

45 degrees face milling cutter

MB45

NEW



1. Development background
2. Product features
3. Evaluation result
4. Selling point and machining tips
5. Caution for use
6. Lineup
7. Q&A

1. Development background

MB45 is 45 degrees face milling cutter that combines the advantages of both positive (single-sided) and negative (double-sided) type inserts and aims to achieve both "High performance" and "Low cost".

KYOCERA conventional 45 degrees face milling cutter



Low cutting force and Excellent surface finish



Machining efficiency (focus on roughing) and high economy

New 45 degree face milling cutter "MB45"



"High performance" and "Low cost" cutter

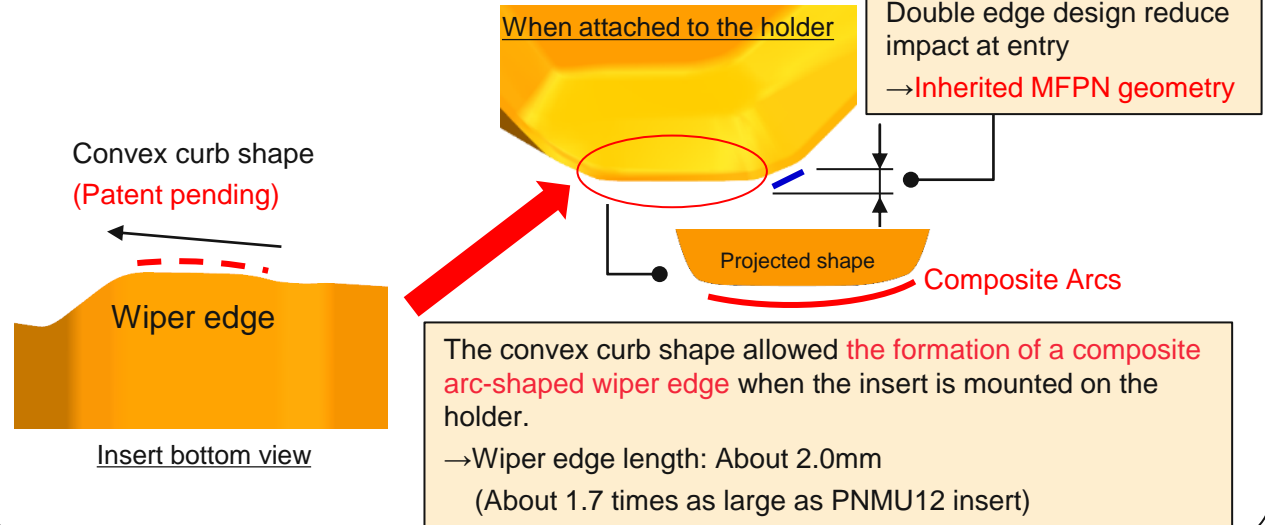
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2. Features

Point 1 Designed for "Versatility" and "High performance"



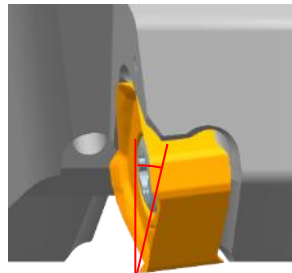
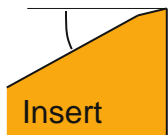
② Long wiper edge and Impact suppression



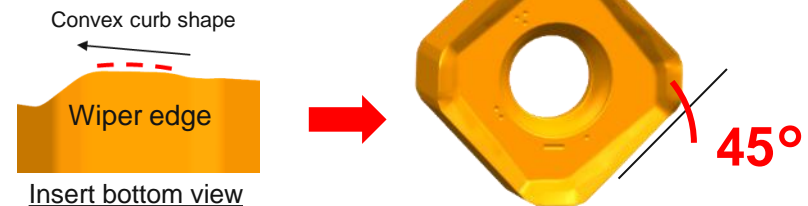
① Low force design

A.R. Max +13°

Large rake angle



③ 45° angle surface

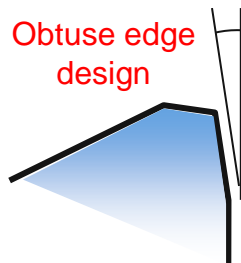
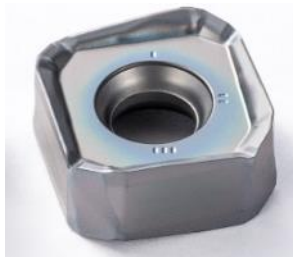


The unique wiper edge shape can make 45° surface.

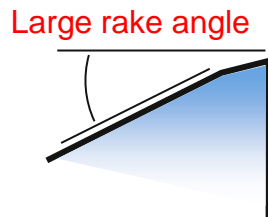
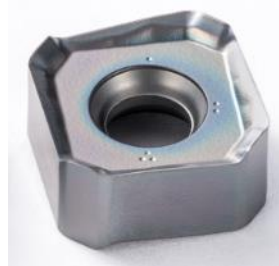
*For chamfering, use a range of ap1.0~3.0mm.

2. Features

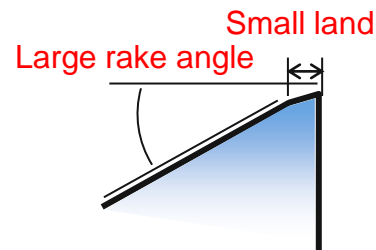
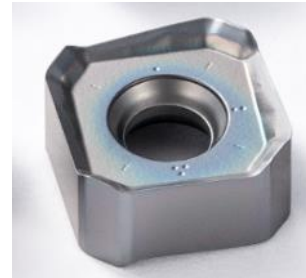
Point2 Various breakers for wide application



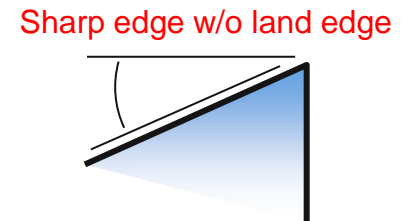
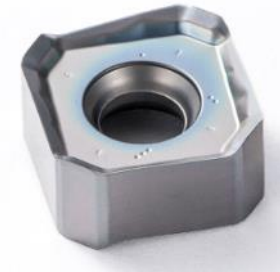
Heavy milling
GH breaker(M class)
● Strong edge due to **obtuse edge design**
→ Heavy milling



General purpose
GM breaker(E/M class)
● **1st recommendation**
→ Wide application
→ M and E-class insert available



Low cutting force
SM breaker(E class)
● Sharpness oriented
→ Low rigidity machine(**BT30**) and workpiece



For aluminum
AM breaker(E class)
● High sharpness due to **sharp edge w/o land edge**

2. Features

Point3 Lineup expansion of small diameter

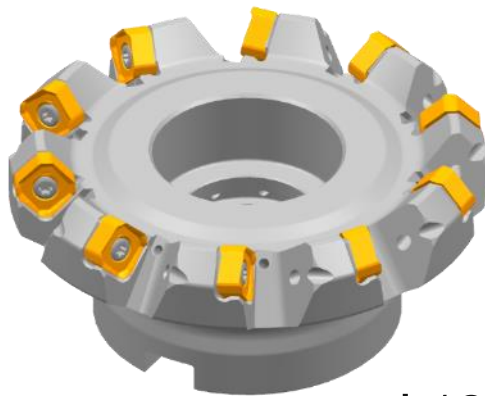
Smaller diameter lineup of holders for use with small M/C such as BT30

→ Added $\Phi 40$, $\Phi 50$ *MFPN45 lineup from $\Phi 63$

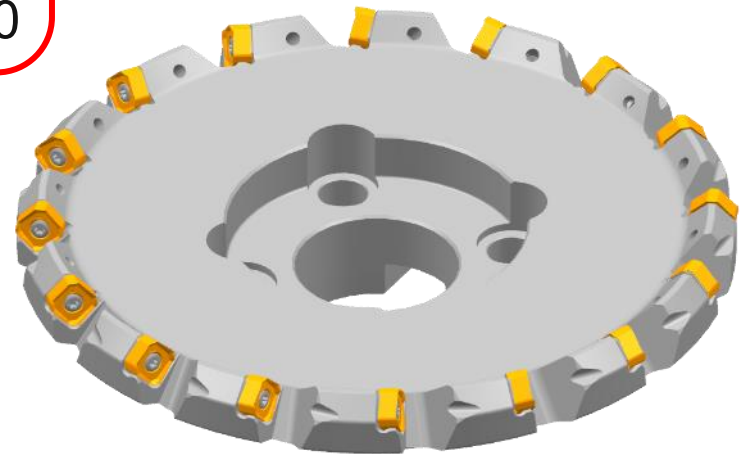
NEW



$\Phi 40$



$\Phi 125$



$\Phi 250$

2. Features

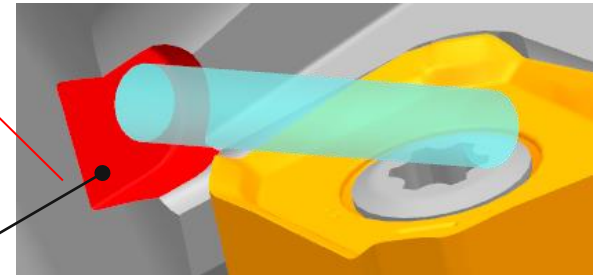
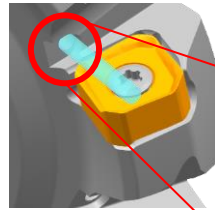
Point4 Special coolant hole

Special coolant hole (~ $\Phi 125$)

→ Internal coolant available

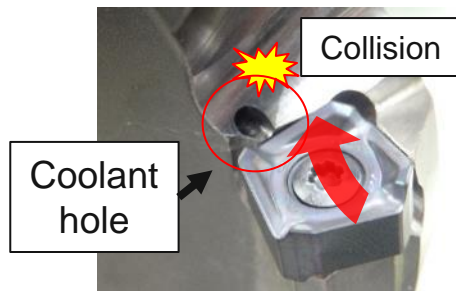
Coolant is discharged at the cutting edge, enabling shiny finish machining

*Due to shape restrictions, some holder model numbers do not have grooves in the coolant holes. (Small dia.)



