

Roughing special serrated edge, difficult-to-cut materials

4/ 5/ 6RFH

High efficiency and stable machining with multi-edge design and coolant hole
 Deep slotting for stainless steel and titanium alloy



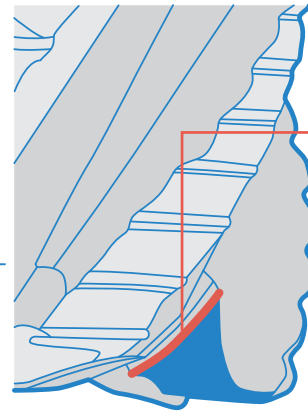
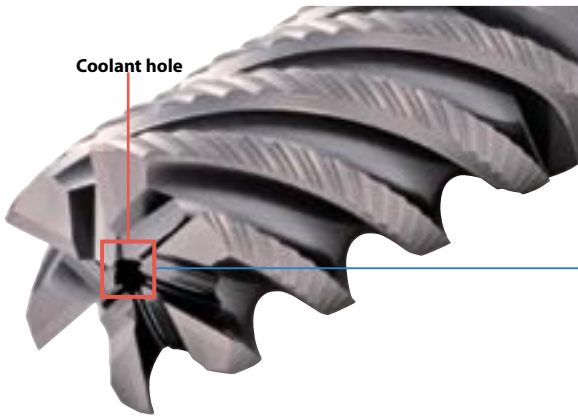
MEGACOAT HARD is applied

1 High efficiency machining with multi-edge design

Multi-edge design with coolant hole. Good chip evacuation with original gash shape

Multi-edge design (ø16 - 6 flutes)

Original gash shape



Radius gash creates better chip flow and evacuation

Good chip evacuation

Deep slotting ($a_p = 2 \times DC$) for stainless steel and titanium alloy

Slotting performance comparison (Internal evaluation)

After machining 1 pass

5RFH (Internal and external coolant)

Competitor A (External coolant)



x Defects (Chip clogging)

Cutting conditions : $n = 2,550 \text{ min}^{-1}$, $v_f = 336 \text{ mm/min}$, $a_p = 20 \text{ mm}$
 End mill dia. Ø10, wet, slotting, workpiece material : SUS304

Competitor A

5RFH

No defects when deep slotting

Recommended workpiece materials

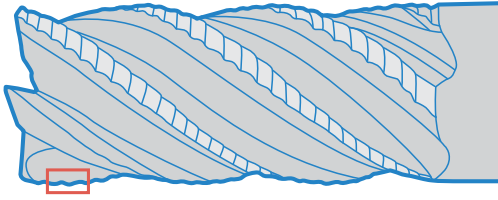
★ 1st Choice



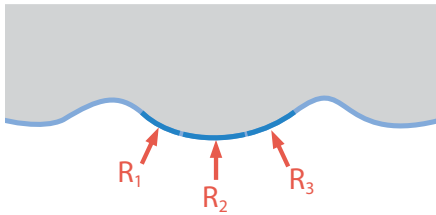
2 Defect resistant

Reduce cutting pressure with radial serrated edge

Stable machining



Special curved radius serrated edge



Serrated curved edge with different radii
(Compound radius shape)
Distributes cutting pressure and provides stress reduction

Blade edge after machining 12m (Internal Evaluation)



5RFH



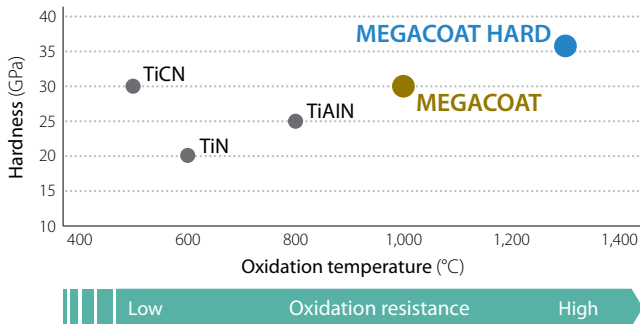
Competitor B

Cutting conditions: $n = 2,900 \text{ min}^{-1}$, $v_f = 712 \text{ mm/min}$, $a_p \times a_e = 5 \times 3 \text{ mm}$
End mill dia. $\varnothing 10$, wet, shouldering workpiece: ti-6al-4v

