

# sutton®

HARMONY AI

**FETOGA**  
A-LINE



# ALUMINIUM MACHINING



Traditional

Trochoidal

## Dynamic & Trochoidal Milling

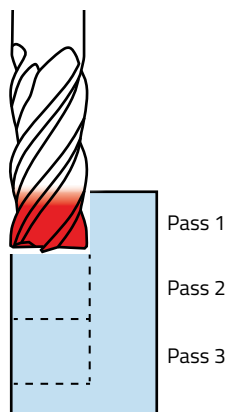
Dynamic & Trochoidal Milling strategies provide a tool engagement angle with the workpiece that utilises more of the cutting edge of the tool, ensuring a stable process, shorter machining times & longer tool life.

They also apply a lower radial step-over ( $ae$ ) and a higher depth of cut ( $ap$ ), spreading the wear, loads and heat across the entire cutting edge.

This method of milling adjusts the parameters to maintain a constant load on the tool, providing more aggressive metal removal rates (MRR).

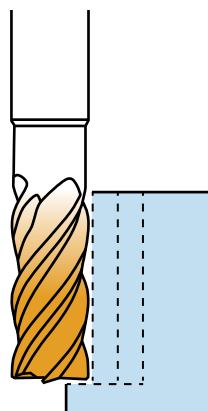
To use this technique, it requires a CAM package to generate the tool path on virtually any CNC machine.

Traditional



Traditional methods are typically higher step-over & lower depth of cut.

Trochoidal

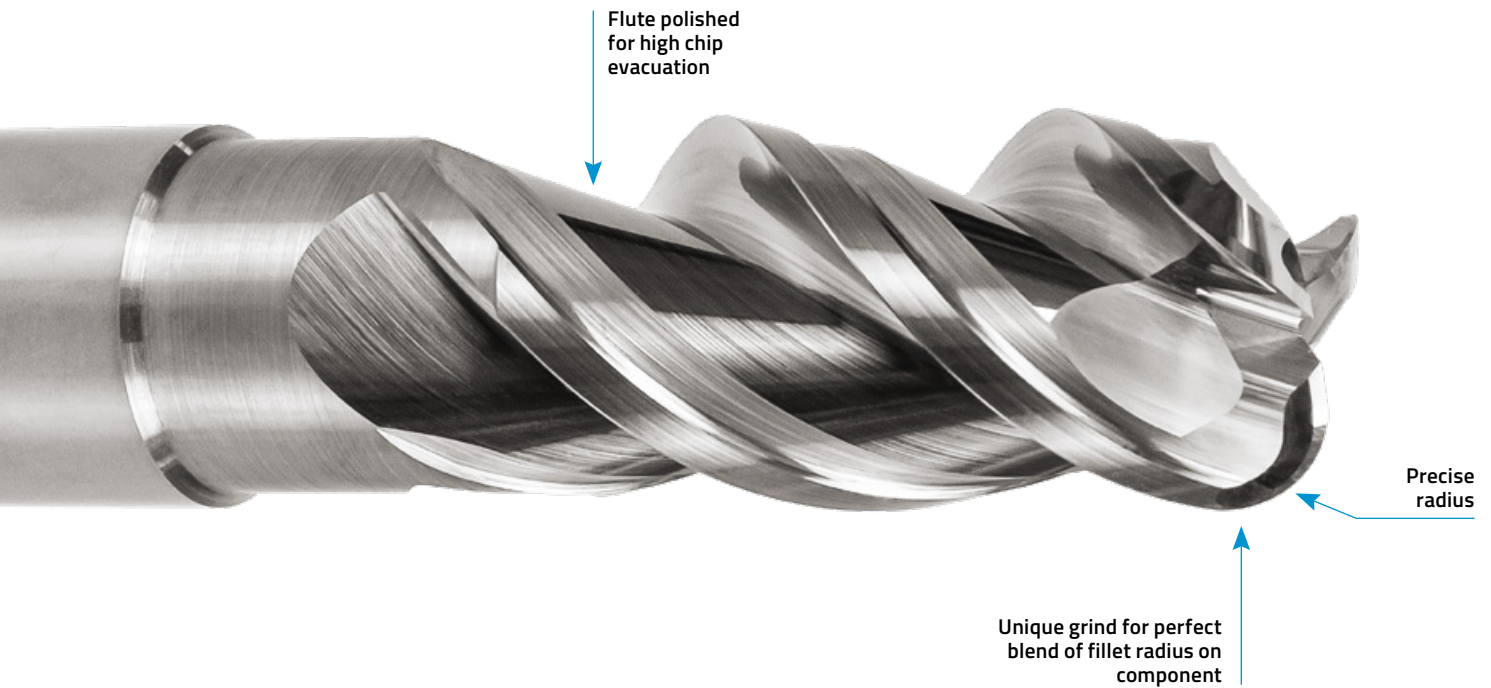


Dynamic & Trochoidal is mostly based on the theory of radial chip thinning that occurs with varying  $ae$  which relates to chip thickness and feed per tooth.

### Advantages of Dynamic & Trochoidal Milling

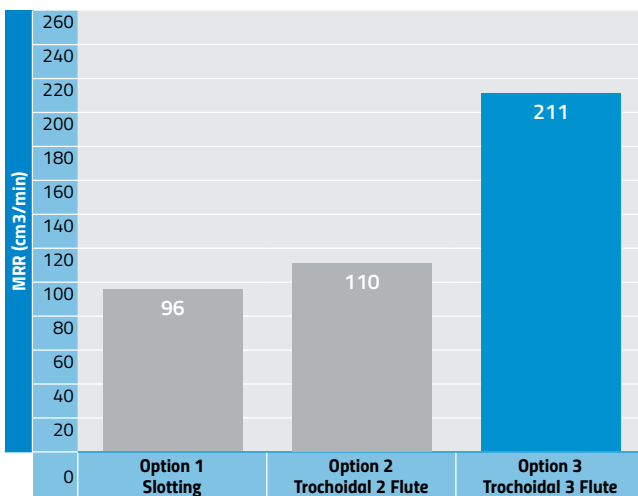
- Decreased cutting forces
- Reduced heat
- Reduced tool wear
- Suitable for lower powered machines
- Greater machining accuracy
- Spindle & machine friendly
- Improved tool life
- Faster cycle time
- One tool for multiple slot sizes (trochoidal)
- Thin wall applications

# E478 Corner Radius Series



## Producing 20mm Slots in Aluminium

- Option 1** Using a **20mm 2-flute endmill** results in high vibration with an under-utilised cutting edge with two passes to get to the full depth. It is a more expensive option due to the larger tool size.
- Option 2** Using a **12mm 2-flute endmill in trochoidal milling** provides a much higher metal removal rate with a smoother cut, resulting in an all-round stable cutting environment as well as a lower tool cost.
- Option 3** Using a **12mm 3-flute endmill in trochoidal milling** similar to Option 2. The design of this tool has a variable helix and when used with trochoidal methods, at least two of the cutting edges are always engaged in the depth of cut (in this case  $ap=24\text{mm}$ ). The variable helix design also suppresses the vibration caused from the interrupted cutting action of milling. This means that greater speeds are possible, increasing the volume of material removed (MRR) dramatically.



