

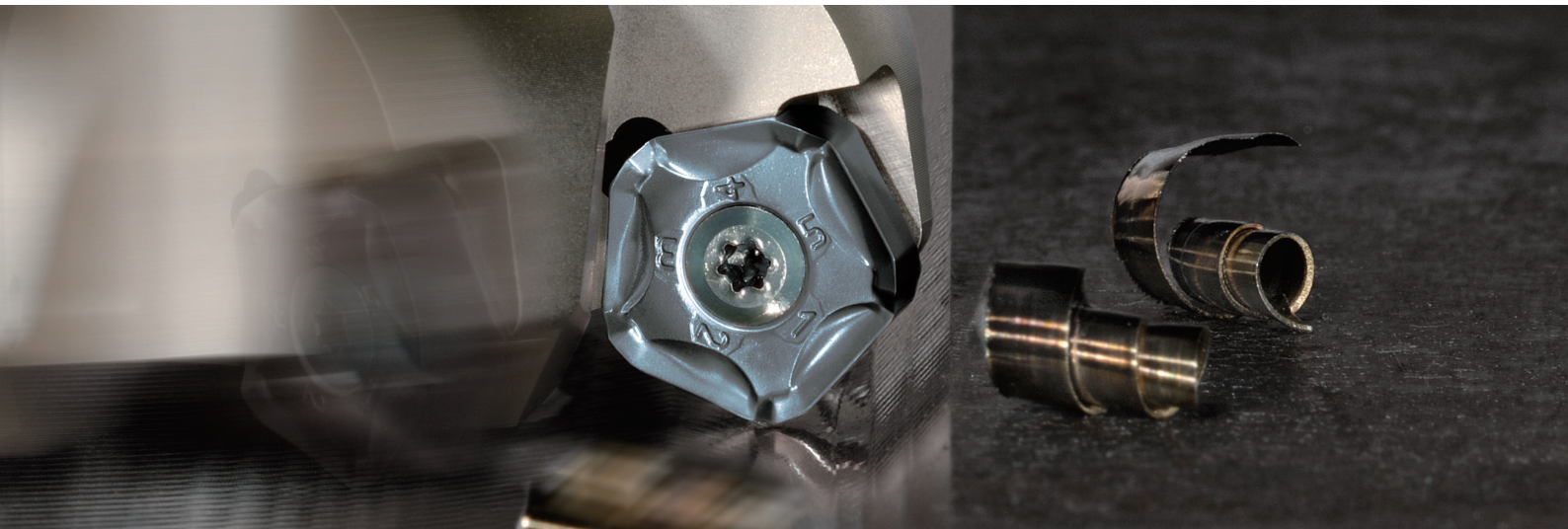
THE NEW VALUE FRONTIER



45° Milling with Double Sided  
10-edge Inserts | **MFPN**

45° Milling with Double Sided 10-edge Inserts

# MFPN



Reduced Chattering with a Low Cutting Force Design and Excellent Fracture Resistance

Economical 10-edge Insert

Low Cutting Force due to Curved Cutting-Edge Design

Suppresses Fracturing with Dual Angle Edge Design



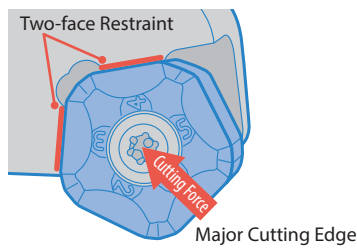
## 45° Milling with Double Sided 10-edge Inserts

# MFPN

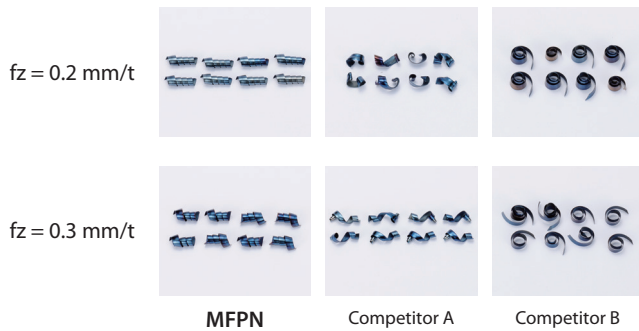
Reduced Chattering with a Low Cutting Force Design and Excellent Fracture Resistance  
Economical 10-edge Insert

