

High Performance Milling

# MEV



## New Generation of High Performance, Economical, Multi-functional Milling Cutters

Newly Developed Triangle Inserts Provide Numerous Solutions to Machining Challenges

High Performance - Low cutting forces and Higher Rigidity for Excellent Chatter Resistance

Economical - Longer Insert and Holder Tool Life

Multi-functional - Can be Used in Shouldering, Slotting, and Ramping Applications

**NEW** End Mill (Long Shank Type), Face Mill Added to Lineup



New Triangular  
Insert Design




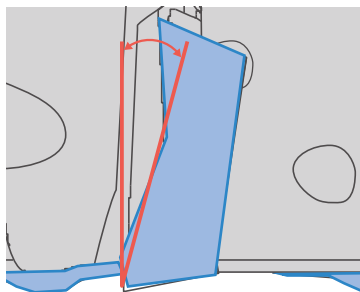
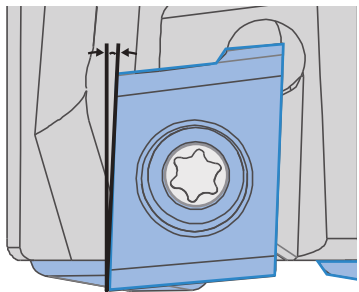

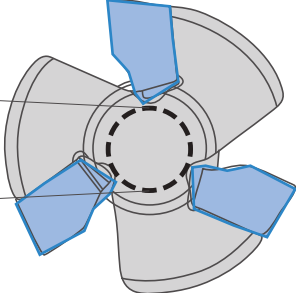
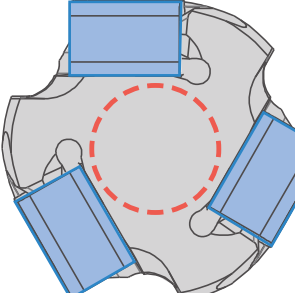
# MEV

Newly Developed Triangular Inserts for Provide Low Cutting Forces and Increased Rigidity  
High Performance, Economical, and Multi-functional Milling Solutions

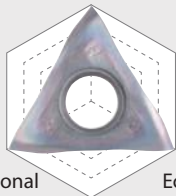
## 1 High Performance: Low Cutting Force and High Rigidity

Newly developed vertical triangle inserts with 3 cutting edges  
Achieve stable machining with reduced chattering

MEV vs Competitor

	MEV (New vertical triangle inserts) <span style="color:red">NEW</span>	Conventional End Mill (Positive inserts)	Conventional End Mill (Vertical inserts)
<b>Cutting Force</b>	A.R. : Large  A.R. Max.+17° Low Cutting Force	A.R. : Large  Low Cutting Force	A.R. : Small  High Cutting Force
<b>Toolholder's Rigidity</b>	Optimal Web Thickness : Large  about 120% Optimal Web Thickness High Rigidity	Optimal Web Thickness : Small  Low Rigidity	Optimal Web Thickness : Large  High Rigidity
	Cutting Force : <b>Low</b> Toolholder's Rigidity : <b>High</b>	Cutting Force : <b>Low</b> Toolholder's Rigidity : <b>Low</b>	Cutting Force : <b>High</b> Toolholder's Rigidity : <b>High</b>

### High Performance



Multi-functional

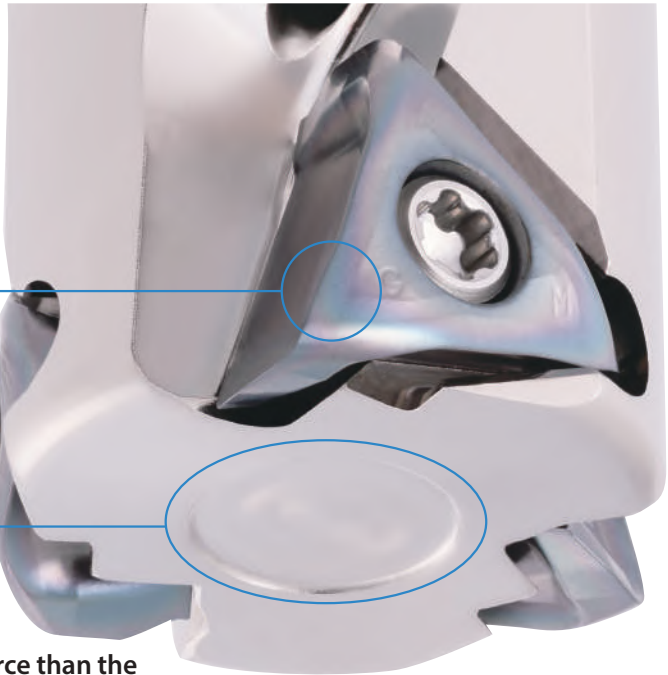
Economical

The MEV's large A.R. produces lower cutting forces and the vertical triangle inserts provide a higher rigidity.

The great performance of the multi-purpose MEV triangle inserts combines both advantages of conventional positive and negative type inserts.

