



High-Efficiency Cutter

MFPN



Low cutting force and excellent fracture resistance

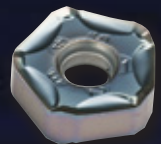


Five Advantages of BIG Pentagon

- 1** Economical Roughing and general-purpose face mill with 10-cornered pentagonal inserts
- 2** New design Low cutting force due to helical cutting-edge design
- 3** Toughness Fractures reduced by the double-edge construction
- 4** New Chipbreaker Chip evacuation improved by molded Chipbreaker
- 5** New grades Coated insert extends tool life

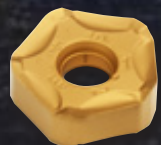
For Ni-based heat-resistant alloys titanium alloys and precipitation-hardened stainless steel

MEGACOAT NANO
PR1535



For martensitic stainless steel and Ni-based heat-resistant alloys

CVD Coated Carbide
CA6535



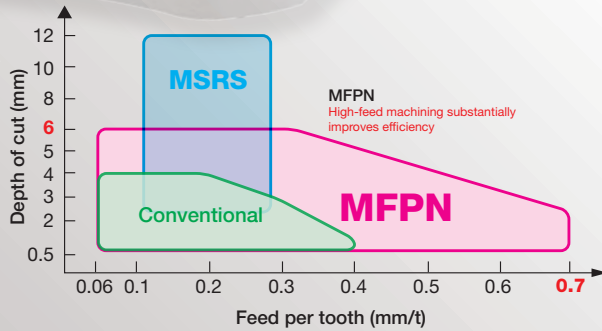
ADVANCING PRODUCTIVITY

Pioneering a New Era in Machining!



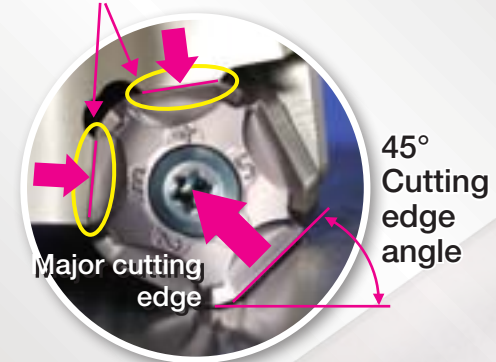
Five Advantages of BIG Pentagon

1 Roughing and general-purpose face mill with 10-cornered pentagonal inserts



- Stability maintained by superior pentagonal double-sided insert
- 10-cornered insert cuts cost per corner

Two-face restraint



High accuracy due to stabilization of two-face constraint of the major cutting edge

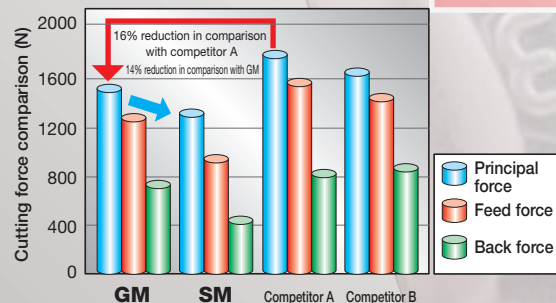
2 Low cutting force due to helical cutting-edge design



- Helical cutting-edge design with low cutting force reduces chattering
- Helical cutting-edge design High rake angle (A.R. Max. +10°)



● Cutting force comparison

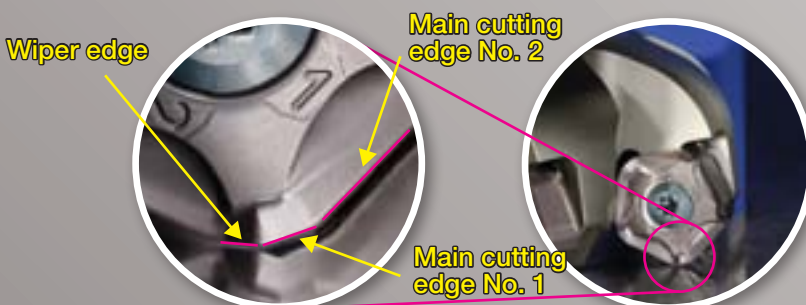


● Cutting Conditions
Workpiece: S50C
Vc=150m/min, fz=0.1mm/t, apxae=5x105 mm, Machine: M/C (BT50)

