

Small Diameter Radius End Mill

Carbide
shank type
expansion

ARX



Long straight shank for
variable depth machining.

**Small diameter end mill with
high radial tolerance for a wider
range of machining operations.**

Small Diameter Radius End Mill

ARX

Features

Tool Diameter and Radius	Holder: Ø10–Ø25 (mm)	Insert: R2.5, R3.0, R3.5 (mm)
Applications	Roughing and Semi-finishing	

Highly Rigid Body

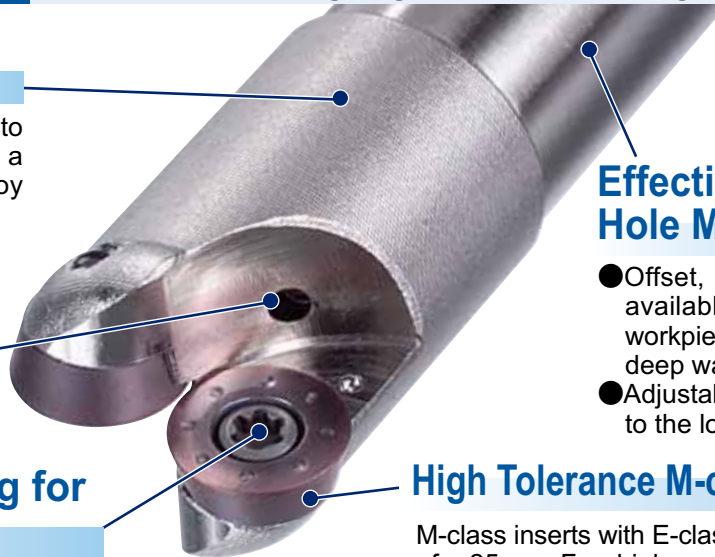
The cutter body is made resistant to corrosion and abrasion by using a superior high heat resistant alloy and special surface treatment.

All Bodies Standardized with Through Air & Coolant holes

For effective cooling, lubrication and chip discharge.

Highly Rigid Clamping for Stable Machining

Strong insert clamping by using a Torx plus® clamp screw system.

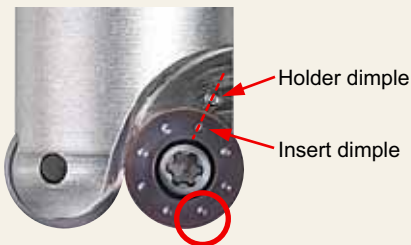


Effective for Deep Hole Machining

- Offset, long shank type available for preventing workpiece interference on deep walled components.
- Adjustable overhang due to the long straight shank.

High Tolerance M-class Inserts

M-class inserts with E-class, close tolerance of $\pm 25\mu\text{m}$. For high precision workpiece surfaces obtained with low tooling costs.

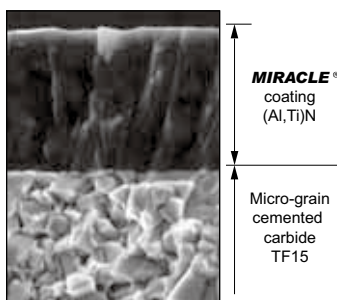


The body and insert has a dimple marking that enables the insert to be rotated to ensure full usage of the cutting edges.

○ = Contact with workpiece (Example: With the cutting edge contact at 45 degrees, the insert can be indexed 8 times.)

Long Tool Life Insert Grade

Stable machining is made possible with **VP15TF MIRACLE®** coated inserts.



