

# Solid End Milling • High-Performance Solid Carbide End Mills

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	*Beyond™ grade	series	D1 diameter (mm)	length of cut	flute Z	helix	internal coolant
HARVI™ I*		F4AS...DL	4–25	1,8–3 x D1			
HARVI I		UADE	4–25	3–4 x D			
HARVI I*		F4AS..WM-WX-WL/UBDE	6–25	2–2,5 x D1			
HARVI I Chipbreaker*		F4BS..WM-WX-WL	6–25	1,5 x D1			
HARVI I Extended Reach		UADE	6–20	2 x D1			
HARVI I Ball Nose*		F4AW..WL-WX	6–16	1 x D1			
HARVI I Taper Ball Nose		F4AW..AWL38-AWX38	4–16	5–7 x D			
XE		XE	2–20	2–2,5 x D1			
XER		XER	2–20	2 x D			
HARVI II*		UCDE	4–25	1,8–2,7 x D1			
HARVI II		UDDE	6–25	1,8–2,2 x D1			
HARVI II LONG		UGDE	6–25	3 x D			
HARVI II LONG		UGDE	6–25	5 x D			
HARVI II Trochoidal		TCDE	8–25	3 x D			
HARVI III		UJDE	10–25	2 x D			
HARVI III		UJDE	10–25	3 x D			
HARVI III Ball Nose		UJBE	10–20	1 x D1			
HARVI III Taper Ball Nose		UJBE	4–10	5–6 x D			
HP Rougher*		F3BH-F4BJ-F6BJ...WS-WM-WL-WX	4–25	1,8–2,7 x D1			
HP Rougher*		F3BH-F4BJ...WS-WM-WL-WX	8–20	1,3–1,9 x D1			
HP Rougher		RUDC	4–25	2 x D			
HP Rougher*		F3BH...DL	4–25	1,8–2 x D1			
HP Rougher*		F3BS..DK-DL	6–20	1–1,6 x D1			
HP Rougher*		F4BJ...DL	6–20	1,9–2,2 x D1			
HP Rougher*		F4BJ-F6BJ...DL	6–25	1,8–2,1 x D1			
RSM II Short		FSDE	10–25	2 x D			
RSM II with neck		FSDE	6–25	2 x D			
HP Finisher*		F3AS...DK	3–20	1–1,3 x D1			
HP Finisher		F3AW...WL-WX	6–16	1 x D1			
HP Finisher*		F8AJ-F10AJ...DK	8–20	1 x D1			
HP Finisher*		F6AJ-F8AJ...DL	6–25	2–3 x D1			
Aluminium MaxiMet™		ABDF	1,5–20	1,9–4 x D1			
Aluminium MaxiMet		ABDE	3–20	1,9–4 x D1			
Aluminium MaxiMet		ABDE	6–25	1,5 x D1			
Aluminium		F1AA	2–12	2–3 x D			
Aluminium		F2AA...DL	4–20	1,6–2 x D7			

						shank		centre cutting	neck	P	M	K	N	C	S	H						product page(s)	cutting data page(s)	
				✓				✓		●	●	●			○								P16	P23
			✓					✓	✓	●	●	●			○								P17	P23
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			✓					✓	✓	●	●	●			○								P20	P25
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			✓							○	●				●	○							P42	P43-P44
		✓	✓					✓		○	●				●	○							P48	P50
		✓	✓					✓	✓	○	●				●	○							P49	P51
					✓					○	●				●	○							P54	P58-P59
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			✓							●	●	●			○								P105	P107
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		✓						✓				●											P111	P114
				✓				✓	✓			●											P112-P113	P114
			✓					✓				●											P118	P126
		✓						✓				●											P119	P126

● first choice  
○ alternate choice

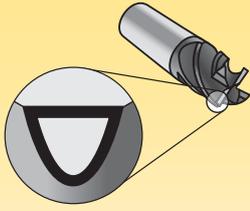
(continued)

(High-Performance Solid Carbide End Mills — continued)

<b>beyond</b>	*Beyond™ grade		series	D1 diameter (mm)	length of cut	flute Z	helix	internal coolant	
Aluminium		F2AA... WM-WL-WX	6–25	1,5 x D1					
Aluminium		F3AA... WS-WM-WL-WX	3–20	1,9–4 x D7					
Aluminium		F3AA... WS-WM-WL-WX	6–25	1,5 x D1					
Aluminium		F3BA... WS-WM-WL-WX	6–25	1,8–2,1 x D1					
Aluminium		F3BA... WS-WM-WL-WX	8–25	1,8–2 x D1					
Aluminium		F3BA...DL	6–20	1,2 x D1					
CFRP*		CCNC	6–12	3 x D1					
CFRP*		CDDC	6–12	3 x D1					
CFRP*		CBDB	6–12	3 x D1					
KenFeed™		KHDA	6–20	—					
KenFeed		KMDA	6–20	—					
Hard Steels		F2AT...WM-WL-WX	2–12	1 x D1					
Hard Steels		F4AT... WS-WM-WL-WX	4–12	1 x D1					
Hard Steels		F4AJ-F5AJ... WS-WM-WL-WX	6–25	1,5 x D1					
Hard Steels		F4AJ-F5AJ-F6AJ WS-WL-WX	6–25	1,5 x D1					
Hard Steels		F6AV-F8AV...DL	6–25	2,2–3 x D1					
Hard Steels Ball Nose		F2AL... WL-WM-WX	2–12	1 x D1					
Hard Steels Ball Nose		F2AL... WL-WM	1–16	1 x D1					
Hard Steels Ball Nose		F2AL... WL-WM-WX	6–16	1 x D1					
Hard Steels Ball Nose		F2AB... WL-WM-WX	2–12	0,5 x D1					
Hard Steels Ball Nose		F4AL... WL-WM-WX	3–10	1,2–1,5 x D1					
Micro		F2AH...WS-WM	0,3–2,5	—					
Micro		F2AH...WS	0,3–2,5	—					
Micro		F3AH...WS	0,4–3	—					
Micro		F2AL...WS	0,5–3	—					
Micro		F2AL...WS	0,5–3	—					
Micro		F2AL...WM	0,5–4	—					
Ceramic Rougher		EADE	4–25	0,75 x D1					
Ceramic Rougher		EADE	4–25	0,75 x D					
HP Finisher		F2AU...DK	1,8–19,7	1 x D1					
HP Finisher		F3AU...DK	2,8–19,7	1–1,3 x D1					
G0mill™		UEDE	2–12	1,2–2 x D1					
G0mill		UEDE	4–12	1,2–1,7 x D1					
G0mill		UEBC	2–12	1,2–2 x D1					
G0mill		UEBE	2–12	1,2–2 x D1					

							shank	centre cutting	neck	P	M	K	N	C	S	H							product page(s)	cutting data page(s)
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		✓						✓						•			✓	✓	✓	✓		✓	P121	P126
					✓			✓	✓					•			✓	✓	✓	✓			P122	P127
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					✓					•	•	•			•	○	✓	✓	✓	✓			P192	P196
					✓					•	•	•			•	○	✓	✓	✓	✓			P193	P196
					✓					•	•	•			•	○	✓	✓			✓		P194	P197
					✓					•	•	•			•	○	✓	✓			✓	✓	P195	P197

• first choice  
○ alternate choice



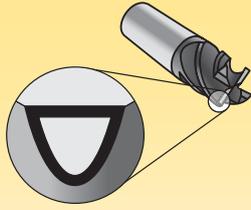
Coatings provide high-speed capability and are engineered for roughing to finishing.

<b>P</b>	Steel
<b>M</b>	Stainless Steel
<b>K</b>	Cast Iron
<b>N</b>	Non-Ferrous
<b>S</b>	High-Temp Alloys
<b>H</b>	Hardened Materials
<b>C</b>	CFRP Materials

wear resistance ← → toughness

Grades

Coating	Grade Description		05	10	15	20	25	30	35	40	45	
<b>KG00</b>	Carbide grade made from high-quality, micrograin materials for cutting all types of workpiece materials. Very high toughness ensures a controlled wear rate. The micrograin structure enables extremely sharp cutting edges.											
		<b>N</b>										
<b>KCPM15</b>	Coated carbide grade with thick PVD coating and optimised chemistry and process for increased wear resistance. Outstanding protection in milling stainless steel to mitigate crater, DOCN (depth-of-cut notching), and flank wear. Excellent performance up to 52 HRC.	<b>P</b>										
		<b>M</b>										
		<b>K</b>										
<b>KC643M</b>	Coated fine-grain grade with PVD multilayer (AlTiN). KC643M™ is a very thin and hard PVD coating particularly suited for cutting steel, cast iron, stainless steel (wet), and titanium (wet). This grade can be used for materials with hardness up to 52 HRC.	<b>P</b>										
		<b>M</b>										
		<b>K</b>										
		<b>S</b>										
<b>KC637M</b>	Coated, tough, wear-resistant carbide grade with hard PVD coating, particularly suitable for machining steels above 48 HRC.											
		<b>S</b>										
		<b>H</b>										
<b>KC635M</b>	Coated carbide grade with TiAlN coating. KC635M is a high-performance grade for higher speeds and is the first choice for stainless steels. KC635M grade is characterised by a high hardness and wear resistance. This grade is suitable for cutting hard materials (up to 65 HRC).	<b>P</b>										
		<b>M</b>										
		<b>K</b>										
		<b>S</b>										



Coatings provide high-speed capability and are engineered for roughing to finishing.

<b>P</b>	Steel
<b>M</b>	Stainless Steel
<b>K</b>	Cast Iron
<b>N</b>	Non-Ferrous
<b>S</b>	High-Temp Alloys
<b>H</b>	Hardened Materials
<b>C</b>	CFRP Materials

wear resistance ← → toughness

Grades

Coating	Grade Description		05	10	15	20	25	30	35	40	45
<b>KC625M</b> 	Coated carbide grade with PVD (TiCN) coating. For universal use due to its high wear resistance and hardness. Only use wet or with MQL (minimum quantity lubrication).	<b>P</b>									
		<b>K</b>									
		<b>S</b>									
<b>KC639M</b> 	PVD (AlTiN)-coated carbide on a submicron carbide substrate. This hard coating provides outstanding performance in milling hardened materials (58–65 HRC).	<b>P</b>									
		<b>H</b>									
		<b>S</b>									
<b>KCSM15</b> 	Coated carbide grade with thick PVD coating and optimised chemistry and process for increased wear resistance. Outstanding protection in milling stainless steel to mitigate crater, DOCN (depth-of-cut notching), and flank wear. Excellent performance up to 52 HRC.	<b>M</b>									
		<b>S</b>									
		<b>H</b>									
<b>KCN05</b> 	High-performance grade A pure, diamond-coated carbide for milling CFRP and graphite. It is a very tough and wear-resistant grade.	<b>C</b>									
		<b>P</b>									
		<b>M</b>									
<b>KC633M</b> 	Coated carbide grade with PVD multilayer coating. KC633M™ is designed for dry milling most types of material, apart from the hardened variety. This grade is characterised by good hardness and wear resistance. It provides outstanding protection for solid carbide tools against cratering and abrasion.	<b>P</b>									
		<b>M</b>									
		<b>S</b>									

# ➤ Beyond™ Solid Carbide End Milling

## High-Performance milling in a new dimension



Kennametal is pleased to announce the KCPM15™ and KCSM15™ grades — the first Beyond grades for solid carbide end mills. KCPM15 and KCSM15 grades feature an improved high-performance carbide substrate with proprietary aluminium titanium nitride (AlTiN) PVD coating.

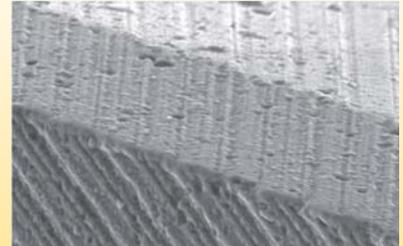
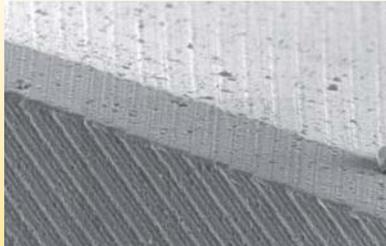
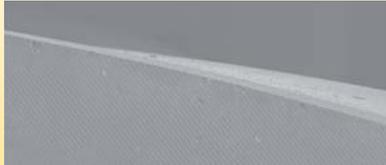
## Features and Benefits

- Engineered to increase tool life and productivity by up to 30%.
- For use in milling steels and stainless steels.
- Improved resistance to cratering, flank wear, and depth-of-cut notching.

Coating		Grade Description	Workpiece Materials:	
KCPM15		Coated carbide grade with thick PVD coating and optimised chemistry and process for increased wear resistance. Outstanding protection in milling stainless steel to mitigate crater, DOCN (depth-of-cut notching), and flank wear. Excellent performance up to 52 HRC.	P	Steel
			M	Stainless Steel
KCSM15		Coated carbide grade with thick PVD coating and optimised chemistry and process for increased wear resistance. Outstanding protection in milling stainless steel to mitigate crater, DOCN (depth-of-cut notching), and flank wear. Excellent performance up to 52 HRC.	K	Cast Iron
			N	Non-Ferrous
			S	High-Temp Alloys
			H	Hardened Materials

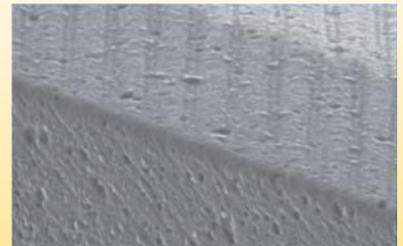
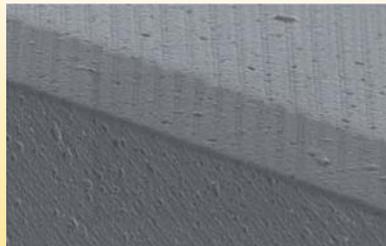
## Conventional End Mill Cutting Edge

### Conventional



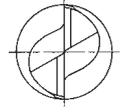
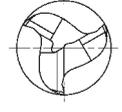
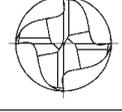
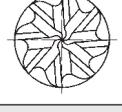
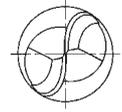
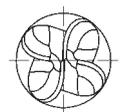
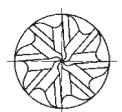
## KCPM15™/KCSM15™ End Mill Cutting Edge

### KCPM15/KCSM15 grade



View: 1st and 2nd relief.

### ■ End Mill Type Recommendation

End Mills									
Z = number of teeth		Fine Finishing	Finishing	Roughing	Slot Milling	Plunging	Contour Milling	Peel Milling	Trochoidal Milling
end mill Z = 1									
end mill Z = 2									
end mill Z = 3									
end mill Z = 4/5									
multi-flute cutter Z = 6-19									
Ball Nose and Torus End Mills									
ball nose end mill Z = 2									
ball nose end mill Z = 4									
ball nose end mill Z = 6									



first choice



suitable with limitations



not recommended

Always select a tool with the shortest possible flute length whenever possible. This will increase the stability of the tool and give the best results.

When selecting an end mill, the following machining factors will affect your selection of the correct end mill for your application:

1. Tool overhang.
2. Coolant flow.
3. Machine and setup stability.
4. Machine power and torque.
5. Material to be machined.
6. Machine adaptor size (DV40, DV50, HSK63, etc.).
7. See Tool Reference Guides on pages P2-P5.

■ Recommended Adaptors per End Mill Platform

SCEM Platform	Recommended Adaptors	
	First Choice	Alternate Choice
HARVI™ I	HydroForce™	Shrink Fit
HARVI II	HydroForce	Shrink Fit
HARVI III	HydroForce	Shrink Fit
HARVI II Long	HydroForce	Shrink Fit
High-Performance Roughers	HydroForce	Weldon® Adaptor
RSM II	Shrink Fit	Shrink Fit
High-Performance Finishers	HydroForce	Shrink Fit
MaxiMet™/Aluminium Tools	HydroForce	Shrink Fit
Hard Material End Mills/KenFeed™	HydroForce	Shrink Fit
GOmill™	Shrink Fit	Weldon Adaptor

■ Select Adaptor per Technical Data/Characteristics

Technical data/characteristics	Toolholders				
	HydroForce high torque	Shrink Fit	Milling chuck	ER collet chuck	Weldon adaptor
torque transmission	★★★★★	★★★★	★★★★★	★★	★★★★★
radial runout (T.I.R.) <sup>1</sup>	★★★★★	★★★★★	★★★★	★★★	★
radial rigidity <sup>2</sup>	★★★★	★★★★★	★★★	★★★	★★★
tool length adjustment	★★★★★	★★★★	★	★★★★	★★
tool shank tolerance requirement	★★★★	★★	★★★	★★★★★	★★★
through coolant	★★★★★	★★★★★	★★★	★★★	★★
minimum quantity lubrication (MQL)	★★★★★	★★★★★	★	★	★
dampening capability	★★★★★	★	★★★	★★★	★★★
shank diameter range <sup>3</sup>	★★★★★	★	★★★★★	★★★★★	★
cost of toolholder	★★	★★★	★	★★★★	★★★★★
low requirement of external devices <sup>4</sup>	★★★★★	★	★★★★	★★★★	★★★★★
ease of handling	★★★★★	★★★	★★	★★★★	★★★★
dust resistance	★★★★★	★★★★★	★★★	★★★	★★★★
high-speed capability	★★★★★	★★★★★	★★★	★★★	★
balancing accuracy	★★★★★	★★★★★	★★★	★★★	★

<sup>1</sup> Radial runout may affect tool life.

<sup>2</sup> Radial rigidity for Weldon holder is low at a direction perpendicular to the screw.

<sup>3</sup> Accepts different shank diameters through the use of reduction sleeves or due to collapse range.

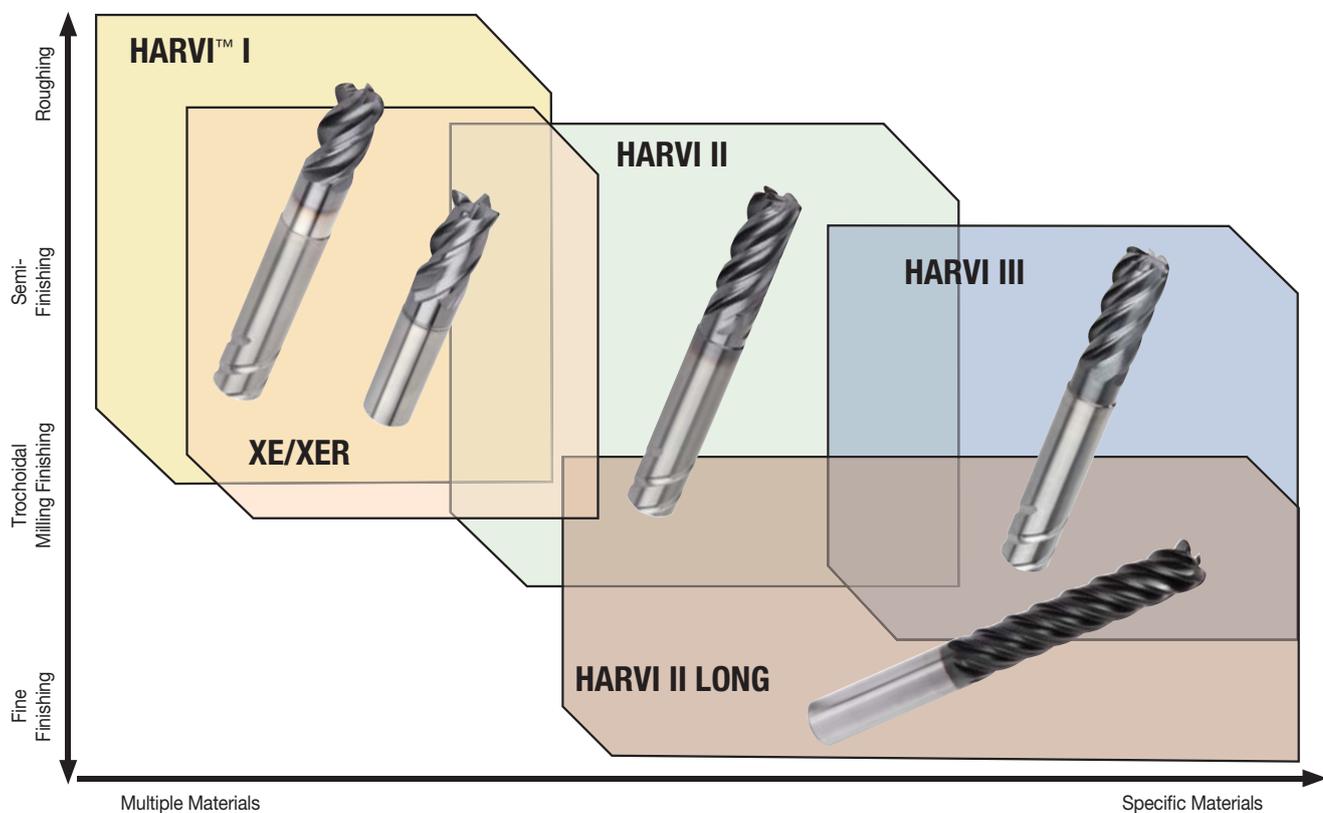
<sup>4</sup> Collet chucks and milling chucks may require the use of a torque or special wrench; Shrink Fit adaptor requires a shrinking unit.

