

**suttontools**  
world class cutting tools



**SUPER ALLOY  
MACHINING**

**HARMONY**



Energy

Oil & Gas

Automotive

Aviation

Medical

# Machining Super Alloys

Cutting tools in industries such as aerospace, medical, oil and gas, are being used on materials such as titaniums, nickel alloys and stainless steels. These are known as difficult-to-machine materials. The properties that make these materials so sought after, is the high toughness, high strength to weight ratio and low thermal conductivity, which is exactly why they are difficult-to-machine and form into complex shapes.

These super alloys have very poor machinability (refer table), since most of the heat is absorbed by the cutting edge.

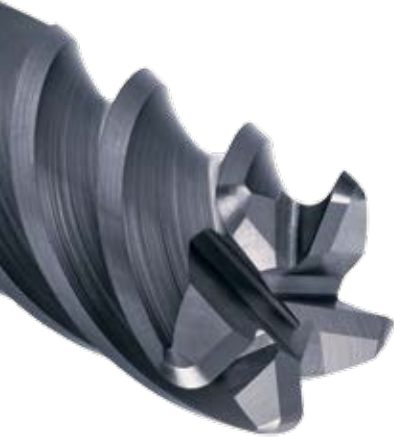
Hence, the importance of High Productivity Milling (HPM) and trochoidal milling strategies that transfers most of the heat to the chips produced. The best performing endmills for these milling strategies are variable helix geometries with optimised carbide grades as well as the ideal PVD (Physical Vapour Deposition) coating that really counteracts the challenging properties.

The Sutton Tools high performing endmills in this brochure have been carefully put together to cater for the above mentioned industries and milling applications.

ISO	Material group	Material Type	Machinability
P	Steels	Free Cutting	100%
		Low Carbon	70-80%
		Medium Carbon	55-65%
		High Carbon	50-60%
M	Stainless Steels	Austenitic	40-50%
		Duplex	40-55%
		Precipitation Hardening	50-65%
S	Titaniums & Super Alloys	Titanium Alloy	30%
		Fe Based	25%
		Nickel Based	10%
		Cobalt Based	5-10%

MILLING	Material Group	Page	Item Code	Tool	Diameter range	Type	Shank Type	No. of Flutes	Geometry	Tool Material	Coating	Standard
	Ti Alloys	5	E464		12mm - 20mm	Square End	DIN6535 HA	5	R40/42 Ti	VHM-Ultra	AlNova	DIN6527 L
E465				DIN6535 HB								
E466				DIN6535 HA								
E467				DIN6535 HB								
9			E468		12mm - 20mm	Square End	DIN6535 HA					
				E469			DIN6535 HB					
			E470			Corner Radius	DIN6535 HA					
				E471			DIN6535 HB					
7		E476		12mm - 20mm	3XL	DIN6535 HA	5	R40/42 Ti	VHM-Ultra	AlNova	Sutton Standard	
			E477			DIN6535 HA						
Ni Alloys		15	E472		6mm - 20mm	Square End	DIN6535 HA	5	R40/42 Ni	VHM-Ultra	X.Ceed	DIN6527 L
				E473			DIN6535 HB					
			E474			Corner Radius	DIN6535 HA					
				E475			DIN6535 HB					
Stainless Steels		11	E459		3mm - 20mm	Square End	DIN6535 HA	4	R40/42 VA	VHM-Ultra	Helica	DIN6527 L
	E460			DIN6535 HB								
	E462			Corner Radius		DIN6535 HA						
			E463			DIN6535 HB						
	13	E251		6mm - 32mm	Square End	DIN1835 B	4, 5, 6	R30 VA-R	SPM	AlCrN	DIN844K	
			E252									DIN844L
E255			10mm - 32mm Corner Radius	DIN844K								

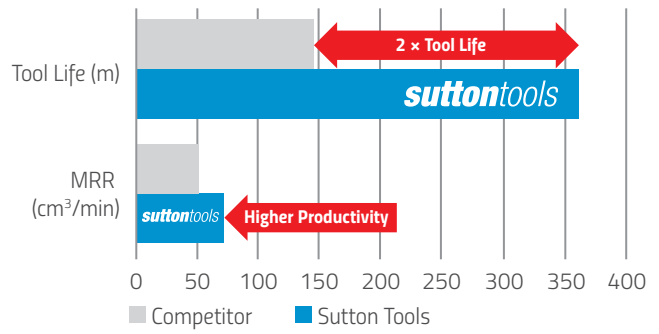
# Performance Comparison - Ti



## Case Study 1

Material	TiAl6V4
Tool	E466 1610
Tool Holder	Collet Chuck (Big Dashowa)
Size	ø16 x 1 Corner Radius
Cutting Speed Vc (m/min)	50
RPM	994
Feed Rate (mm/min)	497
Feed f (mm/flute)	0.1
ae (mm)	5
ap (mm) depth	16

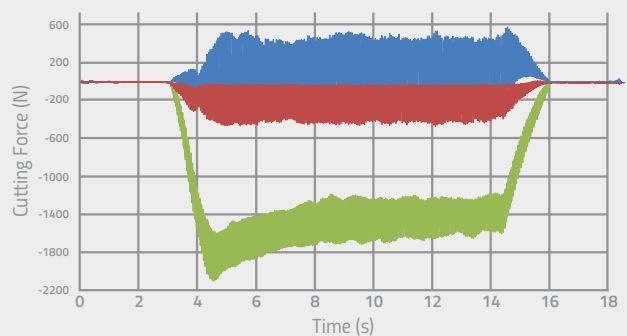
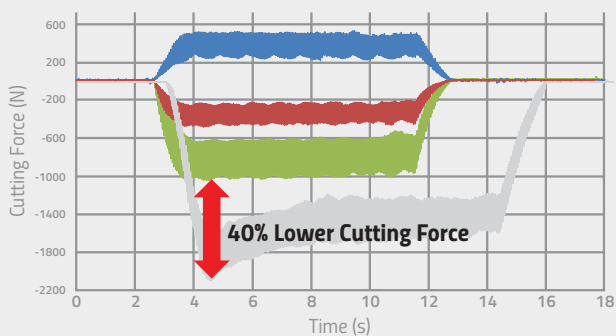
## Results



## Comparison

### Sutton Tools

### Competitor



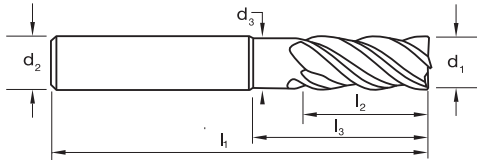
Key: ■ YN ■ XN ■ ZN

# Endmills Carbide, 5 Flute, R40/42 Ti

suttontools

HARMONY

- Optimised design for trochoidal HSM milling strategies in titanium alloys
- Especially suited to large step-overs (ae), offering a high productivity solution
- Variable helix design to suppress vibration
- AlNova for outstanding oxidation resistance and hot hardness



Type	5 Flute	5 Flute
Product Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlNova	AlNova
Sutton Designation	Ti	Ti
Geometry	R40/42	R40/42
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	d <sub>2</sub>	d <sub>3</sub>	z	chf	rad	Item #		
										E464	E465	
<b>DIN6527L - Square End</b>												
1200	12.0	83	26	38	12	11.5	5	-	1.0	E464 1200	E465 1200	
1600	16.0	92	32	44	16	15.5	5	-	2.5	E464 1600	E465 1600	
2000	20.0	104	38	54	20	19.5	5	-	4.0	E464 2000	E465 2000	

<b>DIN6527L - Corner Rad</b>											E466	E467
1210	12.0	83	26	38	12	11.5	5	-	1.0	E466 1210	E467 1210	
1225		83	26	38	12	11.5	5	-	2.5	E466 1225	E467 1225	
1240		83	26	38	12	11.5	5	-	4.0	E466 1240	E467 1240	
1610	16.0	92	32	44	16	15.5	5	-	1.0	E466 1610	E467 1610	
1625		92	32	44	16	15.5	5	-	2.5	E466 1625	E467 1625	
1630		92	32	44	16	15.5	5	-	3.0	E466 1630	E467 1630	
1640		92	32	44	16	15.5	5	-	4.0	E466 1640	E467 1640	
2010	20.0	104	38	54	20	19.5	5	-	1.0	E466 2010	E467 2010	
2025		104	38	54	20	19.5	5	-	2.5	E466 2025	E467 2025	
2040		104	38	54	20	19.5	5	-	4.0	E466 2040	E467 2040	
2050		104	38	54	20	19.5	5	-	5.0	E466 2050	E467 2050	
2060		104	38	54	20	19.5	5	-	6.0	E466 2060	E467 2060	

