

INNOVATIONS CATALOGUE
High-Performance Solid Carbide End Mills
RSM and RSM II
Metric

www.kennametal.com





RSM II — Multi-Flute End Mills

Primary Application

RSM II offers the highest productivity in machining aerospace structural components in titanium and titanium alloys. The RSM II is designed to utilise high-speed peel milling strategies with secure chip formation and evacuation in deep cavities. RSM II is available with **SAFE-LOCK**® by HAIMER.

- Excellent metal removal rates.
- Highest surface quality.
- Unmatched tool life and wear resistance using KC643M™.
- Highest process security.

Features and Benefits

Advanced Technology

- Maximum amount of flutes for increased feed rates and less vibration tendency.
- Proprietary w-shaped flute form improves chip formation and reduces cutting forces.
- Unequal flute spacing increases tool life and surface quality.
- Proprietary AlTiN KC643M for increased tool life.
- Uncoated K600 for milling critical to fly components.

Customisation

- Custom overall length and length of cut.
- Different radii per diameter.
- Custom shank styles.
- Tapered versions available.

Extensive Standard Offering

- Each diameter has an optimised number of flutes for constant edge-to-flute space ratio.
- Different radii per diameter.
- **SAFE-LOCK** and round shank.



36° Helix angle.

Specifically engineered for fine finishing.

W-shaped flute design.

Bigger flute space for optimised chip evacuation.

5 x D neck length.

Machining of deepest cavities and long walls.

SAFE-LOCK® shank.

Prevents end mill pullout. Enables higher feed rates.

Internal coolant.

Increases tool life and flushes out chips in deep cavities.

Eccentric relief grind.

Improves edge stability and enables higher feed rates.

KC643M™ grade.

Unmatched fine finishing and tool life results.

K600 uncoated grade.

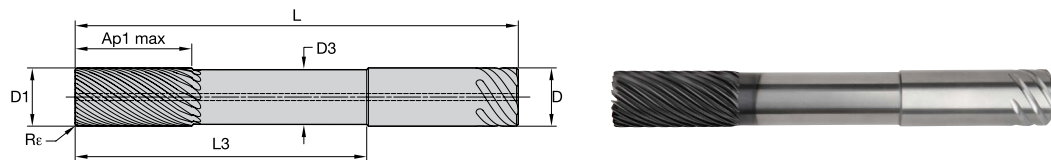
Addresses critical to fly applications for uncoated tools.

High-Performance Solid Carbide End Mills • RSM II

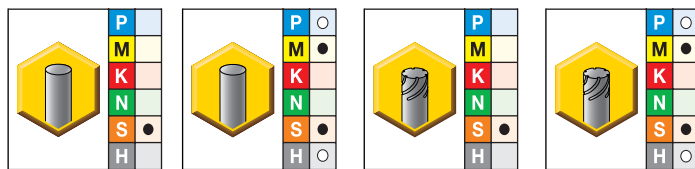
RSM II • FSDE .. • Multi-Flute with Neck • Metric



- Kennametal standard dimensions.
- Non-centre cutting.
- Optimised geometry for titanium machining.
- Unequal flute spacing minimises chatter for smoother machining.
- Reach optimised for machining deep cavities.



