



MEDICAL

APPLICATIONS



INDEX MEDICAL

HIP-SYSTEM

■ Co-Cr Alloy ■ Titanium Alloy ■ UHMWPE

Page



External Turning

The combination of VP coating and a high-strength micro-grain cemented carbide substrate increases wear resistance.



4

Drilling

Employs new TRI-Cooling Technology with anew tool grade DP7020 for high efficiency & longer tool life.



5

Taper Hole Machining

High efficiency taper hole machining using vibration control radius end mills.



7

Profile Machining

The combination of IMPACT MIRACLE coating and a high-strength micro-grain cemented carbide substrate increases wear resistance.



8

KNEE-SYSTEM

■ Co-Cr Alloy ■ Titanium Alloy ■ UHMWPE



Profile Machining

Variable curve geometry ensures stable machining of difficult-to-cut materials.



9

Pocket Machining

High efficiency machining because high feed rates and larger depths of cut can be utilised.



10

BONE PLATES

■ Titanium Alloy ■ SUS316

Page



Multifunctional Milling

Possible to machine complex geometries that are previously difficult to machine.



VF2WB

11

SCREWS

■ Titanium Alloy ■ SUS316 ■ SUS317



Deep Hole Drilling

Ultra productivity machining due to through coolant holes plus the flute geometry and cutting edge geometry are optimised for deep hole drilling.



MWS
Super long drill

12

Deep Machining with Small Diameter

Machining of a deep cavity and complex parts are possible with a variety of neck lengths.



M52XL M52XLB

14

External Turning & Cut Off

The combination of VP coating and a high-strength micro-grain cemented carbide substrate increases wear resistance.



Small Tools
VP15TF

15

SPINE

■ Co-Cr Alloy ■ Titanium Alloy ■ Stainless Steel



Side Cutting

Delivers superior vibration resistance for difficult-to-cut materials and on applications with long overhangs.



IMPACT MIRACLE
Vibration Control
End Mill Series

16

INSTRUMENT

■ Titanium Alloy ■ Stainless Steel



Rough Milling

High efficiency machining possible by using a high feed radius milling cutter when machining difficult-to-cut materials.



AJX

17



Deep Hole Drilling

Ultra productivity machining due to through coolant holes plus the flute geometry and cutting edge geometry are optimised for deep hole drilling.

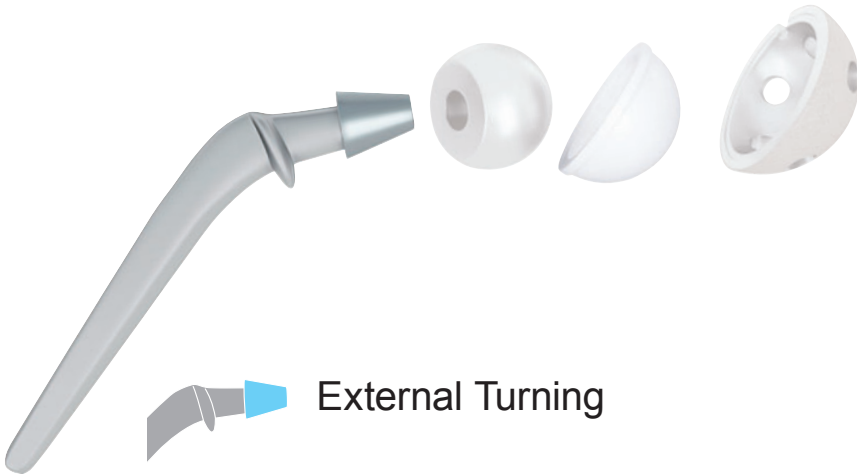


MWS
Super long drill

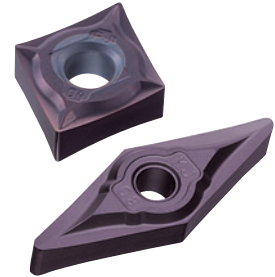
18

HIP-SYSTEM

Work Materials [Co-Cr Alloy, **Titanium Alloy**, UHMWPE]



Good cutting performance



VPO5RT/VP10RT
FJ/MJ Breaker
 (TOOLS NEWS B036G)

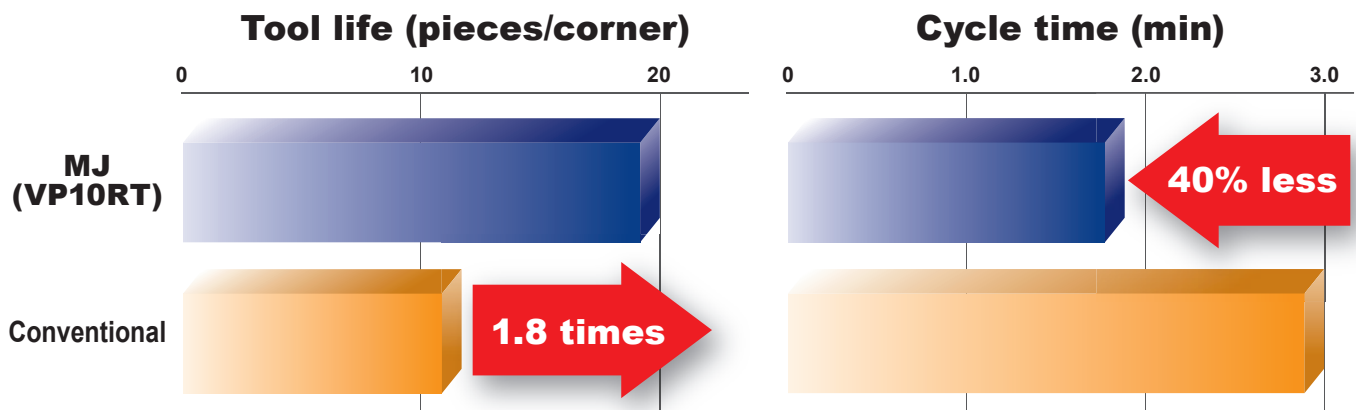
Key Point on Machining

- A good balance of wear and fracture resistance for turning Co-Cr Alloy and Titanium Alloy.
- Reduced heat generation with the use of a sharp cutting edge.

