



M-THREE (MEV)

High Performance Milling



New Generation of High Performance, Economical, Multi-function Milling Cutters

Newly Developed Triangle Inserts Provide Numerous Solutions to Machining Challenges

Low Cutting Forces and Higher Rigidity for Excellent Chatter Resistance

Longer Insert and Holder Tool Life

Can be Used in Shouldering, Slotting, and Ramping Applications

End Mills, Face Mills, and Modular Heads Available



New Triangular
Insert Design



M-THREE (MEV)

High Performance Milling

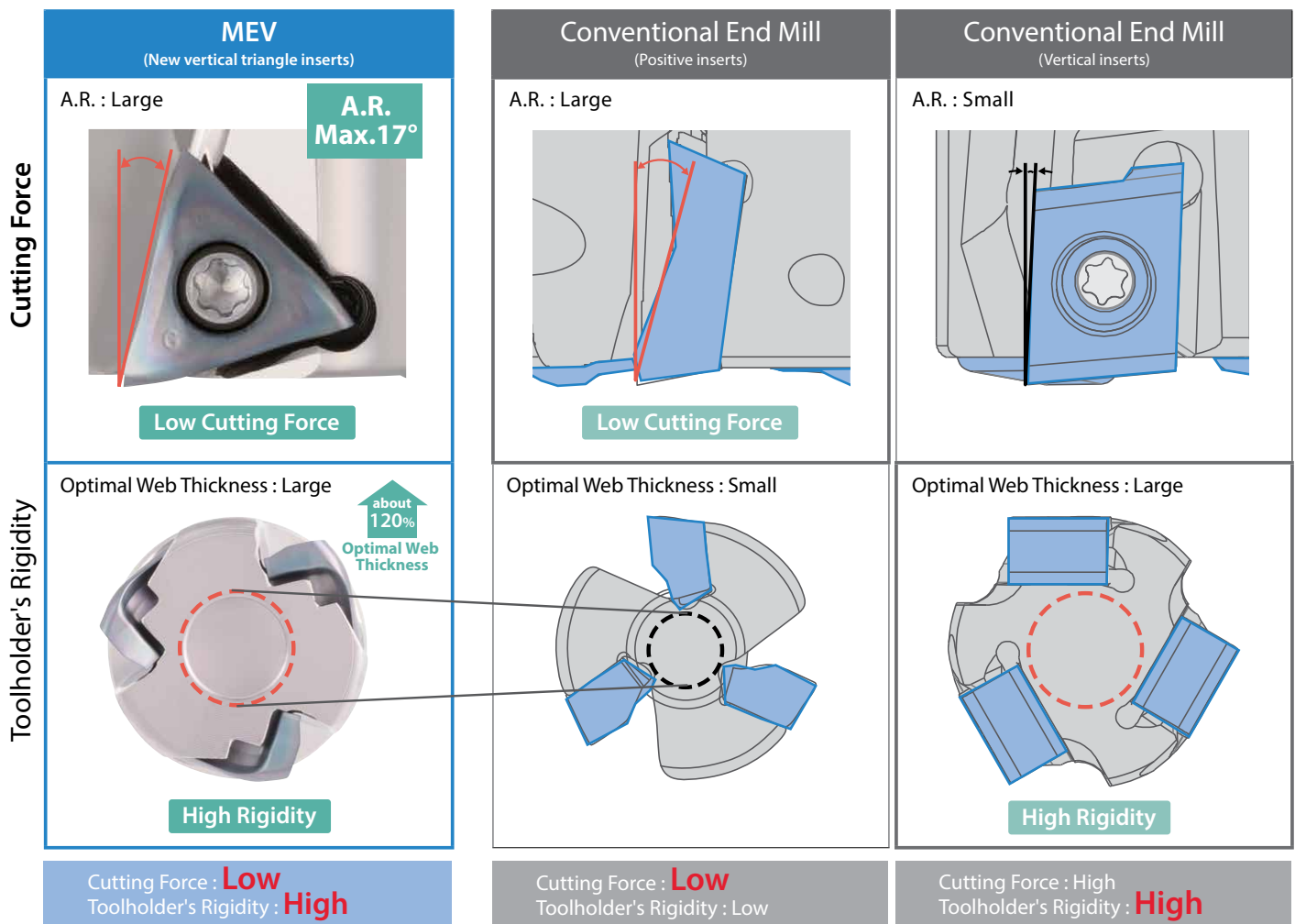


Newly Developed Triangular Inserts Provide Low Cutting Forces and Increased Rigidity
High Performance, Economical, and Multi-functional Milling Solutions

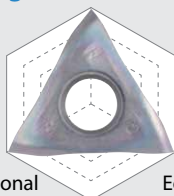
1 High Performance: Low Cutting Force and High Rigidity

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

MEV vs Competitor



High Performance



Multi-functional

Economical

The MEV's large Rake Angle 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.

