MITSUBISHI MATERIALS

VQ2XLB/HVRB/FDRB
Dental Parts Machining

SMART MIRACLE END MILL SERIES FOR DENTAL MILLING



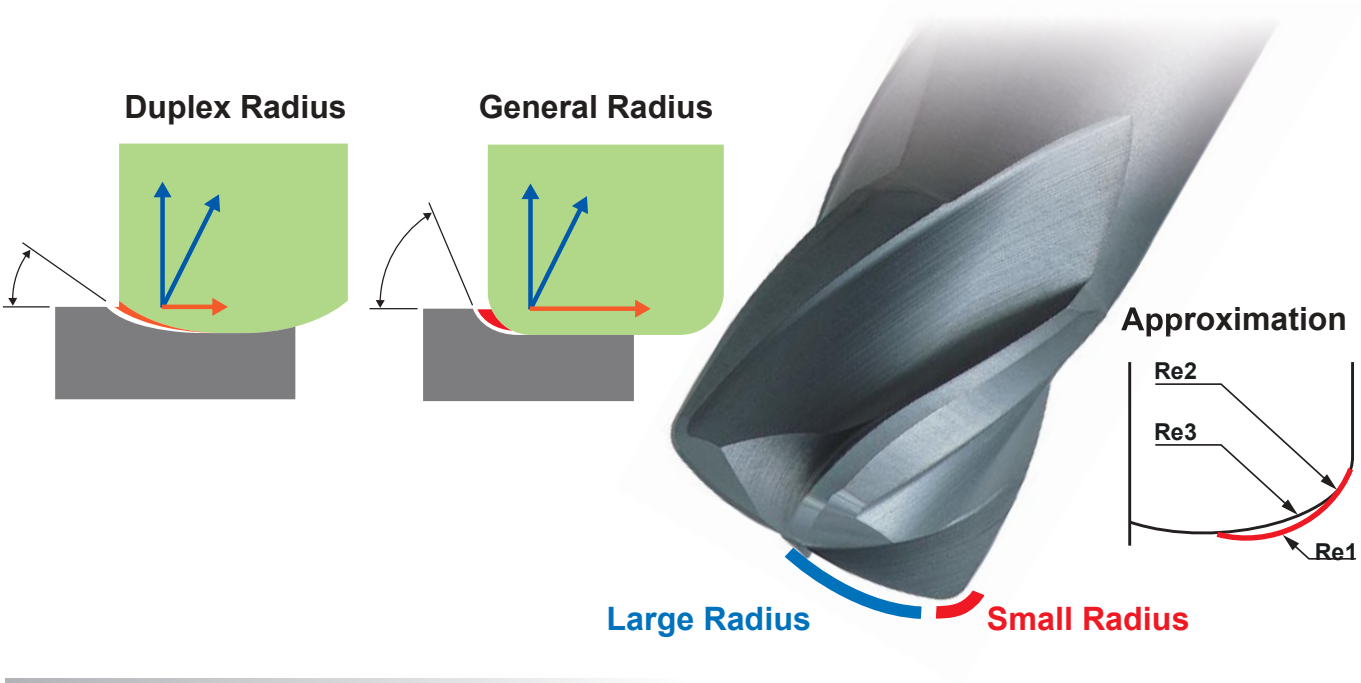


TOOL NEWS **B258A**

Duplex Radius End Mills VQFDRB

VQFDRB provides amazingly long tool life when machining Cobalt Chrome Alloy.

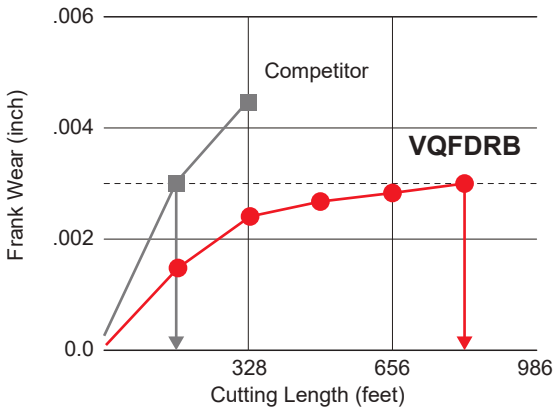
- Improved notch wear via the small side cutting edge angle.
- Reduced flank wear through use of SMART MIRACLE coating and ultra micro-grain cemented carbide.
- Provides stable machining with low radial cutting force.



