

Helical

2020 Product Catalog

NEW!

INTERACTIVE PDF

Click on the underlined text



[Tool #PCU80 on pg 144](#)

NEW

End Mills Optimized for High Efficiency Milling in Titanium

Run FASTER. Push HARDER. Machine SMARTER.

Helical

Let Us Impress You

Exceptional, Fully Stocked Tooling

Helical has earned and maintained a reputation as an industry leading manufacturer of high performance carbide end mills. We consistently outperform other manufacturers by offering **extremely high quality, fully stocked cutting tools** at competitive prices, ensuring that you enjoy the best results while maximizing your shop's profitability.

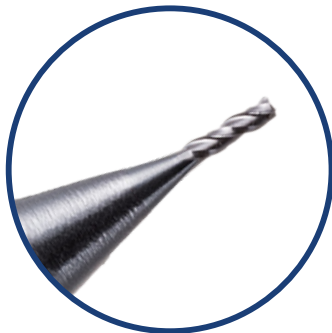
Unbeatable Custom Tool Experience

Helical's Custom-Engineered Solutions Program is designed to give you the best possible custom tool experience from end-to-end. We set ourselves apart with a team of engineers eager to understand every aspect of your project. Within 48 hours, we will return a quote with **expertly crafted geometries designed to produce extraordinary results** in your specific application. We'll then work with you to ensure proper tool setup and running parameters that deliver maximized performance.

Outstanding Technical Expertise

Our team of experienced engineers live and breathe cutting tools and are enthusiastic about maximizing your shop floor productivity. Whether it be in your shop or over the phone, we have **knowledgeable technical field representatives and in-house tool experts** available to help you with tool selection, tool design, application support, and troubleshooting.

Harvey Performance Company combines the leading Harvey Tool, Helical Solutions, and Micro 100 brands to provide world class tooling, unmatched service, and innovative solutions that increase productivity for our customers.



Think Harvey Tool First

More than 23,000 miniature and specialty end mills.
Ship today, in your machine tomorrow.

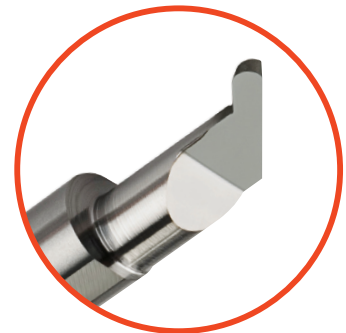
www.harveytool.com



Let Helical Impress You

Material-optimized high performance carbide end mills. Run faster, push harder, machine smarter.

www.helicaltool.com



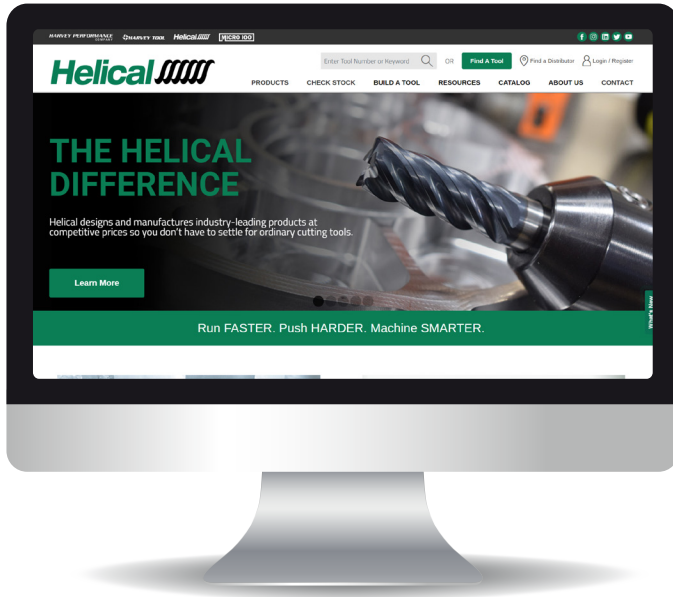
Make More with Micro 100

Exceptional quality turning tools designed for durability and performance in a range of difficult-to-machine materials.

www.micro100.com

A New Helicaltool.com

We're proud to announce the launch of a new Helicaltool.com, your home of the industry's highest performing carbide end mills. Along with an impressive new look, we've created several web tools that will forever change the way you shop for cutting tools (details on [page 182](#)).



The Helical Difference

At Helical, it is our goal to design and manufacture industry-leading products at competitive prices so you don't have to settle for ordinary cutting tools.

Helical end mills are built to last and **excel at aggressive running parameters**, meaning you will experience greatly reduced cycle times, heightened productivity, and superior part finish. This translates directly to savings and efficiencies in your shop, and positively affects your bottom line.

We offer **nearly 4,900 fully stocked tools** optimized for a variety of operations and designed for the unique challenges of non-ferrous and ferrous material groups. If you can't find what you're looking for, consider our custom-engineered solutions program (details on [page 162](#)).

Our Tools Deliver

- ✓ Increased Metal Removal Rates
- ✓ Better Part Finish
- ✓ Extended Tool Life
- ✓ Improved Bottom Line

11 End Mills for Aluminum Alloys & Non-Ferrous Materials



59 End Mills for Steels, High-Temp Alloys, & Titanium



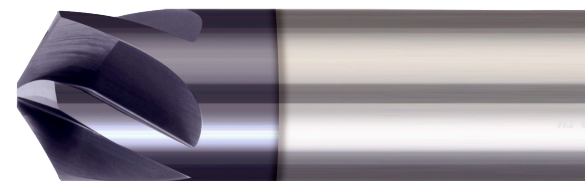
143 End Mills for Titanium - High Efficiency Milling **New!**



147 High Feed End Mills **New!**







153 Chamfer Mills










END MILLS FOR ALUMINUM Aluminum Alloys & Non-Ferrous Materials

ROUGHERS

						PG
	H35ALV-C-3	3 Flute	Corner Radius	35° Helix - Chipbreaker Rougher - Variable Pitch	New Items!	12
	H35ALV-C-RN-3	3 Flute	Corner Radius	35° Helix - Chipbreaker Rghr - Variable Pitch - Reduced Neck	New!	14
	H45AL-C-3	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher		16
	H45AL-C-RN-3	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher - Reduced Neck		17

2 FLUTE





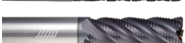

						PG
	HMG-RN-2	2 Flute	Square	High Balance - Reduced Neck		19
	HMG-RN-2	2 Flute	Corner Radius	High Balance - Reduced Neck		20
	H45AL-2	2 Flute	Square	45° Helix		22
	H45AL-2	2 Flute	Ball	45° Helix		24
	H45AL-2	2 Flute	Corner Radius	45° Helix	New!	25
	H45AL-RN-2	2 Flute	Square	45° Helix - Reduced Neck		26
	H45AL-RN-2	2 Flute	Ball	45° Helix - Reduced Neck		27

3 FLUTE







						PG
	HMGC-RN-3	3 Flute	Square	Coolant Through - High Balance - Reduced Neck		29
	HMGC-RN-3	3 Flute	Corner Radius	Coolant Through - High Balance - Reduced Neck		30
	H35AL-3	3 Flute	Square	35° Helix		32
	MH35AL-3	3 Flute	Square	35° Helix	Metric	34
	H35AL-3	3 Flute	Corner Radius	35° Helix		35
	MH35AL-3	3 Flute	Corner Radius	35° Helix	Metric	38
	H35AL-RN-3	3 Flute	Square	35° Helix - Reduced Neck		40
	H40ALV-3	3 Flute	Square	40° Helix - Variable Pitch	New Items!	42
	H40ALV-3	3 Flute	Ball	40° Helix - Variable Pitch	New Items!	44
	H40ALV-3	3 Flute	Corner Radius	40° Helix - Variable Pitch	New Items!	45
	H40ALV-RN-3	3 Flute	Square	40° Helix - Variable Pitch - Reduced Neck	New Items!	48
	H40ALV-RN-3	3 Flute	Ball	40° Helix - Variable Pitch - Reduced Neck	New Items!	50
	H40ALV-RN-3	3 Flute	Corner Radius	40° Helix - Variable Pitch - Reduced Neck		51
	H45AL-3	3 Flute	Square	45° Helix		54
	H45AL-3	3 Flute	Corner Radius	45° Helix		56
	H45AL-RN-3	3 Flute	Square	45° Helix - Reduced Neck		57

Steels, High-Temp Alloys, & Titanium **END MILLS FOR STEELS**









ROUGHERS

						PG
	HSVR-C-4	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	60
	HEV-C-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	63
	HEV-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New!	66
	HEV-C-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	68
	HXVR	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch		70
	HXVR-RN	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch - Reduced Neck		71








3 FLUTE

						PG
	HSV-3	3 Flute	Square	Variable Pitch		74
	HSV-3	3 Flute	Corner Radius	Variable Pitch		75
	HST-3	3 Flute	Ball			77
	HST-3	3 Flute	Corner Radius			78
	HST-RN-3	3 Flute	Ball	Reduced Neck		79
	HST-RN-3	3 Flute	Corner Radius	Reduced Neck		80

4 FLUTE









						PG
	HSV-4	4 Flute	Square	Variable Pitch	New Items!	82
	MHSV-4	4 Flute	Square	Variable Pitch	Metric	84
	HSV-4	4 Flute	Ball	Variable Pitch	New Items!	85
	HSV-4	4 Flute	Corner Radius	Variable Pitch	New Items!	87
	MHSV-4	4 Flute	Corner Radius	Variable Pitch	Metric	92
	HSV-RN-4	4 Flute	Square	Variable Pitch - Reduced Neck		94
	HSV-RN-4	4 Flute	Ball	Variable Pitch - Reduced Neck	New Items!	95
	HSV-RN-4	4 Flute	Corner Radius	Variable Pitch - Reduced Neck		96

5 FLUTE






						PG
	HEV-5	5 Flute	Square	Variable Pitch	New Items!	100
	MHEV-5	5 Flute	Square	Variable Pitch	Metric	102
	HEV-5	5 Flute	Corner Radius	Variable Pitch	New Items!	103
	MHEV-5	5 Flute	Corner Radius	Variable Pitch	Metric	108
	HEV-RN-5	5 Flute	Square	Variable Pitch - Reduced Neck		110
	HEV-RN-5	5 Flute	Corner Radius	Variable Pitch - Reduced Neck		112
	HEF-5	5 Flute	Square	Finisher		116

END MILLS FOR STEELS Steels, High-Temp Alloys, & Titanium (cont.)


6 FLUTE

						PG
	HEV-6	6 Flute	Square	Variable Pitch	New Items!	119
	MHEV-6	6 Flute	Square	Variable Pitch	Metric	120
	HEV-6	6 Flute	Ball	Variable Pitch	New Items!	121
	HEV-6	6 Flute	Corner Radius	Variable Pitch	New Items!	122
	MHEV-6	6 Flute	Corner Radius	Variable Pitch	Metric	125
	HEV-RN-6	6 Flute	Square	Variable Pitch - Reduced Neck	New!	127
	HEV-RN-6	6 Flute	Ball	Variable Pitch - Reduced Neck	New!	128
	HEV-RN-6	6 Flute	Corner Radius	Variable Pitch - Reduced Neck	New!	129

7 FLUTE

						PG
	HEV-7	7 Flute	Square	Variable Pitch	New Items!	131
	MHEV-7	7 Flute	Square	Variable Pitch		132
	HEV-7	7 Flute	Corner Radius	Variable Pitch	New Items!	133
	MHEV-7	7 Flute	Corner Radius	Variable Pitch		135
	HSF-7	7 Flute	Square	Finisher		138

MULTI-FLUTE

						PG
	HXF	Multi-Flute	Corner Radius	Finisher		140

END MILLS FOR TITANIUM

6 FLUTE

						PG
	HVTI-6	6 Flute	Corner Radius	Variable Pitch - For High Efficiency Milling	New!	144

HIGH FEED END MILLS

FOR STEELS UP TO 45 RC

						PG
	HFV	Steels Up to 45 Rc - Variable Pitch - Reduced Neck			New!	148
	MHFV	Steels Up to 45 Rc - Variable Pitch - Reduced Neck			Metric New!	149
	HFVC	Steels Up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck			New!	150
	MHFVC	Steels Up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck			Metric New!	151

CHAMFER MILLS

STRAIGHT FLUTE

PG



HCM 2 & 4 Flute Chamfer Straight Flute

154

HELICAL FLUTE

PG



HPCM 3 & 5 Flute Chamfer Helical Flute - High Performance

New Item!

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TECHNICAL INFORMATION

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New CAM Tool Libraries

Harvey Performance Company works closely with industry-leading CAM software companies to optimize Helical Solutions and Harvey Tool product libraries for their platforms.

CAM Partners



Download Tool Libraries Now

www.harveyperformance.com/tool-libraries

Look for additional industry-leading CAM partners in 2020.

TOOL OFFERING

Material Recommendations

○ = good ● = better ● = best

Our selection of solid carbide end mills gives you countless options for machining in a variety of materials and operations. Choose from different flutes, pitch orientations, and chipbreaker styles to achieve the best performance when slotting, traditional roughing, high efficiency milling, or finishing.

Aluminum & Non-Ferrous Materials (Aluminum Alloys, Copper Alloys, Magnesium Alloys, & Zinc Alloys)						
Product Type	Product Name		Slotting	Traditional Roughing	HEM*	Finishing
Roughers	H35ALV-C-3	3 Flute - 35° Helix - Variable Pitch - Chipbreaker Rougher	●	●	●	
	H45AL-C-3	3 Flute - 45° Helix - Chipbreaker Rougher	○	●	●	
2 Flute	HMG-RN-2	2 Flute - High Balance - Reduced Neck	●	●	○	○
	H45AL-2	2 Flute - 45° Helix	●	●		○
3 Flute	HMGC-RN-3	3 Flute - Coolant Through - High Balance - Reduced Neck	●	●	○	●
	H35AL-3	3 Flute - 35° Helix	●	●	○	●
	H40ALV-3	3 Flute - 40° Helix - Variable Pitch	●	●	●	●
	H45AL-3	3 Flute - 45° Helix	○	○	●	●

Steel (Carbon Steel, Low Alloy Steels, & Tool Steels)						
Product Type	Product Name		Slotting	Traditional Roughing	HEM*	Finishing
Roughers	HSVR-C-4	4 Flute - Chipbreaker Rougher	●	●	●	
	HEV-C-5	5 Flute - Chipbreaker Rougher - Variable Pitch	○	●	●	
	HEV-C-6	6 Flute - Chipbreaker Rougher - Variable Pitch		●	●	
	HEV-C-7	7 Flute - Chipbreaker Rougher - Variable Pitch		●	●	
	HXVR	Multi-Flute - Knuckle Rougher - Variable Pitch	●	●	○	
3 Flute	HSV-3	3 Flute - Variable Pitch	●	●		
	HST-3	3 Flute	●	○		
4 Flute	HSV-4	4 Flute - Variable Pitch	●	●	○	●
5 Flute	HEV-5	5 Flute - Variable Pitch	○	●	●	●
	HEF-5	5 Flute - Finisher		○	●	●
6 Flute	HEV-6	6 Flute - Variable Pitch		○	●	●
7 Flute	HEV-7	7 Flute - Variable Pitch		○	●	●
	HSF-7	7 Flute - Finisher			●	●
Multi-Flute	HXF	Multi-Flute - Finisher			●	●

Stainless Steel						
Product Type	Product Name		Slotting	Traditional Roughing	HEM*	Finishing
Roughers	HSVR-C-4	4 Flute - Chipbreaker Rougher	●	●	●	
	HEV-C-5	5 Flute - Chipbreaker Rougher - Variable Pitch	●	●	●	
	HEV-C-6	6 Flute - Chipbreaker Rougher - Variable Pitch		●	●	
	HEV-C-7	7 Flute - Chipbreaker Rougher - Variable Pitch		●	●	
	HXVR	Multi-Flute - Knuckle Rougher - Variable Pitch	●	●	○	
3 Flute	HSV-3	3 Flute - Variable Pitch	●	●		
	HST-3	3 Flute	●	○		
4 Flute	HSV-4	4 Flute - Variable Pitch	●	●	○	●

*High Efficiency Milling

TOOL OFFERING

Material Recommendations

○ = good ● = better ● = best

Stainless Steel						
Product Type	Product Name		Slotting	Traditional Roughing	HEM*	Finishing
5 Flute	HEV-5	5 Flute - Variable Pitch	●	●	●	●
	HEF-5	5 Flute - Finisher		○	●	●
6 Flute	HEV-6	6 Flute - Variable Pitch		○	●	○
7 Flute	HEV-7	7 Flute - Variable Pitch		○	●	○
	HSF-7	7 Flute - Finisher			●	●
Multi-Flute	HXF	Multi-Flute - Finisher			○	●




Cast Iron						
Product Type	Product Name		Slotting	Traditional Roughing	HEM*	Finishing
Roughers	HSVR-C-4	4 Flute - Chipbreaker Rougher	●	●	○	
	HEV-C-5	5 Flute - Chipbreaker Rougher - Variable Pitch	○	●	●	
	HEV-C-6	6 Flute - Chipbreaker Rougher - Variable Pitch		○	●	
	HEV-C-7	7 Flute - Chipbreaker Rougher - Variable Pitch		○	●	
	HXVR	Multi-Flute - Knuckle Rougher - Variable Pitch	●	●	○	
3 Flute	HSV-3	3 Flute - Variable Pitch	○	○		
	HST-3	3 Flute	○	○		
4 Flute	HSV-4	4 Flute - Variable Pitch	●	●	○	○
5 Flute	HEV-5	5 Flute - Variable Pitch	○	○	●	●
	HEF-5	5 Flute - Finisher		○	●	●
6 Flute	HEV-6	6 Flute - Variable Pitch		○	●	●
7 Flute	HEV-7	7 Flute - Variable Pitch		○	●	●
	HSF-7	7 Flute - Finisher			○	●
Multi-Flute	HXF	Multi-Flute - Finisher			○	●

Exotic Metals (Nickel Alloys, Titanium Alloys, Cobalt Alloys, Molydenum Alloys, & Tungsten Alloys)						
Product Type	Product Name		Slotting	Traditional Roughing	HEM*	Finishing
Roughers	HSVR-C-4	4 Flute - Chipbreaker Rougher	●	●	○	
	HEV-C-5	5 Flute - Chipbreaker Rougher - Variable Pitch	○	●	●	
	HEV-C-6	6 Flute - Chipbreaker Rougher - Variable Pitch		○	●	
	HEV-C-7	7 Flute - Chipbreaker Rougher - Variable Pitch		○	●	
	HXVR	Multi-Flute - Knuckle Rougher - Variable Pitch	○	○	○	
3 Flute	HSV-3	3 Flute - Variable Pitch	●	○		
	HST-3	3 Flute	○	○		
4 Flute	HSV-4	4 Flute - Variable Pitch	●	●	○	○
5 Flute	HEV-5	5 Flute - Variable Pitch	○	○	●	●
	HEF-5	5 Flute - Finisher		○	●	●
6 Flute	HEV-6	6 Flute - Variable Pitch		○	●	○
6 Flute for Ti	HVTI-6	6 Flute - Variable Pitch - For High Efficiency Milling (HEM)			●**	●
7 Flute	HEV-7	7 Flute - Variable Pitch		○	●	○
	HSF-7	7 Flute - Finisher			●	●
Multi-Flute	HXF	Multi-Flute - Finisher			●	●

*High Efficiency Milling **Optimized for Titanium

OUR COATINGS

Standard Coatings

Coating:	<p>Zplus</p> <p>Zplus provides higher hardness, lubricity, and abrasion resistance. While it's specifically engineered for aluminum applications, it is also an optimal coating for other non-ferrous materials. Zplus holds up well in abrasive materials and reduces the chance of built-up-edge in softer, gummy alloys.</p> 	<p>Aplus</p> <p>Aplus allows for high temperature resistance, decreased wear, and improved tool life. Proven to work in high speed machining and dry conditions, these benefits are seen in a wide range of ferrous materials, titanium materials, and exotic alloys.</p> 	<p>Tplus</p> <p>Tplus is an ideal choice for increased wear resistance and longer tool life in rigid, vibration-free machine setups. Tplus excels in a wide variety of ferrous and difficult-to-machine materials including inconel, stainless steel and high hardness materials up to 65 Rc.</p> 
	Max. Usage Temp:	1,110° F	2,012° F
Microhardness (HV 0.05):	2243 (22 GPa)	4079 (40 GPa)	4487 (44 GPa)
Coefficient of Friction:	0.40	0.45	0.35
Coating Color:	light gold / champagne	black / grey	copper
Materials:	Wrought Aluminum, Cast Aluminum, Graphite	Steel, Stainless Steel, Exotic Materials, Titanium	Inconel, Stainless Steel, Hardened Steels, Alloyed Steels

Experience the Benefits of Tplus Coating!

Tplus is an excellent coating choice for use in a wide variety of difficult material families such as Inconel, stainless steel, hardened steels, and other alloyed steels.

Unique features include:

- Higher hardness (44 GPa) for extended tool life
- Increased edge strength for use in difficult, abrasive materials and hardened steels (up to 65 Rc)
- Low coefficient of friction for superior chip flow

As Tplus is an extremely hard coating, it can be greatly beneficial when considering increases in tool life, wear, and heat resistance. Tplus is a high performance coating, and its best performance is achieved with a high quality, rigid machine setup.

Our Tplus coating produces excellent results in steels, high-temp alloys, and high hardness materials up to 65Rc.

END MILLS FOR ALUMINUM

Aluminum Alloys & Non-Ferrous Materials

With proven performance in industry-leading shops, our End Mills for Aluminum are designed with geometries proven to accelerate metal removal rates and achieve a quality finish in aluminum and non-ferrous materials. The end mills in this section are stocked uncoated or with a *Zplus* coating and in 3 helix angles: 35°, 40°, and 45°.



ROUGHERS

PG

new	3 Flute	Corner Radius	35° Helix - Variable Pitch - Chipbreaker Rougher	12
new	3 Flute	Corner Radius	35° Helix - Variable Pitch - Chipbreaker Rougher - Reduced Neck	14
	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher	16
	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher - Reduced Neck	17

2 FLUTE

PG

	2 Flute	Square	High Balance - Reduced Neck	19
	2 Flute	Corner Radius	High Balance - Reduced Neck	20
	2 Flute	Square	45° Helix	22
	2 Flute	Ball	45° Helix	24
new	2 Flute	Corner Radius	45° Helix	25
	2 Flute	Square	45° Helix - Reduced Neck	26
	2 Flute	Ball	45° Helix - Reduced Neck	27

3 FLUTE

PG

	3 Flute	Square	Coolant Through - High Balance - Reduced Neck	29
	3 Flute	Corner Radius	Coolant Through - High Balance - Reduced Neck	30
	3 Flute	Square	35° Helix	32
	3 Flute	Square	35° Helix - Metric	34
	3 Flute	Corner Radius	35° Helix	35
	3 Flute	Corner Radius	35° Helix - Metric	38
	3 Flute	Square	35° Helix - Reduced Neck	40
new	3 Flute	Square	40° Helix - Variable Pitch	42
new	3 Flute	Ball	40° Helix - Variable Pitch	44
new	3 Flute	Corner Radius	40° Helix - Variable Pitch	45
new	3 Flute	Square	40° Helix - Variable Pitch - Reduced Neck	48
new	3 Flute	Ball	40° Helix - Variable Pitch - Reduced Neck	50
	3 Flute	Corner Radius	40° Helix - Variable Pitch - Reduced Neck	51
	3 Flute	Square	45° Helix	54
	3 Flute	Corner Radius	45° Helix	56
	3 Flute	Square	45° Helix - Reduced Neck	57

3 FLUTE - CORNER RADIUS New Items!

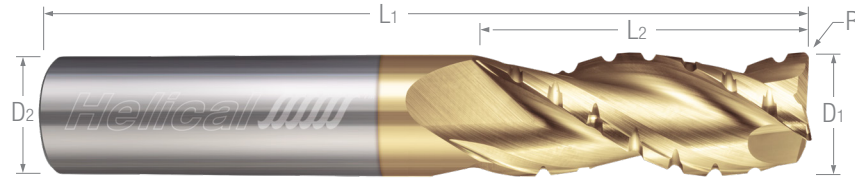


H35ALV-C-3

35° Helix - Variable Pitch - Chipbreaker Rougher

Roughers

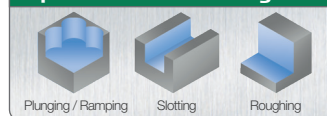
- Engineered with optimized variable pitch and chipbreaker geometry for reduced harmonics and elevated material removal rates
- Unique tool design requires less torque and horsepower
- Unique "3 teeth-to-center" end geometry for ramping applications
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} / _{-0.002"}	Length of Cut L2 ^{+0.032"} / _{-0.000"}	OAL L1 ^{+0.062"} / _{-0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description	
1/8	1/8	.010	1/4	1-1/2	3	82101	82102	H35ALV-C-020-30125-R.010	new
	1/8	.010	3/8	2	3	82103	82104	H35ALV-C-030-30125-R.010	new
	1/8	.010	1/2	2-1/2	3	82105	82106	H35ALV-C-040-30125-R.010	new
3/16	3/16	.010	5/16	2	3	82107	82108	H35ALV-C-016-30187-R.010	new
	3/16	.010	9/16	2-1/2	3	82109	82110	H35ALV-C-030-30187-R.010	new
	3/16	.010	3/4	2-1/2	3	82111	82112	H35ALV-C-040-30187-R.010	new
1/4	1/4	.010	1/2	2-1/2	3	81991	81992	H35ALV-C-020-30250-R.010	
	1/4	.010	3/4	2-1/2	3	81993	81994	H35ALV-C-030-30250-R.010	
	1/4	.010	1	3	3	81995	81996	H35ALV-C-040-30250-R.010	
	1/4	.010	1-1/4	3	3	82113	82114	H35ALV-C-050-30250-R.010	new
	1/4	.015	1/2	2-1/2	3	82115	82116	H35ALV-C-020-30250-R.015	new
	1/4	.015	3/4	2-1/2	3	82117	82118	H35ALV-C-030-30250-R.015	new
	1/4	.020	1/2	2-1/2	3	82119	82120	H35ALV-C-020-30250-R.020	new
	1/4	.020	3/4	2-1/2	3	82121	82122	H35ALV-C-030-30250-R.020	new
	1/4	.030	1/2	2-1/2	3	81997	81998	H35ALV-C-020-30250-R.030	
	1/4	.030	3/4	2-1/2	3	81999	82000	H35ALV-C-030-30250-R.030	
3/8	3/8	.010	1/2	2	3	82123	82124	H35ALV-C-013-30375-R.010	new
	3/8	.010	1	3	3	82125	82126	H35ALV-C-026-30375-R.010	new
	3/8	.010	1-1/4	3-1/2	3	82127	82128	H35ALV-C-033-30375-R.010	new
	3/8	.020	1/2	2	3	82129	82130	H35ALV-C-013-30375-R.020	new
	3/8	.020	1	3	3	82131	82132	H35ALV-C-026-30375-R.020	new
	3/8	.020	1-1/4	3-1/2	3	82133	82134	H35ALV-C-033-30375-R.020	new
	3/8	.030	1/2	2	3	82003	82004	H35ALV-C-013-30375-R.030	
	3/8	.030	1	3	3	82005	82006	H35ALV-C-026-30375-R.030	
	3/8	.030	1-1/4	3-1/2	3	82007	82008	H35ALV-C-033-30375-R.030	
	3/8	.060	1/2	2	3	82009	82010	H35ALV-C-013-30375-R.060	
	3/8	.060	1	3	3	82011	82012	H35ALV-C-026-30375-R.060	
	3/8	.060	1-1/4	3-1/2	3	82013	82014	H35ALV-C-033-30375-R.060	

continued on next page

Speeds & Feeds on Page 15



H35ALV-C-3



New Items!

