MITSUBISHI MATERIALS

# WSF406W

## FACE MILLING CUTTER FOR CAST IRON MACHINING WITH AN ADJUSTABLE RUN-OUT SYSTEM



Double Z Geometry





TOOL NEWS **B265A**

## Face Milling Cutter for Cast Iron Machining with an Adjustable Run-Out System

# WSF406W

## Low Cutting Resistance Insert and Adjustable Cutting Edge Run-Out Produce an Improved Surface Finish and Increased Productivity

### Tough and Sharp Inserts for Low Cutting Resistance

MITSUBISHI MATERIAL's uniquely developed proprietary "Double Sided, Z Geometry" insert combines the features of conventional positive and negative rake inserts to achieve low resistance and sharpness. In addition, the chamfer geometry suppresses edge chipping that tends to occur during cast iron machining.



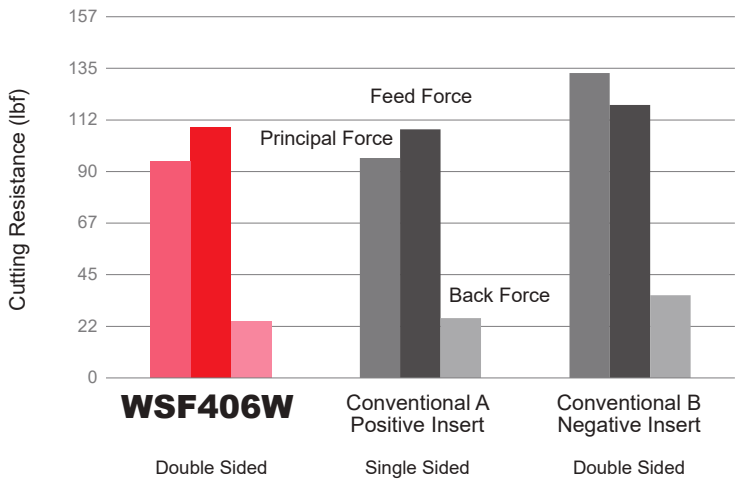
**Double Sided, Z Geometry**



Chamfer Geometry



### Double sided insert with positive insert cutting resistance




**Reduces negative insert cutting resistance by 23%**

<Cutting Conditions>

| | |
|---|---|
| Material | : AISI No. 45 B |
| Tool | : WSF406WR12516EN |
| Insert | : SNMU1206C05ZNER-M (MC520) |
| Cutting Speed | : vc=525 SFM |
| Feed per Tooth | : fz=.004 IPT |
| Depth of Cut | : ap=.118 inch |
| Width of Cut | : ae=3.937 inch |
| Cutting Mode | : Dry Cutting |

## Easy-to-use Adjustable Run-out System

The M-Class insert gives a great cost performance ratio and allows for axial cutting edge adjustments of 0.01 mm or less. This helps to achieve surface finishes of Ra 1.6 µm or less over a wide range of feeds and speeds.

**High precision machining is possible over a wide range of cutting conditions.**

Finish Cutting Conditions

**Ra : 24 µ-inch**



fz=.004 IPT , ap=.012 inch

**Ra : 53 µ-inch**



fz=.012 IPT , ap=.059 inch



<Cutting Conditions>
Material : AISI No. 45 B
Tool : WSF406WR12516EN
(Minur Cutting Edge
Run-out Accuracy : .118 µ-inch)
Insert : SNMU1206C05ZNER-M (MC520)
Cutting Speed : vc=820 SFM
Cutting Mode : Dry Cutting

## Achieves High Accuracy with a Simple Operation

Cutting edge run-out is easily altered by turning the adjustment screw.




①Loosen the adjustment screw.

②Locate the insert and tighten so accurate adjustment can be made.

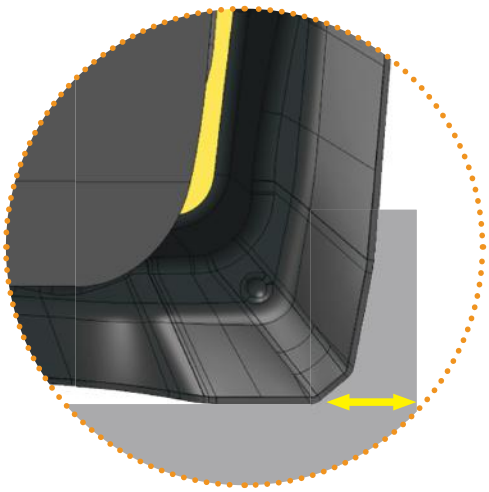
③Turn the adjustment screw until the insert is in the required position.

