THE NEW VALUE FRONTIER

KYOCERA

MRW

High efficient cutter with double sided round insert

The MRW radius cutter lowers cutting costs

Flat lock structure

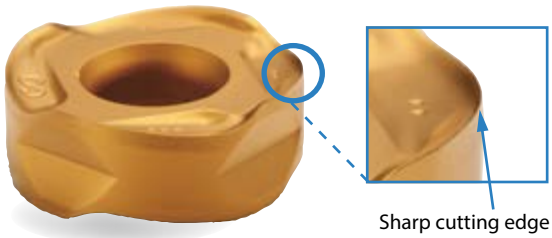
Waved cutting edge design

High efficient cutter with double sided round insert

MRW

1 The MRW radius cutter lowers cutting costs

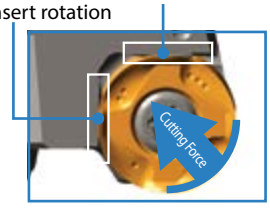
The new cutter lowers cutting costs and increases efficiency due to economical 8-edges per insert. Combining sharpness and cutting edge strength to this geometry makes it applicabale to a wide variety of applicaton by improving the milling performances. The double-sided inserts improve milling in a wide variety of materials.



2 Flat lock structure

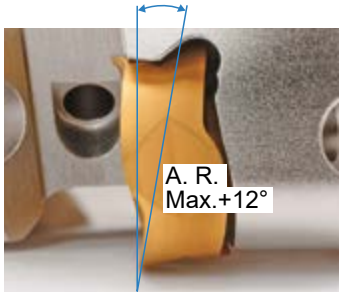
Holds the insert firmly and prevents rotation of the insert during machining and provides stable machining.

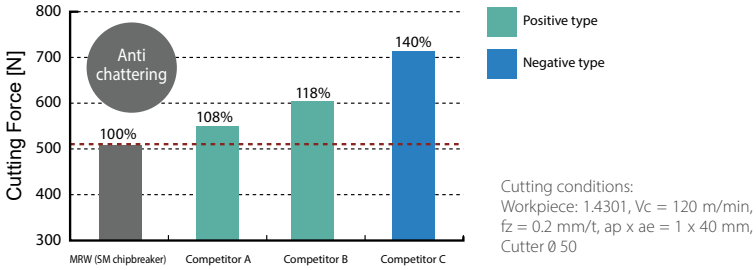
Wide flat binding face
- Receives cutting forces evenly
- Prevents insert rotation



3 Waved cutting edge design

Maximum axial rake 12° lowers cutting forces equivalent to positive type inserts.





Cutting conditions:
Workpiece: 1.4301, Vc = 120 m/min,
fz = 0.2 mm/t, ap x ae = 1 x 40 mm,
Cutter Ø 50

4 Wide range of applications from steel to difficult-to-cut materials

CA6535: CVD

For Ni-base heat resistant alloy and martensitic stainless steel

PR1535: PVD

For titanium alloy and precipitation hardened stainless steel

Workpiece	Recommended insert grade	Recommended chipbreaker
Carbon steel / Alloy steel / Die steel	PR1525	GM, SM, GH
Gray cast iron / Nodular cast iron	PR1510	GH, GM
Martensitic stainless steel	CA6535	SM, GM
Austenitic stainless steel	PR1535	
Precipitation hardened stainless steel		
Ni-base heat-resistant alloy	CA6535	
Titanium alloy	PR1535	

Grades for difficult-to-cut materials

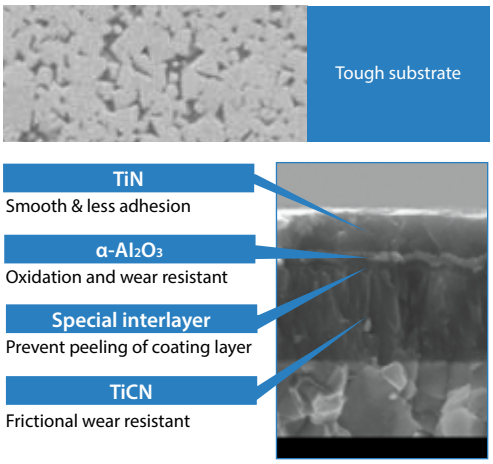
Stable cutting prevents insert fracturing for highly efficient machining

