

SMART MIRACLE End Mill Series for Difficult-to-cut Materials

VQN2MB/4MB/4MBF

NEW

Outstanding Wear Resistance Enables Stable Machining of Heat Resistant Super Alloys



SMART MIRACLE End Mill Series for Difficult-to-cut Materials

VQN2MB/4MB/4MBF

(Al, Ti, Si) N-based coating with outstanding wear resistance, combined with optimised cutting edges, provide high machining efficiency and a stable cutting performance.

Features

(Al, Ti, Si) N-based Coating

The (Al, Ti, Si) based coatings maintain their film hardness and heat resistant properties under the harshest of conditions making it highly suitable for applying to end mills for machining heat resistant super alloys.

New Cutting Edge Geometry

The corner radius cutting edge rake angles have been optimised for consistent contact. Additionally the structure of both the 2 and 4 flutes have been strengthened.



VQN2MB

Versatile 4 Flute Type

When compared to 2-flute types, end mills with 4 flutes have a longer tool life and provide higher efficiency machining. In addition the new types have a much improved chip disposal rate to prevent clogging.

Now available is the new VQN4MBF with a full 4-flute end geometry, ideal for 5 axis machining. The new VQN4MB, with 4 side flutes displays a special end geometry with only 2 flutes, designed with extra space for excellent chip evacuation during rough machining.



VQN4MBF























VQN4MB

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Slot Milling
--------------	----------------------	-----------	------------	----	-------------	--------	----------------	--	--------------

S

Ball End Mill

Medium (ap-3xDC)

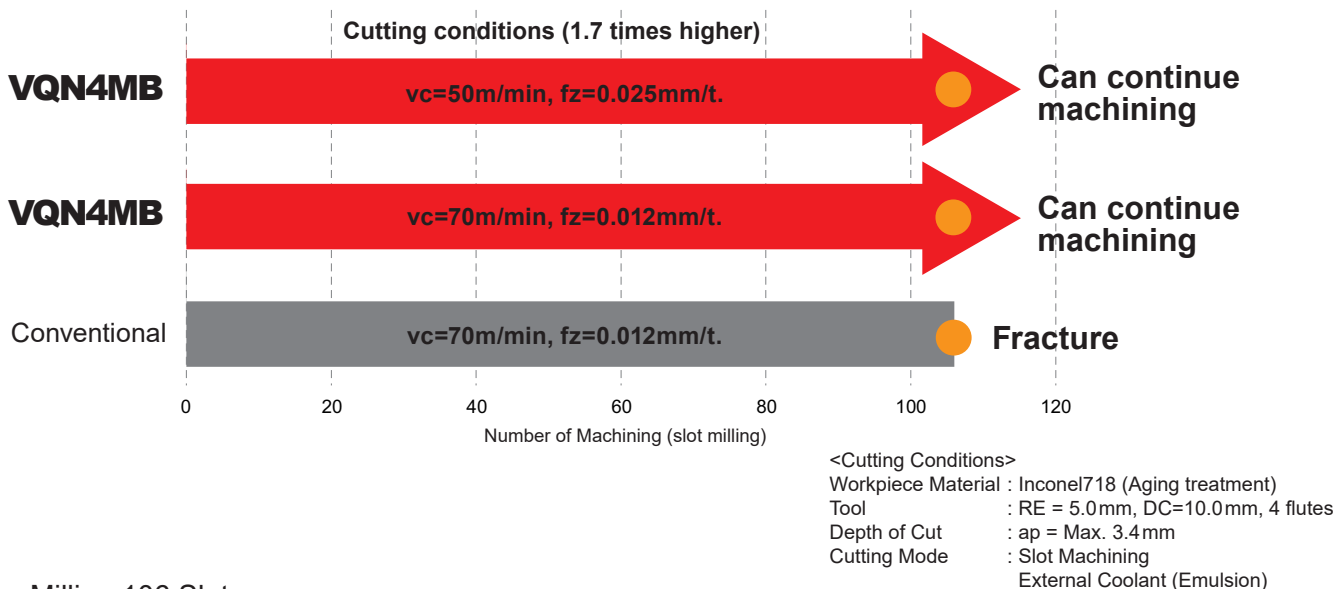
VQN2MB				RE 0.5-1.5	DC	-	2	F  R 	S	○
				RE 2.0-6.0	2-2.4 xDC	-	2	F  R 	S	○
VQN4MB				RE 1.0-6.0	1-2.4 xDC	-	4	F  R 	S	○
VQN4MBF				RE 1.0-6.0	1-2.4 xDC	-	4	F  R 	S	-