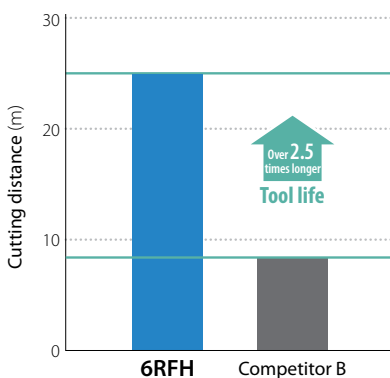
3 Achieves long tool life and stable machining

The MEGACOAT HARD coating technology delivers the highest hardness and thermal resistance of Kyocera's PVD coating

Coating properties



Tool life comparison (Internal Evaluation)



Blade edge after machining 8.4m



6RFH



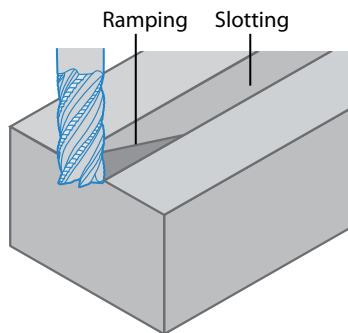
Competitor B

Cutting conditions: $n = 3,500 \text{ min}^{-1}$, $v_f = 840 \text{ mm/min}$, $a_p \times a_e = 5 \times 4.8 \text{ Mm}$
End mill dia. $\varnothing 16$, shouldering, wet workpiece: SUS304

4/ 5/ 6RFH Machining information

Corresponding to medium finishing from rough machining. Reach maximum tool integration

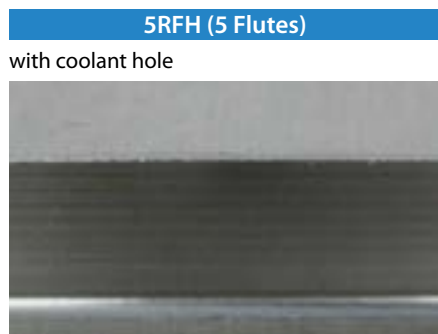
Case studies



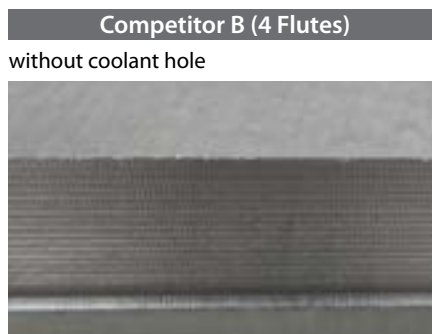
RFH is internal coolant support

RFH with multi-edge design produces excellent surface finish even at the same table feed of competitor B (By lowering the feed per tooth)

Side surface finish comparison (Internal evaluation)



Surface finish: 0.20 Mmra



Surface finish: 1.66 Mmra

Cutting conditions: $n = 3,200 \text{ min}^{-1}$
 $V_f = 310 \text{ mm/min}$, $a_p = 10 \text{ mm}$
 End mill dia. $\varnothing 10$, wet
 Ramping (ramping angle 5°) · slotting
 Workpiece: SUS304

Competitor B needed a semi-finishing tool because of bad surface finish
5RFH did not need a semi-finishing tool because of its excellent surface finish

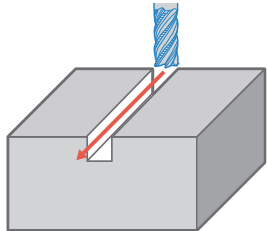
4/5/6RFH can be custom-made for NIKKEN's X-Treme chuck