■ FSDE .. • Multi-Flute with Neck • Metric



K600	KC643M	K600	KC643M	D1	D	D3	Ap1 max	L3	L	Re	Z
FSDE0600A7DYA	FSDE0600A7DYA	-	-	6,00	6,00	5,64	12,00	30,00	76,00	0,20	7
FSDE0600A7DYE	FSDE0600A7DYE	-	-	6,00	6,00	5,64	12,00	30,00	76,00	0,50	7
FSDE0800A7DYA	FSDE0800A7DYA	-	-	8,00	8,00	7,52	16,00	40,00	87,00	0,20	7
FSDE0800A7DYE	FSDE0800A7DYE	-	-	8,00	8,00	7,52	16,00	40,00	87,00	0,50	7
FSDE1000A9DYE	FSDE1000A9DYE	-	-	10,00	10,00	9,40	20,00	50,00	100,00	0,50	9
FSDE1000A9DYG	FSDE1000A9DYG	-	-	10,00	10,00	9,40	20,00	50,00	100,00	1,00	9
-	-	FSDE1200E9DYE	FSDE1200E9DYE	12,00	12,00	11,28	24,00	60,00	125,00	0,50	9
-	-	FSDE1200E9DYG	FSDE1200E9DYG	12,00	12,00	11,28	24,00	60,00	125,00	1,00	9
-	-	FSDE1200E9DYL	FSDE1200E9DYL	12,00	12,00	11,28	24,00	60,00	125,00	2,50	9
-	-	FSDE1600EBDYG	FSDE1600EBDYG	16,00	16,00	15,04	32,00	80,00	141,00	1,00	11
-	-	FSDE1600EBDYL	FSDE1600EBDYL	16,00	16,00	15,04	32,00	80,00	141,00	2,50	11
-	-	FSDE1600EBDYM	FSDE1600EBDYM	16,00	16,00	15,04	32,00	80,00	141,00	3,00	11
-	-	FSDE1600EBDYP	FSDE1600EBDYP	16,00	16,00	15,04	32,00	80,00	141,00	6,00	11
-	-	FSDE2000EFDYG	FSDE2000EFDYG	20,00	20,00	18,80	40,00	100,00	166,00	1,00	15
-	-	FSDE2000EFDYK	FSDE2000EFDYK	20,00	20,00	18,80	40,00	100,00	166,00	2,00	15
-	-	FSDE2000EFDYL	FSDE2000EFDYL	20,00	20,00	18,80	40,00	100,00	166,00	2,50	15
-	-	FSDE2000EFDYP	FSDE2000EFDYP	20,00	20,00	18,80	40,00	100,00	166,00	6,00	15
-	-	FSDE2500EJDYG	FSDE2500EJDYG	25,00	25,00	23,50	50,00	125,00	190,00	1,00	19
-	-	FSDE2500EJDYL	FSDE2500EJDYL	25,00	25,00	23,50	50,00	125,00	190,00	2,50	19
-	-	FSDE2500EJDYP	FSDE2500EJDYP	25,00	25,00	23,50	50,00	125,00	190,00	6,00	19

End Mill Tolerances

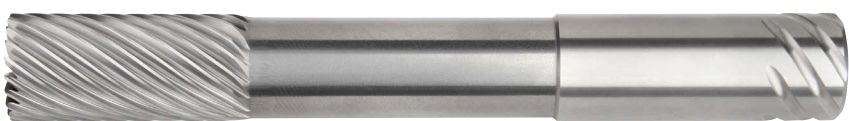
D1	tolerance e8	D	tolerance h6 + / -
≤3	-0,014/-0,028	≤3	+0/-0,006
>3-6	-0,020/-0,038	>3-6	+0/-0,008
>6-10	-0,025/-0,047	>6-10	+0/-0,009
>10-18	-0,032/-0,059	>10-18	+0/-0,011
>18-30	-0,040/-0,073	>18-30	+0/-0,013

■ FSDE .. • Multi-Flute with Neck

Material Group		 											
		Side Milling (A)		KC643M		Recommended feed per tooth (fz = mm/th) for side milling (A).							
		A		Cutting Speed — vc m/min		D1 — Diameter							
		ap	ae	min	max	mm	6,0	8,0	10,0	12,0	16,0	20,0	25,0
P	4	Ap max	0,2–0,3	135	495	fz	0,101	0,111	0,120	0,129	0,149	0,163	0,166
	5	Ap max	0,2–0,3	90	330	fz	0,091	0,099	0,108	0,116	0,135	0,150	0,155
M	1	Ap max	0,2–0,3	135	379,5	fz	0,112	0,124	0,135	0,145	0,169	0,187	0,193
	2	Ap max	0,2–0,3	90	264	fz	0,091	0,099	0,108	0,116	0,135	0,150	0,155
	3	Ap max	0,2–0,3	90	231	fz	0,076	0,084	0,090	0,096	0,110	0,120	0,121
S	1	Ap max	0,2–0,3	75	297	fz	0,112	0,124	0,135	0,145	0,169	0,187	0,193
	2	Ap max	0,2–0,3	75	297	fz	0,112	0,124	0,135	0,145	0,169	0,187	0,193
	3	Ap max	0,2–0,3	37,5	132	fz	0,060	0,066	0,071	0,077	0,090	0,100	0,104
	4	Ap max	0,2–0,3	75	198	fz	0,079	0,092	0,099	0,107	0,124	0,138	0,142
H	1	Ap max	0,2–0,3	120	462	fz	0,101	0,111	0,120	0,129	0,149	0,163	0,166
	2	Ap max	0,2–0,3	105	396	fz	0,076	0,084	0,090	0,096	0,110	0,120	0,121

