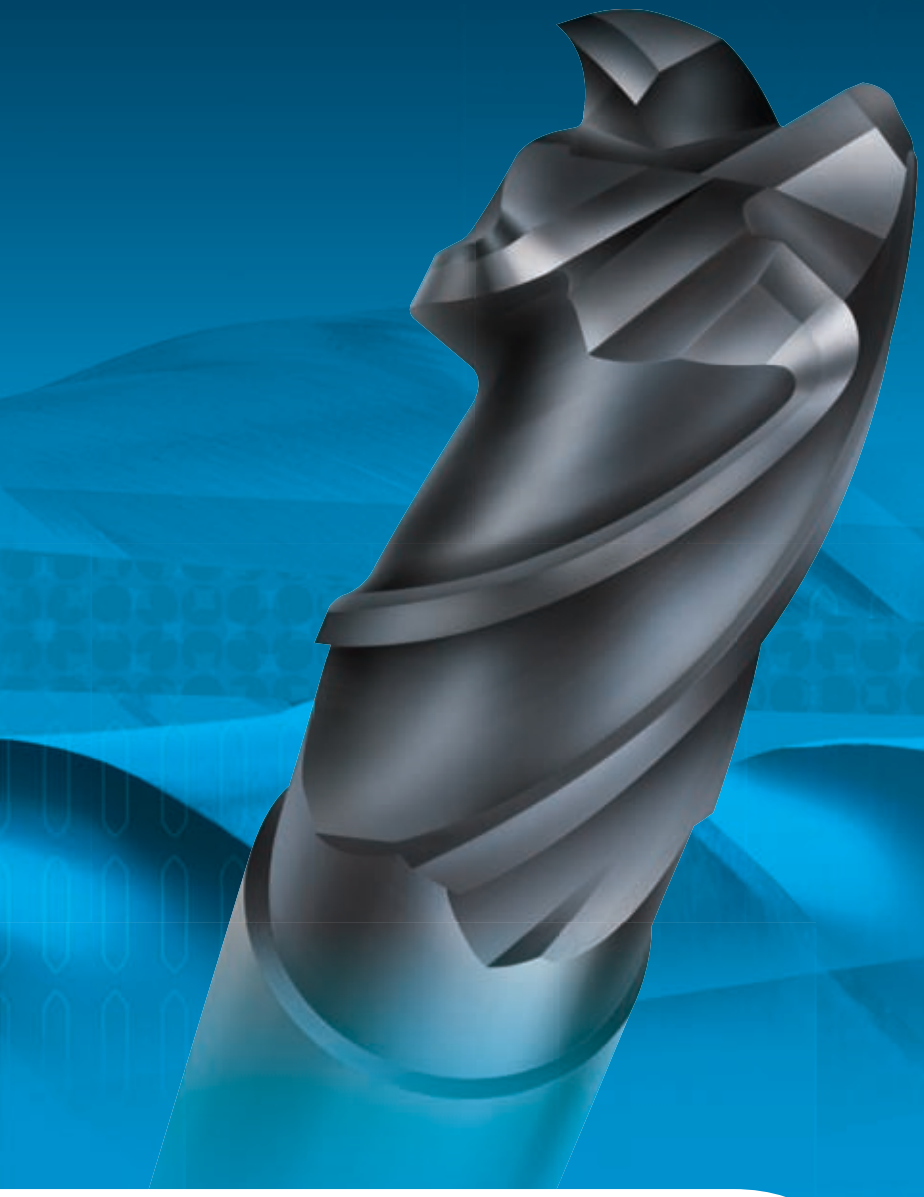
ENGLISH

Performance Unequalled...



HARMONY

ENDMILL SERIES

100% Australian Owned
www.sutton.com.au

Sutton Tools

Case Study Harmony Endmill Series

The Harmony range of endmills represents world's latest technologies to provide increases in both performance and tool life. The key to successful milling is to minimize or eliminate the vibration produced in the cutting action. This is known as a buildup of harmonics in the work piece, which can be detrimental to the tool life of the endmill. Often this vibration has been rectified by slowing down the cutting speed and feeds, altering the size of the cut & increasing the rigidity of the set-up.

The Harmony Endmill overcomes vibration, through a combination of tool design, micro geometry, material & coating, without the need to sacrifice productivity.

Material

The Harmony range is available in both PM-HSS and Carbide.
VHM-ULTRA Harmony Endmills are made from VHM-ULTRA, an ultra fine grain type (0.5µm) which offers the best wear resistance in high performance milling applications.
SPM Harmony Endmills are made from the most advanced grade of Powder Metallurgy High Speed Steel (SPM) available specifically for milling tools, offering higher edge hardness with the HSS benefit of toughness.

Coating

AlCrN The carbide Harmony range is paired with AlCrN coating, which exhibits an unmatched degree of oxidation resistance and hot hardness. These properties have triggered a quantum leap in tool wear resistance, allowing for significantly higher cutting speeds.
TiAlN The SPM HSS Harmony range is complimented by the latest generation of TiAlN (Futura Nano) coating suitable in applications where there is high thermal load. TiAlN has a nano-layered structure which was engineered to give an optimum balance between hardness & internal stress, also has improved sliding properties 30˚ - 32˚.

Tool Design

A combination of a unique unequal flute helix & various optimization with regard to the end-teeth geometry, provides a stable/chatterfree cutting action.

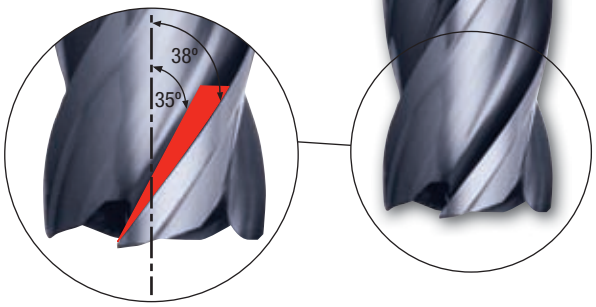
35-38° unequal flute helix, reduces the harmonic build up in the workpiece, resulting in smooth chatter-free milling in various types of milling techniques, increasing your productivity.

45° Corner chamfering provides added strength to the endmills particularly in semi-roughing & roughing type milling applications.

The gash grind of the endteeth blends to the outer corner of the 45° chamfer, strengthening the design in this area.

MICRO Post grind treatment of cutting edges, engineered specifically for the relevant material application.

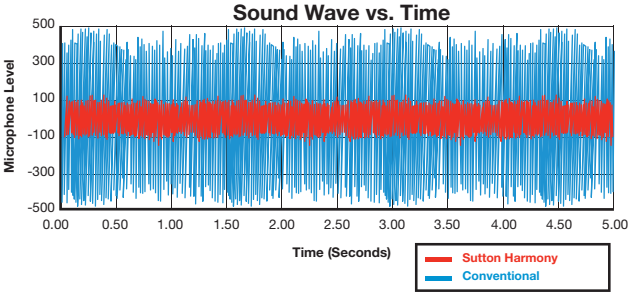
Carbide endmills with neck reduction for extra cutting reach.



Case Study - Performance Comparison

A recent study was conducted comparing the harmonics produced in the workpiece, between the Harmony & a conventional endmill. The graph clearly indicates the smoother cutting action of the Harmony ▸

Tool	Harmony Endmill	Conventional Endmill
Machine	Haas VF2-SS Vertical Machining Centre	
Holder	Hydraulic Chuck	
Size	10mm	
Material:	AISI 1045/ 1.0503 / C45	AISI 1045/ 1.0503 / C45
V_c:	200 m/min	200 m/min
n:	6360 RPM	6360 RPM
f_z:	**0.07 mm/tooth**	0.058 mm/tooth
V_f:	**1781 mm/min**	1463 mm/min
z:	4 flutes	4 flutes
ae:	2 mm	2 mm
ap:	15 mm	15 mm



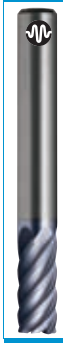
Sutton Tools

				Long Reach, 2 Flute, R30	Long Reach, 2 Flute R30, Corner Rad	2 Flute, R40-AlCarb	3 Flute, R38/37/39	3 Flute, R38/37/39	3 Flute, R45/46/44-Al	Long Reach, 3 Flute, R45/46/44-Al	3 Flute, R55/54/56-VA
			Page	6	7	19	8	9	20	21	25
											
			Catalogue Code	E418	E420	E310	E422	E424	E400	E402	E410
			Material	VHM-ULTRA		VHM	VHM-ULTRA				
			Surface Finish	AlCrN		Brt	AlCrN		CrN		HELICA
			Colour Ring & Application	UNI		Al	UNI		Al		VA
			Standard	-		DIN 6527L	DIN 6527K	DIN 6527L		-	DIN 6527L
			Type of Cut	Slotting			Slotting/Finishing				
Material			Shank Tolerance	h5							
1.1 Mild steels, magnetic soft steel	<200	>200 <400	10	●	●		●	●			○
1.2 Free cutting, structural, unalloyed	<200	>350 <700	30	●	●		●	●			○
1.3 Plain carbon, low alloyed	<300	>350 <850	20	●	●		●	●			○
1.4 Alloy steels harden. / tempered	<250	>500 <850	30	●	●		●	●			○
1.5 Alloy steels harden. / tempered	<350	>850 <1200	30	●	●		●	●			
1.6 Hardened, heat treated, high tensile alloy	<420	>1500	12	●	●		●	●			
1.7 Hardened Steel 45-50 Rc	<550		<12	○	○		○	○			
1.8 Hardened Steel 50-62 Rc	<700		<12								
2.0 Stainless Steels											
2.1 Free machining	<250	<850	25								●
2.2 Austenitic	<250	<850	20								●
2.3 Ferritic + martensitic	<250	<850	20								●
3.0 Cast Irons											
3.1 Lamellar graphite (Grey soft)	<150	<500	10	○	○		○	○			
3.2 Lamellar graphite (Grey hard)	<300	<1000	10	○	○		○	○			
3.3 Nodular (spheroidal graphite & malleable	<200	<700	10	○	○		○	○			
4.0 Titaniums											
4.1 Pure Titanium	<250	<850	20	●	●						●
4.2 Titanium alloys	>250	>850	20	●	●						●
5.0 Nickels											
5.1 Nickel alloys	<250	<850	25								○
5.2 Nickel alloys	>250	>850	25								○
6.0 Coppers											
6.1 Pure Copper (electrolytic copper)	<120	<400	12			●	●		●	●	
6.2 Short chip Brass, Phosphor Bronze, gun metal	<200	<700	12			●	●		●	●	
6.3 Long chip Brass, Bronze	<200	<700	12			●	●		●	●	
7.0 Aluminiums											
7.1 Aluminium unalloyed	<100	<350	15			●			●	●	
7.2 Magnesium unalloyed	<150	<350	15			●			●	●	
7.3 Al Alloyed Si < 1.5 %	<120	<500	15			●			●	●	
7.4 Al Alloyed 1.5 % < Si < 10%	<120	<400	10			●			●	●	
7.5 Al Alloyed > 10% Si	-	<400	N			●			●	●	
7.6 Magnesium alloys	-	<400	N			●			●	●	
8.0 Plastics											
8.1 Plastics, Thermoplastics, Polyethylene	<340	<50	N			●			●	●	

● **Optimal** ○ **Effective**

Sutton Tools

				4 Flute, R35/38	4 Flute, R35/38	4 Flute, R35/38, Corner Rad	4 Flute, R45/44	4 Flute, R45/44, Corner Rad	4 Flute, R55-VA	Long Reach, 4 Flute, R55-VA	4 Flute, R55-VH	6-8 Flute R50/35-VH	Extra Long, 6-8 Flute R50/35-VH
			Page	10	11	12	13	14	26	27	29	31	32
													