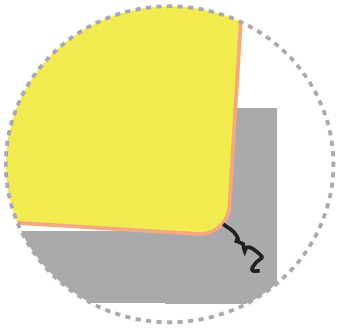
④Fully tighten the insert clamp.

# Chamfer Geometry Prevents Chipping of the Workpiece Material

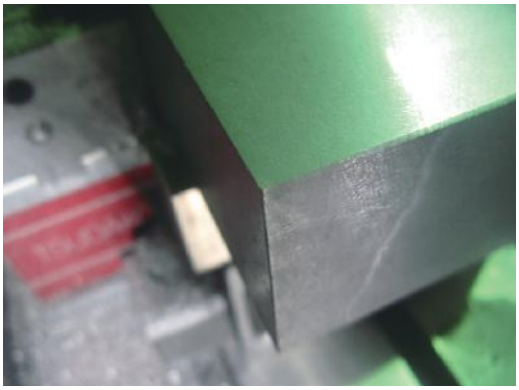
The insert corner is chamfered to provide extra material thickness at the corner to prevent workpiece material cracking.



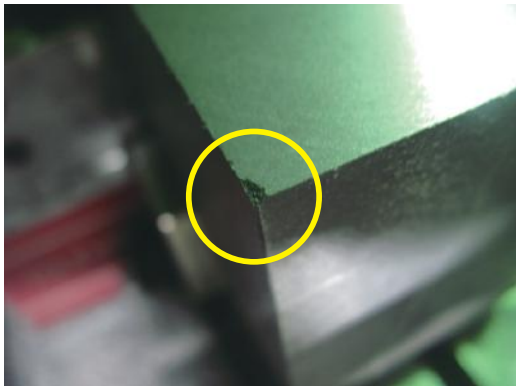




A thin edge is prone to cracks.



**WSF406W**



Conventional

<Cutting Conditions>

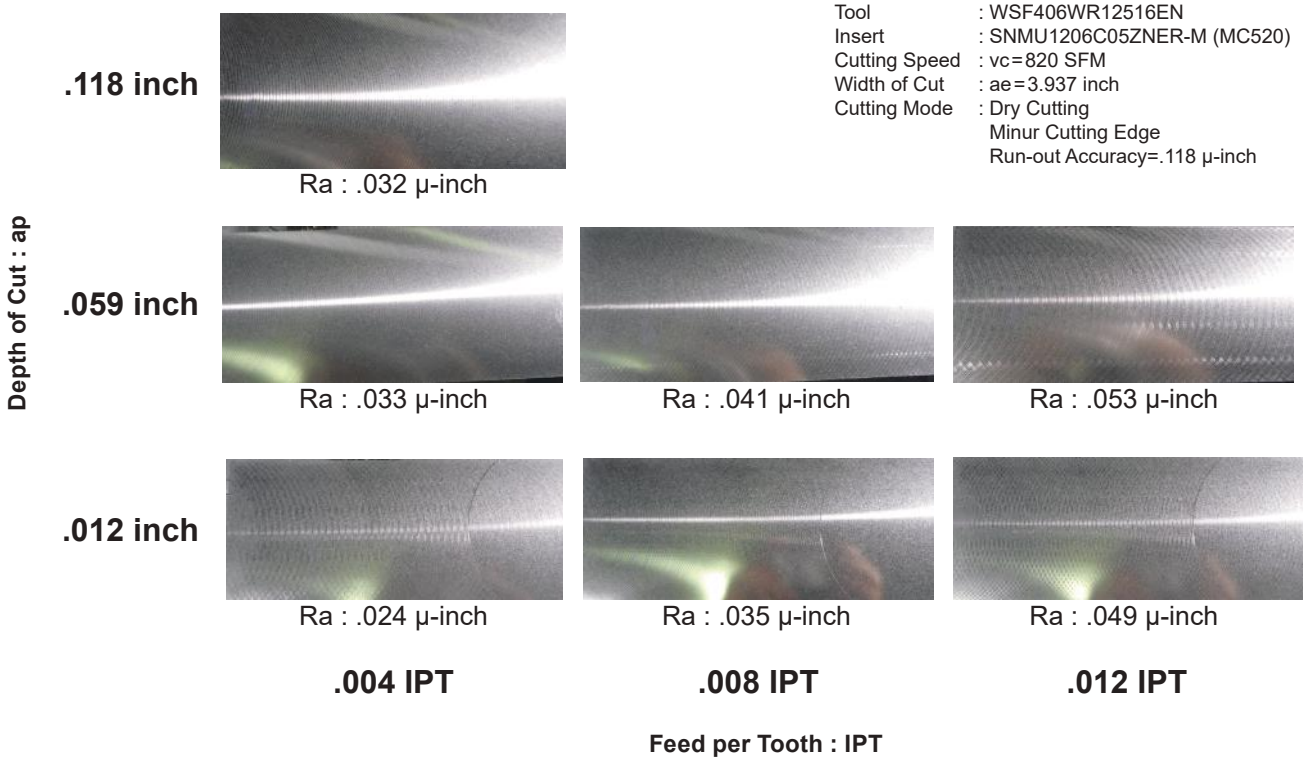
| | |
|---|---|
| Material | : AISI No. 45 B |
| Tool | : WSF406WR12516EN |
| Insert | : SNMU1206C05ZNER-M (MC520) |
| Cutting Speed | : vc=525 SFM |
| Feed per Tooth | : fz=.004 IPT |
| Depth of Cut | : ap=.118 inch |
| Width of Cut | : ae=3.937 inch |
| Cutting Mode | : Dry Cutting |