Cutting Performance : Competitive Comparison

VQFDRB achieved 5 times longer tool life than competitors duplex radius when machining cobalt chrome alloy.

<Cutting Conditions>
Workpiece Material : Co-Cr-Mo Alloy (ASTM F1537)
Tool : VQFDRBD0300N080 ø0.1181″
Revolution : n=8600 min^{-1} (vc=260 SFM)
Feed Rate : vf=51.2 IPM (.0016 IPT)
Depth of Cut : ap=.0079 inch ae=.0512 inch
Coolant : Emulsion



Cutting Example

Competitive Comparison



<Cutting Conditions>
Part Name : Dental Crown
Workpiece Material : Co-Cr-Mo Alloy (ASTM F1537)
Cutting Process : Rough
Tool : VQFDRBD0400N120 (ø.1575" Re: .0279")
Machine : 5 axis M/C (HSK63)
Coolant : Emulsion
CAM : Hyper Dent

hyperDENT®

< Cutting conditions & Result >

VQFDRB can machine at twice the feed rate without chipping.

Tool	Revolution (min^{-1})	Feed rate (IPM)	Depth of Cut (inch)
VQFDRB	6000 (245 SFM)	118 (.0049 IPT)	ap=.0157 ae=.0787
Genral Radius	6000 (245 SFM)	59 (.0025 IPT)	ap=.0157 ae=.0787

Dental Cobalt Chrome Dentures



<Cutting Conditions>
Part Name : Dental Denture
Workpiece Material : Co-Cr-Mo Alloy (CAD/CAM Milling Disc)
Cutting Process : Rough
Tool : VQFDRBD0400N120 (ø.1575" Re: .0279")
Machine : 5 axis M/C (HSK63)
Coolant : Emulsion
Revolution : n=8600 min^{-1} (vc=355 SFM)
Feed Rate : vf=51.2 IPM (.0016 IPT)
Depth of Cut : ap=.0098 inch (Z Level Operation)

Wada Precision Dental Laboratories Co., Ltd.

Vb=.0018"



< Result >

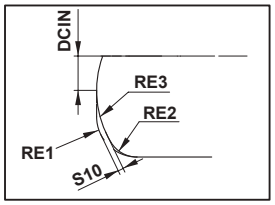
VQFDRB maintained stable machining and achieved good wear resistance throughout machining of disc.

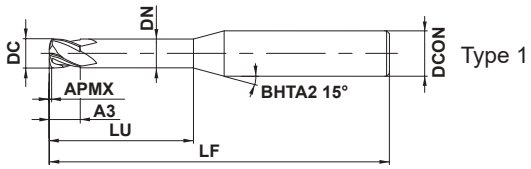
VQFDRB

Duplex corner radius end mill for high speed cutting

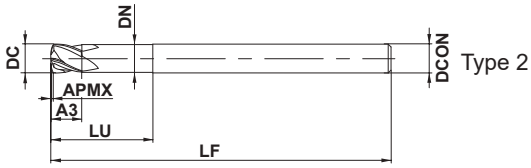
Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Precipitation Hardening Stainless Steel	Austenitic Stainless Steel	Cobalt Chrome Alloy, Heat Resistant Alloy	Titanium Alloy	Aluminum Alloy
					◎	○	







Type 1



Type 2

1<DC≤4					
0 / -0.020					
DCON=6					
0 / -0.005					

- Duplex corner radius type allows more efficient high feed.
- High feed cutting realized through use of multiple cuts.