3 FLUTE - CORNER RADIUS

35° Helix - Variable Pitch - Chipbreaker Rougher (cont.)

continued from previous page

	Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R $\begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	Length of Cut L ₂ $\begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	OAL L ₁ $\begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	Uncoated	Zplus Coated	Tool Description
new	1/2	1/2	.010	5/8	2-1/2	3	82135	82136	H35ALV-C-012-30500-R.010
new		1/2	.010	1	3	3	82137	82138	H35ALV-C-020-30500-R.010
new		1/2	.010	1-1/4	3	3	82139	82140	H35ALV-C-025-30500-R.010
new		1/2	.010	1-5/8	4	3	82141	82142	H35ALV-C-032-30500-R.010
new		1/2	.020	5/8	2-1/2	3	82143	82144	H35ALV-C-012-30500-R.020
new		1/2	.020	1	3	3	82145	82146	H35ALV-C-020-30500-R.020
new		1/2	.020	1-1/4	3	3	82147	82148	H35ALV-C-025-30500-R.020
new		1/2	.020	1-5/8	4	3	82149	82150	H35ALV-C-032-30500-R.020
		1/2	.030	5/8	2-1/2	3	82015	82016	H35ALV-C-012-30500-R.030
		1/2	.030	1	3	3	82017	82018	H35ALV-C-020-30500-R.030
		1/2	.030	1-1/4	3	3	82019	82020	H35ALV-C-025-30500-R.030
		1/2	.030	1-5/8	4	3	82021	82022	H35ALV-C-032-30500-R.030
		1/2	.030	2	4	3	82023	82024	H35ALV-C-040-30500-R.030
new		1/2	.030	2-1/2	5	3	82151	82152	H35ALV-C-050-30500-R.030
		1/2	.060	5/8	2-1/2	3	82025	82026	H35ALV-C-012-30500-R.060
		1/2	.060	1	3	3	82027	82028	H35ALV-C-020-30500-R.060
		1/2	.060	1-1/4	3	3	82029	82030	H35ALV-C-025-30500-R.060
		1/2	.060	1-5/8	4	3	82031	82032	H35ALV-C-032-30500-R.060
	1/2	.060	2	4	3	82033	82034	H35ALV-C-040-30500-R.060	
	5/8	5/8	.030	3/4	3	3	82035	82036	H35ALV-C-012-30625-R.030
		5/8	.030	1-5/8	3-1/2	3	82037	82038	H35ALV-C-026-30625-R.030
		5/8	.060	3/4	3	3	82039	82040	H35ALV-C-012-30625-R.060
		5/8	.060	1-5/8	3-1/2	3	82041	82042	H35ALV-C-026-30625-R.060
new	3/4	3/4	.010	1-5/8	4	3	82153	82154	H35ALV-C-021-30750-R.010
new		3/4	.010	2-1/4	5	3	82155	82156	H35ALV-C-030-30750-R.010
		3/4	.030	1-5/8	4	3	82043	82044	H35ALV-C-021-30750-R.030
		3/4	.030	2-1/4	5	3	82045	82046	H35ALV-C-030-30750-R.030
		3/4	.030	3-1/4	6	3	82047	82048	H35ALV-C-043-30750-R.030
		3/4	.060	1-5/8	4	3	82049	82050	H35ALV-C-021-30750-R.060
		3/4	.060	2-1/4	5	3	82051	82052	H35ALV-C-030-30750-R.060
		3/4	.060	3-1/4	6	3	82053	82054	H35ALV-C-043-30750-R.060
new		3/4	.125	1-5/8	4	3	82157	82158	H35ALV-C-021-30750-R.125
new	3/4	.125	2-1/4	5	3	82159	82160	H35ALV-C-030-30750-R.125	
	1	1	.030	2	5	3	82055	82056	H35ALV-C-020-31000-R.030
		1	.060	2	5	3	82057	82058	H35ALV-C-020-31000-R.060

*.0003 max TIR

3 FLUTE - CORNER RADIUS New!

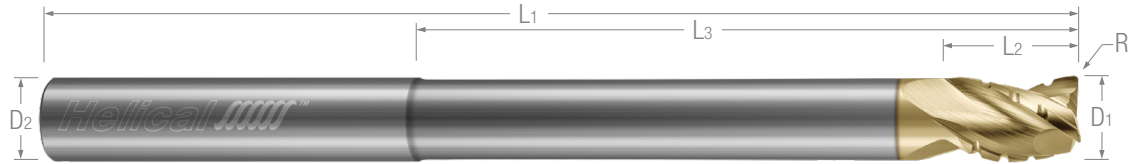


H35ALV-C-RN-3

35° Helix - Variable Pitch - Chipbreaker Rougher - Reduced Neck

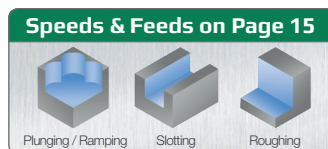
Roughers

- Engineered with optimized variable pitch and chipbreaker geometry for reduced harmonics and elevated material removal rates
- Unique tool design requires less torque and horsepower
- Excellent performance in High Efficiency Milling (HEM)
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.*	Shank Dia.	Corner Radius	Length of Cut	OAL	Reach (LBS)	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description	
D ₁ (h6)	D ₂ (h6)	R ^{+0.002"} / _{-.002"}	L ₂ ^{+0.032"} / _{-.000"}	L ₁ ^{+0.062"} / _{-.062"}	L ₃						
1/4	1/4	.010	3/8	4	1-1/8	.237	3	82161	82162	H35ALV-C-RN-045-30250-R.010	new
	1/4	.010	3/8	4	1-5/8	.237	3	82163	82164	H35ALV-C-RN-065-30250-R.010	new
	1/4	.010	3/8	4	2-1/8	.237	3	82165	82166	H35ALV-C-RN-085-30250-R.010	new
	1/4	.010	3/8	4	2-1/2	.237	3	82167	82168	H35ALV-C-RN-100-30250-R.010	new
3/8	3/8	.030	1/2	4	1-1/8	.356	3	82169	82170	H35ALV-C-RN-030-30375-R.030	new
	3/8	.030	1/2	4	1-5/8	.356	3	82171	82172	H35ALV-C-RN-043-30375-R.030	new
	3/8	.030	1/2	4	2-1/8	.356	3	82173	82174	H35ALV-C-RN-056-30375-R.030	new
	3/8	.030	1/2	5	2-1/2	.356	3	82175	82176	H35ALV-C-RN-066-30375-R.030	new
1/2	1/2	.030	5/8	4	1-3/8	.475	3	82177	82178	H35ALV-C-RN-027-30500-R.030	new
	1/2	.030	5/8	4	1-3/4	.475	3	82179	82180	H35ALV-C-RN-035-30500-R.030	new
	1/2	.030	5/8	4	2-1/4	.475	3	82181	82182	H35ALV-C-RN-045-30500-R.030	new
	1/2	.030	5/8	6	3-3/8	.475	3	82183	82184	H35ALV-C-RN-067-30500-R.030	new
	1/2	.030	5/8	6	4-1/4	.475	3	82185	82186	H35ALV-C-RN-085-30500-R.030	new
	1/2	.060	5/8	4	1-3/8	.475	3	82187	82188	H35ALV-C-RN-027-30500-R.060	new
	1/2	.060	5/8	4	1-3/4	.475	3	82189	82190	H35ALV-C-RN-035-30500-R.060	new
	1/2	.060	5/8	4	2-1/4	.475	3	82191	82192	H35ALV-C-RN-045-30500-R.060	new
	1/2	.060	5/8	6	3-3/8	.475	3	82193	82194	H35ALV-C-RN-067-30500-R.060	new
	1/2	.060	5/8	6	4-1/4	.475	3	82195	82196	H35ALV-C-RN-085-30500-R.060	new
3/4	3/4	.030	1	4	2	.712	3	82197	82198	H35ALV-C-RN-026-30750-R.030	new
	3/4	.030	1	6	2-1/2	.712	3	82199	82200	H35ALV-C-RN-033-30750-R.030	new
	3/4	.030	1	6	3	.712	3	82201	82202	H35ALV-C-RN-040-30750-R.030	new
	3/4	.030	1	6	3-3/8	.712	3	82203	82204	H35ALV-C-RN-045-30750-R.030	new
	3/4	.060	1	4	2	.712	3	82205	82206	H35ALV-C-RN-026-30750-R.060	new
	3/4	.060	1	6	2-1/2	.712	3	82207	82208	H35ALV-C-RN-033-30750-R.060	new
	3/4	.060	1	6	3	.712	3	82209	82210	H35ALV-C-RN-040-30750-R.060	new
	3/4	.060	1	6	3-3/8	.712	3	82211	82212	H35ALV-C-RN-045-30750-R.060	new

* .0003 max TIR



H35ALV-C-3



SPEEDS & FEEDS

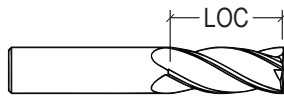
3 Flute - 35° Helix - Variable Pitch - Chipbreaker Rougher

Material Guide		SFM	Inches per Tooth (IPT)													
			1/8		3/16		1/4		3/8		1/2		3/4		1	
			Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0013	.0011	.0020	.0014	.0026	.0021	.0039	.0027	.0051	.0039	.0073	.0050	.0094
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0011	.0021	.0017	.0031	.0022	.0041	.0033	.0061	.0043	.0080	.0061	.0114	.0078	.0145
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0008	.0014	.0011	.0021	.0015	.0028	.0022	.0041	.0029	.0053	.0041	.0076	.0052	.0097

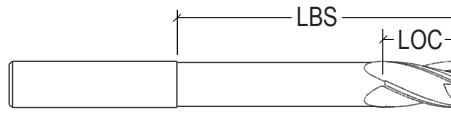
Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	75%-125% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-40% Diameter
	Reached	Up to Max LOC	30%-40% Diameter

NOTES:

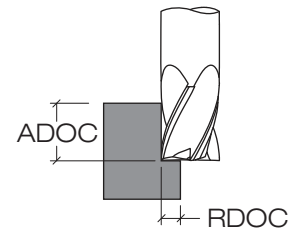
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

Access customized running parameters for your specific setup and material at www.machiningadvisorpro.com



3 FLUTE - CORNER RADIUS

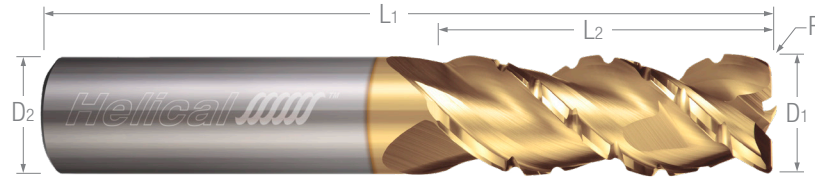


H45AL-C-3

45° Helix - Chipbreaker Rougher

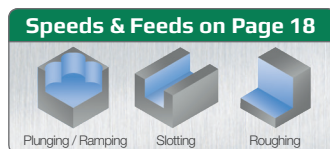
Roughers

- Engineered with high helix and chipbreaker geometry for optimal chip evacuation and a semi-finished surface
- Unique tool design requires less torque and horsepower
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} _{-0.002"}	Length of Cut L2 ^{+0.032"} _{-0.000"}	OAL L1 ^{+0.062"} _{-0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description
1/4	1/4	.020	3/8	2	3	29120	29122	H45AL-C-S-30250-R.020
	1/4	.020	1/2	2-1/2	3	29135	29137	H45AL-C-SR-30250-R.020
	1/4	.020	3/4	2-1/2	3	29150	29152	H45AL-C-R-30250-R.020
	1/4	.020	1	3	3	29165	29167	H45AL-C-M-30250-R.020
	1/4	.020	1-1/4	3	3	29180	29182	H45AL-C-L-30250-R.020
5/16	5/16	.020	1	3	3	29240	29242	H45AL-C-M-30312-R.020
3/8	3/8	.020	1/2	2	3	29285	29287	H45AL-C-S-30375-R.020
	3/8	.020	3/4	2-1/2	3	81305	81306	H45AL-C-SR-30375-R.020
	3/8	.020	1	3	3	29300	29302	H45AL-C-R-30375-R.020
	3/8	.020	1-1/4	3-1/2	3	29315	29317	H45AL-C-M-30375-R.020
	3/8	.020	1-1/2	4	3	29330	29332	H45AL-C-L-30375-R.020
	3/8	.020	2	4	3	29345	29347	H45AL-C-LX-30375-R.020
1/2	1/2	.030	5/8	2-1/2	3	29375	29377	H45AL-C-S-30500-R.030
	1/2	.030	1	3	3	29390	29392	H45AL-C-SR-30500-R.030
	1/2	.030	1-1/4	3	3	29405	29407	H45AL-C-R-30500-R.030
	1/2	.030	1-5/8	4	3	29420	29422	H45AL-C-M-30500-R.030
	1/2	.030	2	4	3	29435	29437	H45AL-C-L-30500-R.030
	1/2	.030	2-1/2	5	3	29450	29452	H45AL-C-LX-30500-R.030
	1/2	.030	3-1/8	6	3	29465	29467	H45AL-C-X-30500-R.030
5/8	5/8	.030	3/4	3	3	29480	29482	H45AL-C-S-30625-R.030
	5/8	.030	1-5/8	3-1/2	3	29495	29497	H45AL-C-R-30625-R.030
	5/8	.030	2-1/8	4	3	29510	29512	H45AL-C-M-30625-R.030
3/4	3/4	.030	1	4	3	29570	29572	H45AL-C-S-30750-R.030
	3/4	.030	1-5/8	4	3	29585	29587	H45AL-C-R-30750-R.030
	3/4	.030	2	4	3	81307	81308	H45AL-C-A-30750-R.030
	3/4	.030	2-1/4	5	3	29600	29602	H45AL-C-M-30750-R.030
	3/4	.030	2-3/4	5	3	81309	81310	H45AL-C-ML-30750-R.030
	3/4	.030	3-1/4	6	3	29615	29617	H45AL-C-L-30750-R.030
1	1	.030	1-1/4	4	3	29645	29647	H45AL-C-S-31000-R.030
	1	.030	2	5	3	29660	29662	H45AL-C-R-31000-R.030
	1	.030	2-5/8	6	3	29675	29677	H45AL-C-M-31000-R.030
	1	.030	3-1/4	6	3	29690	29692	H45AL-C-L-31000-R.030
	1	.030	4-1/8	7	3	29705	29707	H45AL-C-X-31000-R.030

* .0003 max TIR



H45AL-C-RN-3



3 FLUTE - CORNER RADIUS

45° Helix - Chipbreaker Rougher - Reduced Neck

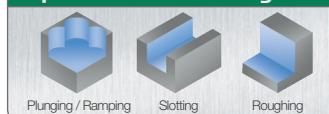
- Engineered with high helix and chipbreaker geometry for optimal chip evacuation and a semi-finished surface
- Unique tool design requires less torque and horsepower
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.*	Shank Dia.	Corner Radius	Length of Cut	OAL	Reach (LBS)	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
D1 (h6)	D2 (h6)	R ^{+0.002"} _{-0.002"}	L2 ^{+0.032"} _{-0.000"}	L1 ^{+0.062"} _{-0.062"}	L3					
1/4	1/4	.020	3/8	4	3/4	.237	3	28105	28107	H45AL-C-RN-S-30250-R.020
	1/4	.020	3/8	4	1-1/8	.237	3	28120	28122	H45AL-C-RN-R-30250-R.020
	1/4	.020	3/8	4	2-1/8	.237	3	28135	28137	H45AL-C-RN-M-30250-R.020
5/16	5/16	.020	7/16	4	1-1/8	.296	3	28165	28167	H45AL-C-RN-R-30312-R.020
	5/16	.020	7/16	4	2-1/8	.296	3	28180	28182	H45AL-C-RN-M-30312-R.020
3/8	3/8	.020	1/2	4	1-1/8	.356	3	28210	28212	H45AL-C-RN-R-30375-R.020
	3/8	.020	1/2	4	2-1/8	.356	3	28225	28227	H45AL-C-RN-M-30375-R.020
1/2	1/2	.030	5/8	4	1-3/8	.475	3	28285	28287	H45AL-C-RN-R-30500-R.030
	1/2	.030	5/8	4	1-3/4	.475	3	81301	81302	H45AL-C-RN-A-30500-R.030
	1/2	.030	5/8	4	2-1/4	.475	3	28300	28302	H45AL-C-RN-M-30500-R.030
	1/2	.030	5/8	6	3-3/8	.475	3	28315	28317	H45AL-C-RN-L-30500-R.030
	1/2	.030	5/8	6	4-1/4	.475	3	28325	28327	H45AL-C-RN-X-30500-R.030
3/4	3/4	.030	1	4	2	.712	3	28405	28407	H45AL-C-RN-R-30750-R.030
	3/4	.030	1	6	2-1/2	.712	3	28420	28422	H45AL-C-RN-M-30750-R.030
	3/4	.030	1	6	3	.712	3	81303	81304	H45AL-C-RN-ML-30750-R.030
	3/4	.030	1	6	3-3/8	.712	3	28435	28437	H45AL-C-RN-L-30750-R.030
	3/4	.030	1	6	4-3/8	.712	3	28445	28447	H45AL-C-RN-X-30750-R.030
1	1	.030	1-1/4	5	2-5/8	.950	3	28465		H45AL-C-RN-R-31000-R.030
	1	.030	1-1/4	6	3-3/8	.950	3	28480		H45AL-C-RN-M-31000-R.030
	1	.030	1-1/4	7	4-3/8	.950	3	28495		H45AL-C-RN-L-31000-R.030

* .0003 max TIR

Speeds & Feeds on Page 18



SPEEDS & FEEDS



H45AL-C-3

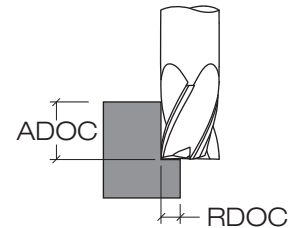
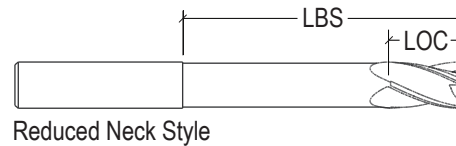
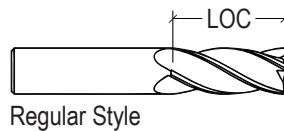
3 Flute - 45° Helix - Chipbreaker Rougher

H45AL-C-3 / H45AL-C-RN-3																
Material Guide		SFM	Inches per Tooth (IPT)													
			1/8		3/16		1/4		3/8		1/2		3/4		1	
			Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0015	.0011	.0022	.0014	.0029	.0021	.0043	.0028	.0056	.0040	.0081	.0051	.0103
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0011	.0023	.0017	.0034	.0022	.0045	.0033	.0067	.0044	.0088	.0062	.0125	.0080	.0160
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn-36Pb3, CuZn10, CuSn5	770	.0008	.0015	.0011	.0023	.0015	.0030	.0022	.0045	.0029	.0059	.0042	.0084	.0053	.0107

Milling Process	ADOC		RDOC
Slot (Full Slotting)	Non-Reached	100%-150% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	100%-150% Diameter	35%-50% Diameter
	Reached	Up to Max LOC	30%-40% Diameter

NOTES:

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

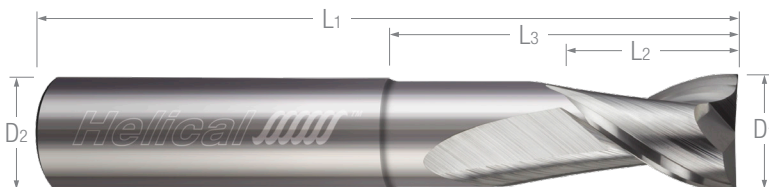
HMG-RN-2



2 FLUTE - SQUARE

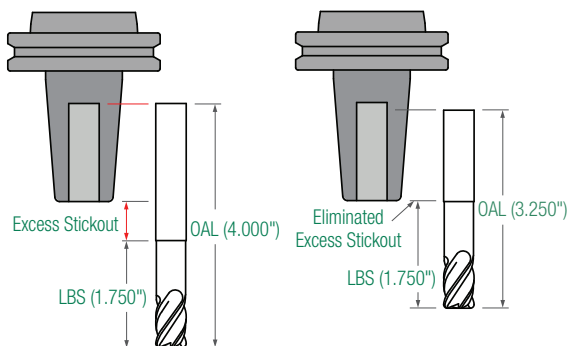
High Balance - Reduced Neck

- Designed for high performance in Makino MAG machining centers capable of elevated RPMs and feed rates
- Precision balanced for high velocity machining in aluminum (up to 33,000 RPM)
- Shank length designed for optimal use in high performance tool holders, providing reduced excess stickout and increased rigidity
- Excellent performance in High Efficiency Milling (HEM)
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- Solid carbide
- CNC ground in the USA



Cutter Dia.*	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Dia.	Flutes	Uncoated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} / _{-0.000"}	L ₁ ^{+0.062"} / _{-0.062"}	L ₃				
3/8	3/8	1/2	2-1/4	1-1/8	.356	2	59968	HMG-RN-030-20375
	3/8	1/2	2-3/4	1-1/2	.356	2	59971	HMG-RN-040-20375
	3/8	1/2	3-1/4	1-3/4	.356	2	59974	HMG-RN-046-20375
	3/8	1/2	3-1/4	2	.356	2	59977	HMG-RN-053-20375
1/2	1/2	5/8	2-3/4	1-3/8	.475	2	59980	HMG-RN-027-20500
	1/2	5/8	3-1/4	1-3/4	.475	2	59983	HMG-RN-035-20500
	1/2	5/8	3-3/4	2	.475	2	59986	HMG-RN-040-20500
	1/2	5/8	3-3/4	2-1/4	.475	2	59989	HMG-RN-045-20500
	1/2	5/8	4-1/4	2-1/2	.475	2	59992	HMG-RN-050-20500
	1/2	5/8	4-1/4	2-3/4	.475	2	59995	HMG-RN-055-20500
	1/2	5/8	4-3/4	3	.475	2	59998	HMG-RN-060-20500
3/4	3/4	1	4	2	.712	2	60001	HMG-RN-026-20750
	3/4	1	4-1/2	2-1/2	.712	2	60004	HMG-RN-033-20750
	3/4	1	5	3	.712	2	60007	HMG-RN-040-20750
	3/4	1	5	3-3/8	.712	2	60010	HMG-RN-045-20750
1	1	1-1/4	4-1/4	2-3/8	.950	2	60013	HMG-RN-023-21000
	1	1-1/4	4-1/4	2-5/8	.950	2	60016	HMG-RN-026-21000
	1	1-1/4	4-3/4	3	.950	2	60019	HMG-RN-030-21000

*.0003 max TIR



Shank length designed for optimal use in high performance tool holders, providing reduced excess stickout and increased rigidity.

Speeds & Feeds on Page 21

Plunging / Ramping Slotting Roughing Finishing

2 Flute

2 FLUTE - CORNER RADIUS

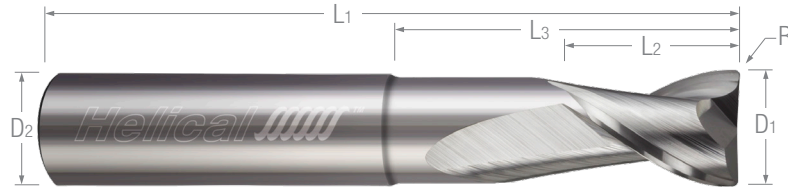


HMG-RN-2

High Balance - Reduced Neck

- Designed for high performance in Makino MAG machining centers capable of elevated RPMs and feed rates
- Precision balanced for high velocity machining in aluminum (up to 33,000 RPM)
- Shank length designed for optimal use in high performance tool holders, providing reduced excess stickout and increased rigidity
- Excellent performance in High Efficiency Milling (HEM)
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- Solid carbide
- CNC ground in the USA

See page 19 for shank length benefits



Cutter Dia.* D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R ^{+0.02"} _{-0.02"}	LOC L2 ^{+0.032"} _{-0.000"}	OAL L1 ^{+0.062"} _{-0.062"}	Reach (LBS) L3	Neck Dia.	Flutes	Uncoated	Tool Description
3/8	3/8	.030	1/2	2-1/4	1-1/8	.356	2	59969	HMG-RN-030-20375-R.030
	3/8	.030	1/2	2-3/4	1-1/2	.356	2	59972	HMG-RN-040-20375-R.030
	3/8	.030	1/2	3-1/4	1-3/4	.356	2	59975	HMG-RN-046-20375-R.030
	3/8	.030	1/2	3-1/4	2	.356	2	59978	HMG-RN-053-20375-R.030
	3/8	.060	1/2	2-1/4	1-1/8	.356	2	59970	HMG-RN-030-20375-R.060
	3/8	.060	1/2	2-3/4	1-1/2	.356	2	59973	HMG-RN-040-20375-R.060
	3/8	.060	1/2	3-1/4	1-3/4	.356	2	59976	HMG-RN-046-20375-R.060
	3/8	.060	1/2	3-1/4	2	.356	2	59979	HMG-RN-053-20375-R.060
1/2	1/2	.030	5/8	2-3/4	1-3/8	.475	2	59981	HMG-RN-027-20500-R.030
	1/2	.030	5/8	3-1/4	1-3/4	.475	2	59984	HMG-RN-035-20500-R.030
	1/2	.030	5/8	3-3/4	2	.475	2	59987	HMG-RN-040-20500-R.030
	1/2	.030	5/8	3-3/4	2-1/4	.475	2	59990	HMG-RN-045-20500-R.030
	1/2	.030	5/8	4-1/4	2-1/2	.475	2	59993	HMG-RN-050-20500-R.030
	1/2	.030	5/8	4-1/4	2-3/4	.475	2	59996	HMG-RN-055-20500-R.030
	1/2	.030	5/8	4-3/4	3	.475	2	59999	HMG-RN-060-20500-R.030
	1/2	.060	5/8	2-3/4	1-3/8	.475	2	59982	HMG-RN-027-20500-R.060
	1/2	.060	5/8	3-1/4	1-3/4	.475	2	59985	HMG-RN-035-20500-R.060
	1/2	.060	5/8	3-3/4	2	.475	2	59988	HMG-RN-040-20500-R.060
	1/2	.060	5/8	3-3/4	2-1/4	.475	2	59991	HMG-RN-045-20500-R.060
	1/2	.060	5/8	4-1/4	2-1/2	.475	2	59994	HMG-RN-050-20500-R.060
3/4	3/4	.030	1	4	2	.712	2	60002	HMG-RN-026-20750-R.030
	3/4	.030	1	4-1/2	2-1/2	.712	2	60005	HMG-RN-033-20750-R.030
	3/4	.030	1	5	3	.712	2	60008	HMG-RN-040-20750-R.030
	3/4	.030	1	5	3-3/8	.712	2	60011	HMG-RN-045-20750-R.030
	3/4	.060	1	4	2	.712	2	60003	HMG-RN-026-20750-R.060
	3/4	.060	1	4-1/2	2-1/2	.712	2	60006	HMG-RN-033-20750-R.060
	3/4	.060	1	5	3	.712	2	60009	HMG-RN-040-20750-R.060
	3/4	.060	1	5	3-3/8	.712	2	60012	HMG-RN-045-20750-R.060
1	1	.030	1-1/4	4-1/4	2-3/8	.950	2	60014	HMG-RN-023-21000-R.030
	1	.030	1-1/4	4-1/4	2-5/8	.950	2	60017	HMG-RN-026-21000-R.030
	1	.030	1-1/4	4-3/4	3	.950	2	60020	HMG-RN-030-21000-R.030
	1	.060	1-1/4	4-1/4	2-3/8	.950	2	60015	HMG-RN-023-21000-R.060
	1	.060	1-1/4	4-1/4	2-5/8	.950	2	60018	HMG-RN-026-21000-R.060
	1	.060	1-1/4	4-3/4	3	.950	2	60021	HMG-RN-030-21000-R.060

*.0003 max TIR

Speeds & Feeds on Page 21

Plunging / Ramping Slotting Roughing Finishing

HMG-RN-2



SPEEDS & FEEDS

2 Flute - High Balance - Reduced Neck

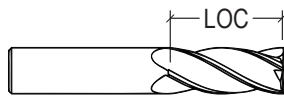
Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0015	.0016	.0011	.0022	.0018	.0014	.0029	.0021	.0021	.0043	.0024	.0028	.0056	.0028	.0040	.0081	.0033	.0051	.0103	.0041
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0011	.0023	.0020	.0017	.0034	.0023	.0022	.0045	.0026	.0033	.0067	.0030	.0044	.0087	.0035	.0062	.0125	.0042	.0079	.0160	.0051
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0008	.0015	.0017	.0011	.0023	.0019	.0015	.0030	.0021	.0022	.0045	.0024	.0029	.0059	.0028	.0042	.0084	.0034	.0053	.0107	.0041

2 Flute

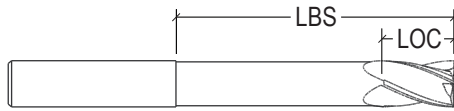
Milling Process	ADOC	RDOC
Slot (Full Slotting)	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Up to Max LOC	35%-50% Diameter
Fin (Finishing)	Up to Max LOC	4%-6% Diameter

NOTES:

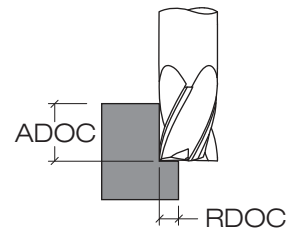
IPT values shown are for 4xD reach tools, and should be adjusted for longer or shorter reaches. For tools with reaches greater than 4xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



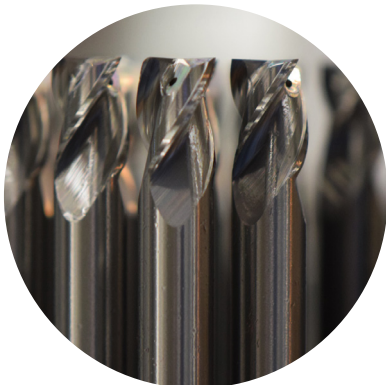
Regular Style



Reduced Neck Style



Key: LOC=Length of Cut ADOC=Axial Depth of Cut RDOC=Radial Depth of Cut



How to Maximize High Balance End Mills

Tool unbalance is a key contributor to machining vibration and poor surface finish. Learn how Helical's High Balance End Mills, optimized for Makino MAG machining centers, work to ensure a smoother machining operation even at high spindle speeds in our "In the Loupe" blog post **How to Maximize High Balance End Mills**.

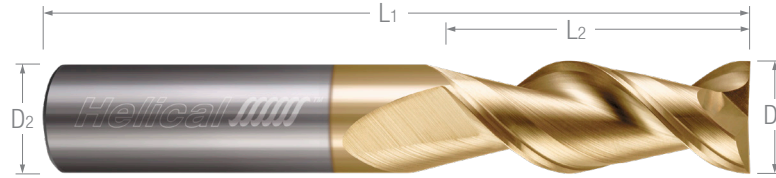
[Read more on helical.blog/intheloupe](http://helical.blog/intheloupe)

2 FLUTE - SQUARE

H45AL-2

45° Helix

- Designed with a high helix for improved part finish and shearing action
- High helix for increased part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA




Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D1 (h6)	D2 (h6)	L2 ^{+0.032"} _{-.000"}	L1 ^{+0.062"} _{-.062"}				
1/8	1/8	1/4	1-1/2	2	00015	00017	H45AL-S-20125
	1/8	3/8	2	2	00030	00032	H45AL-SR-20125
	1/8	1/2	2-1/2	2	00045	00047	H45AL-R-20125
	1/8	3/4	2-1/2	2	00060	00062	H45AL-L-20125
3/16	3/16	5/16	2	2	00090	00092	H45AL-S-20187
	3/16	9/16	2-1/2	2	00105	00107	H45AL-R-20187
	3/16	3/4	2-1/2	2	00120	00122	H45AL-M-20187
	3/16	1	2-1/2	2	81311	81312	H45AL-ML-20187
1/4	1/4	3/8	2	2	00150	00152	H45AL-S-20250
	1/4	1/2	2-1/2	2	00155	00157	H45AL-SR-20250
	1/4	3/4	2-1/2	2	00165	00167	H45AL-R-20250
	1/4	1	3	2	00180	00182	H45AL-M-20250
	1/4	1-1/4	3	2	00195	00197	H45AL-L-20250
	1/4	1-3/4	4	2	00210	00212	H45AL-X-20250
5/16	5/16	7/16	2	2	00240	00242	H45AL-S-20312
	5/16	13/16	2-1/2	2	00255	00257	H45AL-R-20312
	5/16	1	3	2	00270	00272	H45AL-M-20312
	5/16	1-1/4	3	2	00285	00287	H45AL-L-20312
	5/16	2-1/8	4	2	00300		H45AL-X-20312
3/8	3/8	1/2	2	2	00330	00332	H45AL-S-20375
	3/8	3/4	2-1/2	2	81313	81314	H45AL-SR-20375
	3/8	1	3	2	00345	00347	H45AL-R-20375
	3/8	1-1/4	3-1/2	2	00360	00362	H45AL-M-20375
	3/8	1-1/2	4	2	00375	00377	H45AL-L-20375
	3/8	2	4	2	00390	00392	H45AL-LX-20375
	3/8	2-1/2	5	2	00405	00407	H45AL-X-20375


* .0003 max TIR

continued on next page


Speeds & Feeds on Page 28




Plunging / Ramping



Slotting



Roughing



Finishing

H45AL-2

2 FLUTE - SQUARE

45° Helix (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} _{-0.000"}	L ₁ ^{+0.062"} _{-0.062"}				
1/2	1/2	5/8	2-1/2	2	00435	00437	H45AL-S-20500
	1/2	1	3	2	00450	00452	H45AL-SR-20500
	1/2	1-1/4	3	2	00465	00467	H45AL-R-20500
	1/2	1-5/8	4	2	00480	00482	H45AL-M-20500
	1/2	2	4	2	00495	00497	H45AL-L-20500
	1/2	2-1/2	5	2	00510	00512	H45AL-LX-20500
	1/2	3-1/8	6	2	00525	00527	H45AL-X-20500
5/8	5/8	3/4	3	2	00555		H45AL-S-20625
	5/8	1-5/8	3-1/2	2	00570	00572	H45AL-R-20625
	5/8	2-1/8	4	2	00585		H45AL-M-20625
	5/8	2-1/2	5	2	00600	00602	H45AL-L-20625
	5/8	3-3/4	6	2	00615		H45AL-X-20625
3/4	3/4	1	4	2	00645	00647	H45AL-S-20750
	3/4	1-5/8	4	2	00660	00662	H45AL-R-20750
	3/4	2	5	2	81315	81316	H45AL-A-20750
	3/4	2-1/4	5	2	00675	00677	H45AL-M-20750
	3/4	3-1/4	6	2	00690	00692	H45AL-L-20750
	3/4	4	7	2	00705	00707	H45AL-X-20750
1	1	2	5	2	00750		H45AL-R-21000
	1	2-5/8	6	2	00765		H45AL-M-21000
	1	3-1/4	6	2	00780		H45AL-L-21000
	1	4-1/8	7	2	00795		H45AL-X-21000

* .0003 max TIR

Access customized running parameters for your specific setup and material at www.machiningadvisorpro.com