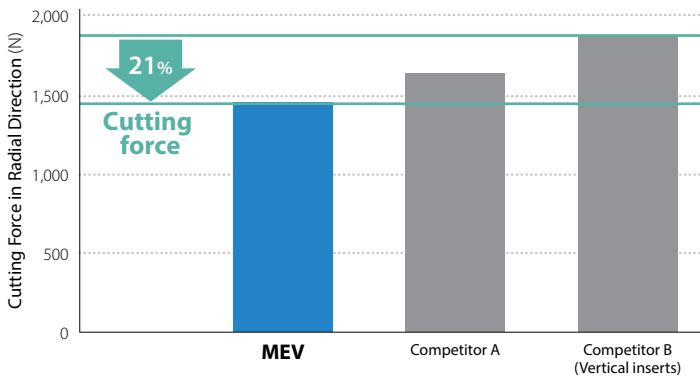
Low Cutting Force and Tough Cutting Edge

High Rigidity Web Thickness



Keeping the max rake angle at 17°, provides lower cutting forces than the positive insert types of competitors

Cutting Force Comparison (Internal Evaluation)

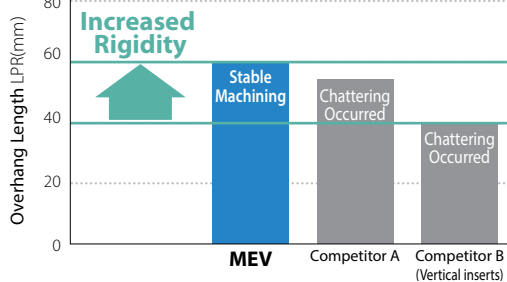
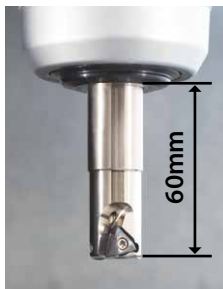


Cutting Conditions: $V_c = 655 \text{ sfm}$, $D.O.C. \times ae = 0.118" \times 0.709"$, $f_z = 0.004 \text{ ipt}$, $\emptyset 0.750"$ (3 flutes), Dry Workpiece : 4140

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

Chatter Resistance Comparison (Internal Evaluation)

Shouldering



Cutting Conditions: $V_c = 655 \text{ sfm}$, $D.O.C. \times ae = 0.118" \times 0.71"$, $f_z = 0.004 \text{ ipt}$, $\emptyset 0.750"$ (3 flutes), Dry Workpiece : 4140 (H)

Slotting

MEV



Competitor A



Competitor B (Vertical Triangle Inserts)



Cutting Conditions: $V_c = 655 \text{ SFM}$, $D.O.C. = 0.118"$ (Slotting), $f_z = 0.004 \text{ ipt}$, $\emptyset 0.750"$ (3 flutes), Dry Workpiece : 4140 (H)

Provides excellent surface finish and perfect 90° shouldering

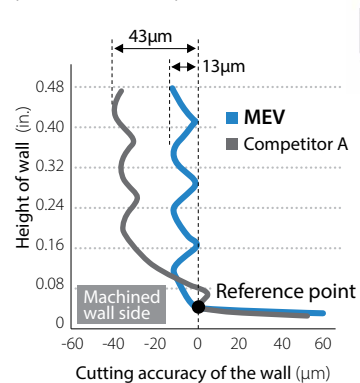
Surface Finish Comparison (Internal Evaluation)



MEV Conventional A

Cutting Conditions: $V_c = 590 \text{ sfm}$, $D.O.C. \times ae = 0.118" \times 1.570"$, $f_z = 0.004 \text{ ipt}$, $\emptyset 2.000"$ (5 flutes), Dry Workpiece : 1049

Wall Accuracy when Step-Milling (Internal Evaluation)



Cutting Conditions: $V_c = 655 \text{ sfm}$, $D.O.C. \times ae = 0.118" \times 0.394"$ (4 pass), $f_z = 0.006 \text{ ipt}$, $\emptyset 2.000"$ (5 inserts), Dry Workpiece : 1049

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

2

The Economical Choice: Improved Insert Life with 3 Cutting Edges

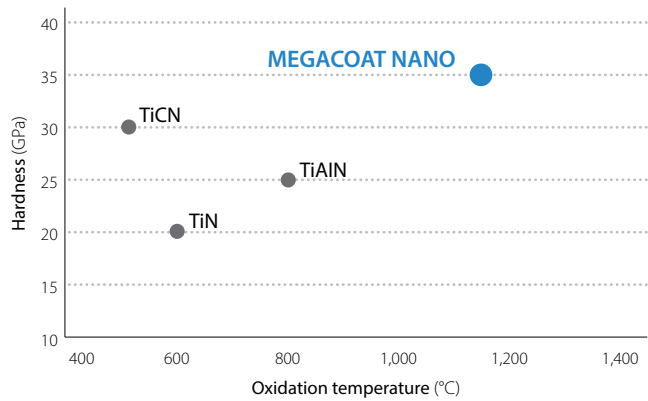
Insert

Unique triangle inserts with 3 cutting edges

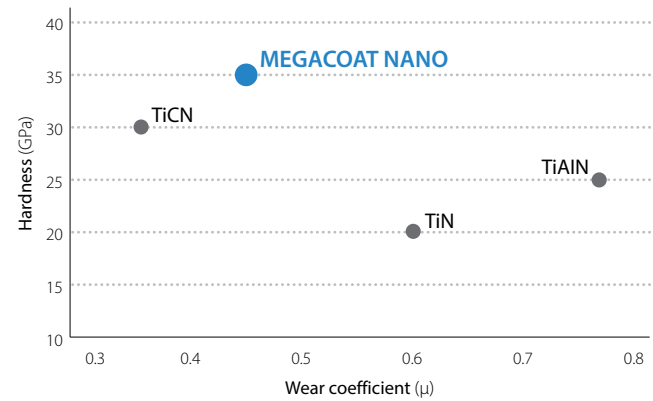
PR15-series utilizes excellent MEGACOAT NANO coating technology with wear and adhesion resistance