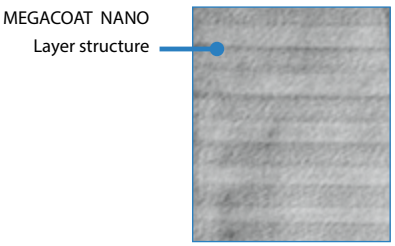
CA6535

- For Ni-base heat resistant alloy and martensitic stainless steel
- High heat resistance and wear resistance with CVD coating
- Improved stability due to thin film coating technology

PR1535

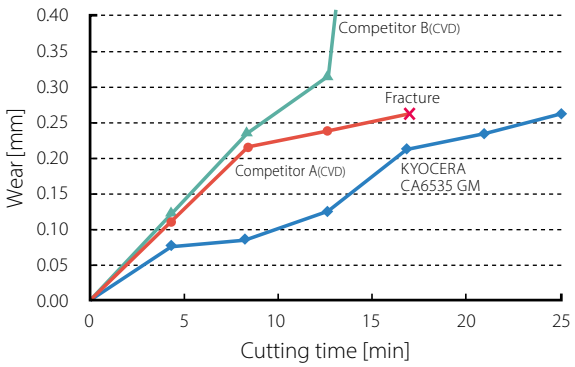
- For titanium alloy and precipitation hardened stainless steel
- Improved stability due to thin film coating technology
- Stabilized milling operation and long tool life with MEGACOAT NANO coating technology





Comparison of tool life

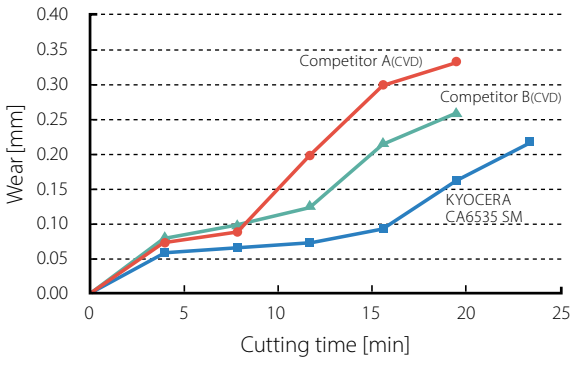
Ni-base heat-resistant alloy



Cutting conditions: Vc = 50 m/min, ap = 1.0 mm, fz = 0.15 mm/t, WET

1st recommendation
GM chipbreaker

Martensitic stainless steel



Cutting conditions: Vc = 300m/min, ap = 2.0 mm, fz = 0.2 mm/t, WET

1st recommendation
SM chipbreaker

MRW face mill (with coolant hole)

