

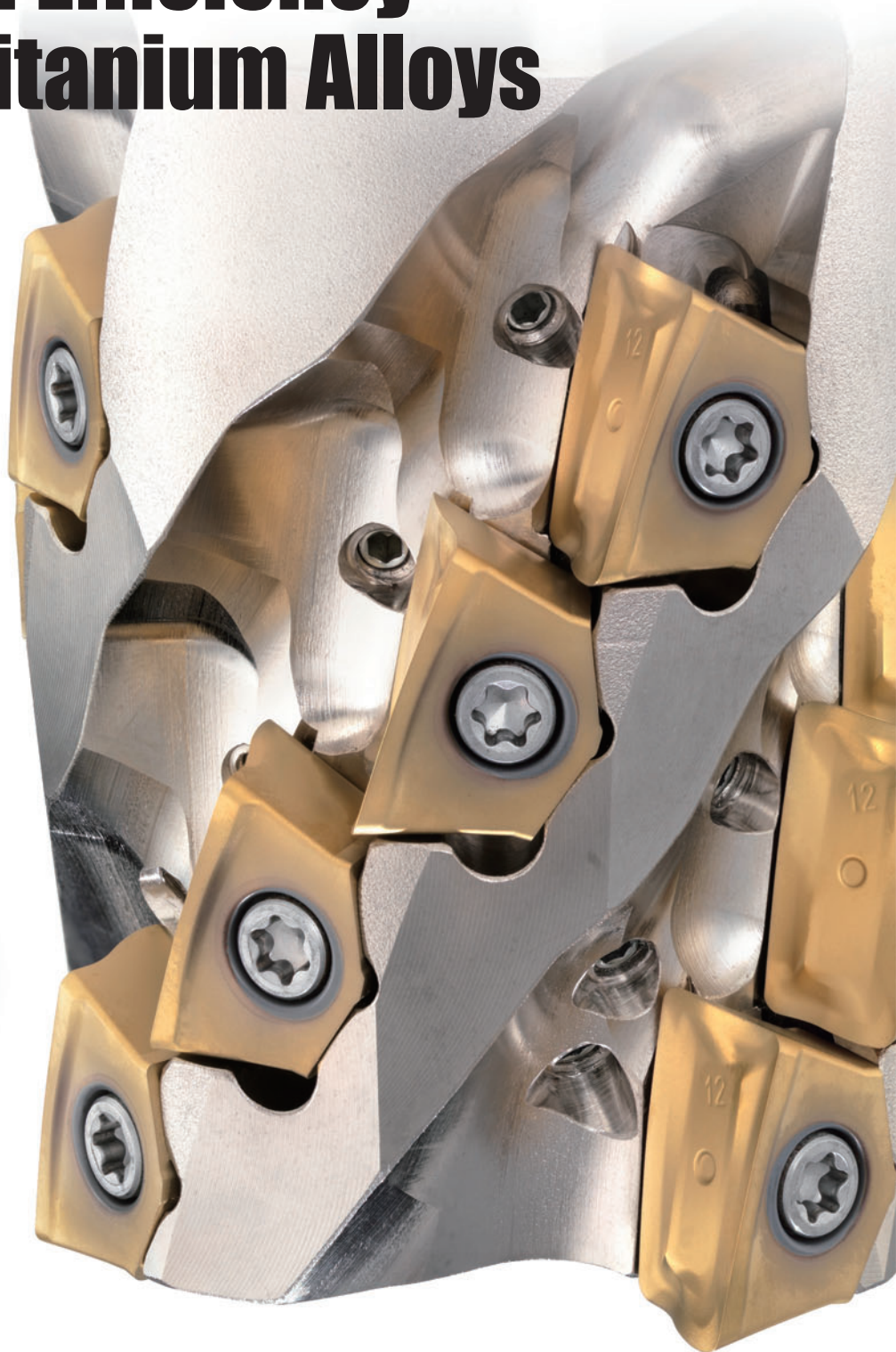
For Titanium Alloy Milling

VFX Series

Item
Expansion

VFX for High Efficiency Milling of Titanium Alloys

Outstanding metal
removal rates up to
400cm³/min.
(with ø63 cutter)



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

VFX Series

High Rigidity Design

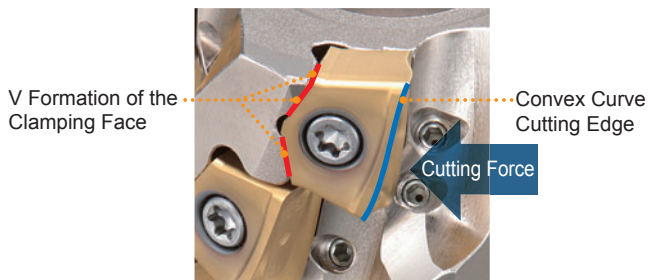
Arranging the inserts vertically absorbs the principal cutting force through the thickness of the insert and achieves extremely high rigidity.