			Catalogue Code	E533	E535	E559	E426	E430	E412	E414	E428	E432	E434
			Material	VHM-ULTRA									
			Surface Finish	AlCrN					HELICA		AlCrN		
			Colour Ring & Application	UNI					VA		VH		
			Standard	DIN 6527K	DIN 6527L	DIN 6527L		-	DIN 6527L	-	DIN 6527L		-
			Type of Cut	Finishing								Fine Finishing	
Material			Shank Tolerance	h6			h5						
1.1 Mild steels, magnetic soft steel	<200	>200 <400	10	●	●	●	●	●			●	●	●
1.2 Free cutting, structural, unalloyed	<200	>350 <700	30	●	●	●	●	●			●	●	●
1.3 Plain carbon, low alloyed	<300	>350 <850	20	●	●	●	●	●			●	●	●
1.4 Alloy steels harden. / tempered	<250	>500 <850	30	●	●	●	●	●			●	●	●
1.5 Alloy steels harden. / tempered	<350	>850 <1200	30	●	●	●	●	●			●	●	●
1.6 Hardened, heat treated, high tensile alloy	<420	>1500	12	●	●	●	●	●			●	●	●
1.7 Hardened Steel 45-50 Rc	<550		<12	○	○	○	○	○				●	●
1.8 Hardened Steel 50-62 Rc	<700		<12	○	○	○						●	●
2.0 Stainless Steels													
2.1 Free machining	<250	<850	25	○	○	○			●	●		○	○
2.2 Austenitic	<250	<850	20	○	○	○			●	●		○	○
2.3 Ferritic + martensitic	<250	<850	20	○	○	○			●	●		○	○
3.0 Cast Irons													
3.1 Lamellar graphite (Grey soft)	<150	<500	10	●	●	●	○	○			○		
3.2 Lamellar graphite (Grey hard)	<300	<1000	10	●	●	●	○	○			○		
3.3 Nodular (spheroidal graphite & malleable	<200	<700	10	○	○	○	○	○			○		
4.0 Titaniums													
4.1 Pure Titanium	<250	<850	20	○	○	○	○	○	●	●	○	○	○
4.2 Titanium alloys	>250	>850	20	○	○	○	○	○	●	●	○	○	○
5.0 Nickels													
5.1 Nickel alloys	<250	<850	25	○	○	○			○	○		○	○
5.2 Nickel alloys	>250	>850	25	○	○	○			○	○			
6.0 Coppers													
6.1 Pure Copper (electrolytic copper)	<120	<400	12										
6.2 Short chip Brass, Phosphor Bronze, gun metal	<200	<700	12	○	○	○							
6.3 Long chip Brass, Bronze	<200	<700	12										
7.0 Aluminiums													
7.1 Aluminium unalloyed	<100	<350	15	○	○	○							
7.2 Magnesium unalloyed	<150	<350	15	○	○	○							
7.3 Al Alloyed Si < 1.5 %	<120	<500	15	○	○	○							
7.4 Al Alloyed 1.5 % < Si < 10%	<120	<400	10	○	○	○							
7.5 Al Alloyed > 10% Si	-	<400	N	○	○	○							
7.6 Magnesium alloys	-	<400	N	○	○	○							
8.0 Plastics													
8.1 Plastics, Thermoplastics, Polyethylene	<340	<50	N	○	○	○							

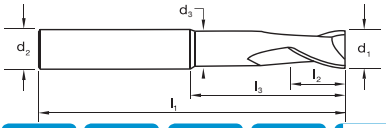
Long Reach 6-8 Flute R50/35-VH Corner Rad	6-8 Flute, R45-VH	4 Flute, R50-H DUO	4 Flute, R50-H DUO, Corner Rad	4 Flute, R50-VH DUO	4 Flute, R50-VH DUO, Corner Rad	4 Flute, R45-STF	3-6 Flute, R45-HRS	3 Flute, R35/36/36-Al HR	3-4 Flute R25-Al NRC	3 Flute, R35/36/36-VA HR	Long Reach, Ballnose, 2 Flute R30	Long Reach, Ballnose, 4 Flute R30	Long Reach, Ballnose, 3 Flute R45/46/44-Al
33	30	34	35	36	37	15	16	22	23	28	17	18	24
													
E436	E543	E562	E564	E566	E568	E545	E549	E404	E406	E416	E440	E442	E408
VHM-ULTRA													
AlCrN				Aldura		AlCrN		CrN		HELICA	AlCrN		CrN
VH		H		VH		UNI		Al		VA	UNI		Al
-	DIN 6527L					DIN 6527L					-		
Finishing						Semi Finishing	Roughing				Profiling		
h5	h6					h6		h5					
●		●	●			●	●				●	●	
●		●	●			●	●				●	●	
●		●	●			●	●				●	●	
●		●	●			●	●				●	●	
●		●	●			●	●				●	●	
●	●	●	●			●	○				●	●	
●	●	○	○	○	○						●	●	
●	●			●	●						●	●	
○		●	●			○	○			●			
○		●	●			○	○			●			
○		●	●	○	○	○	○			●			
		○	○			○	●						
	●	○	○			○	●						
		○	○	○	○	●	○						
○	○	●	●			○	○			●			
○	○	●	●			○	○			●			
○	○	●	●			○	○			●			
		●	●			○	○			●			
						●	●	●	●				●
						○	○	●	●				●
						○	○	●	●				●
								●	●				●
								●	●				●
								●	●				●
								●	●				●
								●	●				●

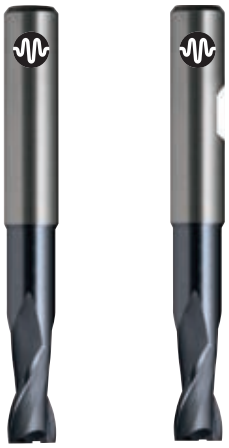
● Optimal ○ Effective

HARMONY Long Reach, 2 Flute, R30

- VHM-ULTRA grade of carbide for high performance
- For precision milling of slots & cavities
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life

Sutton Tools





Catalogue Code Size Ref.

E500 0300

Item #

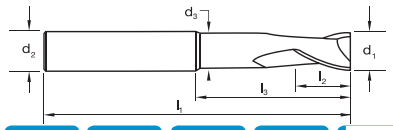
Catalogue Code	E418	E419
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R30	R30
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0200	2,0	54	3	9	6	1,8	2	E418 0200	E419 0200
0250	2,5	54	3,5	9	6	2,2	2	E418 0250	E419 0250
0300	3,0	54	4	11	6	2,7	2	E418 0300	E419 0300
0350	3,5	57	4,5	11	6	3,1	2	E418 0350	E419 0350
0400	4,0	57	5	15	6	3,6	2	E418 0400	E419 0400
0450	4,5	57	5,5	15	6	4,1	2	E418 0450	E419 0450
0500	5,0	62	6	23	6	4,5	2	E418 0500	E419 0500
0550	5,5	62	6,5	23	6	5,0	2	E418 0550	E419 0550
0600	6,0	62	7	24	6	5,4	2	E418 0600	E419 0600
0700	7,0	68	8	28	8	6,3	2	E418 0700	E419 0700
0800	8,0	68	9	30	8	7,2	2	E418 0800	E419 0800
0900	9,0	80	10	36	10	8,2	2	E418 0900	E419 0900
1000	10,0	80	11	38	10	9,0	2	E418 1000	E419 1000
1100	11,0	93	12	44	12	10,0	2	E418 1100	E419 1100
1200	12,0	93	13	46	12	11,0	2	E418 1200	E419 1200
1300	13,0	93	14	44	14	12,0	2	E418 1300	E419 1300
1400	14,0	93	15	46	14	13,0	2	E418 1400	E419 1400
1500	15,0	108	16	56	16	14,0	2	E418 1500	E419 1500
1600	16,0	108	17	58	16	15,0	2	E418 1600	E419 1600
1800	18,0	108	19	58	18	17,0	2	E418 1800	E419 1800
2000	20,0	126	21	74	20	19,0	2	E418 2000	E419 2000

HARMONY Long Reach, 2 Flute, R30, Corner Rad

- VHM-ULTRA grade of carbide for high performance
- For precision milling of slots & cavities
- Suitable for materials up to 1300 N/mm²
- AlCrN for longer tool life

Sutton Tools



Catalogue Code Size Ref.

E500 0300

Item #

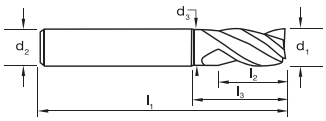
Catalogue Code	E420	E421
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R30	R30
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	rad	Item #	Item #
0403	4,0	57	5	16	6	3,6	2	0,3	E420 0403	E421 0403
0405	4,0	57	5	16	6	3,6	2	0,5	E420 0405	E421 0405
0603	6,0	62	7	24	6	5,4	2	0,3	E420 0603	E421 0603
0605	6,0	62	7	24	6	5,4	2	0,5	E420 0605	E421 0605
0610	6,0	62	7	24	6	5,4	2	1,0	E420 0610	E421 0610
0615	6,0	62	7	24	6	5,4	2	1,5	E420 0615	E421 0615
0803	8,0	68	9	30	8	7,2	2	0,3	E420 0803	E421 0803
0805	8,0	68	9	30	8	7,2	2	0,5	E420 0805	E421 0805
0810	8,0	68	9	30	8	7,2	2	1,0	E420 0810	E421 0810
0815	8,0	68	9	30	8	7,2	2	1,5	E420 0815	E421 0815
1005	10,0	80	11	38	10	9,0	2	0,5	E420 1005	E421 1005
1010	10,0	80	11	38	10	9,0	2	1,0	E420 1010	E421 1010
1015	10,0	80	11	38	10	9,0	2	1,5	E420 1015	E421 1015
1020	10,0	80	11	38	10	9,0	2	2,0	E420 1020	E421 1020
1205	12,0	93	13	46	12	11,0	2	0,5	E420 1205	E421 1205
1210	12,0	93	13	46	12	11,0	2	1,0	E420 1210	E421 1210
1215	12,0	93	13	46	12	11,0	2	1,5	E420 1215	E421 1215
1220	12,0	93	13	46	12	11,0	2	2,0	E420 1220	E421 1220
1610	16,0	108	17	58	16	15,0	2	1,0	E420 1610	E421 1610
1620	16,0	108	17	58	16	15,0	2	2,0	E420 1620	E421 1620
1630	16,0	108	17	58	16	15,0	2	3,0	E420 1630	E421 1630
1640	16,0	108	17	58	16	15,0	2	4,0	E420 1640	E421 1640

HARMONY DIN 6527K, 3 Flute, R38/37/39

- VHM-ULTRA grade of carbide for high performance
- Universal use for slotting & finishing with the one tool
- 38/37/39° variable flute helix for chatter free milling
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life

Sutton Tools



DIN 6527K | 45° | MICRO

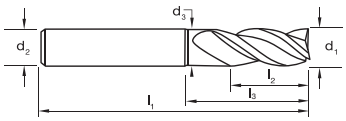
Catalogue Code: E500 | Size Ref.: 0300 → Item #

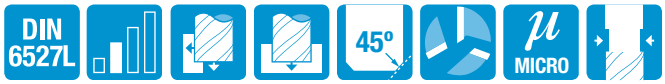
Catalogue Code	E422	E423
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R38/37/39	R38/37/39
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

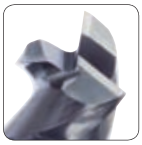
Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0300	3,0	50	5	-	6	-	3	E422 0300	E423 0300
0350	3,5	50	6	-	6	-	3	E422 0350	E423 0350
0400	4,0	54	8	13	6	3,8	3	E422 0400	E423 0400
0450	4,5	54	8	13	6	4,3	3	E422 0450	E423 0450
0500	5,0	54	9	15	6	4,8	3	E422 0500	E423 0500
0550	5,5	54	9	15	6	5,3	3	E422 0550	E423 0550
0600	6,0	54	10	16	6	5,7	3	E422 0600	E423 0600
0800	8,0	58	12	20	8	7,6	3	E422 0800	E423 0800
1000	10,0	66	14	24	10	9,5	3	E422 1000	E423 1000
1200	12,0	73	16	26	12	11,5	3	E422 1200	E423 1200
1400	14,0	73	16	26	14	13,5	3	E422 1400	E423 1400
1600	16,0	82	22	32	16	15,5	3	E422 1600	E423 1600
1800	18,0	82	22	32	18	17,5	3	E422 1800	E423 1800
2000	20,0	92	26	40	20	19,5	3	E422 2000	E423 2000

HARMONY DIN6527L, 3 Flute, R38/37/39

- VHM-ULTRA grade of carbide for high performance
- Universal use for slotting & finishing with the one tool
- 38/37/39º variable flute helix for chatter free milling
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life







Catalogue Code Size Ref.