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions.
For smaller taper machining centres, please adjust parameters accordingly on >12mm diameter.

■ FSDE .. • Multi-Flute with Neck

Material Group		 											
		Side Milling (A)		K600		Recommended feed per tooth (fz = mm/th) for side milling (A).							
		A		Cutting Speed — vc m/min		D1 — Diameter							
		ap	ae	min	max	mm	6,0	8,0	10,0	12,0	16,0	20,0	25,0
P	4	Ap max	0,2–0,3	67,5	247,5	fz	0,101	0,111	0,120	0,129	0,149	0,163	0,166
	5	Ap max	0,2–0,3	45	165	fz	0,091	0,099	0,108	0,116	0,135	0,150	0,155
M	1	Ap max	0,2–0,3	67,5	189,75	fz	0,112	0,124	0,135	0,145	0,169	0,187	0,193
	2	Ap max	0,2–0,3	45	132	fz	0,091	0,099	0,108	0,116	0,135	0,150	0,155
	3	Ap max	0,2–0,3	45	115,5	fz	0,076	0,084	0,090	0,096	0,110	0,120	0,121
S	1	Ap max	0,2–0,3	37,5	148,5	fz	0,112	0,124	0,135	0,145	0,169	0,187	0,193
	2	Ap max	0,2–0,3	37,5	148,5	fz	0,112	0,124	0,135	0,145	0,169	0,187	0,193
	3	Ap max	0,2–0,3	18,75	66	fz	0,060	0,066	0,071	0,077	0,090	0,100	0,104
	4	Ap max	0,2–0,3	37,5	99	fz	0,079	0,092	0,099	0,107	0,124	0,138	0,142
H	1	Ap max	0,2–0,3	60	231	fz	0,101	0,111	0,120	0,129	0,149	0,163	0,166
	2	Ap max	0,2–0,3	52,5	198	fz	0,076	0,084	0,090	0,096	0,110	0,120	0,121

NOTE: Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.
Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.
Above parameters are based on ideal conditions.
For smaller taper machining centres, please adjust parameters accordingly on >12mm diameter.



FSDE 15-Flute End Mill

CHALLENGE

- Finishing contour milling on aerospace part with interrupted cut.
- Depth of cut: 40mm.
- Titanium alloy R56400.
- External emulsion.

SOLUTION

- RSM II multi-flute cutter with KC643M™.
- Ø 20mm with 15 effective cutting edges and 4mm radius.

CUTTING DATA

- vc 70 m/min
- fz 0,07mm/Z
- ap 40mm
- ae 0,3mm

RESULT

- 3.75 times longer tool life compared to competitor solution.

BENEFIT

- Machining time reduction of 46%.
- Metal removal rate increase of 87%.

FSDE 11-Flute End Mill

CHALLENGE

- Finishing long channel on aerospace frame part.
- Depth of cut: 39mm.
- Titanium alloy.
- External emulsion.

SOLUTION

- RSM II multi-flute cutter with KC643M.
- Ø 15.875mm with 11 effective cutting edges and 0.762mm radius.

CUTTING DATA

- vc 130 m/min
- fz 0,05mm/Z
- ap 39,37mm
- ae 0,03mm

RESULT

- 2.5 times higher feed rates compared to initial solution.

BENEFIT

- Machining time reduction of 60%.
- Metal removal rate increase of 150%.