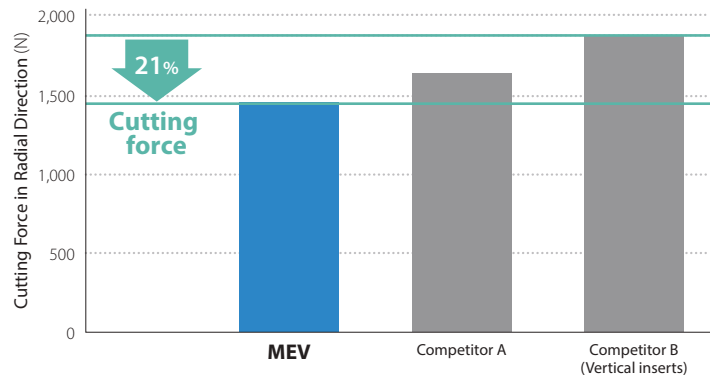
Low cutting force and tough cutting edge

High rigidity web thickness



Keeping A.R. max. at +17°, provides lower cutting force than the positive insert types of competitors

Cutting Force Comparison (Internal evaluation)

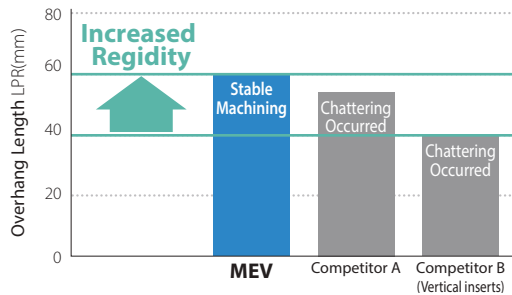


Cutting conditions : Vc = 200 m/min, ap x ae = 3 x 18 mm, fz = 0.10 mm/t, ø20 (3 inserts), Dry Workpiece : SCM440 (H)

Low cutting force and large optimal web thickness provides excellent chattering resistance

Chattering Resistance Comparison (Internal evaluation)

Shouldering



Cutting conditions : Vc = 200 m/min, ap x ae = 3 x 18 mm, fz = 0.10 mm/t, ø20 (3 inserts), Dry Workpiece : SCM440 (H)

Slotting



Cutting conditions : Vc = 220 m/min, ap = 3 mm (Slotting), fz = 0.10 mm/t, ø20 (3 inserts), Dry Workpiece : SCM440 (H)

Provides excellent surface finish and superior cutting accuracy of the wall

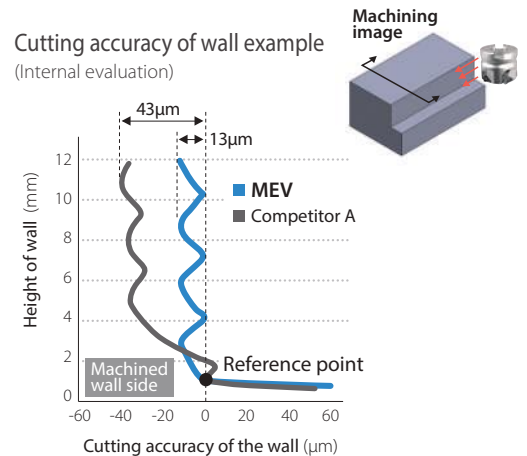
Surface Finish Comparison (Internal evaluation)



Cutting conditions : Vc = 180 m/min, ap x ae = 3 x 40mm, fz = 0.1 mm/t, ø50 (5 inserts), Dry Workpiece : S50C

Cutting accuracy of wall example

(Internal evaluation)



Cutting conditions : Vc = 200 m/min, ap x ae = 3 x 10mm (4 pass), fz = 0.15 mm/t, ø50 (5 inserts), Dry Workpiece : S50C

\*Accuracy of the wall surface varies depending on cutting conditions, machining environment, and insert combination.

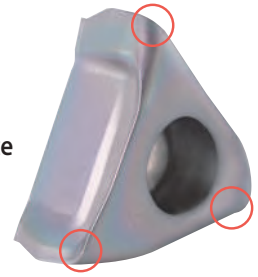
## 2

# The Economical Choice: Lengthened Insert Life with 3 Usable Cutting Edges

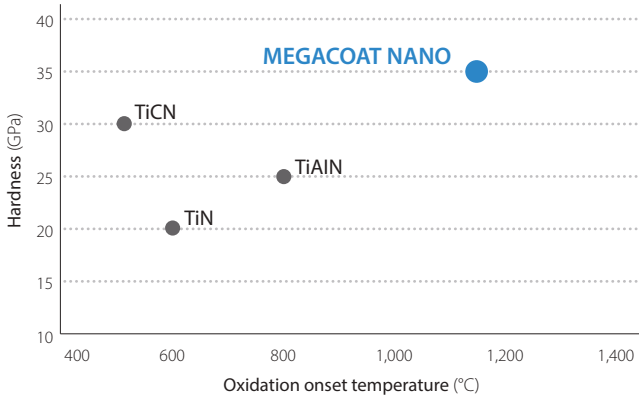
### Insert

Unique triangle inserts with 3 cutting edges

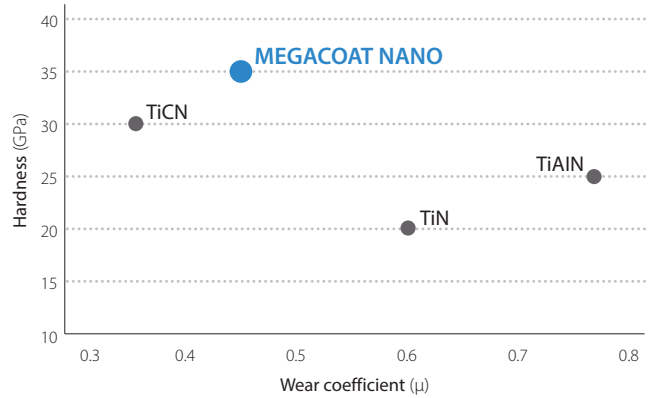
PR15 series utilizes excellent MEGACOAT NANO coating technology with wear and adhesion resistance



Coating Properties (Abrasion resistance)



Coating Properties (Adhesion resistance)



Achieve long tool life with the combination of a tough substrate and a special Nano coating layer

Stable Machining with Excellent Wear Resistance

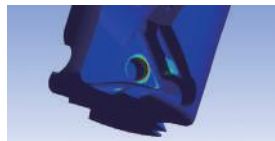
### Toolholder

Engineered with state-of-the-art simulation and analysis technology, the MEV is built to reduce cutting stress on the cutter body