# Cutting Performance

## Comparison of Surface Finishes for Each Depth of Cut and Feed: AISI No. 45 B

Achieves an Ra of .063 µ-inch or less for a wide range of feeds and depth of cut.

<Cutting Conditions>
Material : AISI No. 45 B
Tool : WSF406WR12516EN
Insert : SNMU1206C05ZNER-M (MC520)
Cutting Speed : vc=820 SFM
Width of Cut : ae=3.937 inch
Cutting Mode : Dry Cutting
Minur Cutting Edge
Run-out Accuracy=.118 µ-inch

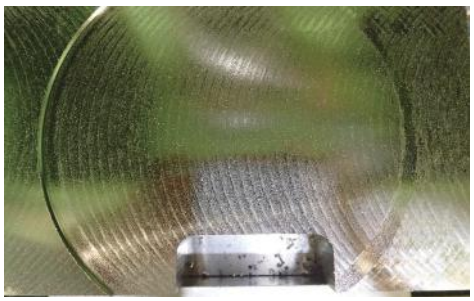



## Comparison of Surface Finish for Wiper Insert : AISI No. 35 B

Achieves excellent finished surface accuracy compared to conventional wiper inserts.



Conventional Ra .048 µ-inch



**WSF406W** Ra .033 µ-inch

<Cutting Conditions>
Material : AISI No. 35 B
Tool : WSF406WR12516EN
Insert : SNMU1206C05ZNER-M(MC520) 15 teeth
WNGU1206ZNER5C-M(MC520) 1 tooth
Cutting Speed : vc=820 SFM
Feed per Tooth : fz=.008 IPT
Depth of Cut : ap=.039 inch
Width of Cut : ae=3.937 inch

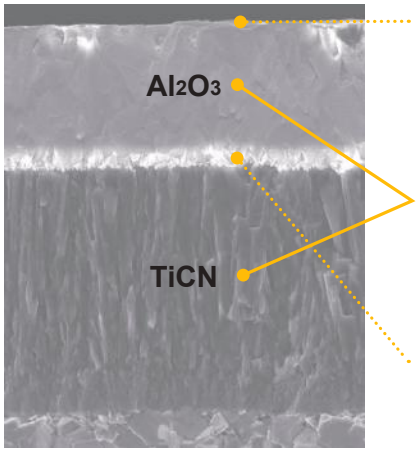
## CVD Coated Carbide Grade for Cast Iron Milling

# MC520

### Ideal for machining grey cast iron due to the improved peeling resistance of the coating layer.

## Improved Peeling Resistance

By optimizing the coating layer and improving the adhesion with the cemented carbide base material, the plastic deformation of the cutting edge is suppressed. The coating layer has an excellent resistance to peeling, thereby providing longer tool life.




### All Black Super-Even Coating

The new, smoother than standard surface coating prevents welding and edge chipping to allow reliable and stable cutting.