ISO	P													M		K					N										S					H													
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41
E464																○																																	
E465																○																																	
E466																○																																	
E467																○																																	

P Steel M Stainless Steel K Cast Iron N Non-Ferrous Metals S Titanium & Super Alloys H Hard Materials

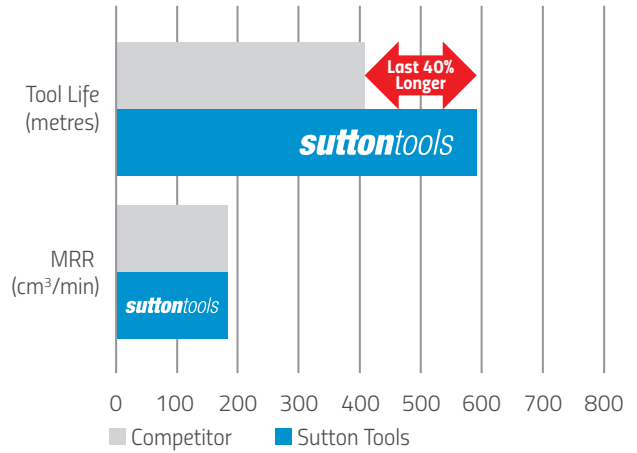
● Optimal ○ Effective



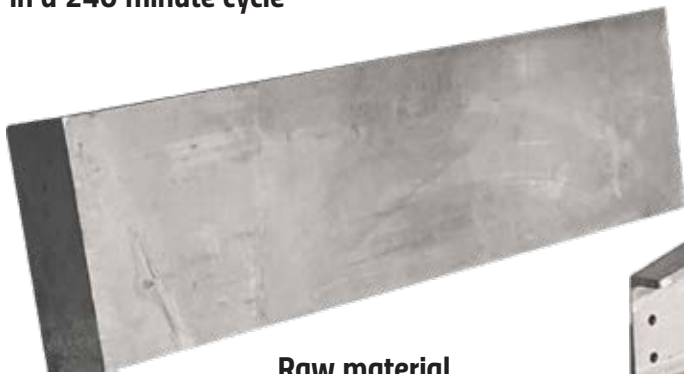
## Case Study 1

Material	TiAl6V4
Tool	E476 1640
Size	ø16 x 4 Corner Radius 3XL
Cutting Speed Vc (m/min)	150
RPM	2981
Feed Rate (mm/min)	1640
Feed f (mm/flute)	0.11
ae (mm)	1.5
ap (mm) depth	57

## Comparison



From raw material to finished component with just one Sutton Tools E476 1640 endmill in a 240 minute cycle



Raw material

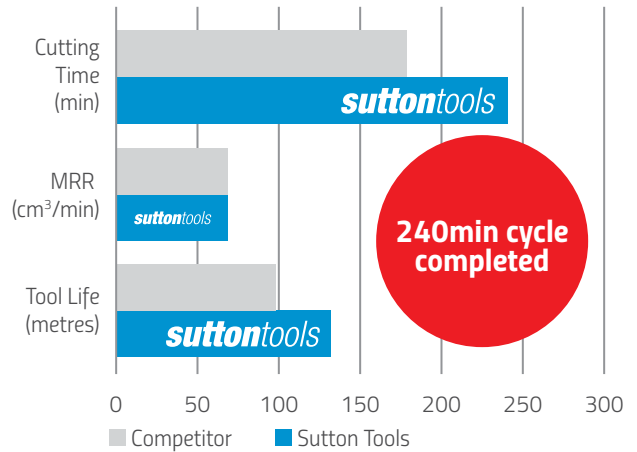


Finished component

## Case Study 2

Material	TiAl6V4
Tool	E476 1640
Size	ø16 x 4 Corner Radius 3XL
Cutting Speed Vc (m/min)	55
RPM	1093
Feed Rate (mm/min)	547
Feed f (mm/flute)	0.1
ae (mm)	3
ap (mm) depth	43

## Comparison

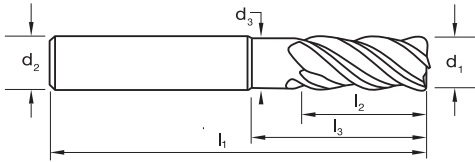


# Endmills Carbide, 5 Flute, R40/42 Ti, Extra Long

## suttontools

## HARMONY

- Optimised design for trochoidal and HSM milling strategies in titanium alloys
- For extra deep pocket milling in typically thin wall components
- Variable helix design to suppress vibration
- AlNova for outstanding oxidation resistance and hot hardness



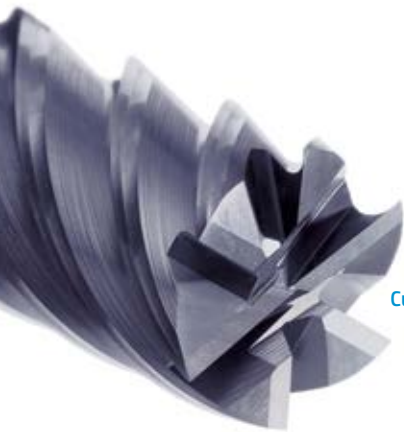
Type	5 Flute	5 Flute
Product Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlNova	AlNova
Sutton Designation	Ti-3XL	Ti-4XL
Geometry	R40/42	R40/42
Shank Form (DIN 6535)	HA	HA
Shank Tolerance	h6	h6

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	d <sub>2</sub>	d <sub>3</sub>	z	rad	Item #	
									E476	E477
1200	12	96	40	51	12	11.5	5	-	E4761200	
1210	12	96	40	51	12	11.5	5	1	E4761210	
1215	12	96	40	51	12	11.5	5	1.5	E4761215	
1220	12	96	40	51	12	11.5	5	2	E4761220	
1225	12	96	40	51	12	11.5	5	2.5	E4761225	
1230	12	96	40	51	12	11.5	5	3	E4761230	
1240	12	96	40	51	12	11.5	5	4	E4761240	
1600	16	105	52	57	16	15.5	5	-	E4761600	
1610	16	105	52	57	16	15.5	5	1	E4761610	
1615	16	105	52	57	16	15.5	5	1.5	E4761615	
1620	16	105	52	57	16	15.5	5	2	E4761620	
1625	16	105	52	57	16	15.5	5	2.5	E4761625	
1630	16	105	52	57	16	15.5	5	3	E4761630	
1640	16	105	52	57	16	15.5	5	4	E4761640	
2000	20	140	64	80	20	19.5	5	-	E4762000	
2010	20	140	64	80	20	19.5	5	1	E4762010	
2015	20	140	64	80	20	19.5	5	1.5	E4762015	
2020	20	140	64	80	20	19.5	5	2	E4762020	
2025	20	140	64	80	20	19.5	5	2.5	E4762025	
2030	20	140	64	80	20	19.5	5	3	E4762030	
2040	20	140	64	80	20	19.5	5	4	E4762040	
2050	20	140	64	80	20	19.5	5	5	E4762050	
1200	12	110	50	65	12	11.5	5	-	E4771200	
1210	12	110	50	65	12	11.5	5	1	E4771210	
1215	12	110	50	65	12	11.5	5	1.5	E4771215	
1220	12	110	50	65	12	11.5	5	2	E4771220	
1225	12	110	50	65	12	11.5	5	2.5	E4771225	
1230	12	110	50	65	12	11.5	5	3	E4771230	
1240	12	110	50	65	12	11.5	5	4	E4771240	
1600	16	130	66	82	16	15.5	5	-	E4771600	
1610	16	130	66	82	16	15.5	5	1	E4771610	
1615	16	130	66	82	16	15.5	5	1.5	E4771615	
1620	16	130	66	82	16	15.5	5	2	E4771620	
1625	16	130	66	82	16	15.5	5	2.5	E4771625	
1630	16	130	66	82	16	15.5	5	3	E4771630	
1640	16	130	66	82	16	15.5	5	4	E4771640	
2000	20	160	82	100	20	19.5	5	-	E4772000	
2010	20	160	82	100	20	19.5	5	1	E4772010	
2015	20	160	82	100	20	19.5	5	1.5	E4772015	
2020	20	160	82	100	20	19.5	5	2	E4772020	
2025	20	160	82	100	20	19.5	5	2.5	E4772025	
2030	20	160	82	100	20	19.5	5	3	E4772030	
2040	20	160	82	100	20	19.5	5	4	E4772040	
2050	20	160	82	100	20	19.5	5	5	E4772050	