E500 0300

Item #

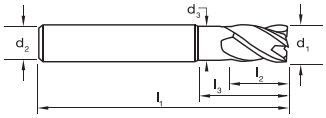
Catalogue Code	E424	E425
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R38/37/39	R38/37/39
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0300	3,0	57	8	14	6	2,8	3	E424 0300	E425 0300
0350	3,5	57	8	14	6	3,3	3	E424 0350	E425 0350
0400	4,0	57	11	16	6	3,8	3	E424 0400	E425 0400
0450	4,5	57	11	16	6	4,3	3	E424 0450	E425 0450
0500	5,0	57	13	18	6	4,8	3	E424 0500	E425 0500
0550	5,5	57	13	18	6	5,3	3	E424 0550	E425 0550
0600	6,0	57	13	19	6	5,7	3	E424 0600	E425 0600
0800	8,0	63	19	25	8	7,6	3	E424 0800	E425 0800
1000	10,0	72	22	30	10	9,5	3	E424 1000	E425 1000
1200	12,0	83	26	36	12	11,5	3	E424 1200	E425 1200
1400	14,0	83	26	36	14	13,5	3	E424 1400	E425 1400
1600	16,0	92	32	42	16	15,5	3	E424 1600	E425 1600
1800	18,0	92	32	42	18	17,5	3	E424 1800	E425 1800
2000	20,0	104	38	52	20	19,5	3	E424 2000	E425 2000

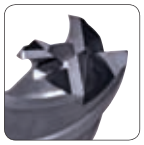
HARMONY DIN6527K, 4 Flute, R35/38

- VHM-ULTRA grade of carbide for high performance
- 35/38º variable flute helix for chatter free milling
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life

Sutton Tools



DIN 6527K | 45º | MICRO



Catalogue Code: E500 | Size Ref.: 0300 → Item #

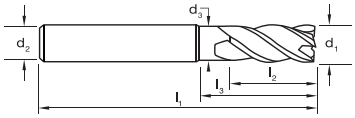
Catalogue Code	E533	E534
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R35 / 38	R35 / 38
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0600	6,0	54	10	18	6	5,5	4	E533 0600	E534 0600
0800	8,0	58	12	22	8	7,5	4	E533 0800	E534 0800
1000	10,0	66	14	24	10	9,5	4	E533 1000	E534 1000
1200	12,0	73	16	28	12	11,2	4	E533 1200	E534 1200
1600	16,0	82	22	34	16	15,0	4	E533 1600	E534 1600
2000	20,0	92	26	42	20	19,0	4	E533 2000	E534 2000

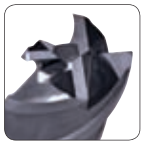
HARMONY DIN6527L, 4 Flute, R35/38

Sutton Tools

- VHM-ULTRA grade of carbide for high performance
- 35/38º variable flute helix for chatter free milling
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life



DIN 6527L | 45º | MICRO



Catalogue Code: E500 | Size Ref.: 0300 | Item #

Catalogue Code	E535	E536
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R35 / 38	R35 / 38
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0300	3,0	57	8	19	6	2,8	4	E535 0300	E536 0300
0400	4,0	57	11	19	6	3,7	4	E535 0400	E536 0400
0500	5,0	57	13	20	6	4,6	4	E535 0500	E536 0500
0600	6,0	57	13	21	6	5,5	4	E535 0600	E536 0600
0800	8,0	63	19	27	8	7,5	4	E535 0800	E536 0800
1000	10,0	72	22	32	10	9,5	4	E535 1000	E536 1000
1200	12,0	83	26	38	12	11,2	4	E535 1200	E536 1200
1400	14,0	83	26	38	14	13,0	4	E535 1400	E536 1400
1600	16,0	92	32	44	16	15,0	4	E535 1600	E536 1600
1800	18,0	92	32	44	18	17,0	4	E535 1800	E536 1800
2000	20,0	104	38	54	20	19,0	4	E535 2000	E536 2000
2500	25,0	120	45	64	25	24,0	4	E535 2500	E536 2500

Case Study R35/38 Harmony Endmills

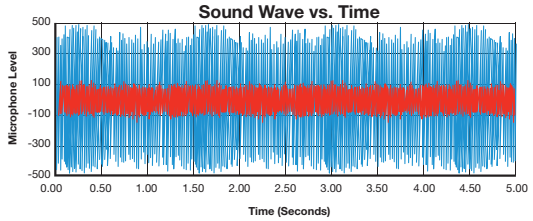
Performance Unequalled...

with chatter-free milling

The Harmony range of endmills represents world's latest technologies to provide increases in both performance and tool life. The key to successful milling is to minimize or eliminate the vibration produced in the cutting action. This is known as a buildup of harmonics in the work piece, which can be detrimental to the tool life of the endmill.

A combination of a unique unequal flute helix & various optimization with regard to the end-teeth geometry, provides a stable/chatterfree cutting action.

35-38° unequal flute helix, reduces the harmonic build up in the workpiece, resulting in smooth chatter-free milling in various types of milling techniques, increasing your productivity.



Case Study - Performance Comparison

A recent study was conducted comparing the harmonics produced in the workpiece, between the Harmony & a conventional endmill.

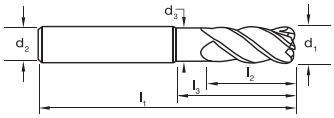
The graph clearly indicates the smoother cutting action of the Harmony ▸

Tool	Harmony Endmill	Conventional Endmill
Machine	Haas VF2-SS Vertical Machining Centre	
Holder	Hydraulic Chuck	
Size	10mm	
Material:	AISI 1045/ 1.0503 / C45	AISI 1045/ 1.0503 / C45
V_c:	200 m/min	200 m/min
n:	6360 RPM	6360 RPM
f_z:	**0.07 mm/tooth**	0.058 mm/tooth
V_f:	**1781 mm/min**	1463 mm/min
z:	4 flutes	4 flutes
ae:	2 mm	2 mm
ap:	15 mm	15 mm

HARMONY DIN6527L, 4 Flute, R35/38, Corner Radius

- VHM-ULTRA grade of carbide for high performance
- 35/38º variable flute helix for chatter free milling
- Suitable for materials up to 1300 N/mm²
- AlCrN for longer tool life

Sutton Tools



DIN 6527L | MICRO

Catalogue Code: E500 | Size Ref.: 0300 → Item #

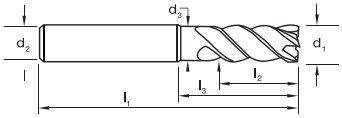
Catalogue Code	E559	E560
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R35 / 38	R35 / 38
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Rad	Item #	Item #
0303	3,0	57	8	19	6	3,7	4	0,3	E559 0303	E560 0303
0305		57	8	19	6	3,7	4	0,5	E559 0305	E560 0305
0403	4,0	57	11	19	6	3,7	4	0,3	E559 0403	E560 0403
0405		57	11	19	6	3,7	4	0,5	E559 0405	E560 0405
0410		57	11	19	6	3,7	4	1,0	E559 0410	E560 0410
0503	5,0	57	13	20	6	4,6	4	0,3	E559 0503	E560 0503
0505		57	13	20	6	4,6	4	0,5	E559 0505	E560 0505
0510		57	13	20	6	4,6	4	1,0	E559 0510	E560 0510
0603	6,0	57	13	21	6	5,5	4	0,3	E559 0603	E560 0603
0605		57	13	21	6	5,5	4	0,5	E559 0605	E560 0605
0610		57	13	21	6	5,5	4	1,0	E559 0610	E560 0610
0803	8,0	63	19	27	8	7,5	4	0,3	E559 0803	E560 0803
0805		63	19	27	8	7,5	4	0,5	E559 0805	E560 0805
0810		63	19	27	8	7,5	4	1,0	E559 0810	E560 0810
0815		63	19	27	8	7,5	4	1,5	E559 0815	E560 0815
0820		63	19	27	8	7,5	4	2,0	E559 0820	E560 0820
1003	10,0	72	22	32	10	9,5	4	0,3	E559 1003	E560 1003
1005		72	22	32	10	9,5	4	0,5	E559 1005	E560 1005
1010		72	22	32	10	9,5	4	1,0	E559 1010	E560 1010
1015		72	22	32	10	9,5	4	1,5	E559 1015	E560 1015
1020		72	22	32	10	9,5	4	2,0	E559 1020	E560 1020
1203	12,0	83	26	38	12	11,2	4	0,3	E559 1203	E560 1203
1205		83	26	38	12	11,2	4	0,5	E559 1205	E560 1205
1210		83	26	38	12	11,2	4	1,0	E559 1210	E560 1210
1215		83	26	38	12	11,2	4	1,5	E559 1215	E560 1215
1220		83	26	38	12	11,2	4	2,0	E559 1220	E560 1220
1230		83	26	38	12	11,2	4	3,0	E559 1230	E560 1230
1605	16,0	92	32	44	16	15,0	4	0,5	E559 1605	E560 1605
1610		92	32	44	16	15,0	4	1,0	E559 1610	E560 1610
1615		92	32	44	16	15,0	4	1,5	E559 1615	E560 1615
1620		92	32	44	16	15,0	4	2,0	E559 1620	E560 1620
1630		92	32	44	16	15,0	4	3,0	E559 1630	E560 1630
2005	20,0	104	38	54	20	19,0	4	0,5	E559 2005	E560 2005
2010		104	38	54	20	19,0	4	1,0	E559 2010	E560 2010
2015		104	38	54	20	19,0	4	1,5	E559 2015	E560 2015
2020		104	38	54	20	19,0	4	2,0	E559 2020	E560 2020
2030		104	38	54	20	19,0	4	3,0	E559 2030	E560 2030

HARMONY DIN 6527L, 4 Flute, R45/44

- VHM-ULTRA grade of carbide for high performance
- 45/44º variable flute helix for chatter free milling
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life

Sutton Tools



DIN 6527L | MICRO | 45º

Catalogue Code: E500 | Size Ref.: 0300

Item #

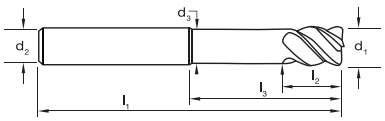
Catalogue Code	E426	E427
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R45/44	R45/44
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0300	3,0	57	8	14	6	2,8	4	E426 0300	E427 0300
0350	3,5	57	11	16	6	3,3	4	E426 0350	E427 0350
0400	4,0	57	11	16	6	3,8	4	E426 0400	E427 0400
0450	4,5	57	13	18	6	4,3	4	E426 0450	E427 0450
0500	5,0	57	13	18	6	4,8	4	E426 0500	E427 0500
0550	5,5	57	13	18	6	5,3	4	E426 0550	E427 0550
0600	6,0	57	13	19	6	5,7	4	E426 0600	E427 0600
0800	8,0	63	19	25	8	7,6	4	E426 0800	E427 0800
1000	10,0	72	22	30	10	9,5	4	E426 1000	E427 1000
1200	12,0	83	26	36	12	11,5	4	E426 1200	E427 1200
1400	14,0	83	26	36	14	13,5	4	E426 1400	E427 1400
1600	16,0	92	32	42	16	15,5	4	E426 1600	E427 1600
1800	18,0	92	32	42	18	17,5	4	E426 1800	E427 1800
2000	20,0	104	38	52	20	19,5	4	E426 2000	E427 2000
2500	25,0	120	45	62	25	24,0	4	E426 2500	E427 2500

HARMONY Long Reach, 4 Flute, R45/44, Corner Rad

- VHM-ULTRA grade of carbide for high performance
- 45/44° variable flute helix for chatter free milling
- Suitable for materials up to 1300 N/mm²
- AlCrN for longer tool life

Sutton Tools



Catalogue Code Size Ref.

E500 0300

Item #

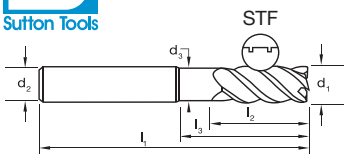
Catalogue Code	E430	E431
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R55	R55
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

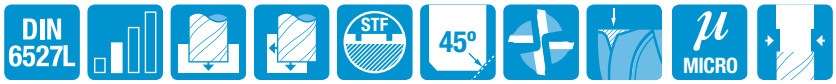
Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	rad	Item #	Item #
0403	4,0	57	5	16	6	3,6	4	0,3	E430 0403	E431 0403
0405	4,0	57	5	16	6	3,6	4	0,5	E430 0405	E431 0405
0603	6,0	62	7	24	6	5,4	4	0,3	E430 0603	E431 0603
0605	6,0	62	7	24	6	5,4	4	0,5	E430 0605	E431 0605
0610	6,0	62	7	24	6	5,4	4	1,0	E430 0610	E431 0610
0615	6,0	62	7	24	6	5,4	4	1,5	E430 0615	E431 0615
0803	8,0	68	9	30	8	7,2	4	0,3	E430 0803	E431 0803
0805	8,0	68	9	30	8	7,2	4	0,5	E430 0805	E431 0805
0810	8,0	68	9	30	8	7,2	4	1,0	E430 0810	E431 0810
0815	8,0	68	9	30	8	7,2	4	1,5	E430 0815	E431 0815
1005	10,0	80	11	38	10	9,0	4	0,5	E430 1005	E431 1005
1010	10,0	80	11	38	10	9,0	4	1,0	E430 1010	E431 1010
1015	10,0	80	11	38	10	9,0	4	1,5	E430 1015	E431 1015
1020	10,0	80	11	38	10	9,0	4	2,0	E430 1020	E431 1020
1205	12,0	93	13	46	12	11,0	4	0,5	E430 1205	E431 1205
1210	12,0	93	13	46	12	11,0	4	1,0	E430 1210	E431 1210
1215	12,0	93	13	46	12	11,0	4	1,5	E430 1215	E431 1215
1220	12,0	93	13	46	12	11,0	4	2,0	E430 1220	E431 1220
1610	16,0	108	17	58	16	15,0	4	1,0	E430 1610	E431 1610
1620	16,0	108	17	58	16	15,0	4	2,0	E430 1620	E431 1620
1630	16,0	108	17	58	16	15,0	4	3,0	E430 1630	E431 1630
1640	16,0	108	17	58	16	15,0	4	4,0	E430 1640	E431 1640

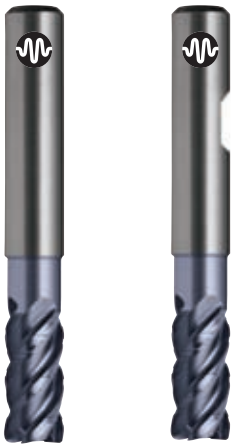
HARMONY DIN6527L, 4 Flute, R45-STF

Sutton Tools

- VHM-ULTRA grade of carbide for high performance
- For finishing & semi-roughing applications
- Suitable for materials up to 1400 N/mm²
- Unequal flute design with Special Tooth Form (STF), produces excellent surface finish
- Eliminates the use of finishing endmills in many cases
- AlCrN for longer tool life







Catalogue Code: E500 | Size Ref.: 0300 → Item #

Catalogue Code	E545	E546
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R45 (Uneq. Flute)	R45 (Uneq. Flute)
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0400	4,0	57	11	19	6	3,7	4	E545 0400	E546 0400
0500	5,0	57	13	20	6	4,6	4	E545 0500	E546 0500
0600	6,0	57	13	21	6	5,5	4	E545 0600	E546 0600
0800	8,0	63	19	27	8	7,5	4	E545 0800	E546 0800
1000	10,0	72	22	32	10	9,5	4	E545 1000	E546 1000
1200	12,0	83	26	38	12	11,2	4	E545 1200	E546 1200
1600	16,0	92	32	44	16	15,0	4	E545 1600	E546 1600
2000	20,0	104	38	54	20	19,0	4	E545 2000	E546 2000

Case Study R45 STF Harmony Endmills

Multi-tasking is here...

finishing, slotting & roughing with the one tool!