(mm)

Order Number	DC	RE1 *1	APMX	A3 *3	LU	DN	LF	DCON	No. F *4	Multi-task radius part				RMPX *2	Stock	Type
										S10	DCIN	RE2	RE3			
VQFDRBD0300N080	3	0.64	0.18	3	8	2.8	50	6	4	0.08	0.75	0.5	2	2.1°	●	1
VQFDRBD0300N120	3	0.64	0.18	3	12	2.8	55	6	4	0.08	0.75	0.5	2	2.1°	●	1
VQFDRBD0400N120	4	0.71	0.25	4	12	3.8	55	6	4	0.13	1.0	0.5	3	1.9°	●	1
VQFDRBD0400N160	4	0.71	0.25	4	16	3.8	60	6	4	0.13	1.0	0.5	3	1.9°	●	1
VQFDRBD0600N180	6	0.92	0.36	6	18	5.6	60	6	4	0.21	1.5	0.6	5	1.7°	●	2

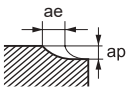
*1 RE1 : Approx. R
*2 RMPX : Max. Ramping Angle
*3 A3 : Cutting Edge Effective Length
*4 Number of Flutes

DC = Dia.
APMX = Length of Cut
LU = Neck Length
DN = Neck Dia.
LF = Overall Length
DCON = Shank Dia.

● : **USA Stock**

Recommended Cutting Conditions

(inch)

Workpiece Material		Titanium Alloys Ti-6Al-4V ELI, ASTM F136, etc.					Cobalt Chromium Alloys ASTM F75:Casting, F1537:Wrought Bar, F799:Forgings, etc.				
DC		Revolution **n** (min-1)	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap**	Width of cut **ae**	Revolution **n** (min-1)	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap**	Width of cut **ae**
(mm)	(inch)										
3	**.118**	8500	260	82.7	.008	.051	6400	195	118.1	.008	.051
4	**.157**	6400	260	86.6	.008	.067	4800	195	106.3	.008	.067
6	**.236**	4200	260	55.1	.012	.079	3200	195	82.7	.012	.102
Depth of Cut											

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.
Note 2) When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
Note 3) If the depth of cut is smaller, the revolution and the feed rate can be increased.

SMART MIRACLE End Mill Series for Dental Milling

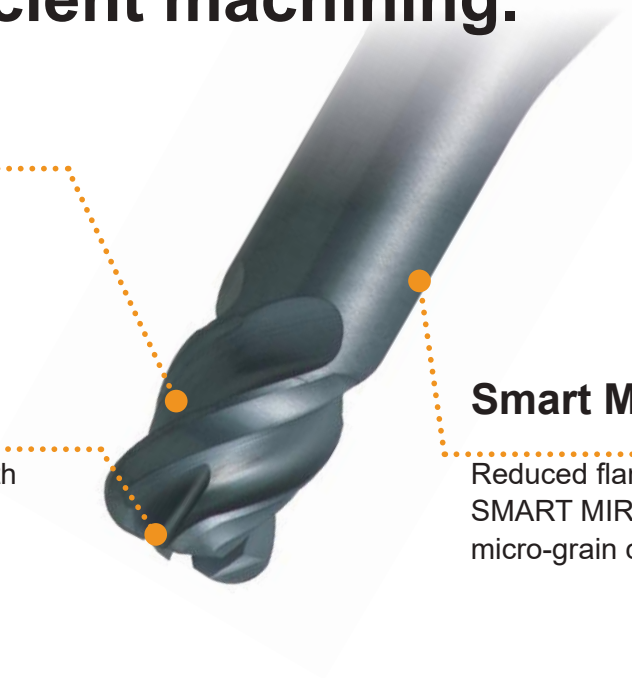
Vibration Control Radius End Mills

VQHVRB

Increased feed rates and large depths of cut are achievable with VQHVRB resulting in highly efficient machining.

Variable Helix

Vibration control geometry
for stable and smooth cutting.



Special Gash

Good chip disposal enables both increased feed rates and large depths of cut.

Smart Miracle Coating

Reduced flank wear through use of SMART MIRACLE coating and ultra micro-grain cemented carbide.