Test Data	Option 1 Slotting	Option 2 Trochoidal 2 Flute	Option 3 Trochoidal 3 Flute
Tool	R40 AI	R40 AI	R42/43/44 HARMONY AI
Part No. / Reference	E3102000	E3101200	E4001200
Tool Diameter (mm)	20	12	12
Z (teeth number)	2	2	3
ae (mm)	20	2	2
ap (mm) / depth	12 + 12 (2 passes)	24 (single pass)	24 (single pass)
RPM	1600	5300	6600
Feed Rate (mm/min)	200	2300	4400

At Sutton Tools, we often talk about 'Good, Better, Best' when diagnosing the right cutting tool for an application. The above example illustrates this concept well. Our R&D Team are continuously running tests to determine the Good, Better or Best tooling solution for our customers' unique requirements.

# Contents

Page	Item Code	Tool	Diameter range	Type	DIN6535	No. of Flutes	Geometry	Surface Finish	Standard	Non-Ferrous Metals	
5	E444		3-12mm	Square End	HA	1	R30	Brt	Sutton Std	●	
6	E310		2-20mm	Square End	HA	2	R40	Brt	DIN6527 L	●	
<b>NEW</b>	7	E660		1-25mm	Square End	HA	2	R55	Brt	DIN6527 L	●
<b>NEW</b>	8	E670		6-20mm	Square End	HA	2	R45	ASX	DIN6527 L	●
<b>NEW</b>	9	E671		3-20mm	Square End	HA	2	R55	ASX	DIN6527 L	●
<b>NEW</b>	10	E672		6-20mm	Square End	HA	2	R55	ASX	DIN6527 L	●
<b>NEW</b>	11	E673		6-20mm	Corner Radius	HA	2	R55	ASX	DIN6527 L	●
<b>NEW</b>	13	E661		3-20mm	Ball Nose	HA	2	R55	Brt	DIN6527 L	●
14	E480		3-20mm	Square End	HA	3	R45/46/44	Brt	DIN6527 L	●	
15	E400		6-25mm	Square End	HA	3	R45/46/44	CrN	DIN6527 L	●	
	HB										
16	E402		6-25mm	Square End	HA	3	R45/46/44	CrN	Sutton Std	●	
	HB										
<b>NEW</b>	17	E668		6-20mm	Square End	HA	3	R40	HCR	DIN6527 L	●
18	E478		12-20mm	Corner Radius	HA	3	R45/46/44	Brt	DIN6527 L	●	
<b>NEW</b>	19	E669		6-20mm	Corner Radius	HA	3	R40	ASX	DIN6527 L	●
21	E408		6-25mm	Corner Radius	HA	3	R45/46/44	CrN	Sutton Std	●	
	HB										
22	E446		6-20mm	Square End	HA	3	R25	Brt	DIN6527 L	●	
	E447				HB						
<b>NEW</b>	23	E662		12-20mm	Corner Radius Int. Coolant	HA	3	R45	Brt	DIN6527 L	●
<b>NEW</b>	E663		6-20mm	Square End Chip Breaker	HA	4	R45	HCR	DIN6527 L	●	
	E664				HB						
<b>NEW</b>	E665		6-20mm	Square End	HA	4	R45	HCR	DIN6527 L	●	
	E666				HB						
<b>NEW</b>	26	E667		12-20mm	Corner Radius	HA	4	R45	HCR	DIN6527 L	●

Optimal ● Effective ○



- For non ferrous aluminium alloys such as aluminium sheet & extrusions, brass & bronze
- Large single flute provides maximum chip evacuation when ran at high RPM & feed rates
- Centre cutting for straight plunging or ramping
- Suitable for use in hi speed routers & air tools for trimming plastics and similar materials



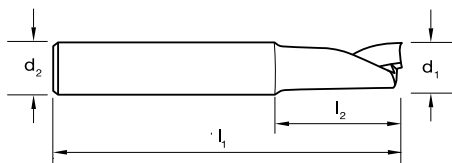
### Fraise 1 dent carbure, R30° AL, courte

- Recommandé pour l'aluminium en feuille et extrusion, les bronzes et plastiques
- Grosse goujure pour une évacuation maximale pendant les utilisations à haute vitesses
- Coupe au centre pour les opérations de plongées ou ramping, utilisation sous AIR recommandée pour les plastiques



### Frese metallo duro, 1 Taglienti, R30 AI, Corte

- Ideale per material non ferrosi, leghe di alluminio, lamiere di alluminio & fusioni, ottone e bronzo
- Ampio vano truciolo in un unico tagliente consentendo al massimo l'evacuazione truciolo riferito ad alti avanzanzamenti
- Tagliente al centro per consentire applicazione forante
- Ideale per essere applicate su utensili pneumatici utili per taglio di aterie plastiche e similari



### Fresas de MD, 1 ranura, R30 AI, Corta

- Para aleaciones de aluminio no ferrosos, como láminas y perfiles de aluminio, latón y bronce
- La ranura única y grande proporciona la máxima evacuación de viruta cuando se trabaja a altas RPM y velocidades de avance
- Corte central para perforaciones o rampas rectas
- Adecuado para usar en husillos de alta velocidad y husillos neumáticos, para recortar plásticos y materiales similares



Catalogue Code	<b>E444</b>
Product Group	B0208
Material	<b>VHM</b>
Surface Finish	<b>Br</b>
Sutton Designation	<b>AI</b>
Geometry	R30
Shank Form (DIN 6535)	HA
Shank Tolerance	h6

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	z	Item #
0300	3.0	50	8	6	1	E444 0300
0400	4.0	54	11	6	1	E444 0400
0500	5.0	54	13	6	1	E444 0500
0600	6.0	54	13	6	1	E444 0600
0800	8.0	58	19	8	1	E444 0800
1000	10.0	66	22	10	1	E444 1000
1200	12.0	73	26	12	1	E444 1200

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						
E444																							●	●	●	○	○	○																											

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





















# Endmills Carbide, 3 Flute, R45/46/44 AI, DIN6527L, Harmony



- VHM-ULTRA grade of carbide for high performance
- Variable flute helix for chatter free milling
- Optimised geometry for soft materials
- CrN for copper and non-ferrous materials