The R45-STF (Special Tooth Form) is a semi-roughing tool, which eliminates the use of finishing endmills in many cases due to its unique chip-breaker design that produces an excellent work piece finish, yet enables higher speeds and feeds, as it produces short chips, even in longer chipping materials.
The high performance - four flute geometry with unequally indexed cutting edges (fig.1 a<b) provides for superior tool stability and lower cutting forces, when combining AlCrN coating effectively.
This results in longer tool life as the build up of harmonics is minimized, hence, the cutting edges remain sharper longer.
Another feature of the geometry, is the 45° chamfer at the outer corners of the cutting edges, which offers increased strength, as often, this area can wear with heavier roughing cuts.
The R45-STF is the complete universal endmill designed for materials from aluminiums and general steels, to a wide range of latest generation materials like (High) Alloyed steels, Stainless & Titanium.

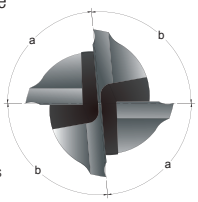
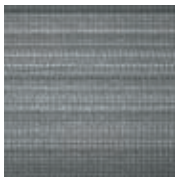
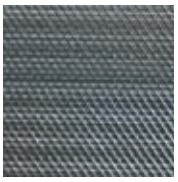


fig. 1
Unequally Indexed Cutting edges

Case Study - Surface Finish Comparison

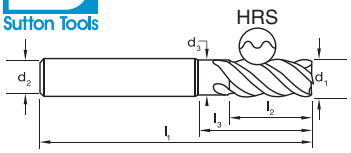
A recent study was conducted comparing the surface finish of the workpiece when taking a semi-roughing side cut, between a standard Harmony, HRS and STF endmills. The images clearly show the benefits of both heavy cut and smooth surface finish when using the R45 STF Harmony Endmill ▸

Tool	Conventional Endmill	Roughing Endmill	R45-STF
Machine	Haas VF2-SS Vertical Machining Centre		
Holder	Hydraulic Chuck		
Size	10mm		
Material:	AISI1045 / C45 / 1.0503		
V_c:	300 m/min	200 m/min	200 m/min
n:	9540 RPM	6360 RPM	6360 RPM
f_z:	0.063 mm/tooth	0.058 mm/tooth	0.058 mm/tooth
V_f:	2385 mm/min	1475 mm/min	1475 mm/min
z:	4 flutes	4 flutes	4 flutes
ae:	1 mm	5 mm	**5 mm**
ap:	15 mm	15 mm	15 mm
Workpiece Surface Finish Images			
Material Chips			

HARMONY DIN6527L, 3-6 Flute, R45-HRS

- VHM-ULTRA grade of carbide for high performance
- For roughing applications
- AlCrN for longer tool life
- HRS geometry allows for heavy cuts in short & long chipping materials
- Suitable for materials up to 1600 N/mm²

Sutton Tools



DIN 6527L | HRS | 45° | MICRO

Catalogue Code | Size Ref.

E500 0300

Item #

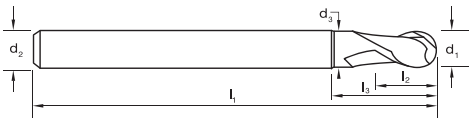
Catalogue Code	E549	E550
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R45 HRS	R45 HRS
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

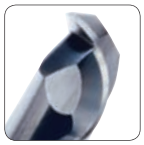
Size Ref.	d_1 (h10)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0400	4,0	57	11	19	6	3,7	3	E549 0400	E550 0400
0500	5,0	57	13	20	6	4,6	4	E549 0500	E550 0500
0600	6,0	57	16	21	6	5,5	4	E549 0600	E550 0600
0800	8,0	63	19	27	8	7,5	4	E549 0800	E550 0800
1000	10,0	72	22	32	10	9,5	4	E549 1000	E550 1000
1200	12,0	83	26	38	12	11,2	4	E549 1200	E550 1200
1600	16,0	92	32	44	16	15,0	5	E549 1600	E550 1600
2000	20,0	104	38	54	20	19,0	6	E549 2000	E550 2000

HARMONY Long Reach, Ballnose 2 Flute, R30

- VHM-ULTRA grade of carbide for high performance
- For profile & contour milling in long reach applications
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life

Sutton Tools





Catalogue Code Size Ref.

E500 0300

Item #

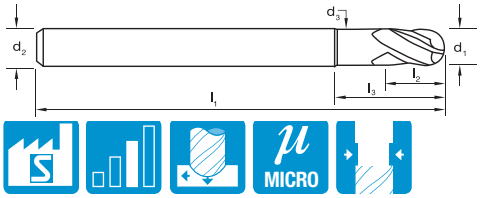
Catalogue Code	E440	E441
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R30	R30
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1(e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0200	2,0	62	3	7,0	6	1,9	2	E440 0200	E441 0200
0300	3,0	62	4	9,5	6	2,8	2	E440 0300	E441 0300
0400	4,0	62	5	12,0	6	4,8	2	E440 0400	E441 0400
0500	5,0	80	6	14,5	6	4,8	2	E440 0500	E441 0500
0600	6,0	80	7	17,0	6	5,7	2	E440 0600	E441 0600
0800	8,0	90	9	22,0	8	7,6	2	E440 0800	E441 0800
1000	10,0	100	11	27,0	10	9,5	2	E440 1000	E441 1000
1200	12,0	120	13	32,0	12	11,5	2	E440 1200	E441 1200
1400	14,0	120	15	37,0	14	13,5	2	E440 1400	E441 1400
1600	16,0	140	17	42,0	16	15,5	2	E440 1600	E441 1600
1800	18,0	140	19	47,0	18	17,5	2	E440 1800	E441 1800
2000	20,0	160	21	52,0	20	19,5	2	E440 2000	E441 2000

HARMONY Long Reach, Ballnose 4 Flute, R30

- VHM-ULTRA grade of carbide for high performance
- For profile & contour milling in long reach applications
- Suitable for materials up to 1600 N/mm²
- AlCrN for longer tool life

Sutton Tools



Catalogue Code Size Ref.

E500 0300

Item #

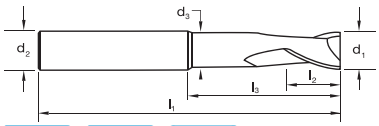
Catalogue Code	E442	E443
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI
Geometry	R30	R30
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0200	2,0	62	3	7,0	6	1,9	4	E442 0200	E443 0200
0300	3,0	62	4	9,5	6	2,8	4	E442 0300	E443 0300
0400	4,0	62	5	12,0	6	4,8	4	E442 0400	E443 0400
0500	5,0	80	6	14,5	6	4,8	4	E442 0500	E443 0500
0600	6,0	80	7	17,0	6	5,7	4	E442 0600	E443 0600
0800	8,0	90	9	22,0	8	7,6	4	E442 0800	E443 0800
1000	10,0	100	11	27,0	10	9,5	4	E442 1000	E443 1000
1200	12,0	120	13	32,0	12	11,5	4	E442 1200	E443 1200
1400	14,0	120	15	37,0	14	13,5	4	E442 1400	E443 1400
1600	16,0	140	17	42,0	16	15,5	4	E442 1600	E443 1600
1800	18,0	140	19	47,0	18	17,5	4	E442 1800	E443 1800
2000	20,0	160	21	52,0	20	19,5	4	E442 2000	E443 2000

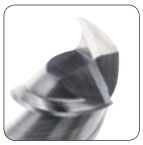
HARMONY DIN6527L, 2 Flute, R40-*AlCarb*

- For precision milling of slots & cavities
- Optimised geometry for aluminiums & non-ferrous materials
- High speed & high feed rates can be achieved
- Highly efficient chip disposal

Sutton Tools



DIN 6527L | 45°



Catalogue Code Size Ref.

E500 0300

Item #

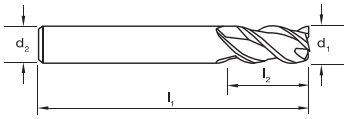
Catalogue Code	E310
Discount Group	B0208
Material	VHM
Surface Finish	Brt
Colour Ring & Application	Al
Geometry	R40
Shank Form (DIN 6535)	HA
Shank Tolerance	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	z	Item #
0200	2,0	57	7	10	6	2	E310 0200
0300	3,0	57	8	10	6	2	E310 0300
0400	4,0	57	11	10	6	2	E310 0400
0500	5,0	57	13	8	6	2	E310 0500
0600	6,0	57	13		6	2	E310 0600
0800	8,0	63	19		8	2	E310 0800
1000	10,0	72	22		10	2	E310 1000
1200	12,0	83	26		12	2	E310 1200
1600	16,0	92	32		16	2	E310 1600
2000	20,0	104	38		20	2	E310 2000

HARMONY DIN 6527L, 3 Flute, R45/46/44-Al

- VHM-ULTRA grade of carbide for high performance
- 45/46/44° variable flute helix for chatter free milling
- Optimised geometry for soft materials
- CrN for copper and non-ferrous materials

Sutton Tools



DIN 6527L | MICRO

Catalogue Code: E500 | Size Ref.: 0300 → Item #

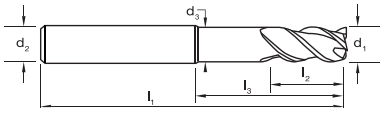
Catalogue Code	E400	E401
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	CrN	CrN
Colour Ring & Application	Al	Al
Geometry	R45/46/44	R45/46/44
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

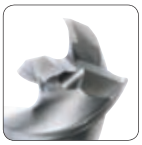
Size Ref.	d_1 (e8)	l_1	l_2	d_2	z	rad	Item #	Item #
1000	10,0	72	24	10	3	0,3	E400 1000	E401 1000
1200	12,0	83	28	12	3	0,4	E400 1200	E401 1200
1400	14,0	83	30	14	3	0,4	E400 1400	E401 1400
1600	16,0	92	35	16	3	0,5	E400 1600	E401 1600
1800	18,0	92	38	18	3	0,5	E400 1800	E401 1800
2000	20,0	104	42	20	3	0,6	E400 2000	E401 2000
2500	25,0	120	50	25	3	0,6	E400 2500	E401 2500

HARMONY Long Reach, 3 Flute, R45/46/44-Al

- VHM-ULTRA grade of carbide for high performance
- 45/46/44º variable flute helix for chatter free milling
- Optimised geometry for soft materials
- CrN for copper and non-ferrous materials

Sutton Tools





Catalogue Code Size Ref.

