General Purpose Double Sided Insert Type Face Mill Features Low Cutting Resistance

WSX445

Unique Double Z Insert Geometry
General Purpose Double Sided Insert Type Face Mill Features Low Cutting Resistance

**WSX445**

New double sided insert type face milling cutter with innovative cutting edge! Perfect balance between convenience and high efficiency!

**Designed to control abnormal insert breakage and body damage**

The unique conical insert pocket seating and Anti Fly Insert mechanism (A.F.I.) combine to securely hold the insert. Since the outer edge of the insert is not in contact with the cutter body, damage from sudden fracturing is unlikely to cause damage to the cutter body. Shims are not needed due to the high rigidity of the very thick insert.

**Through Coolant Holes**

Improves chip discharge and prevents chip welding.

Anti Fly Insert mechanism (A.F.I.)
Mitsubishi Materials’ proprietary “Double sided, Z Geometry” insert features sharp cutting edges with low cutting resistance by utilizing features of conventional positive and negative rake inserts.
CUTTING RESISTANCE

WSX445's low cutting resistance equals that of single sided insert cutters. The low axial and radial forces reduce vibrations to a minimum.

[Comparison of the back force]

CHIP DISCHARGE EFFECT

Chips are discharged outwardly because of the negative/positive edge design. This helps prevent jamming of continuous chips and damage of coolant hole.

Conventional positive insert

WSX445

Conventional negative insert A

Conventional negative insert B

ABRASIVE DAMAGE FROM CHIPS

Depth of cut can be set without regard to the unused corner.

Conventional double sided insert

WSX445

Chips can contact the unused corner.

The chips generated do not contact the unused corner.
CHIPBREAKER SYSTEM

Chipbreaker series for varied cutting condition.

Focus on cutting edge sharpness

Stable Cutting (Continuous cutting, Without scale, etc.)

Unstable Cutting (Interrupted cutting, With scale, etc.)

Focus on cutting edge strength

**L**breaker
The high rake angle boosts cutting performance. Positive land retains strength and provides low cutting resistance.

**M**breaker
First recommendation for general applications. A good balance of edge strength and sharpness is provided by the optimized positive land and rake angle.

**R**breaker
For unstable applications. Enhanced edge strength and retention of sharpness is provided by the negative land and positive rake angle respectively.

**H**breaker
For demanding applications. A stronger land and reduced positive rake angle provides maximum edge strength.

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**TOUGH-Σ Technology**

A fusion of the separate coating technologies; PVD and multi-layering provides extra toughness.

![Image of TOUGH-Σ Technology]

**Dramatically improving the heat and wear resistance!**

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**Wear Resistance**

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**ISO PVD**

**ISO CVD**

**ISO PVD**

**ISO PVD**

**ISO PVD**

**ISO Carbine Alloy**

**ISO PVD**

**ISO PVD**

**ISO PVD**

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**MP6100, MP7100, MP9100** - With accumulated Al-Ti-Cr-N based PVD coating
Suitable for finishing and light cutting. Excellent welding and fracture resistance provides a coated finish.

**CVD coating MC5020**

First recommendation for cast iron milling. MC5020 has excellent wear resistance and also controls thermal cracking and chipping that are common when machining ductile cast iron.

**Black super-smooth coating**

Black super-smooth coating prevents abnormal damage such as weld chipping.

**Comparison of Coating Surface**

| Conventional coating | Black super-smooth coating |

**<Cutting Conditions>**

- Work Material: ASTM A36M
- Cutter Dia.: ø125mm 8 Inserts
- Cutting Speed: 200m/min
- Feed per Tooth: 0.1mm/t.
- Depth of Cut: ap=2.0mm ae=100mm
- Cutting Mode: Dry Cutting Center Cut
  After 8m Cutting Work
General Purpose Double Sided Insert Type Face Mill Features Low Cutting Resistance

**FACE MILLING**

<GENERAL CUTTING>

**WSX445**

- Double sided Z Geometry.
- Smooth chip discharge.

**Arbor Type Right Hand Tool Holder**

KAPR: 45°
GAMP: +17°  T: -7°—2°
GAMF: -6° to +1°  I: +16°—+19°

DC = inch size, DCON = Inch size

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*1 Y=Yes, N=No
*2 Number of Teeth
*3 The cutter body includes a set bolt for an arbor.

Right hand tool holder only.

Fig.1 ø1.5” ø2” ø2.5” ø3”
Fig.2 ø4” ø5” ø6”
Fig.3 ø8”

DC = inch size, DCON = Inch size

<GENERAL CUTTING>

FACE MILLING

45°
Finishing Roughing

* Inventory maintained.