(continued)

(Application Examples — continued)



FSDE 15-Flute End Mill

- CHALLENGE**
- Finishing external profile.
 - Depth of cut: 20mm.
 - Titanium alloy 6Al4V.
 - External emulsion.

- SOLUTION**
- RSM II multi-flute cutter with KC643M™.
 - Ø 20mm with 15 effective cutting edges and 4mm corner radius.

- CUTTING DATA**
- vc 150 m/min
 - fz 0,06mm/Z
 - ap 20mm
 - ae 0,6mm

- RESULT**
- 50% tool life increase.
 - 3x cutting speed.
 - Nearly 8x the feed rates.

- BENEFIT**
- Machining time reduction of 81% from 43.1–8.4 min vs competitor solution.
 - Metal removal rate increase of 360% vs competitor solution.

FSDE 19-Flute End Mill

- CHALLENGE**
- Finishing external profile.
 - Depth of cut: 20mm.
 - Titanium alloy 6Al4V.
 - External emulsion.

- SOLUTION**
- RSM II multi-flute cutter with KC643M.
 - Ø 25mm with 19 effective cutting edges and 1mm corner radius.

- CUTTING DATA**
- vc 150 m/min
 - fz 0,06mm/Z
 - ap 20mm
 - ae 0,6mm

- RESULT**
- 50% tool life increase.
 - 3x cutting speed.
 - Nearly 8x the feed rates.

- BENEFIT**
- Machining time reduction of 81% from 43.1–8.3 min vs competitor solution.
 - Metal removal rate increase of 366% vs competitor solution.

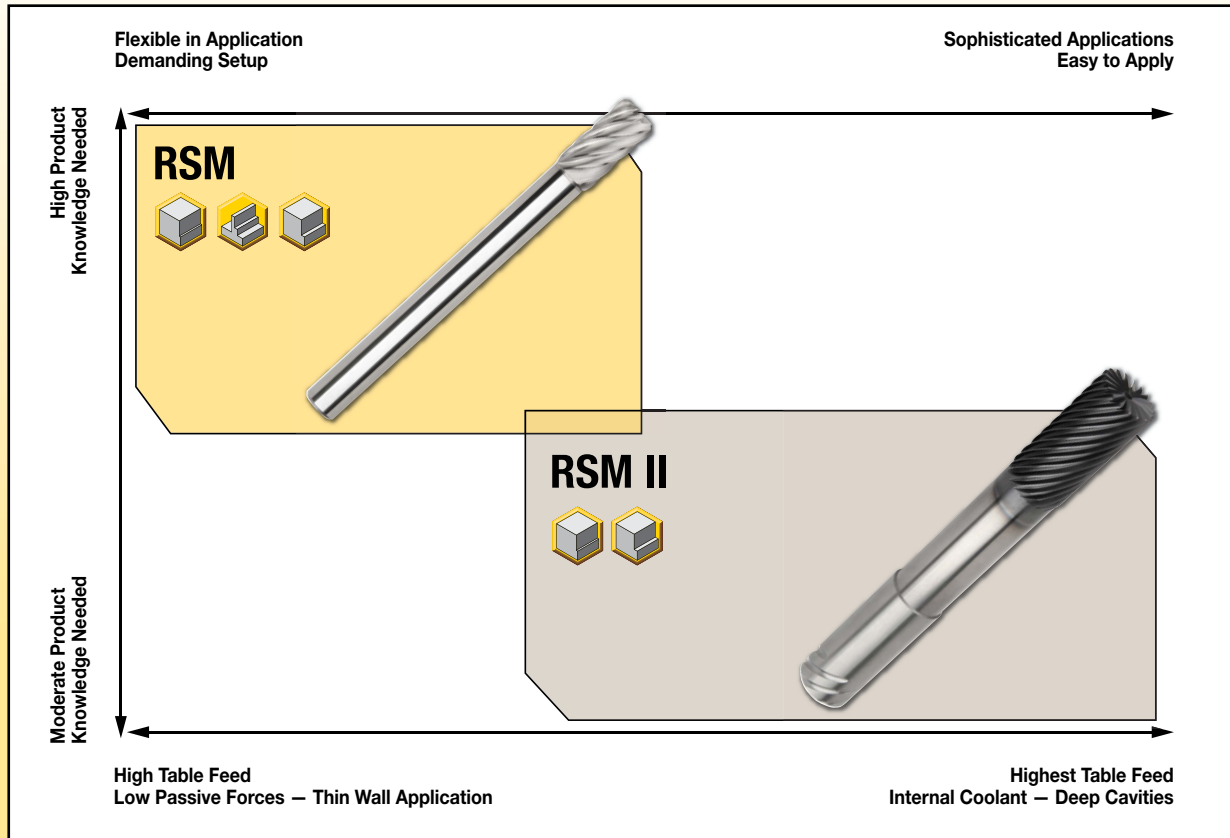
High-Performance Solid Carbide End Mills