Coating Properties (Oxidation Resistance)



Coating Properties (Adhesion Resistance)



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



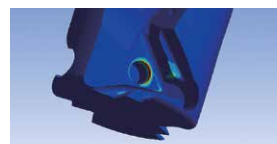
Stable Machining with Excellent Wear Resistance

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



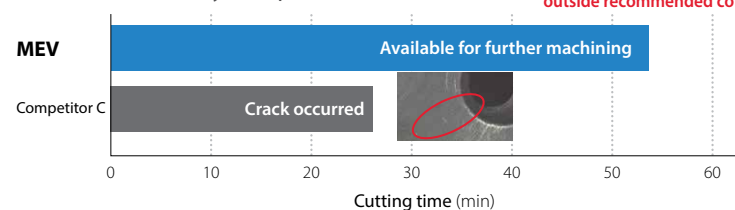
Simulation and Analysis



Prevents breakage from toolholder with decreased max. cutting stress

Toolholder Durability Comparison (Internal Evaluation)

*Comparison at high feed rate outside recommended conditions



Cutting conditions : Vc = 390 sfm, D.O.C. x ae = 0.197" x 0.295", fz = 0.010 ipt, Ø0.750" (1 Flute), Dry Workpiece : 4140 (H)

High Performance

Multi-functional

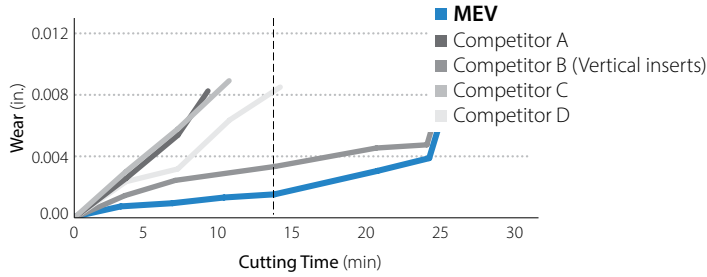
Economical

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

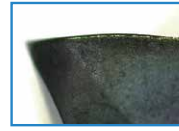
Wear Resistance Comparison (Internal Evaluation)



Cutting conditions : Vc = 590 sfm, D.O.C. \times ae = 0.118" \times 0.394", fz = 0.004 ipt, \emptyset 0.750", Dry Workpiece : D2 (30-35HS)

Cutting Edge (After Machining 14 min)

MEV



Competitor A



Competitor B (Vertical inserts)



Competitor C



Competitor D



Improved Stability with Superior Fracture Resistance

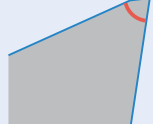


Cutting Edge Cross-Section

MEV

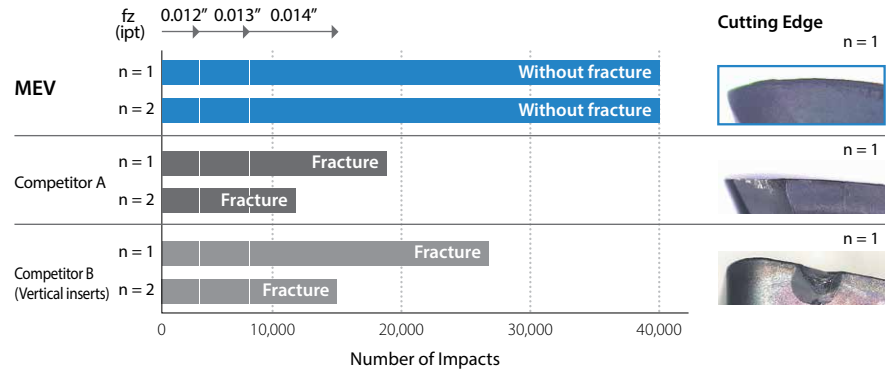


Conventional



The MEV features a convex cutting edge to increase strength

Fracture Resistance Comparison (Internal Evaluation)



Cutting conditions : Vc = 394 sfm, D.O.C. \times ae = 0.079" \times 0.393", fz = 0.012" - 0.014" ipt, \emptyset 0.750" (1 Flute), Dry Workpiece : 4140 (H)

3

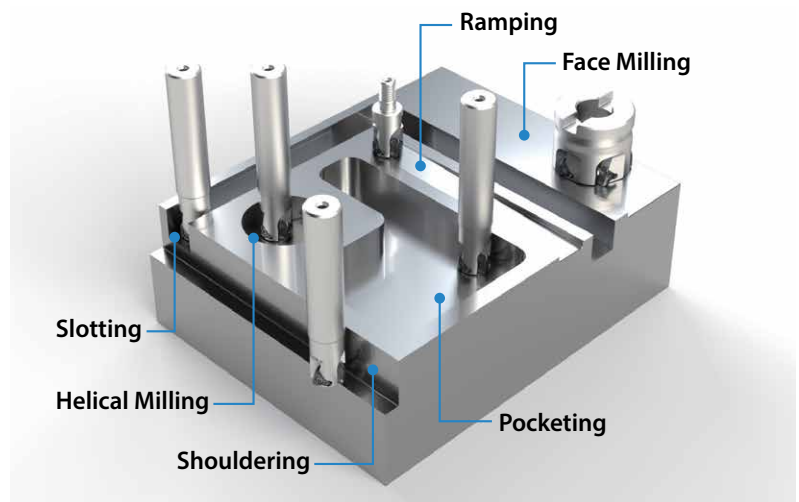
Multi-functional: The MEV Can Perform a Wide Variety of Machining Processes