Increased hardness and wide contact surface for improved durability



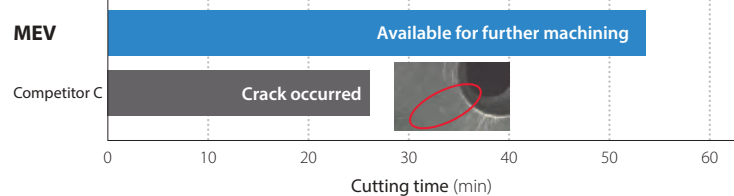
Simulation and analysis (image)



Prevents breakage from toolholder with decreased max. cutting stress

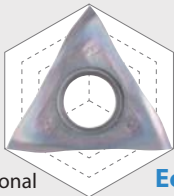
Toolholder Durability Comparison (Internal evaluation)

\*Comparison at high feed rate outside recommended conditions



Cutting conditions :  $V_c = 120$  m/min,  $a_p \times a_e = 5 \times 7.5$  mm,  $f_z = 0.25$  mm/t,  $\phi 20$  (1 insert), Dry Workpiece : SCM440 (H)

High Performance



Multi-functional

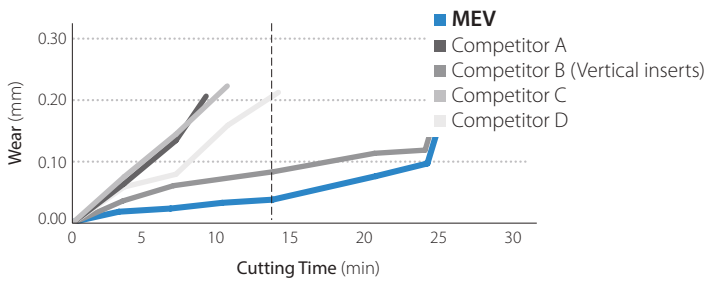
Economical

3 cutting edges combined with PR15 series MEGACOAT NANO coating technology maintains long tool life

Improved toolholder toughness and durability

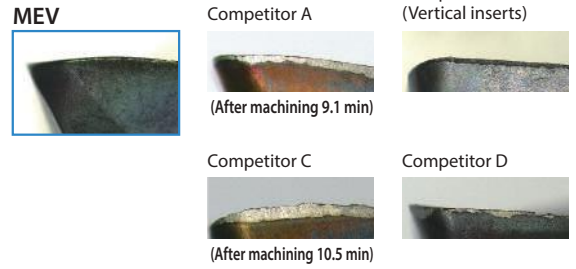
## Long Tool Life with Excellent Wear Resistance

### Wear Resistance Comparison (Internal evaluation)



Cutting conditions :  $V_c = 180$  m/min,  $a_p \times a_e = 3 \times 10$  mm,  $f_z = 0.1$  mm/t,  $\phi 20$ , Dry Workpiece : SKD11 (30~35HS)

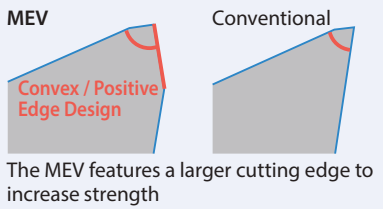
### Cutting Edge (After machining 14 min)



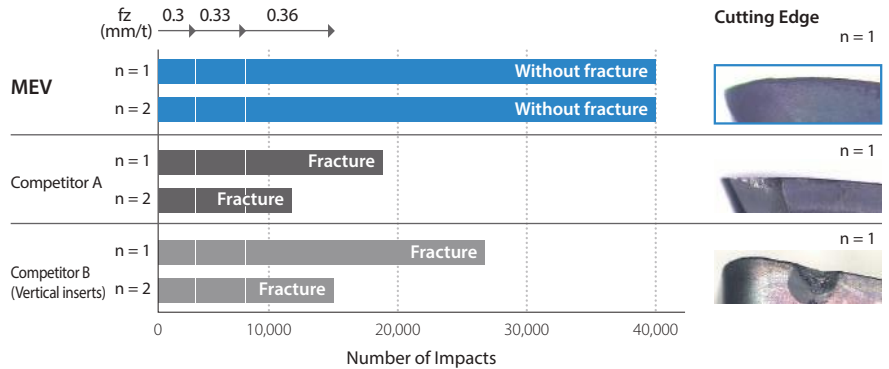
## Improved Stability with Superior Fracture Resistance



### Cutting edge cross-section



### Wear Resistance Comparison (Internal evaluation)



Cutting conditions :  $V_c = 120$  m/min,  $a_p \times a_e = 2 \times 10$  mm,  $f_z = 0.3 - 0.36$  mm/t,  $\phi 20$  (1 insert), Dry Workpiece : SCM440 (H) (37~39HS)

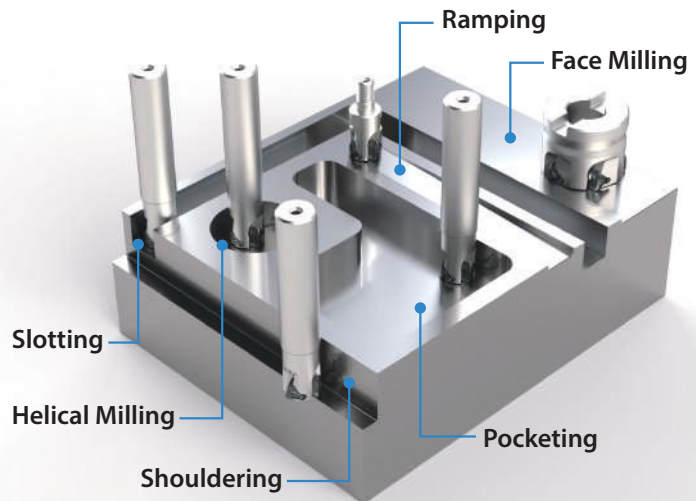
## 3 Multi-functional: The MEV can perform a wide variety of machining processes