## Fraise 3 dents carbure, R45/46/44 AI, DIN6527L Harmony

- Carbure VHM Ultra pour une meilleure performance
- Hélice variable pour la suppression des vibrations
- Géométrie optimisée pour les matériaux légers
- Revêtement CrN pour les cuivres et non-ferreux



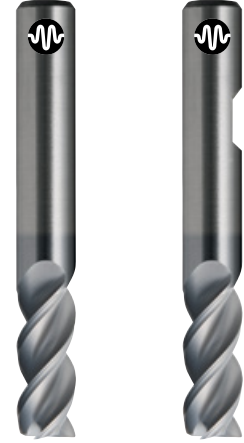
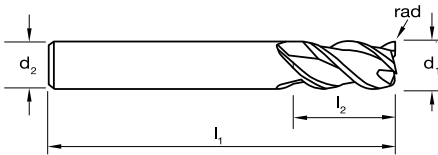
## Frese metallo duro, 3 Taglienti, R45/46/44 AI, DIN6527L, Harmony

- VHM-ULTRA, grado di metallo duro per alte prestazione
- Elica tagliente variabile per lavorazioni senza vibrazioni
- Geometria ottimizzata per materiali morbidi
- CrN specifico per le lavorazioni di rame e materiali non ferrosi



## Fresas de MD, 3 ranuras, R45/46/44 AI, DIN6527L, Harmony

- Grado de MD, VHM-ULTRA para alto rendimiento
- Hélice de ranura variable para fresado sin vibraciones
- Geometría optimizada para materiales blandos
- CrN para cobres y materiales no ferrosos



Catalogue Code	<b>E400</b>	<b>E401</b>
Product Group	B0210	B0210
Material	<b>VHM-ULTRA</b>	<b>VHM-ULTRA</b>
Surface Finish	<b>CrN</b>	<b>CrN</b>
Sutton Designation	<b>AI</b>	<b>AI</b>
Geometry	R45/46/44	R45/46/44
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Item #	Item #
E400 0600	E401 0600
E400 0800	E401 0800
E400 1000	E401 1000
E400 1200	E401 1200
E400 1400	E401 1400
E400 1600	E401 1600
E400 1800	E401 1800
E400 2000	E401 2000
E400 2500	E401 2500

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	d <sub>2</sub>	z	rad	Item #	Item #
<b>0600</b>	<b>6.0</b>	57	13	6	3	0.2	E400 0600	E401 0600
<b>0800</b>	<b>8.0</b>	63	19	8	3	0.2	E400 0800	E401 0800
<b>1000</b>	<b>10.0</b>	72	24	10	3	0.3	E400 1000	E401 1000
<b>1200</b>	<b>12.0</b>	83	28	12	3	0.4	E400 1200	E401 1200
<b>1400</b>	<b>14.0</b>	83	30	14	3	0.4	E400 1400	E401 1400
<b>1600</b>	<b>16.0</b>	92	35	16	3	0.5	E400 1600	E401 1600
<b>1800</b>	<b>18.0</b>	92	38	18	3	0.5	E400 1800	E401 1800
<b>2000</b>	<b>20.0</b>	104	42	20	3	0.6	E400 2000	E401 2000
<b>2500</b>	<b>25.0</b>	120	50	25	3	0.6	E400 2500	E401 2500

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		
E400																							●	●	●	●	●	●	●	●																					
E401																							●	●	●	●	●	●	●	●																					

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





# Endmills Carbide, 3 Flute, Al, Long Reach



- 40° Helix, Centre cutting
- Extra reach with wide gullets to enable higher feed rates
- HCR coating allows for roughing and finishing using the same tool



## Fraise 3 dents carbure AL longue

- Hélice 40°, coupe au centre
- Série longue avec d'importantes goujures pour des avances plus élevées
- Revêtement HCR pour l'ébaushe et la finition avec le meme outil



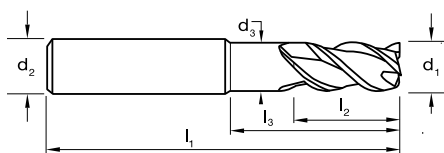
## Fresa metallo duro, 3 taglienti, Al, Lavorazioni profonde

- 40° Elica, Tagliente al centro
- Lunghezza extra con scarico dopo tagliente per avanzamenti elevati
- Rivestimento HCR adatto per sgrossare e finire con lo stesso utensile



## Fresas de MD, 3 ranuras, R40 AL, larga

- Hélice de 40°, corte frontal
- Alcance adicional facetas anchas para permitir mayores velocidades de corte
- El recubrimiento HCR permite desbaste y acabado con la misma herramienta



Catalogue Code	<b>E668</b>
Product Group	B0210
Material	<b>VHM-ULTRA</b>
Surface Finish	<b>HCR</b>
Sutton Designation	<b>AI</b>
Geometry	R40
Shank Form (DIN 6535)	HA
Shank Tolerance	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>	Rad	z	Item #
<b>0600</b>	<b>6.0</b>	100	24	50	6.0	5.70	-	3	E668 0600
<b>0800</b>	<b>8.0</b>	100	25	50	8.0	7.70	-	3	E668 0800
<b>1000</b>	<b>10.0</b>	100	27	50	10.0	9.50	-	3	E668 1000
<b>1200</b>	<b>12.0</b>	100	32	60	12.0	11.50	-	3	E668 1200
<b>1600</b>	<b>16.0</b>	125	39	80	16.0	15.30	-	3	E668 1600
<b>2000</b>	<b>20.0</b>	150	42	100	20.0	19.30	-	3	E668 2000

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
<b>E668</b>																							●	●	●	●	●	●	●	●																			

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

● Optimal ○ Effective

# Endmills Carbide, 3 Flute, R45/46/44 Al, Rad, DIN6527L, Harmony



- VHM-ULTRA grade of carbide for high performance
- Variable flute helix for chatter free milling
- Optimised geometry for soft materials



## Fraise 3 dents carbure, R45/46/44 Al, Longue Harmony

- Carbure VHM-ULTRA pour une meilleure performance
- Hélice variable pour la suppression des vibrations
- Géométrie optimisée les non-ferreux et cuivres



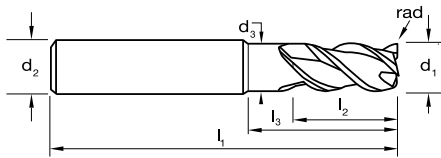
## Fresa metallo duro, 3 Taglienti, R45/46/44 Al, Lunga Portata, Harmony

- VHM-ULTRA, grado di metallo duro per alte prestazione
- Elica tagliente variabile per lavorazioni senza vibrazioni
- Geometria ottimizzata per materiali morbidi