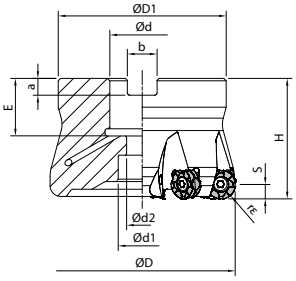


Fig. 1

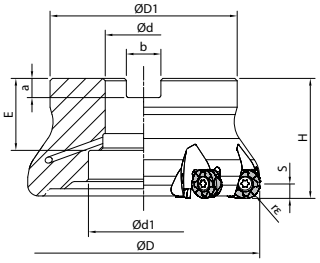


Fig. 2

Toolholder dimension

	Description		Availability	No. of Inserts	Dimension (mm)											Rake Angle (°)		Coolant Hole	Drawing	Weight(kg)	Max. Revolution (min^{-1})
					rε	ØD	ØD1	Ød	Ød1	Ød2	H	E	a	b	S	A.R.	R.R.				
Metric	MRW	050R-12-5T-M	●	5	6	50	48	22	18	11	40	21	6.3	10.4	6.0	+12°	-15.5°	Yes	Fig.1	0.3	16,000
		050R-12-6T-M	●	6																0.3	
		063R-12-6T-M	●	6		63	60		19											0.6	14,000
		063R-12-7T-M	●	7																0.6	
		080R-12-6T-M	●	6		80	70	27	20	13	50	24	7	12.4						1.1	12,000
		080R-12-8T-M	●	8																1.1	
		100R-12-7T-M	●	7		100	78	32	46	-		30	8	14.4					Fig.2	1.5	10,600
		100R-12-9T-M	●	9																1.4	
	MRW	063R-16-5T-M	●	5	8	63	60	22	19	11	40	21	6.3	10.4	8.0	+11°	-16.5°		Fig.1	0.5	12,800
		063R-16-6T-M	●	6																0.5	
		080R-16-6T-M	●	6		80	70	27	20	13	50	24	7	12.4						1.1	11,000
		080R-16-7T-M	●	7																1.0	
		100R-16-6T-M	●	6		100	78	32	46	-		30	8	14.4					Fig.2	1.4	9,600
		100R-16-8T-M	●	8																1.3	
		125R-16-8T-M	●	8		125	89	40	55		63	33	9	16.4						2.6	8,560
		125R-16-10T-M	●	10																2.5	
Inch	MRW	080R-12-6T	○	6	6	80	70	25.4	20	13	50	27	6	9.5	6.0	+12°	-15.5°		Fig.1	1.2	12,000
		080R-12-8T	○	8																1.1	
		100R-12-7T	○	7		100	78	31.75	46	-		34	8	12.7					Fig.2	1.5	10,600
		100R-12-9T	○	9																1.4	
	MRW	080R-16-6T	○	6	8	80	70	25.4	20	13	50	27	6	9.5	8.0	+11°	-16.5°		Fig.1	1.1	11,000
		080R-16-7T	○	7																1.1	
		100R-16-6T	○	6		100	78	31.75	46	-		34	8	12.7					Fig.2	1.4	9,600
		100R-16-8T	○	8																1.4	
		125R-16-8T	○	8		125	89	38.1	55		63	38	10	15.9						2.6	8,560
		125R-16-10T	○	10																2.6	

● Standard item

Spare parts and applicable inserts

Description		Clamp screw	Wrench		Anti-seize compound	Mounting bolt	Applicable inserts
			DTPM-15	TTP-20			
MRW	050R-12...	SB-4085TRP	DTPM-15		MP-1	HH10x30	ROMU12…
	063R-12...	Recommended torque for insert clamp 3.5 Nm				HH12x35	
	080R-12...					-	
	100R-12...						
MRW	063R-16...	SB-50140TRP	TTP-20		MP-1	HH10x30	ROMU16…
	080R-16...	Recommended torque for insert clamp 4.5 Nm				HH12x35	
	100R-16...					-	
	125R-16...						

- Caution with Max. Revolution
  When running an endmill or a cutter at the maximum revolution, the insert or cutter may be damaged by centrifugal force.
- Coat Anti-seize Compound (MP-1) thinly on portion of taper and thread when insert is fixed.
- S is Maxmum ap. For more details, see page 7.

MRW end mill (with coolant hole)