Great performance in shouldering, slotting, and ramping applications (D.O.C. 6 mm or less)

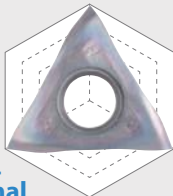
### Chip Example (Slotting)



Cutting conditions :  $V_c = 150$  m/min,  $a_p = 6$  mm (Slotting),  $f_z = 0.2$  mm/t,  $\phi 20$  (3 insert), Dry Workpiece : S5400



High Performance



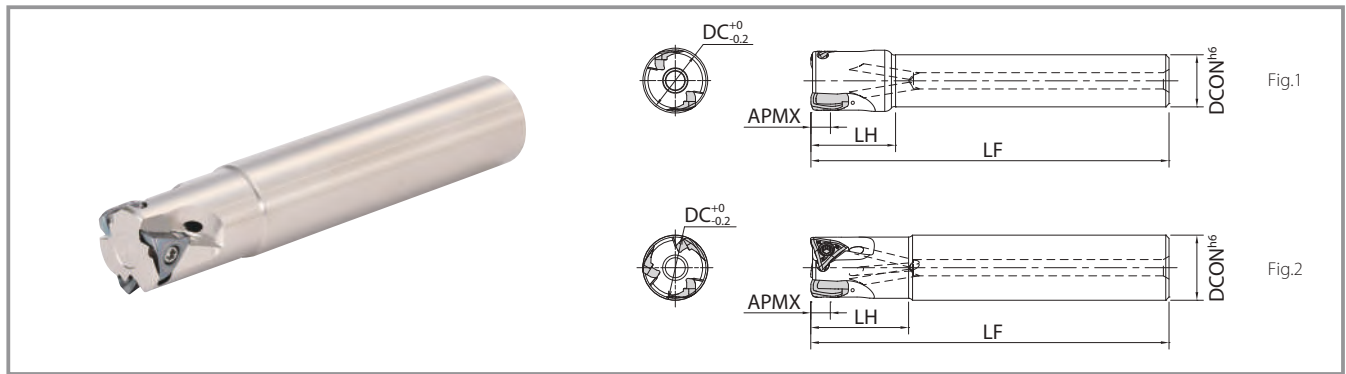
Multi-functional

Economical

Good chip evacuation with a unique insert chipbreaker design

Stable machining in applications like slotting and ramping where chip recutting issues are common

# MEV (End Mills)



## Toolholder Dimensions

Description	Stock	No. of Inserts	Dimensions (mm)					Rake Angle		Coolant Hole	Weight (kg)	Drawing	Max. Revolution (min <sup>-1</sup> )	
			DC	DCON	LF	LH	APMX	A.R.(MAX.)	R.R.					
Straight Shank	Standard (Straight)	MEV 20-S16-06-2T	●	2	20	16	110	26	6	+17°	Yes	Fig.1	●	32,000
			●	2	22	20							29,000	
		MEV 22-S20-06-3T	●	3	25	20	120	29					●	25,000
			●	3	28	25							23,000	
		MEV 25-S20-06-3T	●	4	30	25	130	32					●	21,500
			●	4	32	30							20,000	
		MEV 28-S25-06-3T	●	5	40	32	150	50					●	16,000
			●	5	50	32							120	40
	Same Size Shank	MEV 20-S20-06-2T	●	2	20	20	110	30	6	+17°	Yes	Fig.2	●	32,000
			●	3									25	25
			●	2	32	32	130	40					●	20,000
			●	3									●	0.7
			●	3									●	0.4
			●	4									●	0.2
Long Shank	MEV 20-S18-06-150-2T	●	2	20	18	30	6	+17°	Yes	Fig.1	32,000			
		●			20	40								
		●	2	25	25	170						50	Fig.2	25,000
		●		32	32	200						65		
Long Shank (fine pitch)	MEV 20-S18-06-150-3T	●	3	20	18	30	6	+17°	Yes	Fig.1	32,000			
		●			20	40								
		●	3	25	25	170						50	Fig.2	25,000
		●		32	32	200						65		

### Caution with Max. Revolution







Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on page P9.

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

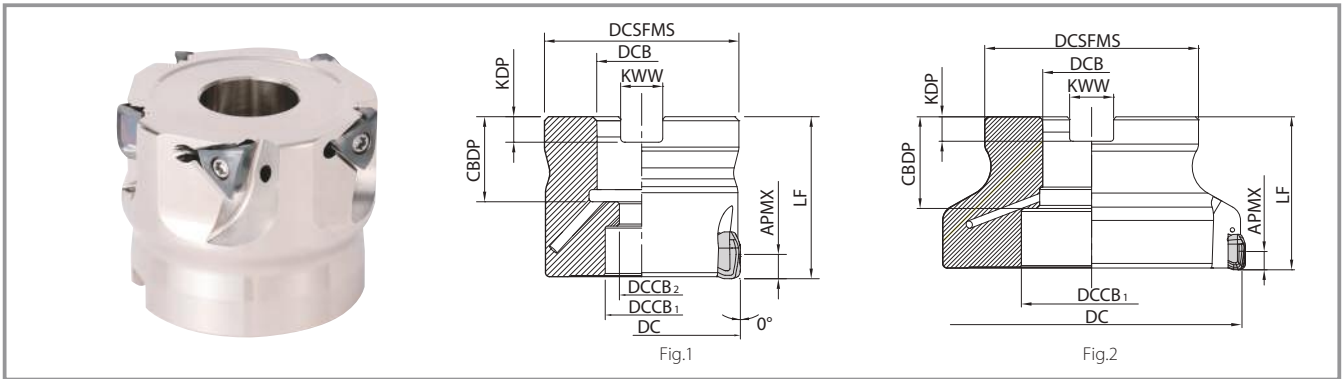
Coat anti-seize compound thinly on portion of taper and thread prior to installation.