# ➤ High-Performance Capability End Mills

## Primary Application

High-performance capability offers plunging, slotting, and profiling at the highest possible feed rates for a wide range of materials from steel, stainless steel, cast iron, and high-temperature alloys to hard materials. These end mills are designed to provide maximum Metal Removal Rates (MRR) and to achieve superior surface conditions.

Several platforms with a wide range of diameters and corner configurations, such as chamfer, radii, sharp edges, and ball nose, are available from stock.



**Designed for roughing and finishing with one tool  
in a wide range of applications and workpiece materials.**



- Roughing, semi-finishing, and finishing with one tool.
- Outstanding metal removal rates increase productivity.
- Excellent surface quality and accuracy.
- KCPM15™ and KCSM15™ Beyond™ grades for long tool life.
- Increased process safety with Safe-Lock™ by HAIMER® shanks.

# HARVI™ I

## High-Performance Solid Carbide End Mills

### Primary Application

The HARVI I system offers plunging, slotting, and profiling at the highest possible feed rates for a wide range of materials. These end mills are designed to provide maximum Metal Removal Rates (MRR) and to achieve superior surface conditions. A wide range of diameters and corner configurations, such as chamfer, radii, and sharp edges, are available from stock. To prevent pull out of end mills during heavy cuts, the HARVI I system is available equipped with the Safe-Lock™ system by HAIMER®.

- Roughing and finishing with one tool.
- Outstanding metal removal rates increase productivity.
- KCPM15™ and KCSM15™ Beyond™ grades for long tool life.

## Features and Benefits

### Advanced Technology

- Four unequally spaced flutes for chatter-free machining at high feed rates.
- Centre cutting design for plunging and improved ramping and helical interpolation capabilities.
- 1 x D full slotting capability in:
  - Steel
  - Stainless steel
  - Titanium

### Tailored Grades

- KCPM15 Beyond grade for outstanding wear protection in stainless steel to mitigate crater, depth-of-cut notching, and flank wear.
- KCSM15 Beyond grade for exceptional tool life in titanium.
- Universal KC643M™ grade suitable for cutting steel, cast iron, stainless steel (wet), and titanium (wet).

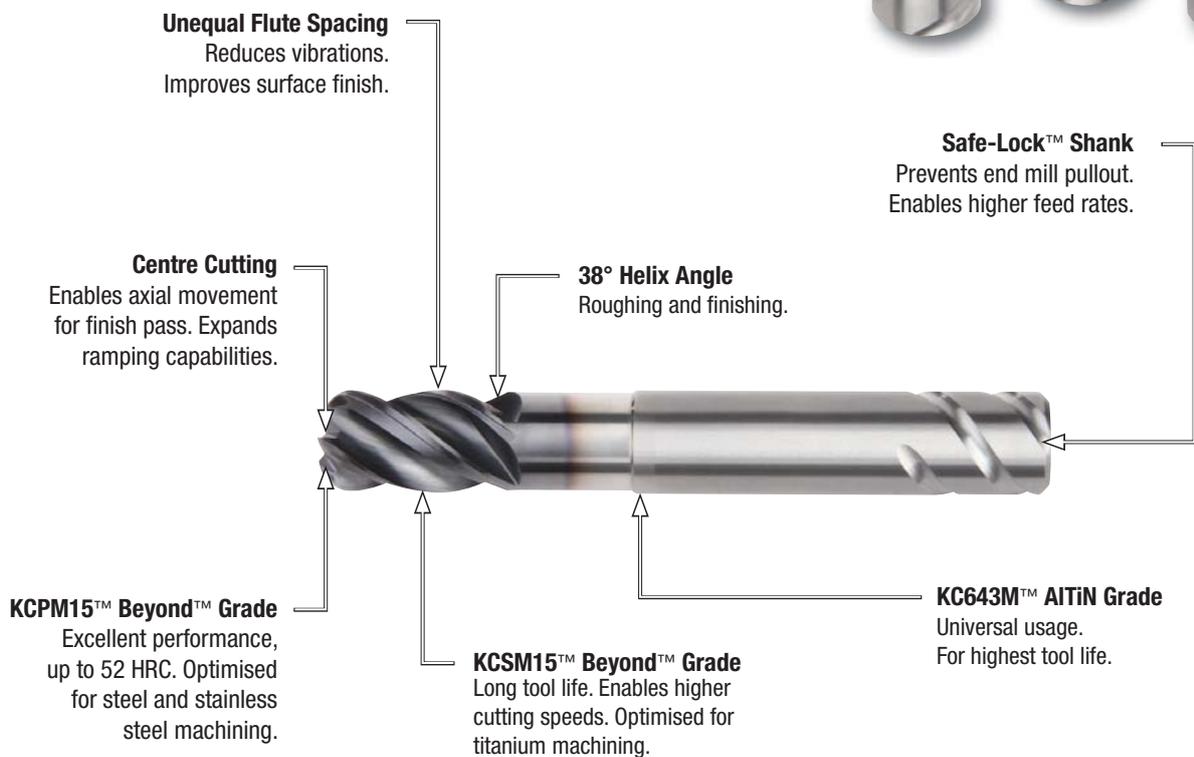
### Customisation

- Intermediate diameters available.
- Expanded length of tool and increased length of cut are possible.
- Chip divider geometry reduces power consumption and improves chip formation in difficult-to-cut materials.
- Internal coolant axial and radial available.
- Various shanks and non-standard coatings available.
- Multiple steps possible.

### Extensive Standard Offering

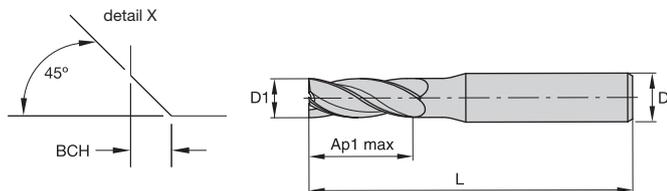
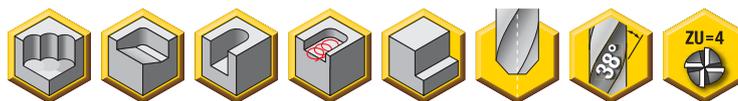
- Diameter range 4–25mm.
- Necked, corner radii and chamfer offering.
- Extended-reach length.
- Ball nose with extended length of cut.
- Chip divider geometry for reduced power consumption and improved chip formation in difficult-to-cut materials.

Designed for roughing and finishing  
with one tool in almost all materials.



**SAFE-LOCK®**  
by HAIMER®

- Single tool for roughing and finishing applications.
- Unequal flute spacing minimises chatter for smoother machining.
- Centre cutting.



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



### F4AS...DL • 4-Flute • Metric

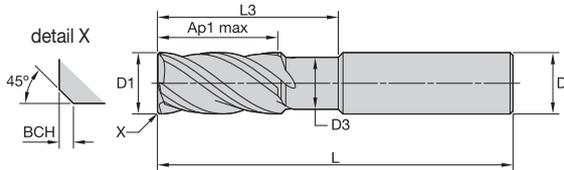


- first choice
- alternate choice

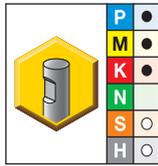
KCPM15	KCPM15	D1	D	Ap1 max	L	BCH
F4AS0400ADL38	F4AS0400BDL38	4,00	6,00	12,00	55,00	0,40
F4AS0500ADL38	F4AS0500BDL38	5,00	6,00	13,00	57,00	0,40
F4AS0600ADL38	F4AS0600BDL38	6,00	6,00	13,00	57,00	0,40
F4AS0800ADL38	F4AS0800BDL38	8,00	8,00	16,00	63,00	0,40
F4AS1000ADL38	F4AS1000BDL38	10,00	10,00	22,00	72,00	0,50
F4AS1200ADL38	F4AS1200BDL38	12,00	12,00	26,00	83,00	0,50
F4AS1400ADL38	F4AS1400BDL38	14,00	14,00	26,00	83,00	0,50
F4AS1600ADL38	F4AS1600BDL38	16,00	16,00	32,00	92,00	0,50
F4AS1800ADL38	F4AS1800BDL38	18,00	18,00	32,00	92,00	0,50
F4AS2000ADL38	F4AS2000BDL38	20,00	20,00	38,00	104,00	0,50
F4AS2500ADL38	F4AS2500BDL38	25,00	25,00	45,00	121,00	0,50

NOTE: For application data, see page P23.

- Kennametal standard dimensions.
- Centre cutting.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.


**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

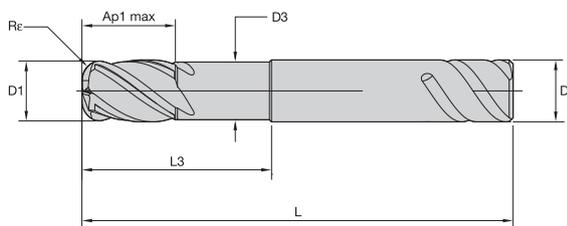
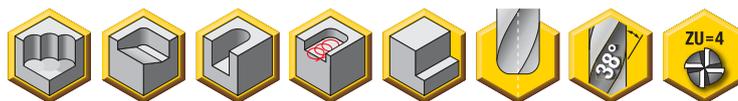
**UADE.. • 4-Flute with Neck • Metric**


- first choice
- alternate choice

KCPM15	KCPM15	D1	D	D3	Ap1 max	L3	L	BCH
UADE0400A4BV	UADE0400B4BV	4,00	6,00	3,76	11,00	16,00	57,00	0,40
UADE0500A4BV	UADE0500B4BV	5,00	6,00	4,70	13,00	18,00	57,00	0,40
UADE0600A4BV	UADE0600B4BV	6,00	6,00	5,64	13,00	18,00	57,00	0,40
UADE0800A4BV	UADE0800B4BV	8,00	8,00	7,52	16,00	24,00	63,00	0,40
UADE1000A4BV	UADE1000B4BV	10,00	10,00	9,40	22,00	30,00	72,00	0,50
UADE1200A4BV	UADE1200B4BV	12,00	12,00	11,28	26,00	36,00	83,00	0,50
UADE1400A4BV	UADE1400B4BV	14,00	14,00	13,16	26,00	42,00	83,00	0,50
UADE1600A4BV	UADE1600B4BV	16,00	16,00	15,04	32,00	48,00	92,00	0,50
UADE2000A4BV	UADE2000B4BV	20,00	20,00	18,80	38,00	60,00	104,00	0,50
UADE2500A4BV	UADE2500B4BV	25,00	25,00	23,50	45,00	75,00	121,00	0,50

NOTE: For application data, see page P23.

- Kennametal standard dimensions.
- Centre cutting.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.

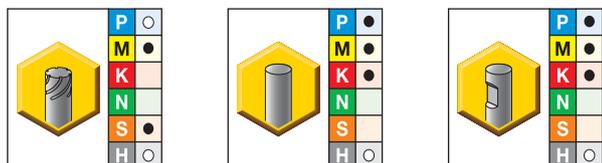


End Mill Tolerances

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



■ UBDE • F4AS.. • 4-Flute with Neck • Metric



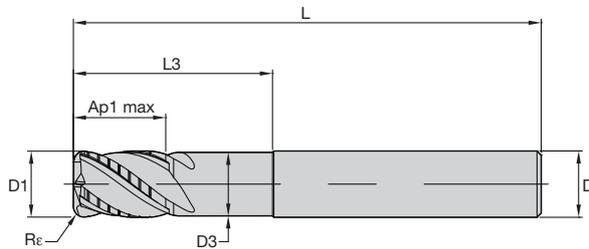
● first choice  
○ alternate choice

	KCSM15	KCPM15	KCPM15	D1	D	D3	Ap1 max	L3	L	Re
—	—	F4AS0600AWM38R050	F4AS0600BWM38R050	6,00	6,00	5,64	9,00	18,00	63,00	0,50
—	—	F4AS0600AWM38R100	F4AS0600BWM38R100	6,00	6,00	5,64	9,00	18,00	63,00	1,00
—	—	F4AS0800AWM38R050	F4AS0800BWM38R050	8,00	8,00	7,52	12,00	24,00	68,00	0,50
—	—	F4AS0800AWM38R100	F4AS0800BWM38R100	8,00	8,00	7,52	12,00	24,00	68,00	1,00
—	—	F4AS1000AWL38R050	F4AS1000BWL38R050	10,00	10,00	9,40	15,00	30,00	76,00	0,50
—	—	F4AS1000AWL38R100	F4AS1000BWL38R100	10,00	10,00	9,40	15,00	30,00	76,00	1,00
—	—	F4AS1000AWL38R200	F4AS1000BWL38R200	10,00	10,00	9,40	15,00	30,00	76,00	2,00
—	—	F4AS1000AWL38R300	F4AS1000BWL38R300	10,00	10,00	9,40	15,00	30,00	76,00	3,00
—	—	F4AS1000AWL38R400	F4AS1000BWL38R400	10,00	10,00	9,40	15,00	30,00	76,00	4,00
UBDE1200E4AQE *	—	F4AS1200AWL38R050	F4AS1200BWL38R050	12,00	12,00	11,28	18,00	36,00	83,00	0,50
UBDE1200E4AQG *	—	F4AS1200AWL38R100	F4AS1200BWL38R100	12,00	12,00	11,28	18,00	36,00	83,00	1,00
UBDE1200E4AQK *	—	F4AS1200AWL38R200	F4AS1200BWL38R200	12,00	12,00	11,28	18,00	36,00	83,00	2,00
UBDE1200E4AQM *	—	F4AS1200AWL38R300	F4AS1200BWL38R300	12,00	12,00	11,28	18,00	36,00	83,00	3,00
UBDE1200E4AQN *	—	F4AS1200AWL38R400	F4AS1200BWL38R400	12,00	12,00	11,28	18,00	36,00	83,00	4,00
UBDE1600E4AQE *	—	F4AS1600AWX38R050	F4AS1600BWX38R050	16,00	16,00	15,04	24,00	48,00	100,00	0,50
UBDE1600E4AQG *	—	F4AS1600AWX38R100	F4AS1600BWX38R100	16,00	16,00	15,04	24,00	48,00	100,00	1,00
UBDE1600E4AQK *	—	F4AS1600AWX38R200	F4AS1600BWX38R200	16,00	16,00	15,04	24,00	48,00	100,00	2,00
UBDE1600E4AQM *	—	F4AS1600AWX38R300	F4AS1600BWX38R300	16,00	16,00	15,04	24,00	48,00	100,00	3,00
UBDE1600E4AQN *	—	F4AS1600AWX38R400	F4AS1600BWX38R400 *	16,00	16,00	15,04	24,00	48,00	100,00	4,00
UBDE1600E4AQP *	—	F4AS1600AWX38R600	F4AS1600BWX38R600	16,00	16,00	15,04	24,00	48,00	100,00	6,00
UBDE2000E4AQE *	—	F4AS2000AWX38R050	F4AS2000BWX38R050	20,00	20,00	18,80	30,00	60,00	115,00	0,50
UBDE2000E4AQG *	—	F4AS2000AWX38R100	F4AS2000BWX38R100	20,00	20,00	18,80	30,00	60,00	115,00	1,00
UBDE2000E4AQK *	—	F4AS2000AWX38R200	F4AS2000BWX38R200 *	20,00	20,00	18,80	30,00	60,00	115,00	2,00
UBDE2000E4AQM *	—	F4AS2000AWX38R300	F4AS2000BWX38R300	20,00	20,00	18,80	30,00	60,00	115,00	3,00
UBDE2000E4AQN *	—	F4AS2000AWX38R400	F4AS2000BWX38R400	20,00	20,00	18,80	30,00	60,00	115,00	4,00
UBDE2000E4AQP *	—	F4AS2000AWX38R600	F4AS2000BWX38R600	20,00	20,00	18,80	30,00	60,00	115,00	6,00
UBDE2500E4AQE *	—	F4AS2500AWX38R050	F4AS2500BWX38R050	25,00	25,00	23,50	37,50	75,00	135,00	0,50
UBDE2500E4AQG *	—	F4AS2500AWX38R100	—	25,00	25,00	23,50	37,50	75,00	135,00	1,00
UBDE2500E4AQK *	—	F4AS2500AWX38R200	F4AS2500BWX38R200	25,00	25,00	23,50	37,50	75,00	135,00	2,00
UBDE2500E4AQM *	—	—	F4AS2500BWX38R300	25,00	25,00	23,50	37,50	75,00	135,00	3,00
UBDE2500E4AQN *	—	F4AS2500AWX38R400	F4AS2500BWX38R400	25,00	25,00	23,50	37,50	75,00	135,00	4,00
UBDE2500E4AQP *	—	F4AS2500AWX38R600	F4AS2500BWX38R600	25,00	25,00	23,50	37,50	75,00	135,00	6,00

NOTE: For application data, see pages P23–P24.

\*Made-to-order standard item. Standard pricing, manufacturing lead time, and minimum order quantity applies.

- Kennametal standard dimensions.
- Centre cutting.
- Unequal flute spacing minimises chatter for smoother machining.
- Chipbreaker profile.