- * ap : Depth of Cut
- * DC : Cutting Diameter
- * RE : Radius of Ball Nose

Cutting Performance

Machining Inconel 718 - Comparison of Fracture Resistance

Cutting time has been reduced due to an increased feed rate and an excellent resistance to fracturing during slotting. Ideal for machining heat resistant alloys typically used in the aerospace industry.

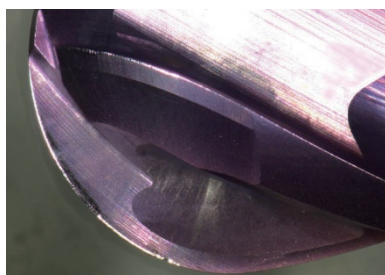


After Milling 106 Slots



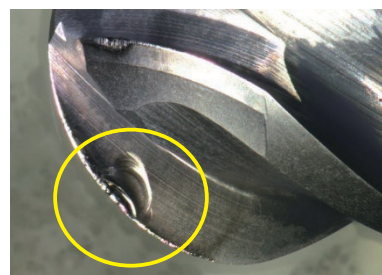
VQN4MB

vc=50m/min, fz=0.025mm/t.



VQN4MB

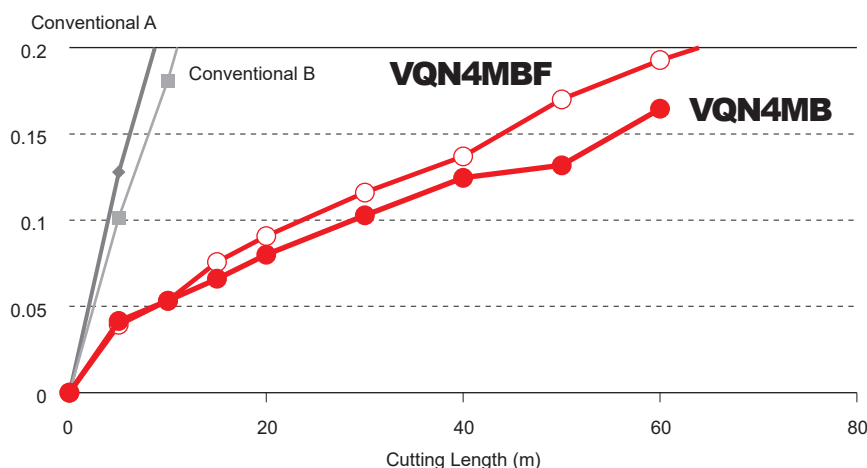
vc=70m/min, fz=0.012mm/t.



Conventional Fracture
vc=70m/min, fz=0.012mm/t.

Machining Inconel 718 - Comparison of Wear Resistance

Both VQN4MBF and VQN4MB have more than four times the wear resistance of conventional products.



4 Times Tool Life

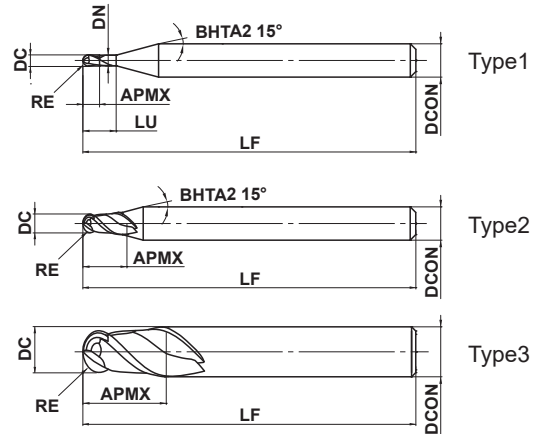
<Cutting Conditions>
 Workpiece Material : Inconel718
 Tool : RE = 3.0 mm, 4 flutes
 Cutting Speed : vc = 40 m/min
 Feed : fz = 0.05 mm/t.
 Depth of Cut : ap = 2.4 mm
 ae = 0.3 mm
 Cutting Mode : Down Cut
 External Coolant (Oil)

