

INNOVATIONS **MASTER CATALOGUE**

Beyond™ EADE Solid
Ceramic End Mills
2014





Beyond™ EADE Solid Ceramic End Mill

Primary Application

EADE Solid Ceramic End Mills offer higher productivity and tool life in roughing nickel-based high-temperature alloys. Beyond™ grade KYS40™ delivers best-in-class tool life and exceptionally high Metal Removal Rates (MRR) surpassing those of other solutions in the market today.

- Outstanding reduction of machining time.
- Less tool changes due to higher tool life.
- Benefit from throw-away type of tooling.

Features and Benefits

Advanced Technology

- KYS40 Beyond grade solid SiAlON ceramic designed for machining nickel-based high-temperature alloys.
- Cutting speeds up to 1000 m/min (3300 SFM) increase Metal Removal Rate (MRR).
- Tool life 5x that of carbide.

Extensive Standard Offering

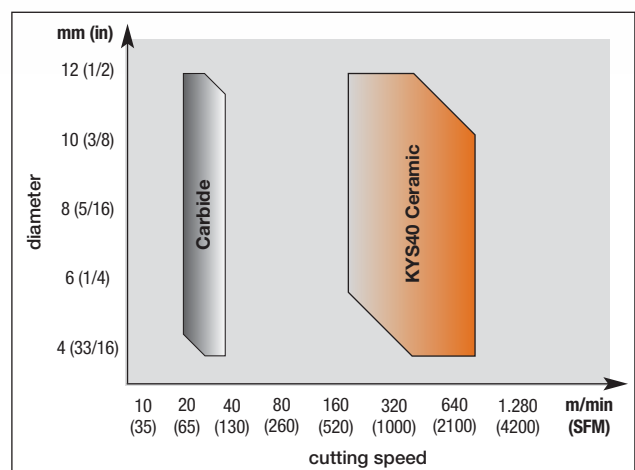
- 4-flute tooling for pocketing and slotting. Undersize end mills leaving stock for finishing operations.
- 6-flute tooling for face milling and profiling.