Application Example

- **1.8 times longer tool life than conventional products !**
 → **Conventional insert chipped, MJ(VP10RT) no damage !**
- **High efficiency with large depth of cut !**

Insert (Grade)	CNMG120404-MJ (VP10RT)
Machine	CNC Lathe Machine
Work Material	Titanium Alloy
Cutting Speed	45 m/min
Revolution	280 min ⁻¹
Feed	0.16 mm/rev
Depth of Cut	Conventional: 1.5 mm → MJ (VP10RT): 2.3 mm 50%UP



HIP-SYSTEM

Work Materials [Co-Cr Alloy, **Titanium Alloy**, UHMWPE]



Key Point on Machining

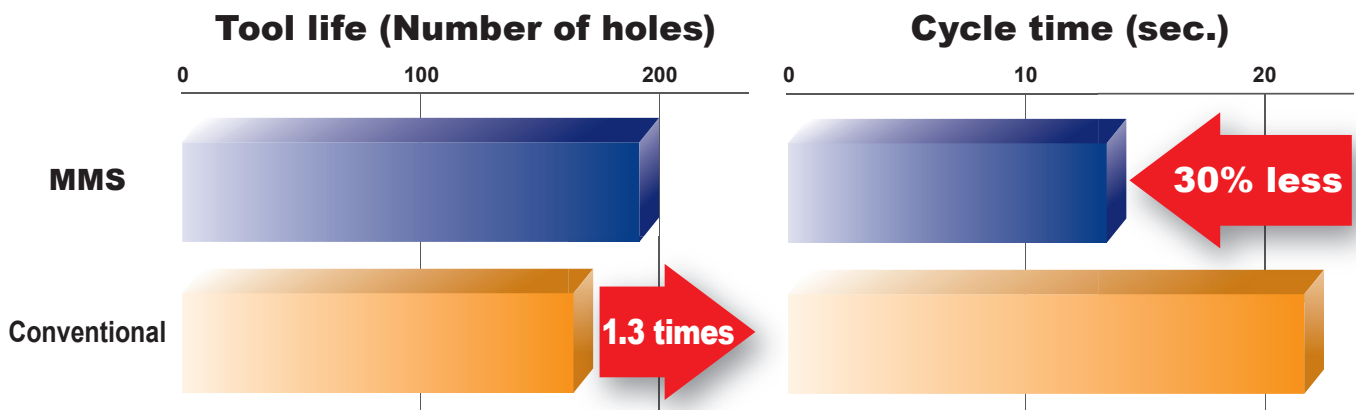
- Promotes smooth chip evacuation.
- Use of internal coolant hole improves cooling effect.

MMS Drill
(TOOLS NEWS B180G)

Application Example

- **1.3 times longer tool life than conventional products !**
- **High efficiency with high-speed drilling.**

Drill (Grade)	MMS1600X3D (DP7020) ø16 mm
Machine	Machining Center
Work Material	Titanium Alloy
Hole Depth	50 mm
Cutting Speed	Conventional: 40 m/min → MMS: 60 m/min 50%UP
Feed	0.15 mm/rev Non-peck
Coolant	W.S.O (0.6 MPa)



HIP-SYSTEM

Work Materials [**Co-Cr Alloy**, Titanium Alloy, UHMWPE]



MMS Drill
(TOOLS NEWS B180G)

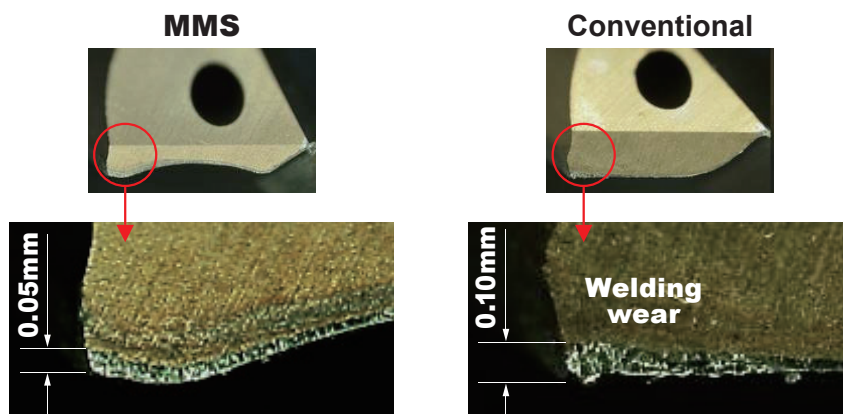
Key Point on Machining

- MMS drill offer longer tool life and can be used for Stainless Steels, Titanium Alloy and Co-Cr Alloy.
- Use of internal coolant holes improves the cooling effect.

Cutting Example

- **MMS drill shows good wear resistance when drilling Co-Cr Alloy !**

Drill (Grade)	MMS0500X5DB (DP7020) ø5 mm
Machine	Machining Center
Work Material	Co-Cr Alloy (42 HRC)
Hole Depth	15 mm
Cutting Speed	30 m/min
Revolution	1900 min ⁻¹
Feed	97 mm/min (0.05 mm/rev) Non-peck
Coolant	W.S.O (0.7 Mpa)



When machining 30 holes

HIP-SYSTEM

Work Materials [Co-Cr Alloy, **Titanium Alloy**, UHMWPE]



 Taper Hole Machining

VFHVRB Vibration Control End Mill

(TOOLS NEWS B177G)

Key Point on Machining

- IMPACT MIRACLE coating with high heat resistance enables to long tool life.
- Enables high efficiency machining and prevent vibration.
- Possible to machine complex geometries previously difficult to machine.

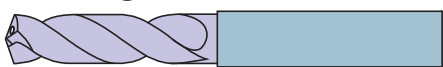
Application Example

- **Three processes with one tool with helical taper milling !**
- **Excellent surface finish !**

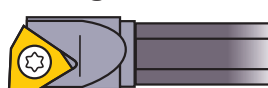
End mill	4 Flute Radius End mill VFHVRBD0800R10N24 (ø8 mm)
Machine	Multi-axis Turning
Work Material	Titanium Alloy
Hole Depth	15 mm
Cutting Speed	60 m/min
Revolution	2400 min ⁻¹
Feed	380 mm/min (0.04 mm/tooth)
Coolant	W.S.O