3 Fractures reduced by the double-edge construction

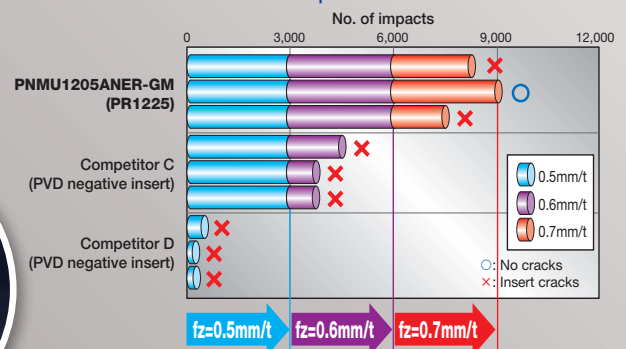


- Double-edge construction
- Major cutting edge makes thin chips, thereby reducing impact load when the cutter enters and exits the workpiece



Double-edge construction

● Fracture resistance comparison



● Cutting Conditions
Workpiece: SCM440 (38-42HS)
Machine: BT50 M/C
Vc=100m/min, fz=0.5-0.7mm/t, apxae=2x100mm workpiece with 20mm width slot

MFPN

Milling-Facing PeNtagonal type

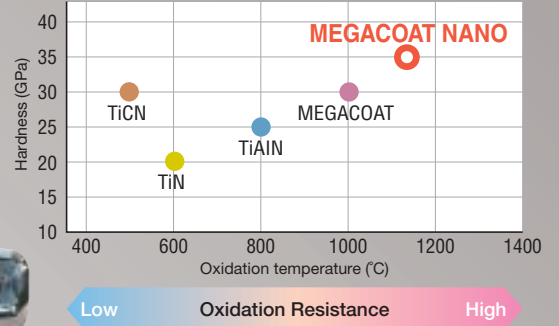
5 Coated insert extends tool life

MEGACOAT NANO

- **PR1525** for steel, **PR1510** for cast iron and **PR1535** for Ni-based heat-resistant alloys, titanium alloys and precipitation-hardened stainless steel
- Prevents wear and fracturing with high hardness (35GPa) and superior oxidation resistance (oxidation temperature: 1,150°C)

CVD Coated Carbide

- **CA6535** for martensite stainless steel and Ni-based heat-resistant alloys



New grades



4 3-dimensional Chipbreaker improves chip evacuation

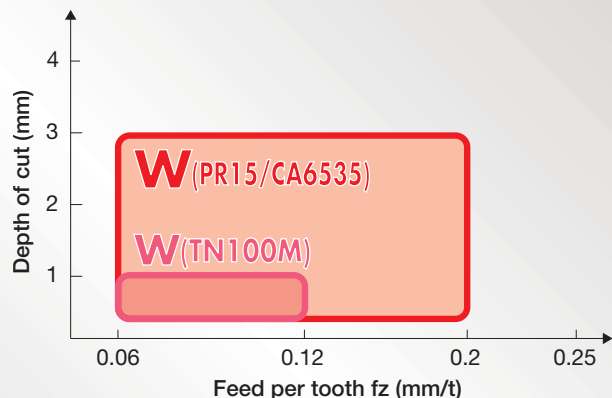
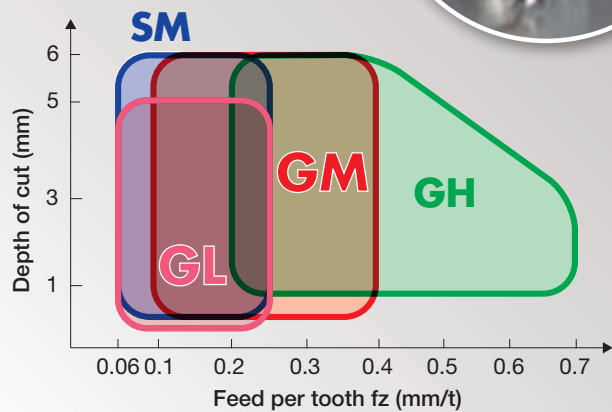
- Smooth chip evacuation reduces chip-biting
- 4 types of Chipbreakers and the wiper insert make milling possible under a wide range of applications

