MITSUBISHI MATERIALS
TOOL NEWS 2017.5 Update B182A

For Titanium Alloy Milling

# VFX Series

Insert Expansion

# VFX for High Efficiency Milling of Titanium Alloys

Outstanding metal removal rates up to
24 inch³/min
(with ø2.5" cutter)



# Unparalleled Chip Ejection Properties Helps Re-define the Parameters for Machining Titanium Alloy

# VFX Series

## High Rigidity Design

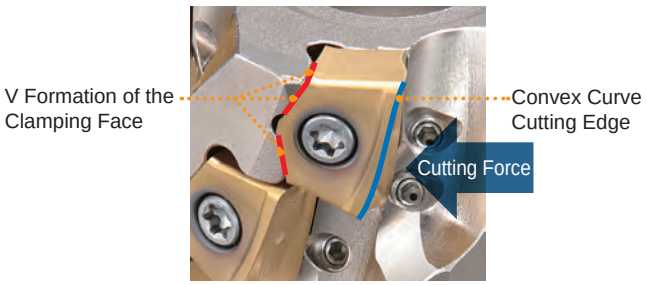
Arranging the inserts vertically absorbs the principal cutting force through the thickness of the insert and achieves extremely high rigidity.

## Highly Reliable Clamping Mechanism

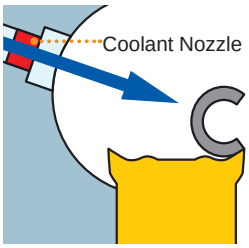
The insert seat has a curved seating face in the radial direction of the tool and a V-shaped seating face on the axis of rotation that can securely handle cutting forces from any direction.

## Low Resistance Convex Curve Cutting Edge

The curved cutting edge resembles the geometry of a solid end mill and achieves low cutting resistance and enables high quality machining.




## Improved Chip Removal with Coolant




Coolant Discharge Position

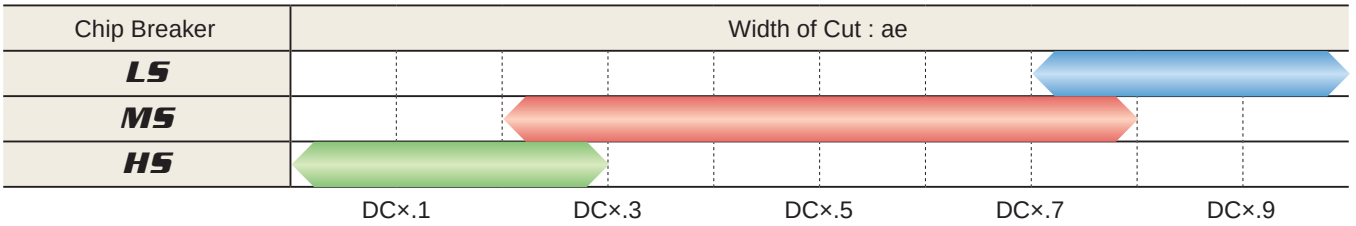
The internal coolant is directed slightly above the rake face of the cutting edge so that it is aimed directly at the chip. Forcibly ejecting the chips prevents them from welding to the cutting edge, enabling higher efficiency machining.

## Replaceable Coolant Nozzle

A replaceable nozzle is used for the internal coolant (hole diameter of the standard nozzle supplied: ø0.8 mm or .031 inch). The coolant pressure can be adjusted by using a nozzle with a smaller or larger diameter. Nozzles with different diameters are available as options.

# Selecting Inserts

| LS | MS | HS |
|---|---|---|
|  |  |  |
| Produces compact chips without increasing cutting resistance. Excellent performance at large widths of cut and during slotting. | Covers a wide range of cutting conditions and applications. | Excellent chip separation and strong cutting edge. Highly efficient machining is possible at small widths of cut. |




## First Recommended
## MP9130

A new and enhanced super fine cemented carbide substrate has increased toughness while maintaining hardness.
The Al-Ti-Cr-N accumulated type coating ensures optimum heat and wear resistance. The combination of these properties gives excellent fracture resistance and a very low coefficient of friction for class leading welding resistance when machining titanium alloy.

## General Purpose Grade
## MP9030

MP9030 uses an accumulated type coating based on a Ti compound that demonstrates excellent abrasion and fracture resistance during titanium alloy machining.

# Combination of Holder and Insert Corner R

## VFX5

Grade: MP9130 MP9030
Insert Type: MS


Grade: MP9130 MP9030
Insert Type: HS


Grade: MP9130
Insert Type: LS


## VFX6

Grade: MP9130 MP9030
Insert Type: MS

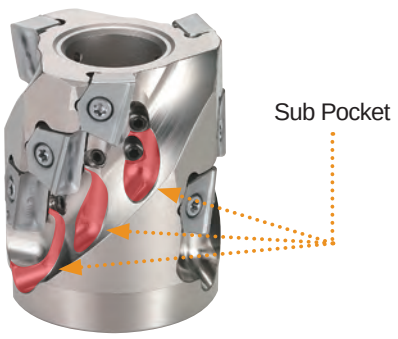

Grade: MP9130 MP9030
Insert Type: HS


Grade: MP9130
Insert Type: LS


*Only the end cutting edge can be changed. On the peripheral cutting edges please use R.047" for VFX6 and R.031" for VFX5.

# Newly Developed 3-flute Holder (VFX5 Only)

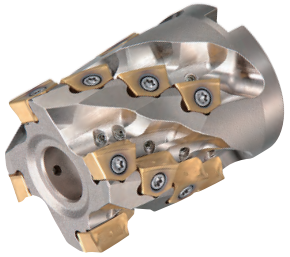
During high chip volume applications such as slotting, chip evacuation performance is important and if insufficient can lead to chipping of the insert.
To solve this problem a 3 flute cutter with maximized main flutes and chip pockets has been developed.
Use of the new LS breaker in conjunction with the 3 flute cutter will maximize the performance benefits.



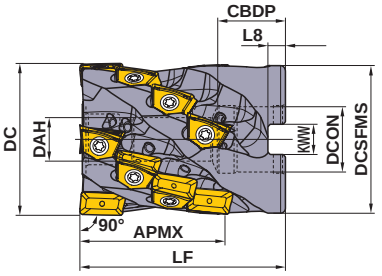
# DEEP SHOULDER MILLING

Roughing

# VFX5



- Vertical inserts with high strength cutting edge.
- Screw-on type clamping.
- High efficiency milling of titanium alloys.




Right hand tool holder only.