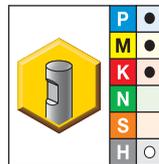
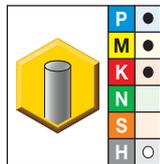


**End Mill Tolerances**

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



**F4BS.. • 4-Flute with Neck and Chipbreaker • Metric**



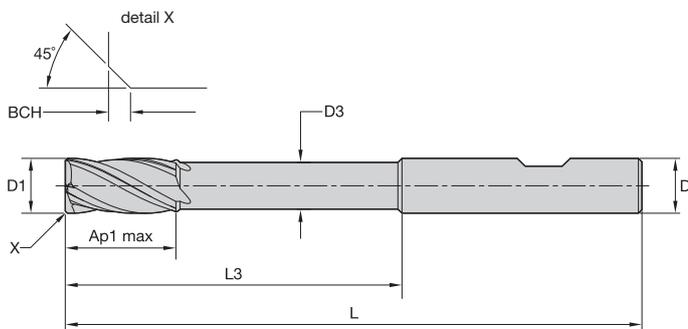
- first choice
- alternate choice

KCPM15	KCPM15	D1	D	D3	Ap1 max	L3	L	Rε
F4BS0600AWM38R050	F4BS0600BWM38R050	6,00	6,00	5,80	9,00	18,00	63,00	0,50
F4BS0600AWM38R100	F4BS0600BWM38R100 *	6,00	6,00	5,80	9,00	18,00	63,00	1,00
F4BS0800AWM38R050	F4BS0800BWM38R050	8,00	8,00	7,80	12,00	24,00	68,00	0,50
F4BS0800AWM38R100	F4BS0800BWM38R100	8,00	8,00	7,80	12,00	24,00	68,00	1,00
F4BS1000AWL38R050	F4BS1000BWL38R050	10,00	10,00	9,50	15,00	30,00	76,00	0,50
F4BS1000AWL38R100	F4BS1000BWL38R100	10,00	10,00	9,50	15,00	30,00	76,00	1,00
F4BS1000AWL38R200	F4BS1000BWL38R200 *	10,00	10,00	9,50	15,00	30,00	76,00	2,00
F4BS1000AWL38R300	F4BS1000BWL38R300	10,00	10,00	9,50	15,00	30,00	76,00	3,00
F4BS1000AWL38R400 *	F4BS1000BWL38R400	10,00	10,00	9,50	15,00	30,00	76,00	4,00
F4BS1200AWL38R050	F4BS1200BWL38R050	12,00	12,00	11,50	18,00	36,00	84,00	0,50
F4BS1200AWL38R100	F4BS1200BWL38R100	12,00	12,00	11,50	18,00	36,00	84,00	1,00
F4BS1200AWL38R200	F4BS1200BWL38R200	12,00	12,00	11,50	18,00	36,00	84,00	2,00
F4BS1200AWL38R300	F4BS1200BWL38R300 *	12,00	12,00	11,50	18,00	36,00	84,00	3,00
F4BS1200AWL38R400	F4BS1200BWL38R400	12,00	12,00	11,50	18,00	36,00	84,00	4,00
F4BS1600AWX38R050	F4BS1600BWX38R050 *	16,00	16,00	15,00	24,00	48,00	100,00	0,50
F4BS1600AWX38R100	F4BS1600BWX38R100 *	16,00	16,00	15,00	24,00	48,00	100,00	1,00
F4BS1600AWX38R200	F4BS1600BWX38R200 *	16,00	16,00	15,00	24,00	48,00	100,00	2,00
F4BS1600AWX38R300 *	F4BS1600BWX38R300	16,00	16,00	15,00	24,00	48,00	100,00	3,00
F4BS1600AWX38R400 *	F4BS1600BWX38R400	16,00	16,00	15,00	24,00	48,00	100,00	4,00
F4BS2000AWX38R050	F4BS2000BWX38R050	20,00	20,00	19,00	30,00	60,00	115,00	0,50
F4BS2000AWX38R100	F4BS2000BWX38R100 *	20,00	20,00	19,00	30,00	60,00	115,00	1,00
F4BS2000AWX38R200 *	F4BS2000BWX38R200 *	20,00	20,00	19,00	30,00	60,00	115,00	2,00
F4BS2000AWX38R300 *	F4BS2000BWX38R300 *	20,00	20,00	19,00	30,00	60,00	115,00	3,00
F4BS2000AWX38R400 *	F4BS2000BWX38R400 *	20,00	20,00	19,00	30,00	60,00	115,00	4,00
F4BS2500AWX38R050 *	F4BS2500BWX38R050 *	25,00	25,00	24,00	37,50	75,00	135,00	0,50
F4BS2500AWX38R100 *	F4BS2500BWX38R100 *	25,00	25,00	24,00	37,50	75,00	135,00	1,00
F4BS2500AWX38R200 *	F4BS2500BWX38R200 *	25,00	25,00	24,00	37,50	75,00	135,00	2,00
F4BS2500AWX38R300 *	F4BS2500BWX38R300 *	25,00	25,00	24,00	37,50	75,00	135,00	3,00
F4BS2500AWX38R400 *	F4BS2500BWX38R400 *	25,00	25,00	24,00	37,50	75,00	135,00	4,00

NOTE: For application data, see page P24.

\*Made-to-order standard item. Standard pricing, manufacturing lead time, and minimum order quantity applies.

- Kennametal standard dimensions.
- Centre cutting.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.

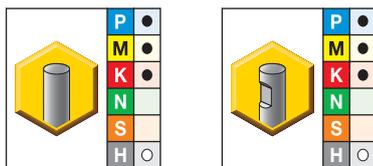


End Mill Tolerances

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



UADE • 4-Flute Extended Reach • Metric

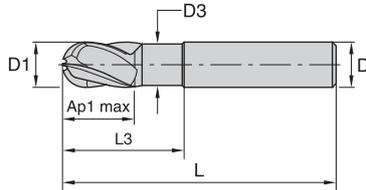


- first choice
- alternate choice

KCPM15	KCPM15	D1	D	D3	Ap1 max	L3	L	BCH
UADE0600A4AL	UADE0600B4AL	6,00	6,00	5,50	12,00	42,00	100,00	0,40
UADE0800A4AL	UADE0800B4AL	8,00	8,00	7,30	16,00	62,00	100,00	0,40
UADE1000A4AL	UADE1000B4AL	10,00	10,00	9,10	20,00	60,00	100,00	0,50
UADE1200A4AL	UADE1200B4AL	12,00	12,00	11,00	24,00	73,00	125,00	0,50
UADE1600A4AL	UADE1600B4AL	16,00	16,00	15,00	32,00	100,00	150,00	0,50
UADE2000A4AL	UADE2000B4AL	20,00	20,00	19,00	40,00	98,00	175,00	0,50

NOTE: For application data, see page P25.

- Kennametal standard dimensions.
- Centre cutting.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.

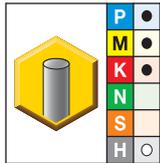


**End Mill Tolerances**

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



**F4AW.. • 4-Flute Extended Reach • Ball Nose • Metric**



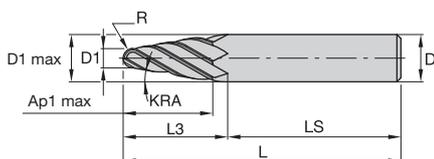
- first choice
- alternate choice

KCPM15	D1	D	D3	Ap1 max	L3	L
F4AW0600AWL38E120	6,00	6,00	5,80	6,00	12,00	76,00
F4AW0800AWL38E160	8,00	8,00	7,80	8,00	16,00	100,00
F4AW1000AWX38E200	10,00	10,00	9,50	10,00	20,00	121,50
F4AW1200AWX38E240	12,00	12,00	11,50	12,00	24,00	125,00
F4AW1600AWX38E320	16,00	16,00	15,00	16,00	32,00	150,00

NOTE: For application data, see page P26.



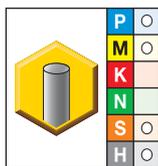
- Centre cutting.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Side milling, slotting, and 3D milling.



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

### F4AW..AWL38-WX38 • Unequal Flute Spacing • Taper Ball Nose



- first choice
- alternate choice

KC633M	D1	D	Ap1 max	L2	LS	L	R	KRA
F4AW0400AWL38W040	4,00	8,0	30,5	36	45	76	2	4.0
F4AW0400AWL38W060	4,00	10,0	30,5	49	58	89	2	6.0
F4AW0500AWL38W040	5,00	10,0	38,0	44	57	89	3	4.0
F4AW0500AWL38W060	5,00	12,0	35,7	55	64	100	3	6.0
F4AW0600AWL38W040	6,00	12,0	45,8	55	54	100	3	4.0
F4AW0600AWL38W060	6,00	16,0	50,4	62	59	110	3	6.0
F4AW0800AWL38W060	8,00	16,0	42,0	62	68	110	4	6.0
F4AW0800AWL38W040	8,00	16,0	61,0	52	49	110	4	4.0
F4AW1000AWX38W040	10,00	16,0	47,7	60	62	110	5	4.0
F4AW1000AWX38W060	10,00	20,0	52,3	75	72	125	5	6.0

NOTE: For application data, see page P27.

**■ HARVI I • UBDE • F4AS...DL • Unequal Flute Spacing**

Material Group																			
	Side Milling (A) and Slotting (B)			KCPM15		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 20%.													
	A		B	Cutting Speed – vc m/min		mm	D1 – Diameter												
	ap	ae	ap	min	max		4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0		
P	0	1,5 x D	0,5 x D	1 x D	150	200	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	1	1,5 x D	0,5 x D	1 x D	150	200	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	2	1,5 x D	0,5 x D	1 x D	140	190	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	3	1,5 x D	0,5 x D	1 x D	120	160	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	4	1,5 x D	0,5 x D	0,75 x D	90	150	fz	0,021	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098	
	5	1,5 x D	0,5 x D	1 x D	60	100	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091	
M	1	1,5 x D	0,5 x D	1 x D	90	115	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	2	1,5 x D	0,5 x D	1 x D	60	80	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091	
	3	1,5 x D	0,5 x D	1 x D	60	70	fz	0,016	0,020	0,025	0,034	0,040	0,047	0,052	0,057	0,061	0,065	0,071	
K	1	1,5 x D	0,5 x D	1 x D	120	150	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	2	1,5 x D	0,5 x D	1 x D	110	140	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	3	1,5 x D	0,5 x D	1 x D	110	130	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091	
S	1	1,5 x D	0,3 x D	0,3 x D	–	–	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	2	1,5 x D	0,3 x D	0,3 x D	–	–	fz	0,013	0,016	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061	
	3	1,5 x D	0,3 x D	0,3 x D	–	–	fz	0,013	0,016	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061	
	4	1,5 x D	0,5 x D	1 x D	–	–	fz	0,016	0,021	0,026	0,037	0,045	0,052	0,058	0,064	0,069	0,074	0,084	
H	1	1,5 x D	0,5 x D	0,75 x D	80	140	fz	0,021	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098	

NOTE: Those guidelines may require variations to achieve optimum results.

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 &gt;12mm diameter.

For better surface finish, reduce feed per tooth.

Side milling applications – for longest reach (L3) tools, reduce ae by 30%.

**■ HARVI I • UADE.. • Unequal Flute Spacing • With Neck**

Material Group																			
	Side Milling (A) and Slotting (B)			KCPM15		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 20%.													
	A		B	Cutting Speed – vc m/min		mm	D1 – Diameter												
	ap	ae	ap	min	max		4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0		
P	0	1,5 x D	0,5 x D	1 x D	150	200	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	1	1,5 x D	0,5 x D	1 x D	150	200	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	2	1,5 x D	0,5 x D	1 x D	140	190	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	3	1,5 x D	0,5 x D	1 x D	120	160	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	4	1,5 x D	0,5 x D	0,75 x D	90	150	fz	0,021	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098	
	5	1,5 x D	0,5 x D	1 x D	60	100	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091	
M	1	1,5 x D	0,5 x D	1 x D	90	115	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	2	1,5 x D	0,5 x D	1 x D	60	80	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091	
	3	1,5 x D	0,5 x D	1 x D	60	70	fz	0,016	0,020	0,025	0,034	0,040	0,047	0,052	0,057	0,061	0,065	0,071	
K	1	1,5 x D	0,5 x D	1 x D	120	150	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124	
	2	1,5 x D	0,5 x D	1 x D	110	140	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	3	1,5 x D	0,5 x D	1 x D	110	130	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091	
S	1	1,5 x D	0,3 x D	0,3 x D	50	90	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114	
	3	1,5 x D	0,3 x D	0,3 x D	25	40	fz	0,013	0,016	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061	
H	1	1,5 x D	0,5 x D	0,75 x D	80	140	fz	0,021	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098	

NOTE: Those guidelines may require variations to achieve optimum results.

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 &gt;12mm diameter.

For better surface finish, reduce feed per tooth.

Side milling applications – for longest reach (L3) tools, reduce ae by 30%.

■ HARVI I • F4AS.. WM-WX-WL • Unequal Flute Spacing • With Neck

Material Group	  			KCPM15		KCSM15		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 10%.												
	Side Milling (A) and Slotting (B)		Cutting Speed – vc m/min	D1 – Diameter																
	A	B		min	max	min	max	mm	4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0	
	ap	ae	ap	min	max	min	max	mm	4,0	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0	
P	0	1,5 x D	0,5 x D	1 x D	150	200	150	200	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	1	1,5 x D	0,5 x D	1 x D	150	200	150	200	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	2	1,5 x D	0,5 x D	1 x D	140	190	140	190	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	3	1,5 x D	0,5 x D	1 x D	120	160	120	160	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	4	1,5 x D	0,5 x D	0,75 x D	90	150	90	150	fz	0,021	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098
	5	1,5 x D	0,5 x D	1 x D	60	100	60	100	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091
M	1	1,5 x D	0,5 x D	1 x D	90	115	90	115	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	2	1,5 x D	0,5 x D	1 x D	60	80	60	80	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091
	3	1,5 x D	0,5 x D	1 x D	60	70	60	70	fz	0,016	0,020	0,025	0,034	0,040	0,047	0,052	0,057	0,061	0,065	0,071
K	1	1,5 x D	0,5 x D	1 x D	120	150	-	-	fz	0,028	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	2	1,5 x D	0,5 x D	1 x D	110	140	-	-	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	3	1,5 x D	0,5 x D	1 x D	110	130	-	-	fz	0,019	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091
S	1	1,5 x D	0,3 x D	0,3 x D	-	-	50	90	fz	0,023	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	2	1,5 x D	0,3 x D	0,3 x D	-	-	25	40	fz	0,013	0,016	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061
	3	1,5 x D	0,3 x D	0,3 x D	-	-	25	40	fz	0,013	0,016	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061
	4	1,5 x D	0,5 x D	1 x D	-	-	50	60	fz	0,016	0,021	0,026	0,037	0,045	0,052	0,058	0,064	0,069	0,074	0,084
H	1	1,5 x D	0,5 x D	0,75 x D	80	140	80	140	fz	0,021	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098

NOTE: Those guidelines may require variations to achieve optimum results.  
 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.  
 For better surface finish, reduce feed per tooth.  
 Side milling applications – for longest reach (L3) tools, reduce ae by 30%.

■ HARVI I • F4BS.. WM-WX-WL • Unequal Flute Spacing • With Neck and Chipbreaker

Material Group	  			KCPM15		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 20%.								
	Side Milling (A) and Slotting (B)		Cutting Speed – vc m/min	D1 – Diameter										
	A	B		min	max	mm	6,0	8,0	10,0	12,0	16,0	20,0	25,0	
	ap	ae	ap	min	max	mm	6,0	8,0	10,0	12,0	16,0	20,0	25,0	
P	1	1,5 x D	0,5 x D	1 x D	150	200	fz	0,044	0,060	0,072	0,083	0,101	0,114	0,124
	2	1,5 x D	0,5 x D	1 x D	140	190	fz	0,044	0,060	0,072	0,083	0,101	0,114	0,124
	3	1,5 x D	0,5 x D	1 x D	120	160	fz	0,036	0,050	0,061	0,070	0,087	0,101	0,114
	4	1,5 x D	0,5 x D	0,75 x D	90	150	fz	0,033	0,045	0,054	0,062	0,077	0,088	0,098
	5	1,5 x D	0,5 x D	1 x D	60	100	fz	0,029	0,040	0,048	0,056	0,070	0,081	0,091
	6	1,5 x D	0,5 x D	0,75 x D	50	75	fz	0,025	0,034	0,040	0,047	0,057	0,065	0,071
M	1	1,5 x D	0,5 x D	1 x D	90	115	fz	0,036	0,050	0,061	0,070	0,087	0,101	0,114
	2	1,5 x D	0,5 x D	1 x D	60	80	fz	0,029	0,040	0,048	0,056	0,070	0,081	0,091
	3	1,5 x D	0,5 x D	1 x D	60	70	fz	0,025	0,034	0,040	0,047	0,057	0,065	0,071
K	1	1,5 x D	0,5 x D	1 x D	120	150	fz	0,044	0,060	0,072	0,083	0,101	0,114	0,124
	2	1,5 x D	0,5 x D	1 x D	110	130	fz	0,036	0,050	0,061	0,070	0,087	0,101	0,114
	3	1,5 x D	0,5 x D	1 x D	100	130	fz	0,029	0,040	0,048	0,056	0,070	0,081	0,091
H	1	1,5 x D	0,5 x D	0,75 x D	80	140	fz	0,033	0,045	0,054	0,062	0,077	0,088	0,098

NOTE: Those guidelines may require variations to achieve optimum results.  
 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.  
 For better surface finish, reduce feed per tooth.  
 Side milling applications – for longest reach (L3) tools, reduce ae by 30%.

**■ HARVI I • UADE • Unequal Flute Spacing • Extended Reach**

Material Group															
	Side Milling (A) and Slotting (B)			KCPM15		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 10%.									
	A		B	Cutting Speed – vc m/min		mm	D1 – Diameter								
	ap	ae	ap	min	max		6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	
P	0	0,75 x D	0,5 x D	0,75 x D	150	200	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114
	1	0,75 x D	0,5 x D	0,75 x D	150	200	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114
	2	0,75 x D	0,5 x D	0,75 x D	140	190	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114
	3	0,75 x D	0,5 x D	0,75 x D	120	160	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101
	4	0,75 x D	0,5 x D	0,5 x D	90	150	fz	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088
	5	0,75 x D	0,5 x D	0,75 x D	60	100	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081
M	6	0,75 x D	0,5 x D	0,5 x D	50	75	fz	0,025	0,034	0,040	0,047	0,052	0,057	0,061	0,065
	1	0,75 x D	0,5 x D	0,75 x D	90	115	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101
	2	0,75 x D	0,5 x D	0,75 x D	60	80	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081
K	3	0,75 x D	0,5 x D	0,75 x D	60	70	fz	0,025	0,034	0,040	0,047	0,052	0,057	0,061	0,065
	1	0,75 x D	0,5 x D	0,75 x D	120	150	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114
	2	0,75 x D	0,5 x D	0,75 x D	110	140	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101
S	3	0,75 x D	0,5 x D	0,75 x D	110	130	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081
	1	0,75 x D	0,5 x D	0,5 x D	80	140	fz	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088

NOTE: Those guidelines may require variations to achieve optimum results.

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.

For better surface finish, reduce feed per tooth.

Side milling applications – for longest reach (L3) tools, reduce ae by 30%.



■ HARVI I • F4AW..WL-WX • Unequal Flute Spacing • Extended Reach • Ball Nose

		Side Milling (A) and Slotting (B)			KCPM15		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 20%.					
Material Group		A		B	Cutting Speed – vc m/min			D1 – Diameter				
		ap	ae	ap	min	max	mm	6,0	8,0	10,0	12,0	16,0
P	0	0,5 x D	0,5 x D	0,5 x D	150	200	fz	0,044	0,060	0,072	0,083	0,101
	1	0,5 x D	0,5 x D	0,5 x D	150	200	fz	0,044	0,060	0,072	0,083	0,101
	2	0,5 x D	0,5 x D	0,5 x D	140	190	fz	0,044	0,060	0,072	0,083	0,101
	3	0,5 x D	0,5 x D	0,5 x D	120	160	fz	0,036	0,050	0,061	0,070	0,087
	4	0,5 x D	0,5 x D	0,5 x D	90	150	fz	0,033	0,045	0,054	0,062	0,077
	5	0,5 x D	0,5 x D	0,5 x D	60	100	fz	0,029	0,040	0,048	0,056	0,070
M	1	0,5 x D	0,5 x D	0,5 x D	90	115	fz	0,036	0,050	0,061	0,070	0,087
	2	0,5 x D	0,5 x D	0,5 x D	60	80	fz	0,029	0,040	0,048	0,056	0,070
	3	0,5 x D	0,5 x D	0,5 x D	60	70	fz	0,025	0,034	0,040	0,047	0,057
K	1	0,5 x D	0,5 x D	0,5 x D	120	150	fz	0,044	0,060	0,072	0,083	0,101
	2	0,5 x D	0,5 x D	0,5 x D	110	130	fz	0,036	0,050	0,061	0,070	0,087
	3	0,5 x D	0,5 x D	0,5 x D	110	130	fz	0,029	0,040	0,048	0,056	0,070
H	1	0,5 x D	0,5 x D	0,5 x D	80	140	fz	0,033	0,045	0,054	0,062	0,077

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.