### Nano-Texture Coating Technology

The optimized crystal growth, and the Nano-Texture Coating Technology provide outstanding wear and chipping resistance.

### TOUGH-Grip Coating Technology

The degree of adhesion between the coating layers has been improved exponentially allowing for greater strength and toughness.

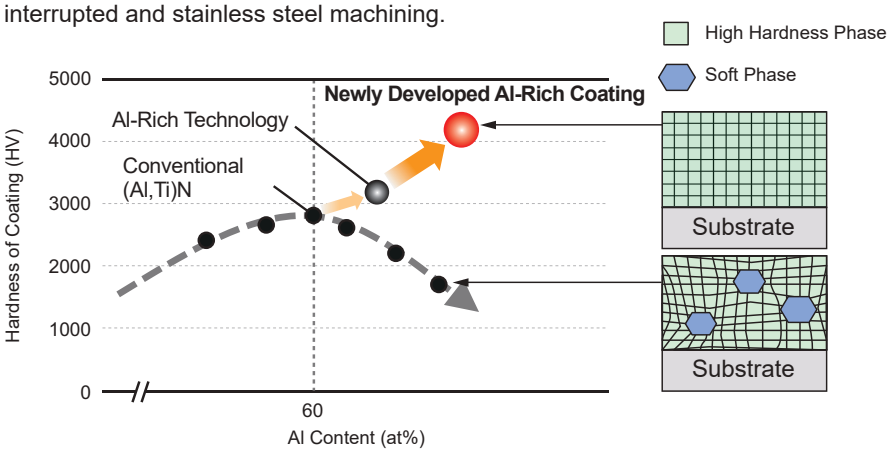
## Coated Carbide Grade for Milling

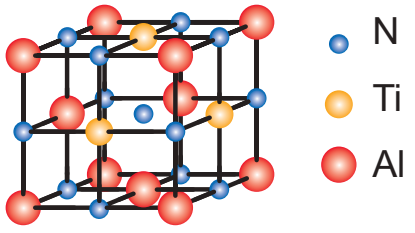
# MV1020/MV1030

### Newly Developed Al-Rich Coating

## Advanced Wear and Thermal Shock Resistance

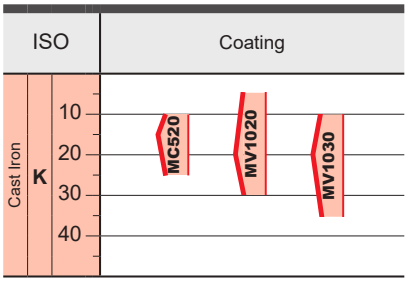
By adopting the newly developed Al-Rich coating technology, the (Al,Ti)N with a high Al content ratio displays a very high hardness. This greatly improves oxidation and wear resistance.
The extreme heat resistance of this new series achieves amazing stability not only during dry cutting, but also when wet cutting where inserts are usually prone to thermal cracking.
MV1020 offers overwhelmingly superior performance in high-speed cutting, and MV1030 achieves stable performance during interrupted and stainless steel machining.




Crystal image of **MV1000** series

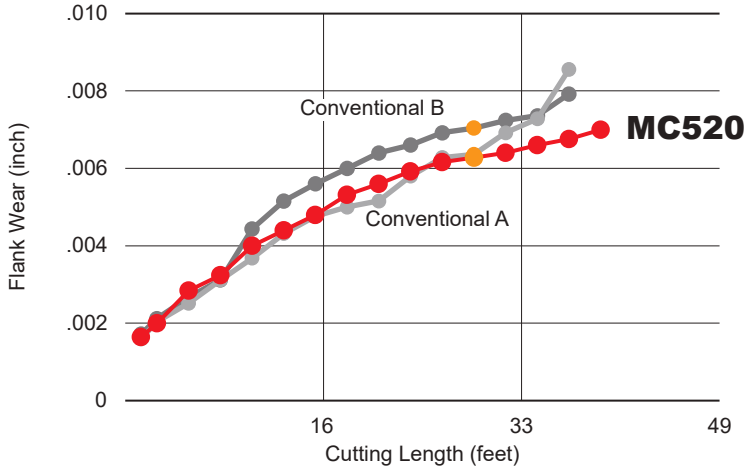
## Insert Grade Suitable for Cast Iron




# Machining Performance

## Comparison of Wear Resistance ; AISI No. 45 B

The MC520 provides excellent wear resistance when machining gray cast iron.