New Chipbreaker

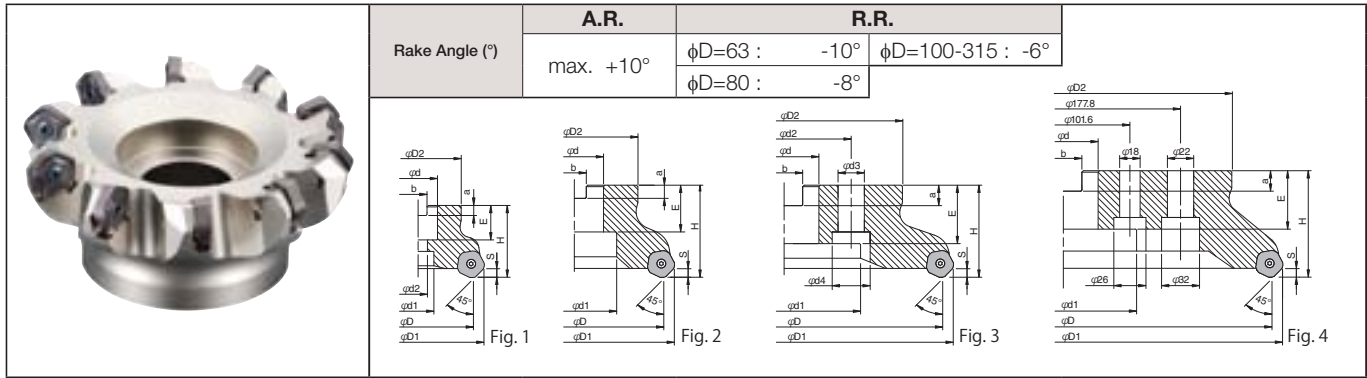


Chipbreaker	Applications	Shape
GM	General	
SM	Low cutting force	
GH	Heavy milling	
GL	Surface finishing oriented	
W	Wiper insert for finishing	

- Attaching one wiper insert to the holder will improve the surface finish.