**■ HARVI I • F4AW..AWL38-WX38 • Unequal Flute Spacing • Taper Ball Nose • Roughing**

Material Group						Recommended feed per tooth (fz = mm/th) for side milling (A).						
	Side Milling (A)		KC633M									
	A		Cutting Speed – vc m/min			D1 – Diameter						
	ap	ae	min		max	mm	4,0	5,0	6,0	8,0	10,0	
P	0	Ap max	0,4 x D	150	–	200	fz	0,028	0,036	0,044	0,060	0,072
	1	Ap max	0,4 x D	150	–	200	fz	0,028	0,036	0,044	0,060	0,072
	2	Ap max	0,4 x D	140	–	190	fz	0,028	0,036	0,044	0,060	0,072
	3	Ap max	0,4 x D	120	–	160	fz	0,023	0,030	0,036	0,050	0,061
	4	Ap max	0,4 x D	90	–	150	fz	0,021	0,027	0,033	0,045	0,054
	5	Ap max	0,4 x D	60	–	100	fz	0,019	0,024	0,029	0,040	0,048
M	1	Ap max	0,4 x D	90	–	115	fz	0,023	0,030	0,036	0,050	0,061
	2	Ap max	0,4 x D	60	–	80	fz	0,019	0,024	0,029	0,040	0,048
	3	Ap max	0,4 x D	60	–	70	fz	0,016	0,020	0,025	0,034	0,040
S	1	Ap max	0,4 x D	50	–	90	fz	0,023	0,030	0,036	0,050	0,061
	2	Ap max	0,4 x D	25	–	40	fz	0,013	0,016	0,019	0,026	0,032
	3	Ap max	0,4 x D	25	–	40	fz	0,013	0,016	0,019	0,026	0,032
	4	Ap max	0,4 x D	50	–	60	fz	0,016	0,021	0,026	0,037	0,045
H	1	Ap max	0,4 x D	80	–	140	fz	0,021	0,027	0,033	0,045	0,054

NOTE: Those guidelines may require variations to achieve optimum results.

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.

Side milling applications – for longest reach (L3) tools, reduce ae by 30%.

**■ HARVI I • F4AW...AWL38-WX38 • Unequal Flute spacing • Taper Ball Nose • Finishing**

Material Group						Recommended feed per tooth (fz = mm/th) for side milling (A).						
	Side Milling (A)		KC633M									
	A		Cutting Speed – vc m/min			D1 – Diameter						
	ap	ae	min		max	mm	4,0	5,0	6,0	8,0	10,0	
P	0	Ap max	0,06 x D	285	–	380	fz	0,034	0,043	0,053	0,072	0,086
	1	Ap max	0,06 x D	285	–	380	fz	0,034	0,043	0,053	0,072	0,086
	2	Ap max	0,06 x D	266	–	361	fz	0,034	0,043	0,053	0,072	0,086
	3	Ap max	0,06 x D	228	–	304	fz	0,028	0,036	0,044	0,060	0,073
	4	Ap max	0,06 x D	171	–	285	fz	0,026	0,033	0,039	0,054	0,065
	4	Ap max	0,06 x D	95	–	142,5	fz	0,019	0,024	0,030	0,040	0,048
M	1	Ap max	0,06 x D	171	–	218,5	fz	0,028	0,036	0,044	0,060	0,073
	2	Ap max	0,06 x D	114	–	152	fz	0,023	0,029	0,035	0,048	0,058
	3	Ap max	0,06 x D	114	–	133	fz	0,019	0,024	0,030	0,040	0,048
S	1	Ap max	0,06 x D	95	–	171	fz	0,028	0,036	0,044	0,060	0,073
	2	Ap max	0,06 x D	47,5	–	76	fz	0,015	0,019	0,023	0,032	0,038
	3	Ap max	0,06 x D	47,5	–	76	fz	0,015	0,019	0,023	0,032	0,038
	4	Ap max	0,06 x D	95	–	114	fz	0,019	0,025	0,031	0,044	0,053
H	1	Ap max	0,06 x D	152	–	266	fz	0,026	0,033	0,039	0,054	0,065

NOTE: Those guidelines may require variations to achieve optimum results.

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.

Side milling applications – for longest reach (L3) tools, reduce ae by 30%.

# HARVI™ II

## High-Performance Solid Carbide End Mills

### Primary Application

The HARVI II system is designed to provide maximum metal removal rates with five unequally spaced flutes for roughing and finishing operations in side milling, slotting, and profiling. A wide range of diameters and corner configurations, such as chamfer, radii, and sharp edges, are available from stock. To prevent pullout of end mills during heavy cuts, the HARVI II system is available equipped with the Safe-Lock™ system by HAIMER®.

- 1 x D slotting in titanium and stainless steels with five unequally spaced flutes.
- Roughing and finishing with one tool.
- KCPM15™ and KCSM15™ Beyond™ grades for long tool life.

## Features and Benefits

### Advanced Technology

- Five unequally spaced flutes for chatter-free machining at high feed rates.
- Proprietary parabolic core design increases stability.
- Ramping up to 3°.
- 1 x D full slotting capability in:
  - Titanium
  - Stainless steel

### Tailored Grades

- KCPM15™ Beyond grade for outstanding wear protection in stainless steel to mitigate crater, depth-of-cut notching, and flank wear.
- KCSM15™ Beyond grade for exceptional tool life in titanium.
- Universal KC643M™ grade suitable for cutting steel, cast iron, stainless steel (wet), and titanium (wet).

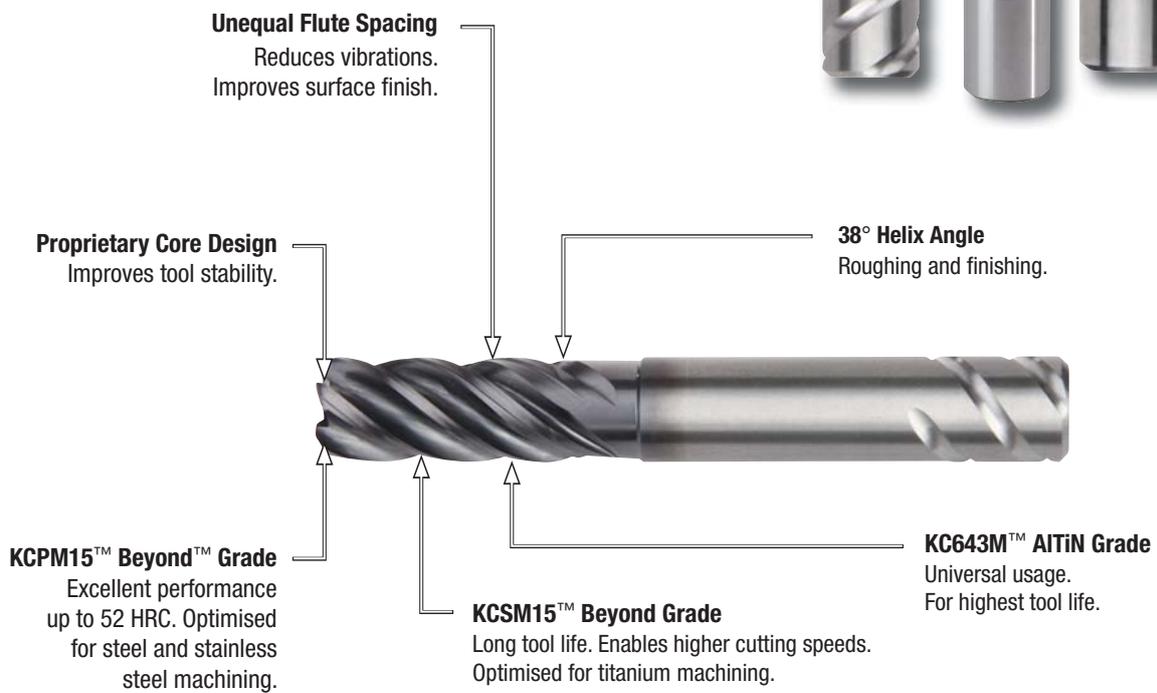
### Customisation

- Intermediate diameters available.
- Expanded length of tool and increased length of cut possible.
- Chip divider geometry reduces power consumption and improves chip formation in difficult-to-cut materials.
- Ball-nose version available.
- Internal coolant axial and radial available.
- Various shanks and non-standard coatings available.
- Multiple steps possible.

### Extensive Standard Offering

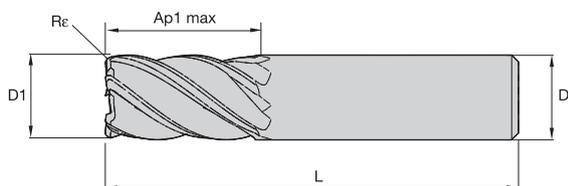
- Diameter range 4–25mm.
- Necked, corner radii, and square-end offering.

# High-feed roughing and finishing with one tool at highest length of cut.



**SAFE-LOCK®**  
by HAIMER®

- Single tool for both roughing and finishing operations for fewer setups.
- Unequal flute spacing minimises chatter for smoother machining.
- Kennametal standard dimensions.
- Non-centre cutting.
- Five-flute geometry enables slotting up to 1 x D.

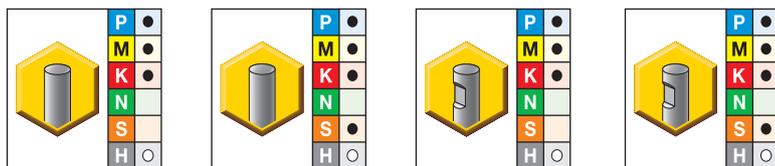


End Mill Tolerances

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



### UCDE • 5-Flute • Metric



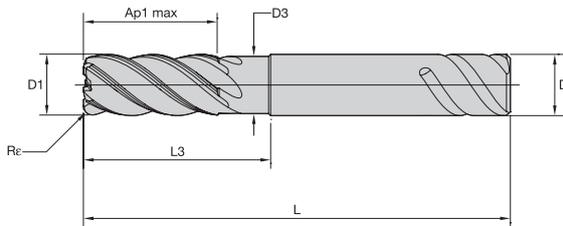
- first choice
- alternate choice

KCPM15	KC643M	KCPM15	KC643M	D1	D	Ap1 max	L	Re
UCDE0400A5ARA	UCDE0400A5ARA	UCDE0400B5ARA	UCDE0400B5ARA	4,00	6,00	11,00	55,00	0,25
UCDE0400A5ASA	UCDE0400A5ASA	—	—	4,00	6,00	11,00	55,00	—
UCDE0500A5ARA	UCDE0500A5ARA	UCDE0500B5ARA	UCDE0500B5ARA	5,00	6,00	13,00	57,00	0,25
UCDE0500A5ASA	UCDE0500A5ASA	—	—	5,00	6,00	13,00	57,00	—
UCDE0600A5ARA	UCDE0600A5ARA	UCDE0600B5ARA	UCDE0600B5ARA	6,00	6,00	13,00	57,00	0,40
UCDE0600A5ASA	UCDE0600A5ASA	—	—	6,00	6,00	13,00	57,00	—
UCDE0700A5ARA	UCDE0700A5ARA	UCDE0700B5ARA	UCDE0700B5ARA	7,00	8,00	16,00	63,00	0,40
UCDE0700A5ASA	UCDE0700A5ASA	—	—	7,00	8,00	16,00	63,00	—
UCDE0800A5ARA	UCDE0800A5ARA	UCDE0800B5ARA	UCDE0800B5ARA	8,00	8,00	19,00	63,00	0,50
UCDE0800A5ASA	UCDE0800A5ASA	—	—	8,00	8,00	19,00	63,00	—
UCDE0900A5ARA	UCDE0900A5ARA	UCDE0900B5ARA	UCDE0900B5ARA *	9,00	10,00	19,00	72,00	0,50
UCDE0900A5ASA	UCDE0900A5ASA	—	—	9,00	10,00	19,00	72,00	—
UCDE1000A5ARA	UCDE1000A5ARA	UCDE1000B5ARA	UCDE1000B5ARA	10,00	10,00	22,00	72,00	0,50
UCDE1000A5ASA	UCDE1000A5ASA	—	—	10,00	10,00	22,00	72,00	—
UCDE1200A5ARA	UCDE1200A5ARA	UCDE1200B5ARA	UCDE1200B5ARA	12,00	12,00	26,00	83,00	0,75
UCDE1200A5ASA	UCDE1200A5ASA	—	—	12,00	12,00	26,00	83,00	—
UCDE1400A5ARA	UCDE1400A5ARA	UCDE1400B5ARA	UCDE1400B5ARA	14,00	14,00	26,00	83,00	0,75
UCDE1400A5ASA	UCDE1400A5ASA	—	—	14,00	14,00	26,00	83,00	—
UCDE1600A5ARA	UCDE1600A5ARA	UCDE1600B5ARA	UCDE1600B5ARA	16,00	16,00	32,00	92,00	0,75
UCDE1600A5ASA	UCDE1600A5ASA	—	—	16,00	16,00	32,00	92,00	—
UCDE1800A5ARA	UCDE1800A5ARA	UCDE1800B5ARA	UCDE1800B5ARA	18,00	18,00	32,00	92,00	0,75
UCDE1800A5ASA	UCDE1800A5ASA	—	—	18,00	18,00	32,00	92,00	—
UCDE2000A5ARA	UCDE2000A5ARA	UCDE2000B5ARA	UCDE2000B5ARA	20,00	20,00	38,00	104,00	0,75
UCDE2000A5ASA	UCDE2000A5ASA	—	—	20,00	20,00	38,00	104,00	—
UCDE2500A5ARA	UCDE2500A5ARA	UCDE2500B5ARA	UCDE2500B5ARA	25,00	25,00	45,00	121,00	0,75
UCDE2500A5ASA	UCDE2500A5ASA	—	—	25,00	25,00	45,00	121,00	—

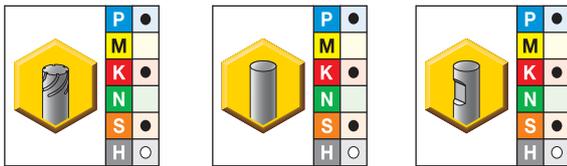
NOTE: For application data, see page P33.

\*Made-to-order standard item. Standard pricing, manufacturing lead time, and minimum order quantity applies.

- Kennametal standard dimensions.
- Non-centre cutting.
- Ramping up to 3°.
- Optimised geometry for titanium machining.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.
- Five-flute geometry enables slotting up to 1 x D.


**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

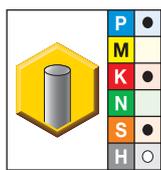

**UDDE • 5-Flute with Neck • Metric**


- first choice
- alternate choice

KCSM15	KC643M	KC643M	D1	D	D3	Ap1 max	L3	L	Re
—	—	UDDE0600B5ARA	6,00	6,00	5,64	13,00	18,00	63,00	0,20
—	UDDE0600A5ARA	UDDE0600B5ARB	6,00	6,00	5,64	13,00	18,00	63,00	0,50
—	UDDE0600A5ARB	UDDE0600B5ARC	6,00	6,00	5,64	13,00	18,00	63,00	1,00
—	UDDE0600A5ARC	UDDE0600B5ARD	6,00	6,00	5,64	13,00	18,00	63,00	1,50
—	UDDE0600A5ASA	—	6,00	6,00	5,64	13,00	18,00	63,00	—
—	—	UDDE0800B5ARA	8,00	8,00	7,52	19,00	24,00	76,00	0,20
—	UDDE0800A5ARA	UDDE0800B5ARB	8,00	8,00	7,52	19,00	24,00	76,00	0,50
—	UDDE0800A5ARB	UDDE0800B5ARC	8,00	8,00	7,52	19,00	24,00	76,00	1,00
—	UDDE0800A5ARC	UDDE0800B5ARD	8,00	8,00	7,52	19,00	24,00	76,00	2,00
—	UDDE0800A5ASA	—	8,00	8,00	7,52	19,00	24,00	76,00	—
—	UDDE1000A5ARA	UDDE1000B5ARA	10,00	10,00	9,40	22,00	30,00	76,00	0,50
—	UDDE1000A5ARB	UDDE1000B5ARB	10,00	10,00	9,40	22,00	30,00	76,00	1,00
—	UDDE1000A5ARC	UDDE1000B5ARC	10,00	10,00	9,40	22,00	30,00	76,00	2,00
—	UDDE1000A5ARD	UDDE1000B5ARD	10,00	10,00	9,40	22,00	30,00	76,00	2,50
—	UDDE1000A5ASA	—	10,00	10,00	9,40	22,00	30,00	76,00	—
UDDE1200E5AQE *	UDDE1200A5ARA	UDDE1200B5ARA	12,00	12,00	11,28	26,00	36,00	83,00	0,50
UDDE1200E5AQG *	UDDE1200A5ARB	UDDE1200B5ARB	12,00	12,00	11,28	26,00	36,00	83,00	1,00
UDDE1200E5AQK *	UDDE1200A5ARC	UDDE1200B5ARC	12,00	12,00	11,28	26,00	36,00	83,00	2,00
UDDE1200E5AQM *	UDDE1200A5ARD	UDDE1200B5ARD	12,00	12,00	11,28	26,00	36,00	83,00	3,00
—	UDDE1200A5ASA	—	12,00	12,00	11,28	26,00	36,00	83,00	—
—	UDDE1400A5ARA	—	14,00	14,00	13,15	26,00	42,00	84,00	0,50
—	—	UDDE1400B5ARB	14,00	14,00	13,15	26,00	42,00	84,00	1,00
—	UDDE1400A5ARC	—	14,00	14,00	13,15	26,00	42,00	84,00	2,00
—	UDDE1400A5ARD	—	14,00	14,00	13,15	26,00	42,00	84,00	3,00
—	UDDE1400A5ASA	—	14,00	14,00	13,15	26,00	42,00	84,00	—
UDDE1600E5AQE *	UDDE1600A5ARA	UDDE1600B5ARA	16,00	16,00	15,04	32,00	48,00	100,00	0,50
UDDE1600E5AQG *	UDDE1600A5ARB	UDDE1600B5ARB	16,00	16,00	15,04	32,00	48,00	100,00	1,00
UDDE1600E5AQK *	UDDE1600A5ARC	UDDE1600B5ARC	16,00	16,00	15,04	32,00	48,00	100,00	2,00

(continued)

(UDDE • 5-Flute with Neck • Metric — continued)



● first choice  
○ alternate choice

KCSM15	KC643M	KC643M	D1	D	D3	Ap1 max	L3	L	Re
UDDE1600E5AQM *	UDDE1600A5ARD	UDDE1600B5ARD	16,00	16,00	15,04	32,00	48,00	100,00	3,00
UDDE1600E5AQN *	UDDE1600A5ARE	UDDE1600B5ARE	16,00	16,00	15,04	32,00	48,00	100,00	4,00
UDDE1600E5AQP *	UDDE1600A5ARP	UDDE1600B5ARP	16,00	16,00	15,04	32,00	48,00	100,00	6,00
—	UDDE1600A5ASA	—	16,00	16,00	15,04	32,00	48,00	100,00	—
UDDE2000E5AQE *	UDDE2000A5ARA	UDDE2000B5ARA	20,00	20,00	18,80	38,00	60,00	115,00	0,50
UDDE2000E5AQG *	UDDE2000A5ARB	UDDE2000B5ARB	20,00	20,00	18,80	38,00	60,00	115,00	1,00
UDDE2000E5AQK *	UDDE2000A5ARC	UDDE2000B5ARC	20,00	20,00	18,80	38,00	60,00	115,00	2,00
UDDE2000E5AQM *	UDDE2000A5ARD	UDDE2000B5ARD	20,00	20,00	18,80	38,00	60,00	115,00	3,00
UDDE2000E5AQN *	UDDE2000A5ARE	UDDE2000B5ARE	20,00	20,00	18,80	38,00	60,00	115,00	4,00
UDDE2000E5AQP *	UDDE2000A5ARP	UDDE2000B5ARP	20,00	20,00	18,80	38,00	60,00	115,00	6,00
—	UDDE2000A5ASA	—	20,00	20,00	18,80	38,00	60,00	115,00	—
UDDE2500E5AQE *	UDDE2500A5ARA	UDDE2500B5ARA	25,00	25,00	23,50	45,00	75,00	135,00	0,50
UDDE2500E5AQG *	UDDE2500A5ARB	UDDE2500B5ARB	25,00	25,00	23,50	45,00	75,00	135,00	1,00
UDDE2500E5AQK *	UDDE2500A5ARC	UDDE2500B5ARC	25,00	25,00	23,50	45,00	75,00	135,00	2,00
UDDE2500E5AQM *	UDDE2500A5ARD	UDDE2500B5ARD	25,00	25,00	23,50	45,00	75,00	135,00	3,00
UDDE2500E5AQN *	UDDE2500A5ARE	UDDE2500B5ARE	25,00	25,00	23,50	45,00	75,00	135,00	4,00
UDDE2500E5AQP *	UDDE2500A5ARP	UDDE2500B5ARP	25,00	25,00	23,50	45,00	75,00	135,00	6,00
—	UDDE2500A5ASA	—	25,00	25,00	23,50	45,00	75,00	135,00	—

NOTE: For application data, see page P33.