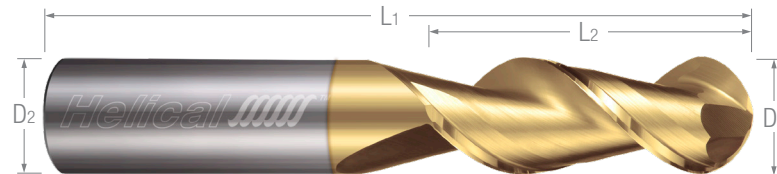


2 FLUTE - BALL

H45AL-2

45° Helix

- Designed with a high helix for improved part finish and shearing action
- High helix for increased part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
					D ₁ (h6)	D ₂ (h6)	
1/8	1/8	1/4	1-1/2	2	17015	17017	H45AL-S-20125-BN
	1/8	3/8	2	2	17030	17032	H45AL-SR-20125-BN
	1/8	1/2	2-1/2	2	17045	17047	H45AL-R-20125-BN
	1/8	3/4	2-1/2	2	81317	81318	H45AL-L-20125-BN
3/16	3/16	5/16	2	2	17090	17092	H45AL-S-20187-BN
	3/16	9/16	2-1/2	2	17105	17107	H45AL-R-20187-BN
	3/16	3/4	2-1/2	2	81319	81320	H45AL-M-20187-BN
1/4	1/4	3/8	2	2	17150	17152	H45AL-S-20250-BN
	1/4	1/2	2-1/2	2	17155	17157	H45AL-SR-20250-BN
	1/4	3/4	2-1/2	2	17165	17167	H45AL-R-20250-BN
	1/4	1	3	2	81321	81322	H45AL-M-20250-BN
5/16	5/16	7/16	2	2	17240	17242	H45AL-S-20312-BN
	5/16	13/16	2-1/2	2	17255	17257	H45AL-R-20312-BN
3/8	3/8	1/2	2	2	17330	17332	H45AL-S-20375-BN
	3/8	1	3	2	17345	17347	H45AL-R-20375-BN
	3/8	1-1/2	3-1/2	2	81323	81324	H45AL-L-20375-BN
1/2	1/2	5/8	2-1/2	2	17435	17437	H45AL-S-20500-BN
	1/2	1	3	2	81325	81326	H45AL-SR-20500-BN
	1/2	1-1/4	3	2	17465	17467	H45AL-R-20500-BN
5/8	5/8	3/4	3	2	17555	17557	H45AL-S-20625-BN
3/4	3/4	1	4	2	17645	17647	H45AL-S-20750-BN
	3/4	1-5/8	4	2	17660	17662	H45AL-R-20750-BN
1	1	2	5	2	17750	17752	H45AL-R-21000-BN

* .0003 max TIR

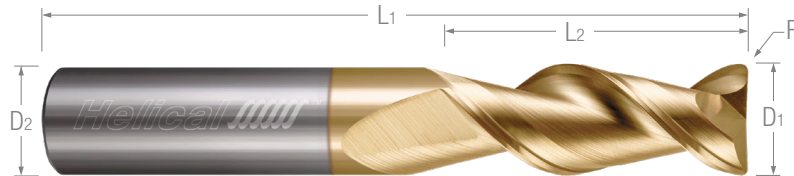
Speeds & Feeds on Page 28



H45AL-2

New! 2 FLUTE - CORNER RADIUS
 45° Helix

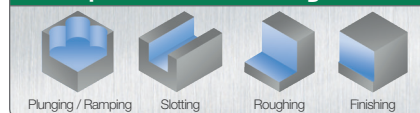
- Designed with a high helix for improved part finish and shearing action
- High helix for increased part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



	Cutter Dia*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
	D ₁ (h6)	D ₂ (h6)	R ^{+0.02"} _{-0.02"}	L ₂ ^{+0.02"} _{-0.00"}	L ₁ ^{+0.02"} _{-0.02"}				
new	1/8	1/8	.010	3/8	2	2	82329	82330	H45AL-SR-20125-R.010
new		1/8	.010	1/2	2-1/2	2	82331	82332	H45AL-R-20125-R.010
new		1/8	.010	3/4	2-1/2	2	82333	82334	H45AL-L-20125-R.010
new	3/16	3/16	.010	5/16	2	2	82335	82336	H45AL-S-20187-R.010
new		3/16	.010	9/16	2-1/2	2	82337	82338	H45AL-R-20187-R.010
new		3/16	.010	3/4	2-1/2	2	82339	82340	H45AL-M-20187-R.010
new	1/4	1/4	.010	1/2	2-1/2	2	82341	82342	H45AL-SR-20250-R.010
new		1/4	.010	3/4	2-1/2	2	82343	82344	H45AL-R-20250-R.010
new		1/4	.010	1	3	2	82345	82346	H45AL-M-20250-R.010
new		1/4	.030	1/2	2-1/2	2	82347	82348	H45AL-SR-20250-R.030
new		1/4	.030	3/4	2-1/2	2	82349	82350	H45AL-R-20250-R.030
new		1/4	.030	1	3	2	82351	82352	H45AL-M-20250-R.030
new	3/8	3/8	.030	1/2	2	2	82353	82354	H45AL-S-20375-R.030
new		3/8	.030	1	3	2	82355	82356	H45AL-R-20375-R.030
new		3/8	.030	1-1/4	3-1/2	2	82357	82358	H45AL-M-20375-R.030
new		3/8	.060	1/2	2	2	82359	82360	H45AL-S-20375-R.060
new		3/8	.060	1	3	2	82361	82362	H45AL-R-20375-R.060
new		3/8	.060	1-1/4	3-1/2	2	82363	82364	H45AL-M-20375-R.060
new	1/2	1/2	.030	1	3	2	82365	82366	H45AL-SR-20500-R.030
new		1/2	.030	1-1/4	3	2	82367	82368	H45AL-R-20500-R.030
new		1/2	.030	1-5/8	4	2	82369	82370	H45AL-M-20500-R.030
new		1/2	.030	2	4	2	82371	82372	H45AL-L-20500-R.030
new		1/2	.060	1	3	2	82373	82374	H45AL-SR-20500-R.060
new		1/2	.060	1-1/4	3	2	82375	82376	H45AL-R-20500-R.060
new		1/2	.060	1-5/8	4	2	82377	82378	H45AL-M-20500-R.060
new		1/2	.060	2	4	2	82379	82380	H45AL-L-20500-R.060
new	3/4	3/4	.030	1-5/8	4	2	82381	82382	H45AL-R-20750-R.030
new		3/4	.030	2-1/4	5	2	82383	82384	H45AL-M-20750-R.030
new		3/4	.060	1-5/8	4	2	82385	82386	H45AL-R-20750-R.060
new		3/4	.060	2-1/4	5	2	82387	82388	H45AL-M-20750-R.060

* .0003 max TIR

Speeds & Feeds on Page 28



2 FLUTE - SQUARE

H45AL-RN-2

45° Helix - Reduced Neck

- Designed with a high helix for improved part finish and shearing action
- High helix for increased part finish and shearing action
- Cylindrically ground to maintain edge strength
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



2 Flute

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} _{-0.000"}	OAL L ₁ ^{+0.062"} _{-0.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	3	1/2	.118	2	02015	02017	H45AL-RN-R-20125
	1/8	5/32	3	3/4	.118	2	02030	02032	H45AL-RN-M-20125
	1/8	5/32	3	1	.118	2	81327	81328	H45AL-RN-L-20125
3/16	3/16	7/32	3	1/2	.178	2	02060	02062	H45AL-RN-R-20187
	3/16	7/32	3	3/4	.178	2	02075	02077	H45AL-RN-M-20187
	3/16	7/32	3	1	.178	2	81329	81330	H45AL-RN-ML-20187
1/4	1/4	3/8	4	3/4	.237	2	02105	02107	H45AL-RN-S-20250
	1/4	3/8	4	1-1/8	.237	2	02120	02122	H45AL-RN-R-20250
	1/4	3/8	4	1-5/8	.237	2	81331	81332	H45AL-RN-A-20250
	1/4	3/8	4	2-1/8	.237	2	02135	02137	H45AL-RN-M-20250
	1/4	3/8	4	2-1/2	.237	2	81333	81334	H45AL-RN-ML-20250
5/16	5/16	7/16	4	1-1/8	.296	2	02165		H45AL-RN-R-20312
	5/16	7/16	4	2-1/8	.296	2	02180		H45AL-RN-M-20312
	5/16	7/16	6	3-1/8	.296	2	02190		H45AL-RN-L-20312
3/8	3/8	1/2	4	1-1/8	.356	2	02210	02212	H45AL-RN-R-20375
	3/8	1/2	4	1-5/8	.356	2	81335	81336	H45AL-RN-A-20375
	3/8	1/2	4	2-1/8	.356	2	02225	02227	H45AL-RN-M-20375
	3/8	1/2	5	2-1/2	.356	2	81337	81338	H45AL-RN-ML-20375
	3/8	1/2	6	3-1/8	.356	2	02235	02237	H45AL-RN-L-20375
	3/8	1/2	6	4	.356	2	02245	02247	H45AL-RN-X-20375
1/2	1/2	5/8	4	1-3/8	.475	2	02285	02287	H45AL-RN-R-20500
	1/2	5/8	4	1-3/4	.475	2	81339	81340	H45AL-RN-A-20500
	1/2	5/8	4	2-1/4	.475	2	02300	02302	H45AL-RN-M-20500
	1/2	5/8	4-1/2	2-3/4	.475	2	81341	81342	H45AL-RN-ML-20500
	1/2	5/8	6	3-3/8	.475	2	02315	02317	H45AL-RN-L-20500
	1/2	5/8	6	4-1/4	.475	2	02325	02327	H45AL-RN-X-20500
5/8	5/8	3/4	4	1-5/8	.593	2	02345		H45AL-RN-R-20625
3/4	3/4	1	4	2	.712	2	02405		H45AL-RN-R-20750
	3/4	1	6	2-1/2	.712	2	02420	02422	H45AL-RN-M-20750
	3/4	1	6	3-3/8	.712	2	02435	02437	H45AL-RN-L-20750
	3/4	1	6	4-3/8	.712	2	02445		H45AL-RN-X-20750
1	1	1-1/4	5	2-5/8	.950	2	02465		H45AL-RN-R-21000
	1	1-1/4	6	3-3/8	.950	2	02480		H45AL-RN-M-21000
	1	1-1/4	7	4-3/8	.950	2	02495		H45AL-RN-L-21000

* .0003 max TIR

Speeds & Feeds on Page 28

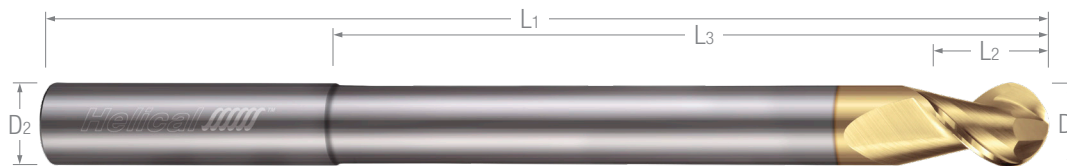
Plunging / Ramping Slotting Roughing Finishing

H45AL-RN-2

2 FLUTE - BALL

45° Helix - Reduced Neck

- Designed with a high helix for improved part finish and shearing action
- High helix for increased part finish and shearing action
- Cylindrically ground to maintain edge strength
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA








2 Flute

Cutter Dia.* D1 (h6)	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	3	1/2	.118	2	18015	18017	H45AL-RN-R-20125-BN
	1/8	5/32	3	3/4	.118	2	18030	18032	H45AL-RN-M-20125-BN
	1/8	5/32	3	1	.118	2	81343	81344	H45AL-RN-L-20125-BN
3/16	3/16	7/32	3	1/2	.178	2	18060	18062	H45AL-RN-R-20187-BN
	3/16	7/32	3	3/4	.178	2	18075	18077	H45AL-RN-M-20187-BN
	3/16	7/32	3	1	.178	2	81345	81346	H45AL-RN-ML-20187-BN
1/4	1/4	3/8	4	3/4	.237	2	18105	18107	H45AL-RN-S-20250-BN
	1/4	3/8	4	1-1/8	.237	2	18120	18122	H45AL-RN-R-20250-BN
	1/4	3/8	4	1-5/8	.237	2	81347	81348	H45AL-RN-A-20250-BN
	1/4	3/8	4	2-1/8	.237	2	18135	18137	H45AL-RN-M-20250-BN
	1/4	3/8	4	2-1/2	.237	2	81349	81350	H45AL-RN-ML-20250-BN
5/16	5/16	7/16	4	1-1/8	.296	2	18165	18167	H45AL-RN-R-20312-BN
	5/16	7/16	4	2-1/8	.296	2	18180		H45AL-RN-M-20312-BN
	5/16	7/16	6	3-1/8	.296	2	18190		H45AL-RN-L-20312-BN
3/8	3/8	1/2	4	1-1/8	.356	2	18210	18212	H45AL-RN-R-20375-BN
	3/8	1/2	4	1-5/8	.356	2	81351	81352	H45AL-RN-A-20375-BN
	3/8	1/2	4	2-1/8	.356	2	18225	18227	H45AL-RN-M-20375-BN
	3/8	1/2	5	2-1/2	.356	2	81353	81354	H45AL-RN-ML-20375-BN
	3/8	1/2	6	3-1/8	.356	2	18235	18237	H45AL-RN-L-20375-BN
	3/8	1/2	6	4	.356	2	18245	18247	H45AL-RN-X-20375-BN
1/2	1/2	5/8	4	1-3/8	.475	2	18285	18287	H45AL-RN-R-20500-BN
	1/2	5/8	4	1-3/4	.475	2	81355	81356	H45AL-RN-A-20500-BN
	1/2	5/8	4	2-1/4	.475	2	18300	18302	H45AL-RN-M-20500-BN
	1/2	5/8	4-1/2	2-3/4	.475	2	81357	81358	H45AL-RN-ML-20500-BN
	1/2	5/8	6	3-3/8	.475	2	18315	18317	H45AL-RN-L-20500-BN
	1/2	5/8	6	4-1/4	.475	2	18325	18327	H45AL-RN-X-20500-BN
3/4	3/4	1	4	2	.712	2	18405		H45AL-RN-R-20750-BN
	3/4	1	6	2-1/2	.712	2	18420	18422	H45AL-RN-M-20750-BN
	3/4	1	6	3-3/8	.712	2	18435	18437	H45AL-RN-L-20750-BN
	3/4	1	6	4-3/8	.712	2	18445		H45AL-RN-X-20750-BN
1	1	1-1/4	5	2-5/8	.950	2	18465		H45AL-RN-R-21000-BN
	1	1-1/4	6	3-3/8	.950	2	18480		H45AL-RN-M-21000-BN
	1	1-1/4	7	4-3/8	.950	2	18495		H45AL-RN-L-21000-BN

* .0003 max TIR

Speeds & Feeds on Page 28

Plunging / Ramping
Slotting
Roughing
Finishing
3D Milling

SPEEDS & FEEDS

H45AL-2

2 Flute - 45° Helix

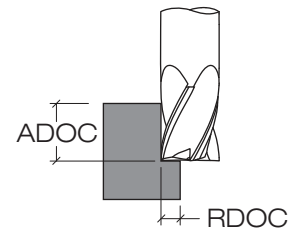
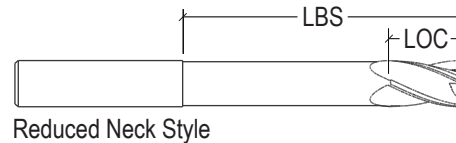
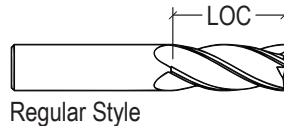
2 Flute

Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0014	.0018	.0010	.0021	.0021	.0014	.0028	.0023	.0020	.0042	.0027	.0027	.0055	.0032	.0038	.0078	.0037	.0048	.0100	.0045
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0011	.0023	.0023	.0016	.0033	.0026	.0022	.0044	.0029	.0032	.0066	.0034	.0042	.0086	.0039	.0060	.0124	.0047	.0077	.0157	.0057
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0007	.0015	.0019	.0011	.0022	.0021	.0014	.0029	.0024	.0021	.0044	.0027	.0028	.0057	.0032	.0040	.0082	.0038	.0051	.0104	.0047

Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	Up to 200% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-50% Diameter
	Reached	Up to Max LOC	30%-50% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

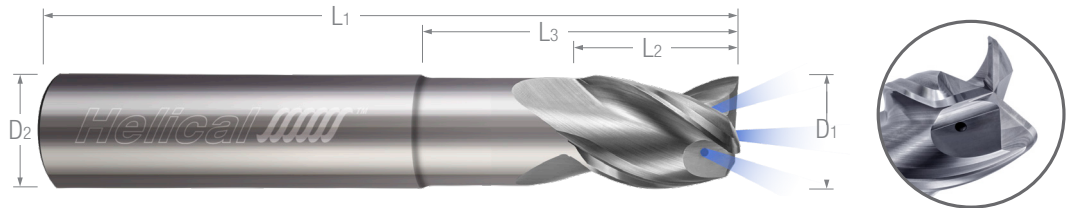
HMGC-RN-3



3 FLUTE - SQUARE

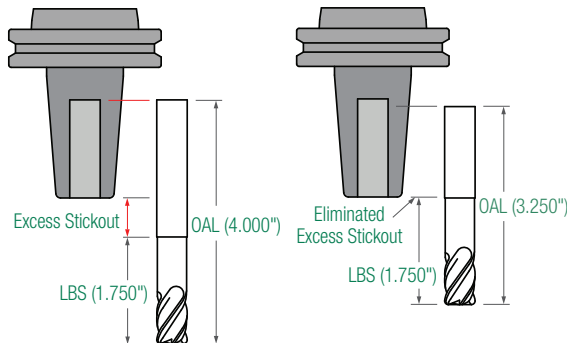
Coolant Through - High Balance - Reduced Neck

- Designed for high performance in Makino MAG machining centers capable of elevated RPMs and feed rates
- Precision balanced for high velocity machining in aluminum (up to 33,000 RPM)
- Shank length designed for optimal use in high performance tool holders, providing reduced excess stickout and increased rigidity
- Excellent performance in High Efficiency Milling (HEM)
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased MRR
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- h6 shank tolerance for high precision tool holders
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D1 (h6)	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} _{-0.000"}	Overall Length L1 ^{+0.062"} _{-0.062"}	Reach (LBS) L3	Neck Dia.	Flutes	Uncoated	Tool Description
3/8	3/8	1/2	2-1/4	1-1/8	.356	3	60022	HMGC-RN-030-30375
	3/8	1/2	2-3/4	1-1/2	.356	3	60025	HMGC-RN-040-30375
	3/8	1/2	3-1/4	1-3/4	.356	3	60028	HMGC-RN-046-30375
	3/8	1/2	3-1/4	2	.356	3	60031	HMGC-RN-053-30375
1/2	1/2	5/8	2-3/4	1-3/8	.475	3	60034	HMGC-RN-027-30500
	1/2	5/8	3-1/4	1-3/4	.475	3	60037	HMGC-RN-035-30500
	1/2	5/8	3-3/4	2	.475	3	60040	HMGC-RN-040-30500
	1/2	5/8	3-3/4	2-1/4	.475	3	60043	HMGC-RN-045-30500
	1/2	5/8	4-1/4	2-1/2	.475	3	60046	HMGC-RN-050-30500
	1/2	5/8	4-1/4	2-3/4	.475	3	60049	HMGC-RN-055-30500
	1/2	5/8	4-3/4	3	.475	3	60052	HMGC-RN-060-30500
3/4	3/4	1	4	2	.712	3	60055	HMGC-RN-026-30750
	3/4	1	4-1/2	2-1/2	.712	3	60058	HMGC-RN-033-30750
	3/4	1	5	3	.712	3	60061	HMGC-RN-040-30750
	3/4	1	5	3-3/8	.712	3	60064	HMGC-RN-045-30750
1	1	1-1/4	4-1/4	2-3/8	.950	3	60067	HMGC-RN-023-31000
	1	1-1/4	4-1/4	2-5/8	.950	3	60070	HMGC-RN-026-31000
	1	1-1/4	4-3/4	3	.950	3	60073	HMGC-RN-030-31000

* .0003 max TIR



Shank length designed for optimal use in high performance tool holders, providing reduced excess stickout and increased rigidity.

Speeds & Feeds on Page 31

3 FLUTE - CORNER RADIUS

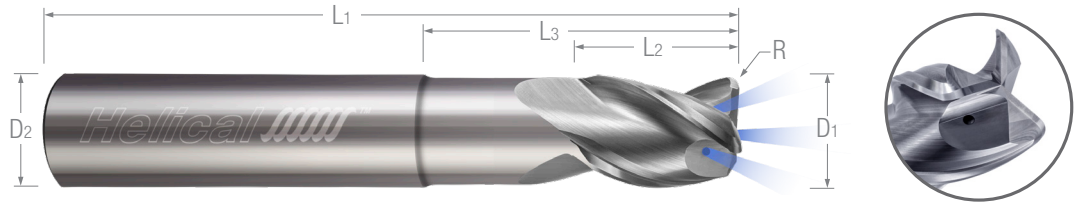


HMGC-RN-3

Coolant Through - High Balance - Reduced Neck

- Designed for high performance in Makino MAG machining centers capable of elevated RPMs and feed rates
- Precision balanced for high velocity machining in aluminum (up to 33,000 RPM)
- Shank length designed for optimal use in high performance tool holders, providing reduced excess stickout and increased rigidity
- Excellent performance in High Efficiency Milling (HEM)
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased MRR
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- h6 shank tolerance for high precision tool holders
- Solid carbide
- CNC ground in the USA

See page 29 for shank length benefits



3 Flute

Cutter Dia.* D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R ^{+0.02"} / _{-0.02"}	LOC L2 ^{+0.32"} / _{-0.00"}	OAL L1 ^{+0.62"} / _{-0.62"}	Reach (LBS) L3	Neck Dia.	Flutes	Uncoated	Tool Description
3/8	3/8	.030	1/2	2-1/4	1-1/8	.356	3	60023	HMGC-RN-030-30375-R.030
	3/8	.030	1/2	2-3/4	1-1/2	.356	3	60026	HMGC-RN-040-30375-R.030
	3/8	.030	1/2	3-1/4	1-3/4	.356	3	60029	HMGC-RN-046-30375-R.030
	3/8	.030	1/2	3-1/4	2	.356	3	60032	HMGC-RN-053-30375-R.030
	3/8	.060	1/2	2-1/4	1-1/8	.356	3	60024	HMGC-RN-030-30375-R.060
	3/8	.060	1/2	2-3/4	1-1/2	.356	3	60027	HMGC-RN-040-30375-R.060
	3/8	.060	1/2	3-1/4	1-3/4	.356	3	60030	HMGC-RN-046-30375-R.060
	3/8	.060	1/2	3-1/4	2	.356	3	60033	HMGC-RN-053-30375-R.060
1/2	1/2	.030	5/8	2-3/4	1-3/8	.475	3	60035	HMGC-RN-027-30500-R.030
	1/2	.030	5/8	3-1/4	1-3/4	.475	3	60038	HMGC-RN-035-30500-R.030
	1/2	.030	5/8	3-3/4	2	.475	3	60041	HMGC-RN-040-30500-R.030
	1/2	.030	5/8	3-3/4	2-1/4	.475	3	60044	HMGC-RN-045-30500-R.030
	1/2	.030	5/8	4-1/4	2-1/2	.475	3	60047	HMGC-RN-050-30500-R.030
	1/2	.030	5/8	4-1/4	2-3/4	.475	3	60050	HMGC-RN-055-30500-R.030
	1/2	.030	5/8	4-3/4	3	.475	3	60053	HMGC-RN-060-30500-R.030
	1/2	.060	5/8	2-3/4	1-3/8	.475	3	60036	HMGC-RN-027-30500-R.060
	1/2	.060	5/8	3-1/4	1-3/4	.475	3	60039	HMGC-RN-035-30500-R.060
	1/2	.060	5/8	3-3/4	2	.475	3	60042	HMGC-RN-040-30500-R.060
	1/2	.060	5/8	3-3/4	2-1/4	.475	3	60045	HMGC-RN-045-30500-R.060
	1/2	.060	5/8	4-1/4	2-1/2	.475	3	60048	HMGC-RN-050-30500-R.060
3/4	3/4	.030	1	4	2	.712	3	60056	HMGC-RN-026-30750-R.030
	3/4	.030	1	4-1/2	2-1/2	.712	3	60059	HMGC-RN-033-30750-R.030
	3/4	.030	1	5	3	.712	3	60062	HMGC-RN-040-30750-R.030
	3/4	.030	1	5	3-3/8	.712	3	60065	HMGC-RN-045-30750-R.030
	3/4	.060	1	4	2	.712	3	60057	HMGC-RN-026-30750-R.060
	3/4	.060	1	4-1/2	2-1/2	.712	3	60060	HMGC-RN-033-30750-R.060
	3/4	.060	1	5	3	.712	3	60063	HMGC-RN-040-30750-R.060
	3/4	.060	1	5	3-3/8	.712	3	60066	HMGC-RN-045-30750-R.060
1	1	.030	1-1/4	4-1/4	2-3/8	.950	3	60068	HMGC-RN-023-31000-R.030
	1	.030	1-1/4	4-1/4	2-5/8	.950	3	60071	HMGC-RN-026-31000-R.030
	1	.030	1-1/4	4-3/4	3	.950	3	60074	HMGC-RN-030-31000-R.030
	1	.060	1-1/4	4-1/4	2-3/8	.950	3	60069	HMGC-RN-023-31000-R.060
	1	.060	1-1/4	4-1/4	2-5/8	.950	3	60072	HMGC-RN-026-31000-R.060
	1	.060	1-1/4	4-3/4	3	.950	3	60075	HMGC-RN-030-31000-R.060

* .0003 max TIR

Speeds & Feeds on Page 31

Plunging / Ramping Slotting Roughing Finishing

HMGC-RN-3



SPEEDS & FEEDS

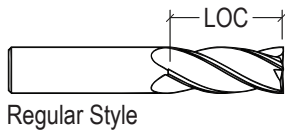
3 Flute - High Balance - Reduced Neck

Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0015	.0016	.0011	.0022	.0018	.0014	.0029	.0021	.0021	.0043	.0024	.0028	.0056	.0028	.0040	.0080	.0033	.0051	.0102	.0040
			.0011	.0023	.0020	.0017	.0034	.0023	.0022	.0045	.0026	.0033	.0066	.0030	.0043	.0087	.0035	.0062	.0124	.0041	.0079	.0158	.0050
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0008	.0015	.0017	.0011	.0023	.0019	.0015	.0030	.0021	.0022	.0044	.0024	.0029	.0058	.0028	.0041	.0083	.0034	.0053	.0106	.0041

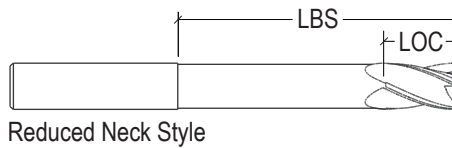
Milling Process	ADOC	RDOC
Slot (Full Slotting)	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Up to Max LOC	35%-50% Diameter
Fin (Finishing)	Up to Max LOC	4%-6% Diameter

NOTES:

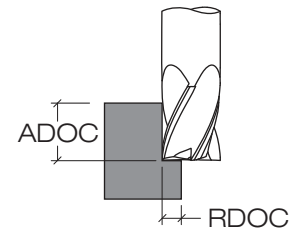
IPT values shown are for 4xD reach tools, and should be adjusted for longer or shorter reaches. For tools with reaches greater than 4xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut ADOC=Axial Depth of Cut RDOC=Radial Depth of Cut

3 Flute

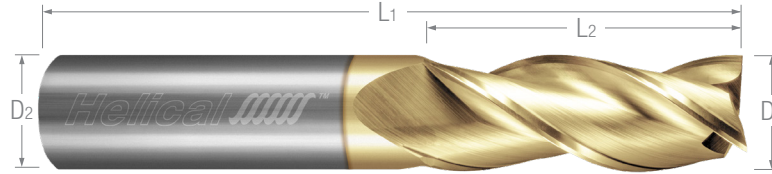
3 FLUTE - SQUARE



H35AL-3

35° Helix

- Designed for tough roughing applications with 3 flutes and 35° helix
- Cylindrically ground to maintain edge strength
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	Flutes	Uncoated	<i>Zplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	3	01015	01017	H35AL-S-30125
	1/8	3/8	2	3	01030	01032	H35AL-SR-30125
	1/8	1/2	2-1/2	3	01045	01047	H35AL-R-30125
	1/8	5/8	2-1/2	3	81359	81360	H35AL-M-30125
	1/8	3/4	2-1/2	3	81361	81362	H35AL-L-30125
3/16	3/16	5/16	2	3	01090	01092	H35AL-S-30187
	3/16	9/16	2-1/2	3	01105	01107	H35AL-R-30187
	3/16	3/4	2-1/2	3	81363	81364	H35AL-M-30187
	3/16	1	2-1/2	3	81365	81366	H35AL-L-30187
1/4	1/4	3/8	2	3	01150	01152	H35AL-S-30250
	1/4	1/2	2-1/2	3	01155	01157	H35AL-SR-30250
	1/4	5/8	2-1/2	3	01165	01167	H35AL-R-30250
	1/4	1	3	3	01180	01182	H35AL-M-30250
	1/4	1-1/4	3	3	01195	01197	H35AL-L-30250
	1/4	1-1/2	3	3	81367	81368	H35AL-LX-30250
	1/4	1-3/4	4	3	81369	81370	H35AL-X-30250
5/16	5/16	7/16	2	3	01240	01242	H35AL-S-30312
	5/16	5/8	2-1/2	3	01255	01257	H35AL-R-30312
	5/16	1	3	3	01270	01272	H35AL-M-30312
	5/16	1-1/4	3	3	01285	01287	H35AL-L-30312
	5/16	2-1/8	4	3	01300	01302	H35AL-X-30312
3/8	3/8	1/2	2	3	01330	01332	H35AL-S-30375
	3/8	3/4	2-1/2	3	81371	81372	H35AL-SR-30375
	3/8	1	3	3	01345	01347	H35AL-R-30375
	3/8	1-1/4	3-1/2	3	01360	01362	H35AL-M-30375
	3/8	1-1/2	4	3	01375	01377	H35AL-L-30375
	3/8	2	4	3	01390	01392	H35AL-LX-30375
	3/8	2-1/2	5	3	01405	01407	H35AL-X-30375

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 41

Plunging / Ramping

Slotting

Roughing

Finishing

3 Flute

H35AL-3



3 FLUTE - SQUARE

35° Helix (cont.)

continued from previous page

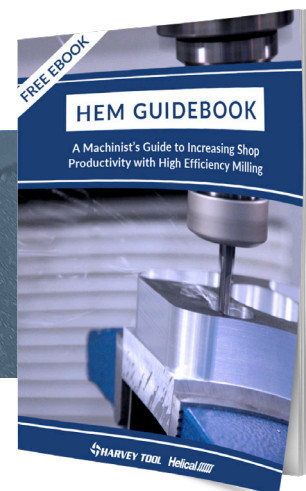
Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} _{-0.000"}	L ₁ ^{+0.062"} _{-0.062"}				
1/2	1/2	5/8	2-1/2	3	01435	01437	H35AL-S-30500
	1/2	1	3	3	01450	01452	H35AL-SR-30500
	1/2	1-1/4	3	3	01465	01467	H35AL-R-30500
	1/2	1-5/8	4	3	01480	01482	H35AL-M-30500
	1/2	2	4	3	01495	01497	H35AL-L-30500
	1/2	2-1/2	5	3	01510	01512	H35AL-LX-30500
	1/2	3-1/8	6	3	01525	01527	H35AL-X-30500
5/8	5/8	3/4	3	3	01555	01557	H35AL-S-30625
	5/8	1-5/8	3-1/2	3	01570	01572	H35AL-R-30625
	5/8	2-1/8	4	3	01585	01587	H35AL-M-30625
	5/8	2-1/2	5	3	01600	01602	H35AL-L-30625
	5/8	3-1/4	6	3	01610	01612	H35AL-LX-30625
	5/8	3-3/4	6	3	01615	01617	H35AL-X-30625
3/4	3/4	1	4	3	01645	01647	H35AL-S-30750
	3/4	1-5/8	4	3	01660	01662	H35AL-R-30750
	3/4	2-1/4	5	3	01675	01677	H35AL-M-30750
	3/4	2-3/4	5	3	81373	81374	H35AL-ML-30750
	3/4	3-1/4	6	3	01690	01692	H35AL-L-30750
	3/4	4	6-1/2	3	01705	01707	H35AL-X-30750
1	1	1-1/4	4	3	01735	01737	H35AL-S-31000
	1	2	5	3	01750	01752	H35AL-R-31000
	1	2-5/8	6	3	01765	01767	H35AL-M-31000
	1	3-1/4	6	3	01780	01782	H35AL-L-31000
	1	4-1/4	7	3	01795	01797	H35AL-X-31000