Great for difficult-to-cut materials and heavy machining
For more information, please contact your kyocera sales representative

Case studies

Test piece SUS304

$n = 1,800 \text{ min}^{-1}$
 $(V_c = 56 \text{ m/min})$
 $V_f = 250 \text{ mm/min}$
 $(f_z = 0.027 \text{ mm/t})$
 $a_p \times a_e = 3 \times 10 \text{ mm (Slotting)}$
 3 passes
 Wet (Internal Coolant)
 5RFH100-250



Load on the main spindle

5RFH
100-250

20%

↓ 10%
Load on the main spindle

Competitor C

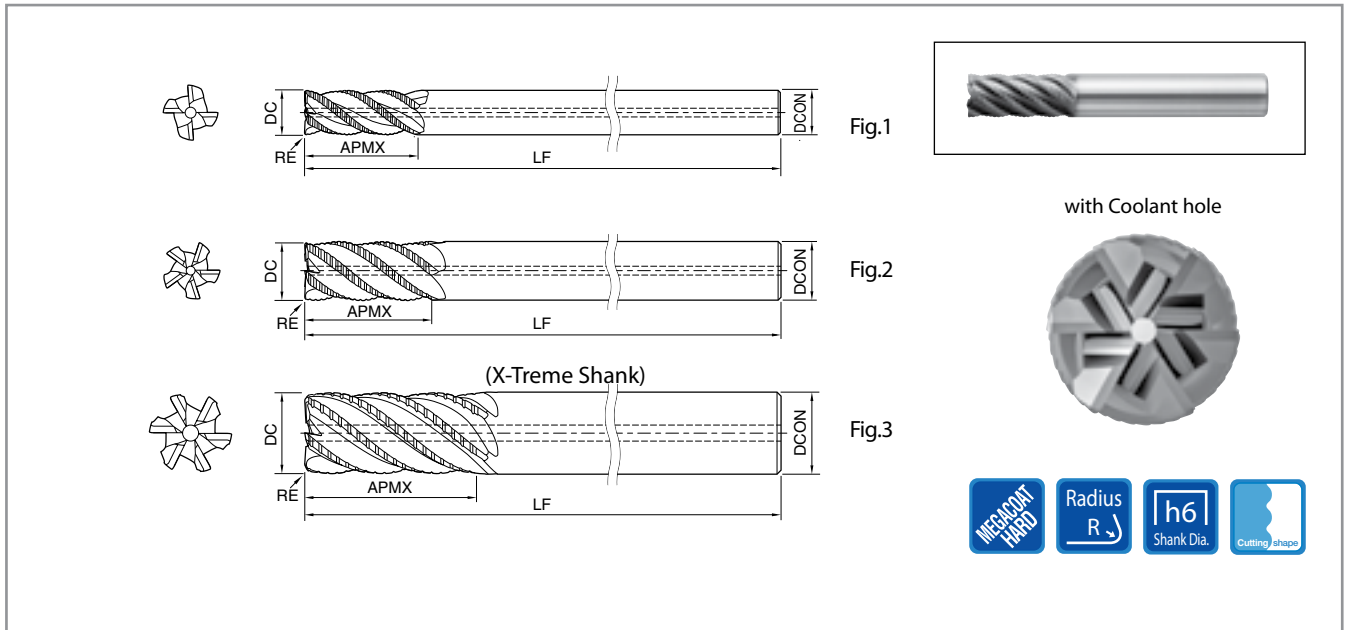
30%

5RFH shows 10% reduced load compared to competitor C. Reduced vibration for quieter machining with excellent surface finish.