Coolant hole with groove (red section)

→ Patent pending

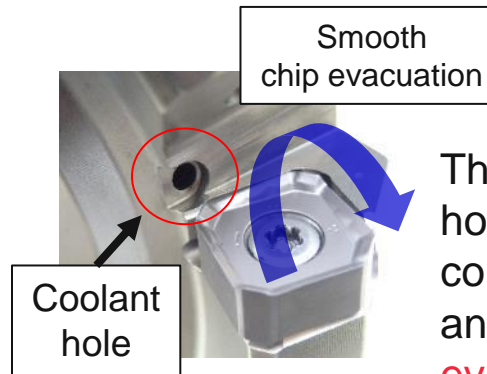


Collision

Coolant hole

Chips generated could **get caught** in the coolant holes.

Competitor



Smooth chip evacuation

Coolant hole

The grooves in the coolant holes prevent chips from contacting the coolant holes and promote **smooth chip evacuation**.

MB45

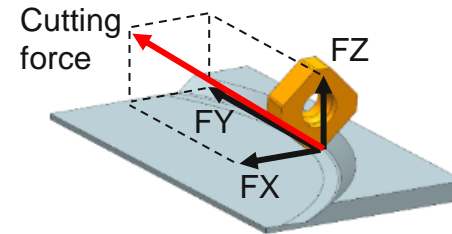
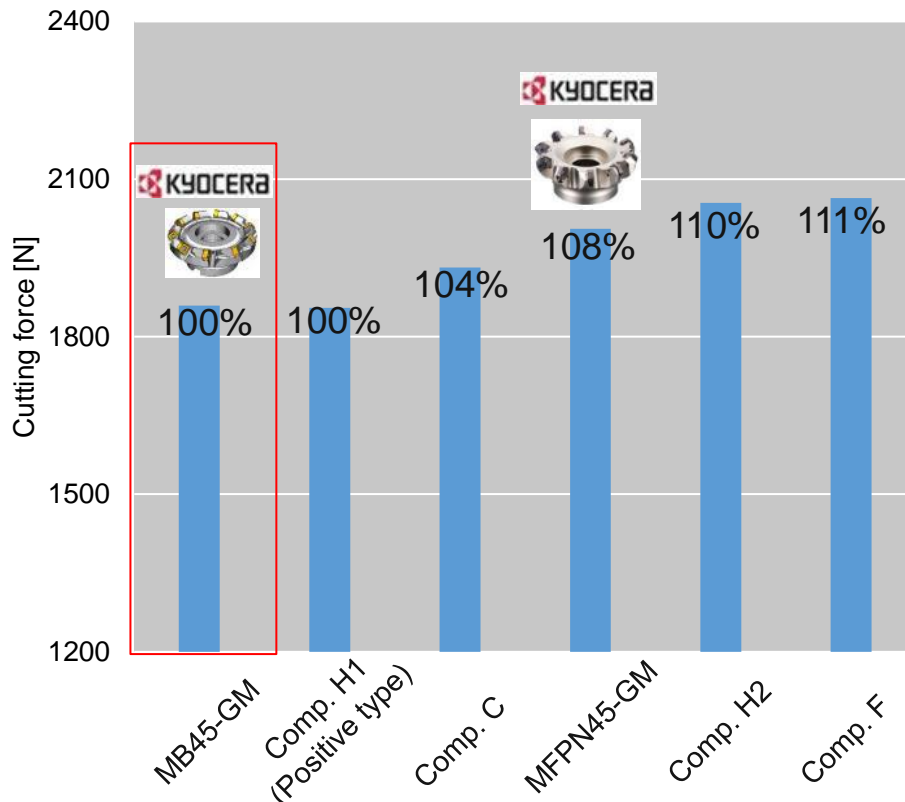
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3. Evaluation result

Cutting condition
 S50C, SNEU1406ANER-GM(PR1825), MB45-125R-14T10C,
 Vc=180m/min, fz=0.2mm/t, ap=3.0mm, ae/Dc=80%, Dry

3.1 Cutting force

General purpose GM breaker has low cutting force with **large rake angle** and **A.R.** comparable to a positive insert type cutter.



Low force design

A.R. Max +13°

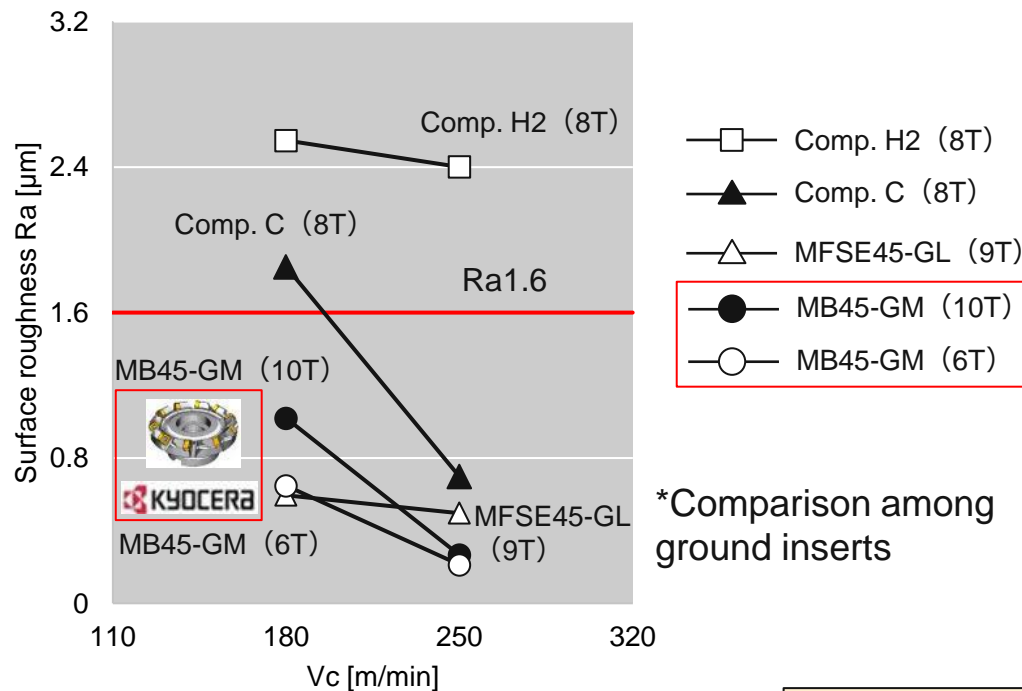
Large rake angle

3. Evaluation result

3.2 Surface roughness

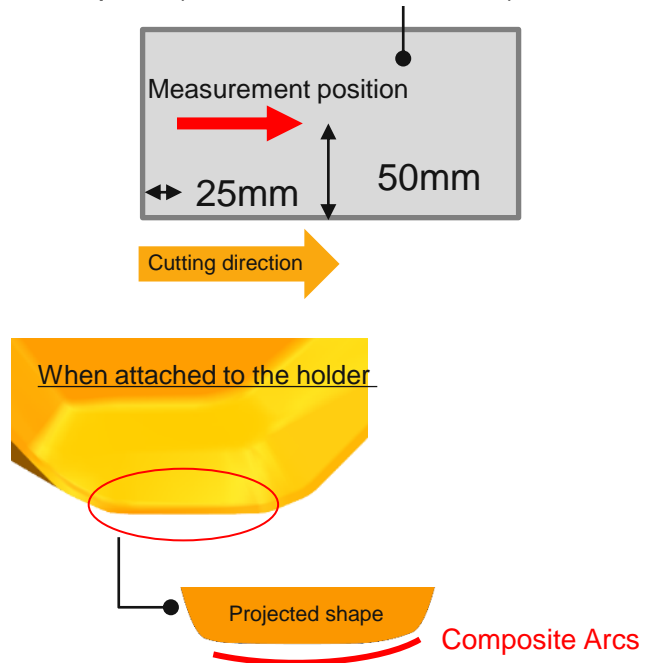
MB45 can achieve Ra1.6 or less by **wiper edge with a large radius of curvature** (composite arc).