MFPN 45 Face mill



Holder Dimensions

Description		Stock	No. of Inserts	Dimension (mm)										Shape	Weight (kg)	Shim			
				φD	φD1	φD2	φd	φd1	φd2	H	E	a	b				φd3	φd4	
Bore Dia. Inch Specs	Coarse-pitch	MFPN 45080R-5T	●	5	80	93	60	25.4	22	13	50	27	6	9.5			Fig. 1	1.1	Yes
		MFPN 45100R-6T	●	6	100	113	70	31.75	48	32		8	12.7						
		MFPN 45125R-7T	●	7	125	138	87	38.1	58	-	36	10	15.9				Fig. 2	2.6	
		MFPN 45160R-8T	●	8	160	173	102	50.8	72					63					
		MFPN 45200R-10T	●	10	200	213	142	47.625	110	101.6	40	14	25.4		18	26	Fig. 3	6.7	
		MFPN 45250R-12T	●	12	250	263								-					
	MFPN 45315R-14T	MTO	14	315	328	220	-	80	-	-	-	-	Fig. 4		21.2				
	Fine-pitch	MFPN 45080R-6T	●	6	80	93	60	25.4	22	13	50	27	6	9.5			Fig. 1	1.1	No
		MFPN 45100R-8T	●	8	100	113	70	31.75	48	32		8	12.7						
		MFPN 45125R-10T	●	10	125	138	87	38.1	58	-	36	10	15.9				Fig. 2	2.7	
		MFPN 45160R-12T	●	12	160	173	102	50.8	72					63					
		MFPN 45200R-14T	●	14	200	213	142	47.625	110	101.6	40	14	25.4		18	26	Fig. 3	6.9	
		MFPN 45250R-16T	●	16	250	263								-					
	MFPN 45315R-18T	MTO	18	315	328	220	-	80	-	-	-	-	Fig. 4		21.5				
	Extra fine-pitch	MFPN 45080R-8T	●	8	80	93	60	25.4	22	13	50	27	6	9.5			Fig. 1	1.1	No
		MFPN 45100R-10T	●	10	100	113	70	31.75	48	32		8	12.7						
		MFPN 45125R-13T	●	13	125	138	87	38.1	58	-	36	10	15.9				Fig. 2	2.7	
		MFPN 45160R-16T	●	16	160	173	102	50.8	72					63					
MFPN 45200R-18T		●	18	200	213	142	47.625	110	101.6	40	14	25.4	18		26	Fig. 3	6.9		
MFPN 45250R-20T		●	20	250	263									-				80	
mm Specs	Fine-pitch	MFPN 45063R-4T-M	●	4	63	76	47	22	19	11	40	21	6.3		10.4				Fig. 1
		MFPN 45080R-5T-M	●	5	80	93	60	27	22	13		50	24	7	12.4				
		MFPN 45100R-6T-M	●	6	100	113	70	32	48	-	30		8	14.4			Fig. 2		1.4
		MFPN 45125R-7T-M	●	7	125	138	87	40	58			63						32	
		MFPN 45160R-8T-M	●	8	160	173	102	68	66.7	63	32		9	16.4	14	20	Fig. 2		3.8
		MFPN 45200R-10T-M	●	10	200	213	142	60	110			101.6						40	
		MFPN 45250R-12T-M	●	12	250	263				-	80		40	14	25.7	18	26		Fig. 3
		MFPN 45315R-14T-M	MTO	14	315	328	220	-	80			-						-	
	Fine-pitch	MFPN 45063R-5T-M	●	5	63	76	47	22	19	11	40	21	6.3	10.4			Fig. 1	0.5	No
		MFPN 45080R-6T-M	●	6	80	93	60	27	22	13		50	24	7					
		MFPN 45100R-8T-M	●	8	100	113	70	32	48	-	30		8	14.4			Fig. 2	1.4	
		MFPN 45125R-10T-M	●	10	125	138	87	40	58			63							
		MFPN 45160R-12T-M	●	12	160	173	102	68	66.7	63	32		9	16.4	14	20	Fig. 2	3.8	
		MFPN 45200R-14T-M	●	14	200	213	142	60	110			101.6							
		MFPN 45250R-16T-M	●	16	250	263				-	80		40	14	25.7	18	26	Fig. 3	
		MFPN 45315R-18T-M	MTO	18	315	328	220	-	80			-							
	Extra fine-pitch	MFPN 45063R-6T-M	●	6	63	76	47	22	19	11	40	21	6.3	10.4			Fig. 1	0.5	No
		MFPN 45080R-8T-M	●	8	80	93	60	27	22	13		50	24	7					
		MFPN 45100R-10T-M	●	10	100	113	70	32	48	-	30		8	14.4			Fig. 2	1.3	
		MFPN 45125R-13T-M	●	13	125	138	87	40	58			63							
		MFPN 45160R-16T-M	●	16	160	173	102	68	66.7	63	32		9	16.4	14	20	Fig. 2	3.9	
		MFPN 45200R-18T-M	●	18	200	213	142	60	110			101.6							
		MFPN 45250R-20T-M	●	20	250	263				-	80		40	14	25.7	18	26	Fig. 3	