E500 0300

Item #

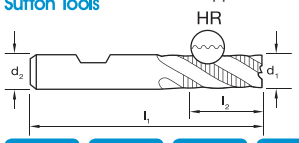
Catalogue Code	E402	E403
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	CrN	CrN
Colour Ring & Application	Al	Al
Geometry	R45/46/44	R45/46/44
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	rad	Item #	Item #
1000	10,0	80	12	38	10	9,0	3	0,3	E402 1000	E403 1000
1200	12,0	93	14	46	12	11,0	3	0,4	E402 1200	E403 1200
1400	14,0	93	16	46	14	13,0	3	0,4	E402 1400	E403 1400
1600	16,0	108	18	58	16	15,0	3	0,5	E402 1600	E403 1600
1800	18,0	108	20	58	18	17,0	3	0,5	E402 1800	E403 1800
2000	20,0	126	22	74	20	19,0	3	0,6	E402 2000	E403 2000
2500	25,0	150	27	92	25	24,0	3	0,6	E402 2500	E403 2500

HARMONY DIN 6527L, 3 Flute, R35/36/36-Al HR

Sutton Tools

- VHM-ULTRA grade of carbide for high performance
- For roughing applications
- 35/36/36º variable flute helix for chatter free milling
- Optimised geometry for soft materials
- CrN for copper and non-ferrous materials



DIN 6527L | HR | 45º | MICRO

Catalogue Code: E500 | Size Ref.: 0300

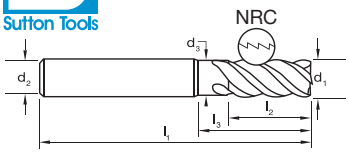
Item #

Catalogue Code	E404	E405
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	CrN	CrN
Colour Ring & Application	Al	Al
Geometry	R35/36/36 HR	R35/36/36 HR
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (h10)	l_1	l_2	d_2	z	Item #	Item #
1000	10,0	72	23	10	3	E404 1000	E405 1000
1200	12,0	83	28	12	3	E404 1200	E405 1200
1400	14,0	83	28	14	3	E404 1400	E405 1400
1600	16,0	92	34	16	3	E404 1600	E405 1600
1800	18,0	92	34	18	3	E404 1800	E405 1800
2000	20,0	104	42	20	3	E404 2000	E405 2000
2500	25,0	120	52	25	3	E404 2500	E405 2500

HARMONY DIN 6527L, 3-4 Flute R25-Al NRC

- VHM-ULTRA grade of carbide for high performance
- For roughing applications
- Optimised geometry for soft materials
- CrN for copper and non-ferrous materials



DIN 6527L | HR | 45º | MICRO

Catalogue Code: E500 | Size Ref.: 0300

Item #

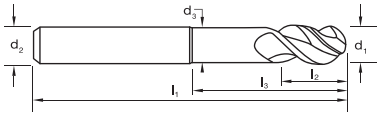
Catalogue Code	E406	E407
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	CrN	CrN
Colour Ring & Application	Al	Al
Geometry	R25 NRC	R25 NRC
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (h10)	l_1	l_2	l_3	d_2	z	Item #	Item #
0400	4,0	57	11	16	6	3	E406 0400	E407 0400
0500	5,0	57	13	18	6	3	E406 0500	E407 0500
0600	6,0	57	13	19	6	3	E406 0600	E407 0600
0800	8,0	63	19	25	8	4	E406 0800	E407 0800
1000	10,0	72	22	30	10	4	E406 1000	E407 1000
1200	12,0	83	26	36	12	4	E406 1200	E407 1200
1600	16,0	92	32	42	16	4	E406 1600	E407 1600
2000	20,0	104	38	52	20	4	E406 2000	E407 2000

HARMONY Long Reach, Ballnose, 3 Flute, R45/46/44-Al

Sutton Tools

- VHM-ULTRA grade of carbide for high performance
- 45/46/44° variable flute helix for chatter free milling
- Optimised geometry for soft materials
- CrN for copper and non-ferrous materials



Catalogue Code Size Ref.

E500 0300

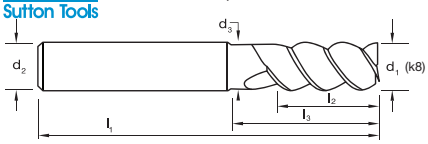
Item #

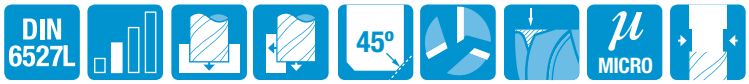
	E408	E409
Catalogue Code	E408	E409
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	CrN	CrN
Colour Ring & Application	Al	Al
Geometry	R45/46/44	R45/46/44
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

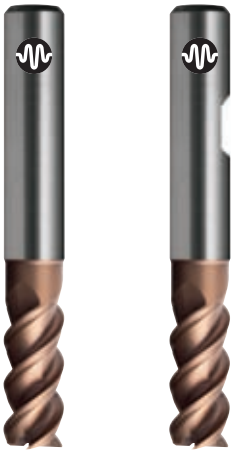
Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	z	Item #	Item #
0600	6,0	62	9	24	6	3	E408 0600	E409 0600
0800	8,0	68	12	30	8	3	E408 0800	E409 0800
1000	10,0	80	15	38	10	3	E408 1000	E409 1000
1200	12,0	93	18	46	12	3	E408 1200	E409 1200
1400	14,0	93	21	46	14	3	E408 1400	E409 1400
1600	16,0	108	24	58	16	3	E408 1600	E409 1600
1800	18,0	108	27	58	18	3	E408 1800	E409 1800
2000	20,0	126	30	74	20	3	E408 2000	E409 2000
2500	25,0	150	38	92	25	3	E408 2500	E409 2500

HARMONY DIN6527L, 3 Flute, R55/54/56-VA

- VHM-ULTRA grade of carbide for high performance
- Optimised geometry for stainless steels
- 55/54/56° variable flute helix for chatter free milling
- Universal use for slotting and finishing with the one tool
- Helica for superior wear resistance in stainless steel







Catalogue Code Size Ref.

E500 0300

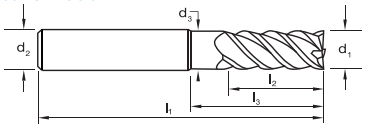
Item #

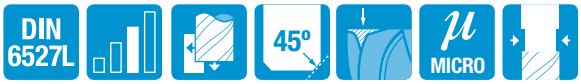
Catalogue Code	E410	E411
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	*HELICA*	*HELICA*
Colour Ring & Application	VA	VA
Geometry	R55/54/56	R55/54/56
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0300	3,0	57	8	14	6	2,8	3	E410 0300	E411 0300
0400	4,0	57	11	16	6	3,8	3	E410 0400	E411 0400
0500	5,0	57	13	18	6	4,8	3	E410 0500	E411 0500
0600	6,0	57	13	19	6	5,7	3	E410 0600	E411 0600
0800	8,0	63	19	25	8	7,6	3	E410 0800	E411 0800
1000	10,0	72	22	30	10	9,5	3	E410 1000	E411 1000
1200	12,0	83	26	36	12	11,5	3	E410 1200	E411 1200
1400	14,0	83	26	36	14	13,5	3	E410 1400	E411 1400
1600	16,0	92	32	42	16	15,5	3	E410 1600	E411 1600
1800	18,0	92	32	42	18	17,5	3	E410 1800	E411 1800
2000	20,0	104	38	52	20	19,5	3	E410 2000	E411 2000

HARMONY DIN6527L, 4 Flute, R55-VA

- VHM-ULTRA grade of carbide for high performance
- Optimised geometry for stainless steel
- For superior finishing applications
- Helica for superior wear resistance in stainless steel





Catalogue Code Size Ref.

E500 0300

Item #

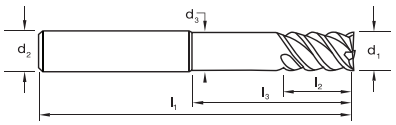
Catalogue Code	E412	E413
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	HELICA	HELICA
Colour Ring & Application	VA	VA
Geometry	R55	R55
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

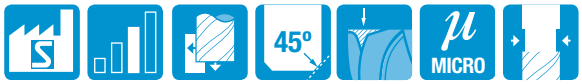
Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0600	6,0	57	13	19	6	5,7	4	E412 0600	E413 0600
0800	8,0	63	19	25	8	7,6	4	E412 0800	E413 0800
1000	10,0	72	22	30	10	9,5	4	E412 1000	E413 1000
1200	12,0	83	26	36	12	11,5	4	E412 1200	E413 1200
1400	14,0	83	26	36	14	13,5	4	E412 1400	E413 1400
1600	16,0	92	32	42	16	15,5	4	E412 1600	E413 1600

HARMONY Long Reach, 4 Flute, R55-VA

- VHM-ULTRA grade of carbide for high performance
- Optimised geometry for stainless steels
- For roughing and finishing applications
- Helica for superior wear resistance in stainless steel

Sutton Tools





Catalogue Code Size Ref.

E500 0300

Item #

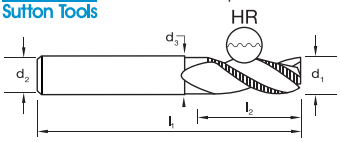
Catalogue Code	E414	E415
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	HELICA	HELICA
Colour Ring & Application	VA	VA
Geometry	R55	R55
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0600	6,0	62	7	24	6	5,0	4	E414 0600	E415 0600
0800	8,0	68	9	30	8	7,0	4	E414 0800	E415 0800
1000	10,0	80	24	38	16	9,0	4	E414 1000	E415 1000
1200	12,0	93	13	46	12	11,0	4	E414 1200	E415 1200
1400	14,0	93	13	46	14	13,0	4	E414 1400	E415 1400
1600	16,0	108	17	58	16	15,0	4	E414 1600	E415 1600

HARMONY DIN6527L, 3 Flute, R35/36/36-VA HR

- VHM-ULTRA grade of carbide for high performance
- For roughing applications
- 35/36/36º variable flute helix for chatter free milling
- Optimised geometry for soft stainless steels
- Helica for superior wear resistance in stainless steel

Sutton Tools



DIN 6527L | HR | 45º | MICRO

Catalogue Code: E500 | Size Ref.: 0300 | Item #

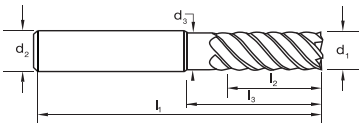
	E416	E417
Catalogue Code	E416	E417
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	HELICA	HELICA
Colour Ring & Application	VA	VA
Geometry	R35/36/36 HR	R35/36/36 HR
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (h10)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0600	6	57	13	19	6	5,7	3	E416 0600	E417 0600
0800	8	63	19	25	8	7,6	3	E416 0800	E417 0800
1000	10	72	22	30	10	9,5	3	E416 1000	E417 1000
1200	12	83	26	36	12	11,5	3	E416 1200	E417 1200
1600	16	92	32	42	16	15,5	3	E416 1600	E417 1600

HARMONY DIN 6527L, 4 Flute, R55-VH

- VHM-ULTRA grade of carbide for high performance
- For super fine finishing applications
- Suitable for hard, short chipping materials up to 67HRc
- AlCrN for longer tool life

Sutton Tools



DIN 6527L | 45° | MICRO

Catalogue Code: E500 | Size Ref.: 0300

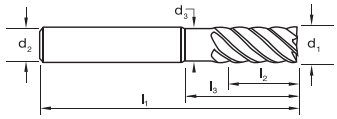
Item #

Catalogue Code	E428	E429
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	VH	VH
Geometry	R55	R55
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0400	4,0	57	11	16	6	3,7	4	E428 0400	E429 0400
0500	5,0	57	13	18	6	4,7	4	E428 0500	E429 0500
0600	6,0	57	13	19	6	5,7	4	E428 0600	E429 0600
0800	8,0	63	19	25	8	7,6	4	E428 0800	E429 0800
1000	10,0	72	22	30	10	9,5	4	E428 1000	E429 1000
1200	12,0	83	26	36	12	11,5	4	E428 1200	E429 1200
1600	16,0	92	32	42	16	15,5	4	E428 1600	E429 1600

HARMONY DIN6527L, 6-8 Flute, R45-VH

- VHM-ULTRA grade of carbide for high performance
- For super fine finishing applications
- Suitable for hard, short chipping materials up to 65 HR_c
- Multi-flute & heavy core design enable high feed rates
- AlCrN for longer tool life



DIN 6527L | MICRO

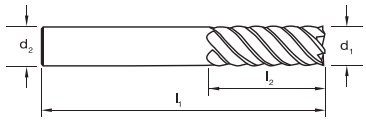
Catalogue Code: E500 | Size Ref.: 0300 → Item #

Catalogue Code	E543	E544
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	VH	VH
Geometry	R45	R45
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (e8)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0600	6,0	57	13	21	6	5,5	6	E543 0600	E544 0600
0800	8,0	63	19	27	8	7,5	6	E543 0800	E544 0800
1000	10,0	72	22	32	10	9,5	6	E543 1000	E544 1000
1200	12,0	83	26	38	12	11,2	6	E543 1200	E544 1200
1600	16,0	92	32	44	16	15,0	8	E543 1600	E544 1600
2000	20,0	104	38	54	20	19,0	8	E543 2000	E544 2000

HARMONY DIN 6527L, 6-8 Flute, R50/35-VH

- VHM-ULTRA grade of carbide for high performance
- For super fine finishing applications
- 50/35º variable flute helix for chatter free milling
- Suitable for hard, short chipping materials up to 67HRc
- AlCrN for longer tool life



DIN 6527L | 45º | MICRO

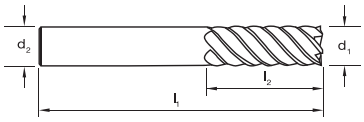
Catalogue Code: E500 | Size Ref.: 0300 → Item #

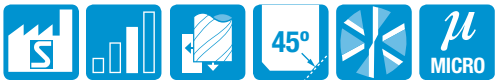
Catalogue Code	E432	E433
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	VH	VH
Geometry	R50/35	R50/35
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	d_2	z	Item #	Item #
0600	6,0	57	13	6	6	E432 0600	E433 0600
0800	8,0	63	19	8	6	E432 0800	E433 0800
1000	10,0	72	22	10	6	E432 1000	E433 1000
1200	12,0	83	26	12	6	E432 1200	E433 1200
1400	14,0	83	26	14	6	E432 1400	E433 1400
1600	16,0	92	32	16	6	E432 1600	E433 1600
1800	18,0	92	32	18	8	E432 1800	E433 1800
2000	20,0	104	38	20	8	E432 2000	E433 2000
2500	25,0	120	45	25	8	E432 2500	E433 2500

HARMONY Extra Long, 6-8 Flute, R50/35-VH

- VHM-ULTRA grade of carbide for high performance
- For super fine finishing applications
- 50/35º variable flute helix for chatter free milling
- Suitable for hard, short chipping materials up to 67HRc
- AlCrN for longer tool life





Catalogue Code Size Ref.