<Conventional>

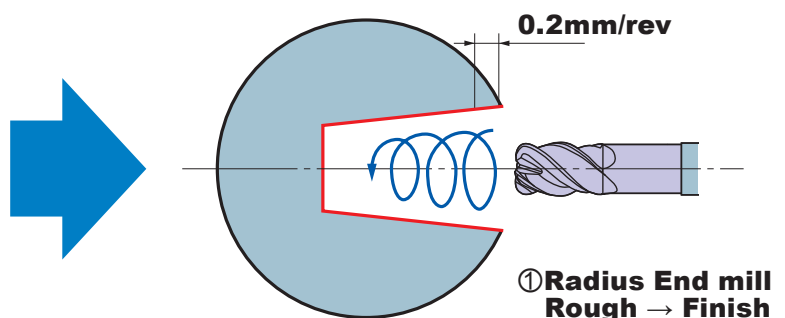
① Drilling



② Taper boring
Rough → Finish

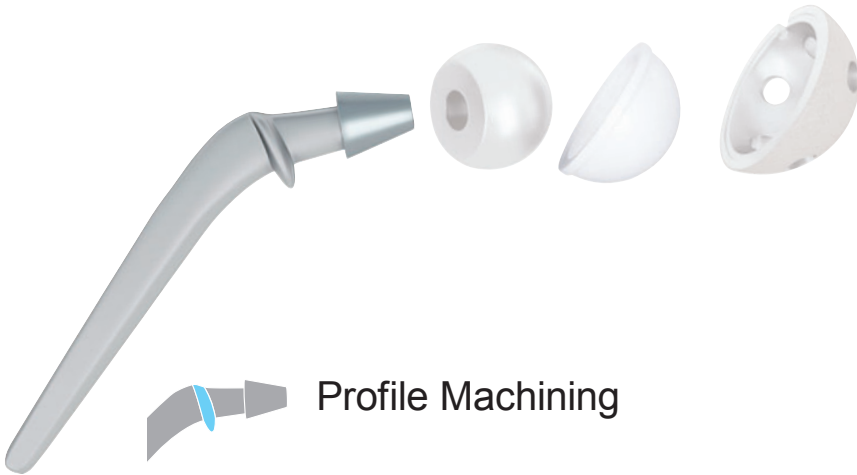


<Helical Taper Milling>



HIP-SYSTEM

Work Materials [**Co-Cr Alloy**, Titanium Alloy, UHMWPE]



Higher efficiency and Longer tool life



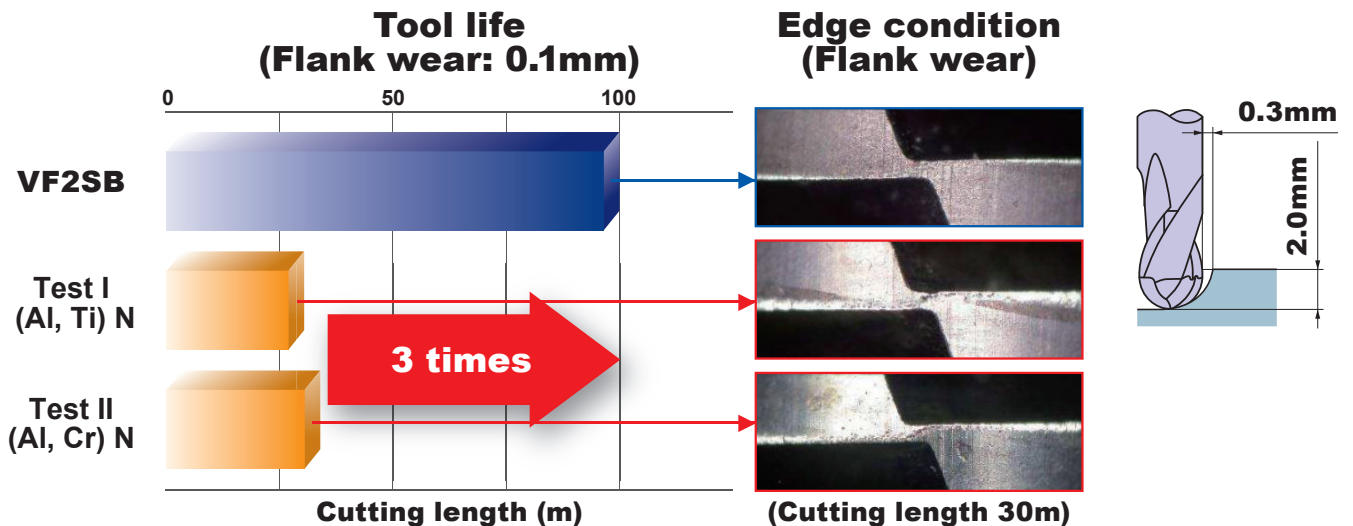
Key Point on Machining

- Cutting edge geometry with excellent chipping resistance.
- IMPACT MIRACLE coating with high heat resistance enables to long tool life.

Application Example

- **3 times longer tool life than conventional products when milling Co-Cr Alloy.**

End mill	2 Flute Ball End mill VF2SBR0300 (ø6 mm)
Machine	Machining Center (BT40)
Work Material	Co-Cr Alloy
Revolution	5000 min ⁻¹ (vc100 m/min)
Feed	1000 mm/min (0.1 mm/tooth)
Coolant	W.S.O



KNEE-SYSTEM

Work Materials [**Co-Cr Alloy**, Titanium Alloy, UHMWPE]



Key Point on Machining

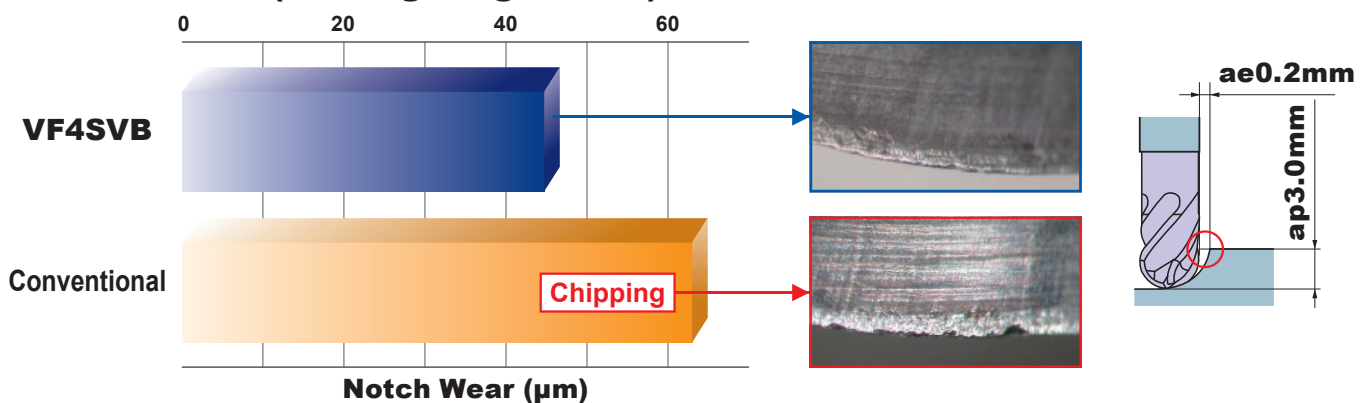
- A good balance of wear and fracture resistance for machining Co-Cr Alloy and Titanium Alloy.
- “Variable curve” radius cutting edges for difficult-to-cut materials.