Cutting Performance : Competitive Comparison

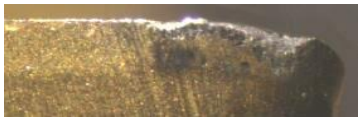
VQHVRB wears less than competitor and enables stable cutting.

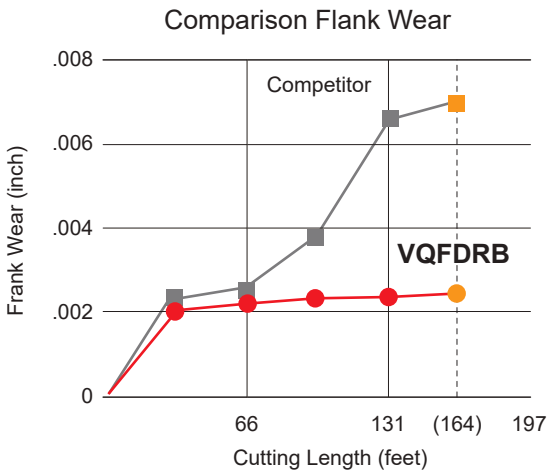
<Cutting Conditions>
Workpiece Material : Titanium Alloy
Tool : VQHVRBD0300R05N180 (ø.118")
Revolution : n=8600min^{-1} (vc=260 SFM)
Feed Rate : vf=51.2 IPM (.002 IPT)
Depth of Cut : ap=.008" ae=.051"
Coolant : Emulsion
Cutting Length : 164 feet

VQHVRB



Competitor



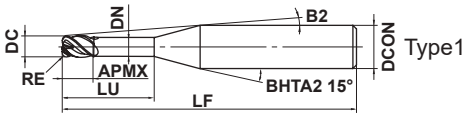


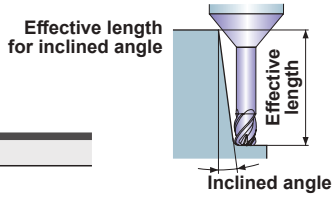
VQHVRB

Corner radius, Short cut length, 4 flute, Irregular helix flutes

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Precipitation Hardening Stainless Steel	Austenitic Stainless Steel	Cobalt Chrome Alloy, Heat Resistant Alloy	Titanium Alloy	Aluminum Alloy
					◎	○	







0.1≤RE≤1			
±0.01			
1≤DC≤4			
0 - 0.02			
DCON=6			
0 - 0.005			

● SMART MIRACLE corner radius end mill for high feed rates and efficient machining.

(mm)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	∗1 No.F	Stock	Type
VQHVRBD0100R01N080	1	0.1	1	8	0.94	8.2°	50	6	4	●	1
VQHVRBD0100R01N120	1	0.1	1	12	0.94	6.7°	55	6	4	●	1
VQHVRBD0200R02N120	2	0.2	2	12	1.9	5.9°	55	6	4	●	1
VQHVRBD0200R02N160	2	0.2	2	16	1.9	4.9°	60	6	4	●	1
VQHVRBD0300R05N100	3	0.5	3	10	2.9	5.6°	55	6	4	●	1
VQHVRBD0300R05N180	3	0.5	3	18	2.9	3.7°	60	6	4	●	1
VQHVRBD0400R10N120	4	1.0	4	12	3.9	3.9°	55	6	4	●	1
VQHVRBD0400R10N200	4	1.0	4	20	3.9	2.5°	60	6	4	●	1

∗1 Number of Flutes

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

● : **USA Stock**

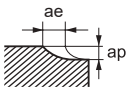
VQHVRB

Corner radius, Short cut length, 4 flute, Irregular helix flutes

Recommended Cutting Conditions

Large Depth of Cut Conditions

(inch)