● : Standard Stock

## Spare Parts and Applicable Inserts

Description		Parts				Applicable Inserts					
		Clamp Screw	Wrench	Anti-Seize Compound	Arbor Bolt						
End Mills	MEV ...-06-...T					General Purpose	Low Cutting Force				
Face Mills	MEV 032R-06-4T-M					SB-3076TRP	DTPM-10	P-37	-	TOMT06...-GM	TOMT06...-SM
	040R-06-5T-M										
	050R-06-5T-M										
	063R-06-6T-M										
	080R-06-7T(-M)										
100R-06-9T(-M)											
Modular Heads	MEV 20-M10-06-2T					Recommended torque for insert screw 2.0 N·m				-	
	20-M10-06-3T										
	25-M12-06-3T										
	32-M16-06-4T										

## MEV (Face Mills)



### Toolholder Dimensions

Description	Stock	No. of Inserts	Dimensions (mm)											Rake Angle		Coolant Hole	Drawing	Weight (kg)	Max. Revolution (min <sup>-1</sup> )
			DC	DCSFMS	DCB	DCCB <sub>1</sub>	DCCB <sub>2</sub>	LF	CBDP	KDP	KWW	APMX	A.R. (MAX.)	R.R.					
Coarse pitch Bore Dia. Metric spec	●	4	MEV 032R-06-4T-M	32	30	16	13.5	9	35	19	5.6	8.4	*6	+17°	-35°	Yes	Fig.1	0.1	20,000
			040R-06-5T-M	40	38	16	15	9	40									0.2	16,000
			050R-06-5T-M	50	48	22	18	11	40									21	6.3
			NEW 063R-06-6T-M	63	48	22	18	11	40	21	6.3	10.4						0.6	10,000
			NEW 080R-06-7T-M	80	60	27	20	13	50	24	7	12.4						1.1	7,900
			NEW 100R-06-9T-M	100	70	32	46	-	50	30	8	14.4						1.4	6,300
NEW Bore Dia. Inch spec	●	7	MEV 080R-06-7T	80	60	25.4	20	13	50	27	6	9.5	*6	+15°	-35°	Yes	Fig.1	1.1	7,900
			100R-06-9T	100	70	31.75	46	-	63	34	8	12.7						1.4	6,300

#### Caution with Max. Revolution

Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on page P9.

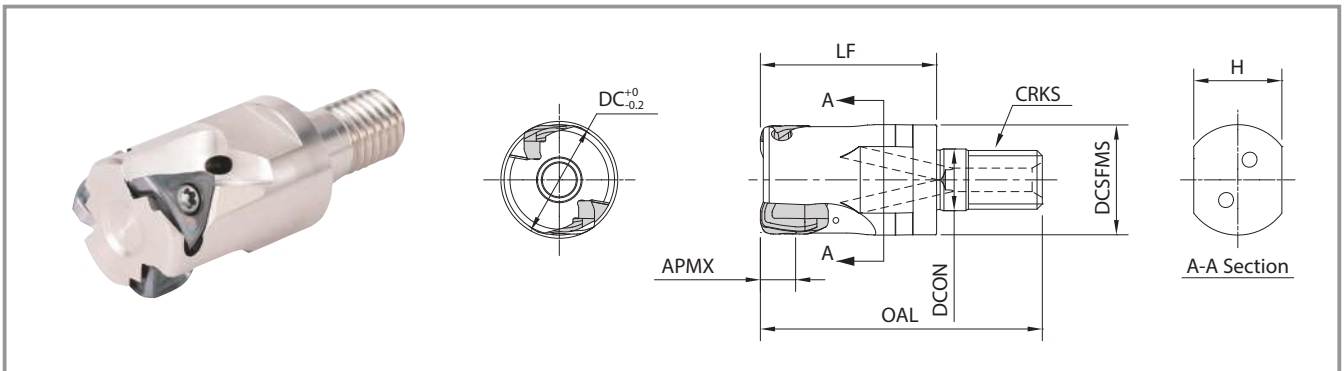
Do not use the end mill or cutter at the maximum revolution or higher since the centrifugal force may cause inserts and parts to scatter even under no load.

Coat anti-seize compound thinly on portion of taper and thread prior to installation.

\*For cutting depth of shouldering with cutter diameter DC $\phi$ 63 or more (Width of cut ae  $\geq$  DC/4) and slotting, refer to the recommended chipbreaker range on P8.