Highly Reliable Clamping Mechanism

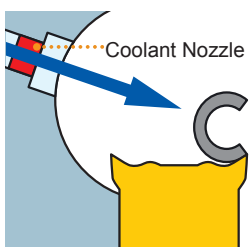
The insert seat has a curved seating face in the radial direction of the tool and a V-shaped seating face on the axis of rotation that can securely handle cutting forces from any direction.

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






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.

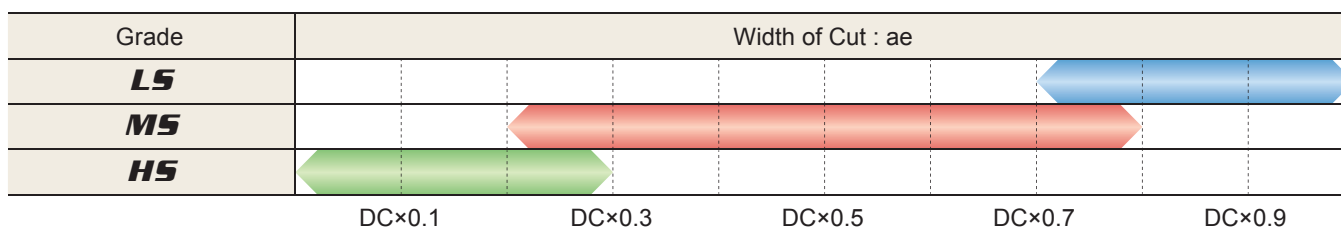
Changeable Coolant Nozzle

A replaceable nozzle is used for the internal coolant (hole diameter of the standard nozzle supplied: $\varnothing 0.8$). 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 increases in 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**

An new and enhanced super fine cemented carbide substrate has increased toughness whilst 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  Diameter $\phi 40-80\text{mm}$
Number of Flutes 3,4,5,6
Length of Tooth 26-75mm

Grade: **MP9130**
MP9030
Insert Type: **MS**




R0.8 R1.2 R1.6 R2.4 R3.2 R4.0

Grade: **MP9130**
MP9030
Insert Type: **HS**



R0.8


Grade: **MP9130**
Insert Type: **LS**



R0.8


VFX6  Diameter $\phi 63-100\text{mm}$
Number of Flutes 4,5,6
Length of Tooth 31-90mm

Grade: **MP9130**
MP9030
Insert Type: **MS**




R1.2 R1.6 R2.4 R3.2 R4.0 R5.0

Grade: **MP9130**
MP9030
Insert Type: **HS**



R1.2

Grade: **MP9130**
Insert Type: **LS**

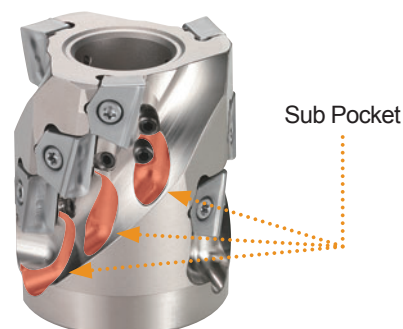


R1.2

*Only the end cutting edge can be changed. On the peripheral cutting edges please use R1.2 for VFX6 and R0.8 for VFX5.

Newly Developed 3-flute Holder (VFX5 Only)

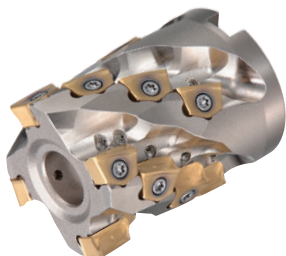
During high chip volume applications such as slotting, chip evacuation performance is important and if insufficient can lead to chipping of the insert. To solve this problem a 3 flute cutter with maximised main flutes and chip pockets has been developed. Use of the new LS breaker in conjunction with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