### 1 Economical 10-edge Insert

Pentagonal Double-sided Inserts Provide Excellent Stability  
Stable Machining at High Feed Machining



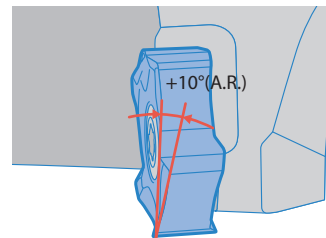
Chip Evacuation (In-house Evaluation)



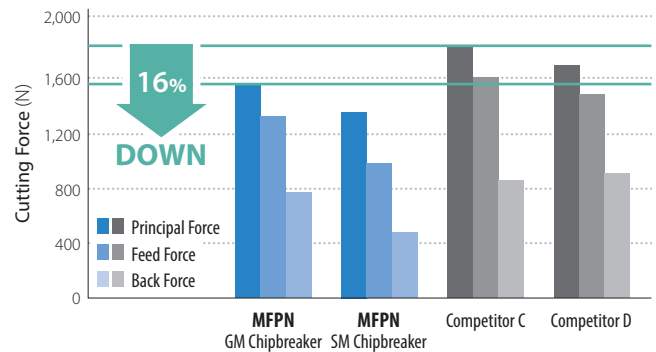
Cutting Conditions: Vc = 150 m/min, fz = 0.2 - 0.3 mm/t, ap x ae = 3 x 110 mm  
Workpiece: S50C

### 2 Resists Chattering

Low Cutting Forces due to Curved Cutting Edge with a  
High Axial Rake Angle (Max 10°)



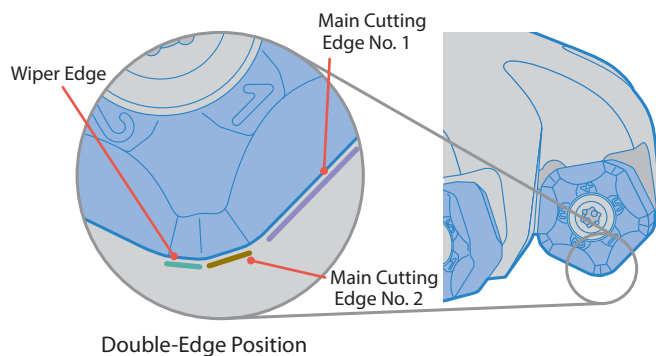
Cutting Force Comparison (In-house Evaluation)



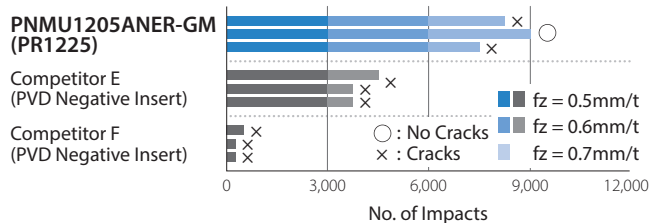
Cutting Conditions: Vc = 150 m/min, fz = 0.1 mm/t, ap x ae = 5 x 105 mm  
Workpiece: S50C

### 3 Fracture Resistance

Double-Edge Position Reduces Impact Load and Controls Vibration when Exiting the Workpiece



Fracture Resistance Comparison (In-house Evaluation)



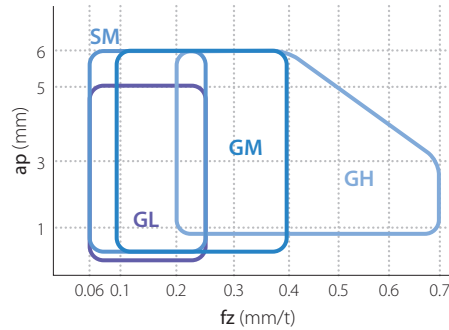
Cutting Conditions: Vc = 100 m/min, fz = 0.5 - 0.7 mm/t, ap x ae = 2 x 100 mm (Workpiece with 20mm Width Slot) Workpiece: SCM440 (38 - 42 HS)