General Purpose Double Sided Insert Type Face Mill Features Low Cutting Resistance

Roughing Finishing

Steel Stainless Steel Cast Iron Non-ferrous Metal Difficult-to-Cut Materials Hardened Steel

Fig.1
Fig.2
Fig.3

*1 Y=Yes, N=No
*2 Number of Teeth
*3 The cutter body includes a set bolt for an arbor.
## Arbor Type Mounting Dimensions

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**DC:** Diameter of Center Hole

**Set Bolt Geometry:**

1. HSCU25011H
2. HSCU37513H
3. HSCU50014H
4. MBAU75016H

**Order Number:**

- **CBDP:** Center drill bit point
- **DAH:** Diameter at head
- **DCCB:** Diameter at the center
- **LCCB:** Length at the center
- **DCSFMS:** Distance center to shoulder face
- **KWW:** Keyway width
- **L8:** Length at shoulder face

**Fig.** Diagram number for visual reference.
## General Purpose Double Sided Insert Type Face Mill Features Low Cutting Resistance

**METRIC Standard**

For inch arbors

### Arbor Type Right Hand Tool Holder

**KAPR**: 45°

**GAMP**: +17°

**GAMF**: -6°—+1°

DC = mm size, DCON = Inch size

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### Arbor Type Left Hand Tool Holder

**DC** = mm size, **DCON** = Inch size

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*1 Y=Yes, N=No

*2 Number of Teeth

*3 Set bolt not included.

**Fig.1**

**Fig.2**

**Fig.3**

**Right hand tool holder shown.**

For inch arbors

For inch arbors

For inch arbors
**METRIC Standard**

For metric arbors

---

**Arbor Type Right Hand Tool Holder**

KAPR: +45°
GAMP: +17°
GAMF: -6°—+1°

KWW: +1°—+19°


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**Arbor Type Left Hand Tool Holder**


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*1 Y=Yes, N=No  
*2 Number of Teeth  
*3 Set bolt not included.
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### Shank Type

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*1 Y=Yes, N=No  
*2 Number of Teeth

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### Straight Shank Type

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*1 Y=Yes, N=No  
*2 Number of Teeth

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● : Inventory maintained (10 inserts in one case)  
★ : Inventory maintained in Japan. (10 inserts in one case)
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**Wiper Inserts**

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**Instructions for use of wiper inserts**

Wiper inserts for WSX445 are two-cornered. Please set as shown in Fig.1.

Excellent surface finish can be achieved with one wiper.

Set more than 2 wiper inserts, equally spaced, when the feed per revolution is larger than 8mm/rev.
# Recommended Cutting Conditions

## Dry Cutting Condition

<table>
<thead>
<tr>
<th>Work Material</th>
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<th>Grade</th>
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**Notes:**
- Light Cutting: [.006 (.004-.008)]
- Medium Cutting: [.008 (.006-.010)]
- Rough Cutting: [.008 (.006-.010)]
- Heavy Cutting: [.010 (.008-.012)]

**Material Types:**
- Austenitic Stainless Steel
- Precipitation Hardening
- Duplex Stainless Steel
- Pre-Hardened Steel
- Ductile Cast Iron
- Gray Cast Iron
- Carbon Steel
- Alloy Steel
- Stainless Steel
- VP15TF
- VP20RT
- MP6120
- MP7130
- MX3030
- VP15TF
- VP20RT
- MP6130
- MP7140
- MC5020

**Hardness Levels:**
- 800MPa
- 450MPa
- 350MPa
- 280MPa
- 200MPa
- 180MPa

**Surface Finish Specifiers:**
- .002 (.002-.004)
- .004 (.002-.006)
- .006 (.004-.008)
- .008 (.006-.010)
- .010 (.008-.012)

**Additional Details:**
- R.H Breaker
- M Breaker
- R,H Breaker
- M,R Breaker
- M Breaker
- M Breaker
- M Breaker
- M Breaker
- M Breaker
- M Breaker
- M Breaker
- M Breaker
- M Breaker
- M Breaker
**Recommended Cutting Conditions**

### Wet Cutting Condition

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<td>VP15TF</td>
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<td>.008 (.006—.010) ≤ .118</td>
<td>.010 (.008—.03) ≤ .197</td>
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<tr>
<td>L,M Breaker</td>
<td>M Breaker</td>
<td>M Breaker</td>
<td>M Breaker</td>
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<tr>
<td>.002 (.002—.004) ≤ .059</td>
<td>.004 (.002—.006) ≤ .079</td>
<td>—</td>
<td>—</td>
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<tr>
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<td>.004 (.002—.006) ≤ .079</td>
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<td>.004 (.002—.006) ≤ .079</td>
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</tbody>
</table>
Cutting Performance