Great performance in shouldering, slotting, and ramping applications (D.O.C. 0.236" or less)

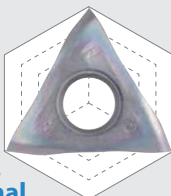
Chip Example (Slotting)



Cutting conditions : Vc = 490 sfm, D.O.C. = 0.236" (Slotting) fz = 0.008 ipt, \emptyset 0.750" (3 Flute), Dry Workpiece : SS400



High Performance

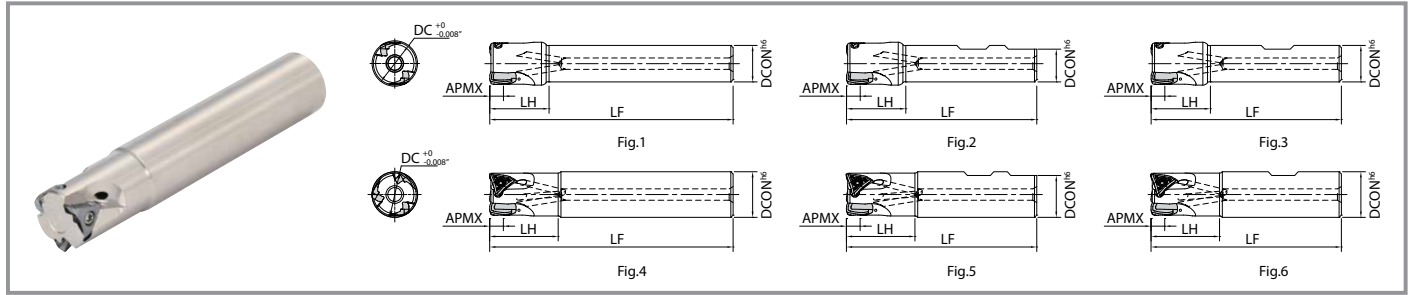


Multi-functional

Economical

Unique insert chipbreaker design provides excellent chip evacuation

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

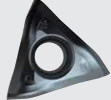
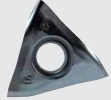


Toolholder Dimensions

	Part Number	Stock	Unit	No. of Inserts	Dimensions					Rake Angle		Coolant Hole	Drawing	Weight (kg)	Max. Revolution (RPM)												
					DC	DCON	LF	LH	APMX	A.R. (MAX.)	R.R.																
Welded	Standard Shank	MEV 0750-W625-06-2T	●	inch	2	0.750	0.625	3.056	1.150	0.236	+17°	-38°	Yes	Fig.3	0.1	32,000											
		0750-W750-06-2T	●		2	0.750	0.750	3.229	1.150					Fig.6	0.2	32,000											
		1000-W750-06-3T	●		3	1.000	0.750	3.231	1.200					Fig.3	0.2	25,000											
		1000-W100-06-3T	●		3	1.000	1.000	3.737	1.400					Fig.5	0.3	25,000											
		1250-W100-06-4T	●		4	1.250	1.000	3.731	1.450					Fig.2	0.4	20,000											
		1250-W125-06-4T	●		4	1.250	1.250	3.987	1.650					Fig.5	0.5	20,000											
Cylindrical	Long Shank	MEV 0750-S750-6-06-2T	●	mm	2	0.750	0.750	6.000	1.600	0.236	+17°	-38°	Yes	Fig.4	0.3	32,000											
		1000-S100-7-06-2T	●		2	1.000	1.000	7.000	2.000					Fig.4	0.6	25,000											
		1000-S100-7-06-3T	●		3	1.000	1.000	7.000	2.000					Fig.4	0.6	25,000											
		1250-S125-8-06-4T	●		4	1.250	1.250	8.000	2.600					Fig.4	1.1	20,000											
		MEV 20-S16-06-2T	●		2	20	16	110	26					6	+17°	-38°	Yes	Fig.1	0.2	32,000							
		20-S20-06-2T	●		2	20	20	110	30									Fig.4	0.2	32,000							
20-S20-06-3T	●	3	20	20	110	30	Fig.4	0.2	32,000																		
22-S20-06-3T	●	3	22	20	110	26	Fig.1	0.2	29,000																		
25-S20-06-3T	●	3	25	20	120	29	Fig.1	0.3	25,000																		
25-S25-06-2T	●	2	25	25	120	32	Fig.4	0.4	25,000																		
Cylindrical	Standard Shank	25-S25-06-3T	●	mm	3	25	25	120	32	6	+17°	-37°	Yes	Fig.4	0.4	25,000											
		28-S25-06-3T	●		3	28	25	120	29					Fig.1	0.4	23,000											
		30-S25-06-4T	●		4	30	25	130	32					Fig.1	0.5	21,500											
		32-S25-06-4T	●		4	32	25	130	32					Fig.1	0.5	20,000											
		32-S32-06-3T	●		3	32	32	130	40					Fig.4	0.7	20,000											
		32-S32-06-4T	●		4	32	32	130	40					Fig.4	0.7	20,000											
		40-S32-06-5T	●		5	40	32	150	50					Fig.1	1.0	16,000											
		50-S32-06-5T	●		5	50	32	120	40					Fig.1	0.9	13,000											
		Cylindrical	Long Shank		MEV 20-S18-06-150-2T	●	mm	2	20					18	150	30	6	+17°	-38°	Yes	Fig.1	0.3	32,000				
					20-S20-06-150-2T	●		2	20					20	150	40					Fig.4	0.3	32,000				
					25-S25-06-170-2T	●		2	25					25	170	50					Fig.4	0.6	25,000				
					32-S32-06-200-2T	●		2	32					32	200	65					Fig.4	1.1	20,000				
					MEV 20-S18-06-150-3T	●		3	20					18	150	30					6	+17°	-38°	Yes	Fig.1	0.3	32,000
					20-S20-06-150-3T	●		3	20					20	150	40									Fig.4	0.3	32,000
25-S25-06-170-3T	●	3	25	25	170	50	Fig.4	0.6	25,000																		
32-S32-06-200-3T	●	3	32	32	200	65	Fig.4	1.1	20,000																		