● : Standard Stock

## MEV (Modular Heads)



### Toolholder Dimensions

Description	Stock	No. of Inserts	Dimensions (mm)								Rake Angle		Coolant Hole	Max. Revolution (min <sup>-1</sup> )			
			DC	DCSFMS	DCON	OAL	LF	CRKS	H	APMX	A.R. (MAX.)	R.R.					
MEV	●	2	20-M10-06-2T	20	18.7	10.5	48	30	M10×P1.5	15	6	+17°	-38°	Yes	32,000		
			20-M10-06-3T	20	18.7	10.5	48	30	M10×P1.5	15							
		3	25-M12-06-3T	25	23	12.5	56	35	M12×P1.75	19						-37°	25,000
			32-M16-06-4T	32	30	17	62	40	M16×P2.0	24						-35°	20,000

#### Caution with Max. Revolution

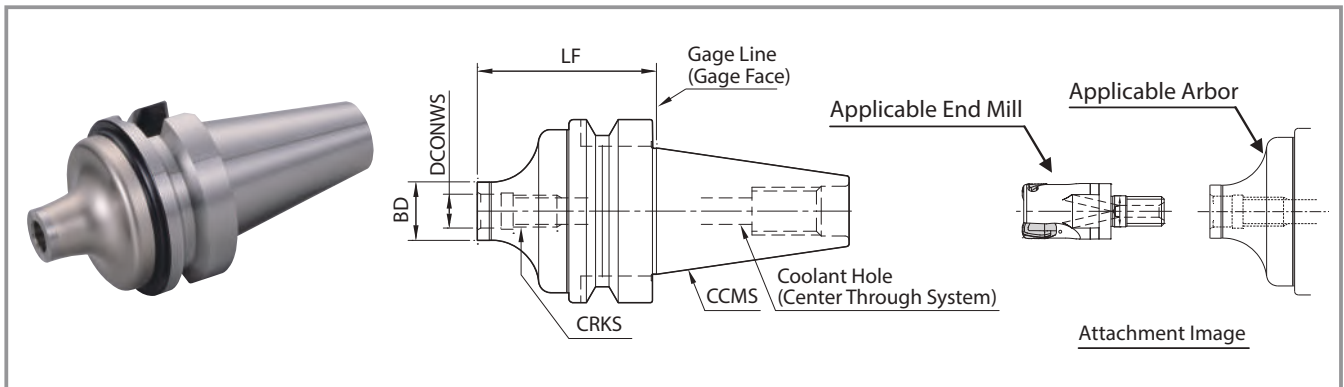
Set the number of revolutions per minute within the recommended cutting speed specified by the workpiece on page P9.

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

Coat anti-seize compound thinly on portion of taper and thread prior to installation.

● : Standard Stock

# BT Arbor for Exchangeable Head / Double-face Clamping Spindle



## Dimensions

Description	Stock	Dimensions (mm)				Coolant Hole	Arbor (Double-face clamping spindle)	
		LF	BD	DCONWS	CRKS		CCMS	Applicable End Mill
BT30K- M10-45	●	45	18.7	10.5	M10×P1.5	Yes	BT30	MEV20-M10..
	●		23	12.5	M12×P1.75			MEV25-M12..
BT40K- M10-60	●	60	18.7	10.5	M10×P1.5	Yes	BT40	MEV20-M10..
	●	55	23	12.5	M12×P1.75			MEV25-M12..
	●	65	30	17	M16×P2.0			MEV32-M16..

● : Standard Stock

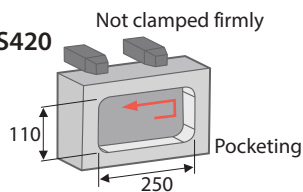
## Actual End Mill Depth

Arbor Description	Applicable End Mill			Actual End Mill Depth (mm)
	Description	Cutting Dia.	Dimensions	LUX
		DC	LF	
BT30K- M10-45	MEV20-M10..	20	30	36.8
	MEV25-M12..	25	35	42.8
BT40K- M10-60	MEV20-M10..	20	30	38.7
	MEV25-M12..	25	35	44.6
	MEV32-M16..	32	40	51.2

## Case study

### Parts for machinery SUS420

Vc = 180 m/min  
 ap × ae = 1 × ~50 mm  
 fz = 0.1 mm/t Dry  
 MEV50-S32-06-5T (5 inserts)  
 TOMT060508ER-GM PR1535



Cutting time

MEV

**vf=575 mm/min**

Machining Efficiency  
 ↑  
**x1.6**

Competitor E

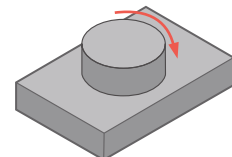
**vf=350 mm/min**

Quiet machining even when cutting speed increased.  
 The MEV shows 1.6 times machining efficiency and good bottom surface finish.

(User evaluation)

### Plate SS400

Vc = 180 m/min  
 ap = 3 mm  
 fz = 0.14 mm/t Dry  
 MEV22-S20-06-3T (ø22-3 inserts)  
 TOMT060508ER-GM PR1525



Number of parts produced

MEV

**160 pcs/corner**

Tool life  
 ↑  
**x2.4**

Competitor F

**65 pcs/corner**



The MEV achieved 2.4 times longer tool life than competitor F.  
 Quieter machining with excellent surface finish.

(User evaluation)

# Applicable Inserts

Insert	Description	Dimensions (mm)					MEGACOAT NANO			CVD Coated Carbide
		IC	S	D1	BS	RE	PR1535	PR1525	PR1510	CA6535
		Classification of usage 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 Material S Heat Resistant Alloy ☆ ★ Titanium Alloy ★ ☆ H Hard Materials □ ★ : Roughing / 1st Choice ☆ : Roughing / 2nd Choice ■ : Finishing / 1st Choice □ : Finishing / 2nd Choice (In Case Hardness is Under 45HRC)								

Insert	Description	Dimensions (mm)					MEGACOAT NANO			CVD Coated Carbide
		IC	S	D1	BS	RE	PR1535	PR1525	PR1510	CA6535
 General Purpose	TOMT 060504ER-GM	7.2	5.7	3.4	1.9	0.4	●	●	●	●
	060508ER-GM				1.5	0.8	●	●	●	●
 Low Cutting Force	TOMT 060508ER-SM	7.2	5.7	3.4	1.5	0.8	●	●	●	●