Comparison of Finished Surface - Aluminum (AISI 6061)

Chipbreaker for Aluminum

Polished rake face
→ Improved welding resistance

Sharp edge
→ Provides smooth cutting

<table>
<thead>
<tr>
<th>Insert</th>
<th>Surface</th>
<th>Measured value</th>
<th>Surface roughness</th>
<th>Surface quality</th>
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</thead>
<tbody>
<tr>
<td>L breaker</td>
<td>TF15</td>
<td>(µ-inch) Ra 4.843 µ-inch Rz 33.15 µ-inch</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Conventional A</td>
<td></td>
<td>(µ-inch) Ra 4.331 µ-inch Rz 36.772 µ-inch</td>
<td>O XX</td>
<td>Cloudiness</td>
</tr>
<tr>
<td>Conventional B</td>
<td></td>
<td>(µ-inch) Ra 30.315 µ-inch Rz 120.551 µ-inch</td>
<td>X O</td>
<td>Rough</td>
</tr>
</tbody>
</table>

<Cutting Conditions>
Cutter Dia. : ø125 mm 4 inserts
Center Cut
Cutting Speed : 1640 SFM
Feed : .004 IPT
Depth of Cut : ap=.079 inch ae=3.937 inch
Cutting Mode : Dry Cutting

Tool Life Comparison when Cutting Ductile Cast Iron

<Cutting Conditions>
Cutter Dia. : ø125 mm 1 insert
Center Cut
Cutting Speed : 655 SFM
Feed : .008 IPT
Depth of Cut : ap=.118 inch ae=3.937 inch
Cutting Mode : Dry Cutting

M breaker MC5020

Conventional A

Conventional B
# Application Examples

<table>
<thead>
<tr>
<th>Cutter Body</th>
<th>WSX445-050A04AR</th>
<th>WSX445-080A08AR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert (Grade)</td>
<td>SNMU140812ANER-R (MP6120)</td>
<td>SNGU140812ANER-M (MP6120)</td>
</tr>
<tr>
<td>Workpiece</td>
<td>Carbon Steel</td>
<td>Ductile Cast Iron</td>
</tr>
<tr>
<td>Component</td>
<td>Round Bar</td>
<td>Automotive Component</td>
</tr>
<tr>
<td>Cutting Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting Speed (SFM)</td>
<td>620</td>
<td>655</td>
</tr>
<tr>
<td>Feed (IPT)</td>
<td>.008</td>
<td>.016</td>
</tr>
<tr>
<td>Depth of Cut (inch)</td>
<td>ap=.079  ae=.984</td>
<td>ap=.079  ae=2.36</td>
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<tr>
<td>Cutting Mode</td>
<td>Dry Cutting</td>
<td>Dry Cutting</td>
</tr>
<tr>
<td>Results</td>
<td>The low cutting resistance enabled WSX double sided inserts to be used with smaller BT30 arbors. Previously, only positive type single sided inserts could be used, therefore doubling the number of cutting edges available.</td>
<td>WSX achieved double tool life compared to conventional products without insert fracturing in interrupted machining.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cutter Body</th>
<th>WSX445R12508EA</th>
<th>WSX445R10007DA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert (Grade)</td>
<td>SNGU140812ANER-M (MP6120)</td>
<td>SNGU140812ANER-L (MP9120)</td>
</tr>
<tr>
<td>Workpiece</td>
<td>Carbon Steel</td>
<td>Hardened Stainless Steel</td>
</tr>
<tr>
<td>Component</td>
<td>Thin Plate</td>
<td>Aerospace Component</td>
</tr>
<tr>
<td>Cutting Conditions</td>
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</tr>
<tr>
<td>Cutting Speed (SFM)</td>
<td>710</td>
<td>150</td>
</tr>
<tr>
<td>Feed (IPT)</td>
<td>.012</td>
<td>.012</td>
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<tr>
<td>Depth of Cut (inch)</td>
<td>ap=.059 – .098  ae=.84</td>
<td>ap=.079 – .118  ae=3.15</td>
</tr>
<tr>
<td>Cutting Mode</td>
<td>Dry Cutting</td>
<td>Wet Cutting</td>
</tr>
<tr>
<td>Results</td>
<td>Spindle load could be reduced to 80% of conventional products, as WSX445 offers improved chip discharge performance resulting in smooth and silent machining.</td>
<td>Number of workpieces increased by 1.5 times or more since WSX prevents thermal cracking.</td>
</tr>
</tbody>
</table>
For Your Safety

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

MITSUBISHI MATERIALS CORPORATION

MITSUBISHI MATERIALS U.S.A. CORPORATION

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URL: http://www.mitsubishicarbide.com
(Tools specifications subject to change without notice.)