Cutting condition
S50C, SNEU1406ANER-GM(PR1825), MB45-125R-14T6C/10C,
fz=0.20mm/t, ap=1.0mm, ae/Dc=80%, Dry, M/C(BT50)



*Comparison among ground inserts

Workpiece(S50C : 100×200×100)



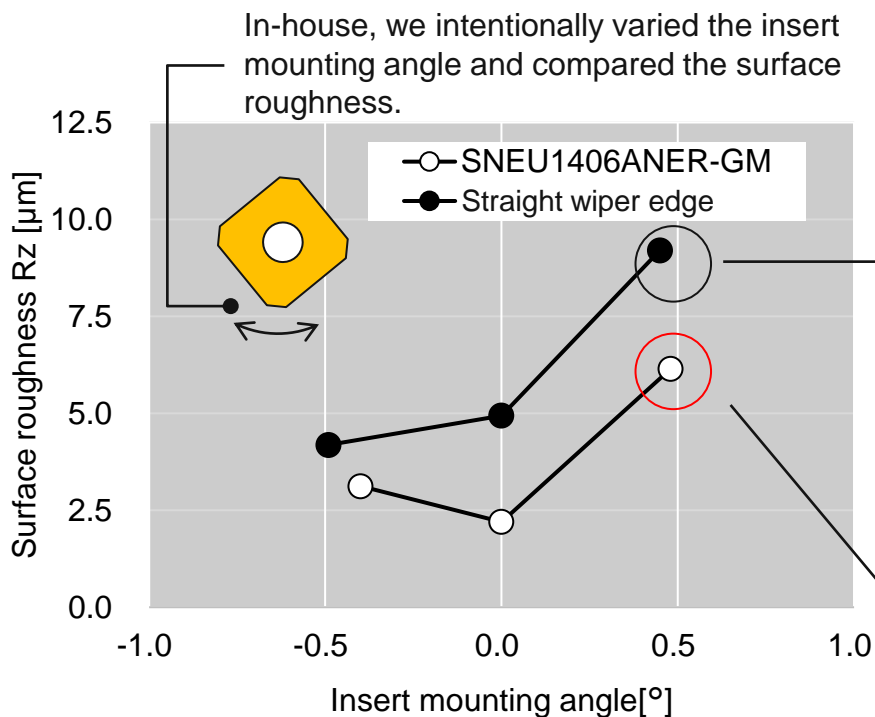
The convex shape **allowed the formation of an arc wiper edge** during holder attachment.
→Wiper edge length: About 2.0mm (About 1.7 times to PNMU12 type)

3. Evaluation result

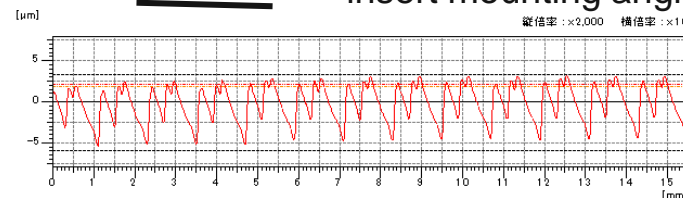
Cutting condition
 S50C, SNEU1406ANER-GM(PR1825), MB45-125R-14T6C,
 Vc=250m/min, fz=0.20mm/t, ap=1.0mm, ae/Dc=80%, Dry, M/C(BT50)

3.2 Surface roughness

The MB45's arc-shaped wiper edge provides stable surface finish less susceptible to insert mount deviation.

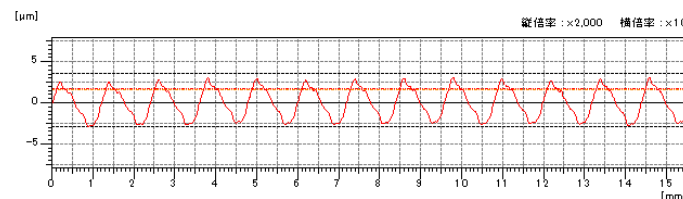


When holder is attached
 Straight wiper edge may provide poor surface roughness depending on insert mounting angle.



Rz 9.2

When holder is attached
 Arc-shaped wiper edge provides stable surface roughness because effect of insert mounting angle is small.



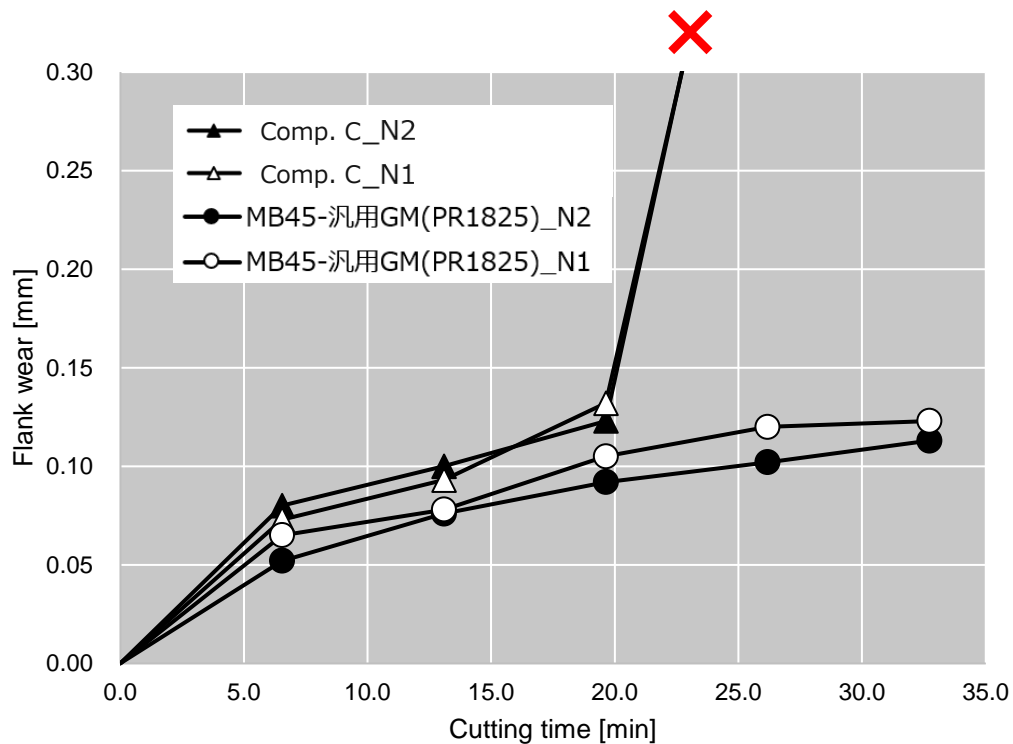
Rz 6.2

3. Evaluation result

Cutting condition
 SKD11(Row material), SNEU1406ANER-GM(PR1825), MB45-125R-14T10C,
 $V_c=120\text{m/min}$, $f_z=0.20\text{mm/t}$, $a_p=2.0\text{mm}$, $a_e/D_c=80\%$, AIR, M/C(BT50)

3.3 Tool life

MEGACOAT NANO EX(PR18) with Special nano lamination x Multilayer lamination achieves longer tool life.



Chipping

Comp.C



Normal wear

MB45-GM(PR1825)

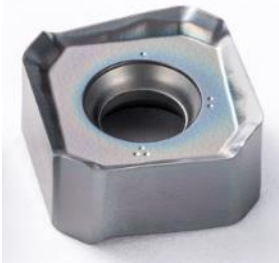
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4. Selling point and machining tips

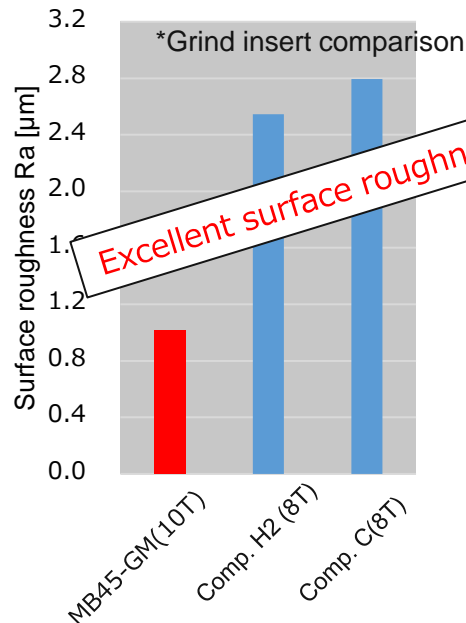
4.1 GM breaker is available for E-class or M-class

E-class inserts provide excellent finishing accuracy and good chip control, allowing consolidation of roughing/finishing process.