# 4 Various Chipbreakers for a Wide Range of Applications

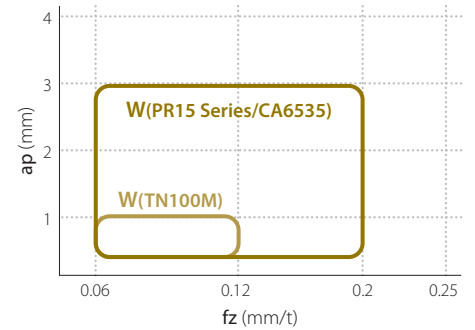
Four Unique Chipbreakers and a Wiper Insert Cover a Wide Range of Milling Applications

Chipbreaker:	Applications	Shape
GM	General	
SM	Low Cutting Force	
GH	Heavy Milling	
GL	Surface Finish Oriented	
W	Wiper Insert for Finishing	

Chipbreaker Recommended Applications



Wiper Insert Recommended Applications



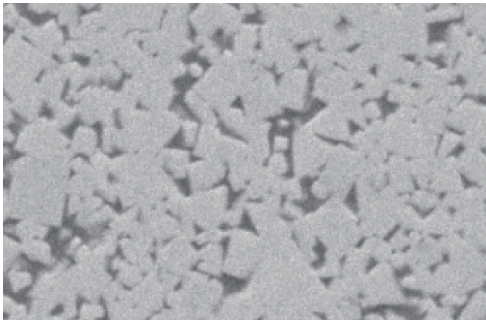
For how to use wiper insert, see page 6

**MEGACOAT NANO PR1535** Fracture resistant with a tough substrate and high heat-resistant coating  
Stable machining of general steel, mold steel, and difficult-to-cut materials

## 1 Toughening by a New Cobalt Mixing Ratio

\*In-house Evaluation

High Toughness Carbide Base Material



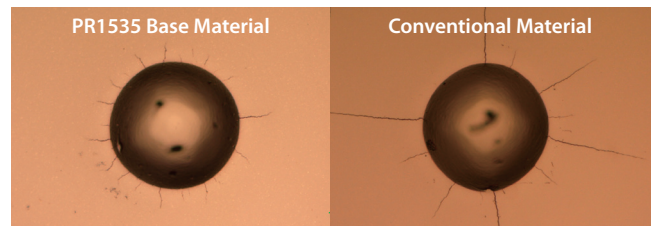
UP  
23%  
Fracture Toughness\*

## 2 Stability Improvement

The coarse grain structure and uniform particle size correspond to improved heat resistance, with conductivity values decreased by 11%. The uniform structure also reduces crack propagation.

Cracking Comparison by Diamond Indenter  
(In-house Evaluation)

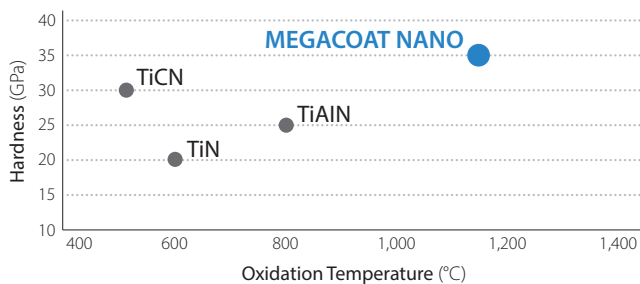
UP  
Shock Resistance



Short Cracks

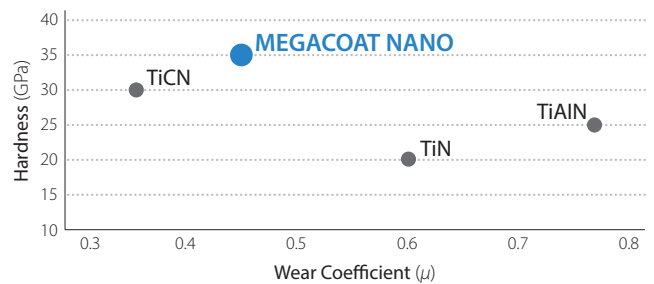
Long Cracks

Coating Properties (Abrasion Resistance)