Workpiece Material				Titanium Alloys Ti-6Al-4V ELI, ASTM F136, etc.					Cobalt Chromium Alloys ASTM F75:Casting, F1537:Wrought Bar, F799:Forgings, etc.				
DC		LU		Revolution **n** (min-1)	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap**	Width of cut **ae**	Revolution **n** (min-1)	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap**	Width of cut **ae**
(mm)	(inch)	(mm)	(inch)										
1	**.039**	**8**	**.315**	2500	25	19.7	.001	.004	2500	25	19.7	.001	.004
1	**.039**	**12**	**.472**	2500	25	13.8	.001	.004	2500	25	13.8	.001	.004
2	**.079**	**12**	**.472**	4800	100	23.6	.003	.012	4800	100	23.6	.003	.012
2	**.079**	**16**	**.630**	4800	100	13.4	.003	.012	4800	100	13.8	.003	.012
3	**.118**	**10**	**.394**	8500	260	94.5	.007	.051	6400	195	86.6	.007	.051
3	**.118**	**18**	**.709**	8500	260	78.7	.007	.051	6400	195	63.0	.007	.051
4	**.157**	**12**	**.472**	6400	260	78.7	.010	.067	4800	195	70.9	.009	.067
4	**.157**	**20**	**.787**	6400	260	78.7	.010	.067	4800	195	70.9	.009	.067
Depth of Cut													

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.
Note 2) When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
Note 3) If the depth of cut is smaller, the revolution and the feed rate can be increased.
Note 4) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abnormal sound can occur.
In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.

SMART MIRACLE End Mill Series for Dental Milling

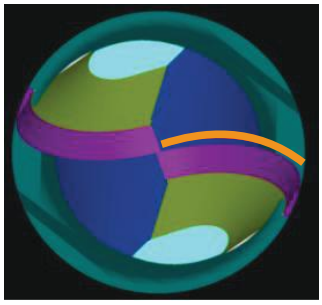
Long Neck Ball Nose End Mills VQ2XLB

VQ2XLB provides long tool life and stable cutting when machining Cobalt Chrome Alloy and Titanium Alloy.

- **Improved resistance to chipping via new cutting edge geometry.**
- **SMART MIRACLE coating providing better wear resistance when machining difficult-to-cut materials.**

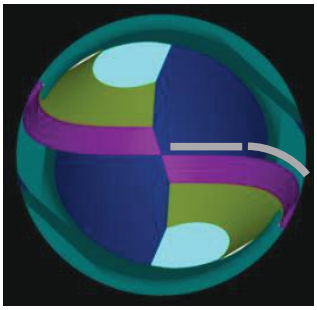
VQ2XLB (For Dental)

Strong S



General (For Mold)

Normal Curve



Tooling Example : Dental Crown (CAD-CAM Disc)

Workpiece Material : Co-Cr-Mo Alloys

Customer Comment

"Machined surface roughness is better than conventional tools under normal conditions"

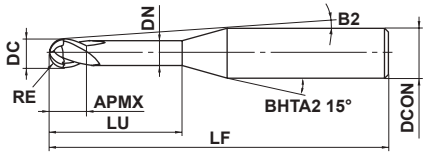
Process		Rough 1	Rough 2	Finish 1	Finish 2
Tool		VQ2XLBR0150N140 Ø.118"(RE.059")	VQ2XLBR0150N140 Ø.118"(RE.059")	VQ2XLBR0100N100S06 Ø.079"(RE.039")	VQ2XLBR0050N080N06 Ø.039"(RE.020")
Cutting Speed **vc** (SFM)		195	260	245	205
Revolution **n** (min^{-1})		6400	8500	12000	20000
Feed Rate **vf** (IPM)		31.5	37.8	31.5	26.0
fz (IPT)		.0025	.0022	.0013	.0007
Depth of Cut	**ap** (inch)	.0059	.0047	.0039	.0020
	ae (inch)	.0394	.0118	.0079	.0031
Cutting Time (min)		400	60	90	150
Wear Condition		Good	Good	Good	Good

VQ2XLB

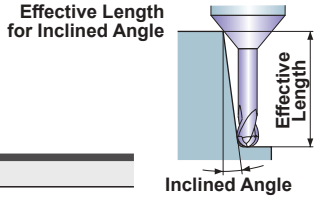
Ball nose, Short cut length, 2 flute, Long neck

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Precipitation Hardening Stainless Steel	Austenitic Stainless Steel	Cobalt Chrome Alloy, Heat Resistant Alloy	Titanium Alloy	Aluminum Alloy
					◎	◎	





Type1



0.05≤RE≤1.5			
±0.005			
4≤DCON≤6			
0 - 0.005			

●SMART MIRACLE coating providing better wear resistance when machining difficult-to-cut materials.