Application Information



Materials to Cut	• Titanium and titanium alloys. • Nickel-based alloys. • Cobalt-based alloys. • Steels (P4–P5). • Stainless steels (M2–M3). • Hardened steels (H1).
Cutting Speed	• Refer to application data recommendation. • Highly dynamic machines recommended.
Feed Rate	• Refer to application data recommendation. • Highly dynamic machines recommended. • High-speed peel milling strategies require control of adequate feed rates.
Depth of Cut	• High-speed peel milling requires small depth of cut (approximately 5% of diameter) not exceeding 1mm.
Coolant	• Internal coolant for machining cavities. • External coolant for peripheral milling.
Adaptation	• HydroForce™ with or without sleeve is preferred clamping. • Shrink Fit adaptation is preferred as alternate recommendation. • High-Performance Milling Chucks (HPMC) are applicable. • Collect chucks are not recommended due to high runout.
Roughing Application	• Not recommended.
Finishing Application	• Finishing and semi-finishing.
Milling Strategy	• Peel milling strategies are recommended. • Trochoidal milling is not required for this tool.
Applications	• Shoulder milling. • Shoulder milling and fine finishing. • Peel milling and HPC techniques. • Non-centre cutting. • No ramping and helical interpolation.
Corner Machining	• Pre-mill corner pocket to leave appropriate depth-of-cut for finishing application. • Use RSM with depth-of-cut at approximately 5% of diameter and below 1mm. • RSM II tool radius shall be smaller than final corner radius.
Engineered Solutions	• Available upon request.
Reconditioning Service	• Available with standard Kennametal reconditioning procedures. • Check services under Kennametal website for detailed information.

■ Scope of Application for Multi-Flute Cutters



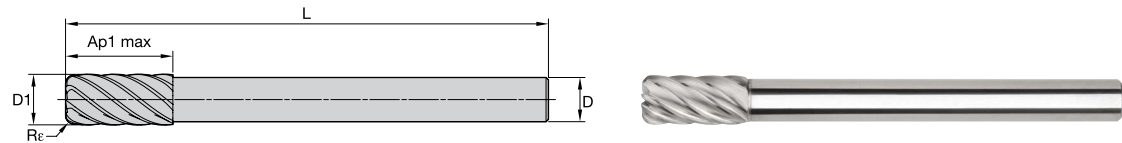
Application Information	RSM	RSM II
Primary Target Material	• Titanium • Titanium alloys	• Titanium • Titanium alloys
Applications	• Shoulder milling • HPC techniques	• Shoulder milling • Fine finishing • Peel milling
Primary Scope of Application	• Thin walls • External walls	• Deep cavities • Internal walls • External walls
Shank Style	• Plain	• SAFE-LOCK® • Plain
Internal Coolant	• No	• Yes
Variable Helix	• Yes — 35°/38°	• No — 36°
Unequal Flute Space	• No	• Yes

High-Performance Solid Carbide End Mills • RSM

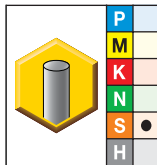
RSM • Multi-Flute Reduced Shank Mill • Metric



- Kennametal standard dimensions.
- Non-centre cutting.
- Optimised geometry for titanium machining.
- Variable helix design minimises chatter for smoother machining.
- Reach optimised for machining deep cavities.