Cutting Example

- **VF4SVB has longer tool life than conventional tools.**

End-mill	4 Flute Ball End mill VF4SVBR0500 (\varnothing 10 mm)
Machine	Machining Center (BT40)
Work Material	Co-Cr Alloy (36 HRC)
Cutting Speed	100 m/min
Revolution	3200 min ⁻¹
Feed	3200 mm/min
Chip Load	0.25 mm/tooth
Coolant	W.S.O

Flank wear comparison (Cutting length 60m)



KNEE-SYSTEM

Work Materials [**Co-Cr Alloy**, Titanium Alloy, UHMWPE]



Special curved surface gash corner radius

VFHVRB **Vibration Control** **End Mill**

(TOOLS NEWS B177G)

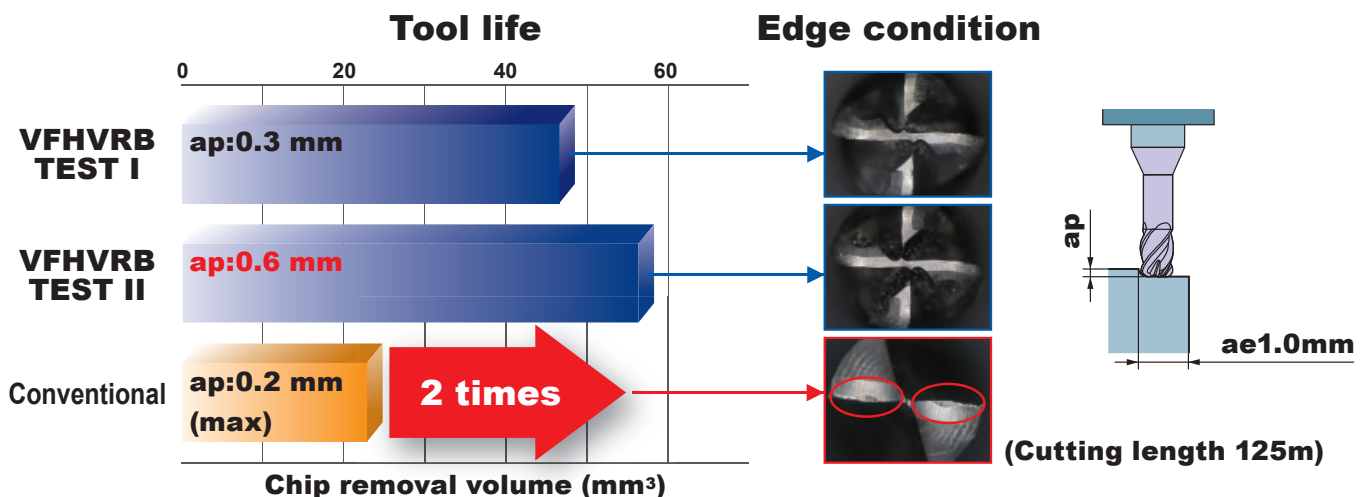
Key Point on Machining

- Vibration control geometry for stable machining and a smooth cutting action.
- VFHVRB makes finishing easy !

Cutting Example: Co-Cr-Alloy

- **2 times longer tool life than conventional products !**
- **High efficiency due to high feed and large depth of cut.**

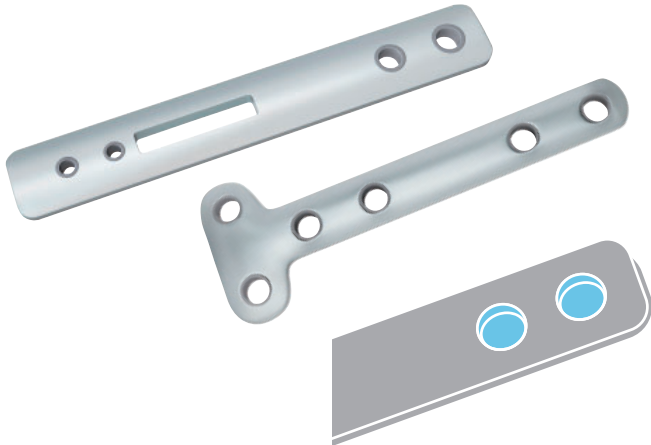
		VFHVRB	Conventional
Size	Dia.	ø3 mm	ø3 mm
	Radius	0.8 mm	0.2 mm
Machine		Micro Machining Center (HSK E-25)	
Numbe of Flute		4	2
Cutting Speed		50 m/min	50 m/min
Feed		2000 mm/min	1000 mm/min
Coolant		W.S.O	





BONE PLATES

Work Materials [**Titanium Alloy**, SUS316]



Drilling+Chamfering

Wide range
Wide application



VF2WB
(TOOLS NEWS B169G)

Key Point on Machining

- IMPACT MIRACLE coating with high heat resistance enables to long tool life.
- Possible to machine complex geometries previously difficult to machine.

Application Example

- **Four processes with one tool when helical machining !**
- **Fine finished surface and small burrs.**

End mill	Wide range Ball End mill VF2WBR0150N080 (ø3 mm)
Machine	Machining Center (BT40)
Work Material	Titanium Alloy
Cutting Speed	113 m/min
Revolution	12000 min ⁻¹
Feed	500 mm/min
Helical Pitch	0.1-0.2 mm/rev
Coolant	W.S.O

<Conventional>

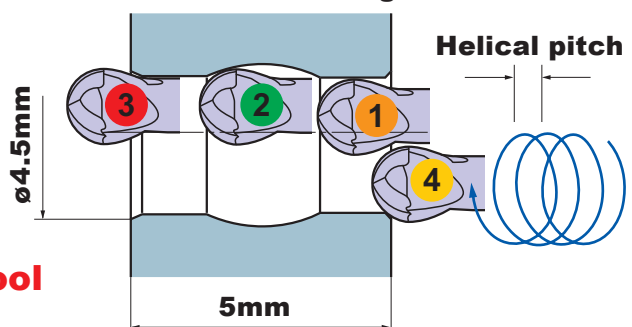
- ① Drilling
- ② Internal profile
- ③ Chamfer
 - Upper
 - Under



Three tools → One tool

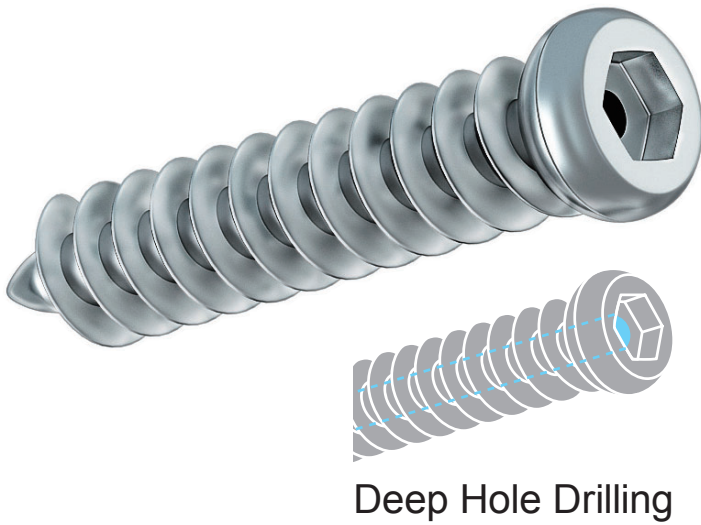
<Improvement>

Helical machining



SCREWS

Work Materials [**Titanium Alloy**, SUS316, SUS317]