## Shell Type

DC = Inch, DCON = Inch (inch)

| Order Number | Stock R | No.F ⁎ | Total | DC | LF | DCON | CBDP | DAH | DCSFMS | KWW | L8 | APMX | WT (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VFX5UR0203CA10** | ● | 3 | 6 | 2.0 | 2.0 | 1.00 | .95 | .520 | 1.929 | .375 | .219 | 1.0 | .20 |
| **VFX5UR0203CA15** | ● | 3 | 9 | 2.0 | 2.5 | 1.00 | 1.00 | .520 | 1.929 | .375 | .219 | 1.5 | .26 |
| **VFX5UR0204AA10** | ● | 4 | 8 | 2.0 | 2.0 | .75 | .75 | .395 | 1.929 | .313 | .187 | 1.0 | .24 |
| **VFX5UR0204AA15** | ● | 4 | 12 | 2.0 | 2.5 | .75 | .75 | .395 | 1.929 | .313 | .187 | 1.5 | .30 |
| **VFX5UR0204CA15** | ● | 4 | 12 | 2.0 | 2.5 | 1.00 | 1.00 | .520 | 1.929 | .375 | .219 | 1.5 | .27 |
| **VFX5UR0204AA20** | ● | 4 | 16 | 2.0 | 2.75 | .75 | .75 | .395 | 1.929 | .313 | .187 | 2.0 | .32 |
| **VFX5UR0204CA20** | ● | 4 | 16 | 2.0 | 3.0 | 1.00 | 1.00 | .520 | 1.929 | .375 | .219 | 2.0 | .33 |
| **VFX5UR2505CA10** | ● | 5 | 10 | 2.5 | 2.5 | 1.00 | 1.25 | .520 | 2.421 | .375 | .219 | 1.0 | .49 |
| **VFX5UR2505CA24** | ● | 5 | 25 | 2.5 | 3.5 | 1.00 | 1.25 | .520 | 2.421 | .375 | .219 | 2.4 | .68 |
| **VFX5UR0306DA29** | ● | 6 | 36 | 3.0 | 4.25 | 1.25 | 1.375 | .645 | 2.894 | .500 | .281 | 2.9 | 1.21 |

⁎ No. F = Number of Flutes

## Spare Parts

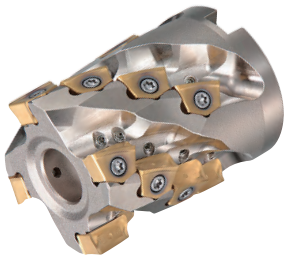
| Order Number | Clamp Screw ⁎2 | Number | Seal Washer | Wrench | Coolant Nozzle ⁎3 | Number | Anti-seize Lubricant | Set Bolt | Number of Insert: End Cutting Edge XNMU1607 ○○R-○○ | Number of Insert: Peripheral ⁎1 Cutting Edge XNMU1607 08R-○○ |
|---|---|---|---|---|---|---|---|---|---|---|
| **VFX5UR0203CA10** | TS352 | 6 | WU500-S1 | TKY10D | HSD04004H08 | 9 | MK1KS | HSCUF50014 | 3 | 3 |
| **VFX5UR0203CA15** | TS352 | 9 | WU500-S1 | TKY10D | HSD04004H08 | 12 | MK1KS | HSCUF50018 | 3 | 6 |
| **VFX5UR0204AA10** | TS352 | 8 | WU375-S1 | TKY10D | HSD04004H08 | 12 | MK1KS | HSCUF37513 | 4 | 4 |
| **VFX5UR0204AA15** | TS352 | 12 | WU375-S1 | TKY10D | HSD04004H08 | 16 | MK1KS | HSCUF37520 | 4 | 8 |
| **VFX5UR0204CA15** | TS352 | 12 | WU500-S1 | TKY10D | HSD04004H08 | 16 | MK1KS | HSCUF50018 | 4 | 8 |
| **VFX5UR0204AA20** | TS352 | 16 | WU375-S1 | TKY10D | HSD04004H08 | 20 | MK1KS | HSCUF37520 | 4 | 12 |
| **VFX5UR0204CA20** | TS352 | 16 | WU500-S1 | TKY10D | HSD04004H08 | 20 | MK1KS | HSCUF50023 | 4 | 12 |
| **VFX5UR2505CA10** | TS352 | 10 | WU500-S1 | TKY10D | HSD04004H08 | 15 | MK1KS | HSCUF50018 | 5 | 5 |
| **VFX5UR2505CA24** | TS352 | 25 | WU500-S1 | TKY10D | HSD04004H08 | 30 | MK1KS | HSCUF50028 | 5 | 20 |
| **VFX5UR0306DA29** | TS352 | 36 | WU625-S1 | TKY10D | HSD04004H08 | 42 | MK1KS | HSCUF62535 | 6 | 30 |

⁎1. Only corner radius RE.031 can be used.
⁎2. Clamp Torque (lbf-in) : TS352=22
⁎3. The .031" nozzels are installed in the standard. Select and use alternate nozzles from below list depending on coolant pressure.

| | ≤140PSI (≤5.3gal/min) | ←Standard→ (140PSI-720PSI) | ≥720PSI (≥7.9gal/min) | ≥1000PSI (≥13.2gal/min) |
|---|---|---|---|---|
| Nozzle Dia. | ø.024" | ø.031" | ø.047" | ø.063" |
| Order Number | **HSD04004H06** | **HSD04004H08** | **HSD04004H12** | **HSD04004H16** |

- Clamp Torque (lbf-in) : HSD0400H○○=13
- The part number for a plug screw without a through nozzle is HSS04004.
- Insert with a corner radius of .125" and above, as corner radius increases the LF dimension increases.
  Corner radius .125": LF+.028"  Corner radius .157": LF+.059"

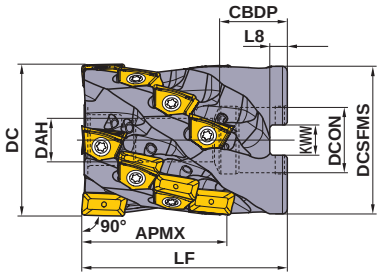
● : Inventory maintained.  ★ : Inventory maintained in Japan.



**Metric Standard**

DC=mm, DCON=Inch

- **Vertical inserts with high strength cutting edge.**
- **Screw-on type clamping.**
- **High efficiency milling of titanium alloys.**




Right hand tool holder only.

## Shell Type

(mm)

| Order Number | Stock R | No.F ⁎ | Total | DC | LF | DCON | CBDP | DAH | DCSFMS | KWW | L8 | APMX | WT(kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VFX5-040A03A026R** | ★ | 3 | 6 | 40 | 50 | 16 | 21 | 8.5 | 38.2 | 8.4 | 5.6 | 26 | 0.3 |
| **VFX5-040A03A038R** | ★ | 3 | 9 | 40 | 60 | 16 | 21 | 8.5 | 38.2 | 8.4 | 5.6 | 38 | 0.4 |
| **VFX5-050X03A026R** | ★ | 3 | 6 | 50 | 50 | 27 | 23 | 12.5 | 48.2 | 12.4 | 7.0 | 26 | 0.4 |
| **VFX5-050X03A038R** | ★ | 3 | 9 | 50 | 60 | 27 | 23 | 12.5 | 48.2 | 12.4 | 7.0 | 38 | 0.5 |
| **VFX5-050A04A026R** | ★ | 4 | 8 | 50 | 50 | 22 | 21 | 10.5 | 48.2 | 10.4 | 6.3 | 26 | 0.5 |
| **VFX5-050A04A038R** | ★ | 4 | 12 | 50 | 60 | 22 | 21 | 10.5 | 48.2 | 10.4 | 6.3 | 38 | 0.6 |
| **VFX5-050X04A038R** | ★ | 4 | 12 | 50 | 60 | 27 | 23 | 12.5 | 48.2 | 12.4 | 7.0 | 38 | 0.5 |
| **VFX5-050A04A050R** | ★ | 4 | 16 | 50 | 70 | 22 | 21 | 10.5 | 48.2 | 10.4 | 6.3 | 50 | 0.7 |
| **VFX5-063A05A026R** | ★ | 5 | 10 | 63 | 60 | 27 | 28 | 12.5 | 61 | 12.4 | 7.0 | 26 | 1.0 |
| **VFX5-063A05A063R** | ★ | 5 | 25 | 63 | 85 | 27 | 28 | 12.5 | 61 | 12.4 | 7.0 | 63 | 1.4 |
| **VFX5-080A06A075R** | ★ | 6 | 36 | 80 | 100 | 32 | 28 | 16.5 | 77.3 | 14.4 | 8.0 | 75 | 2.8 |