(User evaluation)

4 / 5 / 6RFH Medium & Long

No. of Flutes : 4



4 / 5 / 6RFH (Medium)

Shouldering Slotting

(Unit : mm)

Description	Availability	DC	Mill Dia. tolerance	*RE	APMX	DCON	LF	ZEFP	Shape
4RFH060-150	●	6.0	0 -0.050	0.3	15	6	60	4	Fig.1
4RFH080-200	●	8.0	0 -0.050	0.3	20	8	70	4	
5RFH100-250	●	10.0	0 -0.050	0.5	25	10	80	5	Fig.2
5RFH120-260	●	12.0	0 -0.050	0.5	26	12	100	5	
6RFH160-350	●	16.0	0 -0.060	0.5	35	16	110	6	Fig.3
6RFH200-450	●	20.0	0 -0.060	0.5	45	20	125	6	

* Corner-R dimension is reference only

4 / 5 / 6RFH (Long)

Shouldering

(Unit : mm)

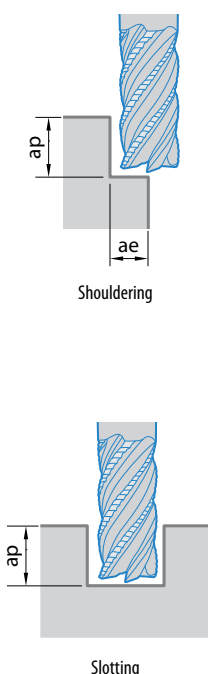
Description	Stock	DC	Mill Dia. tolerance	*RE	APMX	DCON	LF	ZEFP	Shape
4RFH060-300	●	6.0	0 -0.050	0.3	30	6	80	4	Fig.1
4RFH080-400	●	8.0	0 -0.050	0.3	40	8	100	4	
5RFH100-500	●	10.0	0 -0.050	0.5	50	10	110	5	Fig.2
5RFH120-600	●	12.0	0 -0.050	0.5	60	12	130	5	
6RFH160-800	●	16.0	0 -0.060	0.5	80	16	160	6	Fig.3
6RFH200-1000	●	20.0	0 -0.060	0.5	100	20	180	6	

* Corner-R dimension is reference only

● : Available

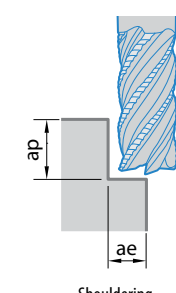
4/ 5/ 6RFH Cutting conditions Medium & Long type

4/5/6RFH (Medium Type)