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	✶1 No.F	Stock	Type
VQ2XLBR0050N080	0.5	1	0.75	8	0.94	6.4°	50	4	2	●	1
VQ2XLBR0050N100	0.5	1	0.75	10	0.94	5.6°	50	4	2	●	1
VQ2XLBR0050N080S06	0.5	1	0.75	8	0.94	8.3°	50	6	2	●	1
VQ2XLBR0050N100S06	0.5	1	0.75	10	0.94	7.5°	55	6	2	●	1
VQ2XLBR0050N120S06	0.5	1	0.75	12	0.94	6.8°	55	6	2	●	1
VQ2XLBR0075N100S06	0.75	1.5	1.1	10	1.44	7.2°	55	6	2	●	1
VQ2XLBR0075N120S06	0.75	1.5	1.1	12	1.44	6.5°	55	6	2	●	1
VQ2XLBR0100N100	1.0	2	1.5	10	1.9	4.5°	50	4	2	●	1
VQ2XLBR0100N100S06	1.0	2	1.5	10	1.9	6.9°	55	6	2	●	1
VQ2XLBR0100N120	1.0	2	1.5	12	1.9	3.9°	50	4	2	●	1
VQ2XLBR0100N120S06	1.0	2	1.5	12	1.9	6.1°	55	6	2	●	1
VQ2XLBR0150N120	1.5	3	2.3	12	2.9	5.3°	55	6	2	●	1
VQ2XLBR0150N140	1.5	3	2.3	14	2.9	4.7°	60	6	2	●	1
VQ2XLBR0150N160	1.5	3	2.3	16	2.9	4.3°	60	6	2	●	1

✶1 Number of Flutes

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

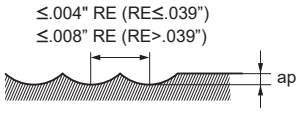
● : **USA Stock**

Recommended Cutting Conditions

(inch)

Workpiece Material				Titanium Alloys Ti-6Al-4V ELI, ASTM F136, etc.					Cobalt Chromium Alloys ASTM F75:Casting, F1537:Wrought Bar, F799:Forgings, etc.				
RE		LU		Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap**	Width of cut **ae**	Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap**	Width of cut **ae**
(mm)	(inch)	(mm)	(inch)										
0.5	**.020**	**8**	**.315**	32000	330	98.4	.002	.004	27000	260	78.7	.002	.004
0.5	**.020**	**10**	**.394**	24000	245	59.1	.002	.004	19000	195	59.1	.002	.004
0.5	**.020**	**12**	**.472**	24000	245	59.1	.001	.004	19000	195	59.1	.001	.004
0.75	**.030**	**10**	**.394**	21000	330	82.7	.005	.012	17000	260	66.9	.003	.004
0.75	**.030**	**12**	**.472**	16000	245	59.1	.005	.012	13000	195	47.2	.003	.004
1	**.039**	**10**	**.394**	16000	330	70.9	.008	.020	13000	260	59.1	.008	.020
1	**.039**	**12**	**.472**	16000	330	70.9	.008	.020	13000	260	59.1	.008	.020
1.5	**.059**	**12**	**.472**	10000	330	63.0	.012	.031	8500	260	51.2	.012	.031
1.5	**.059**	**14**	**.551**	10000	330	63.0	.012	.031	8500	260	51.2	.012	.031
1.5	**.059**	**16**	**.630**	10000	330	63.0	.012	.031	8500	260	51.2	.012	.031