⁎ No. F = Number of Flutes

## Spare Parts

| Order Number | ⁎2 | | | | ⁎3 | | | Number of Insert | |
|---|---|---|---|---|---|---|---|---|---|
| | Clamp Screw | Number | Seal Washer | Wrench | Coolant Nozzle | Number | Anti-seize Lubricant | Set Bolt | End Cutting Edge XNMU1607 ○○R-○○ | Peripheral ⁎1 Cutting Edge XNMU1607 08R-○○ |
| **VFX5-040A03A026R** | TS352 | 6 | W8-S1 | TKY10D | HSD04004H08 | 9 | MK1KS | HSC08040 | 3 | 3 |
| **VFX5-040A03A038R** | TS352 | 9 | W8-S1 | TKY10D | HSD04004H08 | 12 | MK1KS | HSC08050 | 3 | 6 |
| **VFX5-050X03A026R** | TS352 | 6 | W12-S1 | TKY10D | HSD04004H08 | 9 | MK1KS | HSC12035 | 3 | 3 |
| **VFX5-050X03A038R** | TS352 | 9 | W12-S1 | TKY10D | HSD04004H08 | 12 | MK1KS | HSC12045 | 3 | 6 |
| **VFX5-050A04A026R** | TS352 | 8 | W10-S1 | TKY10D | HSD04004H08 | 12 | MK1KS | HSC10035 | 4 | 4 |
| **VFX5-050A04A038R** | TS352 | 12 | W10-S1 | TKY10D | HSD04004H08 | 16 | MK1KS | HSC10045 | 4 | 8 |
| **VFX5-050X04A038R** | TS352 | 12 | W12-S1 | TKY10D | HSD04004H08 | 16 | MK1KS | HSC12045 | 4 | 8 |
| **VFX5-050A04A050R** | TS352 | 16 | W10-S1 | TKY10D | HSD04004H08 | 20 | MK1KS | HSC10055 | 4 | 12 |
| **VFX5-063A05A026R** | TS352 | 10 | W12-S1 | TKY10D | HSD04004H08 | 15 | MK1KS | HSC12045 | 5 | 5 |
| **VFX5-063A05A063R** | TS352 | 25 | W12-S1 | TKY10D | HSD04004H08 | 30 | MK1KS | HSC12070 | 5 | 20 |
| **VFX5-080A06A075R** | TS352 | 36 | W16-S1 | TKY10D | HSD04004H08 | 42 | MK1KS | HSC16080 | 6 | 30 |

⁎1 Only corner radius RE0.8 can be used for the peripheral cutting edges except the end cutting edge.

⁎2 Clamp Torque (N • m) : TS352=2.5

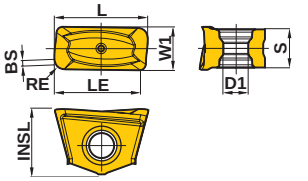
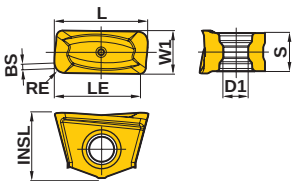
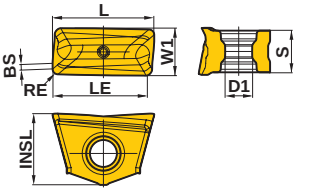
⁎3 Coolant nozzles are available with varying diameters for adjusting coolant pressure. Select nozzles as required by the specification.

| | ≤1Mpa (≤20 l/min.) | ←Standard→ | ≥5Mpa (≥30 l/min.) | ≥7Mpa (≥50 l/min.) |
|---|---|---|---|---|
| Nozzle Dia. | ø0.6mm | ø0.8mm | ø1.2mm | ø1.6mm |
| Order Number | **HSD04004H06** | **HSD04004H08** | **HSD04004H12** | **HSD04004H16** |

- Clamp Torque (N • m) : HSD0400H○○=1.5
- The part number for a plug screw without a through nozzle is HSS04004.
- Insert with a corner radius of 3.2mm and above, as corner radius increases the LF dimension increases.
  Corner radius 3.2mm: LF+0.7mm  Corner radius 4.0mm: LF+1.5mm

## Inserts

(inch)

| Shape | Order Number | Stock Coated MP9030 | Stock Coated MP9130 | | | L | LE | W1 | INSL | S | BS | RE | D1 | Geometry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | **XNMU160708R-MS** | ● | ● | | | .630 | .528 | .276 | .437 | .256 | .039 | .031 | .165 |  |
| | **XNMU160712R-MS** | ● | ● | | | .630 | .543 | .276 | .437 | .256 | .039 | .047 | .165 | |
| | **XNMU160716R-MS** | ● | ● | | | .630 | .543 | .276 | .437 | .256 | .039 | .063 | .165 | |
| | **XNMU160724R-MS** | ● | ● | | | .630 | .543 | .276 | .437 | .256 | .039 | .094 | .165 | |
| | ⁎1 **XNMU160732R-MS** | ● | ● | | | .681 | .567 | .276 | .437 | .256 | — | .126 | .165 | |
| | ⁎1 **XNMU160740R-MS** | ● | ● | | | .744 | .598 | .276 | .437 | .256 | — | .157 | .165 | |
|  | **XNMU160708R-HS** | ● | ● | | | .630 | .528 | .276 | .437 | .256 | .039 | .031 | .165 |  |
|  | **XNMU160708R-LS** | | ● | | | .630 | .528 | .276 | .437 | .256 | .039 | .031 | .165 |  |

⁎1 Note for insert with a corner radius of .125" and above, as corner radius increases the LF dimension increases.
Corner radius .125": LF+.028" Corner radius .157": LF+.059"

● : Inventory maintained. (10 insert in one case)