ISO	P										M					K					N					S					H																			
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41	
E476																																																		
E477																																																		

P Steel M Stainless Steel K Cast Iron N Non-Ferrous Metals S Titanium & Super Alloys H Hard Materials

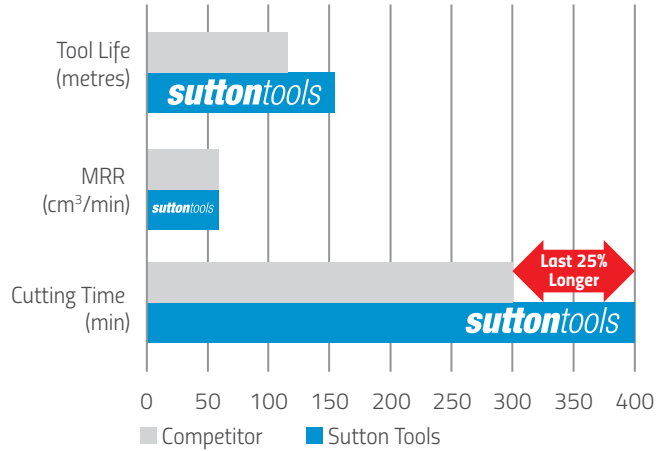
● Optimal ○ Effective



## Case Study 1

Material	TiAl6V4
Tool Holder	HSK63 Shrink Fit
Size	ø20 x R1
ae (mm)	3
ap (mm)	26
Cutting Speed Vc (m/min)	80
RPM	1272
Feed Rate (mm/min)	382
Feed f (mm/flute)	0.06

## Comparison



From the above case study, we demonstrated the tool life could complete the entire 400 minute cycle time with minimal wear. This results in significantly less machine downtime for tool changes which translates to lower tool cost. The edge condition after 400 minutes of milling is also suitable for regrinds, providing further cost savings.

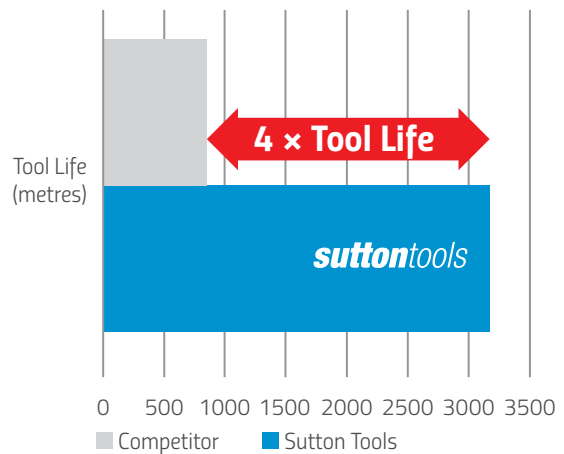
## Edge condition after 400 minutes



## Case Study 2

Material	15-5Ph
Tool	E470 1610
Size	ø16 x 1 Corner radius
ae (mm)	1.2
ap (mm)	12
Cutting Speed Vc (m/min)	130
RPM	2584
Feed Rate (mm/min)	2225
Feed f (mm/flute)	0.144

## Comparison



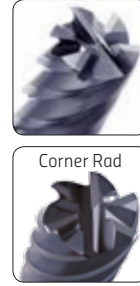
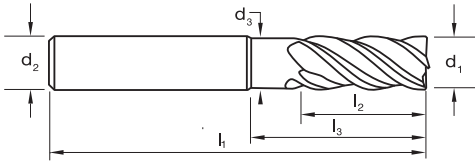


# Endmills Carbide, 6 Flute, R40/42 Ti

## suttontools

## HARMONY

- Optimised design for finishing in titanium alloys
- Variable helix design to suppress vibration
- Ideal for smaller step overs (ae) in smaller spindle machines
- AlNova for outstanding oxidation resistance and hot hardness
- Carefully selected carbide grade for Ti machining

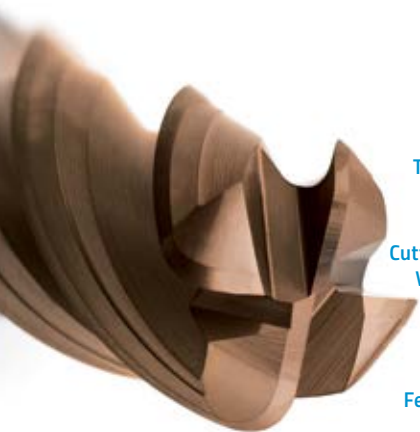


Type	6 Flute	6 Flute
Product Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlNova	AlNova
Sutton Designation	Ti	Ti
Geometry	R40/42	R40/42
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	d <sub>2</sub>	d <sub>3</sub>	z	chf	rad	Item #	
										E468	E469
<b>DIN6527L - Square End</b>											
1200	12.0	83	26	38	12	11.5	6			E468 1200	E469 1200
1600	16.0	92	32	44	16	15.5	6			E468 1600	E469 1600
2000	20.0	104	38	54	20	19.5	6			E468 2000	E469 2000

<b>DIN6527L - Corner Rad</b>										E470	E471
1210	12.0	83	26	38	12	11.5	6	-	1.0	E470 1210	E471 1210
1225		83	26	38	12	11.5	6	-	2.5	E470 1225	E471 1225
1240		83	26	38	12	11.5	6	-	4.0	E470 1240	E471 1240
1610	16.0	92	32	44	16	15.5	6	-	1.0	E470 1610	E471 1610
1625		92	32	44	16	15.5	6	-	2.5	E470 1625	E471 1625
1640		92	32	44	16	15.5	6	-	4.0	E470 1640	E471 1640
2010	20.0	104	38	54	20	19.5	6	-	1.0	E470 2010	E471 2010
2025		104	38	54	20	19.5	6	-	2.5	E470 2025	E471 2025
2040		104	38	54	20	19.5	6	-	4.0	E470 2040	E471 2040
2050		104	38	54	20	19.5	6	-	5.0	E470 2050	E471 2050
2060		104	38	54	20	19.5	6	-	6.0	E470 2060	E471 2060

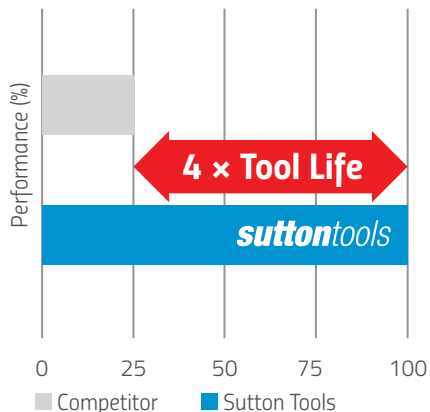
ISO	P										M			K					N										S					H																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41					
E468																○																																						
E469																○																																						
E470																○																																						
E471																○																																						



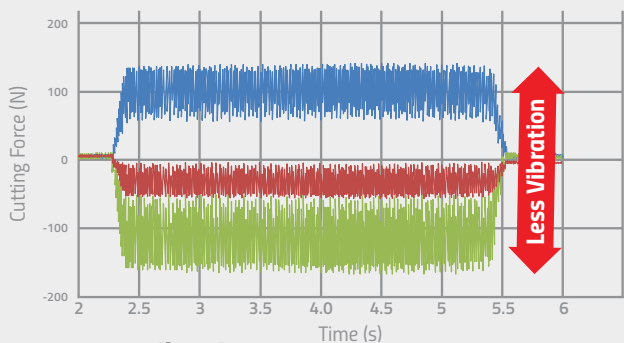
## Case Study 1

Material	15-5Ph
Tool	E462 1640
Tool Holder	Collet Chuck
Size	ø16 x 4 Corner Radius
Cutting Speed Vc (m/min)	120
RPM	2390
Feed Rate (mm/min)	1335
Feed f (mm/ flute)	0.14
ae (mm)	1.2
ap (mm) / depth	12