Excellent chip evacuation

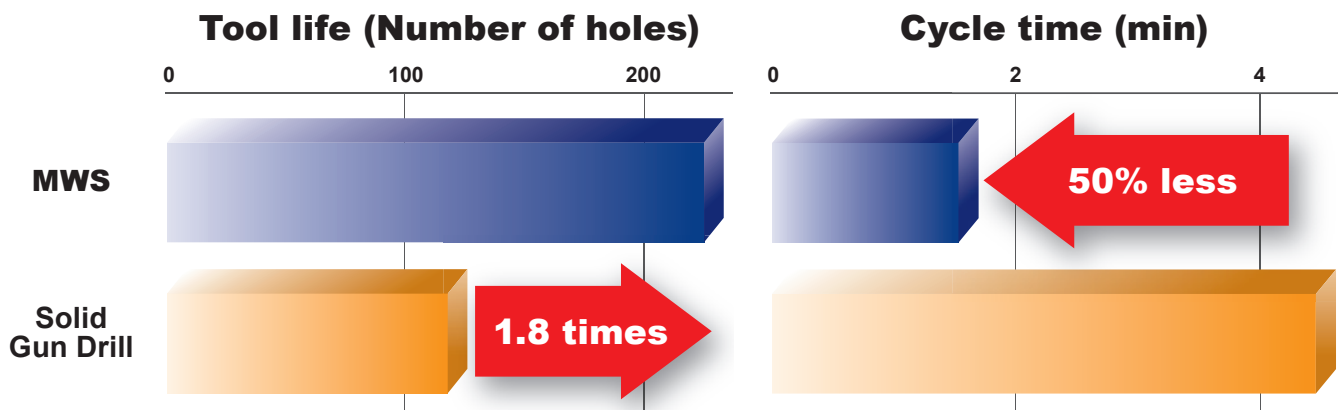
Key Point on Machining

- Promotes smooth chip evacuation.
- Use of internal coolant hole improves cooling.

Application Example

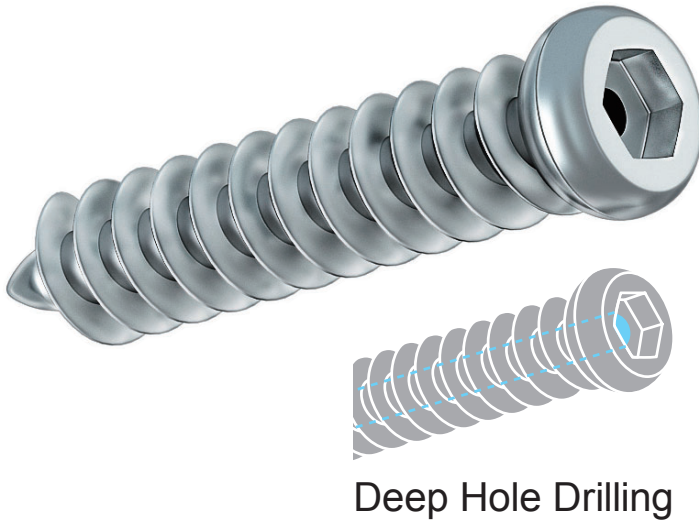
• **Ultra productivity machining and longer tool life !**

Work Material	Titanium Alloy		
Machine	Swiss Lathe Machine		
Hole Size	ø1.8 mm Depth:50 mm	Pilot drill:MWS0180SB (ø1.8 mm)	Depth:4 mm
Drill	MWS0180X30DB (ø1.8 mm)	Solid Gun Drill (ø1.8 mm)	
Revolution	1770 min ⁻¹		2650 min ⁻¹
Cutting Speed	10 m/min		15 m/min
Feed	0.02 mm/rev Non-peck		0.005 mm/rev Non-peck
Coolant	Oil (Coolant pressure 10 MPa)		



SCREWS

Work Materials [Titanium Alloy, **SUS316**, SUS317]



Excellent chip evacuation



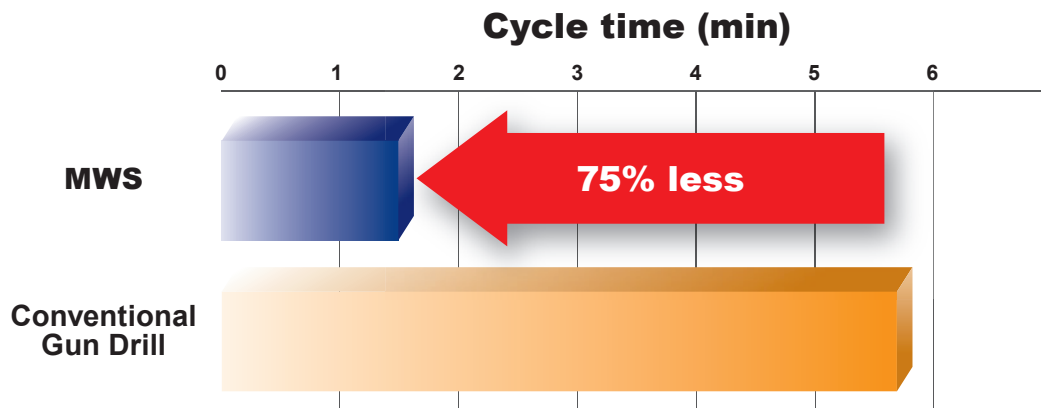
Key Point on Machining

- Promotes smooth chip evacuation.
- Use of internal coolant hole improves cooling.