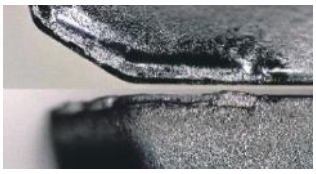



<Cutting Conditions>
Material : AISI No. 45 B
Tool : WSF406WR12516EN
Insert : SNMU1206C05ZNER-M
Cutting Speed : vc=985 SFM
Feed per Tooth : fz=.008 IPT
Depth of Cut : ap=.079 inch
Cutting Mode : Dry Cutting, Single Insert Center Cut

After Machining Cutting Length 26 feet



**MC520**



Conventional A



Conventional B

# FACE MILLING
<HIGH EFFICIENCY CUTTING FOR CAST IRON>

84° KAPR

# WSF406W

P M K N S H



Fig.1
ø80

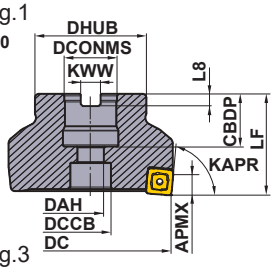



Fig.2
ø100
ø125
ø160

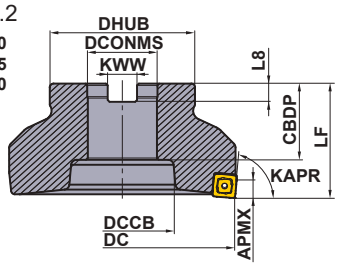
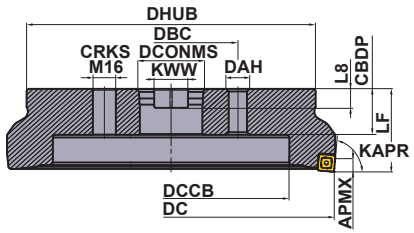



Fig.3
ø200
ø250




Right hand tool holder only.

**Metric Standard**

## Arbor Type

DCON = inch size

(mm)

| DC | Order Number | Stock R | ★1 Coolant Thru | ★2 No.T | LF | DCONMS | WT (kg) | APMX | RPMX (min$^{-1}$) | Fig. |
|---|---|---|---|---|---|---|---|---|---|---|
| 80 | **WSF406WR08006CN** | ★ | N | 6 | 50 | 25.4 | 1.2 | 7.0 | 7,800 | 1 |
| 80 | **WSF406WR08009CN** | ★ | N | 9 | 50 | 25.4 | 1.2 | 7.0 | 7,800 | 1 |
| 100 | **WSF406WR10008DN** | ★ | N | 8 | 50 | 31.75 | 1.7 | 7.0 | 7,000 | 2 |
| 100 | **WSF406WR10012DN** | ★ | N | 12 | 50 | 31.75 | 1.7 | 7.0 | 7,000 | 2 |
| 125 | **WSF406WR12510EN** | ★ | N | 10 | 63 | 38.1 | 3.3 | 7.0 | 6,250 | 2 |
| 125 | **WSF406WR12516EN** | ★ | N | 16 | 63 | 38.1 | 3.2 | 7.0 | 6,250 | 2 |
| 160 | **WSF406WR16014FN** | ★ | N | 14 | 63 | 50.8 | 5 | 7.0 | 5,500 | 2 |
| 160 | **WSF406WR16020FN** | ★ | N | 20 | 63 | 50.8 | 4.9 | 7.0 | 5,500 | 2 |
| 200 | **WSF406WR20016KN** | ★ | N | 16 | 63 | 47.625 | 8.6 | 7.0 | 4,900 | 3 |
| 200 | **WSF406WR20024KN** | ★ | N | 24 | 63 | 47.625 | 8.5 | 7.0 | 4,900 | 3 |
| 250 | **WSF406WR25022KN** | ★ | N | 22 | 63 | 47.625 | 14 | 7.0 | 4,400 | 3 |
| 250 | **WSF406WR25032KN** | ★ | N | 32 | 63 | 47.625 | 13.9 | 7.0 | 4,400 | 3 |

★1 Y=Yes, N=No
★2 Number of Teeth
Note1) A set bolt for the arbor is not supplied with the body. Please refer to page 9 to find the correct type of set bolt to order.