RSM • Reduced Shank Mill • Metric



SU4000	D1	D	Ap1 max	L	Re	Z
RSM100LM6X-E	10,00	9,00	20,00	125,00	0,50	6
RSM100LM6X-G	10,00	9,00	20,00	125,00	1,00	6
RSM100LM6X-K	10,00	9,00	20,00	125,00	2,00	6
RSM100LM6X-M	10,00	9,00	20,00	125,00	3,00	6
RSM120LM6X-E	12,00	10,00	24,00	125,00	0,50	6
RSM120LM6X-G	12,00	10,00	24,00	125,00	1,00	6
RSM120LM6X-K	12,00	10,00	24,00	125,00	2,00	6
RSM120LM6X-M	12,00	10,00	24,00	125,00	3,00	6
RSM160LM6X-G	16,00	14,00	32,00	150,00	1,00	6
RSM160LM6X-K	16,00	14,00	32,00	150,00	2,00	6
RSM160LM6X-M	16,00	14,00	32,00	150,00	3,00	6
RSM160LM6X-P	16,00	14,00	32,00	150,00	4,00	6
RSM160LM8X-G	16,00	14,00	32,00	150,00	1,00	8
RSM160LM8X-K	16,00	14,00	32,00	150,00	2,00	8
RSM160LM8X-M	16,00	14,00	32,00	150,00	3,00	8
RSM160LM8X-P	16,00	14,00	32,00	150,00	4,00	8
RSM200LM6X-G	20,00	18,00	39,00	160,00	1,00	6
RSM200LM6X-K	20,00	18,00	39,00	160,00	2,00	6
RSM200LM6X-M	20,00	18,00	39,00	160,00	3,00	6
RSM200LM6X-P	20,00	18,00	39,00	160,00	4,00	6
RSM200LM6X-Q	20,00	18,00	39,00	160,00	5,00	6
RSM200LM8X-G	20,00	18,00	39,00	160,00	1,00	8
RSM200LM8X-K	20,00	18,00	39,00	160,00	2,00	8
RSM200LM8X-M	20,00	18,00	39,00	160,00	3,00	8
RSM200LM8X-P	20,00	18,00	39,00	160,00	4,00	8
RSM200LM8X-Q	20,00	18,00	39,00	160,00	5,00	8

End Mill Tolerances

D1	tolerance e8	D	tolerance h6 + / -
≤3	-0,014/-0,028	≤3	+0/-0,006
>3-6	-0,020/-0,038	>3-6	+0/-0,008
>6-10	-0,025/-0,047	>6-10	+0/-0,009
>10-18	-0,032/-0,059	>10-18	+0/-0,011
>18-30	-0,040/-0,073	>18-30	+0/-0,013

RSM • Reduced Shank Mill

Material Reference Chart and Recommended Surface Speeds				
	Commercial Name	Hardness HRB HRC HB	Metric	
			vc min (m/min)	vc max (m/min)
S4	Ti-5Al-2.5Sn	HRC36	60	120
	Ti-6Al-4Zr-2Mo-2Sn	HRC28	60	130
	Ti-6Al-4Zr-2Mo-2Sn-0.2Si	HRC28	60	130
	Ti-8Al-1Mo-1V	HRC35	60	120
	Ti-11.5Mo-6Zr-4.5Sn	—	35	70
	Ti-13V-11Cr-3Al	—	35	70
	Ti-3Al-8V-6Cr-4Mo-4Zr	HRC32	35	70
	Ti-8Mo-8V-2Fe-3Al	—	35	70
	Ti-13V-11Cr-3Al	HRC40	30	60
	Ti 10.2.3	HRC35	25	60
	Ti-15Mo	HRC24	50	105
	Ti-15-333	HRC32	35	70
	Ti 45Nb	—	45	95
	5Al-5V-5Mo-3Cr	HRC40	30	60
	Ti-425	HRC36	30	60
	Ti-6Al-4V	HRC30-34	60	120
	Ti-6Al-4V	HRC35-39	55	110
	Ti-6Al-5Zr-0.5Mo-0.25Si	—	50	105
	Ti-6Al-5Zr-4Mo-Cu-0.2Si	—	50	105
	Ti-6Al-6V-2Sn	HRC35	50	110
	Ti-7Al-4Mo	—	50	105
	3-2.5	HRC24	60	130
	6-4ELI	HRC32	60	125
	6-2-4-6	HRC36	55	110
	Ti-17	HRC38	55	110
	Ti-4Al-4Mo-2Sn-0.5Si	HRC35	50	105
	Ti-4Al-4Mo-4Sn-0.5Si	—	50	105
	Ti 99.5	HRB100	90	185
	Ti 99.6	HRB90	95	205
	Ti 99.7	HRB80	105	220
	Ti 99.8	HRB70	115	240