* Dimension S: 6mm (GM, SM, GH Chipbreakers), 5mm (GL Chipbreaker), 3mm (W Chipbreaker: PR15 Series)

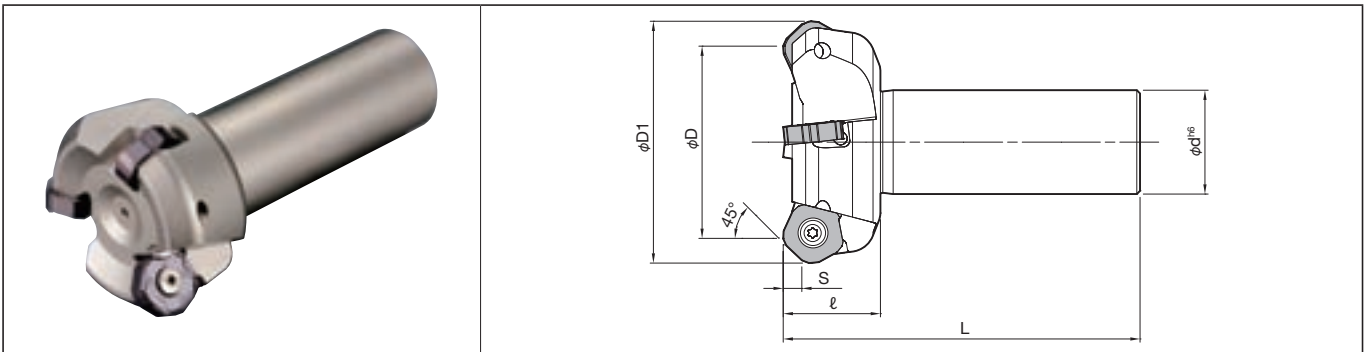
● : Std. Stock
MTO : Made-to-order

● Spare parts (mm / inch common spec)

Description		Spare Parts							
		Clamp Screw	Wrench		Shim	Shim Screw	Wrench	Anti-seize Compound	Arbor Clamp Screw
			TT	DTM					
Coarse-pitch	MFPN 45063R-4T-M	SB-50140TR	TT-15	-	MFPN-45	SPW-7050	LW-5	MP-1	HH10x30
	MFPN 45080R-5T-(M)								HH12x35
	MFPN 45100R-6T-(M)								-
	45315R-14T-(M)	For Insert Clamp Recommended torque is 4.2 N•m.			For Shim Clamp Recommended torque is 6.0 N•m.				
Fine-pitch	MFPN 45063R-5T-M	SB-50140TR	TT-15	-	-	-	-	MP-1	HH10x30
	MFPN 45080R-6T-(M)								HH12x35
	MFPN 45100R-8T-(M)								-
	45315R-18T-(M)	For Insert Clamp Recommended torque is 4.2 N•m.							
Extra fine-pitch	MFPN 45063R-6T-M	SB-40140TRN	-	DTM-15	-	-	-	MP-1	HH10x30
	MFPN 45080R-8T-(M)								HH12x35
	MFPN 45100R-10T-(M)								-
	45250R-20T-(M)	For Insert Clamp Recommended torque is 3.5 N•m.							

Coat Anti-seize Compound (MP-1) thinly on portion of taper and thread when insert is fixed.

■ MFPN 45 End mill



● Holder Dimensions

Description	Stock	No. of Inserts	Dimension (mm)						Rake Angle (°)		Spare Parts		
			φD	φD1	φd	L	ℓ	S	A.R. (MAX.)	R.R.	Clamp Screw	Wrench	Anti-seize Compound
MFPN 45050R-S32-3T	●	3	50	63	32	110	30	6 (5)	+10°	-12°	SB-50140TR	TT-15	MP-1
45063R-S32-4T	●	4	63	76						-10°			
45080R-S32-5T	●	5	80	93						-8°			

* Dimension S: 6mm (GM, SM, GH Chipbreakers), 5mm (GL Chipbreaker), 3mm (W Chipbreaker: PR15 Series)

Coat Anti-seize Compound (MP-1) thinly on portion of taper and thread when insert is fixed.