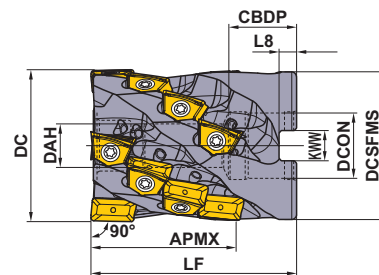
DEEP SHOULDER MILLING



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

(mm)

Order Number	Stock	No.F *	Total	DC	LF	DCON	CDBP	DAH	DCSFMS	KWW	L8	APMX	WT(kg)
	R												
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

*1 Number of Flutes

Spare Parts

Order Number	*2		Seal Washer	Wrench	*3		Anti-seize Lubricant	Set Bolt	Number of Insert	
	Clamp Screw	Number			Coolant Nozzle	Number			End Cutting Edge	Peripheral *1
									XNMU1607 ○○R○○	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 R0.8 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

*4 The part number for a blank screw without a through nozzle is HSS04004.


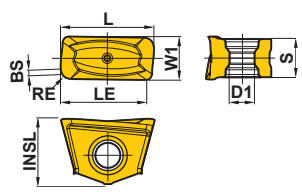

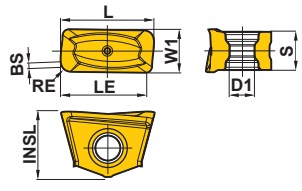

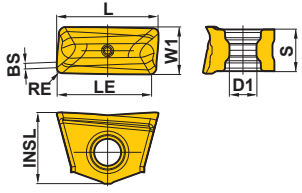
*5 Note for insert with a corner radius of 3.2 and above, as corner radius increases the LF dimension increases.

Corner radius 3.2: LF+0.7mm Corner radius 4.0: LF+1.5mm

● : Inventory maintained in Japan. (10 inserts in one case)

Inserts

(mm)

Shape	Order Number	Stock			L	LE	W1	INSL	S	BS	RE	D1	Geometry
		Coated											
		MP9030	MP9130										
	XNMU160708R-MS	●	●		16.0	13.4	7.0	11.1	6.5	1.0	0.8	4.2	
	XNMU160712R-MS	●	●		16.0	13.8	7.0	11.1	6.5	1.0	1.2	4.2	
	XNMU160716R-MS	●	●		16.0	13.8	7.0	11.1	6.5	1.0	1.6	4.2	
	XNMU160724R-MS	●	●		16.0	13.8	7.0	11.1	6.5	1.0	2.4	4.2	
	*1 XNMU160732R-MS	●	●		17.3	14.4	7.0	11.1	6.5	—	3.2	4.2	
	*1 XNMU160740R-MS	●	●		18.9	15.2	7.0	11.1	6.5	—	4.0	4.2	
	XNMU160708R-HS	●	●		16.0	13.4	7.0	11.1	6.5	1.0	0.8	4.2	
	XNMU160708R-LS	●			16.0	13.4	7.0	11.1	6.5	1.0	0.8	4.2	

*1 Note for insert with a corner radius of 3.2 and above, as corner radius increases the LF dimension increases.

Corner radius 3.2: LF+0.7mm Corner radius 4.0: LF+1.5mm

Recommended Cutting Conditions

VFX5

(mm)