# Recommended Cutting Conditions

## VFX5

(inch)

| | Work Material | DC (inch) | Number of Flutes | Chip Breaker | vc (SFM) | n ($min^{-1}$) | apmax | ae | fz (IPT) | vf (IPM) | Chip Removal Rate Q ($inch^3$/min) | Estimated Cutting Power PC (HP) | Expected Torque (lbf-ft) | Tool Life Ratio (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | Titanium Alloy (Ti6Al4V) | ϕ2.0 | 3 | LS | 130 | 248 | 1.496 | 2.000 | .004 | 2.932 | 9 | 8.6 | 182 | 40 |
| | | | 4 | MS | 165 | 315 | 1.969 | 1.200 | .004 | 4.963 | 12 | 10.7 | 178 | 60 |
| | | | 4 | MS | 195 | 372 | 1.969 | .800 | .004 | 5.865 | 9 | 8.0 | 113 | 80 |
| | | | 4 | HS | 195 | 372 | 1.969 | .400 | .005 | 7.038 | 6 | 5.2 | 74 | 100 |
| | | ϕ2.5 | 5 | LS | 130 | 199 | 2.362 | 2.500 | .004 | 3.910 | 23 | 22.3 | 590 | 40 |
| | | | 5 | MS | 165 | 252 | 2.362 | 1.500 | .004 | 4.963 | 18 | 15.9 | 332 | 60 |
| | | | 5 | MS | 195 | 298 | 2.362 | 1.000 | .004 | 5.865 | 14 | 12.0 | 212 | 80 |
| | | | 5 | HS | 195 | 298 | 2.362 | .500 | .005 | 7.038 | 8 | 7.8 | 137 | 100 |
| | | ϕ3.0 | 6 | LS | 130 | 166 | 2.953 | 3.000 | .004 | 3.910 | 35 | 33.2 | 1055 | 40 |
| | | | 6 | MS | 165 | 210 | 2.953 | 1.800 | .004 | 4.963 | 26 | 23.8 | 594 | 60 |
| | | | 6 | MS | 195 | 248 | 2.953 | 1.200 | .004 | 5.865 | 21 | 17.9 | 379 | 80 |
| | | | 6 | HS | 195 | 248 | 2.953 | .600 | .005 | 7.038 | 12 | 11.6 | 246 | 100 |
| | Titanium Alloy (Ti-5553) | ϕ2.0 | 3 | LS | 80 | 153 | 2.953 | 2.000 | .003 | 1.444 | 9 | 8.5 | 292 | 30 |
| | | | 4 | MS | 80 | 153 | 2.953 | 1.200 | .003 | 1.925 | 7 | 6.5 | 224 | 50 |
| | | | 4 | MS | 100 | 191 | 2.953 | .800 | .004 | 3.008 | 7 | 6.5 | 178 | 70 |
| | | | 4 | HS | 100 | 191 | 2.953 | .400 | .004 | 3.008 | 4 | 3.6 | 98 | 80 |
| | | ϕ2.5 | 5 | LS | 80 | 122 | 2.953 | 2.500 | .003 | 1.925 | 14 | 14.1 | 608 | 30 |
| | | | 5 | MS | 80 | 122 | 2.953 | 1.500 | .003 | 1.925 | 9 | 8.1 | 350 | 50 |
| | | | 5 | MS | 100 | 153 | 2.953 | 1.000 | .004 | 3.008 | 9 | 8.1 | 278 | 70 |
| | | | 5 | HS | 100 | 153 | 2.953 | .500 | .004 | 3.008 | 4 | 4.5 | 154 | 80 |
| | | ϕ3.0 | 6 | LS | 80 | 102 | 3.543 | 3.000 | .003 | 1.925 | 20 | 20.1 | 1035 | 30 |
| | | | 6 | MS | 80 | 102 | 3.543 | 1.800 | .003 | 1.925 | 12 | 11.5 | 595 | 50 |
| | | | 6 | MS | 100 | 127 | 3.543 | 1.200 | .004 | 3.008 | 13 | 11.5 | 474 | 70 |
| | | | 6 | HS | 100 | 127 | 3.543 | .600 | .004 | 3.008 | 6 | 6.3 | 262 | 80 |

## VFX5 (Metric Standard)

(inch)

| | Work Material | DC (inch) | Number of Flutes | Chip Breaker | vc (SFM) | n ($min^{-1}$) | apmax | ae | fz (IPT) | vf (IPM) | Chip Removal Rate Q ($inch^3$/min) | Estimated Cutting Power PC (HP) | Expected Torque (lbf-ft) | Tool Life Ratio (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | Titanium Alloy (Ti6Al4V) | ϕ40 | 3 | LS | 130 | 315 | 1.496 | 1.575 | .004 | 3.724 | 9 | 8.6 | 143 | 40 |
| | | | 3 | MS | 165 | 400 | 1.496 | .945 | .004 | 4.727 | 7 | 6.1 | 80 | 60 |
| | | | 3 | MS | 195 | 473 | 1.496 | .630 | .004 | 5.586 | 5 | 4.6 | 51 | 80 |
| | | | 3 | HS | 195 | 473 | 1.496 | .315 | .005 | 6.704 | 3 | 3.0 | 33 | 100 |
| | | ϕ50 | 3 | LS | 130 | 252 | 1.496 | 1.969 | .004 | 2.979 | 9 | 8.6 | 179 | 40 |
| | | | 4 | MS | 165 | 320 | 1.969 | 1.181 | .004 | 5.042 | 12 | 10.7 | 175 | 60 |
| | | | 4 | MS | 195 | 378 | 1.969 | .787 | .004 | 5.959 | 9 | 8.0 | 112 | 80 |
| | | | 4 | HS | 195 | 378 | 1.969 | .394 | .005 | 7.151 | 6 | 5.2 | 72 | 100 |
| | | ϕ63 | 5 | LS | 130 | 200 | 2.362 | 2.480 | .004 | 3.941 | 23 | 22.3 | 585 | 40 |
| | | | 5 | MS | 165 | 254 | 2.362 | 1.488 | .004 | 5.002 | 18 | 15.9 | 329 | 60 |
| | | | 5 | MS | 195 | 300 | 2.362 | .992 | .004 | 5.911 | 14 | 12.0 | 210 | 80 |
| | | | 5 | HS | 195 | 300 | 2.362 | .496 | .005 | 7.094 | 8 | 7.8 | 136 | 100 |
| | | ϕ80 | 6 | LS | 130 | 158 | 2.953 | 3.150 | .004 | 3.724 | 35 | 33.2 | 1107 | 40 |
| | | | 6 | MS | 165 | 200 | 2.953 | 1.890 | .004 | 4.727 | 26 | 23.8 | 624 | 60 |
| | | | 6 | MS | 195 | 236 | 2.953 | 1.260 | .004 | 5.586 | 21 | 17.9 | 398 | 80 |
| | | | 6 | HS | 195 | 236 | 2.953 | .630 | .005 | 6.704 | 12 | 11.6 | 258 | 100 |
| | Titanium Alloy (Ti-5553) | ϕ40 | 3 | LS | 80 | 194 | 2.362 | 1.575 | .003 | 1.833 | 7 | 6.8 | 185 | 30 |
| | | | 3 | MS | 80 | 194 | 2.362 | .945 | .003 | 1.833 | 4 | 3.9 | 106 | 50 |
| | | | 3 | MS | 100 | 243 | 2.362 | .630 | .004 | 2.865 | 4 | 3.9 | 85 | 70 |
| | | | 3 | HS | 100 | 243 | 2.362 | .315 | .004 | 2.865 | 2 | 2.2 | 47 | 80 |
| | | ϕ50 | 3 | LS | 80 | 155 | 2.953 | 1.969 | .003 | 1.467 | 9 | 8.5 | 287 | 30 |
| | | | 4 | MS | 80 | 155 | 2.953 | 1.181 | .003 | 1.956 | 7 | 6.5 | 220 | 50 |
| | | | 4 | MS | 100 | 194 | 2.953 | .787 | .004 | 3.056 | 7 | 6.5 | 175 | 70 |
| | | | 4 | HS | 100 | 194 | 2.953 | .394 | .004 | 3.056 | 4 | 3.6 | 97 | 80 |
| | | ϕ63 | 5 | LS | 80 | 123 | 2.953 | 2.480 | .003 | 1.940 | 14 | 14.1 | 603 | 30 |
| | | | 5 | MS | 80 | 123 | 2.953 | 1.488 | .003 | 1.940 | 9 | 8.1 | 347 | 50 |
| | | | 5 | MS | 100 | 154 | 2.953 | .992 | .004 | 3.032 | 9 | 8.1 | 276 | 70 |
| | | | 5 | HS | 100 | 154 | 2.953 | .496 | .004 | 3.032 | 4 | 4.5 | 153 | 80 |
| | | ϕ80 | 6 | LS | 80 | 97 | 3.543 | 3.150 | .003 | 1.833 | 20 | 20.1 | 1086 | 30 |
| | | | 6 | MS | 80 | 97 | 3.543 | 1.890 | .003 | 1.833 | 12 | 11.5 | 625 | 50 |
| | | | 6 | MS | 100 | 121 | 3.543 | 1.260 | .004 | 2.865 | 13 | 11.5 | 498 | 70 |
| | | | 6 | HS | 100 | 121 | 3.543 | .630 | .004 | 2.865 | 6 | 6.3 | 275 | 80 |