● : Standard Stock

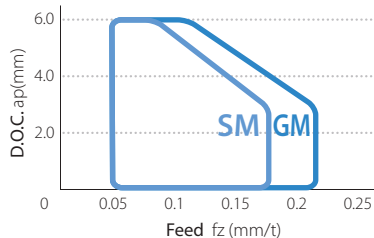
## Recommended Chipbreaker Range

**GM type for General Purpose : Edge Shape Optimized for Various Machining Applications**

**SM type with Low Cutting Force Design : Sharp Cutting and Large Rake Angle**

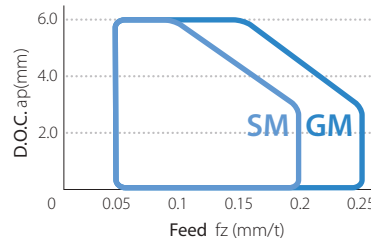
Cutter Dia. :  $\phi 20 \sim \phi 50$

Shouldering



Cutting conditions :  $V_c = 150$  m/min,  $a_e = DC/2$  mm, Workpiece : S50C

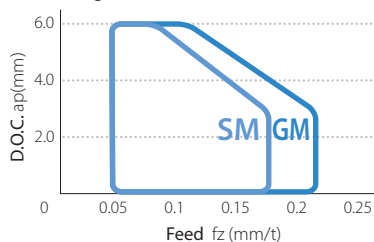
Slotting



Cutting conditions :  $V_c = 150$  m/min,  $a_e = DC$  mm, Workpiece : S50C

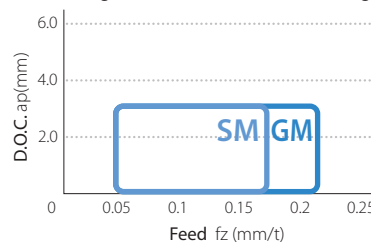
Cutter Dia. :  $\phi 63 \sim \phi 100$

Shouldering (Width of cut  $a_e \leq DC/4$ )



Cutting conditions :  $V_c = 150$  m/min,  $a_e = DC/4$  mm, Workpiece : S50C

Shouldering (Width of cut  $a_e \geq DC/4$ ), Slotting



Cutting conditions :  $V_c = 150$  m/min,  $a_e = DC$  mm, Workpiece : S50C

## Recommended Cutting Conditions ★ : 1st Recommendation ☆ : 2nd Recommendation

Chipbreaker	Workpiece	Feed (fz : mm/t)	Recommended Insert Grade (Cutting Speed Vc : m/min)		
			MEGACOAT NANO		CVD Coated Carbide
			PR1535	PR1525	CA6535
GM	Carbon Steel	0.08 - <b>0.15</b> - 0.25	120 - <b>★180</b> - 250	120 - <b>★180</b> - 250	—
	Alloy Steel	0.08 - <b>0.15</b> - 0.2	100 - <b>★160</b> - 220	100 - <b>★160</b> - 220	—
	Mold Steel	0.08 - <b>0.12</b> - 0.2	80 - <b>★140</b> - 180	80 - <b>★140</b> - 180	—
	Austenitic Stainless Steel	0.08 - <b>0.12</b> - 0.15	100 - <b>★160</b> - 200	100 - <b>★160</b> - 200	—
	Martensitic Stainless Steel	0.08 - <b>0.12</b> - 0.2	150 - <b>★200</b> - 250	—	180 - <b>★240</b> - 300
	Precipitation Hardened Stainless Steel	0.08 - <b>0.12</b> - 0.2	90 - <b>★120</b> - 150	—	—
	Gray Cast Iron	0.08 - <b>0.18</b> - 0.25	—	120 - <b>★180</b> - 250	—
	Nodular Cast Iron	0.08 - <b>0.15</b> - 0.2	—	100 - <b>★150</b> - 200	—
	Ni-base Heat-Resistant Alloy	0.08 - <b>0.12</b> - 0.15	20 - <b>★30</b> - 50	—	20 - <b>★30</b> - 50
	Titanium Alloy	0.08 - <b>0.15</b> - 0.2	40 - <b>★60</b> - 80	—	—
SM	Carbon Steel	0.08 - <b>0.15</b> - 0.2	120 - <b>★180</b> - 250	120 - <b>★180</b> - 250	—
	Alloy Steel	0.08 - <b>0.12</b> - 0.18	100 - <b>★160</b> - 220	100 - <b>★160</b> - 220	—
	Mold Steel	0.08 - <b>0.1</b> - 0.15	80 - <b>★140</b> - 180	80 - <b>★140</b> - 180	—
	Austenitic Stainless Steel	0.08 - <b>0.1</b> - 0.15	100 - <b>★160</b> - 200	100 - <b>★160</b> - 200	—
	Martensitic Stainless Steel	0.08 - <b>0.1</b> - 0.15	150 - <b>★200</b> - 250	—	180 - <b>★240</b> - 300
	Precipitation Hardened Stainless Steel	0.08 - <b>0.1</b> - 0.15	90 - <b>★120</b> - 150	—	—
	Ni-base Heat-Resistant Alloy	0.08 - <b>0.1</b> - 0.12	20 - <b>★30</b> - 50	—	20 - <b>★30</b> - 50
	Titanium Alloy	0.08 - <b>0.12</b> - 0.15	40 - <b>★60</b> - 80	—	—

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. Set the cutting speed and feed rate for wet machining to 70% in the table above.

For high-speed machining, set the feed rate in the table above to 70% (When the cutting speed increases more than the center value of the recommended condition).

Cutting with coolant is recommended for Precipitation Hardening Stainless Steel, Ni-base Heat Resistant Alloy and Titanium Alloy.

Cutting with coolant is recommended for finishing.

Regularly changing the clamp screw is recommended. This is because the clamp screw may be damaged by long-term use or machining under high cutting conditions as shown in the table above.