## Fresas de MD, 3 ranuras, R45/46/44 Al, Larga, Harmony

- Grado de MD, VHM-ULTRA para alto rendimiento
- Hélice de ranura variable para fresado sin vibraciones
- Geometría optimizada para materiales blandos



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>	rad	Item #
1210	12.0	83	26	40	12	11.1	1	E478 1210
1225	12.0	83	26	40	12	11.1	2.5	E478 1225
1230	12.0	83	26	40	12	11.1	3	E478 1230
1240	12.0	83	26	40	12	11.1	4	E478 1240
1610	16.0	92	32	50	16	14.8	1	E478 1610
1625	16.0	92	32	50	16	14.8	2.5	E478 1625
1630	16.0	92	32	50	16	14.8	3	E478 1630
1640	16.0	92	32	50	16	14.8	4	E478 1640
2010	20.0	104	38	60	20	18.5	1	E478 2010
2025	20.0	104	38	60	20	18.5	2.5	E478 2025
2030	20.0	104	38	60	20	18.5	3	E478 2030
2040	20.0	104	38	60	20	18.5	4	E478 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							
E478																																																								

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

● Optimal ○ Effective



Catalogue Code	E478
Product Group	B0210
Material	VHM-ULTRA
Surface Finish	Brt
Sutton Designation	AI
Geometry	R45/46/44
Shank Form (DIN 6535)	HA
Shank Tolerance	h5

# Endmills Carbide, 3 Flute, Long Reach, Al, Corner Rad



- 40° Helix, 3 Teeth to Centre
- Extra reach with wide gullets to enable higher feed rates
- ASX coating allows for roughing and finishing using the same tool



## Fraise 3 dents carbure AL longue avec rayons

- Hélice 40°, 3 dents, coupe au centre avec rayons
- Série longue avec d'importantes goujures pour des avances plus élevées
- Revêtement ASX pour l'ébaushe et la finition avec le même outil



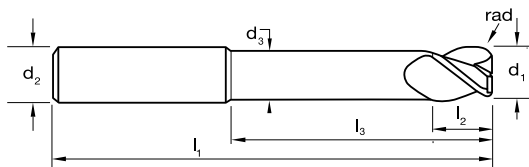
## Fresa metallo duro, 3 taglienti, Lavorazioni profonde, Al, Torica

- 40° Elica, 3 Taglienti al centro
- Lunghezza extra con scarico dopo tagliente per avanzamenti elevati
- Rivestimento ASX adatto per sgrossare e finire con lo stesso utensile



## Fresas de MD, 3 ranuras, R40 AL, larga, Torica

- Hélice de 40°, 3 dientes, corte frontal
- Alcance adicional facetas anchas para permitir mayores velocidades de corte
- El recubrimiento HCR permite desbaste y acabado con la misma herramienta



Catalogue Code	<b>E669</b>
Product Group	B0210
Material	<b>VHM-ULTRA</b>
Surface Finish	<b>ASX</b>
Sutton Designation	<b>AI</b>
Geometry	R40
Shank Form (DIN 6535)	HA
Shank Tolerance	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>	Rad	z	Item #
0605	6.0	100	6	30	6.0	5.70	0.50	3	E669 0605
0610	6.0	100	6	30	6.0	5.70	1.00	3	E669 0610
0615	6.0	100	6	30	6.0	5.70	1.50	3	E669 0615
0620	6.0	100	6	30	6.0	5.70	2.00	3	E669 0620
0805	8.0	100	8	30	8.0	7.70	0.50	3	E669 0805
0810	8.0	100	8	30	8.0	7.70	1.00	3	E669 0810
0815	8.0	100	8	30	8.0	7.70	1.50	3	E669 0815
0820	8.0	100	8	30	8.0	7.70	2.00	3	E669 0820
0825	8.0	100	8	30	8.0	7.70	2.50	3	E669 0825
0830	8.0	100	8	30	8.0	7.70	3.00	3	E669 0830
1005	10.0	100	10	35	10.0	9.50	0.50	3	E669 1005
1010	10.0	100	10	35	10.0	9.50	1.00	3	E669 1010
1015	10.0	100	10	35	10.0	9.50	1.50	3	E669 1015
1020	10.0	100	10	35	10.0	9.50	2.00	3	E669 1020
1025	10.0	100	10	35	10.0	9.50	2.50	3	E669 1025
1030	10.0	100	10	35	10.0	9.50	3.00	3	E669 1030
1205	12.0	100	12	35	12.0	11.50	0.50	3	E669 1205
1210	12.0	100	12	35	12.0	11.50	1.00	3	E669 1210
1215	12.0	100	12	35	12.0	11.50	1.50	3	E669 1215
1220	12.0	100	12	35	12.0	11.50	2.00	3	E669 1220
1225	12.0	100	12	35	12.0	11.50	2.50	3	E669 1225
1230	12.0	100	12	35	12.0	11.50	3.00	3	E669 1230
1605	16.0	125	16	40	16.0	15.30	0.50	3	E669 1605
1610	16.0	125	16	40	16.0	15.30	1.00	3	E669 1610
1615	16.0	125	16	40	16.0	15.30	1.50	3	E669 1615
1620	16.0	125	16	40	16.0	15.30	2.00	3	E669 1620
1625	16.0	125	16	40	16.0	15.30	2.50	3	E669 1625
1630	16.0	125	16	40	16.0	15.30	3.00	3	E669 1630

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
E669																																																	

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

● Optimal ○ Effective

# Endmills Carbide, 3 Flute, Long Reach, Al, Corner Rad



- 40° Helix, 3 Teeth to Centre
- Extra reach with wide gullets to enable higher feed rates
- ASX coating allows for roughing and finishing using the same tool



## Fraise 3 dents carbure AL longue avec rayons

- Hélice 40°, 3 dents, coupe au centre avec rayons
- Série longue avec d'importantes goujures pour des avances plus élevées
- Revêtement ASX pour l'ébaushe et la finition avec le même outil



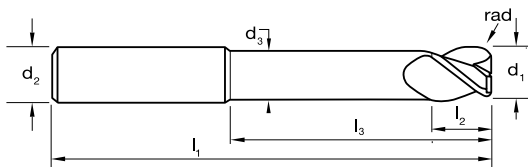
## Fresa metallo duro, 3 taglienti, Lavorazioni profonde, Al, Torica

- 40° Elica, 3 Taglienti al centro
- Lunghezza extra con scarico dopo tagliente per avanzamenti elevati
- Rivestimento ASX adatto per sgrossare e finire con lo stesso utensile



## Fresas de MD, 3 ranuras, R40 AL, larga, Torica

- Hélice de 40°, 3 dientes, corte frontal
- Alcance adicional facetas anchas para permitir mayores velocidades de corte
- El recubrimiento HCR permite desbaste y acabado con la misma herramienta