VQN2MB NEW

Ball nose, Medium cut length, 2 flute



Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-hardened Steel, Hardened Steel (<=45HRC)	Hardened Steel (<=55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
---	--	--------------------------	-------------------------	----------------------------	----------------------	--------------	-----------------



	RE ≤ 6		
	±0.010		
	DCON = 6	8 ≤ DCON ≤ 10	DCON = 12
	0 - 0.005	0 - 0.006	0 - 0.008

- (Al, Ti, Si) N-based coating exhibits excellent wear and chipping resistance when machining heat resistant super alloys.
- The R cutting edge rake angle and ball nose geometry have been optimised to improve strength.

Order Number	RE	DC	APMX	LU	DN	LF	DCON	(mm)		
								No.F*	Stock	Type
VQN2MBR0050	0.5	1	1	4	0.94	60	6	2	●	1
VQN2MBR0100	1.0	2	2	6	1.9	60	6	2	●	1
VQN2MBR0150	1.5	3	3	8	2.9	60	6	2	●	1
VQN2MBR0200	2.0	4	8	—	—	60	6	2	●	2
VQN2MBR0250	2.5	5	12	—	—	60	6	2	●	2
VQN2MBR0300	3.0	6	12	—	—	60	6	2	●	3
VQN2MBR0400	4.0	8	14	—	—	70	8	2	●	3
VQN2MBR0500	5.0	10	18	—	—	80	10	2	●	3
VQN2MBR0600	6.0	12	22	—	—	80	12	2	●	3

* Number of Flutes

DC = Cutting Dia. DN = Neck Dia.
 RE = Radius of Ball Nose LF = Overall Length
 APMX = Length of Cut DCON = Shank Dia.
 LU = Neck Length

● : Inventory maintained in Japan.

End Mills for Machining Difficult-to-cut Materials

VQN2MB

Medium cut length, 2 flute

Recommended Cutting Conditions (mm)

R RE	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p	Depth of cut a_e
	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)		
	0.5	12700	640	12700		
1.0	6300	320	6300	380	0.2	0.50
1.5	4200	250	4200	250	0.3	0.75
2.0	3100	190	3100	220	0.4	1.00
2.5	2500	180	2500	200	0.5	1.25
3.0	2100	170	2100	210	0.6	1.50
4.0	1500	130	1500	160	0.8	2.00
5.0	1200	130	1200	140	1.0	2.50
6.0	1000	110	1000	120	1.2	3.00

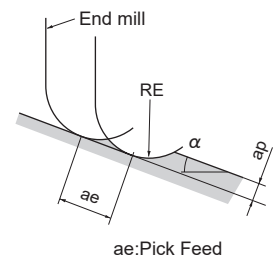
Depth of cut	
--------------	--

Note 1) For heat resistant super alloy, the use of water-soluble coolant is effective.

Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 3) Vibration may occur if the rigidity of machine or workpiece is low. In this case, please reduce the revolution and feed rate proportionately.

Note 4) α is the inclination angle of the machined surface.