E500 0300

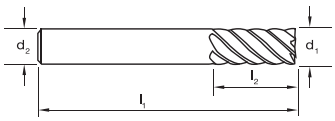
Item #

Catalogue Code	E434	E435
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	VH	VH
Geometry	R50/35	R50/35
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	d_2	z	Item #	Item #
0600	6,0	62	18	6	6	E434 0600	E435 0600
0800	8,0	68	24	8	6	E434 0800	E435 0800
1000	10,0	80	30	10	6	E434 1000	E435 1000
1200	12,0	93	36	12	6	E434 1200	E435 1200
1600	16,0	108	48	16	6	E434 1600	E435 1600
2000	20,0	126	60	20	8	E434 2000	E435 2000
2500	25,0	150	85	25	8	E434 2500	E435 2500

HARMONY Long Reach, 6-8 Flute, R50/35-VH, Corner Rad

- VHM-ULTRA grade of carbide for high performance
- For super fine finishing applications
- 50/35º variable flute helix for chatter free milling
- Suitable for hard, short chipping materials up to 67HRc
- AlCrN for longer tool life



Catalogue Code Size Ref.

E500 0300

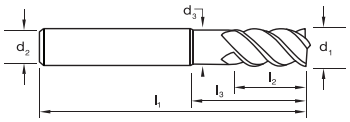
Item #

Catalogue Code	E436	E437
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	VH	VH
Geometry	R50/35	R50/35
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d_1 (e8)	l_1	l_2	d_2	z	rad	Item #	Item #
0605	6,0	62	13	6	6	0,5	E436 0605	E437 0605
0610	6,0	62	13	6	6	1,0	E436 0610	E437 0610
0805	8,0	68	19	8	6	0,5	E436 0805	E437 0805
0810	8,0	68	19	8	6	1,0	E436 0810	E437 0810
1005	10,0	80	22	10	6	0,5	E436 1005	E437 1005
1010	10,0	80	22	10	6	1,0	E436 1010	E437 1010
1015	10,0	80	22	10	6	1,5	E436 1015	E437 1015
1020	10,0	80	22	10	6	2,0	E436 1020	E437 1020
1205	12,0	93	26	12	6	0,5	E436 1205	E437 1205
1210	12,0	93	26	12	6	1,0	E436 1210	E437 1210
1215	12,0	93	26	12	6	1,5	E436 1215	E437 1215
1220	12,0	93	26	12	6	2,0	E436 1220	E437 1220
1605	16,0	108	32	16	6	0,5	E436 1605	E437 1605
1610	16,0	108	32	16	6	1,0	E436 1610	E437 1610
1615	16,0	108	32	16	6	1,5	E436 1615	E437 1615
1620	16,0	108	32	16	6	2,0	E436 1620	E437 1620
2005	20,0	126	38	20	8	0,5	E436 2005	E437 2005
2010	20,0	126	38	20	8	1,0	E436 2010	E437 2010
2015	20,0	126	38	20	8	1,5	E436 2015	E437 2015
2020	20,0	126	38	20	8	2,0	E436 2020	E437 2020

HARMONY DIN6527L, 4 Flute, R50-H DUO

- VHM-ULTRA grade of carbide for high performance
- Dual stepped core for optimal strength
- Ideal design for pocket milling
- Suitable for materials up to 48HRc
- AlCrN for longer tool life



Catalogue Code Size Ref.

E500 0300

Item #

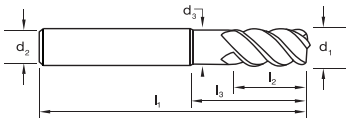
Catalogue Code	E562	E563
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	H	H
Geometry	R50	R50
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (h10)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0600	6,0	57	13	21	6	5,5	4	E562 0600	E563 0600
0800	8,0	63	19	27	8	7,5	4	E562 0800	E563 0800
1000	10,0	72	22	32	10	9,5	4	E562 1000	E563 1000
1200	12,0	83	26	38	12	11,2	4	E562 1200	E563 1200
1400	14,0	83	26	38	14	13,0	4	E562 1400	E563 1400
1600	16,0	92	32	44	16	15,0	4	E562 1600	E563 1600
2000	20,0	104	38	54	20	19,0	4	E562 2000	E563 2000

HARMONY DIN6527L, 4 Flute, R50-H DUO Corner Rad

Sutton Tools

- VHM-ULTRA grade of carbide for high performance
- Dual stepped core for optimal strength
- Ideal design for pocket milling
- Suitable for materials up to 48HRc
- AlCrN for longer tool life



DIN 6527L | r | MICRO

Catalogue Code: E500 | Size Ref.: 0300

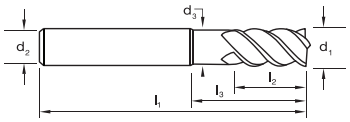
Item #

Catalogue Code	E564	E565
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN
Colour Ring & Application	H	H
Geometry	R50	R50
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (h10)	l_1	l_2	l_3	d_2	d_3	z	Rad	Item #	Item #
0600	6,0	57	13	21	6	5,5	4	1.0	E564 0600	E565 0600
0800	8,0	63	19	27	8	7,5	4	2.0	E564 0800	E565 0800
1000	10,0	72	22	32	10	9,5	4	2.0	E564 1000	E565 1000
1200	12,0	83	26	38	12	11,2	4	3.0	E564 1200	E565 1200
1400	14,0	83	26	38	14	13,0	4	3.0	E564 1400	E565 1400
1600	16,0	92	32	44	16	15,0	4	4.0	E564 1600	E565 1600
2000	20,0	104	38	54	20	19,0	4	4.0	E564 2000	E565 2000

HARMONY DIN6527L, 4 Flute, R50-VH DUO

- VHM-ULTRA grade of carbide for high performance
- Dual stepped core for optimal strength
- Ideal design for hard machining
- Suitable for materials up to 63HRc
- Aldura for longer tool life



DIN 6527L | 45º | MICRO

Catalogue Code: E500 | Size Ref.: 0300 → Item #

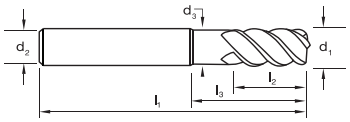
	E566	E567
Catalogue Code	E566	E567
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	*Aldura*	*Aldura*
Colour Ring & Application	VH	VH
Geometry	R50	R50
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (h10)	l_1	l_2	l_3	d_2	d_3	z	Item #	Item #
0600	6,0	57	13	21	6	5,5	4	E566 0600	E567 0600
0800	8,0	63	19	27	8	7,5	4	E566 0800	E567 0800
1000	10,0	72	22	32	10	9,5	4	E566 1000	E567 1000
1200	12,0	83	26	38	12	11,2	4	E566 1200	E567 1200
1400	14,0	83	26	38	14	13,0	4	E566 1400	E567 1400
1600	16,0	92	32	44	16	15,0	4	E566 1600	E567 1600
2000	20,0	104	38	54	20	19,0	4	E566 2000	E567 2000

HARMONY DIN6527L, 4 Flute, R50-VH DUO Corner Rad

Sutton Tools

- VHM-ULTRA grade of carbide for high performance
- Dual stepped core for optimal strength
- Ideal design for hard machining
- Suitable for materials up to 63HRc
- Aldura for longer tool life



DIN 6527L | MICRO

Catalogue Code: E500 | Size Ref.: 0300

Item #

Catalogue Code	E568	E569
Discount Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	*Aldura*	*Aldura*
Colour Ring & Application	VH	VH
Geometry	R50	R50
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

Size Ref.	d_1 (h10)	l_1	l_2	l_3	d_2	d_3	z	Rad	Item #	Item #
0600	6,0	57	13	21	6	5,5	4	1.0	E568 0600	E569 0600
0800	8,0	63	19	27	8	7,5	4	2.0	E568 0800	E569 0800
1000	10,0	72	22	32	10	9,5	4	2.0	E568 1000	E569 1000
1200	12,0	83	26	38	12	11,2	4	3.0	E568 1200	E569 1200
1400	14,0	83	26	38	14	13,0	4	3.0	E568 1400	E569 1400
1600	16,0	92	32	44	16	15,0	4	4.0	E568 1600	E569 1600
2000	20,0	104	38	54	20	19,0	4	4.0	E568 2000	E569 2000

Sutton Tools

	SLOTTING					
Catalogue Code	**E418**	**E420**	**E422**	**E424**	**E410**	**E416**
ap	0.25	0.25	0.2	0.25	1.5	1
ae	1	1	1	1	1	1
Material	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN	AlCrN	AlCrN	HELICA	HELICA
Colour Ring & Application	UNI	UNI	UNI	UNI	VA	VA
Geometry	R30	R30	R38/37/39	R38/37/39	R55/54/56	R35/36/36 HR
						

Materials	HB	N/mm²	% Elong.	Material eg.	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #
1.0 Steels																
1.1 Mild steels, magnetic soft steel	<200	>200 <400	10	RFe100	180-220	8	180-220	8	180-220	8	180-220	10	-	-	-	-
1.2 Free cutting, structural, unalloyed	<200	>350 <700	30	C10, C15, ST37, ST52	160-200	8	160-200	8	160-200	8	160-200	10	-	-	-	-
1.3 Plain carbon, low alloyed	<300	>350 <850	20	C45, C92D, D95-S	140-180	8	140-180	8	140-180	8	140-180	10	-	-	-	-
1.4 Alloy steels harden. / tempered	<250	>500 <850	30	41CrMo4, 36CrNiMo4, X155CrVMo12-1, 90MnV8	120-160	8	120-160	8	120-160	8	120-160	10	-	-	-	-
1.5 Alloy steels harden. / tempered	<350	>850 <1200	30		100-140	8	100-140	8	100-140	8	100-140	10	-	-	-	-
1.6 Hardened, heat treated, high tensile alloy	<420	>1500	12		80-120	8	80-120	8	80-120	8	80-120	10	-	-	-	-
1.7 Hardened Steel 45-50 Rc	<550		<12		-	-	-	-	-	-	-	-	-	-	-	-
1.8 Hardened Steel 50-62 Rc	<700		<12	HS2-10-1-8	-	-	-	-	-	-	-	-	-	-	-	-
2.0 Stainless Steels																
2.1 Free machining	<250	<850	25	X8CrNiS18-9	-	-	-	-	-	-	-	-	120-160	10	120-160	8
2.2 Austenitic	<250	<850	20	X5CrNi18-10	-	-	-	-	-	-	-	-	100-140	10	100-140	8
2.3 Ferritic + martensitic	<250	<850	20	X20Cr13	-	-	-	-	-	-	-	-	60-100	10	60-100	8
3.0 Cast Irons																
3.1 Lamellar graphite (Grey soft)	<150	<500	10	GG10, GG40	-	-	-	-	-	-	-	-	-	-	-	-
3.2 Lamellar graphite (Grey hard)	<300	<1000	10	GGG40, GGG80	-	-	-	-	-	-	-	-	-	-	-	-
3.3 Nodular (spheroidal) graphite & malleable	<200	<700	10		-	-	-	-	-	-	-	-	-	-	-	-
4.0 Titaniums																
4.1 Pure Titanium	<250	<850	20	Ti99.7, Ti99.8	60-100	8	60-100	8	60-100	8	60-100	10	60-100	10	60-100	8
4.2 Titanium alloys	>250	>850	20	TiCu2, TiAl6V4	40-80	8	40-80	8	40-80	8	40-80	10	40-80	10	40-80	8
5.0 Nickels																
5.1 Nickel alloys	<250	<850	25	Ni38, Ni54, NiCr16FeTi	-	-	-	-	-	-	-	-	20-50	9	20-50	7
5.2 Nickel alloys	>250	>850	25		-	-	-	-	-	-	-	-	15-40	9	15-40	7
6.0 Coppers																
6.1 Pure Copper (electrolytic copper)	<120	<400	12	SF-Cu	-	-	-	-	160-250	8	-	-	-	-	-	-
6.2 Short chip Brass, Phosphor Bronze, gun metal	<200	<700	12	G-CuSn12Ni	-	-	-	-	150-220	8	-	-	-	-	-	-
6.3 Long chip Brass, Bronze	<200	<700	12	G-CuPb20Sn	-	-	-	-	100-180	8	-	-	-	-	-	-
7.0 Aluminiums																
7.1 Aluminium unalloyed	<100	<350	15	Al99.5	-	-	-	-	-	-	-	-	-	-	-	-
7.2 Magnesium unalloyed	<150	<350	15	Al99.85Mg0.5	-	-	-	-	-	-	-	-	-	-	-	-
7.3 Al Alloyed Si < 1.5 %	<120	<500	15	AlMg1.5	-	-	-	-	-	-	-	-	-	-	-	-
7.4 Al Alloyed 1.5 % < Si < 10%	<120	<400	10	AlSi10Mg	-	-	-	-	-	-	-	-	-	-	-	-
7.5 Al Alloyed > 10% Si	-	<400	N	AlSi17Cu4	-	-	-	-	-	-	-	-	-	-	-	-
7.6 Magnesium alloys	-	<400	N	MgAl3Zn	-	-	-	-	-	-	-	-	-	-	-	-
8.0 Plastics																
8.1 Plastics, Thermoplastics, Polyethylene	<340	<50	N	ABS, PV C, Polycarbonate	-	-	-	-	-	-	-	-	-	-	-	-