Catalogue Code	<b>E669</b>
Product Group	B0210
Material	<b>VHM-ULTRA</b>
Surface Finish	<b>ASX</b>
Sutton Designation	<b>AI</b>
Geometry	R40
Shank Form (DIN 6535)	HA
Shank Tolerance	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>	Rad	z	Item #
1640	16.0	125	16	40	16.0	15.30	4.00	3	E669 1640
2005	20.0	125	20	40	20.0	15.30	0.50	3	E669 2005
2010	20.0	125	20	40	20.0	19.30	1.00	3	E669 2010
2015	20.0	125	20	40	20.0	19.30	1.50	3	E669 2015
2020	20.0	125	20	40	20.0	19.30	2.00	3	E669 2020
2025	20.0	125	20	40	20.0	19.30	2.50	3	E669 2025
2030	20.0	125	20	40	20.0	19.30	3.00	3	E669 2030
2040	20.0	125	20	40	20.0	19.30	4.00	3	E669 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							
E669																							●	●	●	●	●	●	●	●	●	●																								

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



- VHM-ULTRA grade of carbide for high performance
- Variable flute helix for chatter free milling
- Optimised geometry for soft materials
- CrN for copper and non-ferrous materials



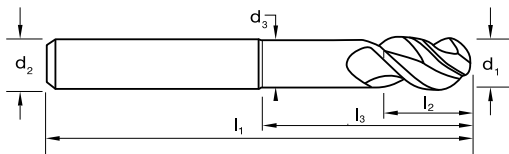
### Fraise 3 dents carbure, Hémisphérique, R45/46/44 Longue, Harmony

- Carbure VHM-ULTRA pour une meilleure performance
- Pour le fraisage de formes et de poches profondes
- Hélice variable pour la suppression des vibrations
- Géométrie optimisée et revêtement CrN pour les non-ferreux et cuivres



### Frese metallo duro, Sferiche, 3 Taglienti, R45/46/44 Al, Lunga Portata, Harmony

- VHM-ULTRA, grado di metallo duro per alte prestazione
- Elica tagliente variabile per lavorazioni senza vibrazioni
- Geometria ottimizzata per materiali morbidi
- CrN specifico per le lavorazioni di rame e materiali non ferrosi



### Fresas de MD, Esférica, 3 ranuras, R45/46/44 Al, Larga, Harmony

- Grado de MD, VHM-ULTRA para alto rendimiento
- Hélice de ranura variable para fresado sin vibraciones
- Geometría optimizada para materiales blandos
- CrN para cobres y materiales no ferrosos



Catalogue Code	<b>E408</b>	<b>E409</b>
Product Group	B0210	B0210
Material	<b>VHM-ULTRA</b>	<b>VHM-ULTRA</b>
Surface Finish	<b>CrN</b>	<b>CrN</b>
Sutton Designation	<b>AI</b>	<b>AI</b>
Geometry	R45/46/44	R45/46/44
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	d <sub>2</sub>	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

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		
E408																							●	●	●	●	●	●	●	●																					
E409																							●	●	●	●	●	●	●	●																					

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

● Optimal ○ Effective



- For roughing applications
- NR geometry allows for heavy cuts
- For soft non ferrous aluminium alloys
- High rake angle for long chipping materials

### Fraise d'ébauche, Profil NR, R25° AL, DIN 6527L

- Carburé VHM-ULTRA pour une meilleure performance
- Hélice variable 45°/46°/44° pour la suppression des vibrations
- Géométrie optimisée et revêtement CrN pour les non-ferreux et cuivres

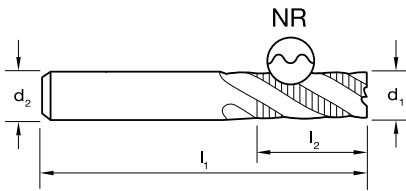
### Fresa metallo duro romptruciolo, NR (normal), R25 Al, DIN 6527L

- Fresa ideale per lavorazioni di sgrossatura
- Geometria NR permette lavorazioni gravose
- Ideale per materiali morbidi o non ferrosi
- Elevato angolo di spoglia per lavorazione di materiale con difficile truciolabilità



### Fresas Desbaste, NR (normal), R25 Al, DIN6527L

- Para aplicaciones de desbaste
- La geometría NR permite grandes pasadas
- Adecuado para materiales no ferrosos y aluminio aleado
- Ángulo de corte positivo, para materiales de viruta larga



Catalogue Code	<b>E446</b>	<b>E447</b>
Product Group	B0208	B0208
Material	<b>VHM</b>	<b>VHM</b>
Surface Finish	<b>Brf</b>	<b>Brf</b>
Sutton Designation	<b>AI</b>	<b>AI</b>
Geometry	R25 NR	R25 NR
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h5	h5

Size Ref.	d <sub>1</sub> (e8)	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	z	Item #	Item #
<b>0600</b>	<b>6.0</b>	57	13	6	3	E446 0600	E447 0600
<b>0800</b>	<b>8.0</b>	63	19	8	3	E446 0800	E447 0800
<b>1000</b>	<b>10.0</b>	72	22	10	3	E446 1000	E447 1000
<b>1200</b>	<b>12.0</b>	83	26	12	3	E446 1200	E447 1200
<b>1400</b>	<b>14.0</b>	83	26	14	3	•	•
<b>1600</b>	<b>16.0</b>	92	32	16	3	E446 1600	E447 1600
<b>1800</b>	<b>18.0</b>	92	32	18	3	•	•
<b>2000</b>	<b>20.0</b>	104	38	20	3	E446 2000	E447 2000

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						
E446																							•	•	•	•	•	•	•	•	•																								
E447																							•	•	•	•	•	•	•	•	•																								

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

• Optimal 
 ○ Effective

# Endmills Carbide, 3 Flute, Al, Through Coolant Rougher



- 45° Helix, Centre Cutting, Sinusoidal Form
- Uniquely designed for high material removal rates
- Enhanced with through coolant and wide flute form for maximum swarf removal



### Fraise 3 dents carbure AL arrosage central profil ebauche

- Hélice 45° sinusoidale, coupe au centre, serie longue
- Idéale pour le fraisage trochoidal et la finition
- Revetement HCR



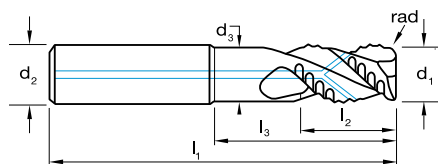
### Fresa metallo duro, 3 taglienti, Al, Refrigerazione interna con rompitruciolo

- 45° Elica, Tagliente al centro, Forma Sinusoidale
- Geometria unica per alti avanzamenti
- Refrigerazione interna centrale e tagliente adatto a massima evacuazione trucioli