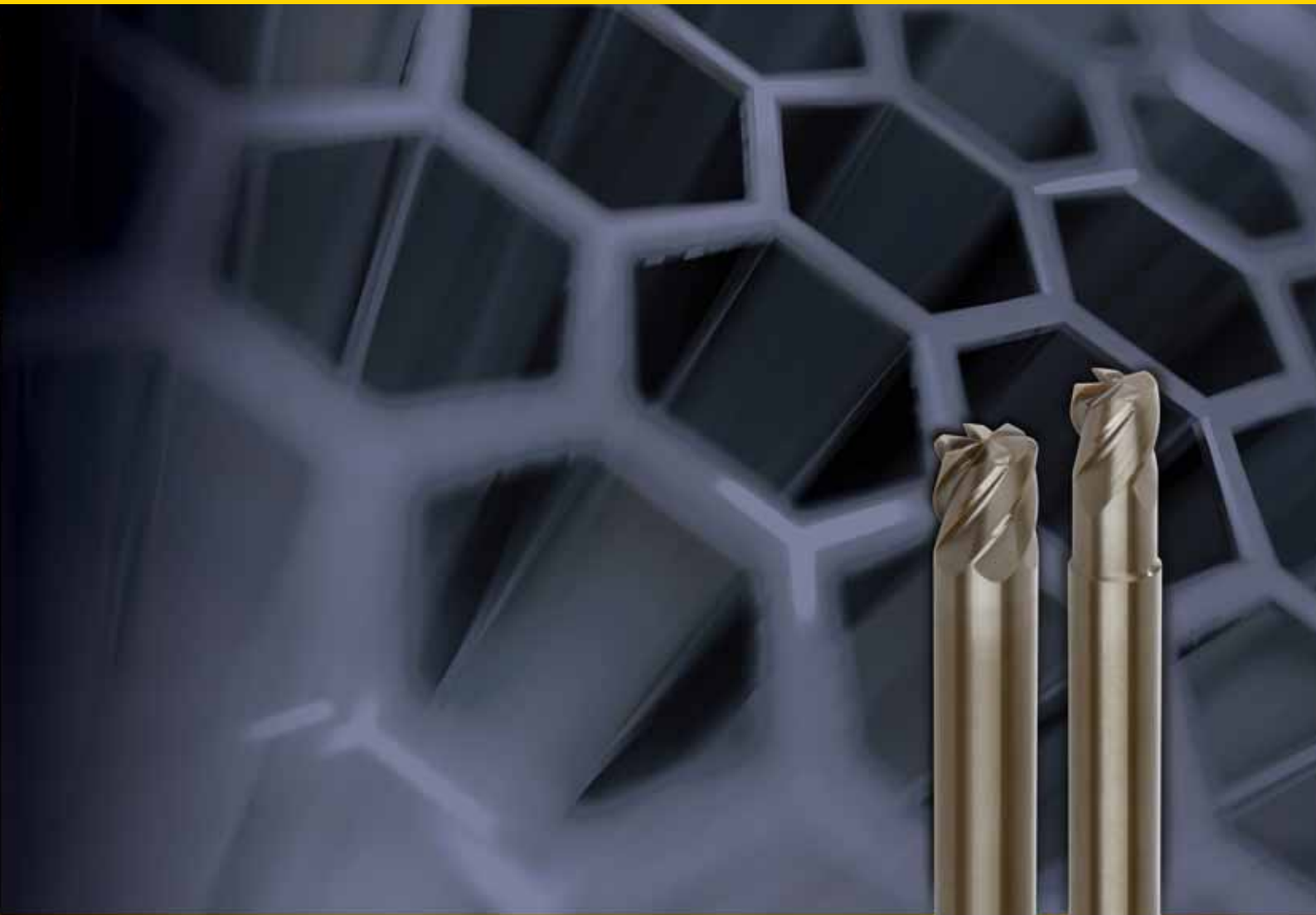
Customisation

- Engineered solutions are available upon request.

Highest Cutting Speed Capability

- Increase compared to carbide.





Ceramic optimised end geometry

Increase in shearing action.
Improved corner stability.

Enlarged core design

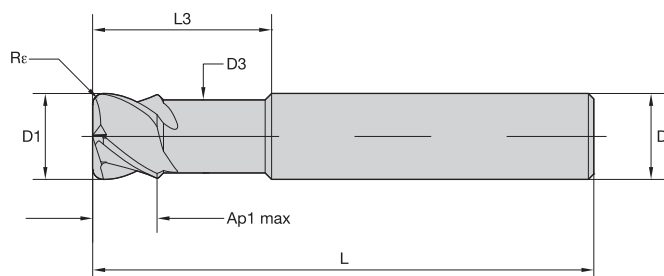
Increasing tool rigidity for less deflection.

40° helix angle
Improves chip evacuation.

KYS40™ Beyond™ grade
Enables highest cutting speeds.



- Kennametal standard dimensions.
- Non-centre cutting.
- Optimised geometry for roughing nickel-based high-temperature alloys.

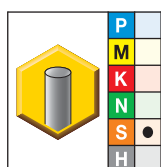


End Mill Tolerances

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



EADE • 4-Flute with Neck • Metric



KYS40

● first choice

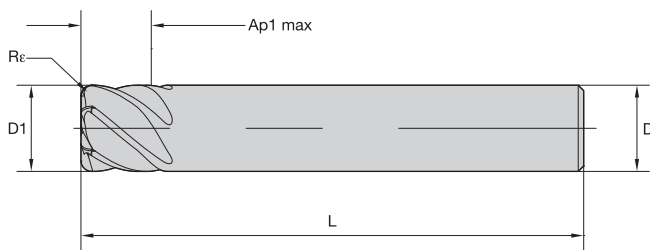
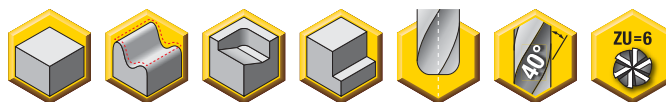
○ alternate choice

	D1	D	D3	Ap1 max	L	L3	Re
EADE0380A4AQE	3,80	6,00	3,65	3,00	50,00	8,00	0,50
EADE0400A4AQE	4,00	6,00	3,84	3,00	50,00	8,00	0,50
EADE0570A4AQF	5,70	6,00	5,47	4,50	50,00	12,00	0,75
EADE0600A4AQF	6,00	6,00	5,76	4,50	50,00	12,00	0,75
EADE0760A4AQG	7,60	8,00	7,30	6,00	57,00	16,00	1,00
EADE0800A4AQG	8,00	8,00	7,68	6,00	57,00	16,00	1,00
EADE0950A4AQH	9,50	10,00	9,12	7,50	63,00	20,00	1,25
EADE1000A4AQH	10,00	10,00	9,60	7,50	63,00	20,00	1,25
EADE1140A4AQJ	11,40	12,00	10,94	9,00	70,00	24,00	1,50
EADE1200A4AQJ	12,00	12,00	11,52	9,00	70,00	24,00	1,50

NOTE: For application data, see page 6.

For full slotting, profiling, and 3D-milling, do not exceed 0,5mm of Ap1 max.

- Kennametal standard dimensions.
- Non-centre cutting.
- Optimised geometry for roughing nickel-based high-temperature alloys.