(Note 1) Note that machining performance varies depending to the conditions such as machine rigidity, work clamping rigidity, coolant supply system, pressure and flow volume etc.

**(Note 2) Internal coolant is recommended. To allow coolant through the tool, use a FMH coolant through type arbor. Using external coolant in combination with through coolant is even more effective.**

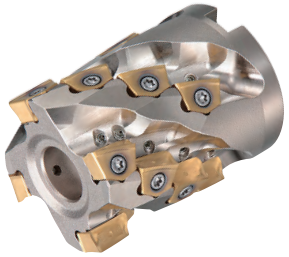
(Note 3) The tool life ratio shows the standard when ae = tool diameter × 20% is assumed to be 100 when shoulder cutting.

(Note 4) The maximum depth of cut (apmax) varies according to the machine rigidity and power.

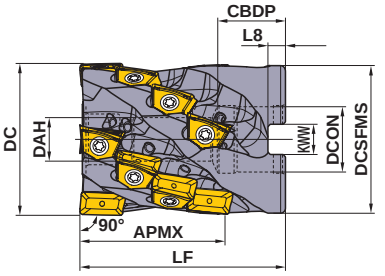
# DEEP SHOULDER MILLING

Roughing

# VFX6



- Vertical inserts with high strength cutting edge.
- Screw-on type clamping.
- High efficiency milling of titanium alloys.




Right hand tool holder only.

## Shell Type

DC = Inch, DCON = Inch (inch)

| Order Number | Stock R | ✶ No.F | Total | DC | LF | DCON | CBDP | DAH | DCSFMS | KWW | L8 | APMX | WT (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VFX6UR2504CA12** | ● | 4 | 8 | 2.5 | 2.5 | 1.00 | 1.25 | .520 | 2.421 | .375 | .219 | 1.2 | .21 |
| **VFX6UR2504CA23** | ● | 4 | 16 | 2.5 | 3.5 | 1.00 | 1.25 | .520 | 2.421 | .375 | .219 | 2.3 | .29 |
| **VFX6UR0305DA12** | ● | 5 | 10 | 3.0 | 2.5 | 1.25 | 1.375 | .645 | 2.894 | .500 | .281 | 1.2 | .30 |
| **VFX6UR0305DA29** | ● | 5 | 25 | 3.0 | 4.25 | 1.25 | 1.375 | .645 | 2.894 | .500 | .281 | 2.9 | .52 |
| **VFX6UR0406EA12** | ● | 6 | 12 | 4.0 | 3.0 | 1.50 | 1.50 | .770 | 3.866 | .625 | .375 | 1.2 | .69 |
| **VFX6UR0406EA35** | ● | 6 | 36 | 4.0 | 5.0 | 1.50 | 1.50 | .770 | 3.866 | .625 | .375 | 3.5 | 1.16 |

✶ No. F = Number of Flutes

## Spare Parts

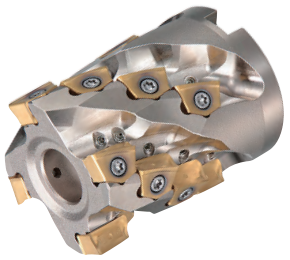
| Order Number | ✶2 Clamp Screw | Number | Seal Washer | Wrench | ✶3 Coolant Nozzle | Number | Anti-seize Lubricant | Set Bolt | Number of Insert: End Cutting Edge XNMU1909 ○○R-○○ | Number of Insert: Peripheral ✶1 Cutting Edge XNMU1909 12R-○○ |
|---|---|---|---|---|---|---|---|---|---|---|
| **VFX6UR2504CA12** | TS450 | 8 | WU500-S1 | TKY20T | HSD04004H08 | 12 | MK1KS | HSCUF50018 | 4 | 4 |
| **VFX6UR2504CA23** | TS450 | 16 | WU500-S1 | TKY20T | HSD04004H08 | 20 | MK1KS | HSCUF50028 | 4 | 12 |
| **VFX6UR0305DA12** | TS450 | 10 | WU625-S1 | TKY20T | HSD04004H08 | 15 | MK1KS | HSCUF62518 | 5 | 5 |
| **VFX6UR0305DA29** | TS450 | 25 | WU625-S1 | TKY20T | HSD04004H08 | 30 | MK1KS | HSCUF62535 | 5 | 20 |
| **VFX6UR0406EA12** | TS450 | 12 | WU750-S1 | TKY20T | HSD04004H08 | 18 | MK1KS | HSCUF75018 | 6 | 6 |
| **VFX6UR0406EA35** | TS450 | 36 | WU750-S1 | TKY20T | HSD04004H08 | 42 | MK1KS | HSCUF75040 | 6 | 30 |

✶1. Only corner radius RE.047" can be used.
✶2. Clamp Torque (lbf-in) : TS450=44
✶3. The .031" nozzels are installed in the standard. Select and use alternate nozzles from below list depending on coolant pressure.