*.0003 max TIR

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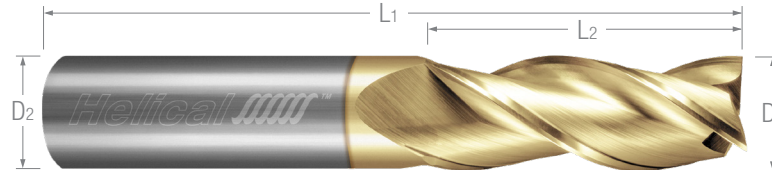


3 FLUTE - SQUARE - METRIC

35° Helix


MH35AL-3
METRIC

- Designed for tough roughing applications with 3 flutes and 35° helix
- Cylindrically ground to maintain edge strength
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.80 mm} _{-.00 mm}	L ₁ ^{+1.60 mm} _{-.160 mm}				
6 mm	6.00 mm	9.00 mm	63 mm	3	59690	59691	MH35AL-015-30600
	6.00 mm	12.00 mm	63 mm	3	59726	59727	MH35AL-020-30600
	6.00 mm	18.00 mm	63 mm	3	59794	59795	MH35AL-030-30600
8 mm	8.00 mm	12.00 mm	63 mm	3	59696	59697	MH35AL-015-30800
	8.00 mm	16.00 mm	63 mm	3	59732	59733	MH35AL-020-30800
	8.00 mm	24.00 mm	75 mm	3	59800	59801	MH35AL-030-30800
10 mm	10.00 mm	15.00 mm	63 mm	3	59702	59703	MH35AL-015-31000
	10.00 mm	20.00 mm	63 mm	3	59738	59739	MH35AL-020-31000
	10.00 mm	25.00 mm	75 mm	3	59766	59767	MH35AL-025-31000
12 mm	12.00 mm	18.00 mm	75 mm	3	59708	59709	MH35AL-015-31200
	12.00 mm	24.00 mm	75 mm	3	59744	59745	MH35AL-020-31200
	12.00 mm	30.00 mm	75 mm	3	59772	59773	MH35AL-025-31200
16 mm	16.00 mm	24.00 mm	89 mm	3	59714	59715	MH35AL-015-31600
	16.00 mm	32.00 mm	89 mm	3	59750	59751	MH35AL-020-31600
	16.00 mm	40.00 mm	89 mm	3	59778	59779	MH35AL-025-31600
20 mm	20.00 mm	30.00 mm	89 mm	3	59720	59721	MH35AL-015-32000
	20.00 mm	40.00 mm	100 mm	3	59756	59757	MH35AL-020-32000
	20.00 mm	50.00 mm	125 mm	3	59784	59785	MH35AL-025-32000
25 mm	25.00 mm	50.00 mm	125 mm	3	59762	59763	MH35AL-020-32500
	25.00 mm	64.00 mm	125 mm	3	59790	59791	MH35AL-025-32500

* .008 mm max TIR

Speeds & Feeds on Page 41



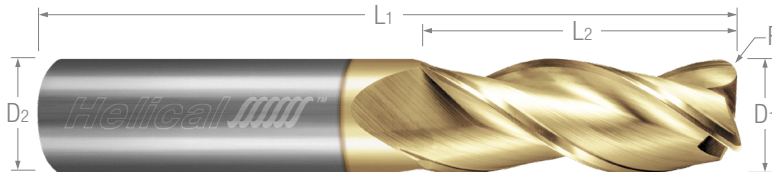
H35AL-3



3 FLUTE - CORNER RADIUS

35° Helix

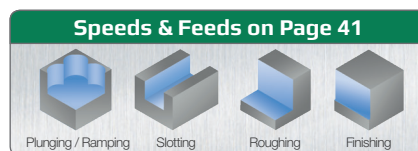
- Designed for tough roughing applications with 3 flutes and 35° helix
- Cylindrically ground to maintain edge strength
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D1 (h6)	D2 (h6)	R ^{+0.002"} _{-0.002"}	L2 ^{+0.032"} _{-0.000"}	L1 ^{+0.062"} _{-0.062"}				
1/8	1/8	.010	1/4	1-1/2	3	59000	59001	H35AL-S-30125-R.010
	1/8	.010	3/8	2	3	59008	59009	H35AL-SR-30125-R.010
	1/8	.015	1/4	1-1/2	3	59002	59003	H35AL-S-30125-R.015
	1/8	.015	3/8	2	3	59010	59011	H35AL-SR-30125-R.015
	1/8	.020	1/4	1-1/2	3	59004	59005	H35AL-S-30125-R.020
	1/8	.020	3/8	2	3	59012	59013	H35AL-SR-30125-R.020
	1/8	.030	1/4	1-1/2	3	59006	59007	H35AL-S-30125-R.030
	1/8	.030	3/8	2	3	59014	59015	H35AL-SR-30125-R.030
3/16	3/16	.010	5/16	2	3	59016	59017	H35AL-S-30187-R.010
	3/16	.010	9/16	2-1/2	3	59024	59025	H35AL-R-30187-R.010
	3/16	.015	5/16	2	3	59018	59019	H35AL-S-30187-R.015
	3/16	.015	9/16	2-1/2	3	59026	59027	H35AL-R-30187-R.015
	3/16	.020	5/16	2	3	59020	59021	H35AL-S-30187-R.020
	3/16	.020	9/16	2-1/2	3	59028	59029	H35AL-R-30187-R.020
	3/16	.030	5/16	2	3	59022	59023	H35AL-S-30187-R.030
	3/16	.030	9/16	2-1/2	3	59030	59031	H35AL-R-30187-R.030
1/4	1/4	.010	3/8	2	3	59032	59033	H35AL-S-30250-R.010
	1/4	.010	5/8	2-1/2	3	59042	59043	H35AL-R-30250-R.010
	1/4	.010	1	3	3	59052	59053	H35AL-M-30250-R.010
	1/4	.015	3/8	2	3	59034	59035	H35AL-S-30250-R.015
	1/4	.015	5/8	2-1/2	3	59044	59045	H35AL-R-30250-R.015
	1/4	.015	1	3	3	59054	59055	H35AL-M-30250-R.015
	1/4	.020	3/8	2	3	59036	59037	H35AL-S-30250-R.020
	1/4	.020	5/8	2-1/2	3	59046	59047	H35AL-R-30250-R.020
	1/4	.020	1	3	3	59056	59057	H35AL-M-30250-R.020
	1/4	.030	3/8	2	3	59038	59039	H35AL-S-30250-R.030
	1/4	.030	5/8	2-1/2	3	59048	59049	H35AL-R-30250-R.030
	1/4	.030	1	3	3	59058	59059	H35AL-M-30250-R.030
	1/4	.060	3/8	2	3	59040	59041	H35AL-S-30250-R.060
	1/4	.060	5/8	2-1/2	3	59050	59051	H35AL-R-30250-R.060
1/4	.060	1	3	3	59060	59061	H35AL-M-30250-R.060	

* .0003 max TIR

continued on next page



3 FLUTE - CORNER RADIUS



H35AL-3

35° Helix (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D1 (h6)	D2 (h6)	R ^{+0.02"} _{-.002"}	L2 ^{+0.032"} _{-.000"}	L1 ^{+0.062"} _{-.062"}				
5/16	5/16	.020	7/16	2	3	59062	59063	H35AL-S-30312-R.020
	5/16	.020	5/8	2-1/2	3	59068	59069	H35AL-R-30312-R.020
	5/16	.020	1	3	3	59074	59075	H35AL-M-30312-R.020
	5/16	.030	7/16	2	3	59064	59065	H35AL-S-30312-R.030
	5/16	.030	5/8	2-1/2	3	59070	59071	H35AL-R-30312-R.030
	5/16	.030	1	3	3	59076	59077	H35AL-M-30312-R.030
	5/16	.060	7/16	2	3	59066	59067	H35AL-S-30312-R.060
	5/16	.060	5/8	2-1/2	3	59072	59073	H35AL-R-30312-R.060
3/8	3/8	.010	1/2	2	3	59080	59081	H35AL-S-30375-R.010
	3/8	.010	1	3	3	59090	59091	H35AL-R-30375-R.010
	3/8	.010	1-1/4	3-1/2	3	59100	59101	H35AL-M-30375-R.010
	3/8	.015	1/2	2	3	59082	59083	H35AL-S-30375-R.015
	3/8	.015	1	3	3	59092	59093	H35AL-R-30375-R.015
	3/8	.015	1-1/4	3-1/2	3	59102	59103	H35AL-M-30375-R.015
	3/8	.020	1/2	2	3	59084	59085	H35AL-S-30375-R.020
	3/8	.020	1	3	3	59094	59095	H35AL-R-30375-R.020
	3/8	.020	1-1/4	3-1/2	3	59104	59105	H35AL-M-30375-R.020
	3/8	.030	1/2	2	3	59086	59087	H35AL-S-30375-R.030
	3/8	.030	1	3	3	59096	59097	H35AL-R-30375-R.030
	3/8	.030	1-1/4	3-1/2	3	59106	59107	H35AL-M-30375-R.030
	3/8	.060	1/2	2	3	59088	59089	H35AL-S-30375-R.060
	3/8	.060	1	3	3	59098	59099	H35AL-R-30375-R.060
3/8	.060	1-1/4	3-1/2	3	59108	59109	H35AL-M-30375-R.060	
1/2	1/2	.010	5/8	2-1/2	3	59110	59111	H35AL-S-30500-R.010
	1/2	.010	1	3	3	59124	59125	H35AL-SR-30500-R.010
	1/2	.010	1-1/4	3	3	59138	59139	H35AL-R-30500-R.010
	1/2	.010	1-5/8	4	3	59152	59153	H35AL-M-30500-R.010
	1/2	.015	5/8	2-1/2	3	59112	59113	H35AL-S-30500-R.015
	1/2	.015	1	3	3	59126	59127	H35AL-SR-30500-R.015
	1/2	.015	1-1/4	3	3	59140	59141	H35AL-R-30500-R.015
	1/2	.015	1-5/8	4	3	59154	59155	H35AL-M-30500-R.015
	1/2	.020	5/8	2-1/2	3	59114	59115	H35AL-S-30500-R.020
	1/2	.020	1	3	3	59128	59129	H35AL-SR-30500-R.020
	1/2	.020	1-1/4	3	3	59142	59143	H35AL-R-30500-R.020
	1/2	.020	1-5/8	4	3	59156	59157	H35AL-M-30500-R.020
	1/2	.030	5/8	2-1/2	3	59116	59117	H35AL-S-30500-R.030
	1/2	.030	1	3	3	59130	59131	H35AL-SR-30500-R.030
	1/2	.030	1-1/4	3	3	59144	59145	H35AL-R-30500-R.030
	1/2	.030	1-5/8	4	3	59158	59159	H35AL-M-30500-R.030
	1/2	.060	5/8	2-1/2	3	59118	59119	H35AL-S-30500-R.060
	1/2	.060	1	3	3	59132	59133	H35AL-SR-30500-R.060
	1/2	.060	1-1/4	3	3	59146	59147	H35AL-R-30500-R.060
	1/2	.060	1-5/8	4	3	59160	59161	H35AL-M-30500-R.060
	1/2	.090	5/8	2-1/2	3	59120	59121	H35AL-S-30500-R.090
	1/2	.090	1	3	3	59134	59135	H35AL-SR-30500-R.090
	1/2	.090	1-1/4	3	3	59148	59149	H35AL-R-30500-R.090
	1/2	.090	1-5/8	4	3	59162	59163	H35AL-M-30500-R.090
1/2	.125	5/8	2-1/2	3	59122	59123	H35AL-S-30500-R.125	
1/2	.125	1	3	3	59136	59137	H35AL-SR-30500-R.125	
1/2	.125	1-1/4	3	3	59150	59151	H35AL-R-30500-R.125	
1/2	.125	1-5/8	4	3	59164	59165	H35AL-M-30500-R.125	

* .0003 max TIR

continued on next page

3 Flute

H35AL-3



3 FLUTE - CORNER RADIUS

35° Helix (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	R ^{+0.002"} _{-.002"}	L ₂ ^{+0.032"} _{-.000"}	L ₁ ^{+0.062"} _{-.062"}				
5/8	5/8	.020	3/4	3	3	59166	59167	H35AL-S-30625-R.020
	5/8	.020	1-5/8	3-1/2	3	59174	59175	H35AL-R-30625-R.020
	5/8	.020	2-1/8	4	3	59182	59183	H35AL-M-30625-R.020
	5/8	.020	2-1/2	5	3	59190	59191	H35AL-L-30625-R.020
	5/8	.030	3/4	3	3	59168	59169	H35AL-S-30625-R.030
	5/8	.030	1-5/8	3-1/2	3	59176	59177	H35AL-R-30625-R.030
	5/8	.030	2-1/8	4	3	59184	59185	H35AL-M-30625-R.030
	5/8	.030	2-1/2	5	3	59192	59193	H35AL-L-30625-R.030
	5/8	.060	3/4	3	3	59170	59171	H35AL-S-30625-R.060
	5/8	.060	1-5/8	3-1/2	3	59178	59179	H35AL-R-30625-R.060
	5/8	.060	2-1/8	4	3	59186	59187	H35AL-M-30625-R.060
	5/8	.060	2-1/2	5	3	59194	59195	H35AL-L-30625-R.060
	5/8	.125	3/4	3	3	59172	59173	H35AL-S-30625-R.125
	5/8	.125	1-5/8	3-1/2	3	59180	59181	H35AL-R-30625-R.125
	5/8	.125	2-1/8	4	3	59188	59189	H35AL-M-30625-R.125
	5/8	.125	2-1/2	5	3	59196	59197	H35AL-L-30625-R.125
3/4	3/4	.030	1-5/8	4	3	59198	59199	H35AL-R-30750-R.030
	3/4	.030	2-1/4	5	3	59210	59211	H35AL-M-30750-R.030
	3/4	.030	3-1/4	6	3	59222	59223	H35AL-L-30750-R.030
	3/4	.060	1-5/8	4	3	59200	59201	H35AL-R-30750-R.060
	3/4	.060	2-1/4	5	3	59212	59213	H35AL-M-30750-R.060
	3/4	.060	3-1/4	6	3	59224	59225	H35AL-L-30750-R.060
	3/4	.090	1-5/8	4	3	59202	59203	H35AL-R-30750-R.090
	3/4	.090	2-1/4	5	3	59214	59215	H35AL-M-30750-R.090
	3/4	.090	3-1/4	6	3	59226	59227	H35AL-L-30750-R.090
	3/4	.125	1-5/8	4	3	59204	59205	H35AL-R-30750-R.125
	3/4	.125	2-1/4	5	3	59216	59217	H35AL-M-30750-R.125
	3/4	.125	3-1/4	6	3	59228	59229	H35AL-L-30750-R.125
	3/4	.190	1-5/8	4	3	59206	59207	H35AL-R-30750-R.190
	3/4	.190	2-1/4	5	3	59218	59219	H35AL-M-30750-R.190
	3/4	.190	3-1/4	6	3	59230	59231	H35AL-L-30750-R.190
	3/4	.250	1-5/8	4	3	59208	59209	H35AL-R-30750-R.250
3/4	.250	2-1/4	5	3	59220	59221	H35AL-M-30750-R.250	
3/4	.250	3-1/4	6	3	59232	59233	H35AL-L-30750-R.250	
1	1	.030	2	5	3	59234	59235	H35AL-R-31000-R.030
	1	.030	3-1/4	6	3	59242	59243	H35AL-L-31000-R.030
	1	.060	2	5	3	59236	59237	H35AL-R-31000-R.060
	1	.060	3-1/4	6	3	59244	59245	H35AL-L-31000-R.060
	1	.125	2	5	3	59238	59239	H35AL-R-31000-R.125
	1	.125	3-1/4	6	3	59246	59247	H35AL-L-31000-R.125
	1	.250	2	5	3	59240	59241	H35AL-R-31000-R.250
	1	.250	3-1/4	6	3	59248	59249	H35AL-L-31000-R.250

*.0003 max TIR

3 FLUTE - CORNER RADIUS - METRIC

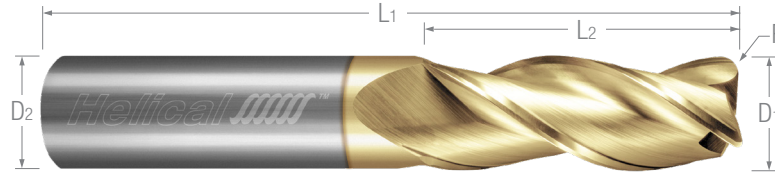


MH35AL-3

METRIC

35° Helix

- Designed for tough roughing applications with 3 flutes and 35° helix
- Cylindrically ground to maintain edge strength
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



3 Flute

Cutter Diameter*	Shank Diameter	Corner Radius	LOC	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	R ^{+0.05 mm} _{-.05 mm}	L ₂ ^{+0.80 mm} _{-.00 mm}	L ₁ ^{+1.60 mm} _{-1.60 mm}				
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	3	59692	59693	MH35AL-015-30600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	3	59728	59729	MH35AL-020-30600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	3	59796	59797	MH35AL-030-30600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	3	59694	59695	MH35AL-015-30600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	3	59730	59731	MH35AL-020-30600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	3	59798	59799	MH35AL-030-30600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	3	59698	59699	MH35AL-015-30800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	3	59734	59735	MH35AL-020-30800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	3	59802	59803	MH35AL-030-30800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	3	59700	59701	MH35AL-015-30800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	3	59736	59737	MH35AL-020-30800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	3	59804	59805	MH35AL-030-30800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	3	59704	59705	MH35AL-015-31000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	3	59740	59741	MH35AL-020-31000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	3	59768	59769	MH35AL-025-31000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	3	59706	59707	MH35AL-015-31000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	3	59742	59743	MH35AL-020-31000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	3	59770	59771	MH35AL-025-31000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	3	59710	59711	MH35AL-015-31200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	3	59746	59747	MH35AL-020-31200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	3	59774	59775	MH35AL-025-31200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	3	59712	59713	MH35AL-015-31200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	3	59748	59749	MH35AL-020-31200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	3	59776	59777	MH35AL-025-31200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	3	59716	59717	MH35AL-015-31600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	3	59752	59753	MH35AL-020-31600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	3	59780	59781	MH35AL-025-31600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	3	59718	59719	MH35AL-015-31600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	3	59754	59755	MH35AL-020-31600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	3	59782	59783	MH35AL-025-31600-R1.00

* .008 mm max TIR

continued on next page

Speeds & Feeds on Page 41

Plunging / Ramping
Slotting
Roughing
Finishing

MH35AL-3**METRIC****3 FLUTE - CORNER RADIUS - METRIC**

35° Helix (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	LOC	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	R ^{+0.05 mm -0.05 mm}	L ₂ ^{+0.80 mm -0.00 mm}	L ₁ ^{+1.60 mm -1.60 mm}				
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	3	59722	59723	MH35AL-015-32000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	3	59758	59759	MH35AL-020-32000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	3	59786	59787	MH35AL-025-32000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	3	59724	59725	MH35AL-015-32000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	3	59760	59761	MH35AL-020-32000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	3	59788	59789	MH35AL-025-32000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	3	59764	59765	MH35AL-020-32500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	3	59792	59793	MH35AL-025-32500-R1.00

*.008 mm max TIR

**The Anatomy of an End Mill**

With how specific part blueprints are, understanding every geometry feature of your tool is pivotal to ensuring your final product is perfect. Get to know the fine details and geometry makeup of an end mill in our “In the Loupe” blog post **The Anatomy of an End Mill**.

[Read more on helical.blog/intheloupe](http://helical.blog/intheloupe)

3 FLUTE - SQUARE



H35AL-RN-3

35° Helix - Reduced Neck

- Designed for tough roughing applications with 3 flutes and 35° helix
- Cylindrically ground to maintain edge strength
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} / _{-.000"}	OAL L ₁ ^{+0.062"} / _{-.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	3	1/2	.118	3	04015	04017	H35AL-RN-R-30125
	1/8	5/32	3	5/8	.118	3	81375	81376	H35AL-RN-A-30125
	1/8	5/32	3	3/4	.118	3	04030	04032	H35AL-RN-M-30125
	1/8	5/32	3	1	.118	3	81377	81378	H35AL-RN-L-30125
3/16	3/16	7/32	3	1/2	.178	3	04060	04062	H35AL-RN-R-30187
	3/16	7/32	3	5/8	.178	3	81379	81380	H35AL-RN-A-30187
	3/16	7/32	3	3/4	.178	3	04075	04077	H35AL-RN-M-30187
	3/16	7/32	3	1	.178	3	81381	81382	H35AL-RN-ML-30187
1/4	1/4	3/8	4	3/4	.237	3	04105	04107	H35AL-RN-S-30250
	1/4	3/8	4	1-1/8	.237	3	04120	04122	H35AL-RN-R-30250
	1/4	3/8	4	1-5/8	.237	3	81383	81384	H35AL-RN-A-30250
	1/4	3/8	4	2-1/8	.237	3	04135	04137	H35AL-RN-M-30250
	1/4	3/8	4	2-1/2	.237	3	81385	81386	H35AL-RN-ML-30250
5/16	5/16	7/16	4	1-1/8	.296	3	04165	04167	H35AL-RN-R-30312
	5/16	7/16	4	2-1/8	.296	3	04180	04182	H35AL-RN-M-30312
	5/16	7/16	6	3-1/8	.296	3	04190	04192	H35AL-RN-L-30312
	5/16	7/16	6	4	.296	3	04200	04202	H35AL-RN-X-30312
3/8	3/8	1/2	4	1-1/8	.356	3	04210	04212	H35AL-RN-R-30375
	3/8	1/2	4	1-5/8	.356	3	81387	81388	H35AL-RN-A-30375
	3/8	1/2	4	2-1/8	.356	3	04225	04227	H35AL-RN-M-30375
	3/8	1/2	5	2-1/2	.356	3	81389	81390	H35AL-RN-ML-30375
	3/8	1/2	6	3-1/8	.356	3	04235	04237	H35AL-RN-L-30375
	3/8	1/2	6	4	.356	3	04245	04247	H35AL-RN-X-30375
1/2	1/2	5/8	4	1-3/8	.475	3	04285	04287	H35AL-RN-R-30500
	1/2	5/8	4	1-3/4	.475	3	81391	81392	H35AL-RN-A-30500
	1/2	5/8	4	2-1/4	.475	3	04300	04302	H35AL-RN-M-30500
	1/2	5/8	4-1/2	2-3/4	.475	3	81393	81394	H35AL-RN-ML-30500
	1/2	5/8	6	3-3/8	.475	3	04315	04317	H35AL-RN-L-30500
	1/2	5/8	6	4-1/4	.475	3	04325	04327	H35AL-RN-X-30500
5/8	5/8	3/4	4	1-5/8	.593	3	04345	04347	H35AL-RN-R-30625
	5/8	3/4	6	2-3/8	.593	3	04360	04362	H35AL-RN-M-30625
	5/8	3/4	6	3-3/8	.593	3	04375	04377	H35AL-RN-L-30625

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 41

Plunging / Ramping

Slotting

Roughing

Finishing

H35AL-3



SPEEDS & FEEDS

3 Flute - 35° Helix (cont.)

continued from previous page

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
3/4	3/4	1	4	2	.712	3	04405	04407	H35AL-RN-R-30750
	3/4	1	6	2-1/2	.712	3	04420	04422	H35AL-RN-M-30750
	3/4	1	6	2-7/8	.712	3	81395	81396	H35AL-RN-ML-30750
	3/4	1	6	3-3/8	.712	3	04435	04437	H35AL-RN-L-30750
	3/4	1	6	4-3/8	.712	3	04445	04447	H35AL-RN-X-30750
1	1	1-1/4	5	2-5/8	.950	3	04465		H35AL-RN-R-31000
	1	1-1/4	6	3-3/8	.950	3	04480		H35AL-RN-M-31000
	1	1-1/4	7	4-3/8	.950	3	04495		H35AL-RN-L-31000

*.0003 max TIR

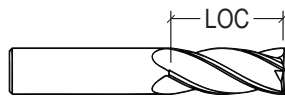
H35AL-3 / H35AL-RN-3

Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0013	.0016	.0011	.0019	.0018	.0014	.0026	.0020	.0021	.0038	.0023	.0027	.0050	.0027	.0039	.0072	.0033	.0050	.0091	.0039
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0011	.0020	.0020	.0017	.0030	.0022	.0022	.0040	.0025	.0033	.0059	.0029	.0043	.0078	.0034	.0061	.0111	.0040	.0078	.0142	.0049
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0008	.0014	.0016	.0011	.0020	.0018	.0015	.0027	.0021	.0022	.0040	.0024	.0029	.0052	.0028	.0041	.0074	.0033	.0052	.0095	.0040

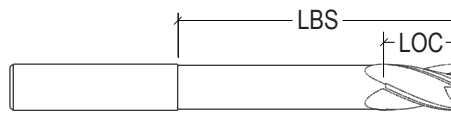
Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	75%-125% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-40% Diameter
	Reached	Up to Max LOC	30%-40% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

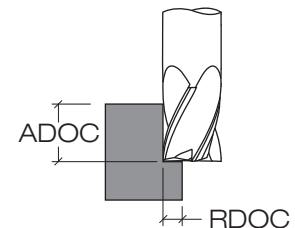
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

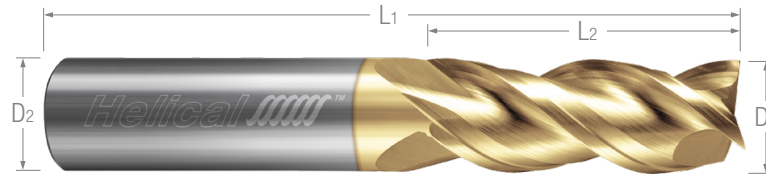
3 FLUTE - SQUARE New Items!



H40ALV-3

40° Helix - Variable Pitch

- Designed with a specialized combination of features for excellent performance in roughing and finishing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- Wiper flat design leaves superior floor finish
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Uncoated tool offers an excellent option for aluminum finishing applications
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	Flutes	Uncoated	<i>Zplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	3	48000	48001	H40ALV-S-30125
	1/8	3/8	2	3	48010	48011	H40ALV-SR-30125
	1/8	1/2	2-1/2	3	48020	48021	H40ALV-R-30125
	1/8	5/8	2-1/2	3	82389	82390	H40ALV-M-30125 new
	1/8	3/4	2-1/2	3	81397	81398	H40ALV-L-30125
3/16	3/16	3/8	2	3	48030	48031	H40ALV-S-30187
	3/16	3/4	2-1/2	3	48045	48046	H40ALV-R-30187
	3/16	1	3	3	48060	48061	H40ALV-M-30187
	3/16	1-3/8	3	3	82391	82392	H40ALV-L-30187 new
1/4	1/4	3/8	2	3	48075	48076	H40ALV-S-30250
	1/4	1/2	2	3	81399	81400	H40ALV-SR-30250
	1/4	3/4	2-1/2	3	48115	48116	H40ALV-R-30250
	1/4	1	3	3	48135	48136	H40ALV-M-30250
	1/4	1-1/4	3	3	81401	81402	H40ALV-L-30250
	1/4	1-1/2	3	3	81403	81404	H40ALV-LX-30250
5/16	5/16	7/16	2	3	81405	81406	H40ALV-S-30312
	5/16	3/4	2-1/2	3	81407	81408	H40ALV-R-30312
	5/16	1	3	3	81409	81410	H40ALV-M-30312
	5/16	1-1/4	3	3	82393	82394	H40ALV-L-30312 new
3/8	3/8	1/2	2	3	48235	48236	H40ALV-S-30375
	3/8	3/4	2-1/2	3	81411	81412	H40ALV-SR-30375
	3/8	1	2-1/2	3	48260	48261	H40ALV-R-30375
	3/8	1-1/4	3	3	81413	81414	H40ALV-M-30375
	3/8	1-1/2	3-1/2	3	48310	48311	H40ALV-L-30375
	3/8	2	4	3	82395	82396	H40ALV-LX-30375 new

continued on next page

Speeds & Feeds on Page 53

Plunging / Ramping

Slotting

Roughing

Finishing

H40ALV-3



New Items!

3 FLUTE - SQUARE

40° Helix - Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} _{-0.000"}	L ₁ ^{+0.062"} _{-0.062"}				
1/2	1/2	5/8	2-1/2	3	48335	48336	H40ALV-S-30500
	1/2	1	3	3	48365	48366	H40ALV-SR-30500
	1/2	1-1/4	3	3	48395	48396	H40ALV-R-30500
	1/2	1-5/8	4	3	48425	48426	H40ALV-M-30500
	1/2	2	4	3	48455	48456	H40ALV-L-30500
	1/2	2-1/2	5	3	81415	81416	H40ALV-LX-30500
	1/2	3-1/8	6	3	82397	82398	H40ALV-X-30500
5/8	5/8	3/4	3	3	48485	48486	H40ALV-S-30625
	5/8	1-1/4	3-1/2	3	48510	48511	H40ALV-SR-30625
	5/8	1-5/8	4	3	48535	48536	H40ALV-R-30625
	5/8	2	4	3	82399	82400	H40ALV-M-30625
3/4	3/4	1	3	3	48585	48586	H40ALV-S-30750
	3/4	1-5/8	4	3	48620	48621	H40ALV-R-30750
	3/4	2-1/4	5	3	48655	48656	H40ALV-M-30750
	3/4	2-3/4	5	3	81417	81418	H40ALV-ML-30750
1	1	1-1/4	4	3	48690	48691	H40ALV-S-31000
	1	2	5	3	48725	48726	H40ALV-R-31000
	1	3-1/4	6	3	48760	48761	H40ALV-M-31000

*.0003 max TIR



Attacking Aluminum: A Machining Guide

Are you attacking aluminum the right way? Aluminum is one of the most commonly machined materials, and is used in many different industries. But with so much popularity, competition for aluminum machining can be intense. Our "In the Loupe," blog post **Attacking Aluminum: A Machining Guide** teaches you how to gain a competitive advantage.

[Read more on helical.blog/intheloupe](http://helical.blog/intheloupe)

3 FLUTE - BALL

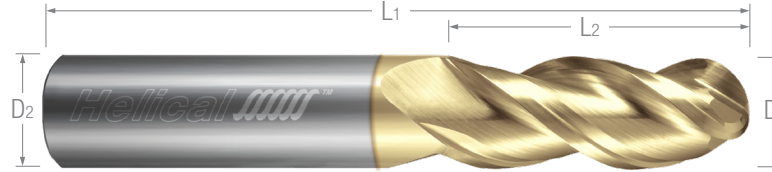
New Items!