\*Made-to-order standard item. Standard pricing, manufacturing lead time, and minimum order quantity applies.

**■ HARVI II • UCDE • Unequal Flute Spacing**

Material Group																			
	Side Milling (A) and Slotting (B)			KC643M		KCPM15		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 10%.											
	A		B	Cutting Speed – vc m/min		Cutting Speed – vc m/min		D1 – Diameter											
	ap	ae	ap	min	max	min	max	mm	5,0	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0	
P	0	1,5 x D	0,5 x D	1 x D	150	200	150	200	fz	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	1	1,5 x D	0,5 x D	1 x D	150	200	150	200	fz	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	2	1,5 x D	0,5 x D	1 x D	140	190	140	190	fz	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	3	1,5 x D	0,5 x D	1 x D	120	160	120	160	fz	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	4	1,5 x D	0,5 x D	0,75 x D	90	150	90	150	fz	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098
	5	1,5 x D	0,5 x D	1 x D	60	100	60	100	fz	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091
M	1	1,5 x D	0,5 x D	1 x D	90	115	90	115	fz	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	2	1,5 x D	0,5 x D	1 x D	60	80	60	80	fz	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091
	3	1,5 x D	0,5 x D	1 x D	60	70	60	70	fz	0,020	0,025	0,034	0,040	0,047	0,052	0,057	0,061	0,065	0,071
K	1	1,5 x D	0,5 x D	1 x D	120	150	120	150	fz	0,036	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124
	2	1,5 x D	0,5 x D	1 x D	110	140	110	140	fz	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	3	1,5 x D	0,5 x D	1 x D	110	130	110	130	fz	0,024	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091
S	1	1,5 x D	0,3 x D	0,3 x D	50	90	–	–	fz	0,030	0,036	0,050	0,061	0,070	0,079	0,087	0,095	0,101	0,114
	2	1,5 x D	0,3 x D	0,3 x D	25	40	–	–	fz	0,016	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061
	3	1,5 x D	0,3 x D	0,3 x D	25	40	–	–	fz	0,016	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061
	4	1,5 x D	0,5 x D	1 x D	50	60	–	–	fz	0,021	0,026	0,037	0,045	0,052	0,058	0,064	0,069	0,074	0,084
H	1	1,5 x D	0,5 x D	0,75 x D	80	140	80	140	fz	0,027	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098

NOTE: Those guidelines may require variations to achieve optimum results.

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 &gt;12mm diameter.

**■ HARVI II • UDDE • Unequal Flute Spacing**

Material Group																			
	Side Milling (A) and Slotting (B)			KCSM15/ KC643M		Recommended feed per tooth (fz = mm/th) for side milling (A). For slotting (B), reduce fz by 10%.													
	A		B	Cutting Speed – vc m/min		D1 – Diameter													
	ap	ae	ap	min	max	mm	6,0	8,0	10,0	12,0	14,0	16,0	18,0	20,0	25,0				
P	5	1,5 x D	0,5 x D	1 x D	60	100	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091			
	6	1,5 x D	0,5 x D	0,75 x D	50	75	fz	0,025	0,034	0,040	0,047	0,052	0,057	0,061	0,065	0,071			
K	1	1,5 x D	0,5 x D	1 x D	120	150	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,108	0,114	0,124			
	2	1,5 x D	0,5 x D	1 x D	110	140	fz	0,036	0,050	0,061	0,07	0,079	0,087	0,095	0,101	0,114			
	3	1,5 x D	0,5 x D	1 x D	110	130	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,076	0,081	0,091			
S	1	1,5 x D	0,3 x D	0,3 x D	50	90	fz	0,036	0,050	0,061	0,07	0,079	0,087	0,095	0,101	0,114			
	2	1,5 x D	0,3 x D	0,3 x D	25	40	fz	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061			
	3	1,5 x D	0,3 x D	0,3 x D	25	40	fz	0,019	0,026	0,032	0,037	0,042	0,046	0,050	0,054	0,061			
	4	1,5 x D	0,5 x D	1 x D	50	60	fz	0,026	0,037	0,045	0,052	0,058	0,064	0,069	0,074	0,084			
H	1	1,5 x D	0,5 x D	0,75 x D	80	140	fz	0,033	0,045	0,054	0,062	0,070	0,077	0,083	0,088	0,098			

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 &gt; 12mm diameter.

Side milling applications — for longest reach (L3) tools, reduce ae by 30%.

Slot milling applications — for longest reach (L3) tools, reduce ae by 30%.

# ➤ HARVI™ II Long

## High-Performance Solid Carbide End Mills

### Primary Application

The HARVI II Long system is designed for machining titanium, steels, and stainless steels with excellent surface finishes at maximum Metal Removal Rates (MRR). The extended cutting length enables the HARVI II Long system to machine deep pockets with thin walls in semi-finishing and finishing operations. It also reduces the number of cuts when machining wing profiles for the aerospace industry.

- Up to 5 x D side milling finishing operations in titanium and stainless steels.
- Exceptionally straight walls.
- Universal KC643M™ grade for long tool life.

## Features and Benefits

### Advanced Technology

- Five unequally spaced flutes for chatter-free machining at high feed rates, improving surface finish and tool life.
- 3 x D and 5 x D lengths for reduced number of cuts.
- Innovative core design increases stability for exceptionally straight walls.
- Improved feed rate in corner machining operations versus conventional cutters.

### Tailored Grades

- Universal KC643M grade suitable for cutting steel, cast iron, stainless steel (wet), and titanium (wet).

### Customisation

- Intermediate diameters available.
- Chip divider geometry available for reduced power consumption and improved chip formation in difficult-to-cut materials.
- Internal coolant axial, as well as radial, available.
- Various shank options and non-standard coatings available.

### Extensive Standard Offering

- Diameter range 6–25mm.
- Various corner radii in stock.

## 3 x D and 5 x D lengths of cut without reduced feed rates when machining corners.

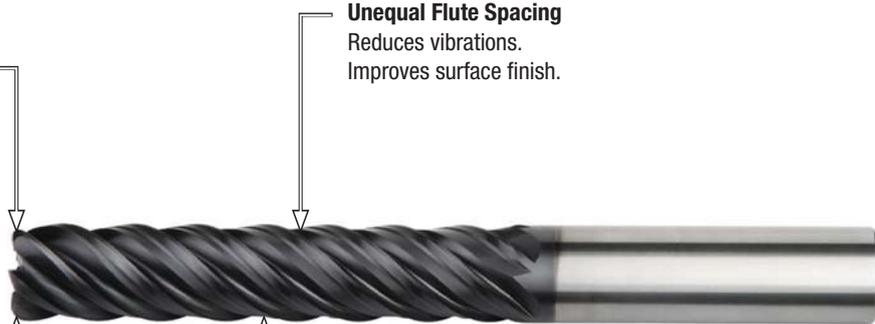


**Innovative Core Design**  
Improves tool stability and wall straightness.

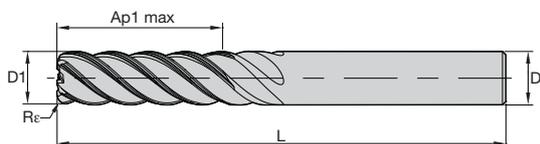
**Unequal Flute Spacing**  
Reduces vibrations.  
Improves surface finish.

**KC643M™ AITiN Grade**  
Universal usage.  
For highest tool life.

**43° Helix Angle**  
Improves results and machining of corners.



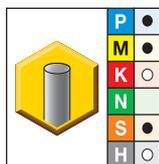
- For finishing and semi-finishing applications.
- Unequal flute spacing minimises chatter for smoother machining.
- Non-centre cutting.
- Kennametal standard dimensions.



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

### ■ HARVI II • UGDE • 3 x D Lengths of Cut



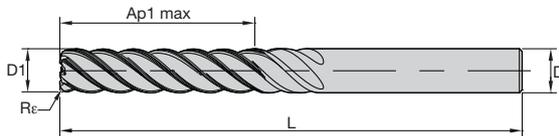
- first choice
- alternate choice

KC643M	D1	D	Ap1 max	L	Re
UGDE0600A5ARA	6,00	6,00	18,00	63,00	0,20
UGDE0600A5ARB	6,00	6,00	18,00	63,00	0,50
UGDE0600A5ARC	6,00	6,00	18,00	63,00	1,00
UGDE0800A5ARA	8,00	8,00	24,00	67,00	0,20
UGDE0800A5ARB	8,00	8,00	24,00	67,00	0,50
UGDE0800A5ARC	8,00	8,00	24,00	67,00	1,00
UGDE1000A5ARA	10,00	10,00	30,00	76,00	0,50
UGDE1000A5ARB	10,00	10,00	30,00	76,00	1,00
UGDE1000A5ARC	10,00	10,00	30,00	76,00	2,00
UGDE1000A5ARD	10,00	10,00	30,00	76,00	2,50
UGDE1200A5ARA	12,00	12,00	36,00	100,00	0,50
UGDE1200A5ARB	12,00	12,00	36,00	100,00	1,00
UGDE1200A5ARC	12,00	12,00	36,00	100,00	2,00
UGDE1200A5ARD	12,00	12,00	36,00	100,00	2,50
UGDE1400A5ARD	14,00	14,00	42,00	100,00	3,00
UGDE1600A5ARA	16,00	16,00	48,00	110,00	1,00
UGDE1600A5ARB	16,00	16,00	48,00	110,00	2,00
UGDE1600A5ARC	16,00	16,00	48,00	110,00	2,50
UGDE1600A5ARD	16,00	16,00	48,00	110,00	3,00
UGDE1600A5ARE	16,00	16,00	48,00	110,00	4,00
UGDE1600A5ARP	16,00	16,00	48,00	110,00	6,00
UGDE2000A5ARA	20,00	20,00	60,00	125,00	1,00
UGDE2000A5ARB	20,00	20,00	60,00	125,00	2,00
UGDE2000A5ARC	20,00	20,00	60,00	125,00	2,50
UGDE2000A5ARD	20,00	20,00	60,00	125,00	3,00
UGDE2000A5ARE	20,00	20,00	60,00	125,00	4,00
UGDE2000A5ARP	20,00	20,00	60,00	125,00	6,00
UGDE2500A5ARA	25,00	25,00	75,00	150,00	1,00
UGDE2500A5ARB	25,00	25,00	75,00	150,00	2,00
UGDE2500A5ARC	25,00	25,00	75,00	150,00	2,50
UGDE2500A5ARD	25,00	25,00	75,00	150,00	3,00
UGDE2500A5ARE	25,00	25,00	75,00	150,00	4,00
UGDE2500A5ARP	25,00	25,00	75,00	150,00	6,00

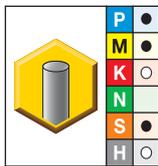
NOTE: For application data, see page P38.

High-Performance Solid Carbide End Mills

- For finishing and semi-finishing applications.
- Unequal flute spacing minimises chatter for smoother machining.
- Non-centre cutting.
- Kennametal standard dimensions.


**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

**■ HARVI II • UGDE • 5 x D Lengths of Cut**


- first choice
- alternate choice

KC643M	D1	D	Ap1 max	L	Re
UGDE0600A5BRA	6,00	6,00	30,00	76,00	0,20
UGDE0600A5BRB	6,00	6,00	30,00	76,00	0,50
UGDE0600A5BRC	6,00	6,00	30,00	76,00	1,00
UGDE0800A5BRA	8,00	8,00	40,00	87,00	0,20
UGDE0800A5BRB	8,00	8,00	40,00	87,00	0,50
UGDE0800A5BRC	8,00	8,00	40,00	87,00	1,00
UGDE1000A5BRA	10,00	10,00	50,00	100,00	0,50
UGDE1000A5BRB	10,00	10,00	50,00	100,00	1,00
UGDE1000A5BRC	10,00	10,00	50,00	100,00	2,00
UGDE1000A5BRD	10,00	10,00	50,00	100,00	2,50
UGDE1200A5BRA	12,00	12,00	60,00	125,00	0,50
UGDE1200A5BRB	12,00	12,00	60,00	125,00	1,00
UGDE1200A5BRC	12,00	12,00	60,00	125,00	2,00
UGDE1200A5BRD	12,00	12,00	60,00	125,00	2,50
UGDE1400A5BRD	14,00	14,00	70,00	120,00	3,00
UGDE1600A5BRA	16,00	16,00	80,00	141,00	1,00
UGDE1600A5BRB	16,00	16,00	80,00	141,00	2,00
UGDE1600A5BRC	16,00	16,00	80,00	141,00	2,50
UGDE1600A5BRD	16,00	16,00	80,00	141,00	3,00
UGDE1600A5BRE	16,00	16,00	80,00	141,00	4,00
UGDE1600A5BRP	16,00	16,00	80,00	141,00	6,00
UGDE2000A5BRA	20,00	20,00	100,00	166,00	1,00
UGDE2000A5BRB	20,00	20,00	100,00	166,00	2,00
UGDE2000A5BRC	20,00	20,00	100,00	166,00	2,50
UGDE2000A5BRD	20,00	20,00	100,00	166,00	3,00
UGDE2000A5BRE	20,00	20,00	100,00	166,00	4,00
UGDE2000A5BRP	20,00	20,00	100,00	166,00	6,00
UGDE2500A5BRA	25,00	25,00	125,00	190,00	1,00
UGDE2500A5BRB	25,00	25,00	125,00	190,00	2,00
UGDE2500A5BRC *	25,00	25,00	125,00	190,00	2,50
UGDE2500A5BRD	25,00	25,00	125,00	190,00	3,00
UGDE2500A5BRE	25,00	25,00	125,00	190,00	4,00
UGDE2500A5BRP	25,00	25,00	125,00	190,00	6,00

NOTE: For application data, see page P39.

\*Made-to-order standard item. Standard pricing, manufacturing lead time, and minimum order quantity applies.

■ HARVI™ II • UGDE • Unequal Flute Spacing • 3 x D Lengths of Cut

Material Group		Side Milling (A)		KC643M		Recommended feed per tooth (fz = mm/th) for side milling (A).								
		A		Cutting Speed – vc m/min		mm	D1 – Diameter							
		ap	ae	min	max		6,0	8,0	10,0	12,0	14,0	16,0	20,0	25,0
		1	2	3	4	5	6	1	2	3	4	5	6	
P	1	Ap1 max	0,05 x D*	300	400	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,114	0,124
	2	Ap1 max	0,05 x D*	280	380	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,114	0,124
	3	Ap1 max	0,05 x D*	240	320	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	4	Ap1 max	0,05 x D*	180	300	fz	0,033	0,045	0,054	0,062	0,070	0,077	0,088	0,098
	5	Ap1 max	0,05 x D*	120	200	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,081	0,091
	6	Ap1 max	0,05 x D*	100	150	fz	0,025	0,034	0,040	0,047	0,052	0,057	0,065	0,071
M	1	Ap1 max	0,05 x D*	180	230	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	2	Ap1 max	0,05 x D*	120	160	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,081	0,091
	3	Ap1 max	0,05 x D*	120	140	fz	0,025	0,034	0,040	0,047	0,052	0,057	0,065	0,071
K	1	Ap1 max	0,05 x D*	240	300	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,114	0,124
	2	Ap1 max	0,05 x D*	220	260	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	3	Ap1 max	0,05 x D*	200	260	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,081	0,091
S	1	Ap1 max	0,05 x D*	100	180	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	2	Ap1 max	0,05 x D*	100	180	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	3	Ap1 max	0,05 x D*	50	80	fz	0,019	0,026	0,032	0,037	0,042	0,046	0,054	0,061
	4	Ap1 max	0,05 x D*	100	120	fz	0,026	0,037	0,045	0,052	0,058	0,064	0,074	0,084
H	1	Ap1 max	0,05 x D*	160	280	fz	0,033	0,045	0,054	0,062	0,070	0,077	0,088	0,098

\* For the above cutting data, do not exceed an overall ae of 0,8mm.

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.

**■ HARVI™ II • UGDE • Unequal Flute Spacing • 5 x D Lengths of Cut**

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	14,0	16,0	20,0	25,0	
P	1	Ap1 max	0,05 x D*	300	400	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,114	0,124
	2	Ap1 max	0,05 x D*	280	380	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,114	0,124
	3	Ap1 max	0,05 x D*	240	320	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	4	Ap1 max	0,05 x D*	180	300	fz	0,033	0,045	0,054	0,062	0,070	0,077	0,088	0,098
	5	Ap1 max	0,05 x D*	120	200	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,081	0,091
	6	Ap1 max	0,05 x D*	100	150	fz	0,025	0,034	0,040	0,047	0,052	0,057	0,065	0,071
M	1	Ap1 max	0,05 x D*	180	230	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	2	Ap1 max	0,05 x D*	120	160	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,081	0,091
	3	Ap1 max	0,05 x D*	120	140	fz	0,025	0,034	0,040	0,047	0,052	0,057	0,065	0,071
K	1	Ap1 max	0,05 x D*	240	300	fz	0,044	0,060	0,072	0,083	0,092	0,101	0,114	0,124
	2	Ap1 max	0,05 x D*	220	260	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	3	Ap1 max	0,05 x D*	200	260	fz	0,029	0,040	0,048	0,056	0,063	0,070	0,081	0,091
S	1	Ap1 max	0,05 x D*	100	180	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	2	Ap1 max	0,05 x D*	100	180	fz	0,036	0,050	0,061	0,070	0,079	0,087	0,101	0,114
	3	Ap1 max	0,05 x D*	50	80	fz	0,019	0,026	0,032	0,037	0,042	0,046	0,054	0,061
	4	Ap1 max	0,05 x D*	100	120	fz	0,026	0,037	0,045	0,052	0,058	0,064	0,074	0,084
H	1	Ap1 max	0,05 x D*	160	280	fz	0,033	0,045	0,054	0,062	0,070	0,077	0,088	0,098

\* For the above cutting data, do not exceed an overall ae of 0,8mm.