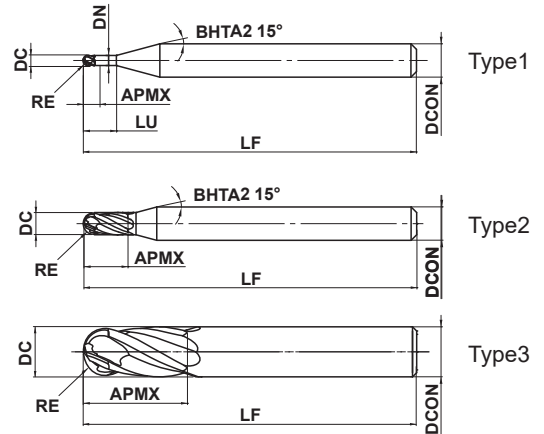


VQN4MB NEW

Ball nose, Medium cut length, 4 flute



Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
---	---	-------------------------	-------------------------	----------------------------	----------------------	--------------	-----------------



RE ≤ 6		
±0.010		



DCON=6	8 ≤ DCON ≤ 10	DCON=12
0 - 0.005	0 - 0.006	0 - 0.008

- (Al, Ti, Si) N-based coating exhibits excellent wear and chipping resistance when machining heat resistant super alloys.
- The 2-flute end cutting edge provides excellent chip evacuation and is ideal for rough machining.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No.F [*]	Stock	Type
VQN4MBR0100	1.0	2	2	6	1.9	60	6	4	●	1
VQN4MBR0150	1.5	3	3	8	2.9	60	6	4	●	1
VQN4MBR0200	2.0	4	8	—	—	60	6	4	●	2
VQN4MBR0250	2.5	5	12	—	—	60	6	4	●	2
VQN4MBR0300	3.0	6	12	—	—	60	6	4	●	3
VQN4MBR0400	4.0	8	14	—	—	70	8	4	●	3
VQN4MBR0500	5.0	10	18	—	—	80	10	4	●	3
VQN4MBR0600	6.0	12	22	—	—	80	12	4	●	3

* Number of Flutes

DC = Cutting Dia. DN = Neck Dia.
 RE = Radius of Ball Nose LF = Overall Length
 APMX = Length of Cut DCON = Shank Dia.
 LU = Neck Length

● : Inventory maintained in Japan.

End Mills for Machining Difficult-to-cut Materials

VQN4MB

Medium cut length, 4 flute

Recommended Cutting Conditions (mm)

R RE	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p	Depth of cut a_e
	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)		
	1.0	6300	380	6300		
1.5	4200	340	4200	420	0.3	0.75
2.0	3100	320	3100	380	0.4	1.00
2.5	2500	250	2500	310	0.5	1.25
3.0	2100	210	2100	250	0.6	1.50
4.0	1500	160	1500	190	0.8	2.00
5.0	1200	150	1200	200	1.0	2.50
6.0	1000	150	1000	170	1.2	3.00

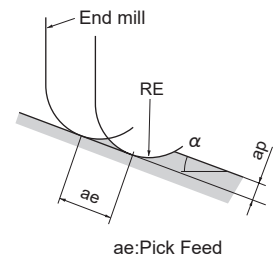
Depth of cut	
--------------	--

Note 1) For heat resistant super alloy, the use of water-soluble coolant is effective.

Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 3) Vibration may occur if the rigidity of machine or workpiece is low. In this case, please reduce the revolution and feed rate proportionately.

Note 4) α is the inclination angle of the machined surface.

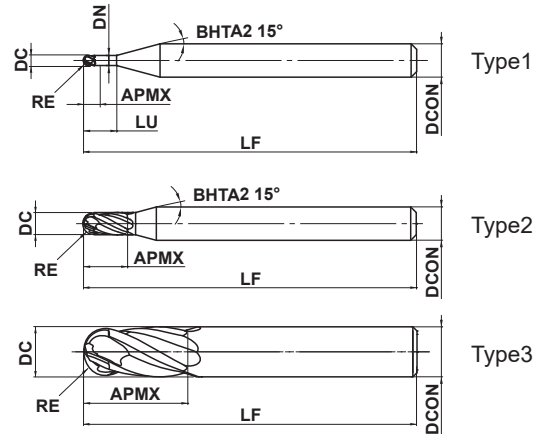


VQN4MBF NEW

Ball nose, Medium cut length, 4 flute



Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-hardened Steel, Hardened Steel (<=45HRC)	Hardened Steel (<=55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Heat Resistant Alloy	Copper Alloy	Aluminium Alloy
---	--	--------------------------	-------------------------	----------------------------	----------------------	--------------	-----------------