### Fresas Debaste, NR, R45 AL, Refrigerante

- Hélice de 45°, corte frontal, forma sinusoidal
- Diseñado exclusivamente para altos arranques de material
- Mejorado con refrigerante interior y forma de ranura ancha para la máxima evacuación de virutas



Catalogue Code	<b>E662</b>
Product Group	B0210
Material	<b>VHM-ULTRA</b>
Surface Finish	<b>Br</b>
Sutton Designation	<b>Al - IK</b>
Geometry	R45
Shank Form (DIN 6535)	HA
Shank Tolerance	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>	Rad	z	Item #
1210	12.0	83	18	40	12.0	-	1.00	3	E662 1210
1220	12.0	83	18	40	12.0	-	2.00	3	E662 1220
1225	12.0	83	18	40	12.0	-	2.50	3	E662 1225
1230	12.0	83	18	40	12.0	-	3.00	3	E662 1230
1240	12.0	83	18	40	12.0	-	4.00	3	E662 1240
1610	16.0	92	18	40	12.0	-	1.00	3	E662 1610
1620	16.0	92	25	50	16.0	-	2.00	3	E662 1620
1625	16.0	92	25	50	16.0	-	2.50	3	E662 1625
1630	16.0	92	25	50	16.0	-	3.00	3	E662 1630
1640	16.0	92	25	50	16.0	-	4.00	3	E662 1640
1650	16.0	92	25	50	16.0	-	5.00	3	E662 1650
2010	20.0	104	36	64	20.0	-	1.00	3	E662 2010
2020	20.0	104	36	64	20.0	-	2.00	3	E662 2020
2025	20.0	104	36	64	20.0	-	2.50	3	E662 2025
2030	20.0	104	36	64	20.0	-	3.00	3	E662 2030
2040	20.0	104	36	64	20.0	-	4.00	3	E662 2040
2050	20.0	104	36	64	20.0	-	5.00	3	E662 2050

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
E662																							●	●	●	●	●	●	●	●	●																		

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

● Optimal ○ Effective

# Endmills Carbide, 4 Flute, Extra Long, Al, Chip Breakers



- 45° Helix, Centre cutting
- Extended flute length and added chip breakers for excellent swarf removal
- Ideal for trochoidal milling
- HCR coating enables excellent feed rates



## Fraise 4 dents carbure AL extra longue, brise copeaux

- Hélice 45°, coupe au centre
- série longue avec brises copeaux
- Idéale pour le fraisage trochoidal
- Revêtement HCR



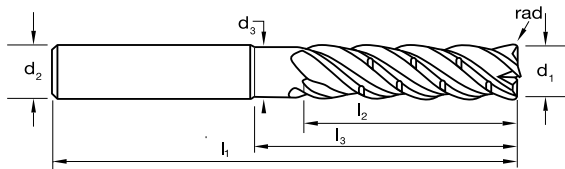
## Fresa metallo duro, 4 taglienti, Extra Lunga, Al, Rompitruciolo

- 45° Elica, Tagliente al centro
- Lunghezza tagliente esteso con rompitruciolo per un'eccellente lavorazione del materiale
- Ideale per lavorazioni in trocoidale
- Rivestimento HCR per supportare alte velocità di taglio



## Fresas de MD, 4 ranuras, R40 AL, extra larga, Torica

- Hélice de 45°, corte frontal
- Longitud de ranura extendida y rompevirutas para un excelente ratio de avance
- Ideal para molienda trocoidal
- El recubrimiento HCR permite excelentes velocidades de alimentación"



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>	Rad	z	Item #	Item #
0600	6.0	100	24	50	6.0	5.70	0.20	4	E663 0600	E664 0600
0800	8.0	100	32	50	8.0	7.70	0.20	4	E663 0800	E664 0800
1000	10.0	100	40	50	10.0	9.50	0.20	4	E663 1000	E664 1000
1200	12.0	100	48	60	12.0	11.50	0.20	4	E663 1200	E664 1200
1600	16.0	125	65	80	16.0	15.30	0.20	4	E663 1600	E664 1600
2000	20.0	150	80	100	20.0	19.30	0.20	4	E663 2000	E664 2000



Catalogue Code	E663	E664
Product Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	HCR	HCR
Sutton Designation	AI - CB	AI - CB
Geometry	R45	R45
Shank Form (DIN 6535)	HA	HB
Shank Tolerance	h6	h6

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								
E663																							●	●	●	●	●	●	●	●																											
E664																							●	●	●	●	●	●	●	●																											

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

● Optimal ○ Effective







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)

Catalogue Code  
Material  
Surface Finish  
Sutton Designation  
Type of Cut: **Slotting**  
**Finishing**  
**Universal**  
**Roughing**  
**Profiling**  
↑  $ap \times \phi$   
↓  $ae \times \phi$

E310		E400 / E401			E402 / E403			E408 / E409			E444			E446 / E447			E478 / E480		
VHM		VHM-ULTRA			VHM-ULTRA			VHM-ULTRA			VHM			VHM			VHM-ULTRA		
Brt		CrN			CrN			CrN			Brt			Brt			Brt		
Al		Al			Al			Al			Al			Al			Al		
•																			
	•																		
		•																	
			•																
				•															
					•														
						•													
							•												
								•											
									•										
1.0	1.5	1.5								0.1	0.1								
1.0	0.25	0.4								0.1	0.05								
Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #	Vc	Feed #
220	8 18 14	200	8 17 13	200	9 18 13	200	18 15	220	3 11 16	220	14 17 19	200	9 18 13	220	8 18 14	350	8 17 13	350	9 18 13
160	8 18 14	350	8 17 13	350	9 18 13	350	18 15	160	3 11 16	160	14 17 19	200	9 18 13	160	14 17 19	200	9 18 13	160	14 17 19
160	8 18 14	350	8 17 13	350	9 18 13	350	18 15	160	3 11 16	160	14 17 19	200	9 18 13	160	14 17 19	200	9 18 13	160	14 17 19
160	8 18 14	350	8 17 13	350	9 18 13	350	18 15	160	3 11 16	160	14 17 19	200	9 18 13	160	14 17 19	200	9 18 13	160	14 17 19
-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -
-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -	-	- - -

Condition: **A** (Annealed), **AH** (Age Hardened), **C** (Cast), **HT** (Hardened & Tempered), **QT** (Quenched & Tempered)  
**Bold** = Optimal | Regular = Effective

### Notes on Milling

- Above values are guidelines for the size and type of cut nominated.
- For long series tools, reduce speed by 40% and feed by 20%.
- For Ramping, reduce speed by and feed by 70%.
- For Ultra High Speeds - high speed/feed balancing & high pressure coolant (50-70 Bar) improves results.