● Precautions for use (How to mount an insert)

- Be sure to remove dust and chips from the insert mounting pocket.
- After applying anti-seize compound on the taper and thread portions, while pressing the insert against the constraint surfaces, put the screw into the hole of the insert and tighten the screw with the appropriate torque. (See Fig. 1 and Fig. 2)
Recommended tightening torque → The torque for coarse-pitch and fine-pitch (using M5 screw) is 4.2 Nm.
The torque for extra fine-pitch (using M4 screw) is 3.5 Nm.
- 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.
- To change the cutting edge of the insert, turn the insert counterclockwise (see Fig. 3). Insert corner identification number (Fig. 4) is stamped on the top surface of the insert (except for the SM Chipbreaker).



Fig. 1



Fig. 2



Fig. 3

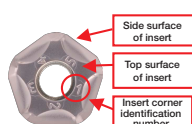


Fig. 4



Fig. 5

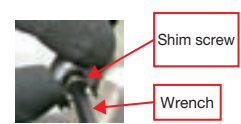


Fig. 6

● How to replace a shim (for coarse-pitch)

- Be sure to remove dust and chips from the insert mounting pocket.
- The shim must be mounted in the proper direction. While aligning the surface of the shim with the mark on it to the corresponding constraint surface (see Fig. 5) and lightly pressing the shim toward the constraint surface, insert the screw into the hole of the shim and tighten it (see Fig. 6). When tightening the screw, make sure that the screw is vertical to the bearing surface. Recommended torque is 6.0N•m.
- After tightening the screw, make sure that there is no clearance between the shim seat surface and the bearing surface. If there is any clearance, remove the shim and mount it again according to the above steps.

Insert description

Milling Inserts (with hole)

NEW NEW

Classification of usage	P		M		K		N		S		H	
	Steel	Die Steel	Austenitic Stainless Steel	Martensitic Stainless Steel	Gray Cast Iron	Nodular Cast Iron	Non-ferrous Material	Heat-resistant Alloys	Titanium Alloys	Hard Materials		
★: Roughing / 1st Choice	■			★					☆			
☆: Roughing / 2nd Choice		■		☆								
■: Finishing / 1st Choice												
□: Finishing / 2nd Choice												
(Hardened material is applicable only under 45HRC)												

Shape	Description	Dimension (mm)					Cermet	CVD Coated Carbide	MEGACOAT NANO				MEGACOAT	
		A	T	φd	X	Z			TN100M	CA6535	PR1535	PR1525	PR1510	PR1225
Surface finishing oriented	PNEU 1205ANER-GL	17.51			2.7	2.7			●	●	●	●	●	●
Surface finishing oriented	PNEU 1205ANEL-GL								●	●	●	●	●	●
General	PNMU 1205ANER-GM	17.88	5.56		6.2	2.0			●	●	●	●	●	●
General	PNMU 1205ANEL-GM								●	●	●	●	●	●
Low cutting force	PNMU 1205ANER-SM	17.98	6.17						●	●	●	●	●	●
Tough Edge (for Heavy Milling)	PNMU 1205ANER-GH								●	●	●	●	●	●
Wiper Insert (2-edges)	PNEU 1205ANER-W	17.85	5.56		2.3	8.1	●	●	●	●	●	●	●	●