Low Oxidation Resistance High

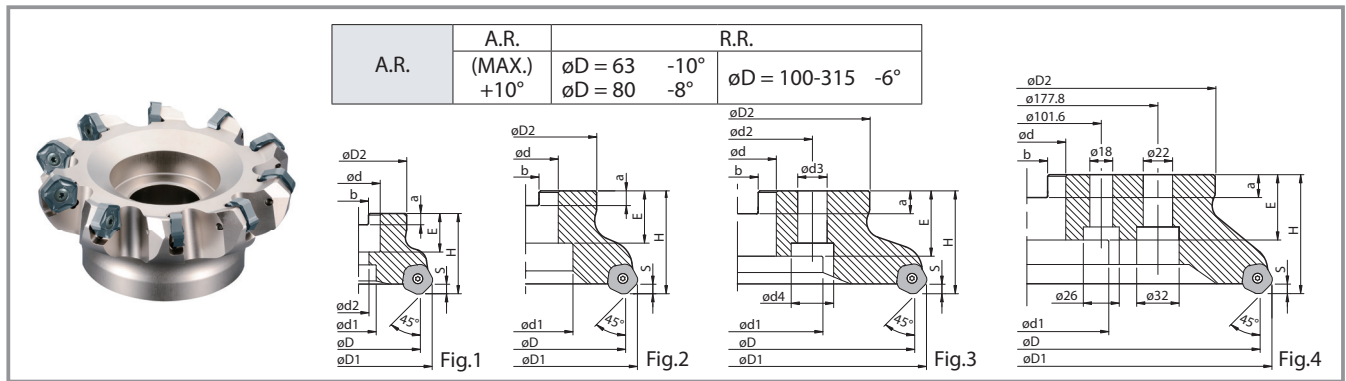
Coating Properties (Deposition Resistance)



High Deposition Resistance Low

Achieve long tool life with the combination of a tough substrate and a special Nano coating layer

Stable Machining with Excellent Wear Resistance



Toolholder Dimensions

	Description	Stock		No. of Inserts	Dimensions (mm)											Shape	Weight (kg)	Shim			
		R	L		øD	øD1	øD2	ød	ød1	ød2	H	E	a	b	ød3				ød4		
Bore Dia. Inch Spec	Coarse Pitch	MFPN 45080 R/L -5T	●	●	5	80	93	60	25.4	22	13	50	27	6	9.5	Fig.1	1.1	Yes			
		MFPN 45100 R/L -6T	●	●	6	100	113	70	31.75	48	—		32	8	12.7		Fig.2		1.4		
		MFPN 45125 R/L -7T	●	●	7	125	138	87	38.1	58			63	36	10				15.9	Fig.3	2.6
		MFPN 45160 R/L -8T	●	●	8	160	173	102	50.8	72	101.6	38		11	19.1		Fig.4		4.0		
		MFPN 45200R-10T	●		10	200	213	142	47.625	110		—	80	40	14				25.4	18	26
		MFPN 45250R-12T	●		12	250	263				210						—				
		MFPN 45315R-14T	MTO		14	315	328	220	—	—		—	—	—	—				—	—	—
	Fine Pitch	MFPN 45080R-6T	●		6	80	93	60	25.4	22	13	50	27	6	9.5	Fig.1	1.1				
		MFPN 45100R-8T	●		8	100	113	70	31.75	48	—		32	8	12.7		Fig.2		1.4		
		MFPN 45125R-10T	●		10	125	138	87	38.1	58			63	36	10				15.9	Fig.3	2.7
		MFPN 45160R-12T	●		12	160	173	102	50.8	72	101.6	38		11	19.1		Fig.4		4.0		
		MFPN 45200R-14T	●		14	200	213	142	47.625	110		—	80	40	14				25.4	18	26
		MFPN 45250R-16T	●		16	250	263				210						—				
		MFPN 45315R-18T	MTO		18	315	328	220	—	—		—	—	—	—				—	—	—
Extra Fine Pitch	MFPN 45080R-8T	●		8	80	93	60	25.4	22	13	50	27	6	9.5	Fig.1	1.1					
	MFPN 45100R-10T	●		10	100	113	70	31.75	48	—		32	8	12.7		Fig.2	1.3				
	MFPN 45125R-13T	●		13	125	138	87	38.1	58			63	36	10			15.9	Fig.3	2.7		
	MFPN 45160R-16T	●		16	160	173	102	50.8	72	101.6	38		11	19.1		Fig.4	4.0				