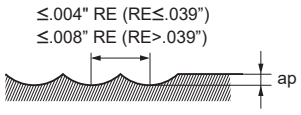
Depth of Cut



RE : Radius

Workpiece Material				Pure Titanium ASTM F67, etc.				
RE		LU		Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap**	Width of cut **ae**
(mm)	(inch)	(mm)	(inch)					
0.5	**.020**	**8**	**.315**	27000	260	63.0	.003	.004
0.5	**.020**	**10**	**.394**	19000	195	47.2	.003	.004
0.5	**.020**	**12**	**.472**	19000	195	47.2	.002	.004
0.75	**.030**	**10**	**.394**	25000	395	78.7	.005	.008
0.75	**.030**	**12**	**.472**	21000	330	63.0	.005	.008
1	**.039**	**10**	**.394**	32000	655	98.4	.013	.031
1	**.039**	**12**	**.472**	29000	590	66.9	.013	.031
1.5	**.059**	**12**	**.472**	21000	655	63.0	.019	.047
1.5	**.059**	**14**	**.551**	21000	655	63.0	.019	.047
1.5	**.059**	**16**	**.630**	21000	655	63.0	.019	.047

Depth of Cut



RE : Radius

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.
Note 2) When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
Note 3) If the depth of cut is smaller, the revolution and the feed rate can be increased.

Dental Line Series

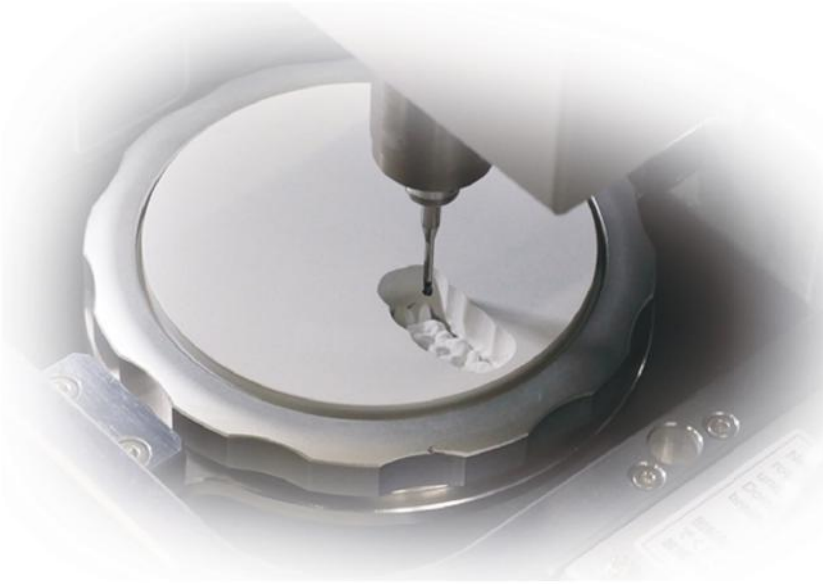
Long Neck Ball Nose End Mills

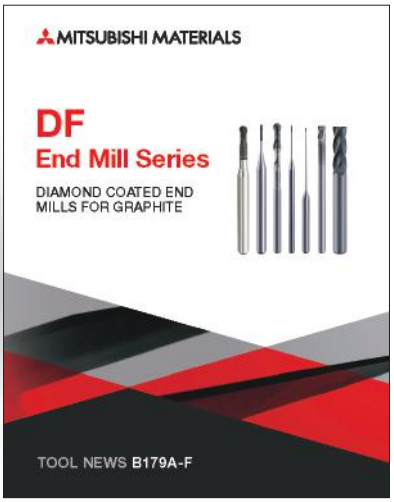
DF2XLBF



Diamond Coating End Mill for Machining Zirconium and Hybrid Resin Dental Applications

The combination of optimized cutting edges and a diamond coating greatly enhances cutting performance.
DF2XLBF provides long tool life and excellent surface finish when machining Zirconium and Hybrid resin.





TOOL NEWS

Memo

MTEC

MACHINING TECHNOLOGY AND EDUCATION CENTER

Welcome to our new world-class Machining Technology and Education Center (MTEC) in Mooresville, NC providing year round support and services to North America.