VP15TF

Effective for Varied Machining

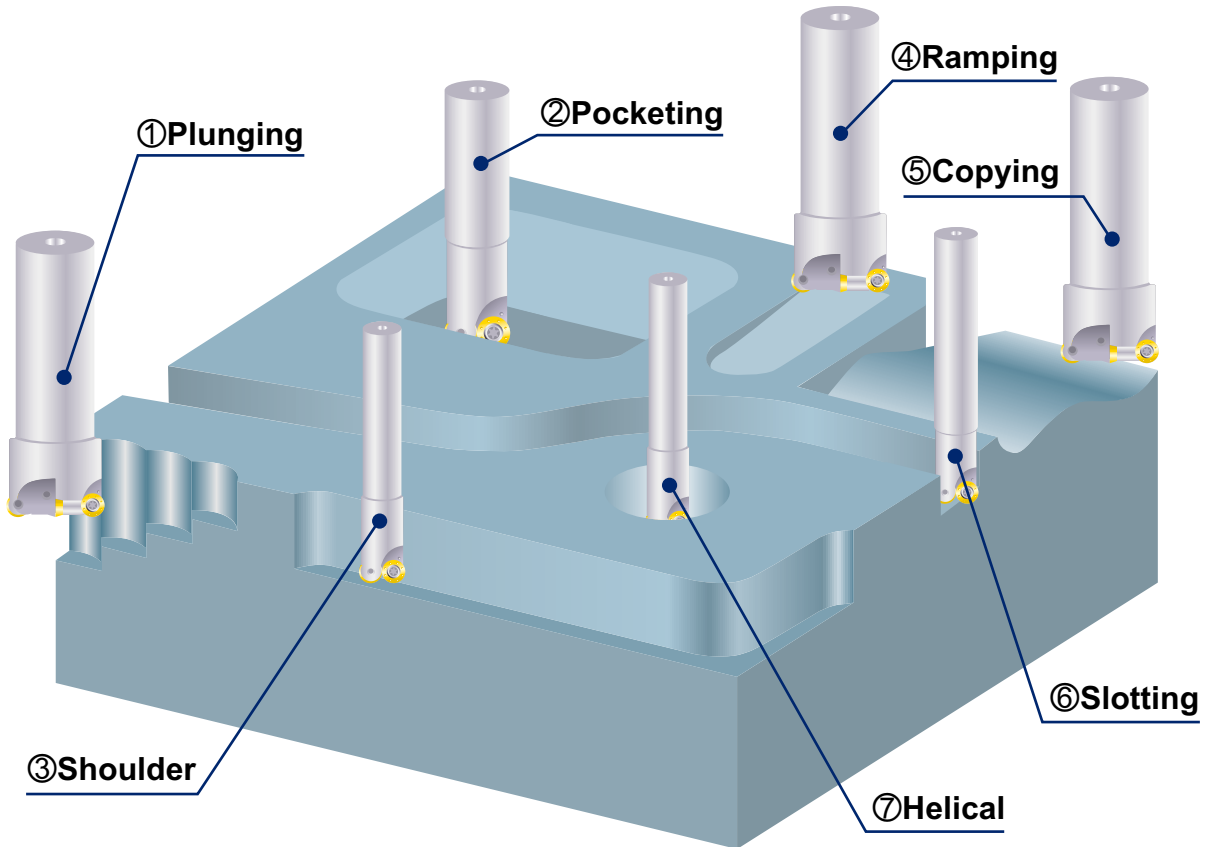
The **ARX** series is available in 2 variations, center cutting and non-center cutting (multi-tooth). For restricted space milling the center cutting type is effective, whereas the multi-tooth type is capable of a large pick feed.



Center cutting edge type.

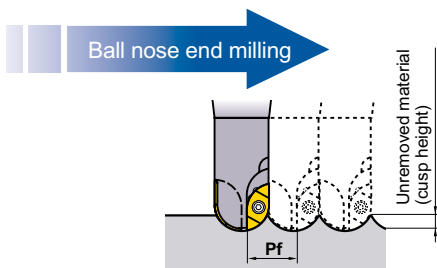
Non-center cutting edge type (multi-tooth)

Cutting Mode

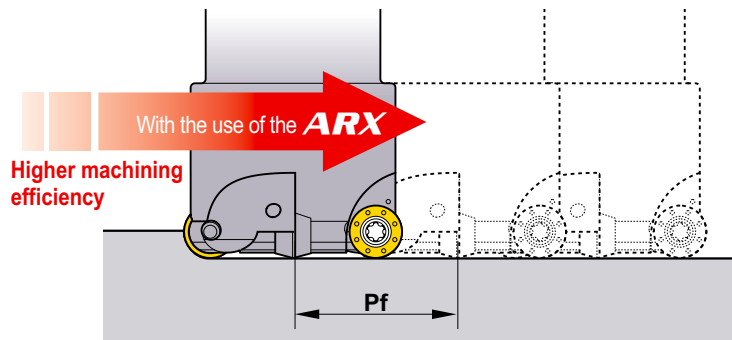


Using the **ARX** Effectively (Reducing Unremoved Material)

● When Milling Even Surfaces

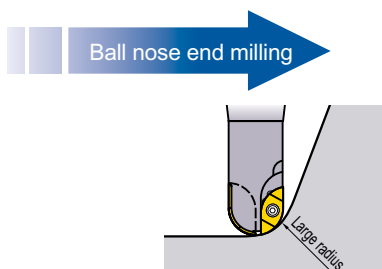


To reduce unremoved material, the pick feed needs to be reduced. (Machining efficiency will decrease.)