| | ≤140PSI (≤5.3gal/min) | ←Standard→ (140PSI-720PSI) | ≥720PSI (≥7.9gal/min) | ≥1000PSI (≥13.2gal/min) |
|---|---|---|---|---|
| Nozzle Dia. | ø.024" | ø.031" | ø.047" | ø.063" |
| Order Number | **HSD04004H06** | **HSD04004H08** | **HSD04004H12** | **HSD04004H16** |

- Clamp Torque (lbf-in) : HSD0400H○○=13
- The part number for a plug screw without a through nozzle is HSS04004.
- Insert with a corner radius of .125" and above, as corner radius increases the LF dimension increases.
  Corner radius .125": LF+.028"  Corner radius .157": LF+.059"  Corner radius .197": LF+.059"

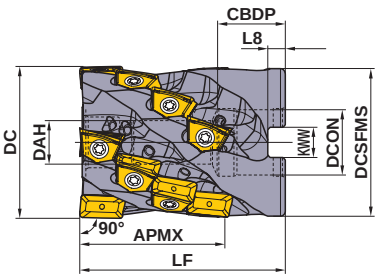
● : Inventory maintained.  ★ : Inventory maintained in Japan.



**Metric Standard**

DC=mm, DCON=Inch

- **Vertical inserts with high strength cutting edge.**
- **Screw-on type clamping.**
- **High efficiency milling of titanium alloys.**




Right hand tool holder only.

## Shell Type

(mm)

| Order Number | Stock R | ⁎ No.F | Total | DC | LF | DCON | CBDP | DAH | DCSFMS | KWW | L8 | APMX | WT(kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VFX6-063A04A031R** | ★ | 4 | 8 | 63 | 60 | 27 | 28 | 12.5 | 61 | 12.4 | 7 | 31 | 0.9 |
| **VFX6-063A04A060R** | ★ | 4 | 16 | 63 | 85 | 27 | 28 | 12.5 | 61 | 12.4 | 7 | 60 | 1.3 |
| **VFX6-080A05A031R** | ★ | 5 | 10 | 80 | 60 | 32 | 28 | 16.5 | 77.3 | 14.4 | 8 | 31 | 1.5 |
| **VFX6-080A05A075R** | ★ | 5 | 25 | 80 | 100 | 32 | 28 | 16.5 | 77.3 | 14.4 | 8 | 75 | 2.6 |
| **VFX6-100A06A031R** | ★ | 6 | 12 | 100 | 65 | 40 | 30 | 20.5 | 96.6 | 16.4 | 9 | 31 | 2.7 |
| **VFX6-100A06A090R** | ★ | 6 | 36 | 100 | 115 | 40 | 30 | 20.5 | 96.6 | 16.4 | 9 | 90 | 4.8 |

⁎ No. F = Number of Flutes

## Spare Parts

| Order Number | ⁎2 Clamp Screw | Number | Seal Washer | Wrench | ⁎3 Coolant Nozzle | Number | Anti-seize Lubricant | Set Bolt | Number of Insert: End Cutting Edge XNMU1909 ○○R-○○ | Number of Insert: Peripheral ⁎1 Cutting Edge XNMU1909 12R-○○ |
|---|---|---|---|---|---|---|---|---|---|---|
| **VFX6-063A04A031R** | TS450 | 8 | W12-S1 | TKY20T | HSD04004H08 | 12 | MK1KS | HSC12045 | 4 | 4 |
| **VFX6-063A04A060R** | TS450 | 16 | W12-S1 | TKY20T | HSD04004H08 | 20 | MK1KS | HSC12070 | 4 | 12 |
| **VFX6-080A05A031R** | TS450 | 10 | W16-S1 | TKY20T | HSD04004H08 | 15 | MK1KS | HSC16040 | 5 | 5 |
| **VFX6-080A05A075R** | TS450 | 25 | W16-S1 | TKY20T | HSD04004H08 | 30 | MK1KS | HSC16080 | 5 | 20 |
| **VFX6-100A06A031R** | TS450 | 12 | W20-S1 | TKY20T | HSD04004H08 | 18 | MK1KS | HSC20040 | 6 | 6 |
| **VFX6-100A06A090R** | TS450 | 36 | W20-S1 | TKY20T | HSD04004H08 | 42 | MK1KS | HSC20090 | 6 | 30 |

⁎1 Only corner radius RE1.2 can be used for the peripheral cutting edges except the end cutting edge.

⁎2 Clamp Torque (N • m) : TS450=5.0

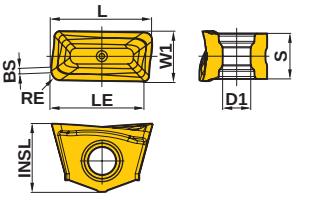
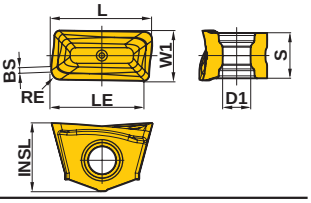
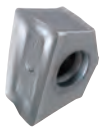
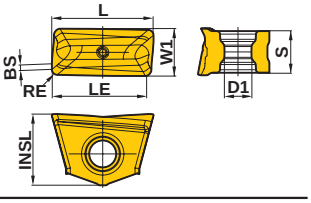
⁎3 Coolant nozzles are available with varying diameters for adjusting coolant pressure. Select nozzles as required by the specification.

| | ≤1Mpa (≤20 l/min.) | ←Standard→ | ≥5Mpa (≥30 l/min.) | ≥7Mpa (≥50 l/min.) |
|---|---|---|---|---|
| Nozzle Dia. | ø0.6mm | ø0.8mm | ø1.2mm | ø1.6mm |
| Order Number | **HSD04004H06** | **HSD04004H08** | **HSD04004H12** | **HSD04004H16** |

- Clamp Torque (N • m) : HSD0400H○○=1.5
- The part number for a plug screw without a through nozzle is HSS04004.
- Insert with a corner radius of 3.2mm and above, as corner radius increases the LF dimension increases.
  Corner radius 3.2mm: LF+0.7mm  Corner radius 4.0mm: LF+1.5mm  Corner radius 5.0mm: LF+1.5mm

## Inserts

(inch)

| Shape | Order Number | Stock Coated MP9030 | Stock Coated MP9130 | | | L | LE | W1 | INSL | S | BS | RE | D1 | Geometry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | XNMU190912R-MS | ● | ● | | | .752 | .650 | .374 | .500 | .335 | .039 | .047 | .205 |  |
| | XNMU190916R-MS | ● | ● | | | .752 | .650 | .374 | .500 | .335 | .039 | .063 | .205 | |
| | XNMU190924R-MS | ● | ● | | | .752 | .654 | .374 | .500 | .335 | .039 | .094 | .205 | |
| | ⁎1 XNMU190932R-MS | ● | ● | | | .795 | .673 | .374 | .500 | .335 | — | .126 | .205 | |
| | ⁎1 XNMU190940R-MS | ● | ● | | | .858 | .701 | .374 | .500 | .335 | — | .157 | .205 | |
| | ⁎1 XNMU190950R-MS | ● | ● | | | .858 | .701 | .374 | .500 | .335 | — | .197 | .205 | |
|  | XNMU190912R-HS | ● | ● | | | .752 | .650 | .374 | .500 | .335 | .039 | .047 | .205 |  |
|  | XNMU190912R-LS | | ● | | | .752 | .650 | .374 | .500 | .335 | .039 | .047 | .205 |  |