	MFPN 45200R-18T	●		18	200	213	142	47.625	110		—	80	40	14			25.4	18	26	Fig.3	6.9
	MFPN 45250R-20T	●		20	250	263				210						—					
mm Spec	Coarse Pitch	MFPN 45063R-4T-M	●		4	63	76	47	22		19	11	40	21	6.3		10.4	Fig.1	0.5		
		MFPN 45080R-5T-M	●		5	80	93	60	27	22	13	50		24	7	12.4	Fig.2		1.1		
		MFPN 45100R-6T-M	●		6	100	113	70	32	48	63			30	8	14.4			Fig.3	1.4	
		MFPN 45125R-7T-M	●		7	125	138	87	40	58		101.6	32	9	16.4	Fig.4	2.6				
		MFPN 45160R-8T-M	●		8	160	173	102	60	68	66.7		32	9	16.4		14		20	Fig.3	3.8
		MFPN 45200R-10T-M	●		10	200	213	142	60	110		101.6	40	14	25.7	18					
		MFPN 45250R-12T-M	●		12	250	263				210						—		—	—	80
		MFPN 45315R-14T-M	MTO		14	315	328	220	—	—		—	—	—	—	—					
	Fine Pitch	MFPN 45063R-5T-M	●		5	63	76	47	22	19	11	40	21	6.3	10.4	Fig.1	0.5				
		MFPN 45080R-6T-M	●		6	80	93	60	27	22	13		50	24	7		12.4	Fig.2	1.0		
		MFPN 45100R-8T-M	●		8	100	113	70	32	48	63			30	8		14.4		Fig.3	1.4	
		MFPN 45125R-10T-M	●		10	125	138	87	40	58		101.6	32	9	16.4		14	20		Fig.4	2.5
		MFPN 45160R-12T-M	●		12	160	173	102	60	68	66.7		32	9	16.4				14		
		MFPN 45200R-14T-M	●		14	200	213	142	60	110		101.6	40	14	25.7		18	26		Fig.3	6.5
		MFPN 45250R-16T-M	●		16	250	263				210								—		
		MFPN 45315R-18T-M	MTO		18	315	328	220	—	—		—	—	—	—		—	—		—	—
	Extra Fine Pitch	MFPN 45063R-6T-M	●		6	63	76	47	22	19	11	40	21	6.3	10.4	Fig.1	0.5				
		MFPN 45080R-8T-M	●		8	80	93	60	27	22	13		50	24	7		12.4	Fig.2	1.1		
		MFPN 45100R-10T-M	●		10	100	113	70	32	48	63			30	8		14.4		Fig.3	1.3	
		MFPN 45125R-13T-M	●		13	125	138	87	40	58		101.6	32	9	16.4		14	20		Fig.4	2.6
		MFPN 45160R-16T-M	●		16	160	173	102	60	68	66.7		32	9	16.4				14		
		MFPN 45200R-18T-M	●		18	200	213	142	60	110		101.6	40	14	25.7		18	26		Fig.3	6.6
		MFPN 45250R-20T-M	●		20	250	263				210								—		