## Mounting Dimensions

(mm)

| DC | Tool Holder Type | DCONMS | CBDP | DAH | DBC | DCCB | CRKS | DHUB | KWW | L8 | Fig. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80 | **WSF406WR080** | 25.4 | 34 | 13 | — | 20 | — | 55 | 9.5 | 6 | 1 |
| 100 | **WSF406WR100** | 31.75 | 32 | — | — | 46 | — | 70 | 12.7 | 8 | 2 |
| 125 | **WSF406WR125** | 38.1 | 42 | — | — | 56 | — | 80 | 15.9 | 10 | 2 |
| 160 | **WSF406WR160** | 50.8 | 45 | — | — | 80 | — | 100 | 19.1 | 11 | 2 |
| 200 | **WSF406WR200** | 47.625 | 35 | 18 | 101.6 | 140 | M16 | 175 | 25.4 | 14.22 | 3 |
| 250 | **WSF406WR250** | 47.625 | 35 | 18 | 101.6 | 180 | M16 | 220 | 25.4 | 14.22 | 3 |

**★ : Stocked in Japan**

## Spare Parts

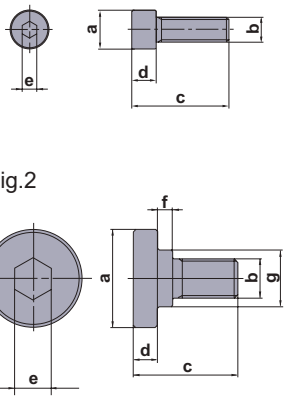
| Tool Holder Type |  |  * |  |  |
|---|---|---|---|---|
| | Wedge | Clamp Screw | Wrench | Adjustable Run-Out System |
| **WSF406W** | CWSF406N | LS0622T | TKY15T | ADW04 |

* Clamp Torque (lbf-in) : LS0622T = 53

## Parts Sold Separately
## Set Bolt

(mm)

| Tool Holder Type | Set Bolt | Fig. | Reference Dimensions | | | | | | | Geometry |
|---|---|---|---|---|---|---|---|---|---|---|
| | Order Number | | a | b | c | d | e | f | g | |
| **WSF406WR080** | HSC12035 | 1 | 18 | M12x1.75 | 47 | 12 | 10 | – | – | Fig.1 |
| **WSF406WR100** | – | 2 | 40 | M16x2 | 43 | 10 | 14 | 6 | 23 | |
| **WSF406WR125** | – | 2 | 50 | M20x2.5 | 54 | 14 | 17 | 6 | 27 | |
| **WSF406WR160** | – | 2 | 65 | M24x3 | 59 | 14 | 17 | 10 | 37 | |
| **WSF406WR200** | – | 1 | 24 | M16x2 | 61- | 16 | 14 | – | – | |
| **WSF406WR250** | – | 1 | 24 | M16x2 | 61- | 16 | 14 | – | – | Fig.2 |

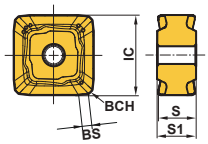
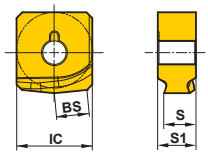



Note 1) Please purchase the appropriate set bolt after confirming the reference dimensions. The items with an order number listed under the Set Bolt columns are also sold by MITSUBISHI MATERIALS.

## Inserts

(inch)

| Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | K | Cast Iron | | | ◆ | ◆ | ◆ | | This is the selection guideline for WSF406W.<br>Please note that the cutting conditions differ depending on multiple factors, for more details refer to the Recommended Cutting Conditions.<br><br>**Edge Preparation :**<br>**E :** Round | | | | | |

| Shape | Order Number | Class | Edge Preparation | Coated | | | | IC | S1 | BS | BCH | S | Geometry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MC520 | MV1020 | MV1030 | | | | | | | |
|  | **SNMU1206C05ZNER-M** | M | E | ★ | ● | ● | | .500 | .244 | .063 | .020 | .236 |  |
|  Wiper | **WNGU1206ZNER5C-M** | G | E | ★ | | | | .484 | .244 | .205 | – | .236 |  |

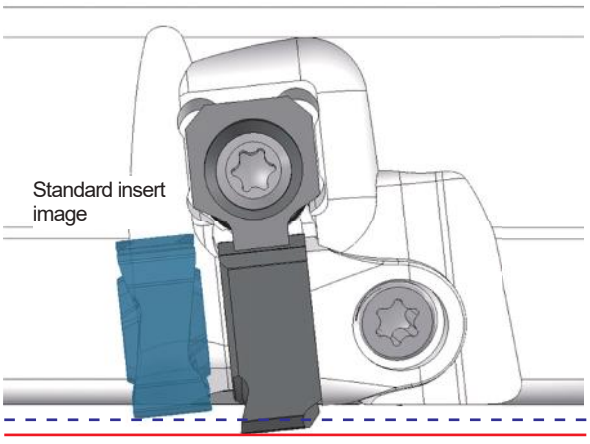




## How to Use Wiper Insert for Best Results

●The WSF406W can obtain a good surface finish when using a standard insert due to the adjustable run-out system, but by using a wiper insert an excellent surface finish can be achieved without having to set a high accuracy face run out.
When a wiper insert is mounted, aim to set the standard insert run out accuracy to within .0016 inch.