## Ramping Reference Data

Description	Cutter Dia. DC (mm)	20	22	25	28	30	32	40	50	63~
MEV... -06- ...	Max. Ramping Angle RMPX	1.00°	0.80°	0.65°	0.60°	0.55°	0.50°	0.40°	0.30°	Not recommended
	tan RMPX	0.017	0.014	0.011	0.010	0.010	0.009	0.007	0.005	

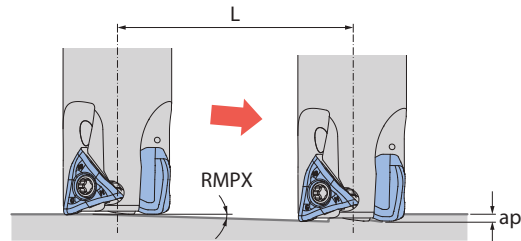
• Make ramping angle smaller if chips are too long.

## Ramping Tips

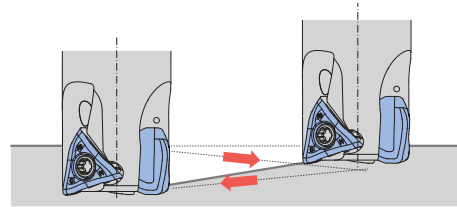
- Ramping angle should be under  $\alpha$  max (maximum ramping angle) in the above cutting conditions.
- Reduce recommended feed rate in cutting conditions less than 70%.

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

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



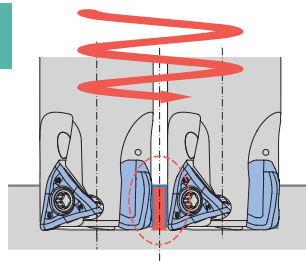
- For two-way ramping, the ramping angle should be half of RMPX.



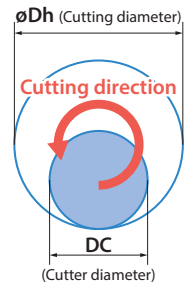
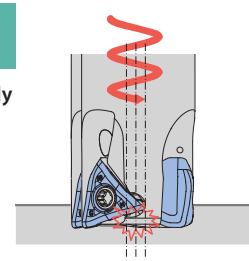
## Helical Milling Tips

For helical milling, use between min. drilling dia. and max. drilling dia.

**Exceeding max. machining dia.**  
Center core remains after machining



**Under min. machining dia.**  
Center core hits holder body



Unit : mm

Description	Min. Cutting Dia.	Max. Cutting Dia.
MEV... -06- ...	$2 \times DC - 5$	$2 \times DC - 2$

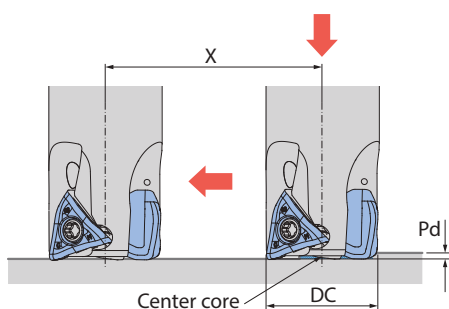
For helical milling, use between min. drilling dia. and max. drilling dia.

Keep machine depth (h) per rotation less than max. ap (S) in the cutter dimensions chart.

Use caution to eliminate incidences caused by producing long chips.

Cutter dia. ø63 and above are not recommended for helical milling.

## Drilling Tips



Unit : mm

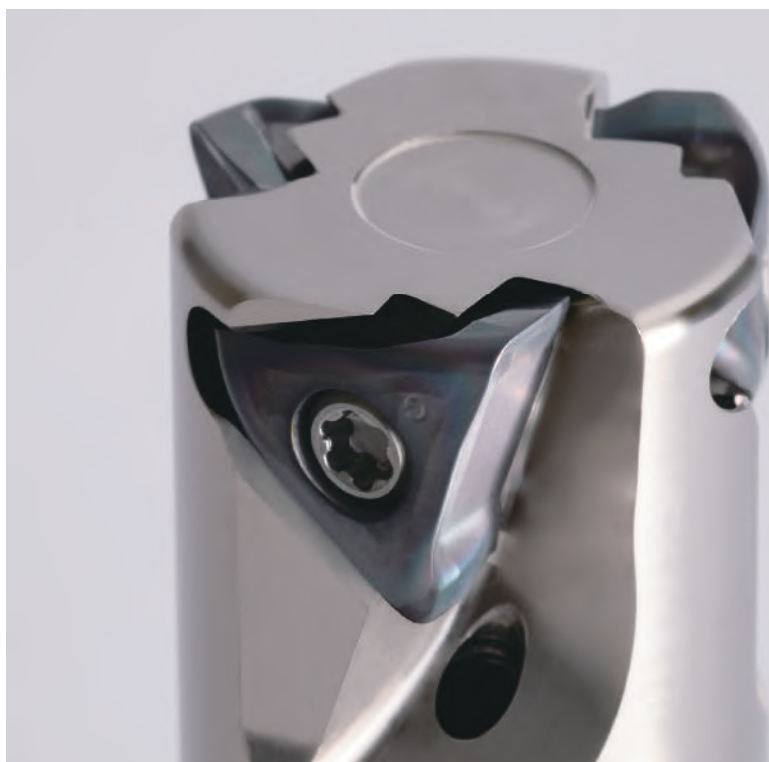
Description	Max. Drilling Depth Pd	Min. Cutting Length X for Flat Bottom Surface
MEV... -06- ...	0.25	$DC - 3$

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  $f < 0.1 \text{ mm/rev}$ .

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## Low Cutting Force



## High Rigidity

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