H40ALV-3

40° Helix - Variable Pitch

- Designed with a specialized combination of features for excellent performance in roughing and finishing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Uncoated tool offers an excellent option for aluminum finishing applications
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter**	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} _{-0.000"}	L ₁ ^{+0.062"} _{-0.062"}				
1/8	1/8	1/4	1-1/2	3	49030*	49031*	H40ALV-S-30125-BN
	1/8	3/8	2	3	49035*	49036*	H40ALV-SR-30125-BN
	1/8	1/2	2-1/2	3	49040*	49041*	H40ALV-R-30125-BN
	1/8	5/8	2-1/2	3	82453*	82454*	H40ALV-M-30125-BN new
	1/8	3/4	2-1/2	3	81455*	81456*	H40ALV-L-30125-BN
3/16	3/16	3/8	2	3	49050*	49051*	H40ALV-S-30187-BN
	3/16	3/4	2-1/2	3	49060*	49061*	H40ALV-R-30187-BN
	3/16	1	3	3	49065*	49066*	H40ALV-M-30187-BN
	3/16	1-3/8	3	3	82455*	82456*	H40ALV-L-30187-BN new
1/4	1/4	3/8	2	3	49075	49076	H40ALV-S-30250-BN
	1/4	1/2	2	3	81457	81458	H40ALV-SR-30250-BN
	1/4	3/4	2-1/2	3	49105	49106	H40ALV-R-30250-BN
	1/4	1	3	3	49120	49121	H40ALV-M-30250-BN
	1/4	1-1/4	3	3	81459	81460	H40ALV-L-30250-BN
5/16	1/4	1-1/2	3	3	82457	82458	H40ALV-LX-30250-BN new
	5/16	7/16	2	3	81461	81462	H40ALV-S-30312-BN
	5/16	3/4	2-1/2	3	81463	81464	H40ALV-R-30312-BN
3/8	5/16	1	3	3	82459	82460	H40ALV-M-30312-BN new
	3/8	1/2	2	3	49195	49196	H40ALV-S-30375-BN
	3/8	3/4	2-1/2	3	82461	82462	H40ALV-SR-30375-BN new
	3/8	1	2-1/2	3	49210	49211	H40ALV-R-30375-BN
	3/8	1-1/4	3	3	81465	81466	H40ALV-M-30375-BN
	3/8	1-1/2	3-1/2	3	49240	49241	H40ALV-L-30375-BN
1/2	3/8	2	4	3	82463	82464	H40ALV-LX-30375-BN new
	1/2	5/8	2-1/2	3	49255	49256	H40ALV-S-30500-BN
	1/2	1	3	3	49270	49271	H40ALV-SR-30500-BN
	1/2	1-1/4	3	3	49285	49286	H40ALV-R-30500-BN
	1/2	1-5/8	4	3	49300	49301	H40ALV-M-30500-BN
	1/2	2	4	3	49315	49316	H40ALV-L-30500-BN
5/8	1/2	2-1/2	5	3	82465	82466	H40ALV-LX-30500-BN new
	5/8	3/4	3	3	49330	49331	H40ALV-S-30625-BN
	5/8	1-1/4	3-1/2	3	49345	49346	H40ALV-SR-30625-BN
3/4	5/8	1-5/8	4	3	49360	49361	H40ALV-R-30625-BN
	3/4	1	3	3	49390	49391	H40ALV-S-30750-BN
	3/4	1-5/8	4	3	49405	49406	H40ALV-R-30750-BN
	3/4	2-1/4	5	3	49420	49421	H40ALV-M-30750-BN
1	3/4	2-3/4	5	3	82467	82468	H40ALV-ML-30750-BN new
	1	1-1/4	4	3	49435	49436	H40ALV-S-31000-BN
	1	2	5	3	49450	49451	H40ALV-R-31000-BN
	1	3-1/4	6	3	49465	49466	H40ALV-M-31000-BN

* 1/8 and 3/16 have 1 tooth to center
 ** .0003 max TIR

Speeds & Feeds on Page 53

Plunging / Ramping

Slotting

Roughing

Finishing

3D Milling

H40ALV-3

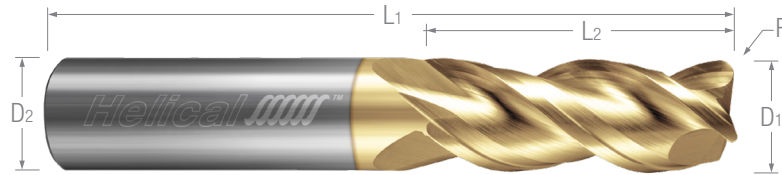


New Items!

3 FLUTE - CORNER RADIUS

40° Helix - Variable Pitch

- Designed with a specialized combination of features for excellent performance in roughing and finishing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- Wiper flat design leaves superior floor finish*
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Uncoated tool offers an excellent option for aluminum finishing applications
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.**	Shank Dia.	Corner Radius	Length of Cut	OAL	Flutes	Uncoated	Zplus Coated	Tool Description	
D1 (h6)	D2 (h6)	R ^{+0.002"} _{-0.002"}	L2 ^{+0.032"} _{-0.000"}	L1 ^{+0.062"} _{-0.062"}					
new new new new	1/8	1/8	.010	1/4	1-1/2	3	82401	82402	H40ALV-S-30125-R.010
		1/8	.010	3/8	2	3	82403	82404	H40ALV-SR-30125-R.010
		1/8	.010	1/2	2-1/2	3	82405	82406	H40ALV-R-30125-R.010
		1/8	.015	1/4	1-1/2	3	48005	48006	H40ALV-S-30125-R.015
		1/8	.015	3/8	2	3	48015	48016	H40ALV-SR-30125-R.015
		1/8	.015	1/2	2-1/2	3	48025	48026	H40ALV-R-30125-R.015
		1/8	.015	5/8	2-1/2	3	82407	82408	H40ALV-M-30125-R.015
		1/8	.030	1/4	1-1/2	3	81419*	81420*	H40ALV-S-30125-R.030
		1/8	.030	3/8	2	3	81421*	81422*	H40ALV-SR-30125-R.030
		1/8	.030	1/2	2-1/2	3	81423*	81424*	H40ALV-R-30125-R.030
new	1/8	.030	5/8	2-1/2	3	82409*	82410*	H40ALV-M-30125-R.030	
new	3/16	3/16	.015	3/8	2	3	48035	48036	H40ALV-S-30187-R.015
		3/16	.015	3/4	2-1/2	3	48050	48051	H40ALV-R-30187-R.015
		3/16	.015	1	3	3	48065	48066	H40ALV-M-30187-R.015
		3/16	.015	1-3/8	3	3	82411	82412	H40ALV-L-30187-R.015
		3/16	.030	3/8	2	3	48040	48041	H40ALV-S-30187-R.030
		3/16	.030	3/4	2-1/2	3	48055	48056	H40ALV-R-30187-R.030
		3/16	.030	1	3	3	48070	48071	H40ALV-M-30187-R.030
		3/16	.030	1-3/8	3	3	82413	82414	H40ALV-L-30187-R.030
new new new new new new	1/4	1/4	.010	3/8	2	3	82415	82416	H40ALV-S-30250-R.010
		1/4	.010	3/4	2-1/2	3	82417	82418	H40ALV-R-30250-R.010
		1/4	.010	1	3	3	82419	82420	H40ALV-M-30250-R.010
		1/4	.015	3/8	2	3	48080	48081	H40ALV-S-30250-R.015
		1/4	.015	1/2	2	3	81425	81426	H40ALV-SR-30250-R.015
		1/4	.015	3/4	2-1/2	3	48120	48121	H40ALV-R-30250-R.015
		1/4	.015	1	3	3	48140	48141	H40ALV-M-30250-R.015
		1/4	.015	1-1/4	3	3	82421	82422	H40ALV-L-30250-R.015
		1/4	.030	3/8	2	3	48085	48086	H40ALV-S-30250-R.030
		1/4	.030	1/2	2	3	81427	81428	H40ALV-SR-30250-R.030
		1/4	.030	3/4	2-1/2	3	48125	48126	H40ALV-R-30250-R.030
		1/4	.030	1	3	3	48145	48146	H40ALV-M-30250-R.030
		1/4	.030	1-1/4	3	3	82423	82424	H40ALV-L-30250-R.030
		1/4	.060	3/8	2	3	48090*	48091*	H40ALV-S-30250-R.060
		1/4	.060	1/2	2	3	81429*	81430*	H40ALV-SR-30250-R.060
		1/4	.060	3/4	2-1/2	3	48130*	48131*	H40ALV-R-30250-R.060
1/4	.060	1	3	3	48150*	48151*	H40ALV-M-30250-R.060		
new	1/4	.060	1-1/4	3	3	82425*	82426*	H40ALV-L-30250-R.060	

* Wiper flats not included if corner radius exceeds 20% of tool diameter.
 ** .0003 max TIR

Speeds & Feeds on Page 53

3 Flute

3 FLUTE - CORNER RADIUS

New Items!



H40ALV-3

40° Helix - Variable Pitch (cont.)

continued from previous page

Cutter Dia.** D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R ^{+ .002"} _{- .002"}	Length of Cut L2 ^{+ .032"} _{- .000"}	OAL L1 ^{+ .062"} _{- .062"}	Flutes	Uncoated	Zplus Coated	Tool Description
3/8	3/8	.010	1/2	2	3	81431	81432	H40ALV-S-30375-R.010
	3/8	.010	1	2-1/2	3	81433	81434	H40ALV-R-30375-R.010
	3/8	.010	1-1/2	3-1/2	3	81435	81436	H40ALV-L-30375-R.010
	3/8	.015	1/2	2	3	48240	48241	H40ALV-S-30375-R.015
	3/8	.015	3/4	2-1/2	3	81437	81438	H40ALV-SR-30375-R.015
	3/8	.015	1	2-1/2	3	48265	48266	H40ALV-R-30375-R.015
	3/8	.015	1-1/2	3-1/2	3	48315	48316	H40ALV-L-30375-R.015
	3/8	.015	2	4	3	82427	82428	H40ALV-LX-30375-R.015 new
	3/8	.030	1/2	2	3	48245	48246	H40ALV-S-30375-R.030
	3/8	.030	3/4	2-1/2	3	81439	81440	H40ALV-SR-30375-R.030
	3/8	.030	1	2-1/2	3	48270	48271	H40ALV-R-30375-R.030
	3/8	.030	1-1/2	3-1/2	3	48320	48321	H40ALV-L-30375-R.030
	3/8	.030	2	4	3	82429	82430	H40ALV-LX-30375-R.030 new
	3/8	.060	1/2	2	3	48250	48251	H40ALV-S-30375-R.060
	3/8	.060	3/4	2-1/2	3	81441	81442	H40ALV-SR-30375-R.060
	3/8	.060	1	2-1/2	3	48275	48276	H40ALV-R-30375-R.060
	3/8	.060	1-1/2	3-1/2	3	48325	48326	H40ALV-L-30375-R.060
	3/8	.060	2	4	3	82431	82432	H40ALV-LX-30375-R.060 new
	3/8	.090	1/2	2	3	48255*	48256*	H40ALV-S-30375-R.090
	3/8	.090	3/4	2-1/2	3	81443*	81444*	H40ALV-SR-30375-R.090
3/8	.090	1	2-1/2	3	48280*	48281*	H40ALV-R-30375-R.090	
3/8	.090	1-1/2	3-1/2	3	48330*	48331*	H40ALV-L-30375-R.090	
3/8	.090	2	4	3	82433*	82434*	H40ALV-LX-30375-R.090 new	
1/2	1/2	.010	5/8	2-1/2	3	81445	81446	H40ALV-S-30500-R.010
	1/2	.010	1	3	3	81447	81448	H40ALV-SR-30500-R.010
	1/2	.010	1-1/4	3	3	81449	81450	H40ALV-R-30500-R.010
	1/2	.010	1-5/8	4	3	81451	81452	H40ALV-M-30500-R.010
	1/2	.010	2	4	3	81453	81454	H40ALV-L-30500-R.010
	1/2	.015	5/8	2-1/2	3	48340	48341	H40ALV-S-30500-R.015
	1/2	.015	1	3	3	48370	48371	H40ALV-SR-30500-R.015
	1/2	.015	1-1/4	3	3	48400	48401	H40ALV-R-30500-R.015
	1/2	.015	1-5/8	4	3	48430	48431	H40ALV-M-30500-R.015
	1/2	.015	2	4	3	48460	48461	H40ALV-L-30500-R.015
	1/2	.015	2-1/2	5	3	82435	82436	H40ALV-LX-30500-R.015 new
	1/2	.030	5/8	2-1/2	3	48345	48346	H40ALV-S-30500-R.030
	1/2	.030	1	3	3	48375	48376	H40ALV-SR-30500-R.030
	1/2	.030	1-1/4	3	3	48405	48406	H40ALV-R-30500-R.030
	1/2	.030	1-5/8	4	3	48435	48436	H40ALV-M-30500-R.030
	1/2	.030	2	4	3	48465	48466	H40ALV-L-30500-R.030
	1/2	.030	2-1/2	5	3	82437	82438	H40ALV-LX-30500-R.030 new
	1/2	.060	5/8	2-1/2	3	48350	48351	H40ALV-S-30500-R.060
	1/2	.060	1	3	3	48380	48381	H40ALV-SR-30500-R.060
	1/2	.060	1-1/4	3	3	48410	48411	H40ALV-R-30500-R.060
	1/2	.060	1-5/8	4	3	48440	48441	H40ALV-M-30500-R.060
	1/2	.060	2	4	3	48470	48471	H40ALV-L-30500-R.060
	1/2	.060	2-1/2	5	3	82439	82440	H40ALV-LX-30500-R.060 new
	1/2	.090	5/8	2-1/2	3	48355	48356	H40ALV-S-30500-R.090
	1/2	.090	1	3	3	48385	48386	H40ALV-SR-30500-R.090
	1/2	.090	1-1/4	3	3	48415	48416	H40ALV-R-30500-R.090
	1/2	.090	1-5/8	4	3	48445	48446	H40ALV-M-30500-R.090
	1/2	.090	2	4	3	48475	48476	H40ALV-L-30500-R.090
1/2	.090	2-1/2	5	3	82441	82442	H40ALV-LX-30500-R.090 new	

* Wiper flats not included if corner radius exceeds 20% of tool diameter.
 ** .0003 max TIR

continued on next page

H40ALV-3



New Items!

3 FLUTE - CORNER RADIUS

40° Helix - Variable Pitch (cont.)

continued from previous page

Cutter Dia.** D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.02° -0.02°}	Length of Cut L ₂ ^{+0.32° -0.00°}	OAL L ₁ ^{+0.62° -0.62°}	Flutes	Uncoated	Zplus Coated	Tool Description
1/2	1/2	.125	5/8	2-1/2	3	48360*	48361*	H40ALV-S-30500-R.125
	1/2	.125	1	3	3	48390*	48391*	H40ALV-SR-30500-R.125
	1/2	.125	1-1/4	3	3	48420*	48421*	H40ALV-R-30500-R.125
	1/2	.125	1-5/8	4	3	48450*	48451*	H40ALV-M-30500-R.125
	1/2	.125	2	4	3	48480*	48481*	H40ALV-L-30500-R.125
	1/2	.125	2-1/2	5	3	82443*	82444*	H40ALV-LX-30500-R.125
5/8	5/8	.030	3/4	3	3	48490	48491	H40ALV-S-30625-R.030
	5/8	.030	1-1/4	3-1/2	3	48515	48516	H40ALV-SR-30625-R.030
	5/8	.030	1-5/8	4	3	48540	48541	H40ALV-R-30625-R.030
	5/8	.030	2	4	3	82445	82446	H40ALV-M-30625-R.030
	5/8	.060	3/4	3	3	48495	48496	H40ALV-S-30625-R.060
	5/8	.060	1-1/4	3-1/2	3	48520	48521	H40ALV-SR-30625-R.060
	5/8	.060	1-5/8	4	3	48545	48546	H40ALV-R-30625-R.060
	5/8	.090	3/4	3	3	48500	48501	H40ALV-S-30625-R.090
	5/8	.090	1-1/4	3-1/2	3	48525	48526	H40ALV-SR-30625-R.090
	5/8	.090	1-5/8	4	3	48550	48551	H40ALV-R-30625-R.090
	5/8	.125	3/4	3	3	48505	48506	H40ALV-S-30625-R.125
	5/8	.125	1-1/4	3-1/2	3	48530	48531	H40ALV-SR-30625-R.125
5/8	.125	1-5/8	4	3	48555	48556	H40ALV-R-30625-R.125	
5/8	.125	2	4	3	82447	82448	H40ALV-M-30625-R.125	
3/4	3/4	.030	1	3	3	48590	48591	H40ALV-S-30750-R.030
	3/4	.030	1-5/8	4	3	48625	48626	H40ALV-R-30750-R.030
	3/4	.030	2-1/4	5	3	48660	48661	H40ALV-M-30750-R.030
	3/4	.030	2-3/4	5	3	82449	82450	H40ALV-ML-30750-R.030
	3/4	.060	1	3	3	48595	48596	H40ALV-S-30750-R.060
	3/4	.060	1-5/8	4	3	48630	48631	H40ALV-R-30750-R.060
	3/4	.060	2-1/4	5	3	48665	48666	H40ALV-M-30750-R.060
	3/4	.090	1	3	3	48600	48601	H40ALV-S-30750-R.090
	3/4	.090	1-5/8	4	3	48635	48636	H40ALV-R-30750-R.090
	3/4	.090	2-1/4	5	3	48670	48671	H40ALV-M-30750-R.090
	3/4	.125	1	3	3	48605	48606	H40ALV-S-30750-R.125
	3/4	.125	1-5/8	4	3	48640	48641	H40ALV-R-30750-R.125
	3/4	.125	2-1/4	5	3	48675	48676	H40ALV-M-30750-R.125
	3/4	.125	2-3/4	5	3	82451	82452	H40ALV-ML-30750-R.125
	3/4	.190	1	3	3	48610*	48611*	H40ALV-S-30750-R.190
	3/4	.190	1-5/8	4	3	48645*	48646*	H40ALV-R-30750-R.190
	3/4	.190	2-1/4	5	3	48680*	48681*	H40ALV-M-30750-R.190
	3/4	.250	1	3	3	48615*	48616*	H40ALV-S-30750-R.250
3/4	.250	1-5/8	4	3	48650*	48651*	H40ALV-R-30750-R.250	
3/4	.250	2-1/4	5	3	48685*	48686*	H40ALV-M-30750-R.250	
1	1	.030	1-1/4	4	3	48695	48696	H40ALV-S-31000-R.030
	1	.030	2	5	3	48730	48731	H40ALV-R-31000-R.030
	1	.030	3-1/4	6	3	48765	48766	H40ALV-M-31000-R.030
	1	.060	1-1/4	4	3	48700	48701	H40ALV-S-31000-R.060
	1	.060	2	5	3	48735	48736	H40ALV-R-31000-R.060
	1	.060	3-1/4	6	3	48770	48771	H40ALV-M-31000-R.060
	1	.125	1-1/4	4	3	48710	48711	H40ALV-S-31000-R.125
	1	.125	2	5	3	48745	48746	H40ALV-R-31000-R.125
	1	.125	3-1/4	6	3	48780	48781	H40ALV-M-31000-R.125
	1	.250	1-1/4	4	3	48720*	48721*	H40ALV-S-31000-R.250
	1	.250	2	5	3	48755*	48756*	H40ALV-R-31000-R.250
	1	.250	3-1/4	6	3	48790*	48791*	H40ALV-M-31000-R.250

* Wiper flats not included if corner radius exceeds 20% of tool diameter.

**.0003 max TIR

3 FLUTE - SQUARE New Items!



H40ALV-RN-3

40° Helix - Variable Pitch - Reduced Neck

- Designed with a specialized combination of features for excellent performance in roughing and finishing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Wiper flat design leaves superior floor finish
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Uncoated tool offers an excellent option for aluminum finishing applications
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



3 Flute

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} _{-.000"}	Overall Length L ₁ ^{+0.062"} _{-.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	2-1/2	1/2	.118	3	46010	46011	H40ALV-RN-R-30125
	1/8	5/32	3	3/4	.118	3	46020	46021	H40ALV-RN-M-30125
	1/8	5/32	3	1	.118	3	81467	81468	H40ALV-RN-L-30125
	1/8	5/32	3	1-1/4	.118	3	82469	82470	H40ALV-RN-LX-30125 new
3/16	3/16	7/32	2-1/2	1/2	.178	3	46045	46046	H40ALV-RN-R-30187
	3/16	7/32	3	3/4	.178	3	46060	46061	H40ALV-RN-M-30187
	3/16	7/32	3	1	.178	3	81469	81470	H40ALV-RN-ML-30187
	3/16	7/32	3	1-5/16	.178	3	82471	82472	H40ALV-RN-LX-30187 new
1/4	1/4	3/8	2-1/2	3/4	.237	3	46075	46076	H40ALV-RN-S-30250
	1/4	3/8	3	1-1/8	.237	3	46095	46096	H40ALV-RN-R-30250
	1/4	3/8	3	1-3/8	.237	3	82473	82474	H40ALV-RN-RA-30250 new
	1/4	3/8	3	1-5/8	.237	3	81471	81472	H40ALV-RN-A-30250
	1/4	3/8	4	1-7/8	.237	3	82475	82476	H40ALV-RN-AM-30250 new
	1/4	3/8	4	2-1/8	.237	3	81473	81474	H40ALV-RN-M-30250
3/8	3/8	1/2	3	1-1/8	.356	3	46220	46221	H40ALV-RN-R-30375
	3/8	1/2	3	1-5/8	.356	3	81475	81476	H40ALV-RN-A-30375
	3/8	1/2	4	2-1/8	.356	3	46245	46246	H40ALV-RN-M-30375
	3/8	1/2	5	2-1/2	.356	3	81477	81478	H40ALV-RN-ML-30375
	3/8	1/2	6	3-1/8	.356	3	82479	82480	H40ALV-RN-LX-30375 new
	1/2	1/2	5/8	3	1-3/8	.475	3	46300	46301
1/2		5/8	3-1/2	1-3/4	.475	3	81479	81480	H40ALV-RN-A-30500
1/2		5/8	4	2-1/4	.475	3	46330	46331	H40ALV-RN-M-30500
1/2		5/8	4-1/2	2-3/4	.475	3	81481	81482	H40ALV-RN-ML-30500
1/2		5/8	5	3-3/8	.475	3	46360	46361	H40ALV-RN-L-30500
1/2		5/8	6	3-3/4	.475	3	81483	81484	H40ALV-RN-LX-30500
1/2		5/8	6	4-1/4	.475	3	46390	46391	H40ALV-RN-X-30500
1/2		5/8	7	5	.475	3	82481	82482	H40ALV-RN-Y-30500 new
5/8	5/8	3/4	4	2-3/8	.593	3	46470	46471	H40ALV-RN-M-30625
	5/8	3/4	6	3-3/8	.593	3	46495	46496	H40ALV-RN-L-30625

continued on next page

Speeds & Feeds on Page 53

Plunging / Ramping

Slotting

Roughing

Finishing

H40ALV-RN-3



New Items!

3 FLUTE - SQUARE

40° Helix - Variable Pitch - Reduced Neck (cont.)

continued from previous page

new

Cutter Dia.*	Shank Dia.	LOC	Overall Length	Reach (LBS)	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} _{-.000"}	L ₁ ^{+0.062"} _{-.062"}	L ₃					
3/4	3/4	1	4	2	.712	3	<u>46555</u>	<u>46556</u>	H40ALV-RN-R-30750
	3/4	1	5	2-1/2	.712	3	<u>81485</u>	<u>81486</u>	H40ALV-RN-A-30750
	3/4	1	6	3-3/8	.712	3	<u>46590</u>	<u>46591</u>	H40ALV-RN-M-30750
	3/4	1	7	4-1/8	.712	3	<u>81487</u>	<u>81488</u>	H40ALV-RN-ML-30750
	3/4	1	7	5	.712	3	<u>46625</u>	<u>46626</u>	H40ALV-RN-L-30750
	3/4	1	10	6	.712	3	<u>82483</u>	<u>82484</u>	H40ALV-RN-LX-30750
1	1	1-1/4	5	2-5/8	.950	3	<u>46695</u>	<u>46696</u>	H40ALV-RN-R-31000
	1	1-1/4	6	3-3/8	.950	3	<u>46730</u>	<u>46731</u>	H40ALV-RN-M-31000
	1	1-1/4	7	4-3/8	.950	3	<u>46765</u>	<u>46766</u>	H40ALV-RN-L-31000
	1	1-1/4	9	6	.950	3	<u>46800</u>	<u>46801</u>	H40ALV-RN-LX-31000

*.0003 max TIR

3 Flute

Access customized running parameters for your specific setup and material at www.machiningadvisorpro.com



3 FLUTE - BALL

New Items!



H40ALV-RN-3

40° Helix - Variable Pitch - Reduced Neck

- Designed with a specialized combination of features for excellent performance in roughing and finishing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Uncoated tool offers an excellent option for aluminum finishing applications
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.**	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
D1 (h6)	D2 (h6)	L2 ^{+0.032"} _{-.000"}	L1 ^{+0.062"} _{-.062"}	L3					
1/8	1/8	5/32	2-1/2	1/2	.118	3	47040*	47041*	H40ALV-RN-R-30125-BN
	1/8	5/32	3	3/4	.118	3	47045*	47046*	H40ALV-RN-M-30125-BN
	1/8	5/32	3	1	.118	3	81533*	81534*	H40ALV-RN-L-30125-BN
	1/8	5/32	3	1-1/4	.118	3	82485*	82486*	H40ALV-RN-LX-30125-BN new
3/16	3/16	7/32	2-1/2	1/2	.178	3	47060*	47061*	H40ALV-RN-R-30187-BN
	3/16	7/32	3	3/4	.178	3	47065*	47066*	H40ALV-RN-M-30187-BN
	3/16	7/32	3	1	.178	3	81535*	81536*	H40ALV-RN-ML-30187-BN
	3/16	7/32	3	1-5/16	.178	3	82487*	82488*	H40ALV-RN-LX-30187-BN new
1/4	1/4	3/8	2-1/2	3/4	.237	3	47075	47076	H40ALV-RN-S-30250-BN
	1/4	3/8	3	1-1/8	.237	3	47090	47091	H40ALV-RN-R-30250-BN
	1/4	3/8	3	1-3/8	.237	3	82489	82490	H40ALV-RN-RA-30250-BN new
	1/4	3/8	3	1-5/8	.237	3	81537	81538	H40ALV-RN-A-30250-BN
	1/4	3/8	4	1-7/8	.237	3	82491	82492	H40ALV-RN-AM-30250-BN new
	1/4	3/8	4	2-1/8	.237	3	81539	81540	H40ALV-RN-M-30250-BN
3/8	3/8	1/2	3	1-1/8	.356	3	47180	47181	H40ALV-RN-R-30375-BN
	3/8	1/2	3	1-5/8	.356	3	81541	81542	H40ALV-RN-A-30375-BN
	3/8	1/2	4	2-1/8	.356	3	47195	47196	H40ALV-RN-M-30375-BN
	3/8	1/2	5	2-1/2	.356	3	81543	81544	H40ALV-RN-ML-30375-BN
	3/8	1/2	6	3-1/8	.356	3	82495	82496	H40ALV-RN-LX-30375-BN new
1/2	1/2	5/8	3	1-3/8	.475	3	47225	47226	H40ALV-RN-R-30500-BN
	1/2	5/8	3-1/2	1-3/4	.475	3	81545	81546	H40ALV-RN-A-30500-BN
	1/2	5/8	4	2-1/4	.475	3	47240	47241	H40ALV-RN-M-30500-BN
	1/2	5/8	4-1/2	2-3/4	.475	3	81547	81548	H40ALV-RN-ML-30500-BN
	1/2	5/8	5	3-3/8	.475	3	47255	47256	H40ALV-RN-L-30500-BN
	1/2	5/8	6	3-3/4	.475	3	81549	81550	H40ALV-RN-LX-30500-BN
	1/2	5/8	6	4-1/4	.475	3	47270	47271	H40ALV-RN-X-30500-BN
	1/2	5/8	7	5	.475	3	82497	82498	H40ALV-RN-Y-30500-BN new
5/8	5/8	3/4	4	1-5/8	.593	3	47300	47301	H40ALV-RN-R-30625-BN
	5/8	3/4	4	2-3/8	.593	3	47315	47316	H40ALV-RN-M-30625-BN
	5/8	3/4	6	3-3/8	.593	3	47330	47331	H40ALV-RN-L-30625-BN
3/4	3/4	1	4	2	.712	3	47360	47361	H40ALV-RN-R-30750-BN
	3/4	1	6	3-3/8	.712	3	47375	47376	H40ALV-RN-M-30750-BN
	3/4	1	7	5	.712	3	47390	47391	H40ALV-RN-L-30750-BN
1	1	1-1/4	5	2-5/8	.950	3	47420	47421	H40ALV-RN-R-31000-BN
	1	1-1/4	6	3-3/8	.950	3	47435	47436	H40ALV-RN-M-31000-BN
	1	1-1/4	7	4-3/8	.950	3	47450	47451	H40ALV-RN-L-31000-BN
	1	1-1/4	9	6	.950	3	47465	47466	H40ALV-RN-LX-31000-BN
	1	1-1/4	12-1/2	9-1/2	.950	3	47480	47481	H40ALV-RN-X-31000-BN

* 1/8 & 3/16 have one tooth to center
 ** .0003 max TIR

Speeds & Feeds on Page 53

Plunging / Ramping

Slotting

Roughing

Finishing

3D Milling

H40ALV-RN-3

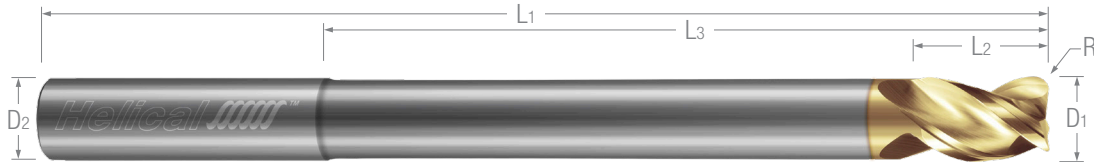


3 FLUTE - CORNER RADIUS

40° Helix - Variable Pitch - Reduced Neck

- Designed with a specialized combination of features for excellent performance in roughing and finishing applications
- Unique "3 teeth-to-center" end geometry for ramping applications
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Wiper flat design leaves superior floor finish*
- Excellent performance in High Efficiency Milling (HEM)