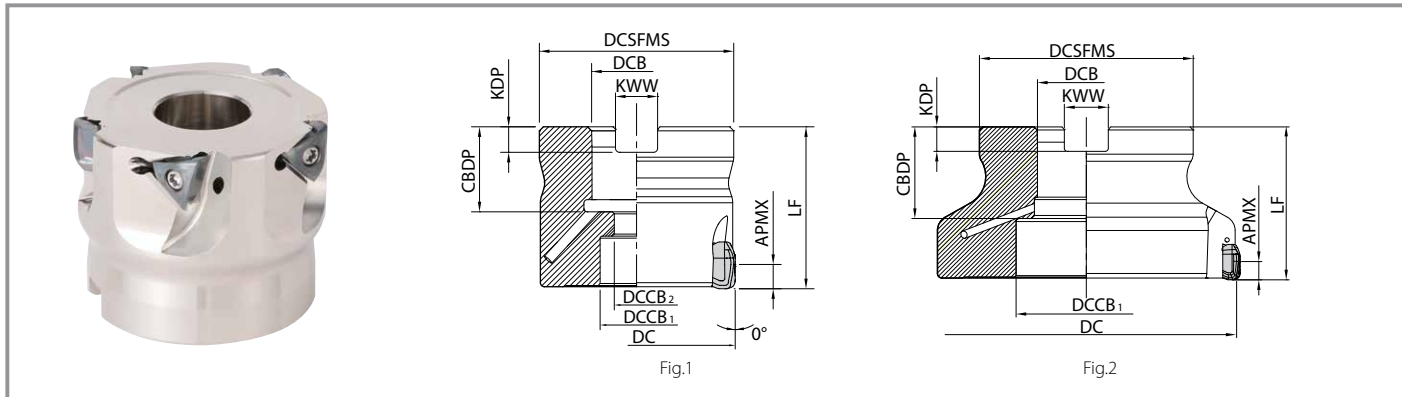
● : Standard Item

Spare Parts and Applicable Inserts

Part Number	Spare Parts				Applicable Inserts				
	Insert Screw	Wrench	Anti-Seize Compound	Arbor Bolt					
End Mills	MEV ...-06-...T			-	TOMT06...-GM	TOMT06...-SM			
Face Mills	MEV 1500R-06-5T	SB-3076TRP	DTPM-10	P-37			HH3/8-1.25		
	MEV 2000R-06-6T							HH8X25	
	MEV 2500R-06-6T								HH10X30
	MEV 032R-06-4T-M								
MEV 040R-06-5T-M	-								
MEV 050R-06-5T-M	-								
Modular Heads	MEV 20-M10-06-2T	Recommended torque for insert screw 2.0 Nm				-			
	MEV 20-M10-06-3T					-			
	MEV 25-M12-06-3T					-			
	MEV 32-M16-06-4T					-			

Caution with Max. Revolution

Set the number of revolutions per minute within the recommended cutting speed on P10
 When running an end mill or a cutter at the maximum revolution, the insert or the cutter may be damaged by centrifugal force.
 Coat anti-seize compound thinly on portion of taper and thread prior to installation.



Toolholder Dimensions

Part Number	Stock	Unit	No. of Inserts	Dimensions										Rake Angle		Coolant Hole	Drawing	Weight (kg)	Max. Revolution (RPM)		
				DC	DCSFMS	DCB	DCCB ₁	DCCB ₂	LF	CBDP	KDP	KWW	APMX	A.R. (MAX.)	R.R.						
MEV 1500R-06-5T	●	inch	5	1.500	1.457											+17°	-35°	Yes	Fig.1	0.2	16,000
	●		6	2.000	1.811	0.750	0.669	0.433	1.575	0.750	0.187	0.312	0.236	+16°	0.4	12,500					
	●		6	2.500	1.969											0.6				10,000	
MEV 080R-06-7T	●	mm	7	80	60	1.000"	20	13	50	1.063"	0.236"	0.375"			+15°	-35°	Yes	Fig.1	1.1	7,900	
	●		9	100	70	1.250"	46	-	63	1.339"	0.315"	0.500"	*6						Fig.2	1.4	6,300
MEV 032R-06-4T-M	●	mm	4	32	30		13.5		35						+17°	-35°	Yes	Fig.1	0.1	20,000	
	●		5	40	38	16	15	9	40	19	5.6	8.4							0.2	16,000	
	●		5	50	48	22	18	11		21	6.3	10.4			+16°				0.4	13,000	
	●		6	63	48	22	18	11	40	21	6.3	10.4			+16°				0.6	10,000	
	●		7	80	60	27	20	13	50	24	7	12.4			+15°				1.1	7,900	
	●		9	100	70	32	46	-	50	30	8	14.4							Fig.2	1.4	6,300