For lower edge cost, we can also propose M-class insert.



Surface roughness



S50C, $\Phi 125$, $V_c=180\text{m/min}$,
 $f_z=0.2\text{mm/t}$, $a_p=1.0\text{mm}$,
 $a_e=100\text{mm}$ Dry, M/C(BT50)

Chip control

Good chip control
even in roughing



$a_p=1.0\text{mm}$



$a_p=3.0\text{mm}$

SS400, **SNEU1406ANER-GM**, $\Phi 250$,
 $V_c=180\text{m/min}$, $f_z=0.2\text{mm/t}$, $a_e=100\text{mm}$,
 Dry, M/C(BT50)

Possible to propose **M-class inserts** for lower edge cost!
 → Price difference from E-class inserts: **-17%**

General purpose
GM breaker(E/M class)

● **1st recommendation**

→ Wide application

→ M and E-class insert

available

4. Selling point and machining tips

4.2 Comparison to positive type cutters

Cutting condition
S50C, SNEU1406ANER-GM(PR1825),
MB45-125R-14T10C,
Vc=180m/min, fz=0.2mm/t, ap=3.0mm,
ae/Dc=80%, Dry, M/C(BT50)

MB45 (Double-sided 8 edges insert) has low cutting force equivalent to positive type cutters and can be proposed against positive type cutters. **Please appeal the low cost per edges** and make a positive proposal.



*Single side 4 edges

Fig. Typical positive type cutters

(MB45)Low cutting force equivalent to positive type cutters

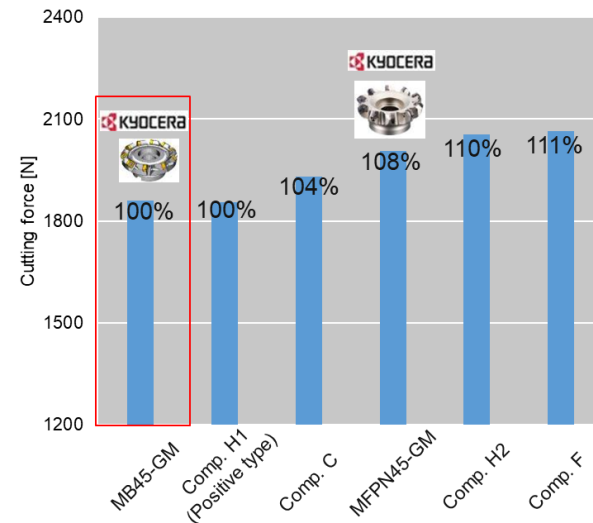


Fig. MFSE45(KYOCERA)

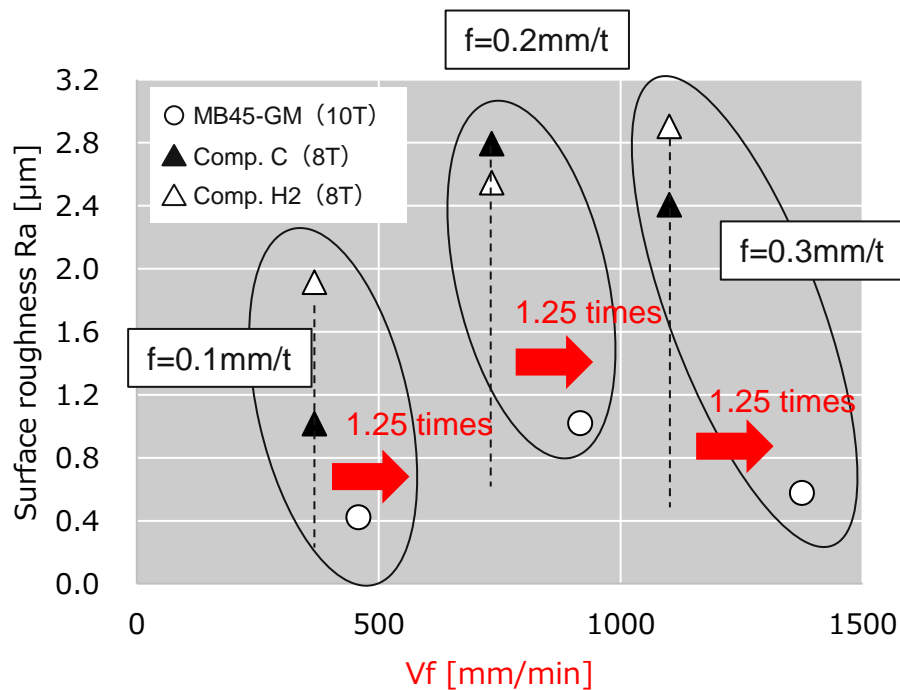
For customers who focus on **insert compatibility** or **use double-spindle milling machines**, etc., please suggest MFSE45.

Cutting condition
 S50C, SNEU1406ANER-GM(PR1825),
 MB45-125R-14T10C,
 $V_c=180\text{m/min}$, $f_z=0.2\text{mm/t}$, $a_p=1.0\text{mm}$,
 $a_e/D_c=80\%$, Dry, M/C(BT50)

4. Selling point and machining tips

4.3 Comparison to negative type cutters

MB45 provides better surface finish even at high feed rates due to its **longer wiper edge length** compared to competitors.



→MB45 has longer wiper edge

and provides better surface finish at high feed rate

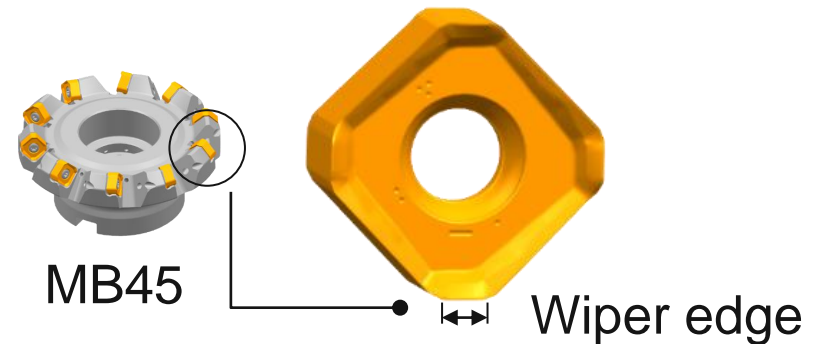


Table .Comparison of wiper edge length
 (Negative type cutters)

	Wiper edge length
MB45-GM	About 2.0mm
Comp. C	About 1.5mm
Comp. H2	About 0.5mm

4. Selling point and machining tips

4.4 BT30(Low rigidity machine)

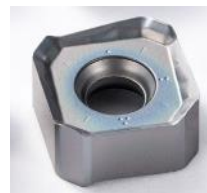
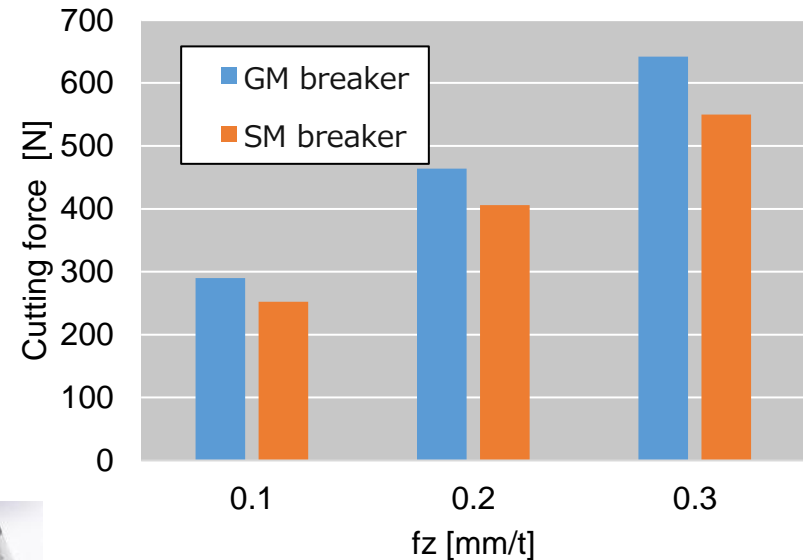
MB45 has **lineup of holders from $\Phi 40$** for use on low-rigidity machines such as BT30.

Please utilize **SM breakers**.