- Center cutting
- h6 shank tolerance for high precision tool holders
- Uncoated tool offers an excellent option for aluminum finishing applications
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.**	Shank Dia.	Corner Radius	LOC	OAL	Reach (LBS)	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	R ^{+0.002"} _{-0.002"}	L ₂ ^{+0.032"} _{-0.000"}	L ₁ ^{+0.062"} _{-0.062"}	L ₃					
1/8	1/8	.015	5/32	2-1/2	1/2	.118	3	46015	46016	H40ALV-RN-R-30125-R.015
	1/8	.015	5/32	3	3/4	.118	3	46025	46026	H40ALV-RN-M-30125-R.015
3/16	3/16	.015	7/32	2-1/2	1/2	.178	3	46050	46051	H40ALV-RN-R-30187-R.015
	3/16	.015	7/32	3	3/4	.178	3	46065	46066	H40ALV-RN-M-30187-R.015
	3/16	.030	7/32	2-1/2	1/2	.178	3	46055	46056	H40ALV-RN-R-30187-R.030
	3/16	.030	7/32	3	3/4	.178	3	46070	46071	H40ALV-RN-M-30187-R.030
1/4	1/4	.015	3/8	2-1/2	3/4	.237	3	46080	46081	H40ALV-RN-S-30250-R.015
	1/4	.015	3/8	3	1-1/8	.237	3	46100	46101	H40ALV-RN-R-30250-R.015
	1/4	.015	3/8	3	1-5/8	.237	3	81489	81490	H40ALV-RN-A-30250-R.015
	1/4	.015	3/8	4	2-1/8	.237	3	81491	81492	H40ALV-RN-M-30250-R.015
	1/4	.030	3/8	2-1/2	3/4	.237	3	46085	46086	H40ALV-RN-S-30250-R.030
	1/4	.030	3/8	3	1-1/8	.237	3	46105	46106	H40ALV-RN-R-30250-R.030
	1/4	.030	3/8	3	1-5/8	.237	3	81493	81494	H40ALV-RN-A-30250-R.030
	1/4	.030	3/8	4	2-1/8	.237	3	81495	81496	H40ALV-RN-M-30250-R.030
	1/4	.060	3/8	2-1/2	3/4	.237	3	46090*	46091*	H40ALV-RN-S-30250-R.060
	1/4	.060	3/8	3	1-1/8	.237	3	46110*	46111*	H40ALV-RN-R-30250-R.060
1/4	.060	3/8	3	1-5/8	.237	3	81497*	81498*	H40ALV-RN-A-30250-R.060	
1/4	.060	3/8	4	2-1/8	.237	3	81499*	81500*	H40ALV-RN-M-30250-R.060	
3/8	3/8	.015	1/2	3	1-1/8	.356	3	46225	46226	H40ALV-RN-R-30375-R.015
	3/8	.015	1/2	3	1-5/8	.356	3	81501	81502	H40ALV-RN-A-30375-R.015
	3/8	.015	1/2	4	2-1/8	.356	3	46250	46251	H40ALV-RN-M-30375-R.015
	3/8	.030	1/2	3	1-1/8	.356	3	46230	46231	H40ALV-RN-R-30375-R.030
	3/8	.030	1/2	3	1-5/8	.356	3	81503	81504	H40ALV-RN-A-30375-R.030
	3/8	.030	1/2	4	2-1/8	.356	3	46255	46256	H40ALV-RN-M-30375-R.030
	3/8	.030	1/2	5	2-1/2	.356	3	81505	81506	H40ALV-RN-ML-30375-R.030
	3/8	.060	1/2	3	1-1/8	.356	3	46235	46236	H40ALV-RN-R-30375-R.060
	3/8	.060	1/2	3	1-5/8	.356	3	81507	81508	H40ALV-RN-A-30375-R.060
	3/8	.060	1/2	4	2-1/8	.356	3	46260	46261	H40ALV-RN-M-30375-R.060
	3/8	.060	1/2	5	2-1/2	.356	3	81509	81510	H40ALV-RN-ML-30375-R.060
	3/8	.090	1/2	3	1-1/8	.356	3	46240*	46241*	H40ALV-RN-R-30375-R.090
	3/8	.090	1/2	4	2-1/8	.356	3	46265*	46266*	H40ALV-RN-M-30375-R.090

* Wiper flats not included if corner radius exceeds 20% of tool diameter. ** .0003 max TIR

continued on next page

Speeds & Feeds on Page 53

Plunging / Ramping Slotting Roughing Finishing

3 FLUTE - CORNER RADIUS



H40ALV-RN-3

40° Helix - Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.** D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R ^{+0.02"} / _{-.002"}	LOC L ₂ ^{+0.032"} / _{-.000"}	OAL L ₁ ^{+0.062"} / _{-.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/2	1/2	.015	5/8	3	1-3/8	.475	3	46305	46306	H40ALV-RN-R-30500-R.015
	1/2	.015	5/8	4	2-1/4	.475	3	46335	46336	H40ALV-RN-M-30500-R.015
	1/2	.015	5/8	5	3-3/8	.475	3	46365	46366	H40ALV-RN-L-30500-R.015
	1/2	.015	5/8	6	4-1/4	.475	3	46395	46396	H40ALV-RN-X-30500-R.015
	1/2	.030	5/8	3	1-3/8	.475	3	46310	46311	H40ALV-RN-R-30500-R.030
	1/2	.030	5/8	3-1/2	1-3/4	.475	3	81511	81512	H40ALV-RN-A-30500-R.030
	1/2	.030	5/8	4	2-1/4	.475	3	46340	46341	H40ALV-RN-M-30500-R.030
	1/2	.030	5/8	4-1/2	2-3/4	.475	3	81513	81514	H40ALV-RN-ML-30500-R.030
	1/2	.030	5/8	5	3-3/8	.475	3	46370	46371	H40ALV-RN-L-30500-R.030
	1/2	.030	5/8	6	4-1/4	.475	3	46400	46401	H40ALV-RN-X-30500-R.030
	1/2	.060	5/8	3	1-3/8	.475	3	46315	46316	H40ALV-RN-R-30500-R.060
	1/2	.060	5/8	3-1/2	1-3/4	.475	3	81515	81516	H40ALV-RN-A-30500-R.060
	1/2	.060	5/8	4	2-1/4	.475	3	46345	46346	H40ALV-RN-M-30500-R.060
	1/2	.060	5/8	4-1/2	2-3/4	.475	3	81517	81518	H40ALV-RN-ML-30500-R.060
	1/2	.060	5/8	5	3-3/8	.475	3	46375	46376	H40ALV-RN-L-30500-R.060
	1/2	.060	5/8	6	4-1/4	.475	3	46405	46406	H40ALV-RN-X-30500-R.060
	1/2	.090	5/8	3	1-3/8	.475	3	46320	46321	H40ALV-RN-R-30500-R.090
	1/2	.090	5/8	4	2-1/4	.475	3	46350	46351	H40ALV-RN-M-30500-R.090
	1/2	.090	5/8	5	3-3/8	.475	3	46380	46381	H40ALV-RN-L-30500-R.090
	1/2	.090	5/8	6	4-1/4	.475	3	46410	46411	H40ALV-RN-X-30500-R.090
1/2	.125	5/8	3	1-3/8	.475	3	46325*	46326*	H40ALV-RN-R-30500-R.125	
1/2	.125	5/8	3-1/2	1-3/4	.475	3	81519*	81520*	H40ALV-RN-A-30500-R.125	
1/2	.125	5/8	4	2-1/4	.475	3	46355*	46356*	H40ALV-RN-M-30500-R.125	
1/2	.125	5/8	4-1/2	2-3/4	.475	3	81521*	81522*	H40ALV-RN-ML-30500-R.125	
1/2	.125	5/8	5	3-3/8	.475	3	46385*	46386*	H40ALV-RN-L-30500-R.125	
1/2	.125	5/8	6	4-1/4	.475	3	46415*	46416*	H40ALV-RN-X-30500-R.125	
5/8	5/8	.030	3/4	4	2-3/8	.593	3	46475	46476	H40ALV-RN-M-30625-R.030
	5/8	.030	3/4	6	3-3/8	.593	3	46500	46501	H40ALV-RN-L-30625-R.030
	5/8	.060	3/4	4	2-3/8	.593	3	46480	46481	H40ALV-RN-M-30625-R.060
	5/8	.090	3/4	4	2-3/8	.593	3	46485	46486	H40ALV-RN-M-30625-R.090
	5/8	.125	3/4	4	2-3/8	.593	3	46490	46491	H40ALV-RN-M-30625-R.125
3/4	3/4	.030	1	4	2	.712	3	46560	46561	H40ALV-RN-R-30750-R.030
	3/4	.030	1	5	2-1/2	.712	3	81523	81524	H40ALV-RN-A-30750-R.030
	3/4	.030	1	6	3-3/8	.712	3	46595	46596	H40ALV-RN-M-30750-R.030
	3/4	.030	1	7	4-1/8	.712	3	81525	81526	H40ALV-RN-ML-30750-R.030
	3/4	.030	1	7	5	.712	3	46630	46631	H40ALV-RN-L-30750-R.030
	3/4	.060	1	4	2	.712	3	46565	46566	H40ALV-RN-R-30750-R.060
	3/4	.060	1	5	2-1/2	.712	3	81527	81528	H40ALV-RN-A-30750-R.060
	3/4	.060	1	6	3-3/8	.712	3	46600	46601	H40ALV-RN-M-30750-R.060
	3/4	.060	1	7	4-1/8	.712	3	81529	81530	H40ALV-RN-ML-30750-R.060
	3/4	.060	1	7	5	.712	3	46635	46636	H40ALV-RN-L-30750-R.060
	3/4	.090	1	4	2	.712	3	46570	46571	H40ALV-RN-R-30750-R.090
	3/4	.090	1	6	3-3/8	.712	3	46605	46606	H40ALV-RN-M-30750-R.090
	3/4	.125	1	4	2	.712	3	46575	46576	H40ALV-RN-R-30750-R.125
	3/4	.125	1	5	2-1/2	.712	3	81531	81532	H40ALV-RN-A-30750-R.125
	3/4	.125	1	6	3-3/8	.712	3	46610	46611	H40ALV-RN-M-30750-R.125
	3/4	.125	1	7	5	.712	3	46645	46646	H40ALV-RN-L-30750-R.125
	3/4	.190	1	4	2	.712	3	46580*	46581*	H40ALV-RN-R-30750-R.190
	3/4	.190	1	6	3-3/8	.712	3	46615*	46616*	H40ALV-RN-M-30750-R.190
	3/4	.250	1	4	2	.712	3	46585*	46586*	H40ALV-RN-R-30750-R.250
	3/4	.250	1	6	3-3/8	.712	3	46620*	46621*	H40ALV-RN-M-30750-R.250
3/4	.250	1	7	5	.712	3	46655*	46656*	H40ALV-RN-L-30750-R.250	

* Wiper flats not included if corner radius exceeds 20% of tool diameter. ** .0003 max TIR

continued on next page

3 Flute

H40ALV-3-RN



SPEEDS & FEEDS

40° Helix - Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.** D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} _{-.002"}	LOC L2 ^{+0.032"} _{-.000"}	OAL L1 ^{+0.062"} _{-.062"}	Reach (LBS) L3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1	1	.030	1-1/4	5	2-5/8	.950	3	46700	46701	H40ALV-RN-R-31000-R.030
	1	.030	1-1/4	6	3-3/8	.950	3	46735	46736	H40ALV-RN-M-31000-R.030
	1	.030	1-1/4	7	4-3/8	.950	3	46770	46771	H40ALV-RN-L-31000-R.030
	1	.030	1-1/4	9	6	.950	3	46805	46806	H40ALV-RN-LX-31000-R.030
	1	.060	1-1/4	5	2-5/8	.950	3	46705	46706	H40ALV-RN-R-31000-R.060
	1	.060	1-1/4	7	4-3/8	.950	3	46775	46776	H40ALV-RN-L-31000-R.060
	1	.125	1-1/4	5	2-5/8	.950	3	46715	46716	H40ALV-RN-R-31000-R.125
	1	.125	1-1/4	6	3-3/8	.950	3	46750	46751	H40ALV-RN-M-31000-R.125
	1	.125	1-1/4	7	4-3/8	.950	3	46785	46786	H40ALV-RN-L-31000-R.125
	1	.125	1-1/4	9	6	.950	3	46820	46821	H40ALV-RN-LX-31000-R.125
	1	.250	1-1/4	5	2-5/8	.950	3	46725*	46726*	H40ALV-RN-R-31000-R.250
	1	.250	1-1/4	6	3-3/8	.950	3	46760*	46761*	H40ALV-RN-M-31000-R.250
	1	.250	1-1/4	7	4-3/8	.950	3	46795*	46796*	H40ALV-RN-L-31000-R.250
1	.250	1-1/4	9	6	.950	3	46830*	46831*	H40ALV-RN-LX-31000-R.250	

* Wiper flats not included if corner radius exceeds 20% of tool diameter. ** .0003 max TIR

H40ALV-3 / H40ALV-RN-3

Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0008	.0014	.0017	.0011	.0021	.0019	.0015	.0028	.0022	.0022	.0041	.0025	.0029	.0054	.0029	.0041	.0077	.0035	.0053	.0098	.0042
			.0012	.0022	.0021	.0017	.0033	.0024	.0023	.0043	.0027	.0034	.0064	.0031	.0045	.0084	.0036	.0064	.0120	.0043	.0082	.0153	.0052
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400																					
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0008	.0015	.0017	.0012	.0022	.0020	.0016	.0029	.0022	.0023	.0043	.0025	.0030	.0056	.0030	.0043	.0081	.0035	.0055	.0103	.0043

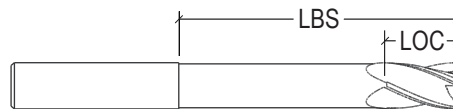
Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	75%-125% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-40% Diameter
	Reached	Up to Max LOC	30%-40% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

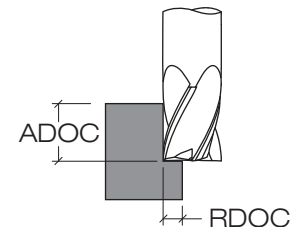
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

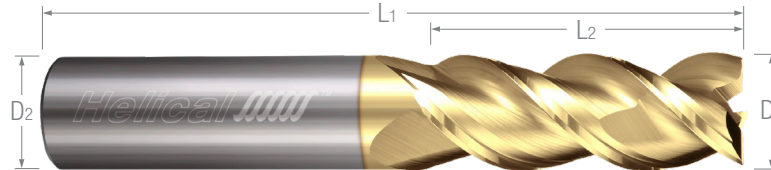
3 FLUTE - SQUARE



H45AL-3

45° Helix

- Designed with a high helix for improved part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- Excellent performance in High Efficiency Milling (HEM)
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA

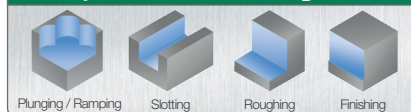


Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.32"} _{-0.000"}	Overall Length L ₁ ^{+0.62"} _{-0.62"}	Flutes	Uncoated	<i>Zplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	3	03015	03017	H45AL-S-30125
	1/8	3/8	2	3	03030	03032	H45AL-SR-30125
	1/8	1/2	2-1/2	3	03045	03047	H45AL-R-30125
	1/8	5/8	2-1/2	3	81551	81552	H45AL-M-30125
	1/8	3/4	2-1/2	3	03060	03062	H45AL-L-30125
3/16	3/16	5/16	2	3	03090	03092	H45AL-S-30187
	3/16	9/16	2-1/2	3	03105	03107	H45AL-R-30187
	3/16	3/4	2-1/2	3	03120	03122	H45AL-M-30187
	3/16	1	2-1/2	3	81553	81554	H45AL-ML-30187
1/4	1/4	3/8	2	3	03150	03152	H45AL-S-30250
	1/4	1/2	2-1/2	3	03155	03157	H45AL-SR-30250
	1/4	3/4	2-1/2	3	03165	03167	H45AL-R-30250
	1/4	1	3	3	03180	03182	H45AL-M-30250
	1/4	1-1/4	3	3	03195	03197	H45AL-L-30250
	1/4	1-1/2	3	3	81555	81556	H45AL-LX-30250
5/16	1/4	1-3/4	4	3	03210	03212	H45AL-X-30250
	5/16	7/16	2	3	03240	03242	H45AL-S-30312
	5/16	13/16	2-1/2	3	03255	03257	H45AL-R-30312
	5/16	1	3	3	03270	03272	H45AL-M-30312
	5/16	1-1/4	3	3	03285	03287	H45AL-L-30312
	5/16	1-9/16	3	3	81557	81558	H45AL-LX-30312
3/8	5/16	2-1/8	4	3	03300	03302	H45AL-X-30312
	3/8	1/2	2	3	03330	03332	H45AL-S-30375
	3/8	3/4	2-1/2	3	81559	81560	H45AL-SR-30375
	3/8	1	3	3	03345	03347	H45AL-R-30375
	3/8	1-1/4	3-1/2	3	03360	03362	H45AL-M-30375
	3/8	1-1/2	4	3	03375	03377	H45AL-L-30375
3/8	3/8	2	4	3	03390	03392	H45AL-LX-30375
	3/8	2-1/2	5	3	03405	03407	H45AL-X-30375

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 58



H45AL-3



3 FLUTE - SQUARE

45° Helix (cont.)

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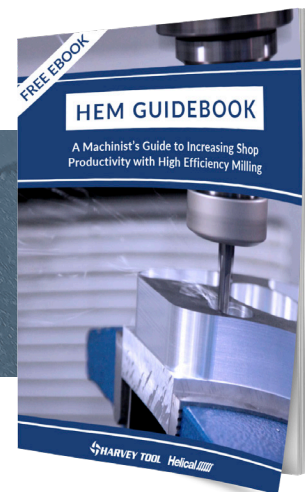
Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Flutes	Uncoated	Zplus Coated	Tool Description
1/2	1/2	5/8	2-1/2	3	03435	03437	H45AL-S-30500
	1/2	1	3	3	03450	03452	H45AL-SR-30500
	1/2	1-1/4	3	3	03465	03467	H45AL-R-30500
	1/2	1-5/8	4	3	03480	03482	H45AL-M-30500
	1/2	2	4	3	03495	03497	H45AL-L-30500
	1/2	2-1/2	5	3	03510	03512	H45AL-LX-30500
	1/2	3-1/8	6	3	03525	03527	H45AL-X-30500
5/8	5/8	3/4	3	3	03555	03557	H45AL-S-30625
	5/8	1-5/8	3-1/2	3	03570	03572	H45AL-R-30625
	5/8	2-1/8	4	3	03585	03587	H45AL-M-30625
	5/8	2-1/2	5	3	03600	03602	H45AL-L-30625
	5/8	3-1/4	6	3	03610	03612	H45AL-LX-30625
3/4	3/4	1	4	3	03645	03647	H45AL-S-30750
	3/4	1-5/8	4	3	03660	03662	H45AL-R-30750
	3/4	2	4	3	81561	81562	H45AL-A-30750
	3/4	2-1/4	5	3	03675	03677	H45AL-M-30750
	3/4	2-3/4	5	3	81563	81564	H45AL-ML-30750
	3/4	3-1/4	6	3	03690	03692	H45AL-L-30750
	3/4	4	6-1/2	3	03705	03707	H45AL-X-30750
1	1	2	5	3	03750	03752	H45AL-R-31000
	1	2-5/8	6	3	03765	03767	H45AL-M-31000
	1	3-1/4	6	3	03780	03782	H45AL-L-31000
	1	4-1/8	7	3	03795	03797	H45AL-X-31000

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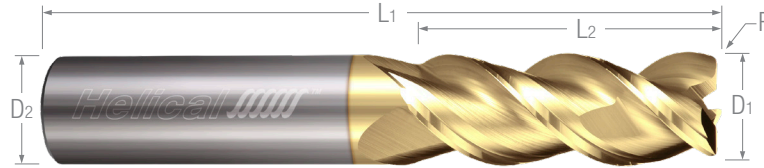
3 FLUTE - CORNER RADIUS



H45AL-3

45° Helix

- Designed with a high helix for improved part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- Excellent performance in High Efficiency Milling (HEM)
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} / _{-0.002"}	Length of Cut L ₂ ^{+0.032"} / _{-0.000"}	OAL L ₁ ^{+0.062"} / _{-0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	.010	1/4	1-1/2	3	81581	81582	H45AL-S-30125-R.010
	1/8	.010	3/8	2	3	81583	81584	H45AL-SR-30125-R.010
	1/8	.010	1/2	2-1/2	3	81585	81586	H45AL-R-30125-R.010
1/4	1/4	.010	1/2	2-1/2	3	81587	81588	H45AL-SR-30250-R.010
	1/4	.010	3/4	2-1/2	3	81589	81590	H45AL-R-30250-R.010
	1/4	.010	1	3	3	81591	81592	H45AL-M-30250-R.010
	1/4	.030	1/2	2-1/2	3	81593	81594	H45AL-SR-30250-R.030
	1/4	.030	3/4	2-1/2	3	81595	81596	H45AL-R-30250-R.030
	1/4	.030	1	3	3	81597	81598	H45AL-M-30250-R.030
3/8	3/8	.030	1/2	2	3	81599	81600	H45AL-S-30375-R.030
	3/8	.030	1	3	3	81601	81602	H45AL-R-30375-R.030
	3/8	.030	1-1/4	3-1/2	3	81603	81604	H45AL-M-30375-R.030
	3/8	.060	1/2	2	3	81605	81606	H45AL-S-30375-R.060
	3/8	.060	1	3	3	81607	81608	H45AL-R-30375-R.060
	3/8	.060	1-1/4	3-1/2	3	81609	81610	H45AL-M-30375-R.060
1/2	1/2	.030	1	3	3	81611	81612	H45AL-SR-30500-R.030
	1/2	.030	1-1/4	3	3	81613	81614	H45AL-R-30500-R.030
	1/2	.030	1-5/8	4	3	81615	81616	H45AL-M-30500-R.030
	1/2	.030	2	4	3	81617	81618	H45AL-L-30500-R.030
	1/2	.060	1	3	3	81619	81620	H45AL-SR-30500-R.060
	1/2	.060	1-1/4	3	3	81621	81622	H45AL-R-30500-R.060
	1/2	.060	1-5/8	4	3	81623	81624	H45AL-M-30500-R.060
	1/2	.060	2	4	3	81625	81626	H45AL-L-30500-R.060
3/4	3/4	.030	1-5/8	4	3	81627	81628	H45AL-R-30750-R.030
	3/4	.030	2-1/4	5	3	81629	81630	H45AL-M-30750-R.030
	3/4	.060	1-5/8	4	3	81631	81632	H45AL-R-30750-R.060
	3/4	.060	2-1/4	5	3	81633	81634	H45AL-M-30750-R.060

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Plunging / Ramping Slotting Roughing Finishing

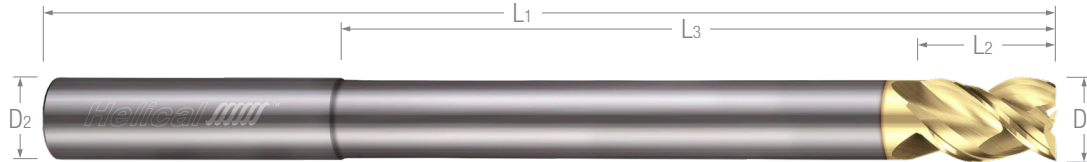
H45AL-RN-3



3 FLUTE - SQUARE

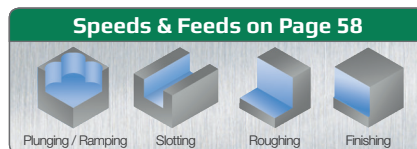
45° Helix - Reduced Neck

- Designed with a high helix for improved part finish and shearing action
- High helix for increased part finish and shearing action
- Cylindrically ground to maintain edge strength
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Zplus coating for maximum performance in aluminum and non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D1 (h6)	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} _{-.000"}	Overall Length L1 ^{+0.062"} _{-.062"}	Reach (LBS) L3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	3	1/2	.118	3	19015	19017	H45AL-RN-R-30125
	1/8	5/32	3	3/4	.118	3	19030	19032	H45AL-RN-M-30125
	1/8	5/32	3	1	.118	3	81565	81566	H45AL-RN-L-30125
3/16	3/16	7/32	3	1/2	.178	3	19060	19062	H45AL-RN-R-30187
	3/16	7/32	3	3/4	.178	3	19075	19077	H45AL-RN-M-30187
	3/16	7/32	3	1	.178	3	81567	81568	H45AL-RN-ML-30187
1/4	1/4	3/8	4	3/4	.237	3	19105	19107	H45AL-RN-S-30250
	1/4	3/8	4	1-1/8	.237	3	19120	19122	H45AL-RN-R-30250
	1/4	3/8	4	1-5/8	.237	3	81569	81570	H45AL-RN-A-30250
	1/4	3/8	4	2-1/8	.237	3	19135	19137	H45AL-RN-M-30250
	1/4	3/8	4	2-1/2	.237	3	81571	81572	H45AL-RN-ML-30250
5/16	5/16	7/16	4	1-1/8	.296	3	19165	19167	H45AL-RN-R-30312
	5/16	7/16	4	2-1/8	.296	3	19180	19182	H45AL-RN-M-30312
3/8	3/8	1/2	4	1-1/8	.356	3	19210	19212	H45AL-RN-R-30375
	3/8	1/2	4	1-5/8	.356	3	81573	81574	H45AL-RN-A-30375
	3/8	1/2	4	2-1/8	.356	3	19225	19227	H45AL-RN-M-30375
	3/8	1/2	6	3-1/8	.356	3	19235	19237	H45AL-RN-L-30375
	3/8	1/2	6	4	.356	3	19245	19247	H45AL-RN-X-30375
1/2	1/2	5/8	4	1-3/8	.475	3	19285	19287	H45AL-RN-R-30500
	1/2	5/8	4	1-3/4	.475	3	81575	81576	H45AL-RN-A-30500
	1/2	5/8	4	2-1/4	.475	3	19300	19302	H45AL-RN-M-30500
	1/2	5/8	4-1/2	2-3/4	.475	3	81577	81578	H45AL-RN-ML-30500
	1/2	5/8	6	3-3/8	.475	3	19315	19317	H45AL-RN-L-30500
	1/2	5/8	6	4-1/4	.475	3	19325	19327	H45AL-RN-X-30500
3/4	3/4	1	4	2	.712	3	19405	19407	H45AL-RN-R-30750
	3/4	1	6	2-1/2	.712	3	19420	19422	H45AL-RN-M-30750
	3/4	1	6	2-7/8	.712	3	81579	81580	H45AL-RN-ML-30750
	3/4	1	6	3-3/8	.712	3	19435	19437	H45AL-RN-L-30750
	3/4	1	6	4-3/8	.712	3	19445	19447	H45AL-RN-X-30750
1	1	1-1/4	7	4-3/8	.950	3	19495	19497	H45AL-RN-L-31000

*.0003 max TIR



SPEEDS & FEEDS



H45AL-3

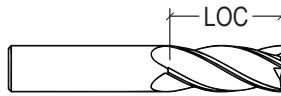
3 Flute - 45° Helix

Material Guide		SFM	Inches per Tooth (IPT)																							
			1/8			3/16			1/4			3/8			1/2			3/4			1					
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin			
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0008	.0016	.0018	.0012	.0023	.0021	.0016	.0031	.0023	.0024	.0045	.0027	.0032	.0059	.0032	.0046	.0085	.0037	.0058	.0108	.0045			
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0013	.0024	.0023	.0019	.0036	.0026	.0025	.0048	.0029	.0038	.0071	.0034	.0049	.0092	.0039	.0071	.0132	.0047	.0090	.0169	.0057			
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0009	.0016	.0019	.0013	.0024	.0021	.0017	.0032	.0024	.0025	.0047	.0027	.0033	.0062	.0032	.0047	.0089	.0038	.0060	.0113	.0047			

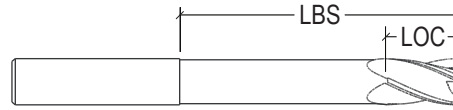
Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	75%-125% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-40% Diameter
	Reached	Up to Max LOC	30%-40% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

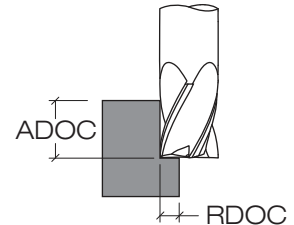
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

3 Flute

END MILLS FOR STEELS

Steels, High-Temp Alloys, & Titanium

ROUGHERS

PG

new	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	60
new	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	63
new	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	66
new	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	68
	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch	70
	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch - Reduced Neck	71

3 FLUTE

PG

	3 Flute	Square	Variable Pitch	74
	3 Flute	Corner Radius	Variable Pitch	75
	3 Flute	Ball		77
	3 Flute	Corner Radius		78
	3 Flute	Ball	Reduced Neck	79
	3 Flute	Corner Radius	Reduced Neck	80

4 FLUTE

PG

new	4 Flute	Square	Variable Pitch	82
	4 Flute	Square	Variable Pitch - Metric	84
new	4 Flute	Ball	Variable Pitch	85
new	4 Flute	Corner Radius	Variable Pitch	87
	4 Flute	Corner Radius	Variable Pitch - Metric	92
	4 Flute	Square	Variable Pitch - Reduced Neck	94
new	4 Flute	Ball	Variable Pitch - Reduced Neck	95
	4 Flute	Corner Radius	Variable Pitch - Reduced Neck	96

5 FLUTE

PG

new	5 Flute	Square	Variable Pitch	100
	5 Flute	Square	Variable Pitch - Metric	102
new	5 Flute	Corner Radius	Variable Pitch	103
	5 Flute	Corner Radius	Variable Pitch - Metric	108
	5 Flute	Square	Variable Pitch - Reduced Neck	110
	5 Flute	Corner Radius	Variable Pitch - Reduced Neck	112
	5 Flute	Square	Finisher	116

6 FLUTE

PG

new	6 Flute	Square	Variable Pitch	119
	6 Flute	Square	Variable Pitch - Metric	120
new	6 Flute	Ball	Variable Pitch	121
new	6 Flute	Corner Radius	Variable Pitch	122
	6 Flute	Corner Radius	Variable Pitch - Metric	125
new	6 Flute	Square	Variable Pitch - Reduced Neck	127
new	6 Flute	Ball	Variable Pitch - Reduced Neck	128
new	6 Flute	Corner Radius	Variable Pitch - Reduced Neck	129

7 FLUTE

PG

new	7 Flute	Square	Variable Pitch	131
	7 Flute	Square	Variable Pitch - Metric	132
new	7 Flute	Corner Radius	Variable Pitch	133
	7 Flute	Corner Radius	Variable Pitch - Metric	135
	7 Flute	Square	Finisher	138

MULTI-FLUTE

PG

	Multi-Flute	Corner Radius	Finisher	140
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4 FLUTE - CORNER RADIUS

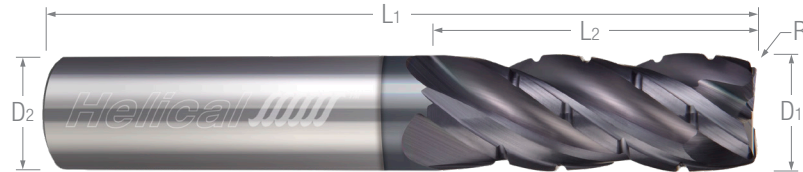
New Items!

HSVR-C-4

Chipbreaker Rougher - Variable Pitch

Roughers

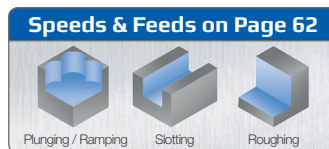
- Engineered with variable pitch and offset chipbreaker geometry for optimal chip evacuation, reduced harmonics, and reduced tool pressure
- Eccentric relief for maximum edge strength
- Redesigned end geometry for optimal ramping, slotting, and plunging
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Dia.	Corner Radius	LOC	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	Tool Description
$D1^{+.000}_{-.002}$	$D2$ (h6)	$R^{+.002}_{-.002}$	$L2^{+.032}_{-.000}$	$L1^{+.062}_{-.062}$				
1/8	1/8	.010	1/4	1-1/2	4	33017		HSVR-C-S-40125-R.010
	1/8	.010	3/8	2	4	82499		HSVR-C-SR-40125-R.010 new
	1/8	.010	1/2	2-1/2	4	33032		HSVR-C-R-40125-R.010 new
	1/8	.010	5/8	2-1/2	4	82500		HSVR-C-A-40125-R.010 new
3/16	3/16	.010	5/16	2	4	33077		HSVR-C-S-40187-R.010
	3/16	.010	7/16	2	4	82501		HSVR-C-SR-40187-R010 new
	3/16	.010	5/8	2-1/2	4	33092		HSVR-C-R-40187-R.010
	3/16	.010	1	2-1/2	4	82502		HSVR-C-M-40187-R.010 new
1/4	1/4	.020	3/8	2	4	33137	33137W	HSVR-C-S-40250-R.020
	1/4	.020	1/2	2-1/2	4	33142	33142W	HSVR-C-SR-40250-R.020 new
	1/4	.020	3/4	2-1/2	4	33152	33152W	HSVR-C-R-40250-R.020
	1/4	.020	1	3	4	33167		HSVR-C-M-40250-R.020
	1/4	.020	1-1/4	3	4	82503		HSVR-C-L-40250-R.020 new
5/16	5/16	.020	1/2	2	4	33227		HSVR-C-S-40312-R.020
	5/16	.020	3/4	2-1/2	4	33242		HSVR-C-R-40312-R.020
	5/16	.020	1	2-1/2	4	82504		HSVR-C-A-40312-R.020 new
	5/16	.020	1-1/4	3	4	33257		HSVR-C-M-40312-R.020
3/8	3/8	.020	1/2	2	4	33317	33317W	HSVR-C-S-40375-R.020
	3/8	.020	7/8	3	4	33332	33332W	HSVR-C-SR-40375-R.020
	3/8	.020	1	3	4	33337	33337W	HSVR-C-R-40375-R.020
	3/8	.020	1-1/4	3	4	33347	33347W	HSVR-C-M-40375-R.020
	3/8	.020	1-1/2	3	4	82505		HSVR-C-L-40375-R.020 new
7/16	7/16	.020	5/8	2-3/4	4	33407		HSVR-C-S-40437-R.020
	7/16	.020	7/8	2-3/4	4	33422		HSVR-C-R-40437-R.020
1/2	1/2	.030	5/8	2-1/2	4	33497	33497W	HSVR-C-S-40500-R.030
	1/2	.030	1	3	4	33512	33512W	HSVR-C-SR-40500-R.030
	1/2	.030	1-1/4	3	4	33527	33527W	HSVR-C-R-40500-R.030
	1/2	.030	1-5/8	4	4	33542	33542W	HSVR-C-M-40500-R.030
	1/2	.030	2	4	4	82506		HSVR-C-L-40500-R.030 new
	1/2	.030	2-1/2	4	4	82507		HSVR-C-LX-40500-R.030 new

* .0005 max TIR

continued on next page



HSVR-C-4

New Items!