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.



# ➤ HARVI™ II Trochoidal

## High-Performance Solid Carbide End Mills

### Primary Application

Kennametal trochoidal end mills are designed for high-feed applications up to 3 x D with low radial engagement and are tailored for CAM tool path generation software.

Designated for both roughing and finishing operations on open contours and deep cavities. Penetration of deep pockets bottoms of via helical interpolation with same tool reduces tool inventory and set-up time.

## Features and Benefits

### Advanced Technology

- Five unequally spaced flutes designed for chatter-free machining at highest feed rates.
- Front-end design optimised for helical operations.
- Patented flute and flute space for optimised chip control.

### Tailored Grades

- KC643M™ grade optimised for steel, stainless, and high-temperature alloys.

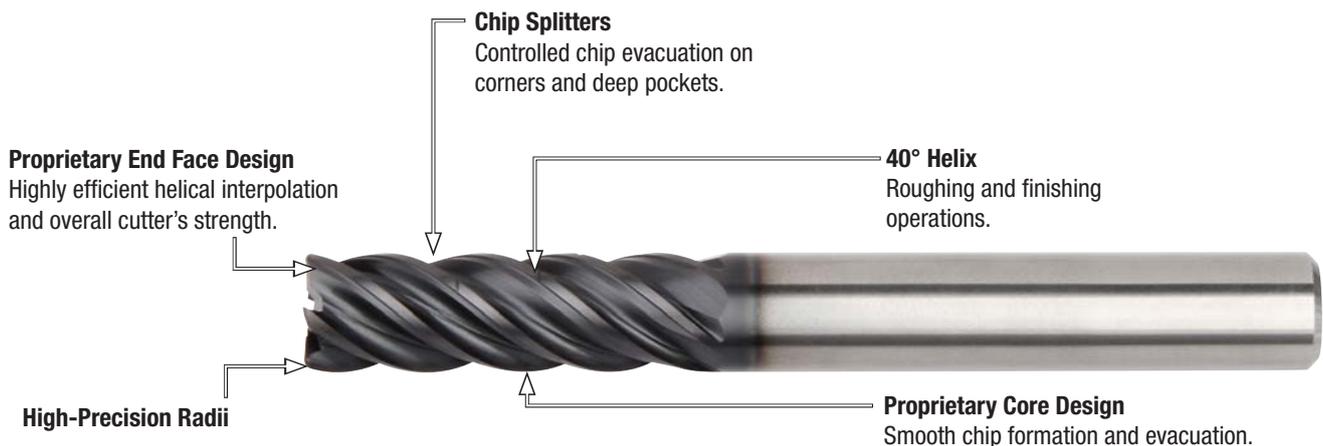
### Customisation

- Intermediate diameters available.
- Expanded length of tool, as well as increased length of cuts is possible.
- Different radii available.

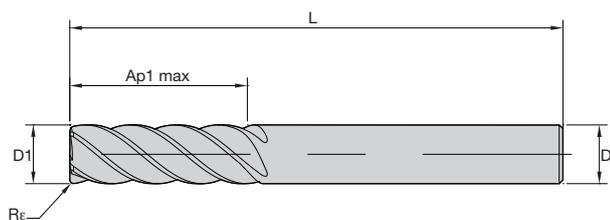
### Standard Offering

- Diameter ranges 8–25mm.

# Designed for dynamic milling and trochoidal milling.



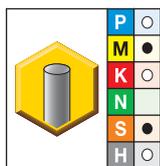
- Kennametal standard dimensions.
- Non-centre cutting.
- Roughing and finishing, cavities and open contour, requiring fewer setups.
- Unequally spaced fluted for chatter-free machining at highest feed rates.
- Optimised for trochoidal milling and helical operations.
- Patented flute and flute space for optimised chip control.



End Mill Tolerances

D1	tolerance	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

### TCDE • Unequal Flute Spacing • With Chipsplitter



- first choice
- alternate choice

KC643M	D1	D	Ap1 max	L	Re
TCDE0800A5CRE	8,00	8,00	24,00	67,00	0,50
TCDE1000A5CRE	10,00	10,00	30,00	80,00	0,50
TCDE1200A5CRF	12,00	12,00	36,00	100,00	0,75
TCDE1600A5CRG	16,00	16,00	48,00	110,00	1,00
TCDE2000A5CRG	20,00	20,00	60,00	125,00	1,00
TCDE2500A5CRG	25,00	25,00	75,00	150,00	1,00

NOTE: For application data, see pages P43–P44.

**■ HARVI II Trochoidal • TCDE • Unequal Flute Spacing • ae 10% of D1**

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	8,0	10,0	12,0	16,0	20,0	25,0
P	0	Ap max	0,1 x D	150	–	440	fz	0,072	0,086	0,099	0,121	0,137	0,149
	1	Ap max	0,1 x D	150	–	440	fz	0,072	0,086	0,099	0,121	0,137	0,149
	2	Ap max	0,1 x D	140	–	418	fz	0,072	0,086	0,099	0,121	0,137	0,149
	3	Ap max	0,1 x D	120	–	352	fz	0,060	0,073	0,084	0,105	0,121	0,137
	4	Ap max	0,1 x D	90	–	330	fz	0,054	0,065	0,075	0,092	0,106	0,117
	5	Ap max	0,1 x D	60	–	220	fz	0,048	0,058	0,067	0,084	0,097	0,109
M	1	Ap max	0,1 x D	90	–	253	fz	0,060	0,073	0,084	0,105	0,121	0,137
	2	Ap max	0,1 x D	60	–	176	fz	0,048	0,058	0,067	0,084	0,097	0,109
	3	Ap max	0,1 x D	60	–	154	fz	0,040	0,048	0,056	0,068	0,078	0,085
K	1	Ap max	0,1 x D	120	–	330	fz	0,072	0,086	0,099	0,121	0,137	0,149
	2	Ap max	0,1 x D	110	–	308	fz	0,060	0,073	0,084	0,105	0,121	0,137
	3	Ap max	0,1 x D	110	–	286	fz	0,048	0,058	0,067	0,084	0,097	0,109
S	1	Ap max	0,1 x D	50	–	198	fz	0,060	0,073	0,084	0,105	0,121	0,137
	2	Ap max	0,1 x D	25	–	88	fz	0,032	0,038	0,045	0,056	0,065	0,074
	3	Ap max	0,1 x D	25	–	88	fz	0,032	0,038	0,045	0,056	0,065	0,074
	4	Ap max	0,1 x D	50	–	132	fz	0,044	0,053	0,062	0,077	0,089	0,100
H	1	Ap max	0,1 x D	80	–	308	fz	0,054	0,065	0,075	0,092	0,106	0,117
	2	Ap max	0,1 x D	70	–	264	fz	0,040	0,048	0,056	0,068	0,078	0,085

**■ HARVI II Trochoidal • TCDE • Unequal Flute Spacing • ae 5% of D1**

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	8,0	10,0	12,0	16,0	20,0	25,0
P	0	Ap max	0,05 x D	150	–	540	fz	0,097	0,117	0,134	0,163	0,185	0,200
	1	Ap max	0,05 x D	150	–	540	fz	0,097	0,117	0,134	0,163	0,185	0,200
	2	Ap max	0,05 x D	140	–	513	fz	0,097	0,117	0,134	0,163	0,185	0,200
	3	Ap max	0,05 x D	120	–	432	fz	0,081	0,098	0,114	0,141	0,164	0,184
	4	Ap max	0,05 x D	90	–	405	fz	0,073	0,087	0,101	0,124	0,143	0,158
	5	Ap max	0,05 x D	60	–	270	fz	0,065	0,078	0,091	0,113	0,131	0,147
M	1	Ap max	0,05 x D	90	–	310,5	fz	0,054	0,065	0,075	0,092	0,105	0,115
	2	Ap max	0,05 x D	60	–	216	fz	0,081	0,098	0,114	0,141	0,164	0,184
	3	Ap max	0,05 x D	60	–	189	fz	0,065	0,078	0,091	0,113	0,131	0,147
K	1	Ap max	0,05 x D	120	–	405	fz	0,097	0,117	0,134	0,163	0,185	0,200
	2	Ap max	0,05 x D	110	–	378	fz	0,081	0,098	0,114	0,141	0,164	0,184
	3	Ap max	0,05 x D	110	–	351	fz	0,065	0,078	0,091	0,113	0,131	0,147
S	1	Ap max	0,05 x D	50	–	243	fz	0,081	0,098	0,114	0,141	0,164	0,184
	2	Ap max	0,05 x D	25	–	108	fz	0,043	0,052	0,060	0,075	0,087	0,099
	3	Ap max	0,05 x D	25	–	108	fz	0,043	0,052	0,060	0,075	0,087	0,099
	4	Ap max	0,05 x D	50	–	162	fz	0,060	0,072	0,084	0,104	0,120	0,135
H	1	Ap max	0,05 x D	80	–	378	fz	0,073	0,087	0,101	0,124	0,143	0,158
	2	Ap max	0,05 x D	70	–	324	fz	0,054	0,065	0,075	0,092	0,105	0,115

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.  
 For better surface finish, reduce feed per tooth.

### ■ HARVI II Trochoidal • TCDE • Unequal Flute Spacing • ae 2% of D1

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	8,0	10,0	12,0	16,0	20,0	25,0	
P	0	Ap max	0,02 x D	150	–	660	fz	0,140	0,168	0,194	0,236	0,267	0,290
	1	Ap max	0,02 x D	150	–	660	fz	0,140	0,168	0,194	0,236	0,267	0,290
	2	Ap max	0,02 x D	140	–	627	fz	0,140	0,168	0,194	0,236	0,267	0,290
	3	Ap max	0,02 x D	120	–	528	fz	0,117	0,142	0,164	0,204	0,236	0,266
	4	Ap max	0,02 x D	90	–	495	fz	0,105	0,126	0,146	0,180	0,206	0,228
	5	Ap max	0,02 x D	60	–	330	fz	0,094	0,113	0,131	0,163	0,189	0,213
M	6	Ap max	0,02 x D	50	–	247,5	fz	0,079	0,095	0,109	0,133	0,152	0,166
	1	Ap max	0,02 x D	90	–	379,5	fz	0,117	0,142	0,164	0,204	0,236	0,266
	2	Ap max	0,02 x D	60	–	264	fz	0,094	0,113	0,131	0,163	0,189	0,213
K	3	Ap max	0,02 x D	60	–	231	fz	0,079	0,095	0,109	0,133	0,152	0,166
	1	Ap max	0,02 x D	120	–	495	fz	0,140	0,168	0,194	0,236	0,267	0,290
	2	Ap max	0,02 x D	110	–	462	fz	0,117	0,142	0,164	0,204	0,236	0,266
S	3	Ap max	0,02 x D	110	–	429	fz	0,094	0,113	0,131	0,163	0,189	0,213
	1	Ap max	0,02 x D	50	–	297	fz	0,117	0,142	0,164	0,204	0,236	0,266
	2	Ap max	0,02 x D	25	–	132	fz	0,062	0,075	0,087	0,109	0,126	0,143
	3	Ap max	0,02 x D	25	–	132	fz	0,062	0,075	0,087	0,109	0,126	0,143
H	4	Ap max	0,02 x D	50	–	198	fz	0,086	0,104	0,121	0,150	0,174	0,196
	1	Ap max	0,02 x D	80	–	462	fz	0,105	0,126	0,146	0,180	0,206	0,228
	2	Ap max	0,02 x D	70	–	396	fz	0,079	0,095	0,109	0,133	0,152	0,166

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.  
 For better surface finish, reduce feed per tooth.

## ■ Dynamic Milling • Trochoidal Milling

### The Concept

- Transfer the basic idea of controlling of chip thickness to dynamic processes.
- Dynamic adaption of feed in relation to ae and wrap angle through an intelligent CAM software.
- Using helix interpolation, D-lanes, and morphing cycles tailored to the workpiece shape and material.



### The Benefits of Trochoidal Milling include:

#### For the tool:

- Better chip evacuation.
- Better usage of tool length.
- Higher cutting speed and feed per tooth possible.

#### For the machining process:

- Tremendously reduced chip load on the cutting edge.
- Reduced temperature during the machining process.
- Reduced cycle time and increased tool life.

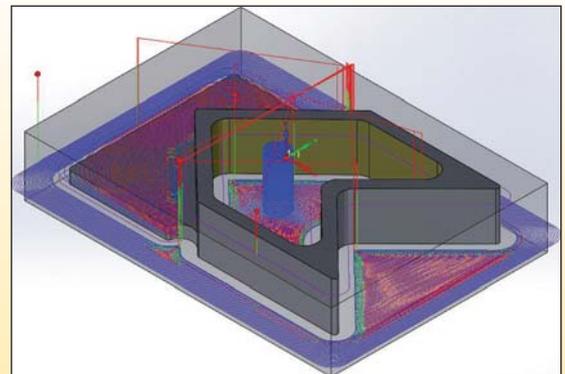
#### For the machining centre:

- Reduced torque and power requirements for the machine.
- Lower risk of spindle damage through torque fluctuation and reduced torque peaks caused by conventional milling processes.
- Addressing market shifts by utilising high RPM spindle machines previously dedicated for aluminium, and now for stainless steel, titanium, and other demanding applications.

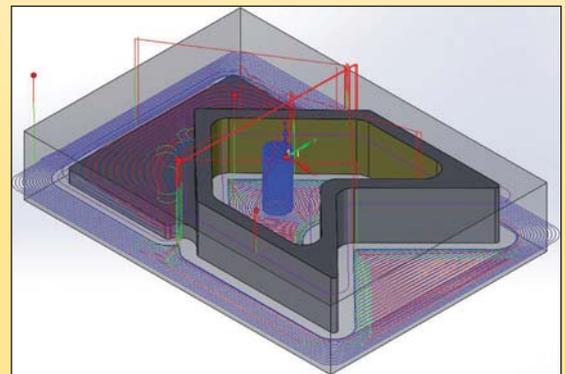
### Requirements:

- Highly dynamic CNC machining centre.
- 3D model based CNC programming.
- CAD/CAM tool path optimisation software.
- Sophisticated end milling tool.
- Cutting data for trochoidal machining.

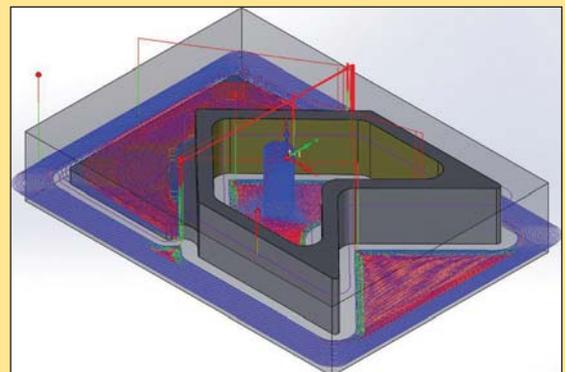
Tool path for high-alloy steel



Tool path for stainless steel



Tool path for titanium



# ➤ HARVI™ III

## High-Performance Solid Carbide End Mills

### Primary Application

The HARVI III system takes high-performance profiling, semi-finishing, and finishing to the next level. These end mills are designed to provide maximum metal removal rates in titanium and stainless steel while achieving supreme surface conditions. A wide range of diameters and corner radii are available from stock as well as the Safe-Lock™ system by HAIMER® shanks.

- Outstanding metal removal rates increase productivity.
- Longest tool life due to eccentric relief grind and proprietary KCSM15™ Beyond™ grade.
- Increased process safety with Safe-Lock™ shanks.

## Features and Benefits

### Advanced Technology

- Six unequally spaced flutes for chatter-free machining at high feed rates.
- Lower cutting forces and pressure on cutting edge through tailored axial and radial rake angles.
- Eccentric relief design increases tool life through higher edge stability.
- Proprietary tapered core provides highest tool stability in roughing and finishing operations.
- Centre cutting design for higher flexibility as well as radial and axial finishing pass after roughing operation.

### Tailored Grades

- KCSM15™ Beyond™ grade for exceptional tool life in titanium and stainless steels.

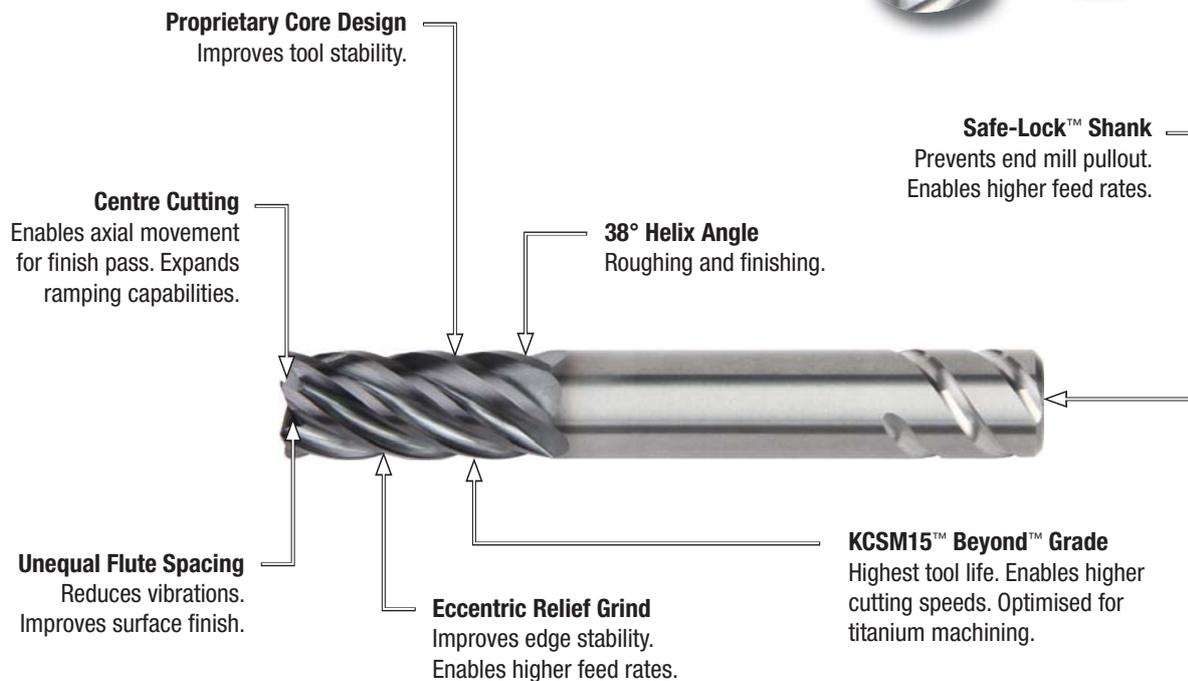
### Customisation

- Engineered solutions, including ball nose versions, are available upon request.

### Extensive Standard Offering

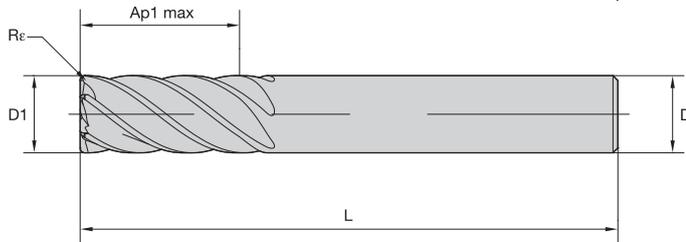
- Diameter ranges 10–25mm.
- Necked, corner radii, and square-end offering.
- Round shank and Safe-Lock™ shank available.

# Maximum metal removal rates in machining titanium and stainless steel with supreme surfaces.



**SAFE-LOCK®**  
by HAIMER®

- Kennametal standard dimensions.
- Centre cutting.
- Optimised geometry for titanium machining.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.