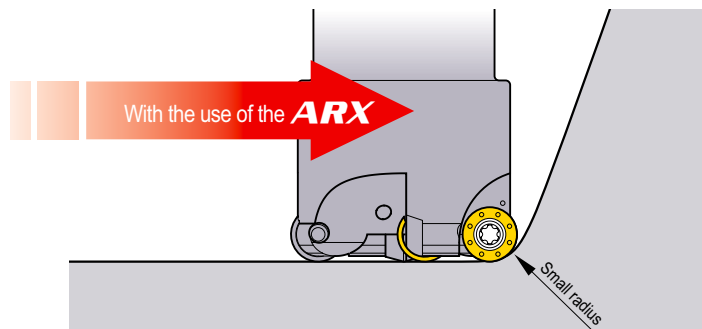


Even with a large pick feed, no unremoved material will remain.

● When Milling Corner Radius



To machine small corner radii, the tool diameter needs to be reduced. (Tool rigidity will decrease.)



A large shank diameter offering high rigidity can also machine small corner radii.

(The cutting load of a subsequent finishing tool will be decreased thereby lengthening its' tool life. Surface finish quality will be improved.)

Steel Shank



Fig. 1 (Type with the center cutting edge)

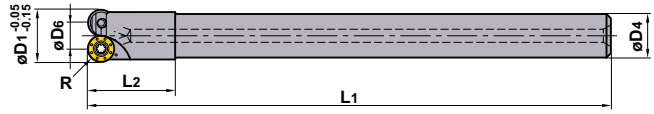
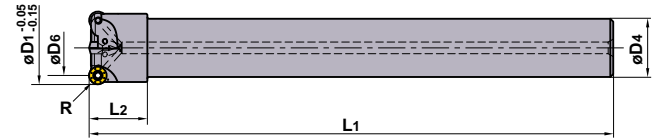


Fig. 2 (Type without the center cutting edge (multi-tooth))



Light Alloy	Cast Iron	General Steel	Stainless Steel	Hardened Steel
	➔			

Right hand tool holder only.
Tolerance when setting with master insert.

Type	Order Number	Stock	Coolant Hole	Number of Teeth	Dimensions (mm)						Inserts	Clamp Screw	Wrench	Fig.
					R	D1	D4	D6	L1	L2				
With the Center Cutting Edge	ARX25R102SA10S	●	○	2	2.5	10	10	5	120	20	RDMW0517M0E	TPS20	TIP06F	1
	30R122SA10S	●	○	2	3.0	12	10	6	120	20	RDMW0620M0E	TPS22S	TIP07FS	1
	35R142SA12S	●	○	2	3.5	14	12	7	140	20	RDMW0724M0E	TPS22	TIP07FS	1
Without the Center Cutting Edge (Multi-tooth)	ARX25R122SA10S	●	○	2	2.5	12	10	7	120	20	RDMW0517M0E	TPS20	TIP06F	2
	25R163SA16S	●	○	3	2.5	16	16	11	180	20	RDMW0517M0E	TPS20	TIP06F	2
	30R163SA16S	●	○	3	3.0	16	16	10	180	20	RDMW0620M0E	TPS22	TIP07FS	2
	25R173SA16S	●	○	3	2.5	17	16	12	180	20	RDMW0517M0E	TPS20	TIP06F	2
	30R173SA16S	●	○	3	3.0	17	16	11	180	20	RDMW0620M0E	TPS22	TIP07FS	2
	25R204SA20S	●	○	4	2.5	20	20	15	180	20	RDMW0517M0E	TPS20	TIP06F	2
	30R203SA20S	●	○	3	3.0	20	20	14	180	20	RDMW0620M0E	TPS22	TIP07FS	2
	25R224SA20S	●	○	4	2.5	22	20	17	180	20	RDMW0517M0E	TPS20	TIP06F	2
	30R224SA20S	●	○	4	3.0	22	20	16	180	20	RDMW0620M0E	TPS22	TIP07FS	2
	25R255SA20S	●	○	5	2.5	25	20	20	180	20	RDMW0517M0E	TPS20	TIP06F	2
	30R254SA20S	●	○	4	3.0	25	20	19	180	20	RDMW0620M0E	TPS22	TIP07FS	2