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

● : Standard Stock MTO : Made-To-Order

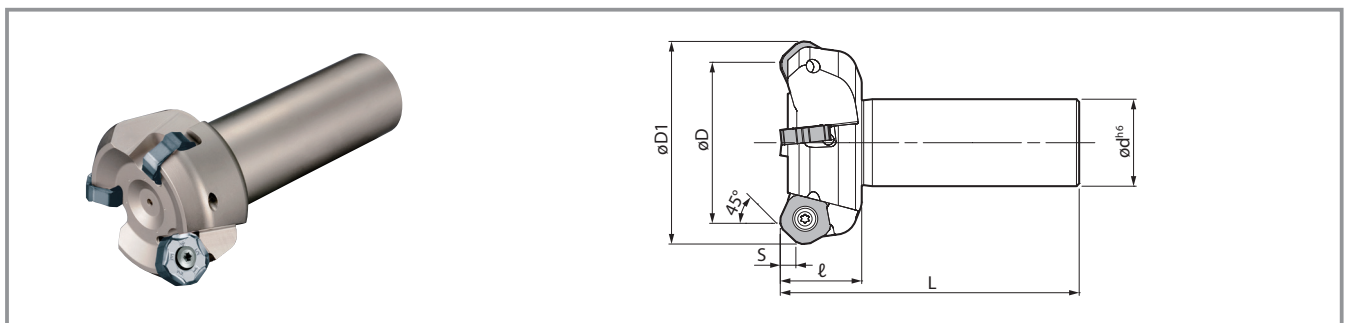


## Spare Parts

Description		Clamp Screw	Wrench		Shim	Shim Screw	Wrench	Anti-Seize Compound	Mounting Bolt
			TT	DTM					
Coarse Pitch	MFPN 45063R-4T-M	SB-50140TR	TTW-15	—	MFPN-45	SPW-7050	LW-5	P-37	HH10 × 30
	MFPN 45080R/L-5T-(M)								HH12 × 35
	MFPN 45100R/L-6T-(M) ? 45315R-14T-(M)								Recommended Torque for Insert Clamp 4.2N·m
Fine Pitch	MFPN 45063R-5T-M	SB-50140TR	TTW-15	—	—	—	—	P-37	HH10 × 30
	MFPN 45080R-6T-(M)								HH12 × 35
	MFPN 45100R-8T-(M) ? 45315R-18T-(M)								Recommended Torque for Insert Clamp 4.2N·m
Extra Fine Pitch	MFPN 45063R-6T-M	SB-40140TRN	—	DTM-15	—	—	—	P-37	HH10 × 30
	MFPN 45080R-8T-(M)								HH12 × 35
	MFPN 45100R-10T-(M) ? 45250R-20T-(M)								Recommended Torque for Insert Clamp 3.5N·m

Coat Anti-Seize Compound (MP-1) thinly on portion of taper and thread prior to installation.

## MFPN45 End Mill



### Toolholder Dimensions

Description	Stock	No. of Inserts	Dimensions (mm)						A.R.		Spare Parts		
			øD	øD1	ød	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	+10°	-12°	SB-50140TR	TTW-15	P-37
45063R-S32-4T	●	4	63	76									
45080R-S32-5T	●	5	80	93									


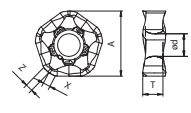

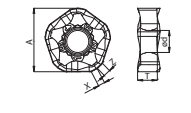

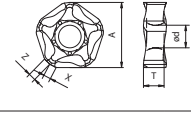

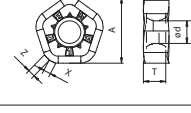

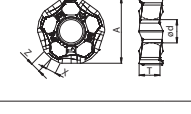

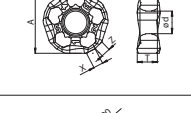

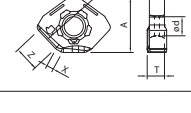
Dimension S: 6mm (GM, SM, GH Chipbreakers), 5mm (GL Chipbreaker), 3mm (W Chipbreaker: PR15 Series)  
Coat Anti-Seize Compound (MP-1) thinly on portion of taper and thread prior to installation.

● : Standard Stock

## Recommended Chipbreaker

Cutter Type	GM	SM (GL)	GH
Coarse Pitch (with shim)	○	○	○
Fine Pitch (without shim)	○	○	△ (Recommended under fz = 0.4 mm/t)
Extra Fine Pitch (without shim)	○	○	Not Recommended

## Applicable Inserts

Classification of Usage	P	Steel	■		☆	★		☆						
		Die Steel	■		☆	★		☆						
★ : Roughing / 1st Choice ☆ : Roughing / 2nd Choice ■ : Finishing / 1st Choice □ : Finishing / 2nd Choice (In case hardness is under 45HRC)	M	Austenitic Stainless Steel			★	☆		☆						
		Martensitic Stainless Steel		★	☆									
		Precipitation Hardened Stainless Steel			★									
	K	Gray Cast Iron						★	☆					
		Nodular Cast Iron						★	☆					
	N	Non-ferrous Metals												
	S	Ni-base Heat-Resistant Alloy (Inconel®718, etc.)		★	☆			☆						
		Titanium Alloy			★				☆					
H	High Hardness Steel						□							
Insert	Description	Dimensions (mm)					Cermet TN100M	CVD Coated Carbide CA6535	MEGACOAT NANO			MEGACOAT		
		A	T	ød	X	Z			PR1535	PR1525	PR1510	PR1225	PR1210	
 General		17.88	5.56	6.2	2.0	2.0			●	●	●	●	●	●
 General									●	●	●	●		
 Low Cutting Force									●	●	●	●	●	●
 Tough Edge (Heavy Milling)									●	●	●	●	●	●
 Surface Finish Oriented (Precision Class)		17.51	5.56		2.7	2.7			●	●	●	●	●	●
 Surface Finish Oriented (Precision Class)									●	●	●	●		
 Wiper Insert (2-edge)		17.85			2.3	8.1	●	●	●	●	●			

● : Standard 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 Finish 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 Inserts





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

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

Using GH + W and GL + W are NOT recommended.