4 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Dia.	Corner Radius	LOC	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
$D_1^{+0.000''}$ $-0.002''$	$D_2 (h6)$	$R^{+0.002''}$ $-0.002''$	$L_2^{+0.032''}$ $-0.000''$	$L_1^{+0.062''}$ $-0.062''$				
new new new new	5/8	.030	3/4	3	4	33557	33557W	HSVR-C-S-40625-R.030
	5/8	.030	1-1/4	3-1/2	4	33572	33572W	HSVR-C-SR-40625-R.030
	5/8	.030	1-5/8	3-1/2	4	33587	33587W	HSVR-C-R-40625-R.030
	5/8	.030	2	4	4	33602	33602W	HSVR-C-M-40625-R.030
	5/8	.030	2-1/2	5	4	82508		HSVR-C-ML-40625-R.030
	5/8	.030	3-1/4	6	4	33617		HSVR-C-L-40625-R.030
new	3/4	.030	7/8	3	4	33632	33632W	HSVR-C-S-40750-R.030
	3/4	.030	1-1/4	4	4	33647	33647W	HSVR-C-SR-40750-R.030
	3/4	.030	1-5/8	4	4	33662	33662W	HSVR-C-R-40750-R.030
	3/4	.030	2-1/4	5	4	33677	33677W	HSVR-C-M-40750-R.030
	3/4	.030	2-3/4	5	4	82509		HSVR-C-ML-40750-R.030
	3/4	.030	3-1/4	6	4	33692	33692W	HSVR-C-L-40750-R.030
1	1	.030	1-1/2	4	4	33707		HSVR-C-S-41000-R.030
	1	.030	2	4-1/2	4	33722		HSVR-C-SR-41000-R.030
	1	.030	2-5/8	5	4	33737	33737W	HSVR-C-R-41000-R.030
	1	.030	3	6	4	33742	33742W	HSVR-C-M-41000-R.030
	1	.030	4-1/4	7	4	33752		HSVR-C-L-41000-R.030

*.0005 max TIR

SPEEDS & FEEDS

HSVR-C-4

4 Flute - Chipbreaker Rougher - Variable Pitch

Roughers

HSVR-C-4																		
Material Guide	Hardness	SFM	Inches per Tooth (IPT)															
			1/8		3/16		1/4		3/8		1/2		3/4		1			
			Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh		
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB 75 - 98 HRB 21 - 36 HRC	455 445 400	.0008 .0006 .0004	.0013 .0009 .0006	.0012 .0008 .0005	.0019 .0014 .0009	.0015 .0011 .0007	.0025 .0018 .0012	.0023 .0017 .0011	.0037 .0027 .0017	.0030 .0022 .0014	.0048 .0035 .0023	.0042 .0031 .0020	.0069 .0051 .0033	.0054 .0040 .0026	.0088 .0065 .0042	
	LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	390 340 260 155	.0005 .0004 .0003 .0003	.0008 .0006 .0005 .0004	.0007 .0005 .0005 .0004	.0012 .0009 .0008 .0006	.0010 .0007 .0006 .0005	.0016 .0012 .0010 .0008	.0014 .0011 .0009 .0007	.0023 .0017 .0015 .0012	.0019 .0014 .0012 .0010	.0031 .0027 .0020 .0016	.0027 .0024 .0018 .0014	.0044 .0033 .0029 .0023	.0034 .0025 .0022 .0017	.0056 .0042 .0036 .0029
		TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	340 250 145 85	.0005 .0004 .0003 .0003	.0008 .0006 .0005 .0004	.0007 .0006 .0005 .0006	.0012 .0009 .0007 .0006	.0010 .0008 .0010 .0005	.0016 .0013 .0010 .0008	.0014 .0011 .0009 .0007	.0023 .0019 .0015 .0012	.0019 .0015 .0012 .0010	.0031 .0024 .0019 .0016	.0027 .0024 .0019 .0014	.0044 .0035 .0027 .0022	.0034 .0024 .0021 .0017
SPECIALTY STEEL			300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB 75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	290 255 175 150 55	.0006 .0005 .0004 .0004 .0002	.0011 .0007 .0007 .0006 .0004	.0010 .0007 .0006 .0005 .0003	.0015 .0011 .0010 .0009 .0004	.0013 .0009 .0008 .0007 .0007	.0021 .0014 .0013 .0011 .0006	.0019 .0013 .0012 .0010 .0010	.0031 .0021 .0019 .0017 .0017	.0025 .0017 .0015 .0014 .0008	.0040 .0028 .0025 .0022 .0014	.0035 .0028 .0022 .0019 .0012	.0058 .0040 .0035 .0032 .0019	.0045 .0031 .0028 .0025 .0015
	AUSTENITIC STAINLESS STEEL		Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	265 225 180	.0005 .0004 .0003	.0008 .0007 .0006	.0007 .0006 .0005	.0011 .0010 .0008	.0009 .0008 .0007	.0015 .0014 .0011	.0014 .0013 .0010	.0023 .0021 .0016	.0018 .0016 .0013	.0030 .0027 .0022	.0026 .0024 .0019	.0043 .0039 .0031	.0033 .0030 .0024
		MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB 21 - 36 HRC	300 280	.0005 .0004	.0008 .0007	.0007 .0006	.0012 .0010	.0010 .0008	.0016 .0014	.0014 .0012	.0024 .0020	.0019 .0016	.0031 .0027	.0027 .0023	.0044 .0038	.0034 .0030
PH STAINLESS STEEL			15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC 36 - 50 HRC	200 145	.0004 .0003	.0006 .0005	.0005 .0008	.0009 .0006	.0007 .0010	.0012 .0010	.0011 .0009	.0017 .0015	.0014 .0012	.0023 .0020	.0020 .0017	.0032 .0028	.0025 .0022
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0008	.0013	.0012	.0019	.0016	.0026	.0023	.0038	.0030	.0050	.0044	.0071	.0055	.0091	
		21 - 36 HRC	370	.0004	.0007	.0006	.0010	.0009	.0014	.0013	.0021	.0017	.0027	.0024	.0039	.0030	.0049	
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0005	.0008	.0008	.0012	.0010	.0016	.0015	.0024	.0019	.0032	.0028	.0045	.0035	.0058	
		21 - 36 HRC	335	.0004	.0007	.0007	.0010	.0009	.0014	.0013	.0021	.0017	.0027	.0024	.0039	.0030	.0049	
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0005	.0009	.0008	.0013	.0010	.0017	.0015	.0025	.0020	.0033	.0029	.0047	.0037	.0060	
		21 - 36 HRC	260	.0004	.0006	.0005	.0008	.0007	.0011	.0010	.0017	.0013	.0022	.0019	.0031	.0024	.0040	
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0007	.0011	.0010	.0016	.0013	.0022	.0020	.0032	.0026	.0042	.0037	.0060	.0047	.0077	
		75 - 98 HRB	250	.0006	.0009	.0008	.0014	.0011	.0018	.0017	.0027	.0022	.0035	.0031	.0051	.0039	.0064	
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0003	.0006	.0005	.0008	.0007	.0011	.0010	.0016	.0013	.0022	.0019	.0031	.0024	.0039	
		21 - 36 HRC	75	.0003	.0005	.0005	.0008	.0006	.0011	.0010	.0016	.0013	.0021	.0018	.0030	.0023	.0037	
		36 - 50 HRC	70	.0003	.0005	.0004	.0007	.0006	.0009	.0008	.0014	.0011	.0018	.0015	.0025	.0020	.0032	
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0009	.0015	.0014	.0022	.0018	.0030	.0027	.0044	.0036	.0058	.0051	.0083	.0065	.106	
		75 - 98 HRB	275	.0008	.0013	.0012	.0019	.0015	.0025	.0023	.0037	.0030	.0049	.0043	.0070	.0054	.089	
		21 - 36 HRC	250	.0006	.0010	.0009	.0014	.0012	.0019	.0017	.0028	.0022	.0037	.0032	.0052	.0041	.067	
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0005	.0008	.0007	.0011	.0009	.0015	.0014	.0022	.0018	.0029	.0025	.0041	.0032	.053	
		36 - 50 HRC	160	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0020	.0016	.0026	.0023	.0038	.0029	.048	
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0004	.0006	.0006	.0009	.0008	.0013	.0011	.0019	.0015	.0024	.0021	.0035	.0027	.0045	
		21 - 36 HRC	170	.0004	.0006	.0006	.0009	.0008	.0012	.0011	.0018	.0014	.0024	.0021	.0034	.0026	.0043	
		36 - 50 HRC	65	.0003	.0004	.0004	.0006	.0005	.0008	.0007	.0012	.0010	.0016	.0014	.0023	.0018	.0029	

Milling Process	Hardness	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	75%-125% Diameter	100% Diameter
	≥ 35 HRC	60%-75% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	20%-40% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

HEV-C-5

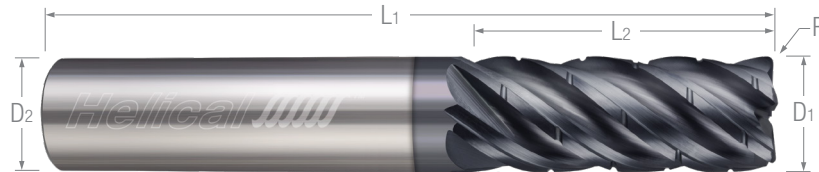


New Items!

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Engineered for excellent performance in High Efficiency Milling (HEM)
- 5 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, reduced harmonics, and reduced tool pressure
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity, higher speeds and feeds, and increased wear resistance
- Solid carbide
- CNC ground in the USA

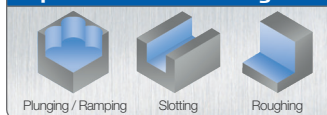


Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1^{+0.000^*}_{-0.002^*}$	$D_2 (h6)$	$R^{+0.002^*}_{-0.002^*}$	$L_2^{+0.032^*}_{-0.000^*}$	$L_1^{+0.062^*}_{-0.062^*}$			
new 1/8	1/8	.010	1/4	1-1/2	5	59391	HEV-C-S-50125-R.010
	1/8	.010	3/8	2	5	82213	HEV-C-SR-50125-R.010
	1/8	.010	1/2	2-1/2	5	59392	HEV-C-R-50125-R.010
	1/8	.010	5/8	2-1/2	5	82214	HEV-C-A-50125-R.010
new 3/16	3/16	.010	5/16	2	5	59393	HEV-C-S-50187-R.010
	3/16	.010	7/16	2	5	81956	HEV-C-SR-50187-R.010
	3/16	.010	9/16	2-1/2	5	59394	HEV-C-R-50187-R.010
	3/16	.010	3/4	2-1/2	5	81957	HEV-C-M-50187-R.010
new 1/4	1/4	.020	3/8	2	5	59395	HEV-C-S-50250-R.020
	1/4	.020	1/2	2-1/2	5	59396	HEV-C-SR-50250-R.020
	1/4	.020	3/4	2-1/2	5	59397	HEV-C-R-50250-R.020
	1/4	.020	1	3	5	59398	HEV-C-M-50250-R.020
	1/4	.020	1-1/4	3	5	82215	HEV-C-L-50250-R.020
new 5/16	5/16	.020	7/16	2	5	59399	HEV-C-S-50312-R.020
	5/16	.020	13/16	2-1/2	5	59400	HEV-C-R-50312-R.020
	5/16	.020	1-1/4	3	5	82216	HEV-C-L-50312-R.020
new 3/8	3/8	.020	1/2	2	5	59401	HEV-C-S-50375-R.020
	3/8	.020	3/4	2-1/2	5	81958	HEV-C-SR-50375-R.020
	3/8	.020	1	3	5	59402	HEV-C-R-50375-R.020
	3/8	.020	1-1/4	3	5	59403	HEV-C-M-50375-R.020
	3/8	.020	1-1/2	3-1/2	5	82217	HEV-C-L-50375-R.020

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 65



5 FLUTE - CORNER RADIUS New Items!



HEV-C-5

Chipbreaker Rougher - Variable Pitch (cont.)

Roughers

continued from previous page

Cutter Diameter* D1 $^{+.000''}$ $_{-.002''}$	Shank Diameter D2 (h6)	Corner Radius R $^{+.002''}$ $_{-.002''}$	Length of Cut L2 $^{+.032''}$ $_{-.000''}$	Overall Length L1 $^{+.062''}$ $_{-.062''}$	Flutes	Aplus Coated	Tool Description
1/2	1/2	.030	5/8	2-1/2	5	59404	HEV-C-S-50500-R.030
	1/2	.030	1	3	5	59405	HEV-C-SR-50500-R.030
	1/2	.030	1-1/4	3	5	59406	HEV-C-R-50500-R.030
	1/2	.030	1-5/8	4	5	59407	HEV-C-M-50500-R.030
	1/2	.030	2	4	5	59408	HEV-C-L-50500-R.030
	1/2	.030	2-1/2	5	5	81959	HEV-C-LX-50500-R.030
	1/2	.030	3-1/8	6	5	82218	HEV-C-X-50500-R.030 new
	1/2	.030	3-5/8	6	5	82219	HEV-C-Y-50500-R.030 new
	1/2	.060	5/8	2-1/2	5	81960	HEV-C-S-50500-R.060
	1/2	.060	1	3	5	81961	HEV-C-SR-50500-R.060
	1/2	.060	1-1/4	3	5	81962	HEV-C-R-50500-R.060
	1/2	.060	1-5/8	4	5	81963	HEV-C-M-50500-R.060
	1/2	.060	2	4	5	81964	HEV-C-L-50500-R.060
	1/2	.060	2-1/2	5	5	81965	HEV-C-LX-50500-R.060
5/8	5/8	.030	3/4	3	5	59409	HEV-C-S-50625-R.030
	5/8	.030	1-1/4	3-1/2	5	59410	HEV-C-SR-50625-R.030
	5/8	.030	1-5/8	3-1/2	5	59411	HEV-C-R-50625-R.030
	5/8	.030	2-1/8	4	5	59412	HEV-C-M-50625-R.030
	5/8	.030	2-1/2	5	5	82220	HEV-C-L-50625-R.030 new
	5/8	.030	3-1/4	6	5	82221	HEV-C-LX-50625-R.030 new
	5/8	.060	3/4	3	5	81966	HEV-C-S-50625-R.060
	5/8	.060	1-1/4	3-1/2	5	81967	HEV-C-SR-50625-R.060
	5/8	.060	1-5/8	3-1/2	5	81968	HEV-C-R-50625-R.060
3/4	3/4	.030	1	3	5	59413	HEV-C-S-50750-R.030
	3/4	.030	1-5/8	4	5	59414	HEV-C-R-50750-R.030
	3/4	.030	2-1/4	5	5	59415	HEV-C-M-50750-R.030
	3/4	.030	2-3/4	5	5	59416	HEV-C-L-50750-R.030
	3/4	.030	3-1/4	6	5	59417	HEV-C-LX-50750-R.030
	3/4	.030	4	6-1/2	5	82222	HEV-C-X-50750-R.030 new
	3/4	.060	1	3	5	81970	HEV-C-S-50750-R.060
	3/4	.060	1-5/8	4	5	81971	HEV-C-R-50750-R.060
	3/4	.060	2-1/4	5	5	81972	HEV-C-M-50750-R.060
	3/4	.060	2-3/4	5	5	81973	HEV-C-L-50750-R.060
1	1	.030	1-1/4	4	5	59418	HEV-C-S-51000-R.030
	1	.030	2	4-1/2	5	59419	HEV-C-R-51000-R.030

* .0005 max TIR



Optimizing Roughing with Chipbreaker Tooling

The unique notch profiles on Chipbreaker End Mills create a serrated cutting edge and work to break up long, stringy chips to aid in the chip evacuation process. Learn about all of the special benefits of this cutting geometry in our "In the Loupe" blog post **Optimize Roughing with Chipbreaker Tooling**.

[Read more on helical.blog/intheloupe](https://helical.blog/intheloupe)

6 FLUTE - CORNER RADIUS New!

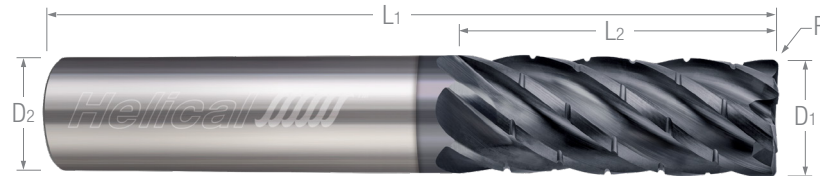


HEV-C-6

Chipbreaker Rougher - Variable Pitch

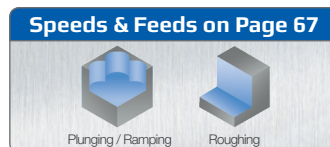
Roughers

- Engineered for excellent performance in High Efficiency Milling (HEM)
- 6 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, reduced harmonics, and reduced tool pressure
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity, higher speeds and feeds, and increased wear resistance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D1 ^{+0.001"} / _{-.002"}	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} / _{-.002"}	Length of Cut L2 ^{+0.032"} / _{-.000"}	Overall Length L1 ^{+0.062"} / _{-.062"}	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	.020	3/8	2	6	82223	HEV-C-S-60250-R.020	new
	1/4	.020	1/2	2-1/2	6	82224	HEV-C-SR-60250-R.020	new
	1/4	.020	3/4	2-1/2	6	82225	HEV-C-R-60250-R.020	new
	1/4	.020	1	3	6	82226	HEV-C-M-60250-R.020	new
3/8	3/8	.030	1/2	2	6	82227	HEV-C-S-60375-R.030	new
	3/8	.030	3/4	2-1/2	6	82228	HEV-C-SR-60375-R.030	new
	3/8	.030	1	3	6	82229	HEV-C-R-60375-R.030	new
	3/8	.030	1-1/4	3	6	82230	HEV-C-M-60375-R.030	new
1/2	1/2	.030	5/8	2-1/2	6	82231	HEV-C-S-60500-R.030	new
	1/2	.030	1	3	6	82232	HEV-C-SR-60500-R.030	new
	1/2	.030	1-1/4	3	6	82233	HEV-C-R-60500-R.030	new
	1/2	.030	1-5/8	4	6	82234	HEV-C-M-60500-R.030	new
	1/2	.030	2	4	6	82235	HEV-C-L-60500-R.030	new
	1/2	.030	2-1/2	5	6	82236	HEV-C-LX-60500-R.030	new
	1/2	.060	5/8	2-1/2	6	82237	HEV-C-S-60500-R.060	new
	1/2	.060	1	3	6	82238	HEV-C-SR-60500-R.060	new
	1/2	.060	1-1/4	3	6	82239	HEV-C-R-60500-R.060	new
	1/2	.060	1-5/8	4	6	82240	HEV-C-M-60500-R.060	new
	1/2	.060	2	4	6	82241	HEV-C-L-60500-R.060	new
	1/2	.060	2-1/2	5	6	82242	HEV-C-LX-60500-R.060	new
5/8	5/8	.060	1-1/4	3-1/2	6	82243	HEV-C-SR-60625-R.060	new
	5/8	.060	1-5/8	3-1/2	6	82244	HEV-C-R-60625-R.060	new
	5/8	.060	2	4	6	82245	HEV-C-M-60625-R.060	new
3/4	3/4	.060	1-5/8	4	6	82246	HEV-C-R-60750-R.060	new
	3/4	.060	2-1/4	5	6	82247	HEV-C-M-60750-R.060	new
	3/4	.060	2-3/4	5	6	82248	HEV-C-L-60750-R.060	new

* .0005 max TIR



HEV-C-6



SPEEDS & FEEDS

6 Flute - Chipbreaker Rougher - Variable Pitch

HEV-C-6

Material Guide		Hardness	SFM							
				1/8	3/16	1/4	3/8	1/2	3/4	1
				Rgh	Rgh	Rgh	Rgh	Rgh	Rgh	Rgh
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0014	.0020	.0028	.0041	.0054	.0077	.0099
		75 - 98 HRB	445	.0010	.0015	.0020	.0030	.0040	.0057	.0073
		21 - 36 HRC	400	.0007	.0010	.0013	.0020	.0026	.0037	.0047
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0009	.0013	.0018	.0026	.0034	.0049	.0063
		21 - 36 HRC	340	.0007	.0010	.0013	.0020	.0026	.0037	.0047
		36 - 50 HRC	260	.0006	.0008	.0011	.0017	.0022	.0032	.0041
		> 50 HRC	155	.0005	.0007	.0009	.0014	.0018	.0025	.0033
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0009	.0013	.0018	.0026	.0034	.0049	.0063
		21 - 36 HRC	250	.0007	.0010	.0014	.0021	.0027	.0039	.0050
		36 - 50 HRC	145	.0006	.0008	.0011	.0016	.0021	.0031	.0040
		> 50 HRC	85	.0005	.0007	.0009	.0013	.0017	.0025	.0032
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0012	.0017	.0023	.0034	.0045	.0064	.0082
		75 - 98 HRB	255	.0008	.0012	.0016	.0023	.0031	.0044	.0056
		21 - 36 HRC	175	.0007	.0010	.0014	.0021	.0027	.0039	.0051
		36 - 50 HRC	150	.0006	.0009	.0013	.0019	.0025	.0035	.0046
		> 50 HRC	55	.0004	.0006	.0008	.0012	.0015	.0022	.0028
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-TMO, 316, 316L, 321, 347	75 - 98 HRB	265	.0009	.0013	.0017	.0025	.0033	.0048	.0061
		21 - 36 HRC	225	.0008	.0011	.0015	.0023	.0030	.0043	.0055
		36 - 50 HRC	180	.0006	.0009	.0012	.0018	.0024	.0034	.0044
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0009	.0013	.0018	.0026	.0034	.0049	.0064
		21 - 36 HRC	280	.0008	.0011	.0015	.0023	.0030	.0043	.0055
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0007	.0010	.0013	.0019	.0025	.0036	.0047
		36 - 50 HRC	145	.0006	.0008	.0011	.0017	.0022	.0031	.0040
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0014	.0021	.0029	.0042	.0056	.0080	.0103
		21 - 36 HRC	370	.0008	.0011	.0016	.0023	.0030	.0043	.0056
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0009	.0013	.0018	.0027	.0035	.0051	.0065
		21 - 36 HRC	335	.0008	.0012	.0016	.0023	.0030	.0043	.0056
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0010	.0014	.0019	.0028	.0037	.0052	.0068
		21 - 36 HRC	260	.0006	.0009	.0012	.0019	.0024	.0035	.0045
		36 - 50 HRC	135	.0004	.0006	.0008	.0012	.0015	.0022	.0029
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0012	.0018	.0024	.0036	.0047	.0067	.0087
		75 - 98 HRB	250	.0010	.0015	.0020	.0030	.0039	.0057	.0073
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0006	.0009	.0012	.0018	.0024	.0034	.0044
		21 - 36 HRC	75	.0006	.0009	.0012	.0017	.0023	.0033	.0042
		36 - 50 HRC	70	.0005	.0007	.0010	.0015	.0020	.0028	.0036
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0017	.0025	.0033	.0050	.0065	.0093	.0120
		75 - 98 HRB	275	.0014	.0021	.0028	.0042	.0055	.0078	.0101
		21 - 36 HRC	250	.0011	.0015	.0021	.0031	.0041	.0059	.0076
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0009	.0012	.0017	.0025	.0032	.0046	.0060
		36 - 50 HRC	160	.0008	.0011	.0015	.0022	.0029	.0042	.0054
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0007	.0010	.0014	.0021	.0027	.0039	.0051
		21 - 36 HRC	170	.0007	.0010	.0014	.0020	.0026	.0038	.0049
		36 - 50 HRC	65	.0005	.0007	.0009	.0014	.0018	.0026	.0033

Milling Process	Hardness	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	15%-25% Diameter
	≥ 35 HRC	Up to Max LOC	10%-20% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

7 FLUTE - CORNER RADIUS

New Items!

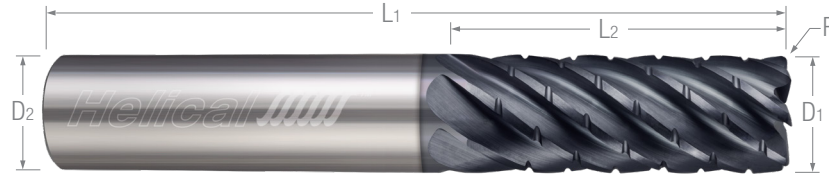


HEV-C-7

Chipbreaker Rougher - Variable Pitch

Roughers

- Engineered for excellent performance in High Efficiency Milling (HEM)
- 7 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, reduced harmonics, and reduced tool pressure
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity, higher speeds and feeds, and increased wear resistance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D1 ^{+0.001"} / _{-.002"}	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} / _{-.002"}	Length of Cut L2 ^{+0.032"} / _{-.000"}	Overall Length L1 ^{+0.062"} / _{-.062"}	Flutes	<i>Aplus</i> Coated	Tool Description
1/4	1/4	.020	3/8	2	7	59420	HEV-C-S-70250-R.020
	1/4	.020	1/2	2	7	59421	HEV-C-SR-70250-R.020
	1/4	.020	3/4	2-1/2	7	59422	HEV-C-R-70250-R.020
	1/4	.020	1	3	7	82249	HEV-C-M-70250-R.020 new
3/8	3/8	.020	1/2	2	7	59423	HEV-C-S-70375-R.020
	3/8	.020	3/4	2-1/2	7	59424	HEV-C-SR-70375-R.020
	3/8	.020	1	2-1/2	7	59425	HEV-C-R-70375-R.020
	3/8	.020	1-1/2	3-1/2	7	82250	HEV-C-L-70375-R.020 new
1/2	1/2	.030	5/8	2-1/2	7	59426	HEV-C-S-70500-R.030
	1/2	.030	1	3	7	59427	HEV-C-SR-70500-R.030
	1/2	.030	1-1/4	3	7	59428	HEV-C-R-70500-R.030
	1/2	.030	1-5/8	4	7	59429	HEV-C-M-70500-R.030
	1/2	.030	2	4	7	81975	HEV-C-L-70500-R.030
	1/2	.030	2-1/2	5	7	82251	HEV-C-LX-70500-R.030 new
	1/2	.030	3-1/8	6	7	82252	HEV-C-X-70500-R.030 new
	1/2	.060	5/8	2-1/2	7	81978	HEV-C-S-70500-R.060
	1/2	.060	1	3	7	81979	HEV-C-SR-70500-R.060
	1/2	.060	1-1/4	3	7	81980	HEV-C-R-70500-R.060
	1/2	.060	1-5/8	4	7	81981	HEV-C-M-70500-R.060
	1/2	.060	2	4	7	81982	HEV-C-L-70500-R.060
5/8	5/8	.030	1-1/4	3-1/2	7	59430	HEV-C-SR-70625-R.030
	5/8	.030	1-5/8	4	7	59431	HEV-C-R-70625-R.030
	5/8	.030	2-1/8	4	7	81976	HEV-C-M-70625-R.030
	5/8	.060	1-1/4	3-1/2	7	81983	HEV-C-SR-70625-R.060
	5/8	.060	1-5/8	4	7	81984	HEV-C-R-70625-R.060
	5/8	.060	2-1/8	4	7	81985	HEV-C-M-70625-R.060
3/4	3/4	.030	1-5/8	4	7	59432	HEV-C-R-70750-R.030
	3/4	.030	2-1/4	5	7	59433	HEV-C-M-70750-R.030
	3/4	.030	2-3/4	5	7	81977	HEV-C-L-70750-R.030
	3/4	.060	1-5/8	4	7	81986	HEV-C-R-70750-R.060
	3/4	.060	2-1/4	5	7	81987	HEV-C-M-70750-R.060
	3/4	.060	2-3/4	5	7	81988	HEV-C-L-70750-R.060

* .0005 max TIR

Speeds & Feeds on Page 69



HEV-C-7



SPEEDS & FEEDS

7 Flute - Chipbreaker Rougher - Variable Pitch

HEV-C-7										
Material Guide		Hardness	SFM	1/8	3/16	1/4	3/8	1/2	3/4	1
				Rgh	Rgh	Rgh	Rgh	Rgh	Rgh	Rgh
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0015	.0023	.0030	.0045	.0058	.0085	.0108
		75 - 98 HRB	445	.0011	.0017	.0022	.0033	.0042	.0062	.0079
		21 - 36 HRC	400	.0007	.0011	.0014	.0021	.0028	.0040	.0051
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0010	.0014	.0019	.0029	.0037	.0054	.0068
		21 - 36 HRC	340	.0007	.0011	.0014	.0021	.0027	.0040	.0051
		36 - 50 HRC	260	.0006	.0009	.0012	.0019	.0024	.0035	.0044
		> 50 HRC	155	.0005	.0007	.0010	.0015	.0019	.0028	.0035
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0010	.0014	.0019	.0029	.0037	.0054	.0068
		21 - 36 HRC	250	.0008	.0011	.0015	.0023	.0029	.0043	.0054
		36 - 50 HRC	145	.0006	.0009	.0012	.0018	.0023	.0033	.0042
		> 50 HRC	85	.0005	.0007	.0010	.0014	.0019	.0027	.0034
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0013	.0019	.0025	.0037	.0048	.0070	.0089
		75 - 98 HRB	255	.0009	.0013	.0017	.0026	.0033	.0048	.0061
		21 - 36 HRC	175	.0008	.0012	.0015	.0023	.0030	.0043	.0055
		36 - 50 HRC	150	.0007	.0011	.0014	.0021	.0027	.0039	.0049
		> 50 HRC	55	.0004	.0006	.0008	.0013	.0016	.0024	.0030
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0009	.0014	.0019	.0028	.0036	.0052	.0066
		21 - 36 HRC	225	.0008	.0013	.0017	.0025	.0032	.0047	.0060
		36 - 50 HRC	180	.0007	.0010	.0013	.0020	.0026	.0038	.0048
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0010	.0015	.0019	.0029	.0037	.0054	.0068
		21 - 36 HRC	280	.0008	.0013	.0017	.0025	.0032	.0047	.0059
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0007	.0011	.0014	.0021	.0027	.0039	.0050
		36 - 50 HRC	145	.0006	.0009	.0012	.0018	.0024	.0034	.0044
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0016	.0024	.0031	.0046	.0060	.0087	.0111
		21 - 36 HRC	370	.0009	.0013	.0017	.0025	.0032	.0047	.0060
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0010	.0015	.0019	.0029	.0038	.0055	.0070
		21 - 36 HRC	335	.0009	.0013	.0017	.0025	.0033	.0047	.0060
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0010	.0016	.0020	.0031	.0039	.0057	.0073
		21 - 36 HRC	260	.0007	.0010	.0013	.0020	.0026	.0038	.0048
		36 - 50 HRC	135	.0004	.0007	.0009	.0013	.0017	.0024	.0031
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0013	.0020	.0026	.0039	.0051	.0074	.0094
		75 - 98 HRB	250	.0011	.0017	.0022	.0033	.0042	.0062	.0079
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0007	.0010	.0013	.0020	.0026	.0037	.0048
		21 - 36 HRC	75	.0007	.0010	.0013	.0019	.0025	.0036	.0046
		36 - 50 HRC	70	.0006	.0008	.0011	.0016	.0021	.0031	.0039
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0018	.0028	.0036	.0054	.0070	.0102	.0129
		75 - 98 HRB	275	.0015	.0023	.0030	.0045	.0059	.0085	.0108
		21 - 36 HRC	250	.0011	.0017	.0023	.0034	.0044	.0064	.0081
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0009	.0014	.0018	.0027	.0035	.0050	.0064
		36 - 50 HRC	160	.0008	.0012	.0016	.0025	.0032	.0046	.0058
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0008	.0012	.0015	.0023	.0029	.0043	.0054
		21 - 36 HRC	170	.0007	.0011	.0015	.0022	.0028	.0041	.0052
		36 - 50 HRC	65	.0005	.0008	.0010	.0015	.0019	.0028	.0036