Carbide Shank

NEW



Fig. 1

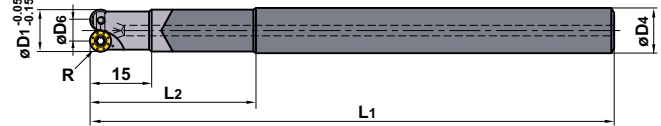


Fig. 2

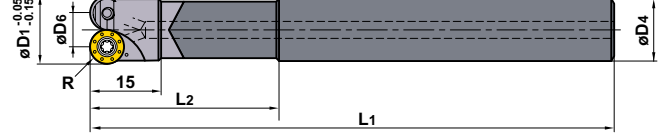
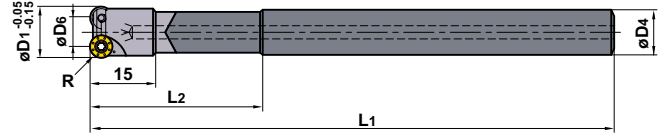


Fig. 3



Right hand tool holder only.
Tolerance when setting with master insert.

Type	Order Number	Stock	Coolant Hole	Number of Teeth	Dimensions (mm)						Inserts	Clamp Screw	Wrench	Fig.
					R	D1	D4	D6	L1	L2				
With the Center Cutting Edge	ARX25R102SA10LW	●	○	2	2.5	10	10	5	150	40	RDMW0517M0E	TPS20	TIP06F	1
	30R122SA10LW	●	○	2	3.0	12	10	6	150	40	RDMW0620M0E	TPS22S	TIP07FS	1
	35R142SA12LW	●	○	2	3.5	14	12	7	170	40	RDMW0724M0E	TPS22	TIP07FS	2
Without the Center Cutting Edge (Multi-tooth)	ARX25R122SA10LW	●	○	2	2.5	12	10	7	150	40	RDMW0517M0E	TPS20	TIP06F	3

Inserts

Shape	Order Number	Grade	Dimensions (mm)		Geometry
			D1	S1	
	RDMW0517M0E	●	5.0	1.70	
	0620M0E	●	6.0	1.99	
	0724M0E	●	7.0	2.38	

Recommended Cutting Conditions

*The cutting conditions below are a guide only.
Please make adjustments according to the machining conditions.

Shoulder • Pocket • Ramping • Copying

Workpiece	Hardness	Grade	Cutting Speed vc (m/min)	ARX25R SA S		ARX30R SA S		ARX35R SA S	
				Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)
P Mild Steel	≤180HB	VP15TF	180 (150–220)	≤1.0	≤0.5	≤1.2	≤0.5	≤1.5	≤0.5
	Carbon Steel Alloy Steel	180–350HB	VP15TF	160 (120–200)	≤0.7	≤0.3	≤0.9	≤0.3	≤1.2
M Stainless Steel	≤270HB	VP15TF	150 (120–180)	≤0.7	≤0.3	≤0.9	≤0.3	≤1.2	≤0.3
K Cast Iron	Tensile strength ≤450MPa	VP15TF	180 (150–220)	≤1.0	≤0.5	≤1.2	≤0.5	≤1.5	≤0.5
H Hardened Steel	45–55HRC	VP15TF	80 (50–120)	≤0.5	≤0.2	≤0.7	≤0.2	≤1.0	≤0.2

Note) When ramping, refer to the machining limits below.