Applications	Workpiece	Application	Depth of Cut ap X ae (mm)	Outside Dia. Dc (mm)	ø 6	ø 8	ø 10	ø 12	ø 16	ø 20
 <p>Shouldering</p> <p>Slotting</p>	Carbon Steel, Alloy Steel, Cast Iron S45C, SCM, SNCM FC	Shouldering	1.5Dc X 0.3Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900
				Feed Rate (mm/min)	1,040	1,050	1,100	1,000	980	920
		Slotting	1.0Dc	Spindle Revolution (min ⁻¹)	5,300	4,000	3,200	2,700	2,000	1,600
				Feed Rate (mm/min)	790	790	830	740	700	640
			2.0Dc	Spindle Revolution (min ⁻¹)	5,300	4,000	3,200	2,700	2,000	1,600
				Feed Rate (mm/min)	550	550	580	510	490	450
	Pre-hardened Steel (30~45HRC)	Shouldering	1.5Dc X 0.3Dc	Spindle Revolution (min ⁻¹)	4,200	3,200	2,500	2,100	1,600	1,300
				Feed Rate (mm/min)	490	620	580	540	490	460
		Slotting	1.0Dc	Spindle Revolution (min ⁻¹)	3,700	2,800	2,200	1,900	1,400	1,100
				Feed Rate (mm/min)	410	410	430	400	370	360
			2.0Dc	Spindle Revolution (min ⁻¹)	3,700	2,800	2,200	1,900	1,400	1,100
				Feed Rate (mm/min)	290	290	300	280	260	250
	Stainless Steel SUS304	Shouldering	1.5Dc X 0.3Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900
				Feed Rate (mm/min)	410	410	410	400	380	380
		Slotting	1.0Dc	Spindle Revolution (min ⁻¹)	5,300	4,000	3,200	2,700	2,000	1,600
				Feed Rate (mm/min)	280	260	310	240	250	250
			2.0Dc	Spindle Revolution (min ⁻¹)	5,300	4,000	3,200	2,700	2,000	1,600
				Feed Rate (mm/min)	220	210	250	190	200	200
Titanium Alloys	Shouldering	1.5Dc X 0.3Dc	Spindle Revolution (min ⁻¹)	4,200	3,200	2,500	2,100	1,600	1,300	
			Feed Rate (mm/min)	330	420	410	390	380	370	
	Slotting	1.0Dc	Spindle Revolution (min ⁻¹)	3,700	2,800	2,200	1,900	1,400	1,100	
			Feed Rate (mm/min)	220	240	240	240	250	250	
		2.0Dc	Spindle Revolution (min ⁻¹)	3,700	2,800	2,200	1,900	1,400	1,100	
			Feed Rate (mm/min)	180	190	190	190	200	200	
Super Alloy	Shouldering	1.5Dc X 0.2Dc	Spindle Revolution (min ⁻¹)	800	600	480	400	300	240	
			Feed Rate (mm/min)	60	60	60	60	60	60	
	Slotting	1.0Dc	Spindle Revolution (min ⁻¹)	530	400	320	270	200	160	
			Feed Rate (mm/min)	28	28	28	28	28	28	
		2.0Dc	Spindle Revolution (min ⁻¹)	530	400	320	270	200	160	
			Feed Rate (mm/min)	20	20	20	20	20	20	

Water soluble coolant is recommended for stainless steel, titanium alloy, and super alloy.

4/5/6RFH (Long Type)

Applications	Workpiece	Application	Depth of Cut ap X ae (mm)	Outside Dia. Dc (mm)	ø 6	ø 8	ø 10	ø 12	ø 16	ø 20
 <p>Shouldering</p>	Carbon Steel, Alloy Steel, Cast Iron S45C, SCM, SNCM FC	Shouldering	ap: 4.0Dc ae: 0.1Dc (Dc ≤ ø12) ae: 1.2mm (Dc > ø12)	Spindle Revolution (min ⁻¹)	5,100	3,800	3,100	2,500	1,900	1,500
				Feed Rate (mm/min)	620	630	660	600	590	550
	Pre-hardened Steel (30~45HRC)	Shouldering	ap: 4.0Dc ae: 0.1Dc (Dc ≤ ø12) ae: 1.2mm (Dc > ø12)	Spindle Revolution (min ⁻¹)	3,400	2,500	2,000	1,700	1,300	1,000
				Feed Rate (mm/min)	340	430	410	380	340	320
	Stainless Steel SUS304	Shouldering	ap: 4.0Dc ae: 0.1Dc (Dc ≤ ø12) ae: 1.2mm (Dc > ø12)	Spindle Revolution (min ⁻¹)	5,100	3,800	3,100	2,500	1,900	1,500
				Feed Rate (mm/min)	290	290	290	280	270	270
	Titanium Alloys	Shouldering	ap: 4.0Dc ae: 0.1Dc (Dc ≤ ø12) ae: 1.2mm (Dc > ø12)	Spindle Revolution (min ⁻¹)	3,400	2,500	2,000	1,700	1,300	1,000
				Feed Rate (mm/min)	230	290	290	270	270	260
	Super Alloy	Shouldering	ap: 4.0 X Dc ae: 0.1Dc (Dc ≤ ø12) ae: 1.0mm (Dc > ø12)	Spindle Revolution (min ⁻¹)	640	480	380	320	240	190
				Feed Rate (mm/min)	20	20	20	20	20	20

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