Product		Dimensions (metric)													
Description	diameter	Profiling								Facing					
		ae min (mm)	ae max (mm)	ap min (mm)	ap max (mm)	for ae min fz min (mm/z)	for ae min fz max (mm/z)	for ae max fz min (mm/z)	for ae max fz max (mm/z)	ae min (mm)	ae max (mm)	ap min (mm)	ap max (mm)	fz min (mm/z)	fz max (mm/z)
RSM100..	10,00	0,17	0,67	10,30	13,00	0,078	0,195	0,040	0,100	Radius +0,5	7,5	0,2	Radius +0,5	0,02	0,057
RSM120..	12,00	0,20	0,80	12,80	15,60	0,078	0,195	0,040	0,100		9				
RSM160..	16,00	0,27	1,07	17,80	20,80	0,078	0,195	0,040	0,100		12				
RSM160..	16,00	0,20	0,80	12,00	20,80	0,090	0,225	0,046	0,115		12				
RSM200..	20,00	0,33	1,33	23,00	26,00	0,078	0,195	0,040	0,100		15				
RSM200..	20,00	0,25	1,00	16,00	26,00	0,090	0,225	0,046	0,115		15				
RSM250..	25,00	0,31	1,25	20,50	32,50	0,090	0,225	0,046	0,115		18,75				
RSM250..	25,00	0,25	1,00	15,50	32,50	0,101	0,251	0,051	0,128		18,75				



CRSM 8-Flute End Mill	CRSM 8-Flute End Mill
CHALLENGE • Full slotting on medical part. • Depth of cut: 25.4mm. • Aluminium 6061. • External emulsion.	CHALLENGE • Peel milling aerospace part. • Depth of cut: 25.4mm. • Titanium 5.5.5.3. • External emulsion.
SOLUTION • CRSM multi-flute cutter with SU4000. • Ø 25.4mm with 8 effective cutting edges and 2.3mm corner radius.	SOLUTION • CRSM multi-flute cutter with SU4000. • Ø 31.75mm with 8 effective cutting edges.
CUTTING DATA • vc 190 m/min • fz 0,03mm/Z • ap 25,4mm • ae 25,4mm	CUTTING DATA • vc 63 m/min • fz 0,13mm/Z • ap 25,4mm • ae 0,51mm
RESULT • Same surface quality with significantly reduced cost per part.	RESULT • Significant increase in tool life.
BENEFIT • Tool cost reduction of 65%. • >90% machining time reduction.	BENEFIT • No wear after 150m cutting. • Material 5.5.5.3.

(continued)

(Application Examples — continued)



CRSM 8-Flute End Mill

CHALLENGE

- Peel milling aerospace part.
- Depth of cut: 30mm.
- Titanium.
- External emulsion.

SOLUTION

- RSM multi-flute cutter with SU4000.
- Ø 32mm with 8 effective cutting edges.

CUTTING DATA

- vc 90 m/min
- fz 0,12mm/Z
- ap 30mm
- ae 0,51mm

RESULT

- 2.3 times the feed rate over the competition.

BENEFIT

- Increased MRR of 130% vs the competition.
- Material 5.5.5.3.

INNOVATIONS CATALOGUE

WORLD AND CORPORATE HEADQUARTERS

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