Application Example

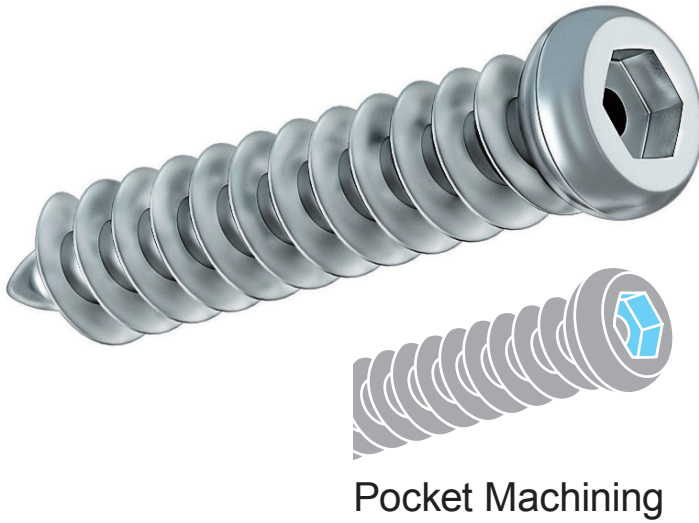
- **High efficiency deep hole drilling of SUS316L.**
- **4 times faster cycle time than a gun drill !**

Work Material	SUS316L	
Machine	Swiss Lathe Machine	
Hole Size	ø2.5 mm Depth:70 mm Pilot drill:MWS0250SB (ø2.5 mm) Depth:5.0 mm	
Drill	MWS0250X30DB (ø2.5 mm)	Gun Drill (ø2.5 mm)
Revolution	2500 min ⁻¹	5000 min ⁻¹
Cutting Speed	20 m/min	40 m/min
Feed	0.020 mm/rev Non-peck	0.0025 mm/rev Non-peck
Coolant	Oil (Coolant pressure 6 MPa)	



SCREWS

Work Materials [**Titanium Alloy**, SUS316, SUS317]



Pocket Machining



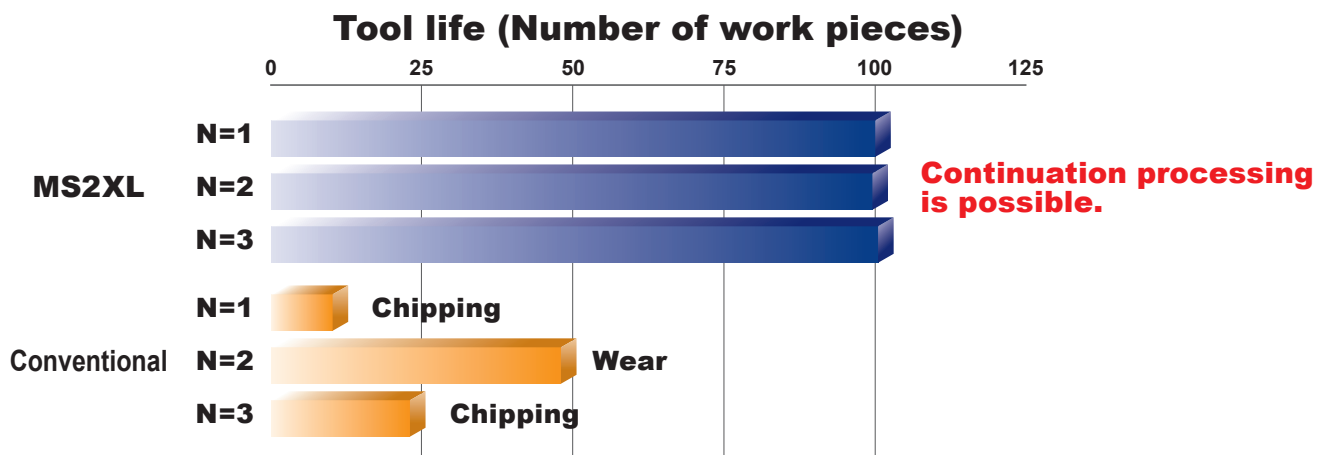
Key Point on Machining

- Cutting edge geometry with excellent chipping resistance.
- Small diameter combined with a variety of neck lengths aid in machining of deep cavity and complex parts.

Application Example

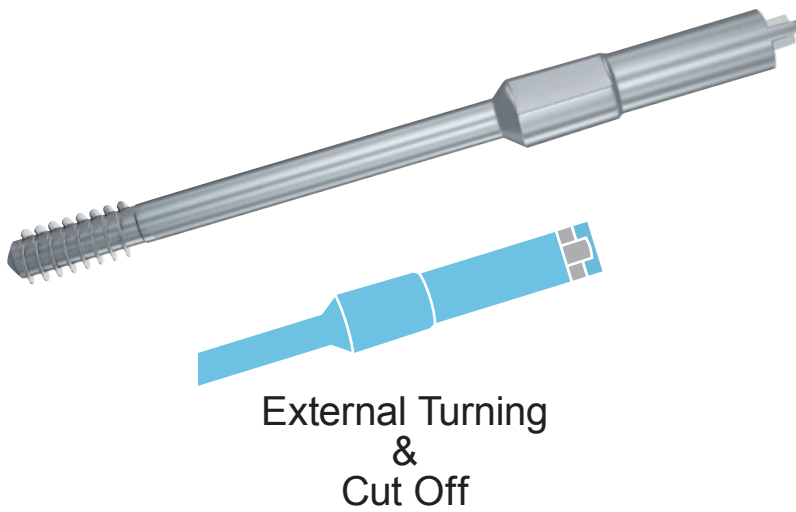
- **Realized stable tool life.**

Work Material	Titanium Alloy
Machine	Swiss Lathe Machine
End mill	Long Neck Square End mill (2 flute) MS2XLD0070N040 (ø0.7 mm)
Revolution	18000 min ⁻¹ (vc40 m/min)
Feed	200 mm/min (0.005 mm/tooth)
Depth of Cut	ap0.06 mm
Coolnat	Oil

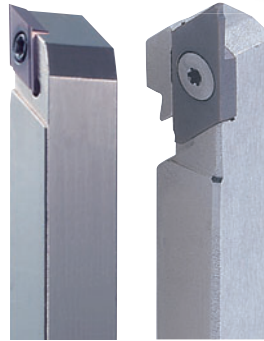


SCREWS

Work Materials [**Titanium Alloy**, SUS316, SUS317]



Good cutting performance



Small Tools
VP15TF
(GENERAL CATALOG C005*)

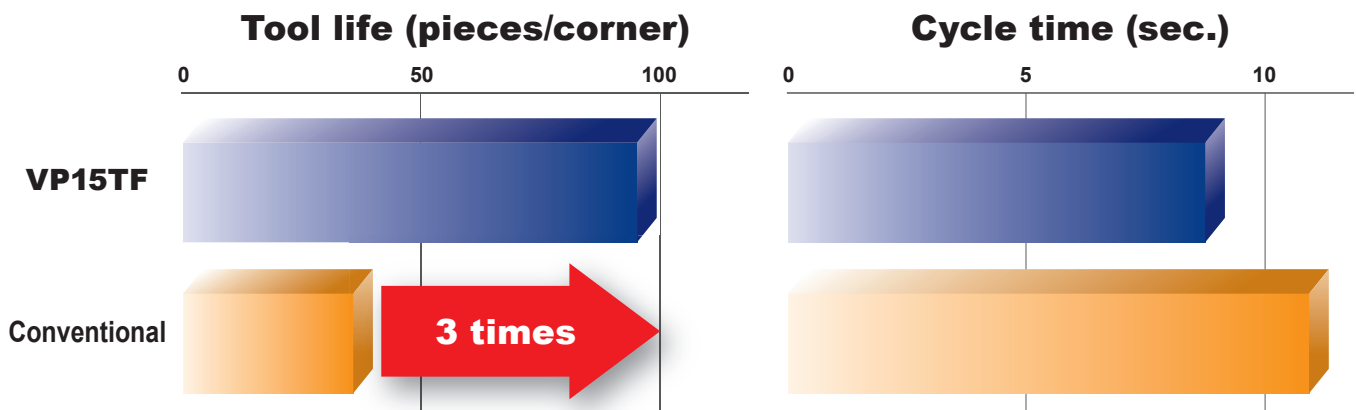
Key Point on Machining

- A good balance of wear and fracture resistance for turning Titanium Alloy and Stainless Steel.
- Reduced heat generation with the use of a sharp cutting edge.