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

## Improved Surface Finish with Wiper Insert

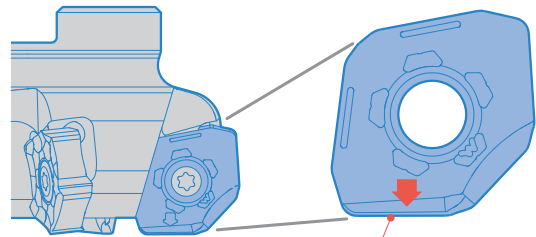
Chipbreaker Combination	Insert	Surface Finish	Workpiece Surface
MFPN Wiper Insert PR1525 (PNMU-GM...9 Inserts) (PNEU-W...1 Inserts)		Ra = 0.48 μm Rz = 3.39 μm	 Shiny Surface
MFPN GL Chipbreaker PR1225 (PNEU-GL...10 Inserts)		Ra = 2.50 μm Rz = 11.41 μm	 Shiny Surface

MFPN45125R-10T (10 Inserts)

Cutting Conditions:  $V_c = 200 \text{ m/min}^{-1}$  ( $n = 510 \text{ min}^{-1}$ ),  $f_z = 0.2 \text{ mm/t}$  ( $V_f = 1,020 \text{ mm/min}$ ),  $a_p \times a_e = 3 \times 100 \text{ mm}$ , Dry Workpiece: SS400

Results above are from an internal evaluation. 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).

## How to Attach Wiper Inserts on the MFPN Cutter

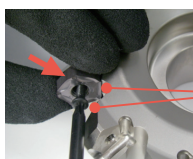


The down arrow symbol (↓) indicates the wiper cutting edge. When mounting inserts, make sure that the arrow points downward.

## How to Mount Inserts

1. Be sure to remove dust and chips from the insert mounting pocket.
2. After applying anti-seize compound on portion of taper and thread, while pressing the insert against the pocket wall, insert the screw into the hole of the insert and tighten the screw with 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.
3. 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 pocket wall of the holder.
4. To change the cutting edge of the insert, turn the insert counterclockwise (see Fig. 3) Insert corner identification number is stamped on the top surface of insert with the exception of the SM chipbreaker (Fig. 4).

Fig. 1



Pocket Wall

Fig. 2

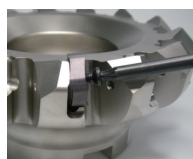
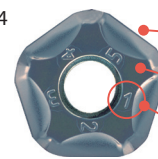


Fig. 3



Fig. 4



Side Surface of Insert

Top Surface of Insert

Insert Corner Identification Number

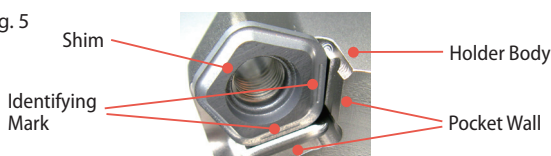
## How to Replace a Shim (for Coarse Pitch)

1. Be sure to remove dust and chips from the insert mounting pocket.
2. The shim must be mounted in the proper direction. While aligning the surface of the shim with the mark on it to the corresponding pocket wall (see Fig. 5) and lightly pressing the shim toward the pocket wall, 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.

3. 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.