Caution with Max. Revolution

Set the number of revolutions per minute within the recommended cutting speed on P10

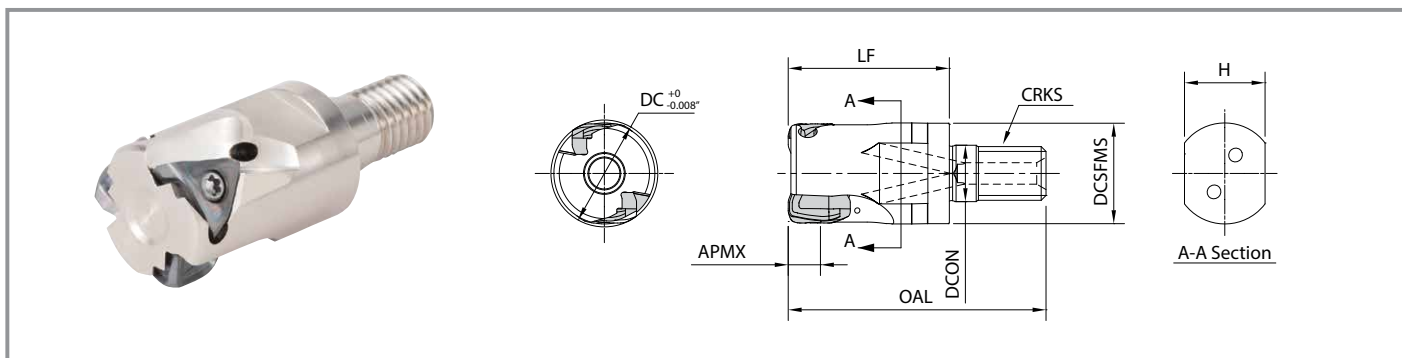
When running an end mill or a cutter at the maximum revolution, the insert or the cutter may be damaged by centrifugal force.

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

*For cutting depth when shouldering with cutter diameter DC = Ø2.500" (Ø63mm) or more (Width of cut ae ≥ DC/4) and slotting, refer to the recommended chipbreaker range on P9.

● : Standard Item

MEV (Modular Heads)



Toolholder Dimensions

Part Number	Stock	No. of Inserts	Dimensions (mm)							Rake Angle		Coolant Hole	Max. Revolution (RPM)			
			DC	DCSFMS	DCON	OAL	LF	CRKS	H	APMX	A.R. (MAX.)			R.R.		
MEV 20-M10-06-2T	●	2	20	18.7	10.5	48	30	M10×P1.5	15	6	+17°	-38°	Yes	32,000		
20-M10-06-3T	●	3														
25-M12-06-3T	●	3	25	23	12.5	56	35	M12×P1.75	19						-37°	25,000
32-M16-06-4T	●	4	32	30	17	62	40	M16×P2.0	24						-36°	20,000

Caution with Max. Revolution

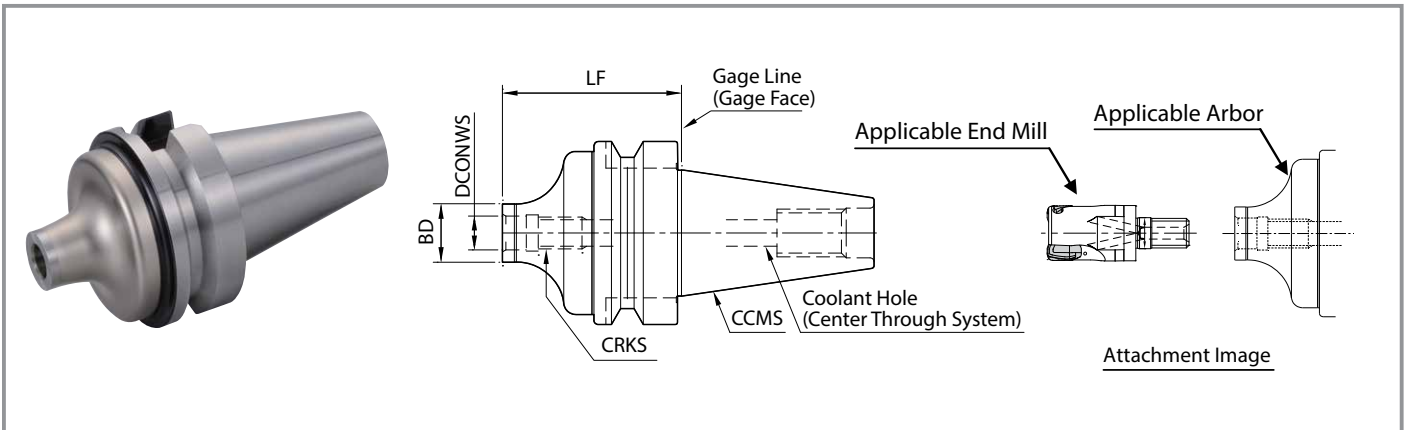
Set the number of revolutions per minute within the recommended cutting speed on P10

When running an end mill or a cutter at the maximum revolution, the insert or the cutter may be damaged by centrifugal force.