Cutting condition
S50C, SNEU1406ANER-GM/SM, MB45-125R-14T10C,
Vc=150m/min, ap=1.0mm, ae/Dc=80%, Dry, M/C(BT50)



Fig. Substantial small-diameter lineup



SM breaker

→SM breaker **has about -10% cutting force** against GM breaker

4. Selling point and machining tips

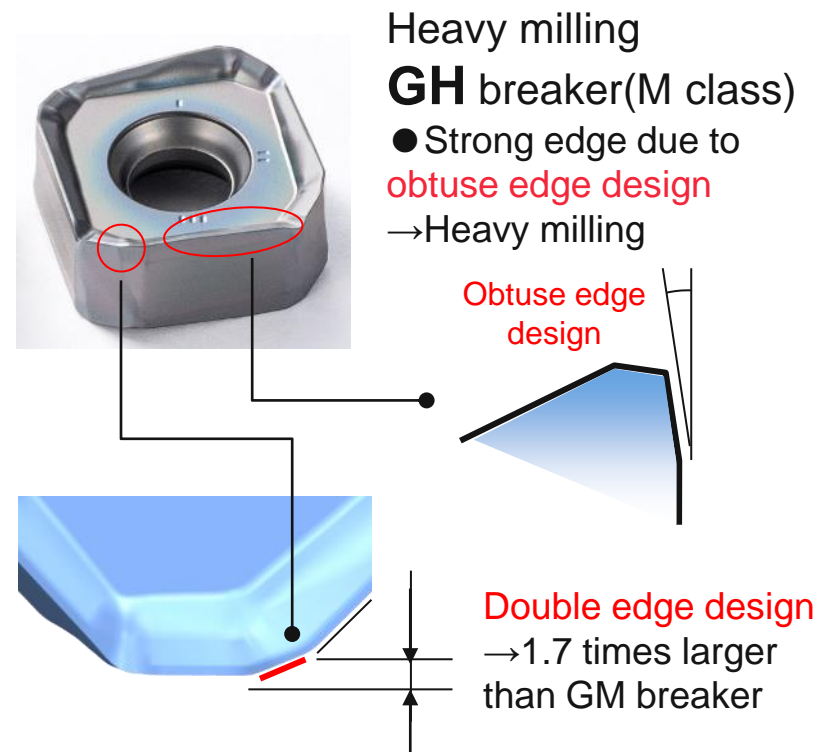
4.5 Heavy milling

Cutting condition
S50C (w/ holes), SNMU1406ANER-GH, MB45-125R-14T10C,
Vc=200m/min, fz=0.25mm/t, ap=2.0mm, ae/Dc=80%, Dry

For workpiece containing strong interrupted sections, please propose **GH breaker** as the first choice. GH breaker has **high toughness** with large double edge design and obtuse edge design



Fig. Heavy milling



4. Selling point and machining tips

4.6 Cermet(TN620M)

Cutting condition

S50C, SNEU1406ANER-GM(TN620M), MB45-125R-14T10C,
Vc=300m/min, fz=0.15mm/t, ap=0.5mm, ae/Dc=80%, Dry

Cermet grade TN620M is effective for high efficiency finishing. It is possible to obtain such a great luster that the cutter is reflected on the finished surface. This is the first recommendation for finishing process at less than $ap=1\text{mm}$.

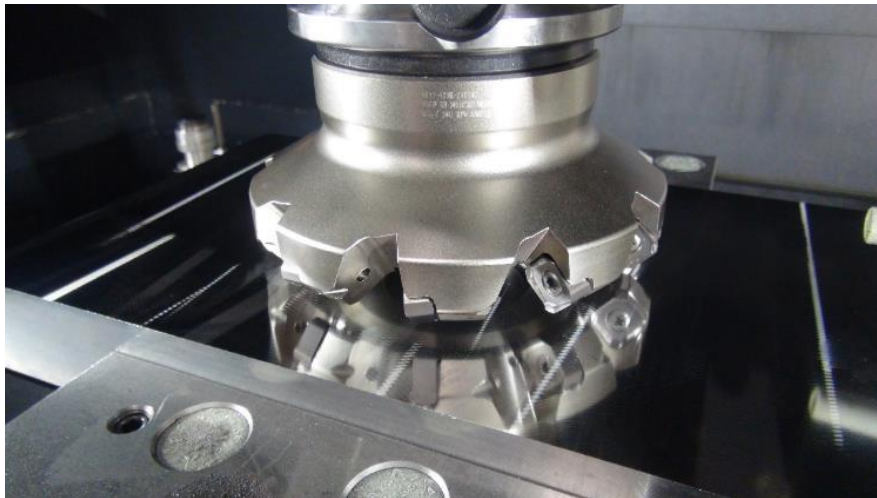
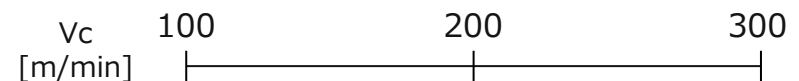


Fig. Surface finish machined by TM620

★Machining tips

- ① Recommend **$ap=3.0\text{mm}$ or less**
- ② High cutting speed
- ③ Recommend Dry cutting

*There are some success case in $ap=1.0\text{mm}$ or less and wet cutting



PVD coated carbide

TN620M

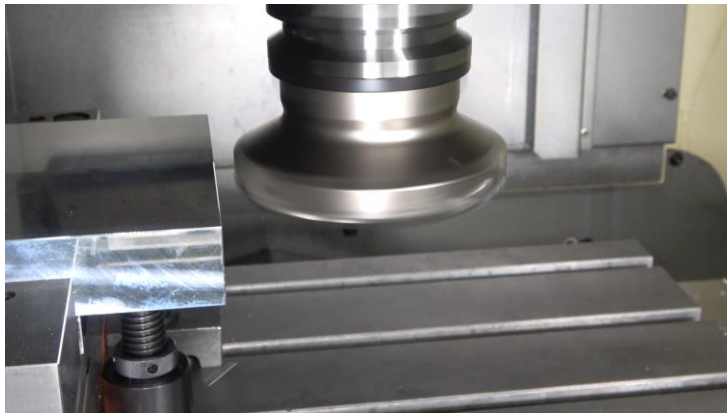
Set **$200\sim 300\text{m/min}$**

4. Selling point and machining tips

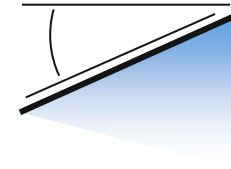
4.7 Aluminum alloy machining

Cutting condition
 A7075, SNEU1406ANFR-AM(PDL025), MB45-125R-14T10C,
 $V_c=500\text{m/min}$, $f_z=0.2\text{mm/t}$, $a_p=3.0\text{mm}$, $a_e/D_c=80\%$, Dry

AM breaker for aluminum have been added to the initial lineup due to strong demand from the sales department. It produces excellent surface finish and can be used for a wide range of applications, from roughing to finishing.



Sharp edge w/o land edge



For aluminum alloys
AM breaker

● High sharpness
 due to **sharp edge**
 w/o land edge

→ Try $V_c=500$, $f_z=0.2$, $a_p=3.0$ at first

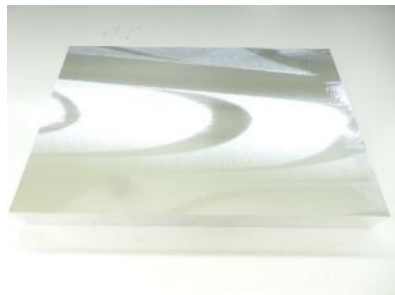


Fig. Shiny surface



Fig. Good chip control
 (A7075)

Table. How to select cutters in aluminum alloys machining

	Application
MB45	Wide range of rough and finish $(V_c=200\sim 900)$
MFAH, MFAS	High speed machining ($\sim V_c=3,000$) Adjustable edge height

4. Selling point and machining tips

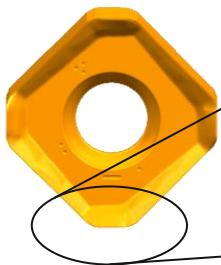
4.8 Machining tips of feed rate(mm/rev)

If finishing accuracy is required, set the **feed rate per revolution (mm/rev)** as follows

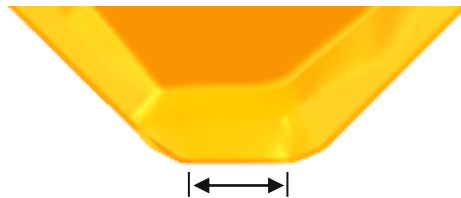
- GM/SM/AM breaker → **2.0mm/rev or less**
- GH breaker → **1.5mm/rev or less**

⇒ Keep feed rate per revolution within wiper edge length.

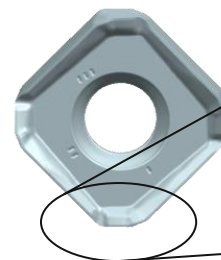
$$\text{Feed per revolution(mm/rev)} = \text{Feed per tooth(mm/t)} \times \text{No. of inserts(z)}$$



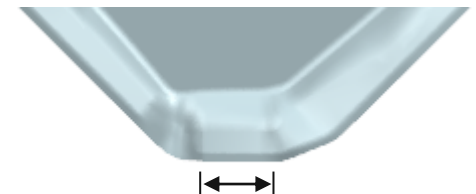
GM/SM/AM
breaker



Wiper edge
About 2.0mm



GH breaker



Wiper edge
About 1.5mm

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5. Caution for use

5.1 Definition of cutting diameter(DC)

Please note that **the machining diameter to be finished to a flat surface** differs for each breaker with respect to the cutting diameter (DC) specified in ISO.