Work Material	Cutting Edge Diameter	Number of Flutes	Recommended Insert	vc (m/min)	n (min ⁻¹)	apmax	ae	fz (mm/t)	vf (mm/min)	Q (cm ³ /min)	Estimated Cutting Power (kW)	Expected Torque (Nm)	Tool Life Ratio (%)
S Titanium Alloy (Ti6Al4V)	φ40	3	LS	40	318	38	40	0.10	95	145	6.5	194	40
		3	MS	50	398	38	24	0.10	119	109	4.5	109	60
		3	MS	60	477	38	16	0.10	143	87	3.5	69	80
		3	HS	60	477	38	8	0.12	172	52	2.3	45	100
	φ50	3	LS	40	255	38	50	0.10	76	145	6.5	242	40
		4	MS	50	318	50	30	0.10	127	191	7.9	237	60
		4	MS	60	382	50	20	0.10	153	153	6.0	151	80
		4	HS	60	382	50	10	0.12	183	92	3.9	98	100
	φ63	5	LS	40	202	60	63	0.10	101	382	16.8	793	40
		5	MS	50	253	60	38	0.10	126	286	11.8	447	60
		5	MS	60	303	60	25	0.10	152	229	9.0	285	80
		5	HS	60	303	60	13	0.12	182	138	5.9	185	100
	φ80	6	LS	40	159	75	80	0.10	95	573	25.0	1500	40
		6	MS	50	199	75	48	0.10	119	430	17.6	846	60
		6	MS	60	239	75	32	0.10	143	344	13.5	539	80
		6	HS	60	239	75	16	0.12	172	206	8.7	350	100
Titanium Alloy (Ti-5553)	φ40	3	LS	25	199	38	40	0.08	48	73	3.4	161	30
		3	MS	25	199	38	24	0.08	48	44	1.9	92	50
		3	MS	30	239	38	16	0.10	72	44	1.8	74	70
		3	HS	30	239	38	8	0.10	72	22	1.0	41	90
	φ50	4	LS	25	159	50	50	0.08	51	127	5.8	350	30
		4	MS	25	159	50	30	0.08	51	76	3.4	201	50
		4	MS	30	191	50	20	0.10	76	76	3.2	160	70
		4	HS	30	191	50	10	0.10	76	38	1.8	89	90
	φ63	5	LS	25	126	60	63	0.08	51	191	8.7	658	30
		5	MS	25	126	60	38	0.08	51	115	5.0	378	50
		5	MS	30	152	60	25	0.10	76	115	4.8	301	70
		5	HS	30	152	60	13	0.10	76	57	2.6	167	90
	φ80	6	LS	25	99	75	80	0.08	48	286	13.0	1246	30
		6	MS	25	99	75	48	0.08	48	172	7.5	716	50
		6	MS	30	119	75	32	0.10	72	172	7.1	570	70
		6	HS	30	119	75	16	0.10	72	86	3.9	316	90

(Note 1) Please 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. Please use an FMH type arbor for through coolant. Using external coolant in combination with through coolant is even more effective.

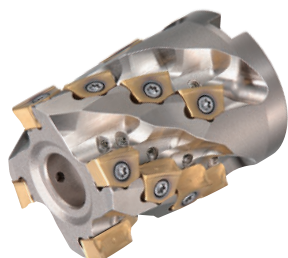
(Note 3) The tool life ratio shows the standard when $ae = \text{tool diameter} \times 20\%$ is assumed to be 100 when shoulder cutting.

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

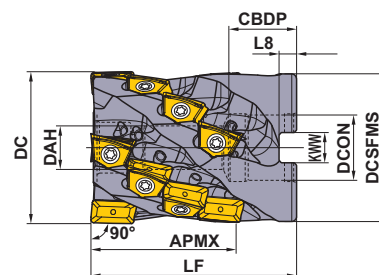
DEEP SHOULDER MILLING



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

(mm)

Order Number	Stock	* No.F	Total	DC	LF	DCON	CBDP	DAH	DCSFMS	KWW	L8	APMX	WT(kg)
	R												
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

*1 Number of Flutes

Spare Parts

Order Number	*2		Seal Washer	Wrench	*3		Anti-seize Lubricant	Set Bolt	Number of Insert	
	Clamp Screw	Number			Coolant Nozzle	Number			End Cutting Edge	Peripheral *1 Cutting Edge
									XNMU1909 ○R-○	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 R1.2 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

*4 The part number for a blank screw without a through nozzle is HSS04004.


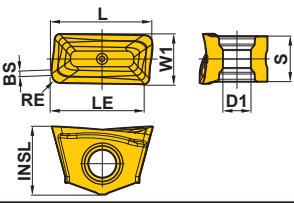

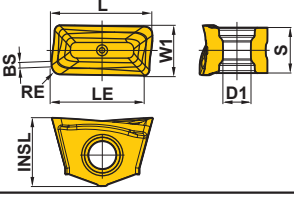

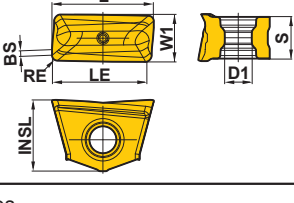
*5 Note for insert with a corner radius of 3.2 and above, as corner radius increases the LF dimension increases.