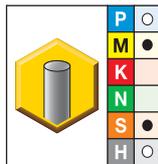


**End Mill Tolerances**

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



■ **UJDE • 6 Flute with Eccentric Relief Grind • Metric**

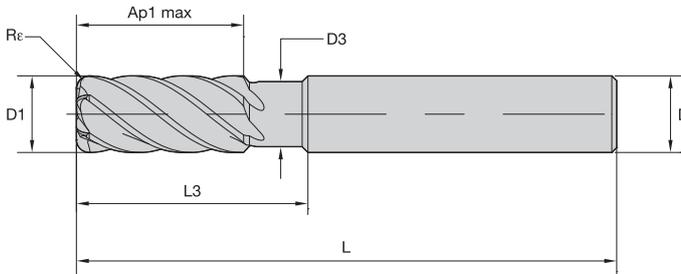


- first choice
- alternate choice

KCSM15	KCSM15	D1	D	Ap1 max	L	Re
—	UJDE1000A6ARE	10,00	10,00	22,00	72,00	0,50
—	UJDE1000A6AS	10,00	10,00	22,00	72,00	—
UJDE1200E6ARF	UJDE1200A6ARF	12,00	12,00	26,00	83,00	0,75
—	UJDE1200A6AS	12,00	12,00	26,00	83,00	—
UJDE1400E6ARF	UJDE1400A6ARF	14,00	14,00	26,00	83,00	0,75
—	UJDE1400A6AS	14,00	14,00	26,00	83,00	—
UJDE1600E6ARF	UJDE1600A6ARF	16,00	16,00	32,00	92,00	0,75
—	UJDE1600A6AS	16,00	16,00	32,00	92,00	—
UJDE2000E6ARF	UJDE2000A6ARF	20,00	20,00	38,00	104,00	0,75
—	UJDE2000A6AS	20,00	20,00	38,00	104,00	—
UJDE2500E6ARF	UJDE2500A6ARF	25,00	25,00	45,00	121,00	0,75
—	UJDE2500A6AS	25,00	25,00	45,00	121,00	—

NOTE: For application data, see page P50.

- Kennametal standard dimensions.
- Centre cutting.
- Optimised geometry for titanium machining.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.

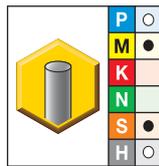


End Mill Tolerances

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



■ UJDE • 6 Flute with Eccentric Relief Grind and Neck • Metric



- first choice
- alternate choice

KCSM15	KCSM15	D1	D	D3	Ap1 max	L3	L	Re
—	UJDE1000A6AQE	10,00	10,00	9,40	22,00	30,00	76,00	0,50
—	UJDE1000A6AQG	10,00	10,00	9,40	22,00	30,00	76,00	1,00
—	UJDE1000A6AQK	10,00	10,00	9,40	22,00	30,00	76,00	2,00
—	UJDE1000A6AQM *	10,00	10,00	9,40	22,00	30,00	76,00	3,00
—	UJDE1000A6ANS	10,00	10,00	9,40	22,00	30,00	76,00	—
UJDE1200E6AQE	UJDE1200A6AQE	12,00	12,00	11,28	26,00	36,00	83,00	0,50
UJDE1200E6AQG	UJDE1200A6AQG	12,00	12,00	11,28	26,00	36,00	83,00	1,00
UJDE1200E6AQK	UJDE1200A6AQK	12,00	12,00	11,28	26,00	36,00	83,00	2,00
UJDE1200E6AQM	UJDE1200A6AQM	12,00	12,00	11,28	26,00	36,00	83,00	3,00
—	UJDE1200A6ANS	12,00	12,00	11,28	26,00	36,00	83,00	—
UJDE1600E6AQE	UJDE1600A6AQE	16,00	16,00	15,04	32,00	48,00	100,00	0,50
UJDE1600E6AQG	UJDE1600A6AQG	16,00	16,00	15,04	32,00	48,00	100,00	1,00
UJDE1600E6AQK	UJDE1600A6AQK	16,00	16,00	15,04	32,00	48,00	100,00	2,00
UJDE1600E6AQM	UJDE1600A6AQM	16,00	16,00	15,04	32,00	48,00	100,00	3,00
UJDE1600E6AQN	UJDE1600A6AQN	16,00	16,00	15,04	32,00	48,00	100,00	4,00
—	UJDE1600A6AQP	16,00	16,00	15,04	32,00	48,00	100,00	6,00
—	UJDE1600A6ANS	16,00	16,00	15,04	32,00	48,00	100,00	—
UJDE2000E6AQE	UJDE2000A6AQE	20,00	20,00	18,80	38,00	60,00	115,00	0,50
UJDE2000E6AQG	UJDE2000A6AQG	20,00	20,00	18,80	38,00	60,00	115,00	1,00
UJDE2000E6AQK	UJDE2000A6AQK	20,00	20,00	18,80	38,00	60,00	115,00	2,00
UJDE2000E6AQM	UJDE2000A6AQM	20,00	20,00	18,80	38,00	60,00	115,00	3,00
UJDE2000E6AQN	UJDE2000A6AQN	20,00	20,00	18,80	38,00	60,00	115,00	4,00
—	UJDE2000A6AQP	20,00	20,00	18,80	38,00	60,00	115,00	6,00
—	UJDE2000A6ANS	20,00	20,00	18,80	38,00	60,00	115,00	—
UJDE2500E6AQE *	UJDE2500A6AQE *	25,00	25,00	23,50	45,00	75,00	135,00	0,50
UJDE2500E6AQG *	UJDE2500A6AQG *	25,00	25,00	23,50	45,00	75,00	135,00	1,00
UJDE2500E6AQK *	UJDE2500A6AQK *	25,00	25,00	23,50	45,00	75,00	135,00	2,00
UJDE2500E6AQM *	UJDE2500A6AQM *	25,00	25,00	23,50	45,00	75,00	135,00	3,00
UJDE2500E6AQN *	UJDE2500A6AQN *	25,00	25,00	23,50	45,00	75,00	135,00	4,00
—	UJDE2500A6AQP	25,00	25,00	23,50	45,00	75,00	135,00	6,00

NOTE: For application data, see page P51.

\*Made-to-order standard item. Standard pricing, manufacturing lead time, and minimum order quantity applies.

■ HARVI III • UJDE • Unequal Flute Spacing • Roughing

		Side Milling (A)		KCSM15		Recommended feed per tooth (fz = mm/th) for side milling (A).							
Material Group		A		Cutting Speed – vc m/min		mm	D1 – Diameter						
		ap	ae	min	max		10,0	12,0	16,0	18,0	20,0	25,0	
P	4	Ap1 max	0,4 x D	90	150	fz	0,054	0,062	0,077	0,083	0,088	0,098	
	5	Ap1 max	0,4 x D	60	100	fz	0,048	0,056	0,070	0,076	0,081	0,091	
M	1	Ap1 max	0,4 x D	90	115	fz	0,061	0,070	0,087	0,095	0,101	0,114	
	2	Ap1 max	0,4 x D	60	80	fz	0,048	0,056	0,070	0,076	0,081	0,091	
	3	Ap1 max	0,4 x D	60	70	fz	0,040	0,047	0,057	0,061	0,065	0,071	
S	1	Ap1 max	0,4 x D	50	90	fz	0,061	0,070	0,087	0,095	0,101	0,114	
	2	Ap1 max	0,4 x D	25	40	fz	0,032	0,037	0,046	0,050	0,054	0,061	
	3	Ap1 max	0,4 x D	25	40	fz	0,032	0,037	0,046	0,050	0,054	0,061	
	4	Ap1 max	0,4 x D	50	60	fz	0,045	0,052	0,064	0,069	0,074	0,084	
H	1	Ap1 max	0,4 x D	80	140	fz	0,054	0,062	0,077	0,083	0,088	0,098	

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.

■ HARVI III • UJDE • Unequal Flute Spacing • Finishing

		Side Milling (A)		KCSM15		Recommended feed per tooth (fz = mm/th) for side milling (A).							
Material Group		A		Cutting Speed – vc m/min		mm	D1 – Diameter						
		ap	ae	min	max		10,0	12,0	14,0	16,0	18,0	20,0	25,0
P	4	Ap1 max	0,06 x D	171	285	fz	0,065	0,075	0,084	0,092	0,099	0,106	0,117
	5	Ap1 max	0,06 x D	114	190	fz	0,058	0,067	0,076	0,084	0,091	0,097	0,109
M	1	Ap1 max	0,06 x D	171	218	fz	0,073	0,084	0,095	0,105	0,113	0,121	0,137
	2	Ap1 max	0,06 x D	114	152	fz	0,058	0,067	0,076	0,084	0,091	0,097	0,109
	3	Ap1 max	0,06 x D	114	133	fz	0,048	0,056	0,062	0,068	0,073	0,078	0,085
S	1	Ap1 max	0,06 x D	95	171	fz	0,073	0,084	0,095	0,105	0,113	0,121	0,137
	2	Ap1 max	0,06 x D	47,5	76	fz	0,038	0,045	0,050	0,056	0,060	0,065	0,074
	3	Ap1 max	0,06 x D	47,5	76	fz	0,038	0,045	0,050	0,056	0,060	0,065	0,074
	4	Ap1 max	0,06 x D	95	152	fz	0,053	0,062	0,070	0,077	0,083	0,089	0,100
H	1	Ap1 max	0,06 x D	152	266	fz	0,065	0,075	0,084	0,092	0,099	0,106	0,117
	2	Ap1 max	0,06 x D	133	228	fz	0,048	0,056	0,062	0,068	0,073	0,078	0,085

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.

**■ HARVI III • UJDE • Unequal Flute Spacing • Roughing • With Neck**

Material Group	Side Milling (A)		KCSM15		Recommended feed per tooth (fz = mm/th) for side milling (A).							
	A		Cutting Speed – vc m/min		mm	D1 – Diameter						
	ap	ae	min	max		10,0	12,0	16,0	18,0	20,0	25,0	
P	4	Ap max	0,4 x D	90	150	fz	0,054	0,062	0,077	0,083	0,088	0,098
	5	Ap max	0,4 x D	60	100	fz	0,048	0,056	0,070	0,076	0,081	0,091
M	1	Ap max	0,4 x D	90	115	fz	0,061	0,070	0,087	0,095	0,101	0,114
	2	Ap max	0,4 x D	60	80	fz	0,048	0,056	0,070	0,076	0,081	0,091
	3	Ap max	0,4 x D	60	70	fz	0,040	0,047	0,057	0,061	0,065	0,071
S	1	Ap max	0,4 x D	50	90	fz	0,061	0,070	0,087	0,095	0,101	0,114
	2	Ap max	0,4 x D	25	40	fz	0,032	0,037	0,046	0,050	0,054	0,061
	3	Ap max	0,4 x D	25	40	fz	0,032	0,037	0,046	0,050	0,054	0,061
	4	Ap max	0,4 x D	50	60	fz	0,045	0,052	0,064	0,069	0,074	0,084
H	1	Ap max	0,4 x D	80	140	fz	0,054	0,062	0,077	0,083	0,088	0,098

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.

**■ HARVI III • UJDE • Unequal Flute Spacing • Finishing • With Neck**

Material Group	Side Milling (A)		KCSM15		Recommended feed per tooth (fz = mm/th) for side milling (A).								
	A		Cutting Speed – vc m/min		mm	D1 – Diameter							
	ap	ae	min	max		10,0	12,0	14,0	16,0	18,0	20,0	25,0	
P	4	Ap max	0,06 x D	171	285	fz	0,065	0,075	0,084	0,092	0,099	0,106	0,117
	5	Ap max	0,06 x D	114	190	fz	0,058	0,067	0,076	0,084	0,091	0,097	0,109
M	1	Ap max	0,06 x D	171	218,5	fz	0,073	0,084	0,095	0,105	0,113	0,121	0,137
	2	Ap max	0,06 x D	114	152	fz	0,058	0,067	0,076	0,084	0,091	0,097	0,109
	3	Ap max	0,06 x D	114	133	fz	0,048	0,056	0,062	0,068	0,073	0,078	0,085
S	1	Ap max	0,06 x D	95	171	fz	0,073	0,084	0,095	0,105	0,113	0,121	0,137
	2	Ap max	0,06 x D	47,5	76	fz	0,038	0,045	0,050	0,056	0,060	0,065	0,074
	3	Ap max	0,06 x D	47,5	76	fz	0,038	0,045	0,050	0,056	0,060	0,065	0,074
	4	Ap max	0,06 x D	95	114	fz	0,053	0,062	0,070	0,077	0,083	0,089	0,100
H	1	Ap max	0,06 x D	152	266	fz	0,065	0,075	0,084	0,092	0,099	0,106	0,117
	2	Ap max	0,06 x D	133	228	fz	0,048	0,056	0,062	0,068	0,073	0,078	0,085

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.

High-Performance Solid Carbide End Mills

# HARVI™ III Ball Nose

High-Performance Solid Carbide End Mills

## Primary Application

HARVI III Ball Nose tooling takes high-performance profiling, semi-finishing, and finishing to the next level. Designed to provide maximum metal removal rates in titanium and stainless steel while achieving supreme surface conditions. A wide range of diameters and length variations are available from stock.

- Outstanding metal removal rates increase productivity.
- Highest tool life due to eccentric relief grind and proprietary KCSM15™ Beyond™ grade.

## Features and Benefits

### Advanced Technology

- Six unequally spaced flutes for chatter-free machining at high feed rates.
- Less cutting forces and pressure on cutting edge through tailored axial and radial rake angles.
- Eccentric relief design increases tool life through higher edge stability.
- Proprietary tapered core provides highest tool stability at roughing and finishing operations.

### Tailored Grade

- KCSM15 Beyond grade for exceptional tool life in titanium and stainless steels.

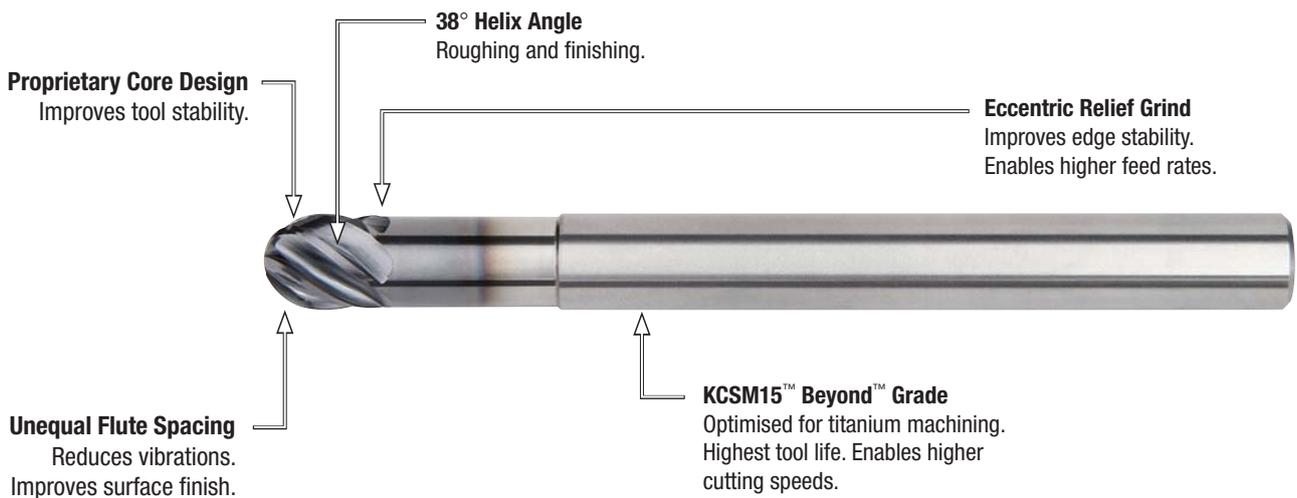
### Extensive Standard Offering

- Diameter ranges 10–20mm.
- Necked, round shank offering in two length variations.

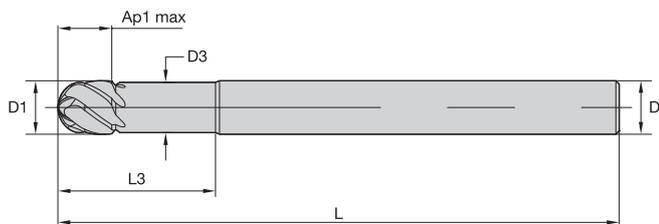
### Customisation

- Engineered solutions, including shank and non-standard length versions are available upon request.

# 3D profiling for highest productivity in titanium and stainless steel.



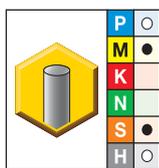
- Kennametal standard dimensions.
- Centre cutting.
- Optimised geometry for titanium machining.
- Unequal flute spacing minimises chatter for smoother machining.
- Single tool for both roughing and finishing operations requiring fewer setups.



End Mill Tolerances

D1	tolerance	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

### ■ UJBE • 6-Flute Ball Nose with Eccentric Relief Grind • Metric



- first choice
- alternate choice

KCSM15	D1	D	D3	Ap1 max	L3	L
UJBE1000A6AN	10,00	10,00	9,40	10,00	30,00	72,00
UJBE1000A6AL	10,00	10,00	9,40	10,00	30,00	121,50
UJBE1200A6AN	12,00	12,00	11,28	12,00	36,00	83,00
UJBE1200A6AL	12,00	12,00	11,28	12,00	36,00	125,00
UJBE1600A6AN	16,00	16,00	15,04	16,00	48,00	100,00
UJBE1600A6AL	16,00	16,00	15,04	16,00	48,00	150,00
UJBE2000A6AN	20,00	20,00	18,80	20,00	60,00	115,00
UJBE2000A6AL	20,00	20,00	18,80	20,00	60,00	150,00

NOTE: For application data, see pages P58–P59.

# EADE Solid Ceramic End Mill

- Roughing nickel-based high-temperature alloys.
- Highest productivity and longest tool life.
- Outstanding reduction of machining time.
- Fewer tool changes due to higher tool life.
- Benefit from throw-away type of tooling.
- Minimum cutting speed of 400 m/min.

#### Offering

- 4-flute necked tools for slotting.
- 6-flute version for face and side milling.

#### KYS40

- Cutting speeds up to 1000 m/min increases Metal Removal Rates (MRR).



beyond™

Visit [kennametal.com](http://kennametal.com) or contact your local  
Authorised Kennametal Distributor.



[kennametal.com](http://kennametal.com)



**HARVI III Ball Nose with Eccentric Relief**

**HARVI III Ball Nose with Eccentric Relief**

CHALLENGE

CHALLENGE

- Finish profile machining of keel for weapon attachment.
- Vertical machining centre.
- Titanium alloy beta (R56400).
- External emulsion.

- Rough profile yoke contour milling of bogey pitch trimmer.
- Lathe with driven tooling.
- 4340 low-alloy steel.
- External emulsion.

SOLUTION

SOLUTION

- HARVI III ball nose Ø 12,7mm with eccentric relief in KCSM15™.
- Six effective teeth.

- HARVI III ball nose Ø 20mm with eccentric relief in KCSM15.
- Six effective teeth.

CUTTING DATA

CUTTING DATA

- vc 91 m/min
- fz 0,053 mm/z
- ap 30,5mm
- ae 0,6mm

- vc 122 m/min
- fz 0,076 mm/z
- ap 43,2mm
- ae 2,5mm

RESULT

RESULT

- Significantly increased tool life.
- Reduced machining time from 210 minutes to 90 minutes.
- Surface finish Ra 2,5 µm.

- Tool completed seven workpieces compared to five workpieces with existing tooling.
- Surface finish Ra 3,2 µm.

BENEFIT

BENEFIT

- Predictable wear at main lands instead of cutting edge flaking with competitive tooling.
- Extended tool life of HARVI III eliminated a mid-part tool change.
- Improved surface finish compared to previous four-flute ball nose tools.