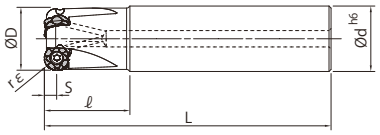


Fig.1

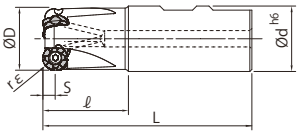


Fig.3

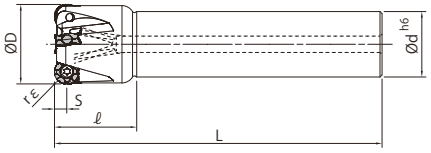


Fig.2

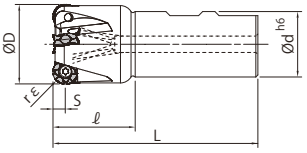


Fig.4

Toolholder dimension

Description			Availability	No. of inserts	Dimension (mm)						Rake angle (°)		Coolant hole	Drawing	Max. Revolution (min^{-1})
					rε	ØD	Ød	L	ℓ	S	A.R. (MAX)	R.R.			
Standard (Cylindrical)	MRW	32-S32-12-3T	●	3	6	32	32	140	40	6.0	+12°	-20°	Yes	Fig. 1	22,000
		40-S32-12-4T	●	4		40		160	40			-16.5°		Fig. 2	18,800
		50-S42-12-5T	●	5		50	42	170	40			-15.5°			16,000
	MRW	40-S32-16-3T	●	3	8	40	32	160	40	8.0	+11°	-18°	Yes	Fig. 2	17,200
		50-S42-16-4T	●	4		50	42	170	40			-16.5°			14,800
		63-S42-16-5T	●	5		63		170	50			-16.5°			12,800
Long shank (Cylindrical)	MRW	32-S32-12-2T-200	●	2	6	32	32	200	40	6.0	+12°	-20°	Yes	Fig. 1	22,000
		40-S32-12-3T-200	●	3		40		200	40			-16.5°		Fig. 2	18,800
		50-S42-12-4T-300	●	4		50	42	300	40			-15.5°			16,000
	MRW	40-S32-16-2T-200	●	2	8	40	32	200	40	8.0	+11°	-18°	Yes	Fig. 2	17,200
		50-S42-16-3T-300	●	3		50	42	300	40			-16.5°			14,800
		63-S42-16-4T-300	●	4		63		300	50			-16.5°			12,800
Standard (Weldon)	MRW	32-W32-12-3T	●	3	6	32	32	102	40	6.0	+12°	-20°	Yes	Fig. 3	22,000
		40-W32-12-4T	●	4		40		100	40			-16.5°		Fig. 4	18,800
		50-W40-12-5T	●	5		50	40	110	40			-15.5°			16,000
	MRW	40-W32-16-3T	●	3	8	40	32	100	40	8.0	+11°	-18°	Yes	Fig. 4	17,200
		50-W40-16-4T	●	4		50	40	110	40			-16.5°			14,800
		63-W40-16-5T	●	5		63		120	50			-16.5°			12,800

●: Available

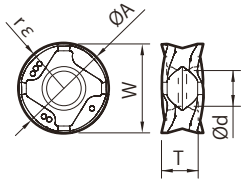
Spare parts and applicable inserts

Description		Clamp Screw	Wrench		Anti-seize Compound	Applicable Inserts
			DTPM-15	TTP-20		
MRW	□□□-12...	SB-4085TRP	DTPM-15		MP-1	ROMU12…
		Recommended torque for insert clamp 3.5 Nm				
MRW	□□□-16...	SB-50140TRP	TTP-20		MP-1	ROMU16…
		Recommended torque for insert clamp 4.5 Nm				

- Caution with Max. Revolution
  When running an endmill or a cutter at the maximum revolution, the insert or cutter may be damaged by centrifugal force.
- Coat Anti-seize Compound (MP-1) thinly on portion of taper and thread when insert is fixed.
- S is Maxmum ap. For more details, see page 7.

Inserts

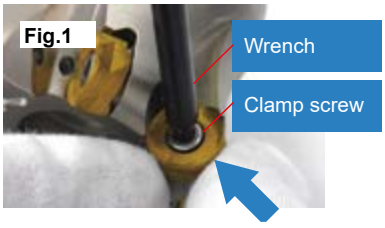
Classification of usage									Applicable Holder Reference Page
	P	Carbon steel / Alloy steel		★					
		Die steel		★					
	M	Austenitic stainless steel	★	☆					
		Martensitic stainless steel	☆			★			
		Precipitation hardened stainless steel	★						
★: Roughing / 1st choice ☆: Roughing / 2nd choice In case hardness is under 45 HRC	K	Gray cast iron			★				
		Nodular cast iron			★				
	S	Ni-base heat resistant alloy	☆			★			
		Titanium alloy	★		☆				
	H	Hard materials		☆					