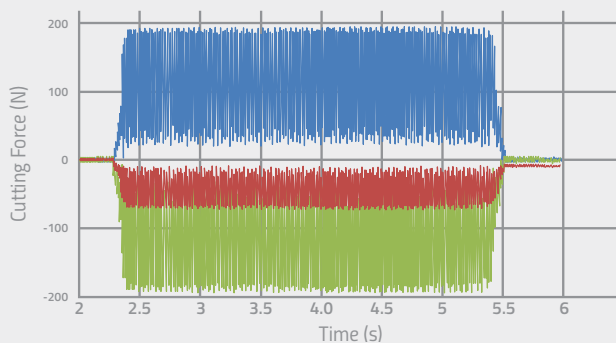
## Comparison



## Comparison Sutton Tools

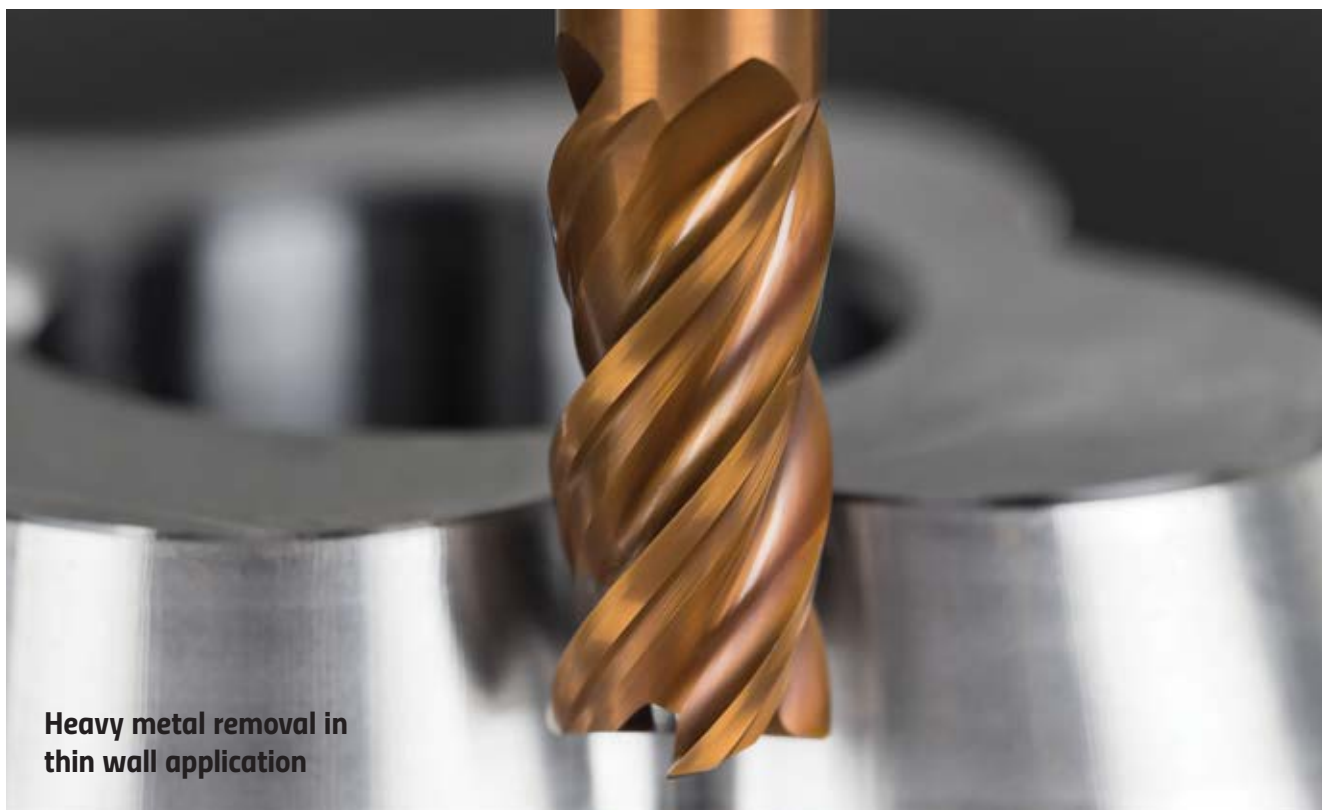


## Competitor



Less Vibration

Key: ■ YN ■ XN ■ ZN



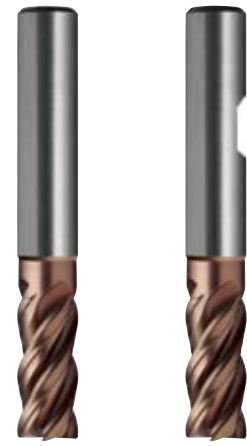
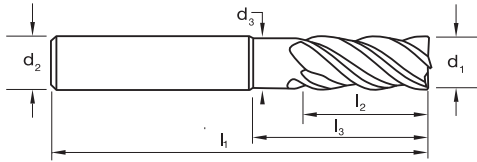
Heavy metal removal in  
thin wall application

# Endmills Carbide, 4 Flute, R40/42 VA

**suttontools**

**HARMONY**

- Excellent solution for stainless steels and super alloy type materials
- Optimised geometry with variable helix design ensures high productivity
- Suitable for slotting, side cutting and finishing applications with the one tool
- HELICA for outstanding oxidation resistance and hot hardness
- VHM-ULTRA grade of carbide for high performance



Type	4 Flute	4 Flute
Product Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	HELICA	HELICA
Sutton Designation	VA	VA
Geometry	R40/42	R40/42
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	d <sub>2</sub>	d <sub>3</sub>	z	chf	rad	Item #	
										E459	E460
<b>DIN6527L - Square End</b>											
<b>0300</b>	<b>3.0</b>	57	8	21	6	2.8	4	0.08	-	E459 0300	E460 0300
<b>0400</b>	<b>4.0</b>	57	11	21	6	3.8	4	0.08	-	E459 0400	E460 0400
<b>0500</b>	<b>5.0</b>	57	13	21	6	4.8	4	0.20	-	E459 0500	E460 0500
<b>0600</b>	<b>6.0</b>	57	13	21	6	5.7	4	0.20	-	E459 0600	E460 0600
<b>0800</b>	<b>8.0</b>	63	19	27	8	7.6	4	0.20	-	E459 0800	E460 0800
<b>1000</b>	<b>10.0</b>	72	22	32	10	9.5	4	0.25	-	E459 1000	E460 1000
<b>1200</b>	<b>12.0</b>	83	26	38	12	11.5	4	0.25	-	E459 1200	E460 1200
<b>1400</b>	<b>14.0</b>	83	26	38	14	13.5	4	0.35	-	E459 1400	E460 1400
<b>1600</b>	<b>16.0</b>	92	32	44	16	15.5	4	0.35	-	E459 1600	E460 1600
<b>1800</b>	<b>18.0</b>	92	32	44	18	17.5	4	0.35	-	E459 1800	E460 1800
<b>2000</b>	<b>20.0</b>	104	38	54	20	19.5	4	0.35	-	E459 2000	E460 2000