Application Example

• **3 times longer tool life than conventional products !**

Machine	Swiss Lathe Machine	
Work material	Titanium Alloy	
Operation	Cut Off	
Width of Insert	1 mm	
Insert (grade)	Mitsubishi	Conventional
	CTAT10120V5RR-B (VP15TF)	Similar Insert (PVD coating)
Cutting Speed	36 m/min	30 m/min
Feed	0.02 mm/rev	0.02 mm/rev



SPINE

Work Materials [Co-Cr Alloy, **Titanium Alloy**, Stainless Steel]



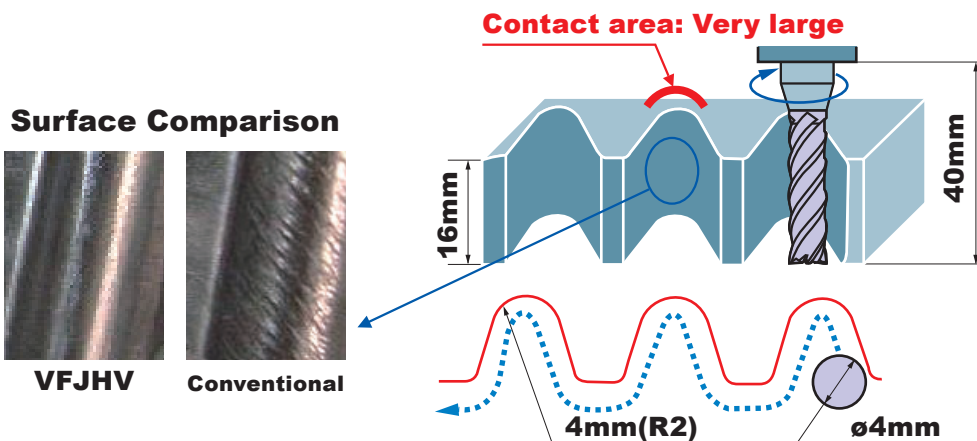
Key Point on Machining

- **IMPACT MIRACLE** coating with high heat resistance enables long tool life.
- Delivers superior vibration resistance for difficult-to-cut materials.

Cutting Example

- **Good surface finish and high efficiency from the use of irregular helix flutes.**

End mill	4 flute Vibration Control Square End mill VFJHVD0400 (ø4 mm)
Machine	Multi-axis Turning (HSK63)
Work Material	Titanium Alloy
Cutting Speed	30 m/min
Revolution	2400 min ⁻¹
Feed	380 mm/min
Depth of Cut	ap16 mm ae0.2 mm
Coolant	W.S.O

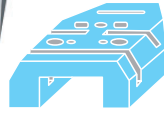


Long over hang and small diameter needed due to the shape of the work piece.



INSTRUMENT

Work Materials [Titanium Alloy, **Stainless Steel**]



Rough Milling



AJX
(TOOLS NEWS B028G)

Improved chip removal

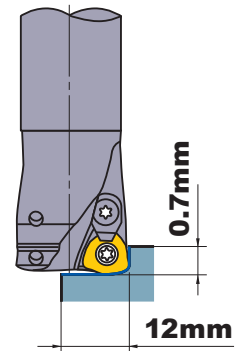
Key Point on Machining

- AJX can achieves extra high feed rates for ultimate efficiency in rough machining.
- Wide selection of inserts with high wear and fracture resistance, for general machining operations.

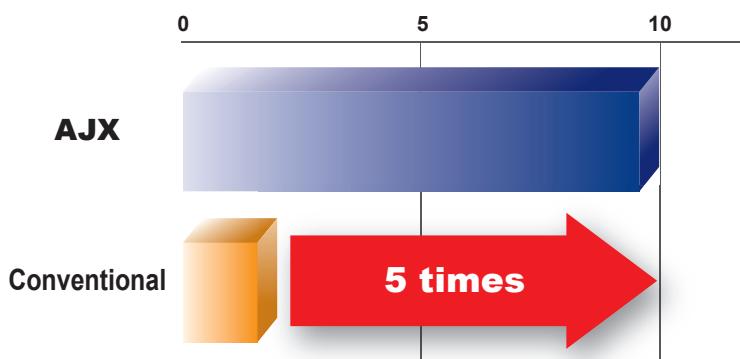
Application Example: Surgical Equipment

- **AJX achieves 5 times longer tool life than conventional products when milling 17-4PH.**

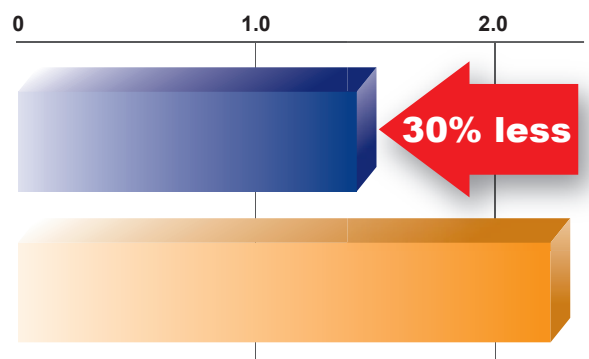
Work Material	17-4PH 42 HRC	
Machine	Machining Center (HSK63)	
Tool	Holder	AJX06R203SA20S (ø20mm 3flutes)
	Insert (Grade)	JOMT06T215ZZSR-JM (VP15TF)
Cutting Speed	120 m/min (Conventional: 100 m/min)	
Feed	2850 mm/min (Conventional: 2000 mm/min)	
Coolant	Air blow	



Tool life (Number of work pieces)