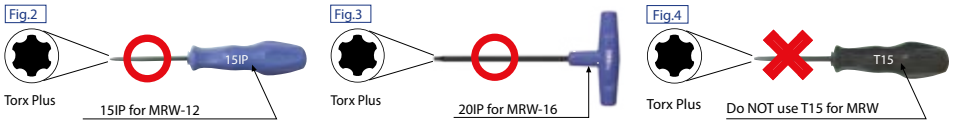
Insert		Description		Dimension (mm)					MEGACOAT NANO			CVD coated carbide			Applicable Holder Reference Page
				ØA	T	Ød	W	rε	PR1535	PR1525	PR1510	CA6535			
 General purpose		ROMU	1204M0ER-GM	12	4.75	4.6	11.8	6	●	●	●	●			P3 P4
			1605M0ER-GM	16	5.48	6.2	15.8	8	●	●	●	●			
 Low cutting force		ROMU	1204M0ER-SM	12	4.75	4.6	11.8	6	●	●		●			
			1605M0ER-SM	16	5.48	6.2	15.8	8	●	●		●			
 Tough edge (Heavy milling)		ROMU	1204M0ER-GH	12	4.75	4.6	11.8	6		●	●				
			1605M0ER-GH	16	5.48	6.2	15.8	8		●	●				

● : Available

How to mount an insert

1. Be sure to remove dust and chips from the insert mounting pocket.
2. Apply anti-seize compound on portion of taper and thread of clamp screw. Attach the screw to the front end of the wrench. While lightly pressing the insert against the constraint surfaces, put the screw into the hole of the insert and tighten. (See Fig. 1)
3. Wrench and clamp screws are "Torx Plus".
   Fig. 2 wrench is for MRW-12.
   Fig. 3 wrench is for MRW-16.
   For recommended torque, see page 4 and 5.
4. After tightening the screw, make sure that there is no clearance between the insert seat surface and the bearing surface of the holder and between the insert side surfaces and the constraint surface of the holder.

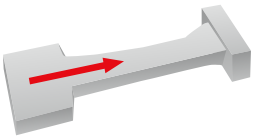




Case studies

12Cr steel

Turbine blade
Vc = 270 m/min, fz = 0.278 mm/t
ap = 0.5~1.0 mm, ae = max. 35 mm,
dry, MRW050R-12-6T-M
(6 inserts), ROMU1204M0ER-SM
(CA6535)



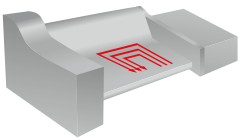
1.2x increased machining efficiency

CA6535	Stable machining
Competitor A Positive type	Unstable machining

MRW improved machining efficiency 1.2 times with same tool life compared to Competitor A.
MRW has a cost advantage due to double sided inserts.

12Cr steel

Turbine blade
Vc = 250 m/min, fz = 0.16 mm/t
ap = 2.0 mm, ae = 5 x 30 mm,
wet, MRW050R-12-5T-M
(5 inserts), ROMU1204M0ER-SM
(CA6535)



Same or longer tool life

CA6535	Stable machining
Competitor B Positive type	Unstable machining

MRW showed less damage on the cutting edge with reduced cutting noise.
MRW has equal or longer tool life and cost advantage due to double sided inserts.

Recommended cutting conditions

Workpiece material	Recommended chipbreaker (fz mm/t) Recommended feed rate (standard value) for ROMU12: ap = 3 mm, ROMU16: ap = 4 mm			Recommended insert grade (Vc m/min)			
				MEGACOAT NANO			CVD coated carbide
	GM	SM	GH	PR1525	PR1510	PR1535	CA6535
Carbon steel	★ 0.1~0.2~0.3	☆ 0.06~0.15~0.2	☆ 0.15~0.3~0.35	★ 120~180~250	-	-	-
Alloy steel	★ 0.1~0.2~0.3	☆ 0.06~0.15~0.2	☆ 0.15~0.3~0.35	★ 100~160~220	-	-	-
Die steel	★ 0.1~0.15~0.25	☆ 0.06~0.12~0.2	☆ 0.15~0.2~0.3	★ 80~140~180	-	-	-
Austenitic stainless steel	☆ 0.1~0.15~0.2	★ 0.06~0.12~0.2	-	☆ 100~160~200	-	★ 100~160~200	-
Martensitic stainless steel	★ 0.1~0.15~0.2	★ 0.06~0.12~0.2	-	-	-	☆ 150~200~250	★ 180~240~300
Precipitation hardened stainless steel	★ 0.1~0.15~0.2	☆ 0.06~0.12~0.2	-	-	-	★ 90~120~150	-
Gray cast iron	★ 0.1~0.2~0.3	-	☆ 0.15~0.3~0.35	-	★ 120~180~250	-	-
Nodular cast iron	★ 0.1~0.15~0.25	-	☆ 0.15~0.2~0.3	-	★ 100~150~200	-	-
Ni-base heat resistant alloy	★ 0.1~0.12~0.15	☆ 0.06~0.1~0.15	-	-	-	☆ 20~30~50	★ 20~30~50
Titanium alloy	☆ 0.1~0.12~0.15	★ 0.06~0.1~0.15	-	-	☆ 30~50~70	★ 40~60~80	-