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	d <sub>2</sub>	d <sub>3</sub>	z	chf	rad	Item #	
										E462	E463
<b>DIN6527L - Corner Rad</b>											
<b>0603</b>	<b>6.0</b>	57	13	21	6	5.5	4	-	0.3	E462 0603	E463 0603
<b>0605</b>		57	13	21	6	5.5	4	-	0.5	E462 0605	E463 0605
<b>0610</b>		57	13	21	6	5.5	4	-	1.0	E462 0610	E463 0610
<b>0803</b>	<b>8.0</b>	63	19	27	8	7.5	4	-	0.3	E462 0803	E463 0803
<b>0805</b>		63	19	27	8	7.5	4	-	0.5	E462 0805	E463 0805
<b>0810</b>		63	19	27	8	7.5	4	-	1.0	E462 0810	E463 0810
<b>0815</b>		63	19	27	8	7.5	4	-	1.5	E462 0815	E463 0815
<b>0820</b>		63	19	27	8	7.5	4	-	2.0	E462 0820	E463 0820
<b>1003</b>	<b>10.0</b>	72	22	32	10	9.5	4	-	0.3	E462 1003	E463 1003
<b>1005</b>		72	22	32	10	9.5	4	-	0.5	E462 1005	E463 1005
<b>1010</b>		72	22	32	10	9.5	4	-	1.0	E462 1010	E463 1010
<b>1015</b>		72	22	32	10	9.5	4	-	1.5	E462 1015	E463 1015
<b>1020</b>		72	22	32	10	9.5	4	-	2.0	E462 1020	E463 1020
<b>1203</b>	<b>12.0</b>	83	26	38	12	11.5	4	-	0.3	E462 1203	E463 1203
<b>1205</b>		83	26	38	12	11.5	4	-	0.5	E462 1205	E463 1205
<b>1210</b>		83	26	38	12	11.5	4	-	1.0	E462 1210	E463 1210
<b>1215</b>		83	26	38	12	11.5	4	-	1.5	E462 1215	E463 1215
<b>1220</b>		83	26	38	12	11.5	4	-	2.0	E462 1220	E463 1220
<b>1230</b>		83	26	38	12	11.5	4	-	3.0	E462 1230	E463 1230
<b>1605</b>	<b>16.0</b>	92	32	44	16	15.5	4	-	0.5	E462 1605	E463 1605
<b>1610</b>		92	32	44	16	15.5	4	-	1.0	E462 1610	E463 1610
<b>1615</b>		92	32	44	16	15.5	4	-	1.5	E462 1615	E463 1615
<b>1620</b>		92	32	44	16	15.5	4	-	2.0	E462 1620	E463 1620
<b>1630</b>		92	32	44	16	15.5	4	-	3.0	E462 1630	E463 1630
<b>1640</b>		92	32	44	16	15.5	4	-	4.0	E462 1640	E463 1640
<b>2005</b>	<b>20.0</b>	104	38	54	20	19.5	4	-	0.5	E462 2005	E463 2005
<b>2010</b>		104	38	54	20	19.5	4	-	1.0	E462 2010	E463 2010
<b>2015</b>		104	38	54	20	19.5	4	-	1.5	E462 2015	E463 2015
<b>2020</b>		104	38	54	20	19.5	4	-	2.0	E462 2020	E463 2020
<b>2030</b>		104	38	54	20	19.5	4	-	3.0	E462 2030	E463 2030
<b>2040</b>		104	38	54	20	19.5	4	-	4.0	E462 2040	E463 2040

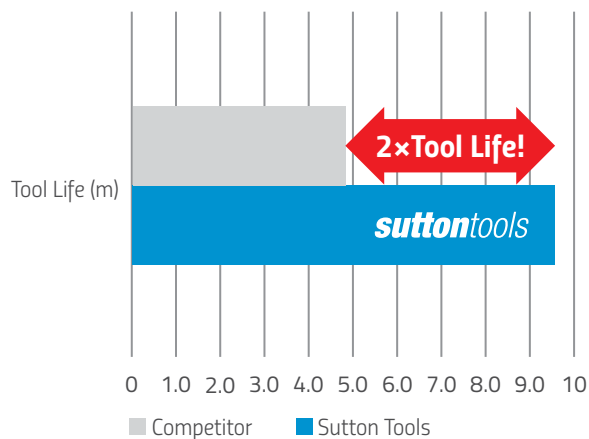
ISO	P										M			K					N										S							H																		
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41					
E459														○	○	○	○																																					
E460														○	○	○	○																																					
E462														○	○	○	○																																					
E463														○	○	○	○																																					



## Case Study 1

Material	TiAl6V4
Tool	E255 1640
Tool Holder	Collet Chuck (BigDashowa)
Size	16mm
Cutting Speed Vc (m/min)	20
RPM	398
Feed Rate (mm/min)	119
Feed f (mm/flute)	0.06
ae (mm)	10
ap (mm) / depth	20

## Results

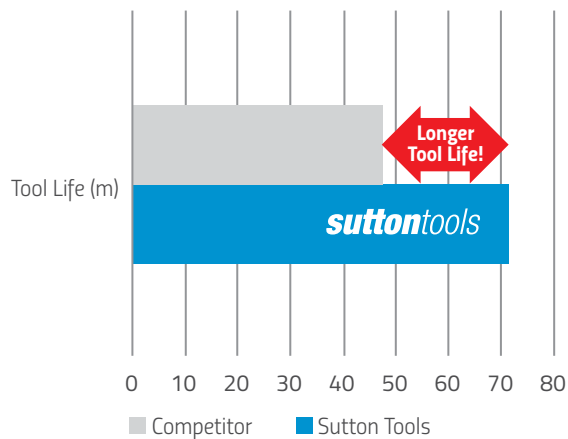


Heavy metal removal in thin wall application

## Case Study 2

Material	TiAl6V4
Tool	Special Custom Make
Tool Holder	Collet Chuck
Size	31.75mm (1-1/4")
Cutting Speed Vc (m/min)	23
RPM	230
Feed Rate (mm/min)	79
Feed f (mm/flute)	0.057
ae (mm)	16
ap (mm) / depth	48

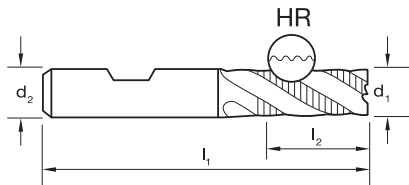
## Results



# Roughers SPM, R30 VA-R, Regular

## suttontools

- HSS-SPM (Powder Metallurgy)
- Unique HR geometry offers stable performance in difficult to machine materials for roughing applications
- Ideal for large volume metal removal



Catalogue Code	<b>E251</b>	<b>E255</b>	<b>E252</b>
Discount Group	B0408	B0408	B0408
Material	<b>SPM</b>	<b>SPM</b>	<b>SPM</b>
Surface Finish	<b>AICrN</b>	<b>AICrN</b>	<b>AICrN</b>
Sutton Designation	<b>VA</b>	<b>VA</b>	<b>VA</b>
Geometry	R30 VA-R	R30 VA-R Corner Rad	R30 VA-R
Shank Form (DIN 1835)	B	B	B
Shank Tolerance	h6	h6	h6

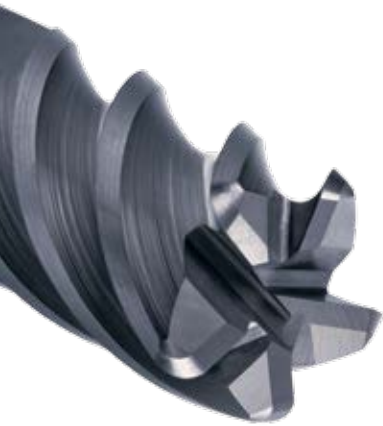
Size Ref.	d <sub>1</sub> (js14)	l <sub>1</sub>	l <sub>2</sub>	d <sub>2</sub>	z	rad	Item #	Item #	Item #
0600	6.0	57	13	6	4	-	E251 0600		
0800	8.0	69	19	10	4	-	E251 0800		
1000	10.0	72	22	10	4	-	E251 1000		
1025	10.0	72	22	10	4	2.5		E255 1025	
1040	10.0	72	22	10	4	4		E255 1040	
1200	12.0	83	26	12	4	-	E251 1200		
1225		83	26	12	4	2.5		E255 1225	
1240		83	26	12	4	4		E255 1240	
1600	16.0	92	32	16	4	-	E251 1600		
1605		92	32	16	5	-	E251 1605		
1625		92	32	16	5	2.5		E255 1625	
1640		92	32	16	5	4		E255 1640	
2000	20.0	104	38	20	4	-	E251 2000		
2005		104	38	20	5	-	E251 2005		
2025		104	38	20	5	2.5		E255 2025	
2040		104	38	20	5	4		E255 2040	
2050		104	38	20	5	5		E255 2050	
2060		104	38	20	5	6		E255 2060	
2500	25.0	121	45	25	5	-	E251 2500		
2525		121	45	25	5	2.5		E255 2525	
2540		121	45	25	5	4		E255 2540	
2550		121	45	25	5	5		E255 2550	
2560		121	45	25	5	6		E255 2560	
3040	30.0	121	45	25	6	4		E255 3040	
3200	32.0	133	53	32	6	-	E251 3200		
3240	32.0	133	53	32	6	4		E255 3240	

0600	6.0	68	24	6	3	-			E252 0600
0800	8.0	88	38	10	3	-			E252 0800
1000	10.0	95	45	10	4	-			E252 1000
1200	12.0	110	53	12	4	-			E252 1200
1600	16.0	123	63	16	4	-			E252 1600
2000	20.0	141	75	20	4	-			E252 2000
2500	25.0	166	90	25	5	-			E252 2500

ISO	P										M			K					N						S					H														
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41			
E251	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
E255	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
E252	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

P Steel 
 M Stainless Steel 
 K Cast Iron 
 N Non-Ferrous Metals 
 S Titanium & Super Alloys 
 H Hard Materials

● Optimal 
 ○ Effective



## R40/42 5-Flute Ni Carbide Endmill E474 Series

Excellent solution for shoulder and finish milling application, particularly for fine surface finish requirements, due to the multi-flute design the cutting forces and loads are distributed over more cutting edges than the conventional 4 flute endmills, resulting longer tool life.