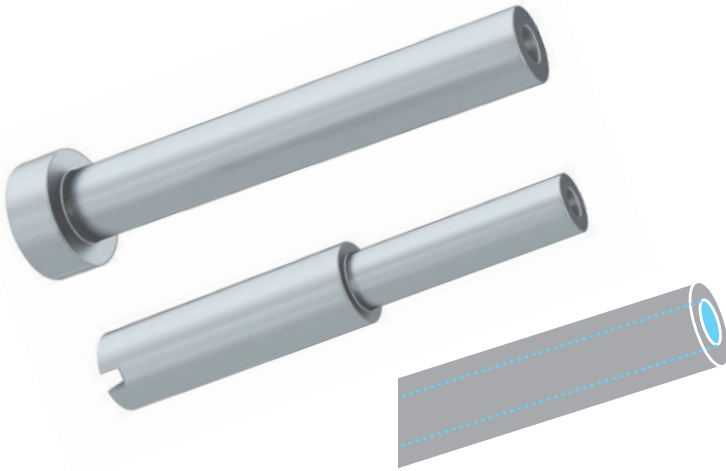


Cycle time (min)



INSTRUMENT

Work Materials [Titanium Alloy, **Stainless Steel**]



Deep Hole Drilling

Excellent chip evacuation



MWS
Super long drill
(TOOLS NEWS B129G)

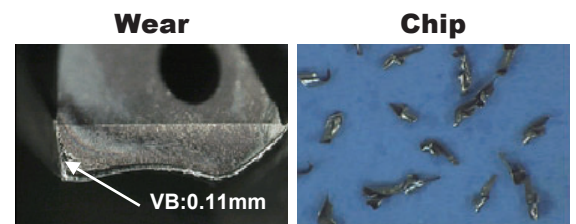
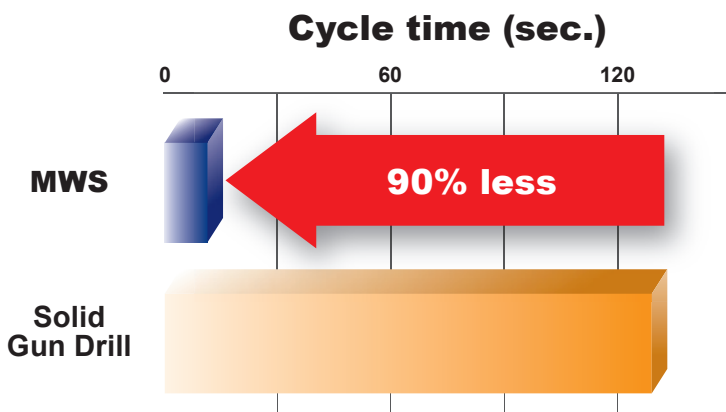
Key Point on Machining

- Promotes smooth chip evacuation.
- Use of internal coolant hole improves cooling.

Cutting Example

- **High efficiency deep hole drilling of 17-4PH.**
- **10 times faster cycle time than gun drill !**

Work Material	17-4PH 32 HRC		
Machine	Swiss Lathe Machine		
Hole Size	ø2.3 mm	Depth:70 mm	Pilot drill:MWS0230SB (ø2.3 mm) Depth:5 mm
Drill	MWS0230X30DB Solid Drill		Solid Gun Drill
Revolution	5500 min ⁻¹		5500 min ⁻¹
Cutting Speed	40 m/min		40 m/min
Feed	0.06 mm/rev Non-peck		0.006 mm/rev Non-peck
Coolant	Oil (Coolant pressure 14 MPa)		



When machining 150holes

Continuation processing is possible.

Memo

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

Global Network



- Sales Office
- Factory
- Representative Office
- Agency



www.mitsubishicarbide.com

JAPAN
MITSUBISHI MATERIALS CORPORATION
 Area Marketing & Operations Department
 KFC bldg., 8F, 1-6-1, Yokoami, Sumida-ku, Tokyo 130-0015 JAPAN
 TEL +81-3-5819-8771 FAX +81-3-5819-8774

USA
MITSUBISHI MATERIALS U.S.A. CORPORATION
 11250 Slater Avenue, Fountain Valley, California,
 92708, USA
 TEL. +1-714-352-6100 FAX +1-714-668-1320

MEXICO
MMC METAL DE MEXICO, S.A. DE C.V.
 Av. La Cañada No.16, Parque Industrial Bernardo Quintana,
 El Marques, Queretaro, CP76246 MEXICO
 TEL +52-442-221-6136 FAX +52-442-221-6134

BRAZIL
MMC-METAL DO BRASIL LTDA.
 Rua Cincinato Braga, 340, 13° Andar,
 Bela Vista-CEP 01333-010, São Paulo-SP, BRAZIL
 TEL +55-11-3506-5600 FAX +55-11-3506-5688

CHINA
MITSUBISHI MATERIALS (SHANGHAI) CORPORATION
 Room 4107, UNITED PLAZA 1468, Nanjing Road West,
 Shanghai, 200040 CHINA
 TEL +86-21-6289-0022 FAX +86-21-6279-1180

THAILAND
MMC Hardmetal (Thailand) CO., Ltd.
 CTI Tower 24Fl., 191/32 Rachadapisek Road,
 Klongtoey, Klongtoey, Bangkok 10110 THAILAND
 TEL +66-2661-8170 FAX +66-2661-8175

INDIA
MMC HARDMETAL INDIA PVT. LTD.
 2/10, 1st Floor, 80 Feet Road, R.M.V 2nd Stage,
 Bangalore - 560 094 Karnataka INDIA
 TEL +91-80-2351-6083 FAX +91-80-2351-6080

GERMANY
MMC HARTMETALL GmbH
 Comeniusstr.2, 40670, Meerbusch, GERMANY
 TEL +49-2159-91890 FAX +49-2159-918966

UNITED KINGDOM
MMC HARDMETAL U.K. LTD
 Mitsubishi House, Galena Close,
 Amington Heights, Tamworth, B77 4AS, U.K.
 TEL +44-1827-312312 FAX +44-1827-312314

FRANCE
MMC METAL FRANCE S.A.R.L.
 6, rue Jacques Monod, 91400, Orsay, FRANCE
 TEL +33-1-69-35-53-53 FAX +33-1-69-35-53-50

ESPANA
MITSUBISHI MATERIALS ESPAÑA, S.A.
 Calle Emperador 2, 46136, Museros, Valencia, SPAIN
 TEL +34-96-144-1711 FAX +34-96-144-3786

ITALY
MMC ITALIA S.R.L
 V.le delle Industrie 2, 20020 Arese (Mi), ITALY
 TEL +39-02-93-77-03-1 FAX +39-02-93-58-90-93

RUSSIA
MMC HARDMETAL OOO LTD.
 ul. Bolschaya Semenovskaya 11, bld. 5,
 107023 Moscow, RUSSIA
 TEL +7-495-72558-85 FAX +7-495-98139-73

POLAND
MMC HARDMETAL POLAND Sp. z o.o.
 Al. Armii Krajowej 61, 40-541 Wrocław, POLAND
 TEL +48-71-335-16-20 FAX +48-71-335-16-21