Corner radius 3.2: LF+0.7mm Corner radius 4.0: LF+1.5mm Corner radius 5.0: LF+1.5mm

For Titanium Alloy Milling

Inserts

(mm)

Shape	Order Number	Stock			L	LE	W1	INSL	S	BS	RE	D1	Geometry
		Coated											
		MP9030	MP9130										
	XNMU190912R-MS	●	●		19.1	16.5	9.5	12.7	8.5	1.0	1.2	5.2	
	XNMU190916R-MS	●	●		19.1	16.5	9.5	12.7	8.5	1.0	1.6	5.2	
	XNMU190924R-MS	●	●		19.1	16.6	9.5	12.7	8.5	1.0	2.4	5.2	
	*1 XNMU190932R-MS	●	●		20.2	17.1	9.5	12.7	8.5	—	3.2	5.2	
	*1 XNMU190940R-MS	●	●		21.8	17.8	9.5	12.7	8.5	—	4.0	5.2	
	*1 XNMU190950R-MS	●	●		21.8	17.8	9.5	12.7	8.5	—	5.0	5.2	
	XNMU190912R-HS	●	●		19.1	16.5	9.5	12.7	8.5	1.0	1.2	5.2	
	XNMU190912R-LS	●			19.1	16.5	9.5	12.7	8.5	1.0	1.2	5.2	

*1 Note for insert with a corner radius of 3.2 and above, as corner radius increases the LF dimension increases.

Corner radius 3.2: LF+0.7mm Corner radius 4.0: LF+1.5mm Corner radius 5.0: LF+1.5mm

● : Inventory maintained in Japan. (10 inserts in one case)

Recommended Cutting Conditions

VFX6

(mm)

Work Material	Cutting Edge Diameter	Number of Flutes	Recommended Insert	vc (m/min)	n (min ⁻¹)	apmax	ae	fz (mm/t)	vf (mm/min)	Q (cm ³ /min)	Estimated Cutting Power (kW)	Expected Torque (Nm)	Tool Life Ratio (%)
S Titanium Alloy (Ti6Al4V)	φ63	4	LS	40	202	60	63	0.10	81	306	13.4	634	40
		4	MS	50	253	60	38	0.10	101	229	9.5	357	60
		4	MS	60	303	60	25	0.10	121	183	7.2	228	80
		4	HS	60	303	60	13	0.12	146	110	4.7	148	100
	φ80	5	LS	40	159	75	80	0.10	80	477	20.8	1250	40
		5	MS	50	199	75	48	0.10	99	358	14.7	705	60
		5	MS	60	239	75	32	0.10	119	286	11.2	449	80
		5	HS	60	239	75	16	0.12	143	172	7.3	291	100
	φ100	6	LS	40	127	90	100	0.10	76	688	29.6	2218	40
		6	MS	50	159	90	60	0.10	95	516	20.9	1252	60
		6	MS	60	191	90	40	0.10	115	413	16.0	798	80
		6	HS	60	191	90	20	0.12	138	248	10.3	517	100
Titanium Alloy (Ti-5553)	φ63	4	LS	25	126	60	63	0.08	40	153	7.0	527	30
		4	MS	25	126	60	38	0.08	40	92	4.0	303	50
		4	MS	30	152	60	25	0.10	61	92	3.8	241	70
		4	HS	30	152	60	13	0.10	61	46	2.1	133	80
	φ80	5	LS	25	99	75	80	0.08	40	239	10.8	1038	30
		5	MS	25	99	75	48	0.08	40	143	6.2	597	50
		5	MS	30	119	75	32	0.10	60	143	5.9	475	70
		5	HS	30	119	75	16	0.10	60	72	3.3	263	80
	φ100	6	LS	25	80	90	100	0.08	38	344	15.3	1841	30
		6	MS	25	80	90	60	0.08	38	206	8.8	1059	50
		6	MS	30	95	90	40	0.10	57	206	8.4	844	70
		6	HS	30	95	90	20	0.10	57	103	4.7	466	80

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

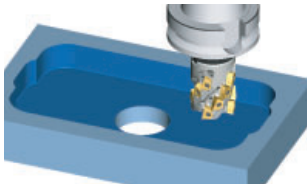
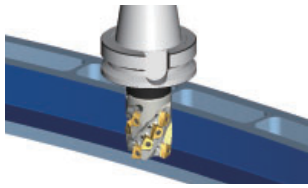
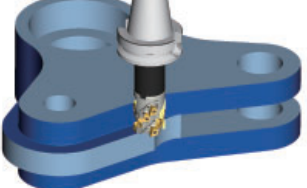
(Note 2) Internal coolant is recommended. Please use an FMH type arbor for through coolant. Using external coolant in combination with through coolant is even more effective.