**METRIC ENDMILLS (mm size)**

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

$\phi$	Feed Table (fz) (mm/tooth)																			
	Feed #																			
	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

# Application Guide Speeds & Feeds - Carbide Endmills



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)

Catalogue Code  
Material  
Surface Finish  
Sutton Designation  
Type of Cut: **Slotting**  
**Finishing**  
**Universal**  
**Roughing**  
**Profiling**  
↑ ap × Ø  
↔ ae × Ø

E660		E661		E662		E663		E665	
VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA		VHM-ULTRA	
Brt		Brt		Brt		HCR		HCR	
Al		Al		Al - IK		Al		Al	
•			•			•			•
	•		•				•		•
		•			•		•		•
					•				•
1.0	1.5	1.5		0.5	1.5	0.1		1.0	1.5
1.0	0.25	0.4		1.0	0.25	0.5		1.0	1.0
								1.0	0.25
								0.4	
								1.0	0.25
								0.4	

ISO	VDI <sup>^</sup> 3323	Material	Condition	HB	Vc	Feed #			Vc	Feed #			Vc	Feed #										
N	21	Aluminum & Magnesium - wrought alloy	Non Heat Treatable		60	400-500	16	18	17	400-500	16	18	17	*Up to 2500	15	16	400-500	16	18	17	400-500	16	18	17
	22		Heat Treatable	AH	100	400-530	16	18	17	400-530	16	18	17		15	16	400-530	16	18	17	400-530	16	18	17
	23	Aluminum & Magnesium - cast alloy ≤12% Si	Non Heat Treatable		75	230-360	15	17	16	230-360	15	17	16		14	15	230-360	15	17	16	230-360	15	17	16
	24		Heat Treatable	AH	90	230-360	15	17	16	230-360	15	17	16		14	15	230-360	15	17	16	230-360	15	17	16
	25	Al & Mg - cast alloy >12% Si	Non Heat Treatable		130	230-360	15	17	16	230-360	15	17	16		14	15	230-360	15	17	16	230-360	15	17	16
	26	Copper & Cu alloys (Brass/Bronze)	Free cutting, Pb > 1%		110	100-210	14	16	15	100-210	14	16	15		14	15	100-210	14	16	15	100-210	14	16	15
	27		Brass (CuZn, CuSnZn)		90	100-210	14	16	15	100-210	14	16	15		14	15	100-210	14	16	15	100-210	14	16	15
	28		Bronze (CuSn)		100	100-210	14	16	15	100-210	14	16	15		14	15	100-210	14	16	15	100-210	14	16	15
	29		Non-metallic - Thermosetting & fiber-reinforced plastics			490-600	18	20	19	490-600	18	20	19		15	16	490-600	18	20	19	490-600	18	20	19
	30		Non-metallic - Hard rubber, wood etc.			-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-

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

**Bold** = Optimal | Regular = Effective

### Notes on Milling

- Above values are guidelines for the size and type of cut nominated.
- For long series tools, reduce speed by 40% and feed by 20%.
- For Ramping, reduce speed by and feed by 70%.
- For Ultra High Speeds - high speed/feed balancing & high pressure coolant (50-70 Bar) improves results.

**METRIC ENDMILLS (mm size)**

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

Ø	Feed Table (f <sub>z</sub> ) (mm/tooth)																			
	Feed #																			
	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

E667				E668				E669				E670				E671				E672				E673							
VHM-ULTRA				VHM-ULTRA				VHM-ULTRA				VHM-ULTRA				VHM-ULTRA				VHM-ULTRA				VHM-ULTRA							
HCR				HCR				ASX				ASX				ASX				ASX				ASX							
Al				Al				Al				Al				Al				Al				Al							
•				•				•				•				•				•				•							
•				•				•				•				•				•				•							
•				•				•				•				•				•				•							
0.5	4.0	2.0		1.0	1.5	1.5		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0	
1.0	0.25	0.4		1.0	0.25	0.4		1.0	0.25	0.4		1.0	0.25	0.4		1.0	0.25	0.4		1.0	0.25	0.4		1.0	0.25	0.4		1.0	0.25	0.4	
Vc	Feed #			Vc	Feed #			Vc	Feed #			Vc	Feed #			Vc	Feed #			Vc	Feed #			Vc	Feed #						
400-500	16	18	17	400-500	16	18	17	400-500	16	18	17	400-500	16	18	17	400-500	16	18	17	400-500	16	18	17	400-500	16	18	17	400-500	16	18	17
400-530	16	18	17	400-530	16	18	17	400-530	16	18	17	400-530	16	18	17	400-530	16	18	17	400-530	16	18	17	400-530	16	18	17	400-530	16	18	17
230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16
230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16
230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16	230-360	15	17	16
100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15
100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15
100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15	100-210	14	16	15
490-600	18	20	19	490-600	18	20	19	490-600	18	20	19	490-600	18	20	19	490-600	18	20	19	490-600	18	20	19	490-600	18	20	19	490-600	18	20	19
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**Condition:** A (Annealed), AH (Age Hardened), C (Cast), HT (Hardened & Tempered), QT (Quenched & Tempered)  
**Bold** = Optimal | Regular = Effective

### Notes on Milling

- Above values are guidelines for the size and type of cut nominated.
- For long series tools, reduce speed by 40% and feed by 20%.
- For Ramping, reduce speed by and feed by 70%.
- For Ultra High Speeds - high speed/feed balancing & high pressure coolant (50-70 Bar) improves results.

### METRIC ENDMILLS (mm size)

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

### Feed Table (fz) (mm/tooth)

Ø	Feed #																			
	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