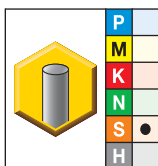


End Mill Tolerances

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



EADE • 6-Flute • Metric



KYS40

	D1	D	Ap1 max	L	Rε
EADE0400A6ARE	4,00	6,00	3,00	50,00	0,50
EADE0600A6ARF	6,00	6,00	4,50	50,00	0,75
EADE0800A6ARG	8,00	8,00	6,00	57,00	1,00
EADE1000A6ARH	10,00	10,00	7,50	63,00	1,25
EADE1200A6ARJ	12,00	12,00	9,00	70,00	1,50



● first choice

○ alternate choice

NOTE: For application data, see page 6.

For face milling, profiling, and 3D-milling, do not exceed 0,5mm of Ap1 max.

4-Flute • Metric

Material Group											
	Side Milling (A) and Slotting (B)										
	A		B	KYS40		Feed per Tooth					
				Cutting Speed —vc m/min		D1 — Diameter					
	ap	ae	ap	min	max	mm	4,0	6,0	8,0	10,0	12,0
S	3	Ap1 max	0,1 x D*	250	1000	fz	0,020	0,024	0,028	0,030	0,032

* For above cutting data, do not exceed an overall ae of 1mm.

6-Flute • Metric

Material Group											
	Side Milling (A) and Profiling										
	A		KYS40		Feed per Tooth						
			Cutting Speed — vc m/min			D1 — Diameter					
	ap	ae	min	max	mm	4,0	6,0	8,0	10,0	12,0	
S	3	Ap1 max	0.01 x D*	250	1000	fz	0.020	0.024	0.028	0.030	0.032

* For above cutting data, do not exceed an overall ae of 1mm.

INTRODUCING

The New Kennametal Innovations iPad™ Application



Available as a **Free Download** from the iTunes™ App Store.



Now Available

The “Kennametal Innovations” iPad™ app features interactive, cutting-edge animations and real-world demonstrations of Kennametal’s productivity-enhancing technologies for machining and industrial processes. With selectable data, it is quick and convenient to compare complimenting and competitive products.

Easy to Download

Go to the iTunes™ App Store, and search for “Kennametal”. Then follow the directions on downloading. It’s simple, fast, and free.

Easy to Use

The simple navigation makes it easy to search via keywords to find specific tooling solutions and product groups. The user-driven navigation map offers drop-down menus with supplemental information, including expandable, and customisable, charts and graphs.



EADE 4-Flute End Mill

- Roughing a slot at turbine blade.
- Depth of slot 22mm (.866").
- INCONEL® 718 material.
- Dry machining.

CHALLENGE

- Engineered solution EADE KYS40™ ceramic end mill with extended neck.
- Ø 11,4mm (.315") with 4 effective cutting edges and 1,5mm (.059") corner radii.

SOLUTION

- vc 800 m/min (2625 SFM)
- fz 0,03 mm/z (.0012 IPT)
- ap 0,5mm (.0197")
- ae 11,4mm (.866")

CUTTING DATA

- Customer proprietary information.

RESULT

- Machining time of 1 minute 54 seconds for one slot only.
- Metal Removal Rate of 15 cm³/min consistently achieved.
- Productivity significantly increased.

BENEFIT

EADE 4-Flute End Mill

- Rough profiling of small turbine blades.
- INCONEL 718 material.
- Dry machining.

CHALLENGE

- Standard EADE KYS40 ceramic end mill.
- Ø 11,4mm (.315") with 4 effective cutting edges and standard neck.

SOLUTION

- vc 645 m/min (2116 SFM)
- fz 0,03 mm/z (.0012 IPT)
- ap 0,5mm (.0197")
- ae 11,4mm (.866")

CUTTING DATA

- 3x tool life compared to 2x tool life with competitive solution in less time.

RESULT

- 3x higher productivity as a result of increased cutting data.
- 50% higher tool life compared to competitive carbide end mill.

BENEFIT



EADE 6-Flute End Mill

- Rough profiling of aerospace parts.
- Haynes™ 288 and INCONEL® 718 material.
- Dry machining.

CHALLENGE

- Standard EADE KYS40™ ceramic end mill.
- Ø 10mm (.394") with 6 effective cutting edges.

SOLUTION

- vc 462 m/min (1516 SFM)
- fz 0,03 mm/z (.0012 IPT)
- ap 0,5–1mm (.0197–.0394")
- ae varying

CUTTING DATA

- Customer proprietary information.

RESULT

- Machining time reduced.
- Productivity significantly increased.

BENEFIT

EADE 6-Flute End Mill

- Rough profiling of blisk (blade integrated disc).
- INCONEL 718 material (42 HRC).
- Compressed air coolant.