Slotting

Workpiece	Hardness	Grade	Cutting Speed vc (m/min)	ARX25R SA S		ARX30R SA S		ARX35R SA S	
				Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)
P Mild Steel	≤180HB	VP15TF	180 (150–220)	≤1.0	≤0.4	≤1.2	≤0.4	≤1.5	≤0.4
	Carbon Steel Alloy Steel	180–350HB	VP15TF	160 (120–200)	≤0.7	≤0.2	≤0.9	≤0.2	≤1.2
M Stainless Steel	≤270HB	VP15TF	150 (120–180)	≤0.7	≤0.2	≤0.9	≤0.2	≤1.2	≤0.2
K Cast Iron	Tensile strength ≤450MPa	VP15TF	180 (150–220)	≤1.0	≤0.4	≤1.2	≤0.4	≤1.5	≤0.4
H Hardened Steel	45–55HRC	VP15TF	80 (50–120)	≤0.5	≤0.1	≤0.7	≤0.1	≤1.0	≤0.1

Plunging

Workpiece	Hardness	Grade	Cutting Speed vc (m/min)	ARX25R SA S		ARX30R SA S		ARX35R SA S	
				Width of Cut ae (mm)	Feed per Tooth fz (mm/tooth)	Width of Cut ae (mm)	Feed per Tooth fz (mm/tooth)	Width of Cut ae (mm)	Feed per Tooth fz (mm/tooth)
P Mild Steel	≤180HB	VP15TF	180 (150–220)	≤2.5	≤0.3	≤3.0	≤0.3	≤3.5	≤0.3
	Carbon Steel Alloy Steel	180–350HB	VP15TF	160 (120–200)	≤2.5	≤0.2	≤3.0	≤0.2	≤3.5
M Stainless Steel	≤270HB	VP15TF	150 (120–180)	≤2.5	≤0.2	≤3.0	≤0.2	≤3.5	≤0.2
K Cast Iron	Tensile strength ≤450MPa	VP15TF	180 (150–220)	≤2.5	≤0.3	≤3.0	≤0.3	≤3.5	≤0.3
H Hardened Steel	45–55HRC	VP15TF	80 (50–120)	≤2.5	≤0.1	≤3.0	≤0.1	≤3.5	≤0.1

Helical Drilling

Workpiece	Hardness	Grade	Cutting Speed vc (m/min)	ARX25R SA S		ARX30R SA S		ARX35R SA S	
				Depth of Cut Per Pass ap (mm/pass)	Feed per Tooth fz (mm/tooth)	Depth of Cut Per Pass ap (mm/pass)	Feed per Tooth fz (mm/tooth)	Depth of Cut Per Pass ap (mm/pass)	Feed per Tooth fz (mm/tooth)
P Mild Steel	≤180HB	VP15TF	180 (150–220)	≤1.0	≤0.3	≤1.0	≤0.3	≤1.0	≤0.3
	Carbon Steel Alloy Steel	180–350HB	VP15TF	160 (120–200)	≤0.7	≤0.2	≤0.9	≤0.2	≤1.0
M Stainless Steel	≤270HB	VP15TF	150 (120–180)	≤0.7	≤0.2	≤0.9	≤0.2	≤1.0	≤0.2
K Cast Iron	Tensile strength ≤450MPa	VP15TF	180 (150–220)	≤1.0	≤0.3	≤1.0	≤0.3	≤1.0	≤0.3
H Hardened Steel	45–55HRC	VP15TF	80 (50–120)	≤0.5	≤0.1	≤0.7	≤0.1	≤1.0	≤0.1

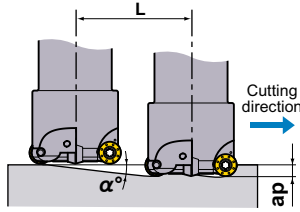
Note) When helical drilling, refer to the machining limits below.

Cutting Mode Maximum Capacities

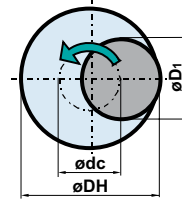
Ramping

Finding a cutters' distance moved "L" when depth of cut reaches "ap" at a ramping angle of "α°".

$$L = ap / \tan \alpha \text{ (mm)}$$



Helical Drilling



- Setting a tool's center excursion

$$\text{ødc} = \text{øDH} - \text{øD1}$$



Tool's center excursion Required bore diameter Tool's cutting diameter

- For the depth of cut per pass, refer to the cutting conditions above for helical drilling.

- Set the machine spindle revolution so that the tool is rotating and cutting in a down cut direction.