Fig. 5



Shim

Holder Body

Identifying Mark

Pocket Wall

Fig. 6



Shim Screw

Wrench

# Recommended Cutting Conditions ★ 1st Recommendation ☆ 2nd Recommendation

Insert	Workpiece	Recommended 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	★ 120 – 180 – 250	—	—
	Alloy Steel (SCM)	0.1 – 0.2 – 0.4	☆ 100 – 160 – 220	★ 100 – 160 – 220	—	—
	Die Steel (SKD)	0.1 – 0.2 – 0.35	★ 80 – 140 – 180	★ 80 – 140 – 180	—	—
	Austenitic Stainless Steel (SUS304)	0.1 – 0.2 – 0.4	☆ 100 – 160 – 200	☆ 100 – 160 – 200	—	—
	Martensitic Stainless Steel (SUS403)	0.1 – 0.2 – 0.4	☆ 150 – 200 – 250	—	—	☆ 180 – 240 – 300
	Precipitation Hardened Stainless Steel (SUS630)	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-base Heat-Resistant Alloy (Inconel®718, etc.)	0.1 – 0.12 – 0.2	☆ 20 – 30 – 50	—	—	★ 20 – 30 – 50
SM *(GL)	Carbon Steel (SXXC)	0.06 – 0.12 – 0.25	☆ 120 – 180 – 250	☆ 120 – 180 – 250	—	—
	Alloy Steel (SCM)	0.06 – 0.12 – 0.25	☆ 100 – 160 – 220	☆ 100 – 160 – 220	—	—
	Die Steel (SKD)	0.06 – 0.1 – 0.2	☆ 80 – 140 – 180	☆ 80 – 140 – 180	—	—
	Austenitic Stainless Steel (SUS304)	0.06 – 0.12 – 0.25	★ 100 – 160 – 200	☆ 100 – 160 – 200	—	—
	Martensitic Stainless Steel (SUS403)	0.06 – 0.12 – 0.25	☆ 150 – 200 – 250	—	—	★ 180 – 240 – 300
	Precipitation Hardened Stainless Steel (SUS630)	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-base Heat-Resistant Alloy (Inconel®718, etc.)	0.06 – 0.1 – 0.15	☆ 20 – 30 – 50	—	—	☆ 20 – 30 – 50
	Titanium Alloy (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	☆ 120 – 180 – 250	—	—
	Alloy Steel (SCM)	0.2 – 0.4 – 0.6	☆ 100 – 160 – 220	☆ 100 – 160 – 220	—	—
	Die Steel (SKD)	0.2 – 0.35 – 0.5	☆ 80 – 140 – 180	☆ 80 – 140 – 180	—	—
	Austenitic Stainless Steel (SUS304)	0.2 – 0.3 – 0.4	☆ 100 – 160 – 200	☆ 100 – 160 – 200	—	—
	Martensitic Stainless Steel (SUS403)	0.2 – 0.3 – 0.4	☆ 150 – 200 – 250	—	—	☆ 180 – 240 – 300
	Precipitation Hardened Stainless Steel (SUS630)	0.2 – 0.3 – 0.4	☆ 90 – 120 – 150	—	—	—
	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	—
	Ni-base Heat-Resistant Alloy (Inconel®718, etc.)	0.2 – 0.3 – 0.4	☆ 20 – 30 – 50	—	—	☆ 20 – 30 – 50

The number in bold font is recommended starting conditions. Adjust the cutting speed and the feed rate within the above conditions according to the actual machining situation

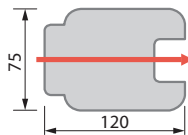
\*GL Chipbreaker is recommended for surface finish-oriented application

GH Chipbreaker is suitable for fine pitch cutter (fz ≤ 0.4 mm/t). It is not recommended for extra fine pitch cutter.

## Case Studies

### Construction Machine Part SCM440H

Vc = 250 m/min  
 ap × ae = 2 ~ 3 × 75 mm  
 fz = 0.15 mm/t  
 (Vf = 900 mm/min)  
 Dry  
 MFPN4580R-6T (6 Inserts)  
 PNMU1205ANER-SM (PR1225)



Chip Removal Rate

**PR1225**

**202 cc/min**



Competitor G

**94 cc/min**

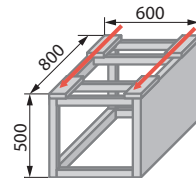
MFPN cutter improved machining efficiency 2.1 times of the Competitor E without changing spindle load.

MFPN cutter was very stable at the entrance and exit of the machining. It controls chatter and remains stable even with low rigid machine.

(User Evaluation)

### Case SUS304

Vc = 90 m/min  
 ap × ae = 0.4 × 50 mm  
 fz = 0.19 mm/t  
 (Vf = 410 mm/min)  
 Dry  
 MFPN45080R-6T (6 Inserts)  
 PNMU1205ANER-SM (PR1225)



Machining Efficiency

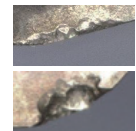
**PR1225**

**1.5 pcs/corner**



Competitor H  
(for Roughing)

**1 pcs/corner**



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.

(User Evaluation)