●: Std. Stock

Reference for selecting a face mill and insert suitable for each milling purpose

Milling Purpose	Face mill type			Chipbreaker				
	Coarse-pitch	Fine-pitch	Extra fine-pitch	GM	SM	GH	GL	W
General milling for steel and alloy steel		○		○				
Steel and alloy steel (to prevent chattering due to low rigidity machine or poor clamping power)	○				○			
Productivity oriented (Running cost decrease) (Over ap=4 mm, over fz=0.35 mm/t)	○					○		
Surface finishing oriented	○	○					○	
General milling for stainless steel		○			○			
Stainless steel (to prevent chattering due to low rigidity machine or poor clamping power)	○				○			
Cast iron (for processing efficiency improvement)			○	○				
Cast iron (Over ap=4 mm, over fz=0.35 mm/t)	○					○		
Improved Surface Finish in High-Efficiency Milling		○	○					○

● How to use wiper insert

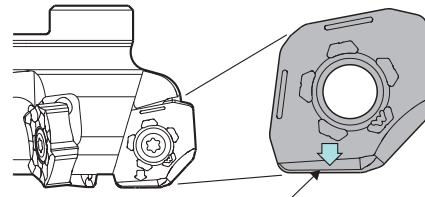
1. Please use one wiper insert on one cutter. (If you use more than 2 inserts on one cutter, the workpiece surface may be muddy white.)
2. Combination of Wiper Insert with Other Chipbreakers

Chipbreaker	GM	SM	W
Combination			
Recommended Combination	○		○
Recommended Combination		○	○

The combinations of GH+W and GL+W are NOT recommended.

3. Use tool presetter for measuring protrusion amount of wiper edge (recommended protrusion amount: 0.1mm)

● How to attach wiper inserts on MFPN cutter



- ↓ The down arrow symbol (↓) indicates wiper cutting edge.
- ↓ When attaching inserts, make sure that the arrow symbol points downward.

■ Improved Surface Finish by Wiper Insert

Workpiece : SS400

Workpiece : $V_c = 200\text{m/min}$ ($n=510\text{min}^{-1}$), $f_z = 0.2\text{ mm/t}$ ($V_f=1,020\text{mm/min}$)
(MFPN45125R-10T) $a_{p \times a_e} = 3 \times 100\text{mm}$, DRY

Chipbreaker Combination	Insert	Surface Finish	Workpiece Surface	Surface Finish
Wiper Insert PR1525 (PNMU-GM...9 pcs) (PNEU-W...1 pc)		$R_a = 0.48\mu\text{m}$ $R_z = 3.39\mu\text{m}$	 Shiny Surface	
GL Chipbreaker PR1225 (PNEU-GL...10 pcs)		$R_a = 2.50\mu\text{m}$ $R_z = 11.41\mu\text{m}$	 Shiny Surface	

- The result above is one of our internal evaluation examples.
- The surface roughness also depends on the workpiece, cutting conditions or situation of each user.
- When the surface roughness is unstable, please set the cutting speed higher, the feed rate lower or use a wiper insert (TN100M).

■ Case studies

SCM440H

Construction machine part

- $V_c=250\text{m/min}$
- $a_{p \times a_e}=2-3 \times 75\text{mm}$
- $f_z=0.15\text{mm/t}$ ($V_f=900\text{mm/min}$)
- DRY
- Cutter
MFPN4580R-6T (6 edges)
- Insert
PNMU1205ANER-SM (PR1225)

face milling

Milling efficiency increased by 2.1 times

MFPN cutter (PR1225)	202cc/min Chip evacuation rate
Competitor E	94cc/min Chip evacuation rate

- MFPN cutter improved machining efficiency 2.1 times of the Competitor E without changing spindle load.
- MFPN cutter was very stable at the entrance and exit of the machining. It controls chatter and remains stable even with low rigid machine.