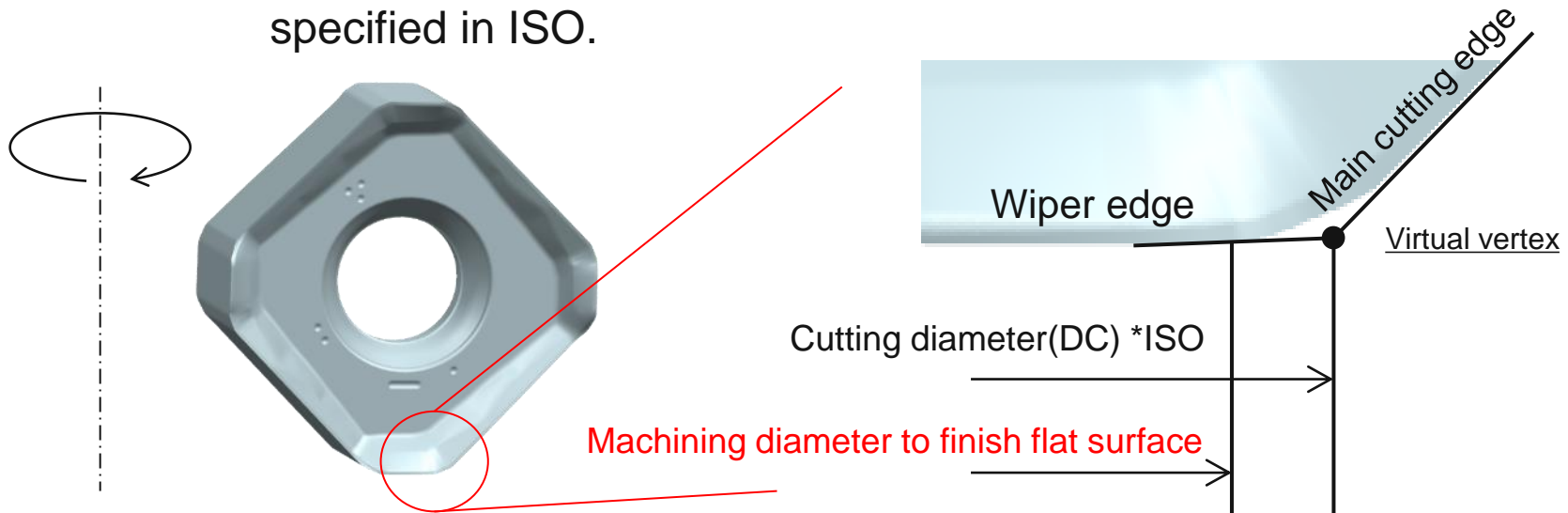


Table Machining diameter to finish flat surface (In case of $\Phi 125$)

	GM breaker	GH breaker	SM breaker	AM breaker
Machining diameter to finish flat surface [mm] *Dimensional Tolerance $\begin{matrix} 0 \\ -0.2 \end{matrix}$	123.9	123.0	123.9	123.9
Difference to cutting diameter (DC)	-1.1	-2.0	-1.1	-1.1

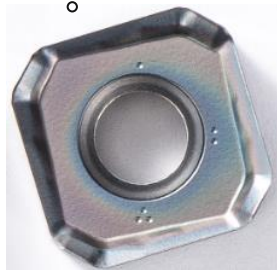
*GH breaker has a larger difference from cutting diameter(DC) against other breakers due to larger double edge size.

5. Caution for use

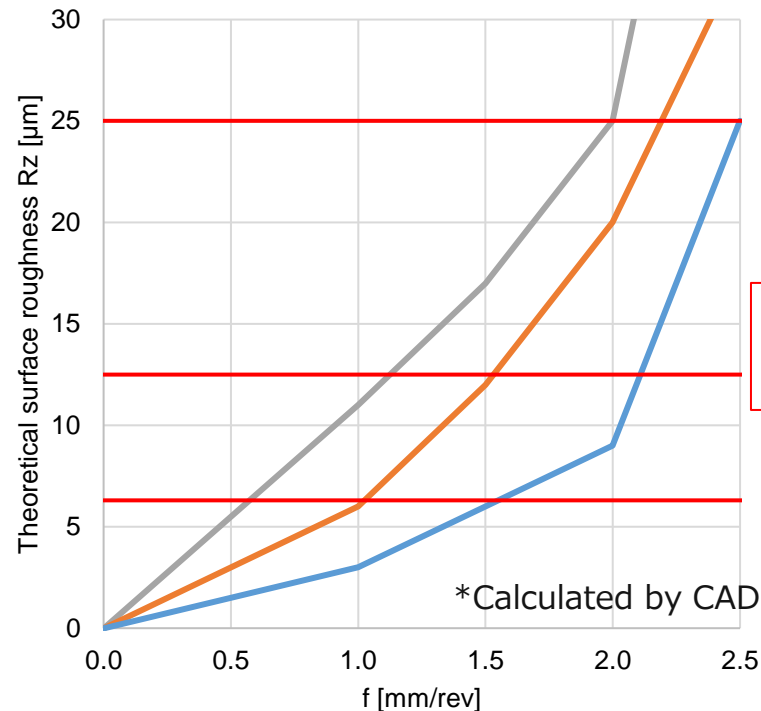
5.2 How to use E-class and M-class inserts in GM breaker

Products have **tolerances**. If you want to obtain a more stable finished surface, please suggest E-class inserts.

Do we use E-class or M-class inserts?



- SNEU1406ANER-GM
- SNMU1406ANER-GM



- Tolerance upper limit for GH (M-class)
*Straight wiper edge
- Tolerance upper limit for GM (M-class)
- Tolerance upper limit for GM (E-class)

*The graph shows the theoretical surface roughness, taking into account product tolerances.

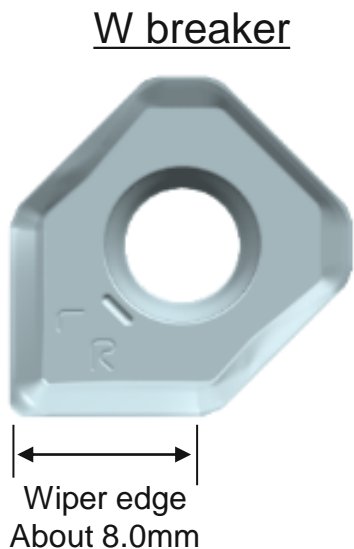
*Surface roughness may be larger than the theoretical surface roughness in actual machining.

5. Caution for use

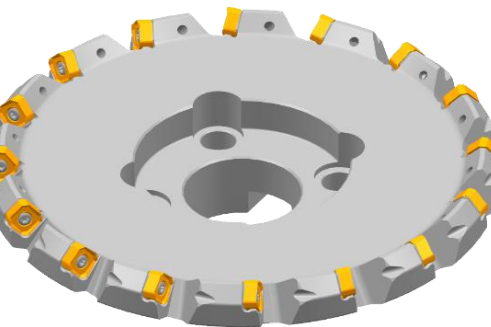
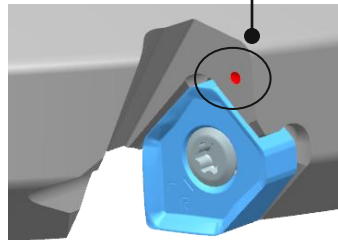
Wiper inserts will be released around October 2023.

5.3 Wiper insert

Wiper inserts should be suggested in situations where finishing accuracy is required and $f > 2.0$ mm/rev.



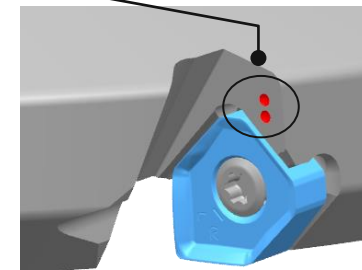
For cutters with large number of inserts, there are cases where $f = 2.0$ mm/rev or more in finishing.



Wiper inserts should be mounted in pockets with "One dot".

If two wiper inserts are to be mounted, mount them in the diagonal pocket of the first wiper.