### Case Study 1 Test Data

Material	Inconel 718 (45 HRC)	
Tool Holder	ER Collet Chuck	
Size	ø16 x R1	
ae (mm)	3	
ap (mm)	28	
	<b>Sutton Tools</b>	<b>Competitor</b>
Tool	E474 1610	VA Tool 4 Flute
Cutting Speed Vc (m/min)	28	25
RPM	557	557
Feed Rate Vf (mm/min)	195	156
Feed fz (mm/tooth)	0.07	0.07

### Wear Comparison

Sutton Tools 5 Flute Ni

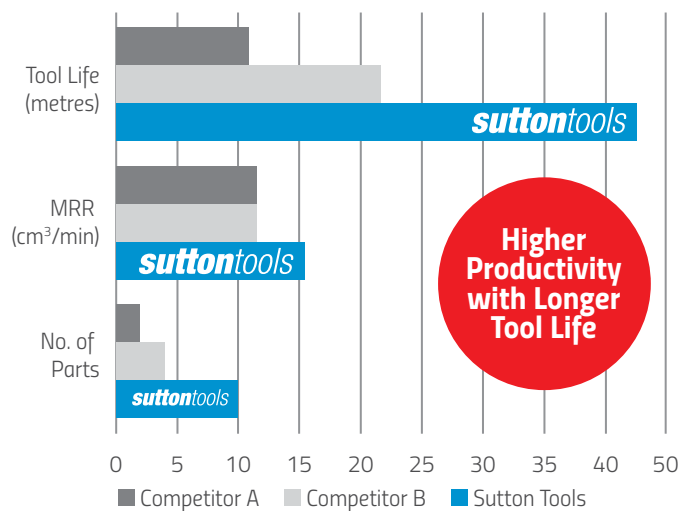


Competitor 4 Flute VA Tool



### Case Study 2 Test Data

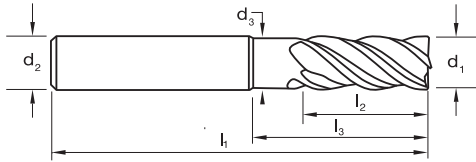
Material	Inconel 625		
Tool	E474 1010		
Tool Holder	BT40 Hydraulic Chuck		
Size	ø10 x 1 Corner Radius		
	<b>Sutton Tools</b>	<b>Competitor A</b>	<b>Competitor B</b>
z (teeth number)	5	4	4
ae (mm)	0.5	0.4	0.4
ap (mm)	22	22	22
Cutting Speed Vc (m/min)	45	45	45
RPM	1431	1431	1431
Feed Rate Vf (mm/min)	500	343	343
Feed fz (mm/tooth)	0.07	0.06	0.06



Higher Productivity with Longer Tool Life



- Excellent solution for stainless steels and super alloy type materials
- Optimised geometry with variable helix design ensures high productivity
- Suitable for slotting, side cutting and finishing applications with the one tool
- Xceed for outstanding oxidation resistance and hot hardness
- VHM-ULTRA grade of carbide for high performance



Type	5 Flute	5 Flute
Product Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	Xceed	Xceed
Sutton Designation	Ni	Ni
Geometry	R40/42 Ni	R40/42 Ni
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	d <sub>2</sub>	d <sub>3</sub>	z	chf	rad	Item #	
										E472	E473
<b>DIN6527L - Square End</b>											
<b>0600</b>	<b>6.0</b>	57	13	21	6	5.7	5	0.20	-	E472 0600	E473 0600
<b>0800</b>	<b>8.0</b>	63	19	27	8	7.6	5	0.20	-	E472 0800	E473 0800
<b>1000</b>	<b>10.0</b>	72	22	32	10	9.5	5	0.25	-	E472 1000	E473 1000
<b>1200</b>	<b>12.0</b>	83	26	38	12	11.5	5	0.25	-	E472 1200	E473 1200
<b>1600</b>	<b>16.0</b>	92	32	44	16	15.5	5	0.35	-	E472 1600	E473 1600
<b>2000</b>	<b>20.0</b>	104	38	54	20	19.5	5	0.35	-	E472 2000	E473 2000
<b>DIN6527L - Corner Rad</b>											
<b>0605</b>	<b>6.0</b>	57	13	21	6	5.5	5	-	0.5	E474 0605	E475 0605
<b>0610</b>		57	13	21	6	5.5	5	-	1.0	E474 0610	E475 0610
<b>0805</b>	<b>8.0</b>	63	19	27	8	7.5	5	-	0.5	E474 0805	E475 0805
<b>0810</b>		63	19	27	8	7.5	5	-	1.0	E474 0810	E475 0810
<b>1005</b>	<b>10.0</b>	72	22	32	10	9.5	5	-	0.5	E474 1005	E475 1005
<b>1010</b>		72	22	32	10	9.5	5	-	1.0	E474 1010	E475 1010
<b>1210</b>	<b>12.0</b>	83	26	38	12	11.5	5	-	1.0	E474 1210	E475 1210
<b>1215</b>		83	26	38	12	11.5	5	-	1.5	E474 1215	E475 1215
<b>1225</b>		83	26	38	12	11.5	5	-	2.5	E474 1225	E475 1225
<b>1240</b>		83	26	38	12	11.5	5	-	4.0	E474 1240	E475 1240
<b>1610</b>	<b>16.0</b>	92	32	44	16	15.5	5	-	1.0	E474 1610	E475 1610
<b>1615</b>		92	32	44	16	15.5	5	-	1.5	E474 1615	E475 1615
<b>1625</b>		92	32	44	16	15.5	5	-	2.5	E474 1625	E475 1625
<b>1640</b>		92	32	44	16	15.5	5	-	4.0	E474 1640	E475 1640
<b>2010</b>	<b>20.0</b>	104	38	54	20	19.5	5	-	1.0	E474 2010	E475 2010
<b>2015</b>		104	38	54	20	19.5	5	-	1.5	E474 2015	E475 2015
<b>2025</b>		104	38	54	20	19.5	5	-	2.5	E474 2025	E475 2025
<b>2040</b>		104	38	54	20	19.5	5	-	4.0	E474 2040	E475 2040

ISO	P											M			K							N											S					H																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41								
VDI 3323																																																									
E472																																																									
E473																																																									
E474																																																									
E475																																																									



ISO	VDI	Material Group	Sutton
P	A	Steel	N
M	R	Stainless Steel	VA
K	F	Cast Iron	GG
N	N	Non-Ferrous Metals, Aluminiums & Coppers	Al W
S	S	Titaniums & Super Alloys	Ti Ni
H	H	Hard Materials (≥ 45 HRC)	H

^ VDI 3323 material groups can also be determined by referring to the workpiece material cross reference listing. Refer to main index of this section.

For expert tooling recommendations, go to: [www.suttontools.com/expert-tool-selector](http://www.suttontools.com/expert-tool-selector)

### Special Notes

- These cutting conditions are a guide for HPM applications & will vary subject to the user own machine conditions and set-up variables.
- Careful consideration has been given to chip loads based on the step over (ae) size of cut to ensure chip thinning is eliminated, with deflection kept to a minimum.