CHALLENGE

- Standard EADE KYS40 ceramic end mill.
- Ø 12mm (.472") with 6 effective cutting edges.

SOLUTION

- vc 679 m/min (2228 SFM)
- fz 0,03 mm/z (.0012 IPT)
- ap varying up to 0,5mm (.0197")
- ae varying

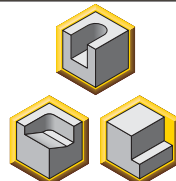
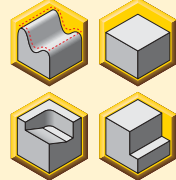
CUTTING DATA

- 2 blisk segments machined with one tool.
- 12 minute machining time per segment.

RESULT

- Unprecedented reduction in machining time.

BENEFIT

Materials to Cut	<ul style="list-style-type: none"> • Nickel-based high-temperature alloys. • Cobalt-based alloys after consulting technical assistance. • P6 and M1-3 stainless steels after consulting technical assistance. • Titanium after consulting technical assistance. • Do not apply on iron-based high-temperature alloys. 	P6
		M1
		M2
		M3
		S3
Cutting Speed	<ul style="list-style-type: none"> • Maximum RPM machine can provide recommended cutting speed: 250–1000 m/min (825–3300 SFM). • Highly dynamic machines recommended. • Use of spindle speeders applicable (no wet coolant). 	
Feed Rate	<ul style="list-style-type: none"> • Refer to cutting data recommendation. • General starting condition fz 0,03mm/Z (.0012 IPT). 	
Depth of cut	<ul style="list-style-type: none"> • Refer to cutting data recommendation. • General starting condition ap 0,5mm (.0197"). 	
Coolant	<ul style="list-style-type: none"> • Power cool nozzle preferred to flush chips away. • Pressurized air applicable. • Minimal Quantity Lubrication (MQL) and dry applicable. • No coolant with emulsion or oil due to thermal shock. 	
Adaptation	<ul style="list-style-type: none"> • Hydraulic chuck with or without sleeve preferred. • Collet or milling power chucks applicable. • Balancing at 25,000 RPM (2,5G) preferred. • Shrink adaptation not recommended. 	
Roughing Application	Yes	
Finishing Applications	No	
Milling Strategy	<ul style="list-style-type: none"> • Conventional milling preferred at lower speeds. • Climb milling preferred at higher speeds. 	
4-Flute EADE	<ul style="list-style-type: none"> • Slotting and pocketing. • Common sizes and undersize leaving finishing stock. • Side milling possible up to ap max with increased feed. • Non-centre cutting. • Ramping and helical interpolation possible under 2.5°. 	
6-Flute EADE	<ul style="list-style-type: none"> • Profiling and face milling. • Non-centre cutting. • Side milling possible up to ap max with increased feed. • Ramping and helical interpolation possible under 2°. 	
Engineered Solutions	Available upon request	
Reconditioning Service	Not applicable	

■ Wear Indication

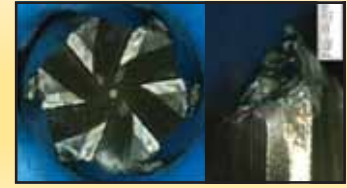
New



Used



End of Tool Life



Wear rate 0,48mm (.019")
Still good to use.

Wear rate 1,4mm (.055")
End of tool life reached.

■ Chip Formation

Carbide



Regular curled chips. Shape and length depending on end mill geometry and cutting data.

Ceramic



Chips are nearly like dust. Pressurized air coolant recommended to blow away chips.

■ Causes of and Remedies for End Milling Problems

problem	cause	remedy
Excessive bur formation	<ul style="list-style-type: none"> Softness of material to cut. Excessive wear on radii. 	<ul style="list-style-type: none"> Use undersize end mills that leave stock for finishing operation. Replace tool as end of tool life reached. Check tool runout.
Sudden breakage	<ul style="list-style-type: none"> Vibration of the workpiece. Unstable tool clamping. Use of 6-flute tooling in slotting. 	<ul style="list-style-type: none"> Check workpiece and tool clamping. Use of 4-flute EADE recommended.
Chips sticking	<ul style="list-style-type: none"> Lack of cutting speed. 	<ul style="list-style-type: none"> Increase cutting speed.
Chipping	<ul style="list-style-type: none"> Unstable tool and/or workpiece clamping. Initial cutting speed too high. 	<ul style="list-style-type: none"> Check workpiece and tool clamping. Reduce cutting speed during initial cut and increase as cutting continues.
Thermal cracks	<ul style="list-style-type: none"> Wet coolant. 	<ul style="list-style-type: none"> Do not use wet coolant.

INNOVATIONS **MASTER CATALOGUE**

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