★: 1st recommendation ☆: 2nd recommendation

* Machining with coolant is recommended for Ni-base Heat Resistant Alloy and Titanium Alloy.
* Adjust the cutting speed and the feed rate within the above conditions according to the actual machining situation.
* Recommended feed rate is the reference value when ap is rε/2 (3mm for ROMU12, 4mm for ROMU16). For lower feed rates than the above conditions, the conversion factor in the following table is recommended.

Conversion factor for feed per tooth by depth of cut (ap)

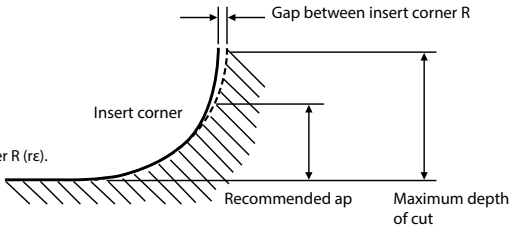
Insert	ap (recommended)	ap (max)	Conversion factor for feed per tooth				
			ap = 0.5 mm	ap = 1 mm	ap = 2 mm	ap = 3 mm	ap = 4 mm
ROMU12 type	3 mm or less	6 mm	2.1	1.5	1.1	1.0 Standard	–
ROMU16 type	4 mm or less	8mm	2.4	1.7	1.3	1.1	1.0 Standard

* Example (ROMU12 type, Carbon Steel, GM chipbreaker, ap=1mm)
* Recommended feed/tooth: 0.2mm/t (standard value for Carbon Steel / GM chipbreaker) x 1.5 (Conversion factor for ROMU12 / ap=1mm)=0.3mm/t
* Recommended ap: 3mm or less for ROMU12, 4mm or less for ROMU16

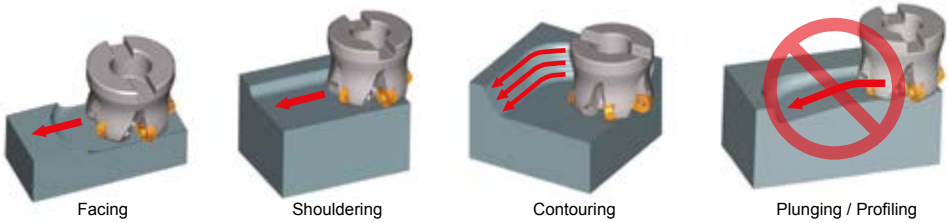
Corner R shape during processing

Insert	ap (max)	X	Y
ROMU12 type	6 mm	3 mm	0.1 mm
ROMU16 type	8 mm	4 mm	0.1 mm

Corner R shape during processing with MRW (see Fig.)
* When machining with larger ap than recommended ap (X), there is a gap (Y) between the workpiece corner and insert corner R (rε).
* The above figure is an estimation. There is a ±0.2mm variation depending on the cutting conditions.



Application



Facing Shouldering Contouring Plunging / Profiling

High efficiency radius cutter

MRX

- Economical positive round inserts with 6 usable cutting edges
- Low cutting force with helical cutting edge design
- CA6535 and PR1535 insert grades available for difficult-to-cut material
- R4, R5, R6 and R8 radius sizes available

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