### Catalogue Code

### Material

### Surface Finish

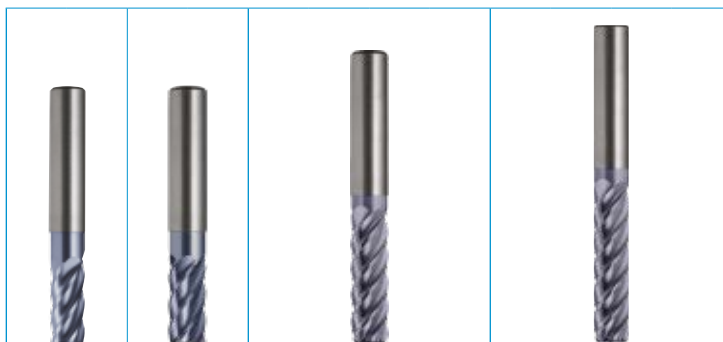
### Sutton Designation

### Type of Cut: Finishing

### Roughing

↕ ap × Ø

↔ ae × Ø



Catalogue Code	E464/E465	E466/E467	E476	E477
Material	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA
Surface Finish	AINova	AINova	AINova	AINova
Sutton Designation	Ti	Ti-3XL	Ti-3XL	Ti-4XL
Type of Cut: Finishing	•	•	•	•
Roughing	•	•	•	•
ap × Ø	1.5	1.5	3	3
ae × Ø	0.05	0.3	0.05	0.25

ISO	VDI <sup>^</sup> 3323	Material	Condition	HB	N/mm <sup>2</sup>	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	
M	14.1	Stainless Steel	Austenitic	AH	180	610	-	-	-	-	-	-	-	-	-	-	-	
	14.2		Duplex		250	840	-	-	-	-	-	-	-	-	-	-	-	
	14.3		Precipitation Hardening		250	840	120	11	100	13	80	11	60	13	60	10	50	12
S	31	High temp. alloys	Fe based	A	200	680	-	-	-	-	-	-	-	-	-	-	-	
	32			AH	280	950	-	-	-	-	-	-	-	-	-	-	-	
	33		Ni / Co based	A	250	840	-	-	-	-	-	-	-	-	-	-	-	
	34			AH	350	1180	-	-	-	-	-	-	-	-	-	-	-	
	35			C	320	1080	-	-	-	-	-	-	-	-	-	-	-	
	36	Titanium & Ti alloys	CP Titanium		400 MPa		100	8	100	11	70	7	70	10	65	7	65	10
	37.1		Alpha alloys		860 MPa		90	8	80	11	65	7	55	10	60	7	50	10
	37.2		Alpha / Beta alloys	A	960 MPa		90	8	70	11	65	7	50	10	60	7	45	10
				AH	1170 MPa		70	8	60	11	50	7	40	10	45	7	35	10
	37.4		Beta alloys	A	830 MPa		90	8	80	11	65	7	55	10	60	7	50	10
37.5	AH	1400 MPa			70	8	60	11	50	7	40	10	45	7	35	10		

Condition: A (Annealed), AH (Age Hardened), C (Cast), HT (Hardened & Tempered), QT (Quenched & Tempered)

Bold = Optimal | Regular = Effective

Ø	Feed Table (fz) (mm/tooth)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	0.001	0.002	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.010	0.011	0.013	0.014	0.016	0.018	0.020	0.022	0.024	0.026	0.030
3	0.002	0.003	0.004	0.005	0.006	0.008	0.009	0.010	0.012	0.014	0.016	0.018	0.020	0.023	0.025	0.028	0.032	0.034	0.038	0.042
4	0.004	0.005	0.006	0.007	0.009	0.010	0.012	0.014	0.016	0.018	0.021	0.023	0.026	0.030	0.032	0.036	0.040	0.044	0.045	0.050
5	0.005	0.006	0.008	0.009	0.011	0.013	0.015	0.017	0.020	0.023	0.025	0.030	0.032	0.036	0.040	0.044	0.050	0.055	0.060	0.065
6	0.006	0.008	0.009	0.011	0.013	0.016	0.018	0.021	0.024	0.028	0.030	0.034	0.038	0.042	0.045	0.050	0.055	0.060	0.070	0.075
8	0.010	0.012	0.014	0.017	0.019	0.022	0.025	0.028	0.032	0.036	0.040	0.045	0.050	0.055	0.060	0.065	0.075	0.080	0.085	0.095
10	0.013	0.015	0.018	0.021	0.024	0.028	0.032	0.036	0.040	0.045	0.050	0.055	0.060	0.070	0.075	0.085	0.090	0.100	0.11	0.12
12	0.016	0.019	0.022	0.026	0.030	0.034	0.038	0.044	0.050	0.055	0.060	0.065	0.075	0.080	0.090	0.100	0.11	0.12	0.13	0.14
16	0.020	0.024	0.028	0.034	0.038	0.044	0.050	0.055	0.060	0.070	0.080	0.085	0.095	0.11	0.12	0.13	0.14	0.16	0.17	0.18
20	0.022	0.028	0.032	0.038	0.044	0.050	0.060	0.065	0.075	0.085	0.095	0.11	0.12	0.13	0.15	0.16	0.18	0.19	0.21	0.23
25	0.025	0.032	0.038	0.045	0.055	0.060	0.070	0.080	0.090	0.10	0.12	0.13	0.15	0.16	0.18	0.20	0.22	0.24	0.26	0.29



E468/E469	E470/E471	E459/E460	E461/E462	E251	E255	E252	E472/E473/E474/E475								
VHM-ULTRA		VHM-ULTRA		SPM	SPM		VHM-ULTRA								
AINova		HELICA		TICN	AlCrN		XCeed								
Ti 6 Flute		VA		VA	VA		Ni								
•	•	•	•	•	•	•	•								
1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.5								
0.05	0.25	0.05	0.3	0.5	0.5	0.5	0.05								
Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #
-	-	-	-	120	8	100	9	40	10	40	10	40	10	120	14
-	-	-	-	100	8	90	9	40	10	40	10	40	10	120	14
120	11	100	13	100	8	90	9	25	6	25	6	25	6	100	14
-	-	-	-	-	-	-	-	25	4	25	4	25	4	60	14
-	-	-	-	-	-	-	-	15	4	15	4	15	4	50	14
-	-	-	-	-	-	-	-	25	4	25	4	25	4	50	14
-	-	-	-	-	-	-	-	10	4	10	4	10	4	40	13
-	-	-	-	-	-	-	-	15	4	15	4	15	4	30	11
100	8	100	11	110	7	70	8	30	5	30	5	30	5	-	-
90	8	80	11	100	7	60	8	15	4	15	4	15	4	-	-
90	8	70	11	90	7	50	8	15	4	15	4	15	4	-	-
70	8	60	11	80	7	50	8	12	4	12	4	12	4	-	-
90	8	80	11	100	7	60	8	15	4	15	4	15	4	-	-
70	8	60	11	80	7	50	8	12	4	12	4	12	4	-	-

### METRIC ENDMILLS (mm size)

Ø	= nominal tool diameter (mm)	$n = \frac{v_c \times 1000}{\phi \times \pi} \approx \frac{v_c}{\phi} \times 318$
n	= Spindel speed (RPM)	
v <sub>c</sub>	= Cutting speed (m/min)	
f <sub>z</sub>	= Feed rate per tooth (mm/tooth)	$v_c = \frac{n \times \phi \times \pi}{1000} \approx \frac{n \times \phi}{318}$
v <sub>f</sub>	= Feed rate (mm/min)	
z	= No. cutting edges	$f_z = \frac{v_f}{z \times n} \quad v_f = f_z \times z \times n$
Q	= Metal removal rate (cm <sup>3</sup> /min)	
a <sub>p</sub>	= Cutting depth (mm)	
a <sub>e</sub>	= Cutting width (mm)	$Q = \frac{a_p \times a_e \times v_f}{1000}$

### Regrinding

The relationship with you does not end after the delivery of our products. Sutton Tools supports you by reducing your production costs through our regrinding service of carbide tools available at our state-of-the-art facility.

Using our regrinding service means:

- ✓ Reground with original geometry
- ✓ Quality assured
- ✓ Handled by highly experienced personnel
- ✓ Lower tooling cost

### Recoating

As a total solution provider, Sutton Tools uses world leading heat treatment PVD coating (Physical Vapour Deposition) based on Oerlikon Balzers technology on their latest INNOVA coating machine to add life to our products.