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

● : Standard Item

BT Arbor for Exchangeable Head / Double-face Clamping Spindle



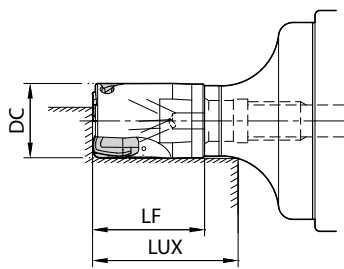
Dimensions

Part Number	Stock	Dimensions (mm)				Coolant Hole	Arbor (Double-face clamping spindle)		Applicable End Mill
		LF	BD	DCONWS	CRKS		CCMS		
BT30K- M10-45	●	45	18.7	10.5	M10×P1.5	Yes	BT30		MEV20-M10-
	●	45	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 Item

Actual End Mill Depth

Arbor Part Number	Applicable End Mill			Actual End Mill Depth (mm)	
	Part Number	Cutting Dia.	Dimensions	LUX	
		DC (mm)	LF (mm)		
BT30K- M10-45	MEV20-M10-	20	30	36.8	
	M12-45	MEV25-M12-	25	35	42.8
BT40K- M10-60	M10-60	MEV20-M10-	20	30	38.7
	M12-55	MEV25-M12-	25	35	44.6
	M16-65	MEV32-M16-	32	40	51.2



Case study

Parts for machinery: 420

Vc = 590 sfm
 D.O.C. x ae = 0.040" x ~1.97"
 fz = 0.004 ipt Dry
 MEV50-S32-06-5T (5 Flutes)
 TOMT060508ER-GM PR1535

Cutting time

MEV

v_f = 22.50 ipm

Machining Efficiency
x1.6

Competitor E

v_f = 13.75 ipm

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

(User Evaluation)

Not clamped firmly

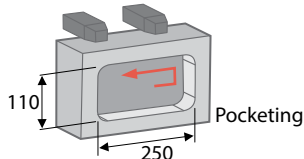


Plate: SS400

Vc = 590 sfm
 D.O.C. = 0.118"
 fz = 0.005 ipt Dry
 MEV22-S20-06-3T (Ø22 - 3 Flutes)
 TOMT060508ER-GM PR1525

Number of parts produced

MEV

160 pcs/corner

Tool life
x2.4

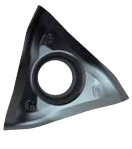
Competitor F

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	Part Number	Dimensions (in)					MEGACOAT NANO			CVD Coating
		IC	S	D1	BS	RE	PR1535	PR1525	PR1510	CA6535
 General Purpose	TOMT 060504ER-GM	0.283	0.224	0.134	0.075	1/64	●	●	●	●
	060508ER-GM				0.059	1/32	●	●	●	●
	TOMT 060508ER-SM	0.283	0.224	0.134	0.059	1/32	●	●		●

Usage Classification

★ : Roughing / 1st Choice
 ☆ : Roughing / 2nd Choice
 ■ : Finishing / 1st Choice
 □ : Finishing / 2nd Choice
 (In Case Hardness is Under 45HRC)

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		□		

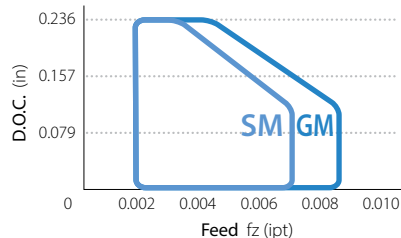
● : Standard Item

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

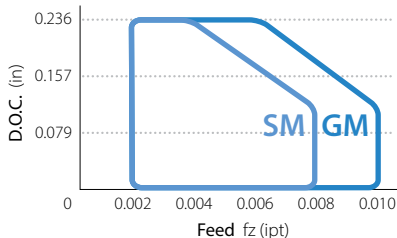
Cutter Dia. : Ø0.750"~Ø2.000" (Ø20mm~Ø50mm)

Shouldering



Cutting conditions : Vc = 490 sfm, ae = DC/2, Workpiece : 1049

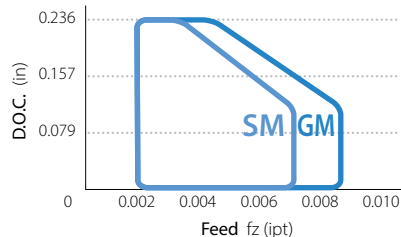
Slotting



Cutting conditions : Vc = 490 sfm, ae = DC, Workpiece : 1049

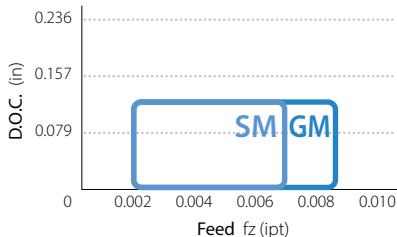
Cutter Dia. : Ø2.500"~Ø4.000" (Ø63mm~Ø100mm)

Shouldering (Width of cut ae ≤ DC/4)