ABOUT MTEC

TOOLING PROPOSALS & EVALUATION

We will review your current processes or outline a new process. From this review, we will improve productivity, analyze programming methods and output a solution with programming, tooling and time savings.

MACHINING SIMULATION

Using the latest CAD/CAM software and our cutting tool experience, we will outline a new process using proper machining techniques to maximize tool life and productivity.

TECHNICAL SUPPORT

Dedicated local professionals to answer any of your order, product or technical questions.

TRAINING

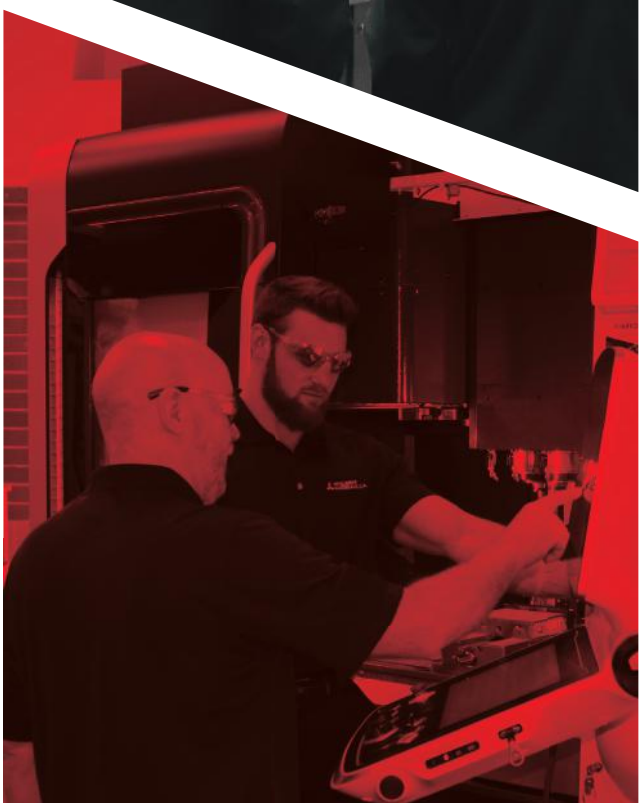
We are excited to offer several levels of training with goals to reach our highest level--Craftsman Machining Technology. At MTEC NC, we will train using a combination of classroom and hands-on machine time to develop skills and real-world understanding of materials, tools and applications. In addition to multi-day courses, we will have Machining Technology skills seminars, as well as seminars from our partners to complement our apprentice level courses, our journeyman courses, and up to our craftsman level courses.

PROCESS IMPROVEMENTS

Review of the complete part processing and recommend changes of speed, feed, new tooling, reduction of passes, modifying programming and other solutions to reduce cycle time, save money and be proactive.







WEBINARS

Our FREE online webinar series is available anytime on-demand. Narrated by the MTEC training staff, you will receive in-depth knowledge of the topic. Simply register online at the link below for access. You will receive a certificate upon completion of each course.

mmusnewsstand.com/register

ONLINE TRAINING

Our FREE e-learning program offers 11 courses in drilling, milling, turning, threading, tool grades and workpiece materials. Once each course is completed, you will be given the opportunity to print a certificate.

- Basic Drilling
- Basic Milling
- Basic Turning
- Advanced Drilling
- Advanced End Milling
- Advanced Turning
- Basic Threading
- Advanced Face Milling
- Basic Workpiece Materials
- Tool Grades
- Advanced Workpiece Materials

TRAINING COURSES

Programs are designed for several levels of skill development – from basic understanding to advance manufacturing with digital solutions, complementing to your valued experience in CNC machining environment. Participate in machining demonstrations with Mitsubishi Materials' skilled engineers. Discover methods to reduce setup and cycle time, optimize programs and enhance your knowledge base.

Information on course schedule,
course description, and accommodations

MTECTRAINING.INFO

Follow the QR Code for a virtual facility tour

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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.

www.mmc-carbide.com/us

Tools specifications subject to change without notice.

B258A-US-2026.9