Ø	Feed Table (f) (mm/tooth) Feed No.															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2.0	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
3.0	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
4.0	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	0.029	0.032	0.036
5.0	0.005	0.006	0.008	0.009	0.011	0.013	0.015	0.017	0.020	0.023	0.025	0.029	0.032	0.036	0.040	0.044
6.0	0.006	0.008	0.009	0.011	0.013	0.016	0.018	0.021	0.024	0.027	0.030	0.034	0.038	0.042	0.047	0.052
8.0	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	0.061	0.067
10.0	0.013	0.015	0.018	0.021	0.024	0.028	0.031	0.035	0.040	0.045	0.050	0.055	0.062	0.068	0.075	0.083
12.0	0.016	0.019	0.022	0.026	0.029	0.033	0.038	0.043	0.048	0.053	0.059	0.066	0.073	0.081	0.090	0.099
16.0	0.020	0.024	0.028	0.033	0.038	0.043	0.049	0.055	0.062	0.070	0.078	0.087	0.096	0.107	0.118	0.130
20.0	0.022	0.027	0.032	0.038	0.044	0.051	0.059	0.067	0.075	0.085	0.095	0.106	0.118	0.132	0.146	0.161
25.0	0.025	0.031	0.038	0.045	0.053	0.062	0.071	0.081	0.092	0.104	0.117	0.131	0.146	0.163	0.181	0.200

Notes on Milling

1. Above values are guidelines for the size & type of cut nominated.

LEGEND

n = rev. per minute
vc = m/min
fz = mm/tooth
vf = mm/min
z = no. cutting edges
Q = metal removal rate (cm^3/min)

FORMULAS

$n = vc \times 1000 / Ø \times \pi$
$vc = Ø \times \pi \times n / 1000$
$fz = vf / z \times n$
$vf = fz \times z \times n$
$Q = ae \times ap \times vf / 1000$

SLOTTING

E310	E400	E402	E404	E562	E564	E566	E568
0.2	1.5	0.5	1.5	1	1	0.5	0.5
1	1	1	1	1	1	1	1
VHM	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA
Brt	CrN	CrN	CrN	AlCrN	AlCrN	Aldura	Aldura
Al	Al	Al	Al	H	H	VH	VH
R40	R45/46/44	R45/46/44	R35/36/36HR	R50	R50	R50	R50
							

Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	150-200	8	150-200	8	-	-	-	-
-	-	-	-	-	-	-	-	150-200	8	150-200	8	-	-	-	-
-	-	-	-	-	-	-	-	120-160	8	120-160	8	-	-	-	-
-	-	-	-	-	-	-	-	80-120	8	80-120	8	-	-	-	-
-	-	-	-	-	-	-	-	60-90	8	60-90	8	-	-	-	-
-	-	-	-	-	-	-	-	40-60	8	40-60	8	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	20-30	2	20-30	2
-	-	-	-	-	-	-	-	70-80	8	70-80	8	-	-	-	-
-	-	-	-	-	-	-	-	50-60	8	50-60	8	-	-	-	-
-	-	-	-	-	-	-	-	40-50	8	40-50	8	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	50-60	7	50-60	7	-	-	-	-
-	-	-	-	-	-	-	-	40-50	7	40-50	7	-	-	-	-
-	-	-	-	-	-	-	-	30-40	6	30-40	6	-	-	-	-
-	-	-	-	-	-	-	-	20-25	6	20-25	6	-	-	-	-
160-320	9	250-300	9	250-300	9	250-300	9	-	-	-	-	-	-	-	-
160-280	9	200-250	9	200-250	9	200-250	9	-	-	-	-	-	-	-	-
120-240	9	150-200	9	150-200	9	150-200	9	-	-	-	-	-	-	-	-
160-300	9	300-600	9	300-600	9	350-700	9	-	-	-	-	-	-	-	-
160-300	9	250-500	9	250-500	9	300-600	9	-	-	-	-	-	-	-	-
160-300	9	250-500	9	250-500	9	250-500	9	-	-	-	-	-	-	-	-
150-220	9	200-400	9	200-400	9	200-400	9	-	-	-	-	-	-	-	-
150-220	9	100-250	9	100-250	9	100-250	9	-	-	-	-	-	-	-	-
150-220	9	250-350	9	250-350	9	250-350	9	-	-	-	-	-	-	-	-
120-240	9	200-400	9	200-400	9	200-400	9	-	-	-	-	-	-	-	-


Slotting


Finishing


Semi-finishing


Roughing


Profiling

Sutton Tools

	SHOULDER - HEAVY FINISH				
Catalogue Code	E418	E422	E424	E426	E430
ap	1	1	1	1	1
ae	0.3	0.3	0.25	0.3	0.25
Material	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN	AlCrN	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI	UNI	UNI	UNI
Geometry	R30	R38/37/39	R38/37/39	R45/44	R45/44
					

Materials	HB	N/mm²	% Elong.	Material eg.	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #
1.0 Steels														
1.1 Mild steels, magnetic soft steel	<200	>200 <400	10	RFe100	180-220	9	180-220	10	180-220	10	180-220	10	180-220	9
1.2 Free cutting, structural, unalloyed	<200	>350 <700	30	C10, C15, ST37, ST52	160-200	9	160-200	10	160-200	10	160-200	10	160-200	9
1.3 Plain carbon, low alloyed	<300	>350 <850	20	C45, C92D, D95-S	140-180	9	140-180	10	140-180	10	140-180	10	140-180	9
1.4 Alloy steels harden. / tempered	<250	>500 <850	30	41CrMo4, 36CrNiMo4, X155CrVMo12-1, 90MnV8	120-160	9	120-160	10	120-160	10	120-160	10	120-160	9
1.5 Alloy steels harden. / tempered	<350	>850 <1200	30		100-140	9	100-140	10	100-140	10	100-140	10	100-140	9
1.6 Hardened, heat treated, high tensile alloy	<420	>1500	12		80-120	9	80-120	10	80-120	10	80-120	10	80-120	9
1.7 Hardened Steel 45-50 Rc	<550		<12		-	-	-	-	-	-	-	-	-	-
1.8 Hardened Steel 50-62 Rc	<700		<12	HS2-10-1-8	-	-	-	-	-	-	-	-	-	-
2.0 Stainless Steels														
2.1 Free machining	<250	<850	25	X8CrNiS18-9	-	-	-	-	-	-	-	-	-	-
2.2 Austenitic	<250	<850	20	X5CrNi18-10	-	-	-	-	-	-	-	-	-	-
2.3 Ferritic + martensitic	<250	<850	20	X20Cr13	-	-	-	-	-	-	-	-	-	-
3.0 Cast Irons														
3.1 Lamellar graphite (Grey soft)	<150	<500	10	GG10, GG40	-	-	-	-	-	-	-	-	-	-
3.2 Lamellar graphite (Grey hard)	<300	<1000	10	GGG40, GGG80	-	-	-	-	-	-	-	-	-	-
3.3 Nodular (spheroidal) graphite & malleable	<200	<700	10		-	-	-	-	-	-	-	-	-	-
4.0 Titaniums														
4.1 Pure Titanium	<250	<850	20	Ti99.7, Ti99.8	-	-	60-100	10	60-100	10	60-100	10	60-100	9
4.2 Titanium alloys	>250	>850	20	TiCu2, TiAl6V4	-	-	40-80	10	40-80	10	40-80	10	40-80	9
5.0 Nickels														
5.1 Nickel alloys	<250	<850	25	Ni38, Ni54, NiCr16FeTi	-	-	-	-	-	-	-	-	-	-
5.2 Nickel alloys	>250	>850	25		-	-	-	-	-	-	-	-	-	-
6.0 Coppers														
6.1 Pure Copper (electrolytic copper)	<120	<400	12	SF-Cu	-	-	-	-	-	-	-	-	-	-
6.2 Short chip Brass, Phosphor Bronze, gun metal	<200	<700	12	G-CuSn12Ni	-	-	-	-	-	-	-	-	-	-
6.3 Long chip Brass, Bronze	<200	<700	12	G-CuPb20Sn	-	-	-	-	-	-	-	-	-	-
7.0 Aluminiums														
7.1 Aluminium unalloyed	<100	<350	15	Al99.5	-	-	-	-	-	-	-	-	-	-
7.2 Magnesium unalloyed	<150	<350	15	Al99.85Mg0.5	-	-	-	-	-	-	-	-	-	-
7.3 Al Alloyed Si < 1.5 %	<120	<500	15	AlMg1.5	-	-	-	-	-	-	-	-	-	-
7.4 Al Alloyed 1.5 % < Si < 10%	<120	<400	10	AlSi10Mg	-	-	-	-	-	-	-	-	-	-
7.5 Al Alloyed > 10% Si	-	<400	N	AlSi17Cu4	-	-	-	-	-	-	-	-	-	-
7.6 Magnesium alloys	-	<400	N	MgAl3Zn	-	-	-	-	-	-	-	-	-	-
8.0 Plastics														
8.1 Plastics, Thermoplastics, Polyethylene	<340	<50	N	ABS, PV C, Polycarbonate	-	-	-	-	-	-	-	-	-	-

Feed Table (f) (mm/tooth)																
Ø	Feed No.															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2.0	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
3.0	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
4.0	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	0.029	0.032	0.036
5.0	0.005	0.006	0.008	0.009	0.011	0.013	0.015	0.017	0.020	0.023	0.025	0.029	0.032	0.036	0.040	0.044
6.0	0.006	0.008	0.009	0.011	0.013	0.016	0.018	0.021	0.024	0.027	0.030	0.034	0.038	0.042	0.047	0.052
8.0	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	0.061	0.067
10.0	0.013	0.015	0.018	0.021	0.024	0.028	0.031	0.035	0.040	0.045	0.050	0.055	0.062	0.068	0.075	0.083
12.0	0.016	0.019	0.022	0.026	0.029	0.033	0.038	0.043	0.048	0.053	0.059	0.066	0.073	0.081	0.090	0.099
16.0	0.020	0.024	0.028	0.033	0.038	0.043	0.049	0.055	0.062	0.070	0.078	0.087	0.096	0.107	0.118	0.130
20.0	0.022	0.027	0.032	0.038	0.044	0.051	0.059	0.067	0.075	0.085	0.095	0.106	0.118	0.132	0.146	0.161
25.0	0.025	0.031	0.038	0.045	0.053	0.062	0.071	0.081	0.092	0.104	0.117	0.131	0.146	0.163	0.181	0.200

Notes on Milling

1. Above values are guidelines for the size & type of cut nominated.

LEGEND

n = rev. per minute
vc = m/min
fz = mm/tooth
vf = mm/min
z = no. cutting edges
Q = metal removal rate (cm^3/min)

FORMULAS

$n = vc \times 1000 / Ø \times \pi$
$vc = Ø \times \pi \times n / 1000$
$fz = vf / z \times n$
$vf = fz \times z \times n$
$Q = ae \times ap \times vf / 1000$