## Regrinding and Recoating Services

### 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

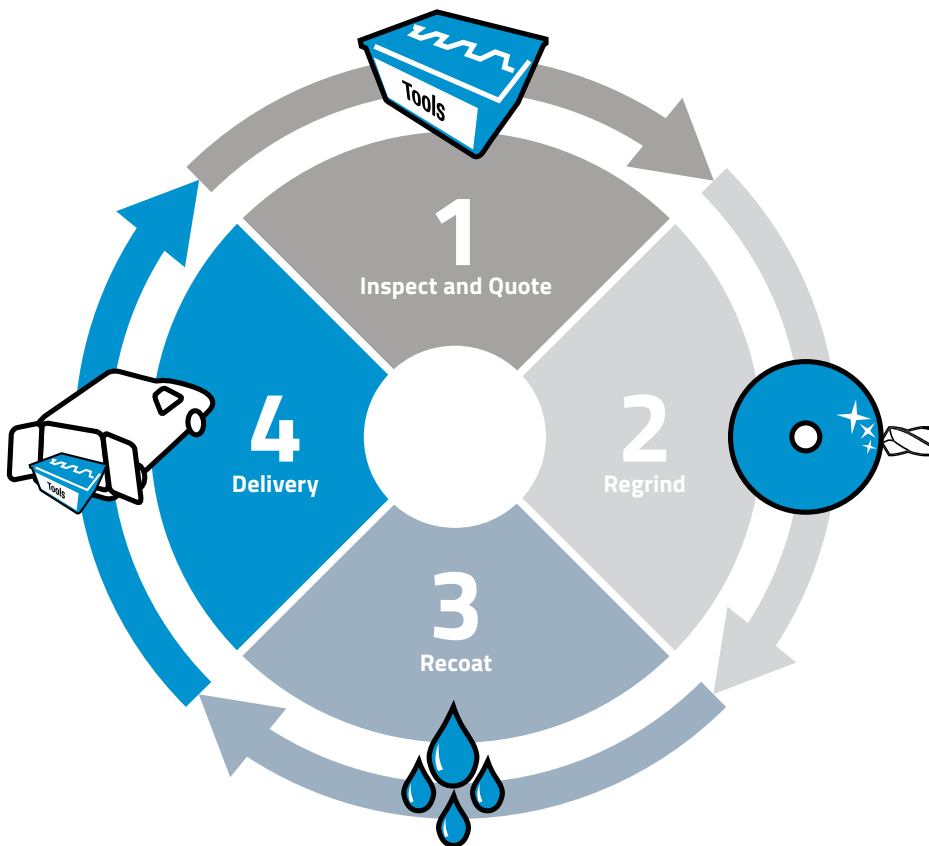
### Recoating

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

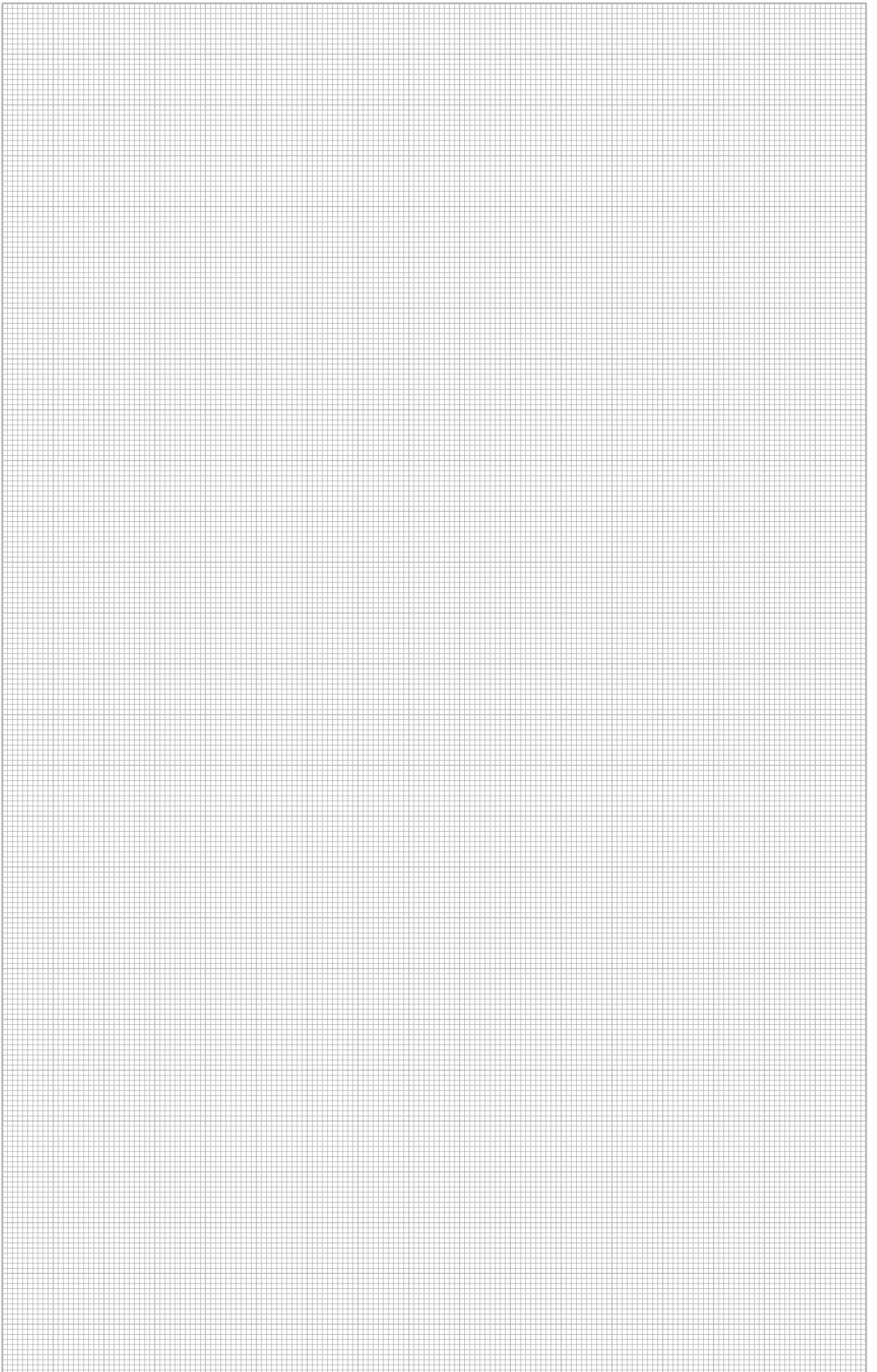
## Tool Regrinding and Recoating Process



## Custom Tools and Modifications

With the 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.





**Sutton Tools Pty Ltd** ABN 12 004 175 731

**Australia (Head Office)**

378 Settlement Road, Thomastown 3074, Victoria Australia

**T** +61 3 9280 0800 **F** +61 3 9464 0015

**Customer Service**

**T** 1800 335 350 **F** 1800 333 127 **E** [cservice@sutton.com.au](mailto:cservice@sutton.com.au)

**Special Sales**

**T** 1800 035 010 **F** 1800 804 084 **E** [specsales@sutton.com.au](mailto:specsales@sutton.com.au)

**Regrinds**

382 Settlement Road, Thomastown 3074, Victoria Australia

**T** (03) 9466 3315 **F** (03) 9464 4871 **E** [regrind@sutton.com.au](mailto:regrind@sutton.com.au)

**The Netherlands** Bruijellestraat 4, 5048 Ae Tilburg, Nederland

**T**+31 13 220 1480 **E** [steurope@sutton.com.au](mailto:steurope@sutton.com.au)

**Global Offices**

**Australasia** Australia (Head Office) ■ New Zealand

**Europe** France ■ The Netherlands

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

499990531.0624