⁎1 Note for insert with a corner radius of .125" and above, as corner radius increases the LF dimension increases.
Corner radius .125": LF+.028" Corner radius .157": LF+.059" Corner radius .197": LF+.059"

● : Inventory maintained. (10 insert in one case)

# Recommended Cutting Conditions

## VFX6

(inch)

| | Work Material | DC (inch) | Number of Flutes | Chip Breaker | vc (SFM) | n ($min^{-1}$) | apmax | ae | fz (IPT) | vf (IPM) | Chip Removal Rate Q ($inch^3$/min) | Estimated Cutting Power PC (HP) | Expected Torque (lbf-ft) | Tool Life Ratio (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | Titanium Alloy (Ti6Al4V) | ϕ2.5 | 4 | LS | 130 | 199 | 2.362 | 2.500 | .004 | 3.128 | 18 | 17.8 | 472 | 40 |
| | | | 4 | MS | 165 | 252 | 2.362 | 1.500 | .004 | 3.970 | 14 | 12.7 | 266 | 60 |
| | | | 4 | MS | 195 | 298 | 2.362 | 1.000 | .004 | 4.692 | 11 | 9.6 | 170 | 80 |
| | | | 4 | HS | 195 | 298 | 2.362 | .500 | .005 | 5.630 | 7 | 6.2 | 110 | 100 |
| | | ϕ3.0 | 5 | LS | 130 | 166 | 2.953 | 3.000 | .004 | 3.258 | 29 | 27.7 | 879 | 40 |
| | | | 5 | MS | 165 | 210 | 2.953 | 1.800 | .004 | 4.136 | 22 | 19.8 | 495 | 60 |
| | | | 5 | MS | 195 | 248 | 2.953 | 1.200 | .004 | 4.887 | 17 | 14.9 | 316 | 80 |
| | | | 5 | HS | 195 | 248 | 2.953 | .600 | .005 | 5.865 | 10 | 9.7 | 205 | 100 |
| | | ϕ4.0 | 6 | LS | 130 | 124 | 3.543 | 4.000 | .004 | 2.932 | 42 | 39.3 | 1663 | 40 |
| | | | 6 | MS | 165 | 158 | 3.543 | 2.400 | .004 | 3.722 | 32 | 28.1 | 937 | 60 |
| | | | 6 | MS | 195 | 186 | 3.543 | 1.600 | .004 | 4.399 | 25 | 21.2 | 599 | 80 |
| | | | 6 | HS | 195 | 186 | 3.543 | .800 | .005 | 5.278 | 15 | 13.8 | 388 | 100 |
| | Titanium Alloy (Ti-5553) | ϕ2.5 | 4 | LS | 80 | 122 | 2.362 | 2.500 | .003 | 1.540 | 9 | 9.1 | 392 | 30 |
| | | | 4 | MS | 80 | 122 | 2.362 | 1.500 | .003 | 1.540 | 5 | 5.2 | 225 | 50 |
| | | | 4 | MS | 100 | 153 | 2.362 | 1.000 | .004 | 2.406 | 6 | 5.2 | 179 | 70 |
| | | | 4 | HS | 100 | 153 | 2.362 | .500 | .004 | 2.406 | 3 | 2.9 | 99 | 80 |
| | | ϕ3.0 | 5 | LS | 80 | 102 | 2.953 | 3.000 | .003 | 1.604 | 14 | 14.1 | 730 | 30 |
| | | | 5 | MS | 80 | 102 | 2.953 | 1.800 | .003 | 1.604 | 9 | 8.1 | 419 | 50 |
| | | | 5 | MS | 100 | 127 | 2.953 | 1.200 | .004 | 2.506 | 9 | 8.1 | 334 | 70 |
| | | | 5 | HS | 100 | 127 | 2.953 | .600 | .004 | 2.506 | 4 | 4.5 | 185 | 80 |
| | | ϕ4.0 | 6 | LS | 80 | 76 | 3.543 | 4.000 | .003 | 1.444 | 20 | 20.1 | 1380 | 30 |
| | | | 6 | MS | 80 | 76 | 3.543 | 2.400 | .003 | 1.444 | 12 | 11.5 | 794 | 50 |
| | | | 6 | MS | 100 | 95 | 3.543 | 1.600 | .004 | 2.256 | 13 | 11.5 | 632 | 70 |
| | | | 6 | HS | 100 | 95 | 3.543 | .800 | .004 | 2.256 | 6 | 6.3 | 349 | 80 |

## VFX6 (Metric Standard)

(inch)

| | Work Material | DC (inch) | Number of Flutes | Chip Breaker | vc (SFM) | n ($min^{-1}$) | apmax | ae | fz (IPT) | vf (IPM) | Chip Removal Rate Q ($inch^3$/min) | Estimated Cutting Power PC (HP) | Expected Torque (lbf-ft) | Tool Life Ratio (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | Titanium Alloy (Ti6Al4V) | ϕ63 | 4 | LS | 130 | 200 | 2.362 | 2.480 | .004 | 3.153 | 18 | 17.8 | 468 | 40 |
| | | | 4 | MS | 165 | 254 | 2.362 | 1.488 | .004 | 4.002 | 14 | 12.7 | 263 | 60 |
| | | | 4 | MS | 195 | 300 | 2.362 | .992 | .004 | 4.729 | 11 | 9.6 | 168 | 80 |
| | | | 4 | HS | 195 | 300 | 2.362 | .496 | .005 | 5.675 | 7 | 6.2 | 109 | 100 |
| | | ϕ80 | 5 | LS | 130 | 158 | 2.953 | 3.150 | .004 | 3.104 | 29 | 27.7 | 923 | 40 |
| | | | 5 | MS | 165 | 200 | 2.953 | 1.890 | .004 | 3.939 | 22 | 19.8 | 520 | 60 |
| | | | 5 | MS | 195 | 236 | 2.953 | 1.260 | .004 | 4.655 | 17 | 14.9 | 332 | 80 |
| | | | 5 | HS | 195 | 236 | 2.953 | .630 | .005 | 5.586 | 10 | 9.7 | 215 | 100 |
| | | ϕ100 | 6 | LS | 130 | 126 | 3.543 | 3.937 | .004 | 2.979 | 42 | 39.3 | 1637 | 40 |
| | | | 6 | MS | 165 | 160 | 3.543 | 2.362 | .004 | 3.782 | 32 | 28.1 | 923 | 60 |
| | | | 6 | MS | 195 | 189 | 3.543 | 1.575 | .004 | 4.469 | 25 | 21.2 | 590 | 80 |
| | | | 6 | HS | 195 | 189 | 3.543 | .787 | .005 | 5.363 | 15 | 13.8 | 382 | 100 |
| | Titanium Alloy (Ti-5553) | ϕ63 | 4 | LS | 80 | 123 | 2.362 | 2.480 | .003 | 1.552 | 9 | 9.1 | 389 | 30 |
| | | | 4 | MS | 80 | 123 | 2.362 | 1.488 | .003 | 1.552 | 5 | 5.2 | 223 | 50 |
| | | | 4 | MS | 100 | 154 | 2.362 | .992 | .004 | 2.425 | 6 | 5.2 | 178 | 70 |
| | | | 4 | HS | 100 | 154 | 2.362 | .496 | .004 | 2.425 | 3 | 2.9 | 98 | 80 |
| | | ϕ80 | 5 | LS | 80 | 97 | 2.953 | 3.150 | .003 | 1.528 | 14 | 14.1 | 766 | 30 |
| | | | 5 | MS | 80 | 97 | 2.953 | 1.890 | .003 | 1.528 | 9 | 8.1 | 440 | 50 |
| | | | 5 | MS | 100 | 121 | 2.953 | 1.260 | .004 | 2.387 | 9 | 8.1 | 350 | 70 |
| | | | 5 | HS | 100 | 121 | 2.953 | .630 | .004 | 2.387 | 4 | 4.5 | 194 | 80 |
| | | ϕ100 | 6 | LS | 80 | 78 | 3.543 | 3.937 | .003 | 1.467 | 20 | 20.1 | 1358 | 30 |
| | | | 6 | MS | 80 | 78 | 3.543 | 2.362 | .003 | 1.467 | 12 | 11.5 | 781 | 50 |
| | | | 6 | MS | 100 | 97 | 3.543 | 1.575 | .004 | 2.292 | 13 | 11.5 | 622 | 70 |
| | | | 6 | HS | 100 | 97 | 3.543 | .787 | .004 | 2.292 | 6 | 6.3 | 344 | 80 |