●Just one wiper insert is enough to achieve excellent finished surfaces.
However, if the feed per revolution is greater than .197 IPR, attach two or more wiper inserts so that they are evenly spaced in the cutter body and set the run out accuracy between multiple wiper inserts to within .0001 inch before use.




By figure image

Please set the wiper insert to protrude by up to .0028 inch

**★ : Stocked in Japan (10 inserts in one case)**

**Cutting Conditions (Guide) :**
● : Stable Cutting ◔ : General Cutting ✠ : Unstable Cutting

## Recommended Cutting Conditions

### Dry Cutting

(inch)

| | Material | Properties | Cutting Conditions | Depth of Cut **ap** | Grades | Cutting Speed **vc** (SFM) | Feed per Tooth **fz** (IPT) | Width of Cut **ae** |
|---|---|---|---|---|---|---|---|---|
| K | Gray Cast Iron | Tensile Strength ≤350MPa | ● | ap≤.020 | MC520, MV1020 | 985(820—985) | .005(.003—.008) | ≤.8DC |
| | | | | | MV1030 | 490(330—655) | .005(.003—.008) | ≤.8DC |
| | | | | ap≤.079 | MC520, MV1020 | 820(690—985) | .006(.004—.010) | ≤.8DC |
| | | | | | MV1030 | 490(330—655) | .006(.004—.010) | ≤.8DC |
| | | | | .079< ap≤.157 | MC520, MV1020 | 720(620—850) | .005(.004—.008) | ≤.8DC |
| | | | | | MV1030 | 460(260—655) | .005(.004—.008) | ≤.8DC |
| | | | | .157< ap≤.295 | MC520, MV1020 | 655(590—755) | .004(.003—.006) | ≤.8DC |
| | | | | | MV1030 | 360(195—525) | .004(.003—.006) | ≤.8DC |
| | | | ◔ | ap≤.020 | MC520, MV1020 | 820(690—985) | .005(.003—.008) | ≤.8DC |
| | | | | | MV1030 | 490(330—655) | .005(.003—.008) | ≤.8DC |
| | | | | ap≤.079 | MC520, MV1020 | 720(620—850) | .006(.004—.010) | ≤.8DC |
| | | | | | MV1030 | 490(330—655) | .006(.004—.010) | ≤.8DC |
| | | | | .079< ap≤.157 | MC520, MV1020 | 655(590—755) | .005(.004—.008) | ≤.8DC |
| | | | | | MV1030 | 460(260—655) | .005(.004—.008) | ≤.8DC |
| | | | | .157< ap≤.295 | MC520, MV1020 | 590(525—690) | .004(.003—.006) | ≤.8DC |
| | | | | | MV1030 | 360(195—525) | .004(.003—.006) | ≤.8DC |
| | | | ✠ | ap≤.020 | MC520, MV1020 | 720(620—850) | .005(.003—.008) | ≤.8DC |
| | | | | | MV1030 | 460(260—655) | .005(.003—.008) | ≤.8DC |
| | | | | ap≤.079 | MC520, MV1020 | 655(590—755) | .006(.004—.010) | ≤.8DC |
| | | | | | MV1030 | 460(260—655) | .006(.004—.010) | ≤.8DC |
| | | | | .079< ap≤.157 | MC520, MV1020 | 590(525—690) | .005(.004—.008) | ≤.8DC |
| | | | | | MV1030 | 360(195—525) | .005(.004—.008) | ≤.8DC |
| | | | | .157< ap≤.295 | MC520, MV1020 | 490(330—590) | .004(.003—.006) | ≤.8DC |
| | | | | | MV1030 | 260(130—395) | .004(.003—.006) | ≤.8DC |
| | Ductile Cast Iron | Tensile Strength ≤800MPa | ● | ap≤.020 | MC520, MV1020 | 755(655—820) | .005(.003—.008) | ≤.8DC |
| | | | | | MV1030 | 360(195—525) | .005(.003—.008) | ≤.8DC |
| | | | | ap≤.079 | MC520, MV1020 | 655(560—755) | .006(.004—.010) | ≤.8DC |
| | | | | | MV1030 | 360(195—525) | .006(.004—.010) | ≤.8DC |
| | | | | .079< ap≤.157 | MC520, MV1020 | 590(490—690) | .005(.004—.008) | ≤.8DC |
| | | | | | MV1030 | 295(165—425) | .005(.004—.008) | ≤.8DC |
| | | | | .157< ap≤.295 | MC520, MV1020 | 525(425—620) | .004(.003—.006) | ≤.8DC |
| | | | | | MV1030 | 230(130—330) | .004(.003—.006) | ≤.8DC |
| | | | ◔ | ap≤.020 | MC520, MV1020 | 655(560—755) | .005(.003—.008) | ≤.8DC |
| | | | | | MV1030 | 360(195—525) | .005(.003—.008) | ≤.8DC |
| | | | | ap≤.079 | MC520, MV1020 | 590(490—690) | .006(.004—.010) | ≤.8DC |
| | | | | | MV1030 | 360(195—525) | .006(.004—.010) | ≤.8DC |
| | | | | .079< ap≤.157 | MC520, MV1020 | 525(425—620) | .005(.004—.008) | ≤.8DC |
| | | | | | MV1030 | 295(165—425) | .005(.004—.008) | ≤.8DC |
| | | | | .157< ap≤.295 | MC520, MV1020 | 460(360—560) | .004(.003—.006) | ≤.8DC |
| | | | | | MV1030 | 230(130—330) | .004(.003—.006) | ≤.8DC |
| | | | ✠ | ap≤.020 | MC520, MV1020 | 590(490—655) | .005(.003—.008) | ≤.8DC |
| | | | | | MV1030 | 295(165—425) | .005(.003—.008) | ≤.8DC |
| | | | | ap≤.079 | MC520, MV1020 | 525(425—620) | .006(.004—.010) | ≤.8DC |
| | | | | | MV1030 | 295(165—425) | .006(.004—.010) | ≤.8DC |
| | | | | .079<ap≤.157 | MC520, MV1020 | 460(360—560) | .005(.004—.008) | ≤.8DC |
| | | | | | MV1030 | 230(130—330) | .005(.004—.008) | ≤.8DC |
| | | | | .157< ap≤.295 | MC520, MV1020 | 395(295—490) | .004(.003—.006) | ≤.8DC |
| | | | | | MV1030 | 195(100—295) | .004(.003—.006) | ≤.8DC |