*Cutters with 12 or more no. of inserts have pockets with "two dots"
*If two wiper inserts are used, see table below

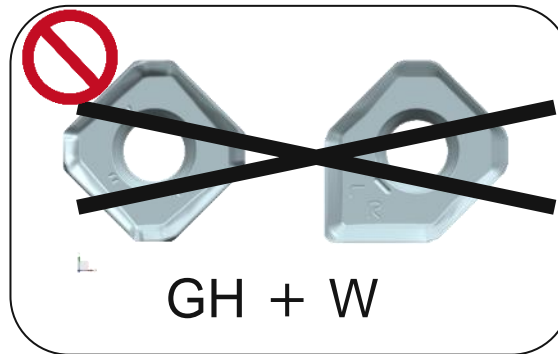
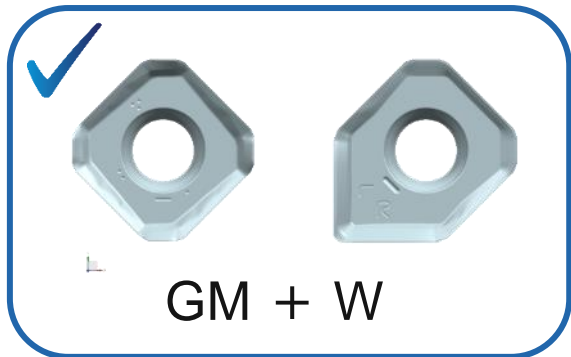


Feed per revolution	Number of wiper inserts installed	Wiper insert mounting points
$2.0 < f[\text{mm/rev}] \leq 4.0$	1	Pocket with "One dot".
$4.0 < f[\text{mm/rev}]$	2	Pockets with "one dot" and "two dots" *Pockets with "two dots" are only for cutters with 12 or more inserts

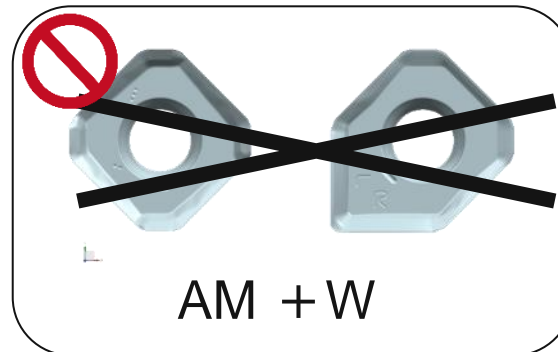
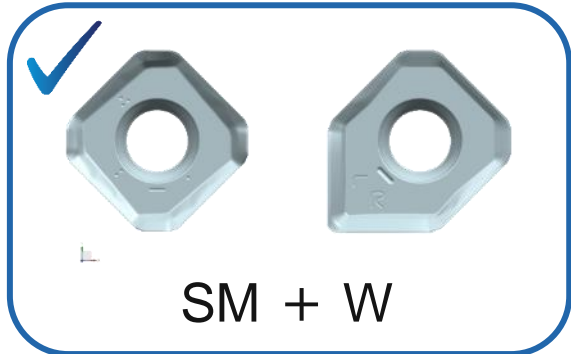
5. Caution for use

Wiper inserts will be released around October 2023.

5.4 Recommended breaker for combination with wiper inserts



GH breakers are not recommended for combination with wiper inserts due to the different edge protrusion compared to other breakers.
 ⇒ Wiper inserts may be broken off.



AM : Sharp edge
 W : R honing
 → Unmatched edge specifications

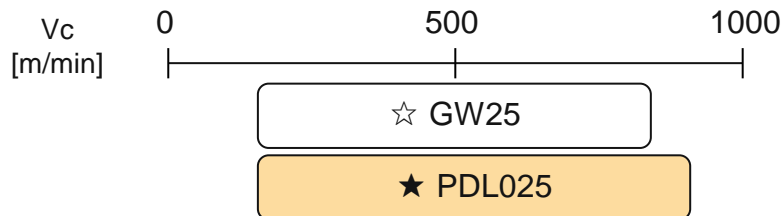
Table Unmatched blade edge specifications

	GM	GH	SM	AM
W	✓	⊘	✓	⊘

5. Caution for use

5.5 Aluminum alloy machining

- Be sure to **use within recommended conditions.**
- **Do not rotate beyond the maximum speed** indicated on the holder. *The speed indicated on the holder is the maximum speed at no load.



	Recommended cutting speed [m/min]
PDL025	200~600~900
GW25	200~500~800

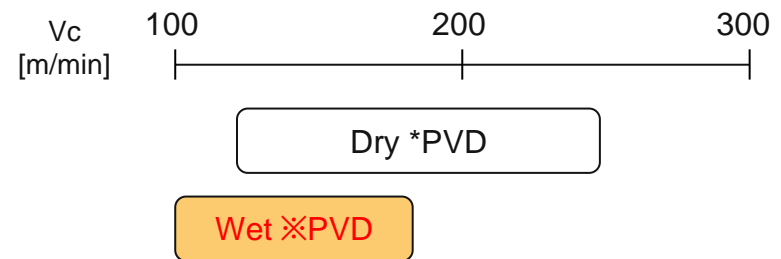


MB45-125R-14T10C
 SCREW: SB-50110TRP WRENCH: ***
MAX 7,200 RPM ****

Do not rotate at or above the maximum RPM

5.6 Wet machining in steel

For wet machining, select **PR1835** and set **cutting speed to 70% or less** to prevent sudden breakage due to heat cracks

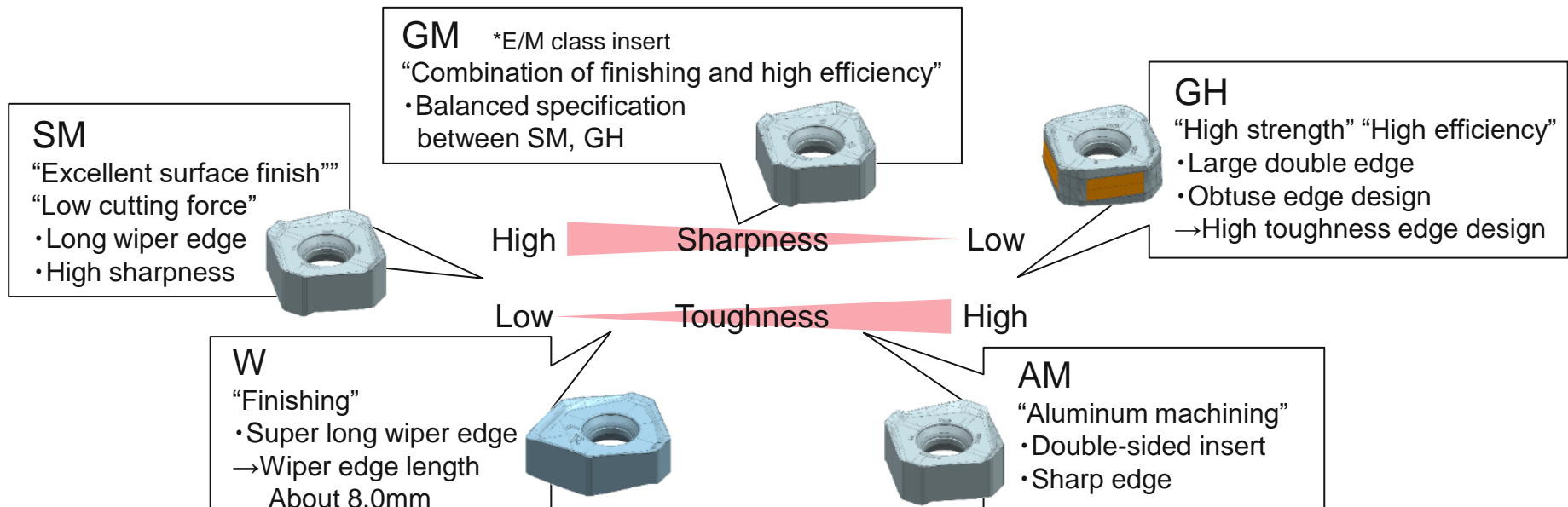


1. Development background
2. Product features
3. Evaluation result
4. Selling point and machining tips
5. Caution for use
6. Lineup
7. Q&A

6. Lineup

6.2 Insert lineup

	Description	PVD				CVD	Cermet	DLC	Carbide
		Steel PR1825	Steel·SUS PR1835	Cast iron PR1810	Hardened steel PR015S	SUS· HRSA CA6535	Finishing TN620M	Aluminum PDL025	Aluminum GW/25
General(M)	SNMU1406ANER-GM	●	●	●		●	●		
Tough(M)	SNMU1406ANER-GH	●	●	●	●	●			
Low force(E)	SNEU1406ANER-SM	●	●			●			
General(E)	SNEU1406ANER-GM	●	●	●		●	●		
Wiper(E)	SNEU1406ANEN-W	●	●	●		●	●		
For aluminum(E)	SNEU1406ANFR-AM							●	●



45 degree face milling cutter MB45



6. Lineup

6.2 Holder lineup

Table Face mill (Inch bore)