Cutting Conditions : Vc = 490 sfm, ae = DC/4, Workpiece : 1049

Shouldering (Width of cut ae ≥ DC/4), Slotting



Cutting conditions : Vc = 490 sfm, ae = DC, Workpiece : 1049

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

Chipbreaker	Workpiece	Feed (fz : ipt)	Recommended Insert Grade (Cutting Speed Vc : sfm)		
			MEGACOAT NANO		CVD Coating
			PR1535	PR1525	CA6535
GM	Carbon Steel	0.003 – 0.006 – 0.010	☆ 390 – 590 – 820	★ 390 – 590 – 820	—
	Alloy Steel	0.003 – 0.006 – 0.008	☆ 330 – 520 – 720	★ 330 – 520 – 720	—
	Mold Steel	0.003 – 0.005 – 0.008	☆ 260 – 560 – 590	★ 260 – 460 – 590	—
	Austenitic Stainless Steel	0.003 – 0.005 – 0.006	☆ 330 – 520 – 660	☆ 330 – 520 – 660	—
	Martensitic Stainless Steel	0.003 – 0.005 – 0.008	☆ 490 – 660 – 820	—	★ 590 – 790 – 980
	Precipitation Hardened Stainless Steel	0.003 – 0.005 – 0.008	★ 290 – 390 – 490	—	—
	Gray Cast Iron	0.003 – 0.007 – 0.010	—	☆ 390 – 590 – 820	—
	Nodular Cast Iron	0.003 – 0.006 – 0.008	—	☆ 330 – 490 – 660	—
	Ni-base Heat-Resistant Alloy	0.003 – 0.005 – 0.006	☆ 60 – 100 – 160	—	★ 60 – 100 – 160
	Titanium Alloy	0.003 – 0.006 – 0.008	☆ 130 – 200 – 260	—	—
SM	Carbon Steel	0.003 – 0.006 – 0.008	☆ 390 – 590 – 820	★ 390 – 590 – 820	—
	Alloy Steel	0.003 – 0.005 – 0.18	☆ 330 – 520 – 720	★ 330 – 520 – 720	—
	Mold Steel	0.003 – 0.004 – 0.006	☆ 260 – 460 – 590	★ 260 – 460 – 590	—
	Austenitic Stainless Steel	0.003 – 0.004 – 0.006	★ 330 – 520 – 660	☆ 330 – 520 – 660	—
	Martensitic Stainless Steel	0.003 – 0.004 – 0.006	☆ 490 – 660 – 820	—	★ 590 – 790 – 980
	Precipitation Hardened Stainless Steel	0.003 – 0.004 – 0.006	☆ 300 – 390 – 490	—	—
	Ni-base Heat-Resistant Alloy	0.003 – 0.004 – 0.005	☆ 60 – 100 – 160	—	★ 60 – 100 – 160
	Titanium Alloy	0.003 – 0.005 – 0.006	★ 130 – 200 – 260	—	—

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

Part Number	Cutter Dia. DC (in)	0.750"	-	1.000"	-	-	1.250"	1.500"	2.000"	2.500" or larger
	Cutter Dia. DC (mm)	20mm	22mm	25mm	28mm	30mm	32mm	40mm	50mm	63mm or larger
MEV... -06- ...	Max. Ramping Angle α max (°)	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	

• Reduce ramping angle if chips are too long

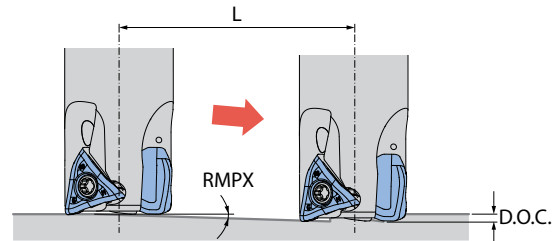
Ramping Tips

Ramping angle should not exceed 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

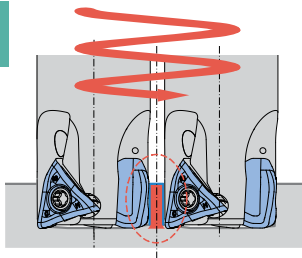
$$L = \frac{\text{D.O.C.}}{\tan \text{RMPX}}$$



Helical Milling Tips

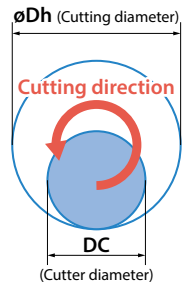
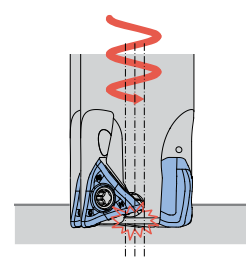
Exceeding max. machining dia.

Center core remains after machining



Under min. machining dia.

Center core hits holder body



Unit : inch

Part Number	Min. Cutting Dia.	Max. Cutting Dia.
MEV... -06- ...	$2 \times DC - 0.197"$	$2 \times DC - 0.079"$

For helical milling, stay within the recommended min. and max. drilling dia.

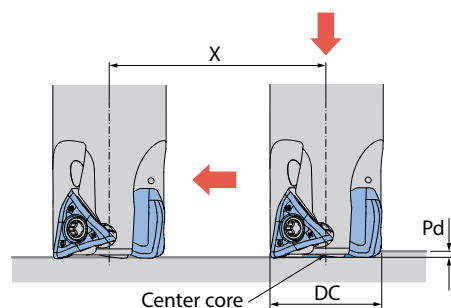
Keep machine depth (h) per rotation less than max. D.O.C. (APMX) in the cutter dimensions chart

Use caution to eliminate incidences caused by producing long chips

Cutter diameters $\geq 2.500"$ ($\geq 63\text{mm}$) and above are not recommended for helical milling.

Drilling Tips

Unit : inch



Part Number	Max. Drilling Depth Pd	Min. Cutting Length X for Flat Bottom Surface
MEV... -06- ...	0.010"	$DC - 0.118"$

Reduce feed by 25% of recommendation until the center core is removed when traversing after drilling

Recommended Axial feed rate per revolution is $f < 0.004$ ipr



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