- Reduced machining time from 88 minutes to 49 minutes.
- About 30% higher feed rate due to feed per tooth and six flutes rather than four flutes.

(continued)

(continued)



### HARVI III Ball Nose with Eccentric Relief

### HARVI III Ball Nose with Eccentric Relief

- CHALLENGE**
- Hem stitch profile neck to flanged blend.
  - Lathe with driven tooling.
  - 4340 low alloy steel.
  - External emulsion.

- CHALLENGE**
- Finish interior walls and blend filet radius.
  - Horizontal machining centre.
  - 4340 low alloy steel.
  - External emulsion.

- SOLUTION**
- HARVI III ball nose Ø 12,7mm with eccentric relief in KCSM15™.
  - Six effective teeth.

- SOLUTION**
- HARVI III ball nose Ø 12,7mm with eccentric relief in KCSM15.
  - Six effective teeth.

- CUTTING DATA**
- vc 107 m/min
  - fz 0,064 mm/z
  - ap 1,3mm
  - ae 1,3mm

- CUTTING DATA**
- vc 107 m/min
  - fz 0,064 mm/z
  - ap 14mm
  - ae 1,3mm

- RESULT**
- Increase in cutting speed from 46 m/min to 107 m/min.
  - Tool completed ten workpieces compared to six workpieces with existing tooling.

- RESULT**
- Tool completed six workpieces compared to two workpieces with existing solution.
  - Surface finish Ra 2,75 µm.

- BENEFIT**
- Reduced machining time to eight minutes compared to 29 minutes with competitive four-flute ball nose tool.
  - 200% increase in Metal Removal Rates (MRR).

- BENEFIT**
- Reduced machining time from 25 minutes to 10 minutes.
  - Improved surface finish from Ra 3,93 µm to Ra 2,75 µm at accelerated feeds and speeds.
  - Reduction in harmonics, noise level, and vibrations with HARVI III ball nose tooling.

### ■ HARVI III • UJBE • Ball Nose • Unequal Flute Spacing • Roughing

Material Group												
	Side Milling (A)		KCSM15				Recommended feed per tooth (fz = mm/th) for side milling (A).					
	A		Cutting Speed – vc m/min			mm	D1 – Diameter					
	ap	ae	min		max		10,0	12,0	16,0	20,0	25,0	
P	0	Ap max	0,4 x D	150	–	200	fz	0,072	0,083	0,101	0,114	0,124
	1	Ap max	0,4 x D	150	–	200	fz	0,072	0,083	0,101	0,114	0,124
	2	Ap max	0,4 x D	140	–	190	fz	0,072	0,083	0,101	0,114	0,124
	3	Ap max	0,4 x D	120	–	160	fz	0,061	0,070	0,087	0,101	0,114
	4	Ap max	0,4 x D	90	–	150	fz	0,054	0,062	0,077	0,088	0,098
	5	Ap max	0,4 x D	60	–	100	fz	0,048	0,056	0,070	0,081	0,091
M	6	Ap max	0,4 x D	50	–	75	fz	0,040	0,047	0,057	0,065	0,071
	1	Ap max	0,4 x D	90	–	115	fz	0,061	0,070	0,087	0,101	0,114
	2	Ap max	0,4 x D	60	–	80	fz	0,048	0,056	0,070	0,081	0,091
S	3	Ap max	0,4 x D	60	–	70	fz	0,040	0,047	0,057	0,065	0,071
	1	Ap max	0,4 x D	50	–	90	fz	0,061	0,070	0,087	0,101	0,114
	2	Ap max	0,4 x D	25	–	40	fz	0,032	0,037	0,046	0,054	0,061
	3	Ap max	0,4 x D	25	–	40	fz	0,032	0,037	0,046	0,054	0,061
H	4	Ap max	0,4 x D	50	–	60	fz	0,045	0,052	0,064	0,074	0,084
	1	Ap max	0,4 x D	80	–	140	fz	0,054	0,062	0,077	0,088	0,098

NOTE: Those guidelines may require variations to achieve optimum results.

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.

**■ HARVI III • UJBE • Ball Nose • Unequal Flute Spacing • Finishing**

Material Group												
	Side Milling (A)		KCSM15			Recommended feed per tooth (fz = mm/th) for side milling (A).						
	A		Cutting Speed – vc m/min			mm	D1 – Diameter					
	ap	ae	min		max		10,0	12,0	16,0	20,0	25,0	
P	0	Ap max	0,06 x D	285	–	380	fz	0,086	0,099	0,121	0,137	0,149
	1	Ap max	0,06 x D	285	–	380	fz	0,086	0,099	0,121	0,137	0,149
	2	Ap max	0,06 x D	266	–	361	fz	0,086	0,099	0,121	0,137	0,149
	3	Ap max	0,06 x D	228	–	304	fz	0,073	0,084	0,105	0,121	0,137
	4	Ap max	0,06 x D	171	–	285	fz	0,065	0,075	0,092	0,106	0,117
	5	Ap max	0,06 x D	114	–	190	fz	0,058	0,067	0,084	0,097	0,109
M	1	Ap max	0,06 x D	171	–	218,5	fz	0,073	0,084	0,105	0,121	0,137
	2	Ap max	0,06 x D	114	–	152	fz	0,058	0,067	0,084	0,097	0,109
	3	Ap max	0,06 x D	114	–	133	fz	0,048	0,056	0,068	0,078	0,085
S	1	Ap max	0,06 x D	95	–	171	fz	0,073	0,084	0,105	0,121	0,137
	2	Ap max	0,06 x D	47,5	–	76	fz	0,038	0,045	0,056	0,065	0,074
	3	Ap max	0,06 x D	47,5	–	76	fz	0,038	0,045	0,056	0,065	0,074
	4	Ap max	0,06 x D	95	–	114	fz	0,053	0,062	0,077	0,089	0,100
H	1	Ap max	0,06 x D	152	–	266	fz	0,065	0,075	0,092	0,106	0,117

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.



# ➤ HARVI™ III Taper Ball Nose

## High-Performance Solid Carbide End Mills

### Primary Application

HARVI III taper ball nose addresses the demand from energy and aerospace turbine customers to increase output and solve capacity issues by significantly reducing of machining time in 5-axis machining.

- Up to 50% higher Metal Removal Rates (MRR) with same tool life or up to 50% higher tool life due to 6-flute geometry with unequal flute spacing.
- Different tapered front end for highest tool stability on a variety of long-reach applications.
- Proprietary KCSM15™ grade for high tool life.

## Features and Benefits

### Advanced Technology

- Six flutes in ball nose and taper section for highest metal removal rates.
- Unequally spaced flutes to minimise vibrations and provide high tool life and superior surface quality.

### Tailored Grades

- KCSM15 Beyond™ grade for outstanding wear protection in stainless steels and high-temperature alloys.

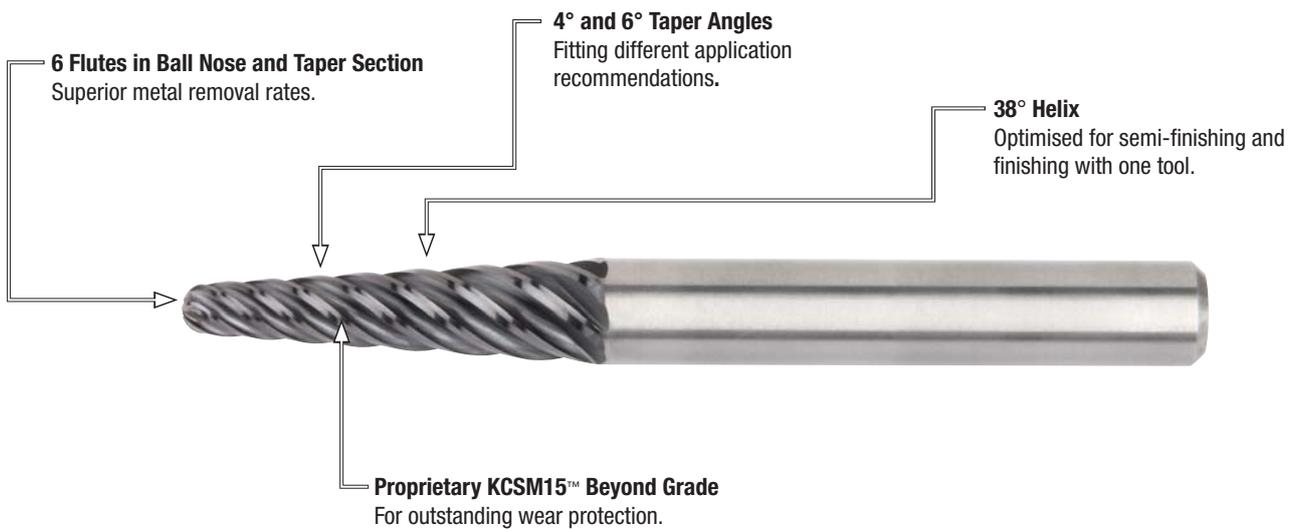
### Customisation

- Intermediate diameters available.
- Expanded length of tool and increased length of cut are possible.

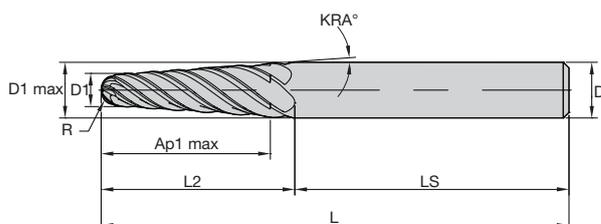
### Standard Offerings

- Diameter ranges 4–10mm

Designed for 5-axis machining in steel,  
stainless steel, nickel-based alloys,  
and titanium.



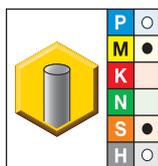
- Centre cutting.
- 6 flutes for highest material removal rates.
- Unequal flute spacing minimises chatter for smoother machining.
- 2 taper angle versions for optimised stability in long-reach operations.
- Single tool for both semi-finishing and finishing operations requiring fewer setups.
- Optimised geometry for stainless, nickel-based alloys, and titanium machining.



End Mill Tolerances

D1	tolerance	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

### UJBE • 6-Flute Taper Ball Nose • Unequal Flute Spacing



- first choice
- alternate choice

KCSM15	D1	D	Ap1 max	L2	L	LS	R	KRA
UJBE0400A6CP	4,00	8,00	26,00	3 0,53	76,00	45,47	2,00	4,00
UJBE0400A6BP	4,00	10,00	25,00	30,44	89,00	58,56	2,00	6,00
UJBE0500A6CP	5,00	10,00	33,00	38,16	89,00	50,84	2,50	4,00
UJBE0500A6BP	5,00	12,00	29,00	35,67	100,00	64,33	2,50	6,00
UJBE0600A6BP	6,00	12,00	39,00	45,80	100,00	54,20	3,00	4,00
UJBE0600A6CP	6,00	16,00	42,00	50,42	110,00	59,59	3,00	6,00
UJBE0700A6BP	7,00	12,00	33,00	39,13	100,00	60,87	3,50	4,00
UJBE0700A6CP	7,00	16,00	38,00	46,13	110,00	63,87	3,50	6,00
UJBE0800A6CP	8,00	14,00	39,00	46,76	100,00	53,24	4,00	4,00
UJBE0800A6BP	8,00	16,00	33,00	41,85	110,00	68,15	4,00	6,00
UJBE1000A6BP	10,00	16,00	25,00	33,28	110,00	76,72	5,00	6,00
UJBE1000A6CP	10,00	16,00	39,00	47,73	110,00	62,27	5,00	4,00

NOTE: For application data, see pages P68–P69.

# Superior Finishing **MaxiMet™**

Designed to significantly reduce machining time in aluminium!  
The innovative geometry designs include a wiper facet for superior surface finish on aluminium parts. MaxiMet handles roughing and finishing cuts with one tool.

- Use only one tool for roughing and finishing operations.
- Slotting is effective up to full 1 x D axial depth; side milling is effective up to 0,5 x D radial, by 1,5 x D axial depth.
- Three-flute series uses unequal flute spacing for chatter-free performance.
- Effective in a full range of machine speeds.
- Multiple corner radii and extended neck configurations are available as standard.



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### Ball Nose Surface Finish

Unit: inch

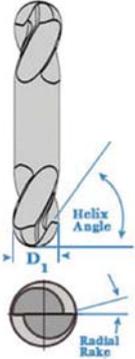
Ball Nose Radius:  in

Helix Angle:  °

Radial Rake:  °

Choose Additional Parameter(s)

⚠ These calculations are based upon theoretical values and are only intended for planning purposes. Actual results will vary. No responsibility from Kennametal is assumed.



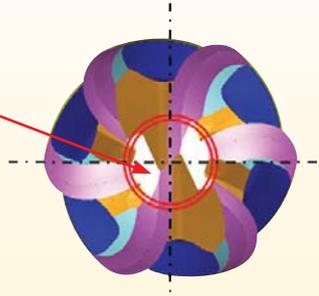
Ra Surface finish: 20.31  $\mu$  in.

Use 5–10° for radial rake angle.

***Make use of calculators such as:  
kennametal.com/en/resources/calculators/  
end-milling-calculators/ball-nose-surface-finish.html***

Not all 6 cutting edges are reaching to the centre of the HARVI III taper ball nose end mill.  
Therefore, certain machining angles will result in different numbers of effective cutting edges.

Between 15–17° transition from  
4–6 effective cutting edges due  
to grinding profile.



0°

Avoid (centre cutting speed = 0)



15°

<15° z = 2 effective cutting edges



17°

>17° z = 6 effective cutting edges



**HARVI™ III Taper Ball Nose UJBE**

**CHALLENGE**

- Finishing contour milling with lightly interrupted cut.
- Blade machining for energy customer.
- X22 CrMoV12.
- External emulsion.

**SOLUTION**

- HARVI III taper ball nose UJBE, 6° taper angle, and KCSM15™ with 6 effective cutting edges, Ø 6mm.

**CUTTING DATA**

- vc 100 m/min
- fz 0,05mm/Z
- ap 2mm
- ae 0,6mm

**RESULT**

- 73% increased productivity.

**BENEFIT**

- Reduced cost per component as the tool life increased.
- New 6-flute geometry has given better surface finish compared to 4 flutes.
- Regrindable tool.

**HARVI III Taper Ball Nose UJBE**

**CHALLENGE**

- Finishing intersection and hub on blade airfoil.
- Blade machining for energy customer.
- X22CrMoV12-1.
- External emulsion.

**SOLUTION**

- HARVI III taper ball nose UJBE, 6° taper angle, and KCSM15 with 6 effective cutting edges, Ø 10mm.

**CUTTING DATA**

- vc 260 m/min
- fz 0,06mm/Z
- ap 0,6mm
- ae 0,6mm

**RESULT**

- 50% increase in feed.
- 28% increase in tool life.
- Improved surface finish and minimum wear on edges.

**BENEFIT**

- Reduced tooling cost.
- Reduction in cost per component.
- Good surface finish.
- Regrindable tool.

(continued)

(continued)



### HARVI™ III Taper Ball Nose UJBE

#### CHALLENGE

- Finishing intersection and hub on blade airfoil.
- X22CrMoV12-1.
- External emulsion.

#### SOLUTION

- UJBE with KCSM15™.
- Ø 4mm with 8 effective cutting edges.

#### CUTTING DATA

- vc 140 m/min
- fz 0,015mm/Z
- ap 0,5mm
- ae 0,35mm

#### RESULT

- Substantial increase in Metal Removal Rates (MRR).

#### BENEFIT

- Improved surface quality.
- Regrindable tool to reduce tool cost.

### ■ HARVI III • UJBE • 6-Flute Taper Ball Nose • Unequal Flute Spacing • Semi-Finishing

Material Group		Side Milling (A)		KCSM15			Recommended feed per tooth (fz = mm/th) for side milling (A).						
		A		Cutting Speed – vc m/min			D1 – Diameter						
		ap	ae	min		max	mm	10,0	12,0	16,0	18,0	20,0	25,0
				min		max	mm	10,0	12,0	16,0	18,0	20,0	25,0
P	0	Ap max	0,4 x D	150	–	200	fz	0,072	0,083	0,101	0,108	0,114	0,124
	1	Ap max	0,4 x D	150	–	200	fz	0,072	0,083	0,101	0,108	0,114	0,124
	2	Ap max	0,4 x D	140	–	190	fz	0,072	0,083	0,101	0,108	0,114	0,124
	3	Ap max	0,4 x D	120	–	160	fz	0,061	0,070	0,087	0,095	0,101	0,114
	4	Ap max	0,4 x D	90	–	150	fz	0,054	0,062	0,077	0,083	0,088	0,098
M	1	Ap max	0,4 x D	90	–	115	fz	0,061	0,070	0,087	0,095	0,101	0,114
	2	Ap max	0,4 x D	60	–	80	fz	0,048	0,056	0,070	0,076	0,081	0,091
	3	Ap max	0,4 x D	60	–	70	fz	0,040	0,047	0,057	0,061	0,065	0,071
S	1	Ap max	0,4 x D	50	–	90	fz	0,061	0,070	0,087	0,095	0,101	0,114
	2	Ap max	0,4 x D	25	–	40	fz	0,032	0,037	0,046	0,050	0,054	0,061
	3	Ap max	0,4 x D	25	–	40	fz	0,032	0,037	0,046	0,050	0,054	0,061
	4	Ap max	0,4 x D	50	–	60	fz	0,045	0,052	0,064	0,069	0,074	0,084
H	1	Ap max	0,4 x D	80	–	140	fz	0,054	0,062	0,077	0,083	0,088	0,098

\* For the above cutting data, do not exceed an overall ae of 0,8mm.

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.

**■ UJBE • 6-Flute Taper Ball Nose • Unequal Flute Spacing • Finishing**

Material Group													
	Side Milling (A)		KCSM15			Recommended feed per tooth (fz = mm/th) for side milling (A).							
	A		Cutting Speed – vc m/min			mm	D1 – Diameter						
	ap	ae	min		max		10,0	12,0	16,0	18,0	20,0	25,0	
P	0	Ap max	0,06 x D	285	–	380	fz	0,086	0,099	0,121	0,130	0,137	0,149
	1	Ap max	0,06 x D	285	–	380	fz	0,086	0,099	0,121	0,130	0,137	0,149
	2	Ap max	0,06 x D	266	–	361	fz	0,086	0,099	0,121	0,130	0,137	0,149
	3	Ap max	0,06 x D	228	–	304	fz	0,073	0,084	0,105	0,113	0,121	0,137
	4	Ap max	0,06 x D	171	–	285	fz	0,065	0,075	0,092	0,099	0,106	0,117
M	1	Ap max	0,06 x D	171	–	218,5	fz	0,073	0,084	0,105	0,113	0,121	0,137
	2	Ap max	0,06 x D	114	–	152	fz	0,058	0,067	0,084	0,091	0,097	0,109
	3	Ap max	0,06 x D	114	–	133	fz	0,048	0,056	0,068	0,073	0,078	0,085
S	1	Ap max	0,06 x D	95	–	171	fz	0,073	0,084	0,105	0,113	0,121	0,137
	2	Ap max	0,06 x D	47,5	–	76	fz	0,038	0,045	0,056	0,060	0,065	0,074
	3	Ap max	0,06 x D	47,5	–	76	fz	0,038	0,045	0,056	0,060	0,065	0,074
H	1	Ap max	0,06 x D	95	–	114	fz	0,053	0,062	0,077	0,083	0,089	0,100
H	1	Ap max	0,06 x D	152	–	266	fz	0,065	0,075	0,092	0,099	0,106	0,117

\* For the above cutting data, do not exceed an overall ae of 0,8mm.

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.