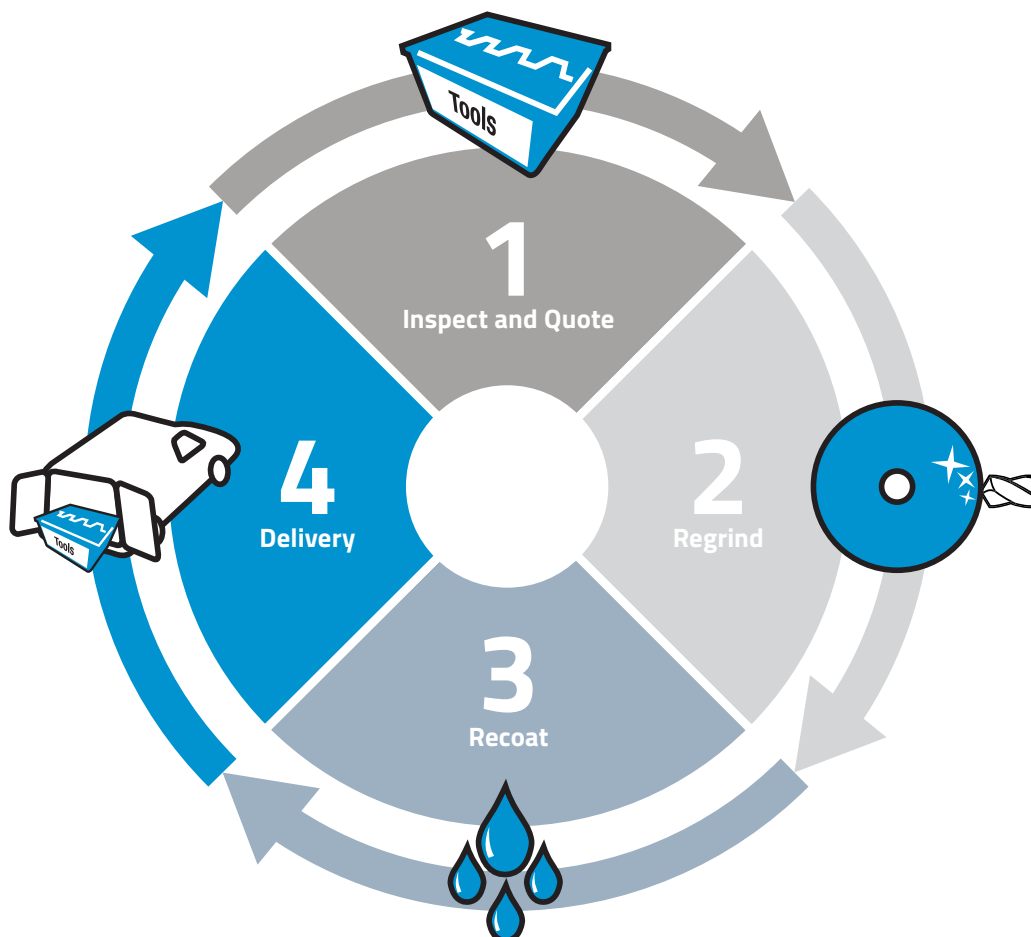
The benefits of PVD coatings include:

- ✓ 300%–1000% increase in tool life
- ✓ Increased productivity
- ✓ Uniform thickness
- ✓ Corrosion resistant
- ✓ Less tool changes due to less wear
- ✓ Better wear condition for regrinds

### Custom Tools and Modifications

With these synergy of facility and services, Sutton Tools are able to manufacture custom tools to your exact requirements. Simply provide your details via our enquiry form and our team of engineers will be able to design a custom solution for your tooling needs in no time.

## Tool Regrinding and Recoating Process



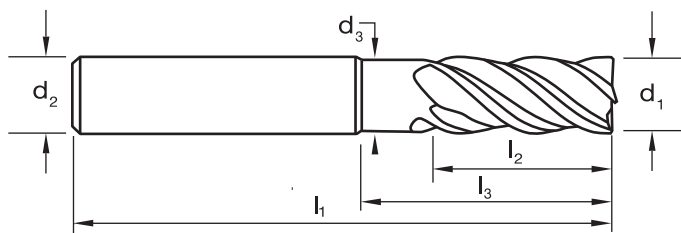
**SPECIAL ENDMILL ENQUIRY**

<b>Customer No.:</b> _____	<b>New Customer</b> <input type="checkbox"/>	<b>Order No.</b>
<b>Company:</b> _____		<b>Contact:</b> _____
<b>Address:</b> _____		<b>Phone:</b> _____
<b>State / Province:</b> _____		<b>Fax:</b> _____
<b>Country:</b> _____		<b>Email:</b> _____

**Endmill Details**

Quantity: \_\_\_\_\_

**Basic Dimensions**



Norm-Ø	<u>        </u>	$d_1$
Shank-Ø to DIN 6535	<u>        </u>	$d_2$
Shank length to DIN 6535	<u>        </u>	$d_3$
Total length	<u>        </u>	$l_1$
Cutting length	<u>        </u>	$l_2$
Reach length	<u>        </u>	$l_3$

**Shank Design**

Straight Shank (DIN 6535)     HA     HB     HE

**Edge Geometry**

Finishing endmills (Ø 3 – 20mm)     N     with Chip Breaker

Roughing endmills (Ø 6 – 20mm)     Fine     Coarse

**Face Geometry**

Cutting to Centre     Yes     No

**Corner Preparation**

Sharp edge	<input type="checkbox"/> Yes <input type="checkbox"/> No
Corner protection	<u>        </u> mm x 45° (Ø 0.03 – 1.5mm)
Corner radius	<u>        </u> mm x $d_1$ (Ø 0.3 – 2/3mm)
Ballnose	<input type="checkbox"/> Yes <input type="checkbox"/> No

**Internal Cooling**     Yes     No

**Coating**     Yes     No

AlNova     Xceed     TiAlN     AlCrN

**Tool Material**

Carbide    \_\_\_\_\_

HSS (SPM)    \_\_\_\_\_

**Application Details**

ae (mm)    \_\_\_\_\_

ap (mm)    \_\_\_\_\_

Material description    \_\_\_\_\_

Material hardness    \_\_\_\_\_ (N/mm<sup>2</sup> or HRC)

Application types

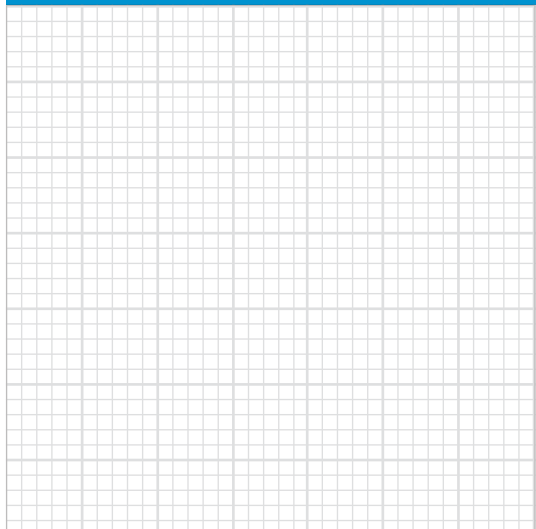
Slotting

Roughing

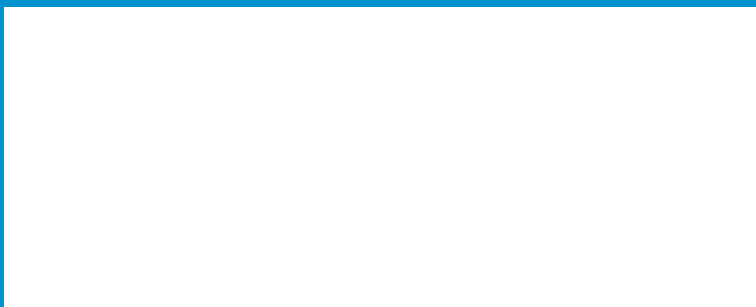
Finishing

HSM/Pocketing/Trochoidal

**Drawing / Notes**



## Distributed by:



**Sutton Tools Europe Cooperatie U.A.** TVA/VAT No. NL 821219674B01

**Australia (Head Office)** 378 Settlement Road, Thomastown 3074, Victoria Australia  
**T** +61 3 9280 0800 **F** +61 3 9464 0015 **E** [cservice@sutton.com.au](mailto:cservice@sutton.com.au)

**The Netherlands (Europe Head Office)** Bruijellestraat 4, 5048 Ae Tilburg, Nederland  
**T** +31 13 220 1480 **E** [suttontools.eu@sutton.com.au](mailto:suttontools.eu@sutton.com.au)

**France** **T** +33 788 557 404 **E** [suttontools.fr@sutton.com.au](mailto:suttontools.fr@sutton.com.au)

**UK and Ireland** **T** +44 (0) 7725 846 432 **E** [suttontools.uk@sutton.com.au](mailto:suttontools.uk@sutton.com.au)

**Central and Eastern Europe** **T** +421 948 520 246 **E** [suttontools.ceu@sutton.com.au](mailto:suttontools.ceu@sutton.com.au)

**Spain** **T** +34 648 020 098 **E** [suttontools.es@sutton.com.au](mailto:suttontools.es@sutton.com.au)

[www.suttontools.com](http://www.suttontools.com)

499980512\_0119