SHOULDER - HEAVY FINISH

E400		E402		E410		E412		E414		E428		E562		E564		E566		E568	
2		0.5		2.3-1.75		1.75		0.5		1		1		1		1		1	
0.5		0.25		0.3		0.3		0.3		0.4		0.4		0.4		0.4		0.4	
VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA	
CrN		CrN		HELICA		HELICA		HELICA		AlCrN		AlCrN		AlCrN		Aldura		Aldura	
Al		**Al**		**VA**		**VA**		**VA**		**VH**		**H**		**H**		**VH**		**VH**	
R45/46/44		R45/46/44		R55/54/56		R55		R55		R55		R50		R50		R50		R50	
																			
Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #
-	-	-	-	-	-	-	-	-	-	180-220	9	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	160-200	9	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	140-180	9	200-250	10	200-250	10	-	-	-	-
-	-	-	-	-	-	-	-	-	-	120-160	9	200-250	10	200-250	10	-	-	-	-
-	-	-	-	-	-	-	-	-	-	100-140	9	150-200	10	150-200	10	-	-	-	-
-	-	-	-	-	-	-	-	-	-	80-120	9	100-150	10	100-150	10	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	80-100	10	80-100	10	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30-40	3	30-40	3
-	-	-	-	120-160	12	120-160	8	120-160	8	-	-	80-100	10	80-100	10	-	-	-	-
-	-	-	-	100-140	12	100-140	8	100-140	8	-	-	70-90	10	70-90	10	-	-	-	-
-	-	-	-	60-100	12	60-100	8	60-100	8	-	-	50-70	10	50-70	10	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	60-100	12	60-100	8	60-100	8	60-100	9	70-80	9	70-80	9	-	-	-	-
-	-	-	-	40-80	12	40-80	8	40-80	8	40-80	9	60-70	9	60-70	9	-	-	-	-
-	-	-	-	20-50	10	20-50	8	20-50	7	-	-	40-50	8	40-50	8	-	-	-	-
-	-	-	-	15-40	10	15-40	8	15-40	7	-	-	30-35	8	30-35	8	-	-	-	-
250-300	12	250-300	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200-250	12	200-250	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-200	12	150-200	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300-600	12	300-600	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
250-500	12	250-500	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
250-500	12	250-500	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200-400	12	200-400	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100-250	12	100-250	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
250-350	12	250-350	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200-400	12	200-400	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-


Slotting


Finishing


Semi-finishing


Roughing


Profiling

Sutton Tools

	FINE FINISHING					
Catalogue Code	E535	E559	E543	E432	E434	E436
ap	1.5	1.5	1	2	2.5	2.0-1.75
ae	0.1	0.1	.02	0.05	0.05	0.05
Material	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA	VHM-ULTRA
Surface Finish	AlCrN	AlCrN	AlCrN	AlCrN	AlCrN	AlCrN
Colour Ring & Application	UNI	UNI	VH	VH	VH	VH
Geometry	R35/38	R35/38	R45	R50/35	R50/35	R50/35
						

Materials	HB	N/mm²	% Elong.	Material eg.	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #
1.0 Steels																
1.1 Mild steels, magnetic soft steel	<200	>200 <400	10	RFe100	200-240	15	200-240	15	-	-	180-220	12	180-220	12	180-220	12
1.2 Free cutting, structural, unalloyed	<200	>350 <700	30	C10, C15, ST37, ST52	200-240	15	200-240	15	-	-	160-200	12	160-200	12	160-200	12
1.3 Plain carbon, low alloyed	<300	>350 <850	20	C45, C92D, D95-S	180-220	15	180-220	15	-	-	140-180	12	140-180	12	140-180	12
1.4 Alloy steels harden. / tempered	<250	>500 <850	30	41CrMo4, 36CrNiMo4, X155CrVMo12-1, 90MnV8	140-160	13	140-160	13	-	-	120-160	12	120-160	12	120-160	12
1.5 Alloy steels harden. / tempered	<350	>850 <1200	30		95-115	10	95-115	10	-	-	80-120	12	80-120	12	80-120	12
1.6 Hardened, heat treated, high tensile alloy	<420	>1500	12		80-100	10	80-100	10	80-90	10	50-90	12	50-90	12	50-90	12
1.7 Hardened Steel 45-50 Rc	<550		<12		65-85	10	65-85	10	60-70	10	28-35	12	28-35	12	28-35	12
1.8 Hardened Steel 50-62 Rc	<700		<12	HS2-10-1-8	50-70	8	50-70	8	40-50	8	25-32	12	25-32	12	25-32	12
2.0 Stainless Steels																
2.1 Free machining	<250	<850	25	X8CrNiS18-9	90-100	12	90-100	12	-	-	-	-	-	-	-	-
2.2 Austenitic	<250	<850	20	X5CrNi18-10	80-90	12	80-90	12	-	-	-	-	-	-	-	-
2.3 Ferritic + martensitic	<250	<850	20	X20Cr13	90-100	12	90-100	12	-	-	-	-	-	-	-	-
3.0 Cast Irons																
3.1 Lamellar graphite (Grey soft)	<150	<500	10	GG10, GG40	150-170	15	150-170	15	-	-	-	-	-	-	-	-
3.2 Lamellar graphite (Grey hard)	<300	<1000	10	GGG40, GGG80	120-140	15	120-140	15	100-120	10	-	-	-	-	-	-
3.3 Nodular (spheroidal) graphite & malleable	<200	<700	10		100-120	15	100-120	15	-	-	-	-	-	-	-	-
4.0 Titaniums																
4.1 Pure Titanium	<250	<850	20	Ti99.7, Ti99.8	70-90	8	70-90	8	-	-	50-80	12	50-80	12	50-80	12
4.2 Titanium alloys	>250	>850	20	TiCu2, TiAl6V4	60-80	8	60-80	8	-	-	40-60	12	40-60	12	40-60	12
5.0 Nickels																
5.1 Nickel alloys	<250	<850	25	Ni38, Ni54, NiCr16FeTi	60-80	8	60-80	8	-	-	-	-	-	-	-	-
5.2 Nickel alloys	>250	>850	25		50-70	8	50-70	8	-	-	-	-	-	-	-	-
6.0 Coppers																
6.1 Pure Copper (electrolytic copper)	<120	<400	12	SF-Cu	-	-	-	-	-	-	-	-	-	-	-	-
6.2 Short chip Brass, Phosphor Bronze, gun metal	<200	<700	12	G-CuSn12Ni	280-300	12	280-300	12	-	-	-	-	-	-	-	-
6.3 Long chip Brass, Bronze	<200	<700	12	G-CuPb20Sn	-	-	-	-	-	-	-	-	-	-	-	-
7.0 Aluminiums																
7.1 Aluminium unalloyed	<100	<350	15	Al99.5	300-400	15	300-400	15	-	-	-	-	-	-	-	-
7.2 Magnesium unalloyed	<150	<350	15	Al99.85Mg0.5	300-400	15	300-400	15	-	-	-	-	-	-	-	-
7.3 Al Alloyed Si < 1.5 %	<120	<500	15	AlMg1.5	300-400	15	300-400	15	-	-	-	-	-	-	-	-
7.4 Al Alloyed 1.5 % < Si < 10%	<120	<400	10	AlSi10Mg	250-300	15	250-300	15	-	-	-	-	-	-	-	-
7.5 Al Alloyed > 10% Si	-	<400	N	AlSi17Cu4	200-250	15	200-250	15	-	-	-	-	-	-	-	-
7.6 Magnesium alloys	-	<400	N	MgAl3Zn	200-250	15	200-250	15	-	-	-	-	-	-	-	-
8.0 Plastics																
8.1 Plastics, Thermoplastics, Polyethylene	<340	<50	N	ABS, PV C, Polycarbonate	150-170	7	150-170	7	-	-	-	-	-	-	-	-

Feed Table (f) (mm/tooth)																
Ø	Feed No.															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2.0	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
3.0	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
4.0	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	0.029	0.032	0.036
5.0	0.005	0.006	0.008	0.009	0.011	0.013	0.015	0.017	0.020	0.023	0.025	0.029	0.032	0.036	0.040	0.044
6.0	0.006	0.008	0.009	0.011	0.013	0.016	0.018	0.021	0.024	0.027	0.030	0.034	0.038	0.042	0.047	0.052
8.0	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	0.061	0.067
10.0	0.013	0.015	0.018	0.021	0.024	0.028	0.031	0.035	0.040	0.045	0.050	0.055	0.062	0.068	0.075	0.083
12.0	0.016	0.019	0.022	0.026	0.029	0.033	0.038	0.043	0.048	0.053	0.059	0.066	0.073	0.081	0.090	0.099
16.0	0.020	0.024	0.028	0.033	0.038	0.043	0.049	0.055	0.062	0.070	0.078	0.087	0.096	0.107	0.118	0.130
20.0	0.022	0.027	0.032	0.038	0.044	0.051	0.059	0.067	0.075	0.085	0.095	0.106	0.118	0.132	0.146	0.161
25.0	0.025	0.031	0.038	0.045	0.053	0.062	0.071	0.081	0.092	0.104	0.117	0.131	0.146	0.163	0.181	0.200

Notes on Milling

1. Above values are guidelines for the size & type of cut nominated.

LEGEND

n = rev. per minute
vc = m/min
fz = mm/tooth
vf = mm/min
z = no. cutting edges
Q = metal removal rate (cm^3/min)

FORMULAS

$n = vc \times 1000 / Ø \times \pi$
$vc = Ø \times \pi \times n / 1000$
$fz = vf / z \times n$
$vf = fz \times z \times n$
$Q = ae \times ap \times vf / 1000$

SEMI-FINISH		ROUGHING								PROFILING							
E545		E549		E404		E406		E416		E420		E440		E442		E408	
1.5		1.5		2		1.5		1.75		1		0.1		0.1		0.1	
0.5		0.5		0.3		0.4		0.5		0.3		0.05		0.05		0.05	
VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA	
AlCrN		AlCrN		CrN		CrN		HELICA		AlCrN		AlCrN		AlCrN		CrN	
UNI		UNI		Al		Al		VA		UNI		UNI		UNI		Al	
R45 5TF		R45 HRS		R35/36/36HR		R25 NRC		R35/36/36HR		R30		R30		R30		R45/46/44	
																	
Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #	Vc (m/min)	Feed #
250-320	12	140-160	12	-	-	-	-	-	-	180-220	10	180-220	16	180-220	16	-	-
250-320	12	120-140	12	-	-	-	-	-	-	160-200	10	160-200	16	160-200	16	-	-
210-300	12	110-130	12	-	-	-	-	-	-	140-180	10	140-180	16	140-180	16	-	-
170-250	9	85-105	7	-	-	-	-	-	-	120-160	10	120-160	16	120-160	16	-	-
130-200	7	70-90	6	-	-	-	-	-	-	100-140	10	100-140	16	100-140	16	-	-
70-80	6	60-80	6	-	-	-	-	-	-	80-120	10	80-120	16	80-120	16	-	-
-	-	-	-	-	-	-	-	-	-	-	-	28-35	16	28-35	16	-	-
-	-	-	-	-	-	-	-	-	-	-	-	25-32	16	25-32	16	-	-
120-150	8	90-110	8	-	-	-	-	120-160	7	-	-	-	-	-	-	-	-
90-130	8	80-100	8	-	-	-	-	100-140	7	-	-	-	-	-	-	-	-
70-100	6	65-85	6	-	-	-	-	60-100	7	-	-	-	-	-	-	-	-
210-250	11	130-150	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140-170	11	100-120	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100-150	11	80-100	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50-70	8	50-70	8	-	-	-	-	60-100	7	50-80	10	-	-	-	-	-	-
40-60	8	40-60	8	-	-	-	-	40-80	7	40-60	10	-	-	-	-	-	-
50-70	8	50-70	8	-	-	-	-	20-50	7	-	-	-	-	-	-	-	-
40-60	8	40-60	8	-	-	-	-	15-40	7	-	-	-	-	-	-	-	-
400-450	7	300-320	7	250-300	13	250-300	12	-	-	-	-	-	-	-	-	180-220	15
200-250	7	240-260	7	200-250	13	200-250	12	-	-	-	-	-	-	-	-	180-220	15
200-250	7	200-220	7	150-200	13	150-200	12	-	-	-	-	-	-	-	-	180-220	15
-	-	-	-	350-700	13	350-700	12	-	-	-	-	-	-	-	-	300-450	15
-	-	-	-	300-600	13	300-600	12	-	-	-	-	-	-	-	-	250-400	15
-	-	-	-	250-500	13	250-500	12	-	-	-	-	-	-	-	-	250-400	15
-	-	-	-	200-400	13	200-400	12	-	-	-	-	-	-	-	-	250-400	15
-	-	-	-	100-250	13	100-250	12	-	-	-	-	-	-	-	-	200-300	15
-	-	-	-	250-350	13	250-350	12	-	-	-	-	-	-	-	-	200-300	15
-	-	-	-	200-400	13	200-400	12	-	-	-	-	-	-	-	-	150-200	15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