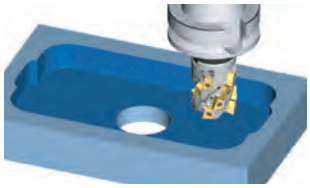
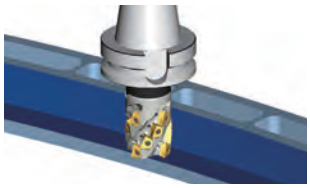
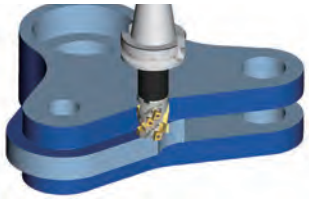
(Note 1) Note that machining performance varies depending to the conditions such as machine rigidity, work clamping rigidity, coolant supply system, pressure and flow volume etc.

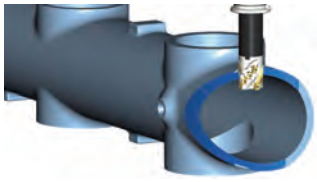
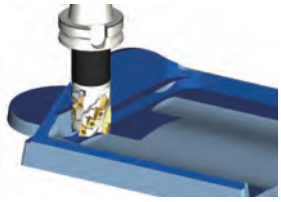
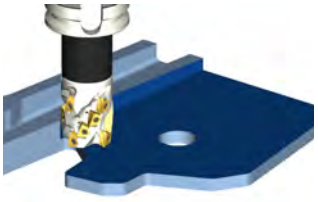
**(Note 2) Internal coolant is recommended. To allow coolant through the tool, use a FMH coolant through type arbor. Using external coolant in combination with through coolant is even more effective.**

(Note 3) The tool life ratio shows the standard when ae = tool diameter × 20% is assumed to be 100 when shoulder cutting.

(Note 4) The maximum depth of cut (apmax) varies according to the machine rigidity and power.

## Application Examples

| | Tool | VFX5-050A04A050R | VFX5-050A04A050R | VFX5-050A04A050R |
|---|---|---|---|---|
| | Workpiece | Titanium Alloy (Ti6Al4V)  | Titanium Alloy (Ti6Al4V)  | Titanium Alloy (Ti6Al4V)  |
| | Component | Aerospace Parts | Aerospace Parts | Aerospace Parts |
| Cutting Conditions | Cutting Speed (SFM) | 130 | 165 | 180 |
| | Table Feed (IPM) | 4.0 | 5.0 | 5.5 |
| | Feed per Tooth (IPT) | .004 | .004 | .004 |
| | Width of Cut **ae** (inch) | .197-1.181 | .394 | .591 |
| | Depth of Cut **ap** (inch) | .197-2.362 | 1.969 | 1.378 |
| | Cutting Mode | Wet Cutting (Internal:435PSI) | Wet Cutting (External:220PSI) | Wet Cutting (External:435PSI) |
| | Results | Efficiency was increased by a factor of 1.3. | Efficiency increased by a factor of 1.5 and was also possible to achieve stable machining of thin walled parts. | It was possible to use 2 times increased cutting conditions for greater cost reduction. |

| | Tool | VFX6-080A05A075R | VFX6-063A04A060R | VFX6-063A04A060R |
|---|---|---|---|---|
| | Workpiece | Titanium Alloy (Ti-5553)  | Titanium Alloy (Ti6Al4V)  | Titanium Alloy (Ti6Al4V)  |
| | Component | Aerospace Parts | Aerospace Parts | Aerospace Parts |
| Cutting Conditions | Cutting Speed (SFM) | 105 | 180 | 145 |
| | Table Feed (IPM) | 1.0 | 10.9 | 8.9 |
| | Feed per Tooth (IPT) | .002 | .005 | .002 |
| | Width of Cut **ae** (inch) | .394-1.181 | .394-1.772 | .197-.945 |
| | Depth of Cut **ap** (inch) | 1.181-2.362 | .984-2.362 | .472-1.457 |
| | Cutting Mode | Wet Cutting (Internal:1015PSI) | Wet Cutting (Internal:1450PSI) | Wet Cutting (External:220PSI) |
| | Results | With the same tool life (190 mins) as conventional tools, it was possible to use 1.2 times increased cutting conditions for greater efficiency. | At a metal removal rate of 4.7inch$^3$ /min, tool life was constant at 60mins and efficiency increased x 1.5. VFX was stable in tests at a max. metal removal rate of 24inch$^3$ /min. | Three times tool life at cutting conditions improved by a factor of 2.7. Total cost reductions of 62%. |

●With reference to the above examples, adjust the cutting conditions according to the machine specifications, workpiece geometry and clamping method used.

**For your safety**
●Don't touch breakers and chips without gloves. ●Please machine within recommended application range, and exchange expired tools with new parts in advance. ●Please use safety cover and wear safety glasses. ●When using compounded cutting oils, please take fire prevention. ●When attaching inserts or spare parts, please use the attached wrench or driver. ●When using tools in revolution machining, please make a trial run to check run-out, vibration, abnormal sounds etc.



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