RE ≤ 6		
±0.010		



DCON = 6	8 ≤ DCON ≤ 10	DCON = 12
0 - 0.005	0 - 0.006	0 - 0.008

- (Al, Ti, Si) N-based coating exhibits excellent wear and chipping resistance when machining heat resistant super alloys.
- The 4-flute end cutting edge is also ideal for 5-axis machining.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No.F [*]	Stock	Type
VQN4MBFR0100	1.0	2	2	6	1.9	60	6	4	●	1
VQN4MBFR0150	1.5	3	3	8	2.9	60	6	4	●	1
VQN4MBFR0200	2.0	4	8	—	—	60	6	4	●	2
VQN4MBFR0250	2.5	5	12	—	—	60	6	4	●	2
VQN4MBFR0300	3.0	6	12	—	—	60	6	4	●	3
VQN4MBFR0400	4.0	8	14	—	—	70	8	4	●	3
VQN4MBFR0500	5.0	10	18	—	—	80	10	4	●	3
VQN4MBFR0600	6.0	12	22	—	—	80	12	4	●	3

* Number of Flutes

DC = Cutting Dia. DN = Neck Dia.
 RE = Radius of Ball Nose LF = Overall Length
 APMX = Length of Cut DCON = Shank Dia.
 LU = Neck Length

● : Inventory maintained in Japan.

End Mills for Machining Difficult-to-cut Materials

VQN4MBF

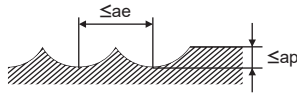
Medium cut length, 4 flute

Recommended Cutting Conditions

(mm)

R RE	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap
	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut ae	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut ae	
	1.0	6300	180	0.40	6300	310	
1.5	4200	170	0.60	4200	340	0.75	0.3
2.0	3100	190	0.80	3100	320	1.00	0.4
2.5	2500	150	1.00	2500	250	1.25	0.5
3.0	2100	170	1.20	2100	250	1.50	0.6
4.0	1500	130	1.60	1500	190	2.00	0.8
5.0	1200	100	2.00	1200	200	2.50	1.0
6.0	1000	130	2.40	1000	170	3.00	1.2

Depth of cut

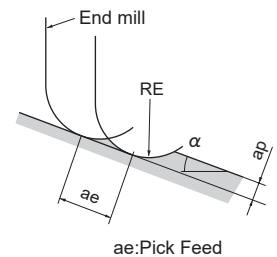


Note 1) For heat resistant super alloy, the use of water-soluble coolant is effective.

Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 3) Vibration may occur if the rigidity of machine or workpiece is low. In this case, please reduce the revolution and feed rate proportionately.

Note 4) α is the inclination angle of the machined surface.



ae:Pick Feed

Memo

A series of horizontal dashed lines for writing, spanning the width of the page.



SMART MIRACLE End Mill Series for Difficult-to-cut Materials

VQN2MB/4MB/4MBF

For Your Safety

●Don't handle inserts and chips without gloves. ●Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage. ●Please use safety covers and wear safety glasses. ●When using compounded cutting oils, please take fire precautions. ●When attaching inserts or spare parts, please use only the correct wrench or driver. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

 **MITSUBISHI MATERIALS CORPORATION**

MITSUBISHI MATERIALS CORPORATION

Overseas Sales Dept, Asian Region

KFC bldg., 8F, 1-6-1 Yokoami, Sumida-ku, Tokyo 130-0015, Japan
TEL +81-3-5819-8771 FAX +81-3-5819-8774

Overseas Sales Dept, European & American Region

KFC bldg., 8F, 1-6-1 Yokoami, Sumida-ku, Tokyo 130-0015, Japan
TEL +81-3-5819-8772 FAX +81-3-5819-8774

<http://www.mitsubishicarbide.com/en/>
(Tools specifications subject to change without notice.)