SUS304

- Case
- $V_c=90\text{m/min}$
- $a_{p \times a_e}=0.4 \times 50\text{mm}$
- $f_z=0.19\text{mm/t}$ ($V_f=410\text{mm/min}$)
- DRY
- Cutter
MFPN45080R-6T (6 edges)
- Insert
PNMU1205ANER-SM (PR1225)

Milling efficiency increased by 1.5 times

MFPN cutter (PR1225)	1.5 pcs/edge	
Competitor F (for roughing)	1 pc/edge	

- Even when the cutting depth, cutting speed and feed rate cannot be raised due to the low rigidity of a workpiece, MFPN facemill enables stable milling without chattering and also has an improved tool life of 1.5 times

Recommended cutting conditions

Chipbreaker	Workpiece Material	feed fz (mm/t)	Recommended Insert Grade (Vc: m/min)			
			MEGACOAT NANO (MEGACOAT)			CVD Coated Carbide
			PR1535	PR1525 (PR1225)	PR1510 (PR1210)	CA6535
GM	Carbon Steel SxxC	0.1-0.2-0.4	-	★ 120-180-250	-	-
	Alloy Steel SCM etc	0.1-0.2-0.4	-	★ 100-160-220	-	-
	Mold Steel SKD NAK etc	0.1-0.2-0.35	-	★ 80-140-180	-	-
	Austenitic Stainless Steel SUS304 etc	0.1-0.2-0.4	☆ 100-150-200	-	-	-
	Martensitic Stainless Steel SUS403 etc	0.1-0.2-0.4	-	-	-	☆ 180-240-300
	Precipitation-hardened Stainless Steel SUS630 etc	0.1-0.2-0.3	★ 90-120-150	-	-	-
	Gray Cast Iron FC	0.1-0.2-0.4	-	-	★ 120-180-250	-
	Nodular Cast Iron FCD	0.1-0.2-0.35	-	-	★ 100-150-200	-
	Ni-based High-heat-resistant Alloys	0.1-0.12-0.2	★ 20-30-50	-	-	☆ 20-40-50
SM *(GL)	Carbon Steel SxxC	0.06-0.12-0.25	-	☆ 120-180-250	-	-
	Alloy Steel SCM etc	0.06-0.12-0.25	-	☆ 100-160-220	-	-
	Mold Steel SKD NAK etc	0.06-0.1-0.2	-	☆ 80-140-180	-	-
	Austenitic Stainless Steel SUS304 etc	0.06-0.12-0.25	★ 100-150-200	-	-	-
	Martensitic Stainless Steel SUS403 etc	0.06-0.12-0.25	-	-	-	★ 180-240-300
	Precipitation-hardened Stainless Steel SUS630 etc	0.06-0.12-0.25	☆ 90-120-150	-	-	-
	Gray Cast Iron FC	0.06-0.12-0.25	-	-	☆ 120-180-250	-
	Nodular Cast Iron FCD	0.06-0.1-0.2	-	-	☆ 100-150-200	-
	Ni-based High-heat-resistant Alloys	0.06-0.1-0.15	☆ 20-30-50	-	-	☆ 20-40-50
	Titanium Alloys Ti-6Al-4V	0.06-0.08-0.15	★ 40-60-80	-	-	-
GH	Carbon Steel SxxC	0.2-0.4-0.7	-	☆ 120-180-250	-	-
	Alloy Steel SCM etc	0.2-0.4-0.6	-	☆ 120-160-220	-	-
	Mold Steel SKD NAK etc	0.2-0.35-0.5	-	☆ 80-140-180	-	-
	Gray Cast Iron FC	0.2-0.4-0.7	-	-	☆ 120-180-250	-
	Nodular Cast Iron FCD	0.2-0.35-0.5	-	-	☆ 100-150-200	-

• The figure in bold font is 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.

★: 1st recommendation
☆: 2nd recommendation

• Machining with coolant is recommended for Ni-based high-heat-resistant alloys and titanium alloys.
* GL Chipbreaker is recommended for Surface finishing oriented milling.

Recommended Chipbreaker

Cutter type	Chipbreaker		
	GM	SM (GL)	GH
Coarse-pitch (with shim)	○	○	○
Fine-pitch (without shim)	○	○	△ Recommended under fz=0.4mm/t
Extra fine-pitch (without shim)	○	○	Not recommended

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