Note 1) Refer to the table above for more details on how to set the cutting conditions according the usage.
Note 2) When using a wiper insert, the cutting conditions for the finishing area are ap≤.020 inch.

MITSUBISHI MATERIALS U.S.A.

**MITSUBISHI MATERIALS U.S.A. CORPORATION**


### California Office
(Headquarters)

3535 Hyland Avenue, Suite 200
Costa Mesa, CA 92626
Customer Service: 800.523.0800
Technical Service: 800.486.2341

### Chicago Office
(Engineering)

300 N. Martingale Road, Suite 500
Schaumburg, IL 60173
Main: 847.252.6300
Fax: 847.519.1732

### MMC Metal de Mexico, S.A. DE C.V.

Av. La Cañada No.16,
Parque Industrial Bernardo
Quintana, El Marques,
Queretaro C.P. 76246 MEXICO
Main: +52.442.221.61.36
Fax: +52.442.221.61.34

### North Carolina-MTEC
(Marketing & Technical Center)

105 Corporate Center Drive, Suite A
Mooresville, NC 28117
Main: 980.312.3100
Fax: 704.746.9292

### Toronto Office
(Canada Branch)

600 Matheson Blvd. Unit 5 (Office)
Mississauga, ON L5R 4C1
Main: 905.814.0240
Fax: 905.814.0245

### Detroit Office
(Moldino CS)

41700 Gardenbrook Road, Suite 120
Novi, MI 48375
Main: 248.308.2620
Fax: 248.308.2627


## FOR YOUR SAFETY

- Don't handle inserts and chips without gloves.
- Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage.
- Please use safety covers and wear safety glasses.
- When using compounded cutting oils, please take fire precautions.
- When attaching inserts or spare parts, please use only the correct wrench or driver.
- When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

**www.mmc-carbide.com/us**

Tools specifications subject to change without notice.

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