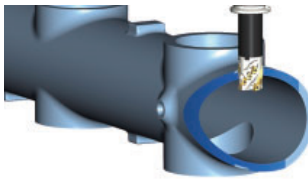
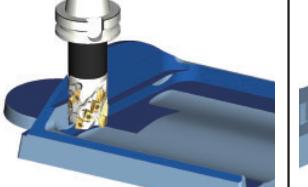
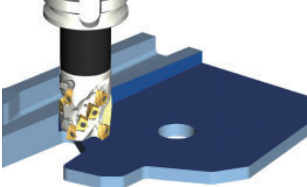
(Note 3) The tool life ratio shows the standard when $ae = \text{tool diameter} \times 20\%$ is assumed to be 100 when shoulder cutting.

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

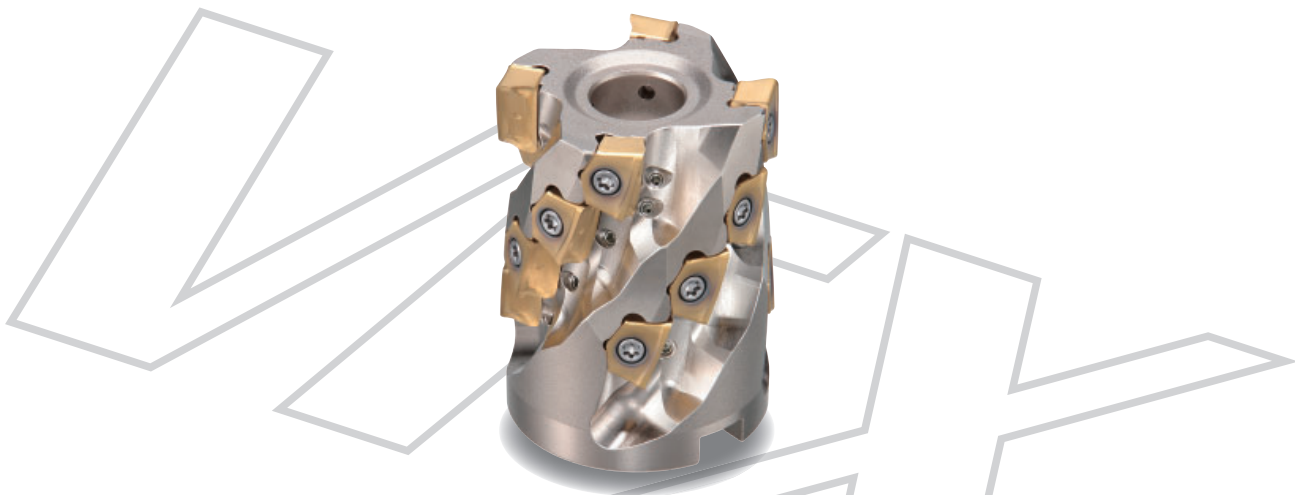
For Titanium Alloy Milling

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 (m/min)	40	50	55
	Table Feed (mm/min)	102	127	140
	Feed per Tooth (mm/t.)	0.10	0.1	0.1
	Depth of Cut ae (mm)	5-30	50	35
	Depth of Cut ap (mm)	5-60	10	15
Cutting Mode		Wet Cutting (Internal:3MPa)	Wet Cutting (External:1.5MPa)	Wet Cutting (External:3MPa)
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 (m/min)	32.5	55	45
	Table Feed (mm/min)	25	278	227
	Feed per Tooth (mm/t.)	0.04	0.12	0.05
	Depth of Cut ae (mm)	10-30	10-45	12-37
	Depth of Cut ap (mm)	30-60	25-60	5-24
Cutting Mode		Wet Cutting (Internal:7MPa)	Wet Cutting (Internal:10MPa)	Wet Cutting (External:1.5MPa)
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 120cm 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 400cm 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 Titanium Alloy Milling

VFX

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.

MITSUBISHI MATERIALS CORPORATION

MITSUBISHI MATERIALS CORPORATION
Overseas Sales Dept, Asian Region
KFC bldg., 8F, 1-6-1 Yokoami, Sumida-ku, Tokyo 130-0015, Japan
TEL +81-3-5819-8771 FAX +81-3-5819-8774
Overseas Sales Dept, European & American Region
KFC bldg., 8F, 1-6-1 Yokoami, Sumida-ku, Tokyo 130-0015, Japan
TEL +81-3-5819-8772 FAX +81-3-5819-8774

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