Pitch	Description	R	No. of flutes	DC
Coarse pitch	MB45-080R-14T5C	●	5	80
	MB45-100R-14T5C	●	5	100
	MB45-125R-14T6C	●	6	125
	MB45-160R-14T7	●	7	160
	MB45-200R-14T8	●	8	200
	MB45-250R-14T10	●	10	250
	MB45-315R-14T14	△	14	315
	Fine pitch	MB45-080R-14T6C	●	6
MB45-100R-14T8C		●	8	100
MB45-125R-14T10C		●	10	125
MB45-160R-14T12		●	12	160
MB45-200R-14T14		●	14	200
MB45-250R-14T16		●	16	250
MB45-315R-14T18		△	18	315
Extra fine pitch	MB45-080R-14T8C	●	8	80
	MB45-100R-14T10C	●	10	100
	MB45-125R-14T13C	●	13	125
	MB45-160R-14T16	●	16	160
	MB45-200R-14T18	●	18	200
	MB45-250R-14T20	●	20	250

Table Endmill

Description	R	No. of flutes	DC
MB45-40S32-14T2C	●	2	40
MB45-50S32-14T3C	●	3	50
MB45-63S32-14T4C	●	4	63
MB45-80S32-14T2C	●	5	80

Table Face mill (Metric bore)

● : Std. Item

△ : Check availability

Pitch	Description	R	No. of flutes	DC
Coarse pitch	MB45-040R-14T2C-M	●	2	40
	MB45-050R-14T3C-M	●	3	50
	MB45-063R-14T4C-M	●	4	63
	MB45-080R-14T5C-M	●	5	80
	MB45-100R-14T5C-M	●	5	100
	MB45-125R-14T6C-M	●	6	125
	MB45-160R-14T7-M	●	7	160
	MB45-200R-14T8-M	●	8	200
	MB45-250R-14T10-M	●	10	250
	MB45-315R-14T14-M	△	14	315
	Fine pitch	MB45-040R-14T3C-M	●	3
MB45-050R-14T4C-M		●	4	50
MB45-063R-14T5C-M		●	5	63
MB45-080R-14T6C-M		●	6	80
MB45-100R-14T8C-M		●	8	100
MB45-125R-14T10C-M		●	10	125
MB45-160R-14T12-M		●	12	160
MB45-200R-14T14-M		●	14	200
MB45-250R-14T16-M		●	16	250
MB45-315R-14T18-M		△	18	315
Extra fine pitch		MB45-040R-14T4C-M	●	4
	MB45-050R-14T5C-M	●	5	50
	MB45-063R-14T6C-M	●	6	63
	MB45-080R-14T8C-M	●	8	80
	MB45-100R-14T10C-M	●	10	100
	MB45-125R-14T13C-M	●	13	125
	MB45-160R-14T16-M	●	16	160
	MB45-200R-14T18-M	●	18	200
	MB45-250R-14T20-M	●	20	250

1. Development background
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7. Q&A

① Why did you decide on double-sided 8-edge inserts?

→ Because we aimed for both cutting performance and economy.

	Performance *Finished surface	Economy *edge cost
Single-sided 4 edges inserts (MFSE45)	◎	△
Double-sided 8-edge inserts (MB45)	◎	○
Double-sided 10 or 16-edge inserts(MFPN45 etc.)	△ *Short wiper edge	◎

② How do we select no. of flutes?

→ Please refer to the table below to select no. of flutes **according to the machining situation.**

	Example
Coarse pitch	<ul style="list-style-type: none"> • Surface finish oriented • To prevent chattering due to low rigidity machine or poor clamping power
Fine pitch	<ul style="list-style-type: none"> • When both finishing and efficiency are required
Extra fine pitch	<ul style="list-style-type: none"> • High efficiency oriented • Cast iron(for processing efficiency improvement)

THE NEW VALUE FRONTIER



京セラ株式会社

45 degree face milling cutter MB45



Recommended cutting conditions

★ : 1st recommendation ☆ : 2nd recommendation

Chipbreaker	Workpiece material	fz (mm/t) (): TN620M	Recommended insert grades (Cutting speed Vc: m/min)							
			Cermet	MEGACOAT NANO EX (PV coated carbide)				CVD coated carbide	DLC coated carbide	Carbide
			TN620M	PR1835	PR1825	PR1810	PR015S	CA6535	PDL025	GW25
GM	Carbon steel	0.1~0.2~0.4 (0.06~0.12~0.20)	★ 200~250~300	☆ 120~180~250	★ 120~180~250	-	-	-	-	
	Alloy steel	0.1~0.2~0.4 (0.06~0.12~0.20)	★ 180~220~250	☆ 100~160~220	★ 100~160~220	-	-	-	-	
	Mold steel	0.1~0.2~0.35 (0.06~0.08~0.15)	★ 150~180~220	☆ 80~140~180	★ 80~140~180	-	-	-	-	
	Austenitic stainless steel	0.1~0.2~0.4	-	☆ 100~160~200	☆ 100~160~200	-	-	-	-	
	Martensitic stainless steel	0.1~0.2~0.4	-	☆ 150~200~250	-	-	☆ 180~240~300	-	-	
	Precipitation hardened stainless steel	0.1~0.2~0.3	-	★ 90~120~150	-	-	-	-	-	
	Gray cast iron	0.1~0.2~0.4	-	-	★ 120~180~250	-	-	-	-	
	Nodular cast iron	0.1~0.2~0.35	-	-	★ 100~150~200	-	-	-	-	
	Ni-base heat-resistant alloys	0.1~0.12~0.2	-	☆ 20~30~50	-	-	★ 20~30~50	-	-	
SM	Carbon steel	0.06~0.12~0.25	-	☆ 120~180~250	☆ 120~180~250	-	-	-	-	
	Alloy steel	0.06~0.12~0.25	-	☆ 100~160~220	☆ 100~160~220	-	-	-	-	
	Mold steel	0.06~0.1~0.2	-	☆ 80~140~180	☆ 80~140~180	-	-	-	-	
	Austenitic stainless steel	0.06~0.12~0.25	-	★ 100~160~200	☆ 100~160~200	-	-	-	-	
	Martensitic stainless steel	0.06~0.12~0.25	-	☆ 150~200~250	-	-	★ 180~240~300	-	-	
	Precipitation hardened stainless steel	0.06~0.12~0.25	-	☆ 90~120~150	-	-	-	-	-	
	Gray cast iron	0.06~0.12~0.25	-	-	☆ 120~180~250	-	-	-	-	
	Nodular cast iron	0.06~0.1~0.2	-	-	☆ 100~150~200	-	-	-	-	
	Ni-base heat-resistant alloys	0.06~0.1~0.15	-	☆ 20~30~50	-	-	☆ 20~30~50	-	-	
	Titanium alloys	0.06~0.08~0.15	-	★ 40~60~80	-	-	-	-	-	

45 degree face milling cutter MB45



Recommended cutting conditions

★ : 1st recommendation ☆ : 2nd recommendation

Chipbreaker	Workpiece material	fz (mm/t) (): TN620M	Recommended insert grades (Cutting speed Vc: m/min)							
			Cermet	MEGACOAT NANO EX (PV coated carbide)				CVD coated carbide	DLC coated carbide	Carbide
			TN620M	PR1835	PR1825	PR1810	PR015S	CA6535	PDL025	GW25
GH	Carbon steel	0.2~ 0.3 ~0.5		☆ 120~ 180 ~250	☆ 120~ 180 ~250	-		-	-	-
	Alloy steel	0.2~ 0.3 ~0.5		☆ 100~ 160 ~220	☆ 120~ 160 ~220	-		-	-	-
	Mold steel	0.2~ 0.3 ~0.45		☆ 80~ 140 ~180	☆ 80~ 140 ~180	-		-	-	-
	Austenitic stainless steel	0.2~ 0.3 ~0.4		☆ 100~ 160 ~200	☆ 100~ 160 ~200	-		-	-	-
	Martensitic stainless steel	0.2~ 0.3 ~0.4		☆ 150~ 200 ~250	-	-		☆ 180~ 240 ~300	-	-
	Precipitation hardened stainless steel	0.2~ 0.3 ~0.4		☆ 90~ 120 ~150	-	-		-	-	-
	Gray cast iron	0.2~ 0.3 ~0.5		-	-	☆ 120~ 180 ~250		-	-	-
	Nodular cast iron	0.2~ 0.3 ~0.45		-	-	☆ 100~ 150 ~200		-	-	-
	Ni-base heat-resistant alloys	0.1~ 0.2 ~0.3		☆ 20~ 30 ~50	-	-		☆ 20~ 30 ~50	-	-
Hardened material (60HRC or less)	0.05~ 0.1 ~0.2					★ 50~ 80 ~100				
AM	Aluminum alloys	0.1~ 0.2 ~0.4		-	-	-		★ 200~ 600 ~900	☆ 200~ 500 ~800	

The figures in bold font represent the center value of the recommended cutting conditions. Adjust the cutting speed and the feed rate within the above conditions according to the actual machining situation.

- Machining with coolant is recommended for Ni-base Heat resistant alloy and Titanium alloy
- Set the cutting speed under 70% in case of other workpiece material machining applying coolant
- When machining aluminum, be sure to use within the recommended conditions. Do not rotate the holder beyond the maximum speed indicated on the holder itself.