Type	Order Number	D1 (mm)	R (mm)	Number of Teeth	Ramping			Helical Drilling	
					max. α°	ap max. (mm)	L (mm)	DH min. (mm)	DH max. (mm)
With the Center Cutting Edge	ARX25R102SA10S	10	2.5	2	90	2.5	0	15	19
	25R102SA10LW	10	2.5	2	90	2.5	0	15	19
	30R122SA10S	12	3.0	2	90	3.0	0	18	23
	30R122SA10LW	12	3.0	2	90	3.0	0	18	23
	35R142SA12S	14	3.5	2	90	3.5	0	21	27
	35R142SA12LW	14	3.5	2	90	3.5	0	21	27
Without the Center Cutting Edge (Multi-tooth)	ARX25R122SA10S	12	2.5	2	27.17	2.5	4.87	19	23
	25R122SA10LW	12	2.5	2	27.17	2.5	4.87	19	23
	30R163SA16S	16	3.0	3	21.25	3.0	7.71	26	31
	25R163SA16S	16	2.5	3	13.70	2.5	10.26	27	31
	30R173SA16S	17	3.0	3	18.42	3.0	9.01	28	33
	25R173SA16S	17	2.5	3	12.22	2.5	11.54	29	33
	30R203SA20S	20	3.0	3	13.21	3.0	12.78	34	39
	25R204SA20S	20	2.5	4	9.23	2.5	15.38	35	39
	30R224SA20S	22	3.0	4	11.13	3.0	15.25	38	43
	25R224SA20S	22	2.5	4	7.94	2.5	17.92	39	43
	30R254SA20S	25	3.0	4	9.01	3.0	18.92	44	49
	25R255SA20S	25	2.5	5	6.57	2.5	21.71	45	49

Application Examples

Tool		ARX25R255SA20S	ARX25R102SA10S
Insert		RDMW0517M0E	RDMW0517M0E
Grade		VP15TF	VP15TF
Machine		Vertical type M/C	Vertical type M/C
Workpiece		DH31-S 	DH31-S(48HRC) 
Cutting Mode		Cylindrical milling	Concave milling
Cutting Conditions	Cutting Speed (m/min)	196 (2500min ⁻¹)	157 (5000min ⁻¹)
	Table Feed (mm/min)	3000	3000
	Feed per Tooth (mm/tooth)	0.24	0.30
	Depth of Cut (mm)	0.5	0.5
	Width of Cut (mm)	15	6
Coolant		Water soluble	Mist
Results		Machining time could be reduced by 75% when compared to a competitor's solid ball nose end mill. Regrinding costs could also be reduced.	Machining time could be reduced by 75% when compared to a competitor's solid ball nose end mill. Due to inserts with a long tool life and high fracture resistance, automation has now become possible.

Notes on Clamping

*When clamping inserts, follow the recommendations below.

1. Clean the insert seat.
2. Fasten the clamp screw while pressing the insert against the insert seat.
3. For with-the-center-cutting-edge type, two inserts will slightly overlap near the center of the tool end. Set the second insert on the insert seat so as not to touch the first insert, while pressing the second insert, fasten the clamp screw.



To prevent inserts from touching each other, the **ARX** is designed so that inserts will fit below the centerline of the tool (positive radial rake). Therefore, slide the second insert in from the side to prevent contact between the first and second inserts.

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 spanner. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

MITSUBISHI MATERIALS CORPORATION



The Scope of the Registration:
Design, Development and
Production of General
Carbide Tools and Carbide
Blanks



The Scope of the Registration:
Design, Development and
Production of Cutting Tools,
Wear-resistant Tools, Rock
Drilling Tools, Cemented
Carbide Blanks and Coated
Products



MITSUBISHI MATERIALS CORPORATION Area Marketing & Operations Dept.

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

MMC HARTMETALL GmbH

Comeniusstr.2, 40670, Meerbusch GERMANY
TEL +49-2159-9189-0 FAX +49-2159-918966

MITSUBISHI MATERIALS U.S.A. CORPORATION Headquarters

17401, Eastman Street, Irvine, California, 92614, USA
TEL +1-949-862-5100 FAX +1-949-862-5180

MMC METAL SINGAPORE PTE LTD.

10, Arumugam Road, #04-00 Lion Industrial Bldg., 409957, SINGAPORE
TEL +65-6743-9370 FAX +65-6749-1469

Mitsubishi Carbide Home page : <http://www.mitsubishicarbide.com>

(Tools specifications subject to change without notice.)