Milling Process	Hardness	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	10%-20% Diameter
	≥ 35 HRC	Up to Max LOC	10%-20% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

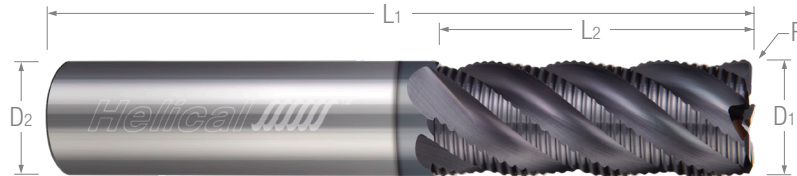
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

MULTI-FLUTE - CORNER RADIUS

HXVR

Knuckle Rougher - Variable Pitch

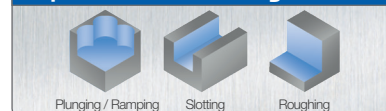
- Engineered with staggered "low profile" edge geometry for chip control and minimized cutting forces
- Available in 4 flute and 5 flute options
- Center cutting
- h6 shank tolerance for high precision tool holders
- Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter $D_1^{+0.000}_{-0.002}$	Shank Diameter D_2 (h6)	Corner Radius $R^{+0.002}_{-0.002}$	Length of Cut $L_2^{+0.032}_{-0.000}$	Overall Length $L_1^{+0.062}_{-0.062}$	Flutes	<i>Aplus</i> Coated	Tool Description
1/4	1/4	.030	3/8	2	4	54017	HXVR-S-40250-R.030
	1/4	.030	3/4	2-1/2	4	54047	HXVR-R-40250-R.030
3/8	3/8	.040	1/2	2	4	54092	HXVR-S-40375-R.040
	3/8	.040	1/2	2	5	55092	HXVR-S-50375-R.040
	3/8	.040	1	3	4	54107	HXVR-R-40375-R.040
	3/8	.040	1	3	5	55107	HXVR-R-50375-R.040
1/2	1/2	.040	5/8	2-1/2	4	54152	HXVR-S-40500-R.040
	1/2	.040	5/8	2-1/2	5	55152	HXVR-S-50500-R.040
	1/2	.040	1-1/4	3	4	54182	HXVR-R-40500-R.040
	1/2	.040	1-1/4	3	5	55182	HXVR-R-50500-R.040
5/8	5/8	.060	3/4	3	4	54227	HXVR-S-40625-R.060
	5/8	.060	3/4	3	5	55227	HXVR-S-50625-R.060
	5/8	.060	1-5/8	3-1/2	4	54257	HXVR-R-40625-R.060
	5/8	.060	1-5/8	3-1/2	5	55257	HXVR-R-50625-R.060
3/4	3/4	.060	1	3	4	54302	HXVR-S-40750-R.060
	3/4	.060	1	3	5	55302	HXVR-S-50750-R.060
	3/4	.060	1-5/8	4	4	54317	HXVR-R-40750-R.060
	3/4	.060	1-5/8	4	5	55317	HXVR-R-50750-R.060
1	1	.060	1-1/4	4	4	54377	HXVR-S-41000-R.060
	1	.060	1-1/4	4	5	55377	HXVR-S-51000-R.060
	1	.060	2	4-1/2	4	54392	HXVR-R-41000-R.060
	1	.060	2	4-1/2	5	55392	HXVR-R-51000-R.060

* .0005 max TIR

Speeds & Feeds on Pages 72-73

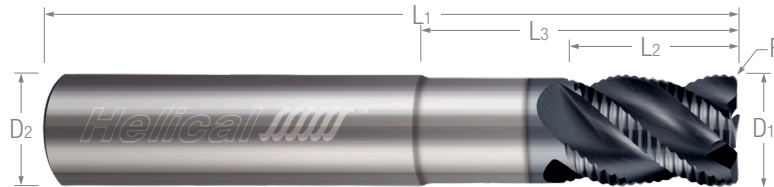


HXVR-RN

MULTI-FLUTE - CORNER RADIUS

Knuckle Rougher - Variable Pitch - Reduced Neck

- Engineered with staggered "low profile" edge geometry for chip control and minimized cutting forces
- Available in 4 flute and 5 flute options
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.*	Shank Dia.	Corner Radius	Length of Cut	Overall Length	Reach (LBS)	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1^{+0.000}_{-0.002}$	D_2 (h6)	$R^{+0.002}_{-0.002}$	$L_2^{+0.032}_{-0.000}$	$L_1^{+0.062}_{-0.062}$	L_3				
1/4	1/4	.030	3/8	2-1/2	1-1/8	.237	4	64032	HXVR-RN-R-40250-R.030
3/8	3/8	.040	1/2	2-1/2	1-1/8	.356	4	64077	HXVR-RN-R-40375-R.040
	3/8	.040	1/2	2-1/2	1-1/8	.356	5	65077	HXVR-RN-R-50375-R.040
1/2	1/2	.040	5/8	3	1-3/8	.475	4	64152	HXVR-RN-R-40500-R.040
	1/2	.040	5/8	3	1-3/8	.475	5	65152	HXVR-RN-R-50500-R.040
5/8	5/8	.060	3/4	3-1/2	1-5/8	.593	5	65227	HXVR-RN-R-50625-R.060
3/4	3/4	.060	1	4	2	.712	5	65302	HXVR-RN-R-50750-R.060
1	1	.060	1-1/4	5	2-5/8	.950	5	65377	HXVR-RN-R-51000-R.060

*.0005 max TIR



Shank Tolerances, Collet Fits, & h6 Benefits

A cutting tool's shank is one of the most vital parts of a tool, as it's critical to the collet-tool connection. There are several types of shanks, each with their own tolerances and suitable tool holder methods. One common tool holding style is a shrink fit tool holder. Learn about this method, and others, in our "In the Loupe" post **Shank Tolerances, Collet Fits, & h6 Benefits**.

[Read more on helical.blog/intheloupe](https://helical.blog/intheloupe)

Speeds & Feeds on Pages 72-73



HXVR-5

SPEEDS & FEEDS

5 Flute - Knuckle Rougher - Variable Pitch

Table with 18 columns: Material Guide, Hardness, SFM, and IPT values for 1/8, 3/16, 1/4, 3/8, 1/2, 3/4, 1 (Slot and Rgh). Rows include Carbon Steel, Low Alloy Steel, Tool Steel, Specialty Steel, Austenitic Stainless Steel, Martensitic & Ferritic Stainless Steel, PH Stainless Steel, Gray Cast Iron, Malleable Cast Iron, Nodular (Ductile) Cast Iron, Pure Nickel, Nickel Alloy, Pure Titanium, Titanium Alloy, and Cobalt Alloy.

Summary table with 4 columns: Milling Process, Hardness, ADOC, RDOC. Rows show Slot (Full Slotting) and Rgh (Traditional Roughing) for hardness < 35 HRC and ≥ 35 HRC.

NOTES:

Hardness Scales: HRB = Rockwell B, HRC = Rockwell C

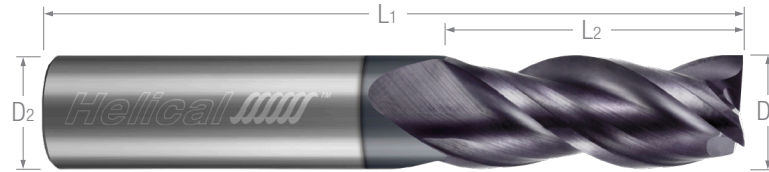
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.

3 FLUTE - SQUARE

HSV-3

Variable Pitch

- Designed with variable pitch and 3 flutes for reduced harmonics, increased chip clearance, and higher quality parts in full slotting and heavy roughing applications
- Eccentric relief for maximum edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter D_2 (h6)	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	3	23010	HSV-S-30125
	1/8	1/2	2-1/2	3	23020	HSV-R-30125
3/16	3/16	5/16	2	3	23040	HSV-S-30187
	3/16	9/16	2-1/2	3	23050	HSV-R-30187
1/4	1/4	3/8	2	3	23070	HSV-S-30250
	1/4	1/2	2-1/2	3	23080	HSV-SR-30250
	1/4	3/4	2-1/2	3	23090	HSV-R-30250
	1/4	1	3	3	23100	HSV-M-30250
5/16	5/16	7/16	2	3	23120	HSV-S-30312
	5/16	13/16	2-1/2	3	23130	HSV-R-30312
	5/16	1-1/4	3	3	23140	HSV-M-30312
3/8	3/8	1/2	2	3	23150	HSV-S-30375
	3/8	1	3	3	23160	HSV-R-30375
	3/8	1-1/4	3	3	23170	HSV-M-30375
1/2	1/2	5/8	2-1/2	3	23190	HSV-S-30500
	1/2	1	3	3	23200	HSV-SR-30500
	1/2	1-1/4	3	3	23210	HSV-R-30500
	1/2	1-5/8	4	3	23220	HSV-M-30500
5/8	5/8	3/4	3	3	23240	HSV-S-30625
	5/8	1-1/8	3-1/2	3	23250	HSV-SR-30625
	5/8	1-5/8	4	3	23260	HSV-R-30625
	5/8	2-1/8	4	3	23270	HSV-M-30625
3/4	3/4	1	3	3	23290	HSV-S-30750
	3/4	1-5/8	4	3	23300	HSV-R-30750
	3/4	2-1/4	5	3	23310	HSV-M-30750
1	1	1-1/4	4	3	23330	HSV-S-31000
	1	2	4-1/2	3	23340	HSV-R-31000
	1	2-5/8	6	3	23350	HSV-M-31000

*.0005 max TIR

Speeds & Feeds on Page 76



Plunging / Ramping



Slotting



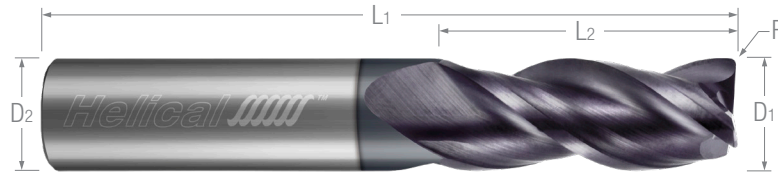
Roughing

HSV-3

3 FLUTE - CORNER RADIUS

Variable Pitch

- Designed with variable pitch and 3 flutes for reduced harmonics, increased chip clearance, and higher quality parts in full slotting and heavy roughing applications
- Eccentric relief for maximum edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	D_2 (h6)	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$			
1/8	1/8	.010	1/4	1-1/2	3	23011	HSV-S-30125-R.010
	1/8	.010	1/2	2-1/2	3	23021	HSV-R-30125-R.010
3/16	3/16	.010	5/16	2	3	23041	HSV-S-30187-R.010
	3/16	.010	9/16	2-1/2	3	23051	HSV-R-30187-R.010
1/4	1/4	.020	3/8	2	3	23072	HSV-S-30250-R.020
	1/4	.020	1/2	2-1/2	3	23082	HSV-SR-30250-R.020
	1/4	.020	3/4	2-1/2	3	23092	HSV-R-30250-R.020
	1/4	.020	1	3	3	23102	HSV-M-30250-R.020
5/16	5/16	.020	7/16	2	3	23122	HSV-S-30312-R.020
	5/16	.020	13/16	2-1/2	3	23132	HSV-R-30312-R.020
	5/16	.020	1-1/4	3	3	23142	HSV-M-30312-R.020
3/8	3/8	.020	1/2	2	3	23152	HSV-S-30375-R.020
	3/8	.020	1	3	3	23162	HSV-R-30375-R.020
	3/8	.020	1-1/4	3	3	23172	HSV-M-30375-R.020
1/2	1/2	.030	5/8	2-1/2	3	23193	HSV-S-30500-R.030
	1/2	.030	1	3	3	23203	HSV-SR-30500-R.030
	1/2	.030	1-1/4	3	3	23213	HSV-R-30500-R.030
	1/2	.030	1-5/8	4	3	23223	HSV-M-30500-R.030
5/8	5/8	.030	3/4	3	3	23243	HSV-S-30625-R.030
	5/8	.030	1-1/8	3-1/2	3	23253	HSV-SR-30625-R.030
	5/8	.030	1-5/8	4	3	23263	HSV-R-30625-R.030
	5/8	.030	2-1/8	4	3	23273	HSV-M-30625-R.030
3/4	3/4	.030	1	3	3	23293	HSV-S-30750-R.030
	3/4	.030	1-5/8	4	3	23303	HSV-R-30750-R.030
	3/4	.030	2-1/4	5	3	23313	HSV-M-30750-R.030
1	1	.030	1-1/4	4	3	23333	HSV-S-31000-R.030
	1	.030	2	4-1/2	3	23343	HSV-R-31000-R.030
	1	.030	2-5/8	6	3	23353	HSV-M-31000-R.030

* .0005 max TIR

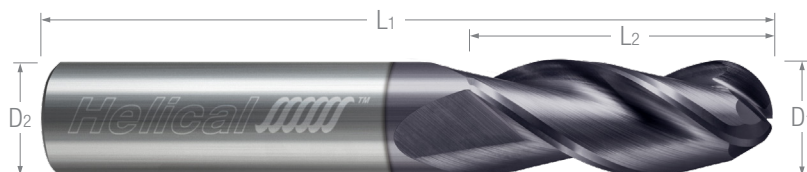
Speeds & Feeds on Page 76



HST-3

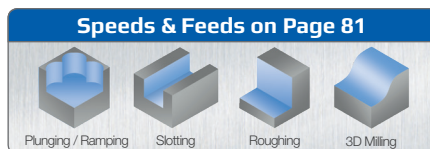
3 FLUTE - BALL

- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	D_2 (h6)	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$			
1/8	1/8	1/4	1-1/2	3	12017	HST-S-30125-BN
	1/8	1/2	2-1/2	3	12032	HST-R-30125-BN
3/16	3/16	5/16	2	3	12062	HST-S-30187-BN
	3/16	9/16	2-1/2	3	12077	HST-R-30187-BN
1/4	1/4	3/8	2	3	12107	HST-S-30250-BN
	1/4	1/2	2-1/2	3	12112	HST-SR-30250-BN
	1/4	3/4	2-1/2	3	12122	HST-R-30250-BN
5/16	5/16	7/16	2	3	12167	HST-S-30312-BN
	5/16	13/16	2-1/2	3	12182	HST-R-30312-BN
3/8	3/8	1/2	2	3	12212	HST-S-30375-BN
	3/8	1	3	3	12227	HST-R-30375-BN
1/2	1/2	5/8	2-1/2	3	12317	HST-S-30500-BN
	1/2	1	3	3	12332	HST-SR-30500-BN
	1/2	1-1/4	3	3	12347	HST-R-30500-BN
5/8	5/8	1-1/8	3-1/2	3	12407	HST-SR-30625-BN
3/4	3/4	1	3	3	12467	HST-S-30750-BN
	3/4	1-5/8	4	3	12482	HST-R-30750-BN
1	1	1-1/4	4	3	12527	HST-S-31000-BN
	1	2	4-1/2	3	12542	HST-R-31000-BN

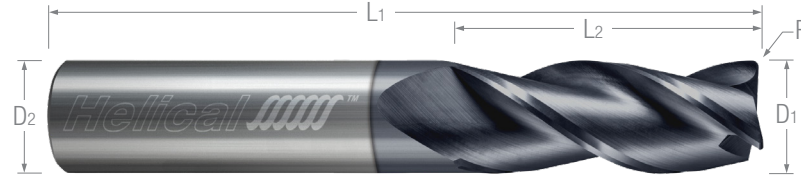
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3 FLUTE - CORNER RADIUS

HST-3

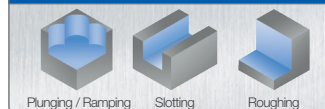
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1^{+.000" / -.002"}$	$D_2 (h6)$	$R^{+.002" / -.002"}$	$L_2^{+.032" / -.000"}$	$L_1^{+.062" / -.062"}$			
1/8	1/8	.010	1/4	1-1/2	3	08017	HST-S-30125-R.010
	1/8	.010	1/2	2-1/2	3	08032	HST-R-30125-R.010
3/16	3/16	.010	5/16	2	3	08062	HST-S-30187-R.010
	3/16	.010	9/16	2-1/2	3	08077	HST-R-30187-R.010
1/4	1/4	.020	3/8	2	3	08107	HST-S-30250-R.020
	1/4	.020	1/2	2-1/2	3	08112	HST-SR-30250-R.020
	1/4	.020	3/4	2-1/2	3	08122	HST-R-30250-R.020
	1/4	.020	1	3	3	08137	HST-M-30250-R.020
5/16	5/16	.020	7/16	2	3	08167	HST-S-30312-R.020
	5/16	.020	13/16	2-1/2	3	08182	HST-R-30312-R.020
	5/16	.020	1-1/4	3	3	08192	HST-M-30312-R.020
3/8	3/8	.020	1/2	2	3	08212	HST-S-30375-R.020
	3/8	.020	1	3	3	08227	HST-R-30375-R.020
	3/8	.020	1-1/4	3	3	08242	HST-M-30375-R.020
1/2	1/2	.030	5/8	2-1/2	3	08317	HST-S-30500-R.030
	1/2	.030	1	3	3	08332	HST-SR-30500-R.030
	1/2	.030	1-1/4	3	3	08347	HST-R-30500-R.030
	1/2	.030	1-5/8	4	3	08362	HST-M-30500-R.030
5/8	5/8	.030	3/4	3	3	08392	HST-S-30625-R.030
	5/8	.030	1-1/8	3-1/2	3	08407	HST-SR-30625-R.030
	5/8	.030	1-5/8	4	3	08422	HST-R-30625-R.030
	5/8	.030	2-1/8	4	3	08437	HST-M-30625-R.030
3/4	3/4	.030	1	3	3	08467	HST-S-30750-R.030
	3/4	.030	1-5/8	4	3	08482	HST-R-30750-R.030
	3/4	.030	2-1/4	5	3	08497	HST-M-30750-R.030
1	1	.030	1-1/4	4	3	08527	HST-S-31000-R.030
	1	.030	2	4-1/2	3	08542	HST-R-31000-R.030
	1	.030	2-5/8	6	3	08557	HST-M-31000-R.030

* .0005 max TIR

Speeds & Feeds on Page 81

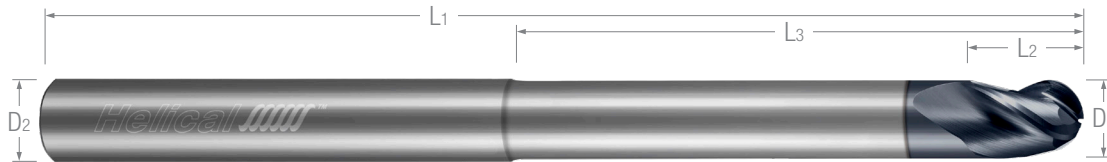


HST-RN-3

3 FLUTE - BALL

Reduced Neck

- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Reach (LBS)	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1^{+.000^*}_{-.002^*}$	$D_2 (h6)$	$L_2^{+.032^*}_{-.000^*}$	$L_1^{+.062^*}_{-.062^*}$	L_3				
1/8	1/8	5/32	3	3/8	.118	3	13017	HST-RN-S-30125-BN
	1/8	5/32	3	1/2	.118	3	13032	HST-RN-R-30125-BN
	1/8	5/32	3	5/8	.118	3	13047	HST-RN-M-30125-BN
3/16	3/16	7/32	3	1/2	.178	3	13077	HST-RN-R-30187-BN
	3/16	7/32	3	3/4	.178	3	13092	HST-RN-M-30187-BN
1/4	1/4	3/8	4	3/4	.237	3	13112	HST-RN-S-30250-BN
	1/4	3/8	4	1-1/8	.237	3	13122	HST-RN-R-30250-BN
	1/4	3/8	4	2-1/8	.237	3	13137	HST-RN-M-30250-BN
5/16	5/16	7/16	4	1-1/8	.296	3	13157	HST-RN-R-30312-BN
	5/16	7/16	4	2-1/8	.296	3	13167	HST-RN-M-30312-BN
3/8	3/8	1/2	4	1-1/8	.356	3	13197	HST-RN-R-30375-BN
	3/8	1/2	6	2-3/8	.356	3	13212	HST-RN-M-30375-BN
	3/8	1/2	6	3-3/8	.356	3	13227	HST-RN-L-30375-BN
	3/8	1/2	6	4	.356	3	13232	HST-RN-X-30375-BN
1/2	1/2	5/8	4	1-3/8	.475	3	13302	HST-RN-R-30500-BN
	1/2	5/8	6	2-3/8	.475	3	13317	HST-RN-M-30500-BN
	1/2	5/8	6	3-3/8	.475	3	13332	HST-RN-L-30500-BN
	1/2	5/8	6	4-1/8	.475	3	13347	HST-RN-X-30500-BN

* .0005 max TIR

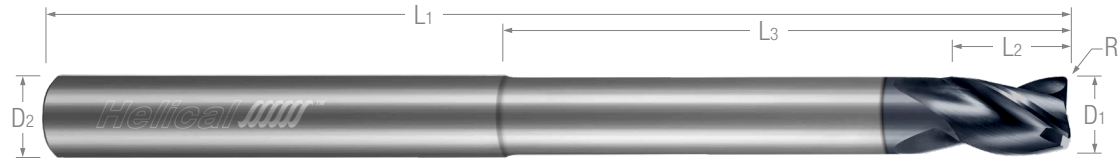


3 FLUTE - CORNER RADIUS

HST-RN-3

Reduced Neck

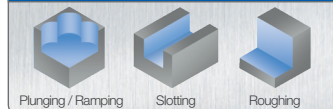
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* $D_1^{+0.000^*}_{-0.002^*}$	Shank Dia. D_2 (h6)	Corner Radius $R^{+0.02^*}_{-0.02^*}$	Length of Cut $L_2^{+0.032^*}_{-0.000^*}$	OAL $L_1^{+0.062^*}_{-0.062^*}$	Reach (LBS) L_3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	.010	5/32	3	3/8	.118	3	10017	HST-RN-S-30125-R.010
	1/8	.010	5/32	3	5/8	.118	3	10047	HST-RN-M-30125-R.010
3/16	3/16	.010	7/32	3	3/4	.178	3	10092	HST-RN-M-30187-R.010
	1/4	.020	3/8	4	3/4	.237	3	10112	HST-RN-S-30250-R.020
1/4	1/4	.020	3/8	4	1-1/8	.237	3	10122	HST-RN-R-30250-R.020
	1/4	.020	3/8	4	2-1/8	.237	3	10137	HST-RN-M-30250-R.020
	5/16	.020	7/16	4	1-1/8	.296	3	10157	HST-RN-R-30312-R.020
5/16	5/16	.020	7/16	4	2-1/8	.296	3	10167	HST-RN-M-30312-R.020
	3/8	.020	1/2	4	1-1/8	.356	3	10197	HST-RN-R-30375-R.020
3/8	3/8	.020	1/2	6	2-3/8	.356	3	10212	HST-RN-M-30375-R.020
	1/2	.030	5/8	4	1-3/8	.475	3	10302	HST-RN-R-30500-R.030
1/2	1/2	.030	5/8	6	2-3/8	.475	3	10317	HST-RN-M-30500-R.030
	1/2	.030	5/8	6	3-3/8	.475	3	10332	HST-RN-L-30500-R.030
	1/2	.030	5/8	6	4-1/8	.475	3	10347	HST-RN-X-30500-R.030
	1/2	.030	5/8	6	4-1/8	.475	3		

* .0005 max TIR

Speeds & Feeds on Page 81



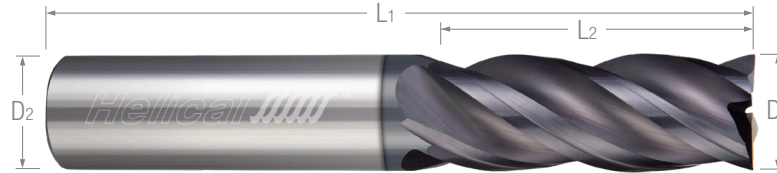
4 FLUTE - SQUARE

New Items!

HSV-4

Variable Pitch

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- CNC ground in the USA

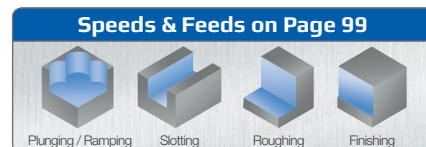


4 Flute

Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	<i>Tplus</i> Coated	Tool Description
$D1^{+.000}_{-.002}$ "	D2 (h6)	$L2^{+.032}_{-.000}$ "	$L1^{+.062}_{-.062}$ "					
1/8	1/8	1/4	1-1/2	4	30017			HSV-S-40125
	1/8	3/8	2	4	81635			HSV-SR-40125
	1/8	1/2	2-1/2	4	30032			HSV-R-40125
	1/8	5/8	2-1/2	4	81636			HSV-A-40125
	1/8	3/4	2-1/2	4	81637			HSV-M-40125
	1/8	7/8	2-1/2	4	82253			HSV-L-40125 new
5/32	3/16	3/16	2	4	30047			HSV-S-40156
	3/16	7/16	2-1/2	4	30062			HSV-R-40156
	3/16	9/16	2-1/2	4	81638			HSV-M-40156
	3/16	3/4	2-1/2	4	82254			HSV-ML-40156 new
3/16	3/16	5/16	2	4	30077			HSV-S-40187
	3/16	7/16	2	4	81639			HSV-SR-40187
	3/16	5/8	2-1/2	4	30092			HSV-R-40187
	3/16	1	2-1/2	4	81640			HSV-M-40187
	3/16	1-3/16	3	4	82255			HSV-L-40187 new
7/32	1/4	1/4	2	4	30107			HSV-S-40218
	1/4	7/16	2-1/2	4	30122			HSV-R-40218
	1/4	5/8	2-1/2	4	82256			HSV-A-40218 new
1/4	1/4	3/8	2	4	30137	30137W	82262	HSV-S-40250 new
	1/4	1/2	2-1/2	4	30142	30142W	82263	HSV-SR-40250 new
	1/4	3/4	2-1/2	4	30152	30152W	82264	HSV-R-40250 new
	1/4	1	3	4	30167	30167W	82265	HSV-M-40250 new
	1/4	1-1/4	3	4	81641			HSV-L-40250
	1/4	1-1/2	3	4	81642			HSV-LX-40250
9/32	5/16	7/16	2	4	30182			HSV-S-40281
	5/16	5/8	2-1/2	4	30197			HSV-R-40281
	5/16	1	3	4	30212			HSV-M-40281

*.0005 max TIR

continued on next page



HSV-4

New Items!

4 FLUTE - SQUARE

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* $D_1 \begin{smallmatrix} +.000 \\ -.002 \end{smallmatrix}$ "	Shank Diameter D_2 (h6)	Length of Cut $L_2 \begin{smallmatrix} +.032 \\ -.000 \end{smallmatrix}$ "	Overall Length $L_1 \begin{smallmatrix} +.062 \\ -.062 \end{smallmatrix}$ "	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
new	5/16	5/16	1/2	2	4	30227	30227W		HSV-S-40312
new		5/16	3/4	2-1/2	4	30242	30242W		HSV-R-40312
		5/16	1	2-1/2	4	81643			HSV-A-40312
		5/16	1-1/4	3	4	30257			HSV-M-40312
new		5/16	1-9/16	4	4	82257			HSV-ML-40312
new	3/8	3/8	1/2	2	4	30317	30317W	82266	HSV-S-40375
new		3/8	7/8	3	4	30332	30332W	82267	HSV-SR-40375
new		3/8	1	3	4	30337	30337W	82268	HSV-R-40375
new		3/8	1-1/4	3	4	30347	30347W	82269	HSV-M-40375
		3/8	1-1/2	3	4	81644			HSV-L-40375
new		3/8	2	4	4	82258			HSV-LX-40375
	13/32	7/16	1/2	2-3/4	4	30362			HSV-S-40406
	7/16	7/16	5/8	2-3/4	4	30407			HSV-S-40437
		7/16	7/8	2-3/4	4	30422			HSV-R-40437
		7/16	1-1/8	3-1/2	4	30437			HSV-M-40437
new	1/2	1/2	5/8	2-1/2	4	30497	30497W	82270	HSV-S-40500
new		1/2	1	3	4	30512	30512W	82271	HSV-SR-40500
new		1/2	1-1/4	3	4	30527	30527W	82272	HSV-R-40500
new		1/2	1-5/8	4	4	30542	30542W	82273	HSV-M-40500
		1/2	2	4	4	81645			HSV-L-40500
		1/2	2-1/2	5	4	81646			HSV-LX-40500
new		1/2	3-1/8	6	4	82259			HSV-X-40500
new	5/8	5/8	3/4	3	4	30557			HSV-S-40625
		5/8	1-1/4	3-1/2	4	30572	30572W		HSV-SR-40625
		5/8	1-5/8	3-1/2	4	30587	30587W		HSV-R-40625
		5/8	2	4	4	30602			HSV-M-40625
new		5/8	2-1/2	5	4	82260			HSV-ML-40625
	5/8	3-1/4	6	4	30617			HSV-L-40625	
new	3/4	3/4	7/8	3	4	30632			HSV-S-40750
		3/4	1-1/4	4	4	30647			HSV-SR-40750
new		3/4	1-5/8	4	4	30662	30662W	82274	HSV-R-40750
new		3/4	2-1/4	5	4	30677	30677W	82275	HSV-M-40750
		3/4	2-3/4	5	4	81647			HSV-ML-40750
new		3/4	3-1/4	6	4	30692	30692W		HSV-L-40750
new		3/4	4	6-1/2	4	82261			HSV-LX-40750
	1	1	1-1/2	4	4	30707			HSV-S-41000
		1	2	4-1/2	4	30722			HSV-R-41000
		1	2-5/8	5	4	30737			HSV-M-41000
		1	3	6	4	30742			HSV-ML-41000
		1	4-1/4	7	4	30752			HSV-L-41000

*.0005 max TIR

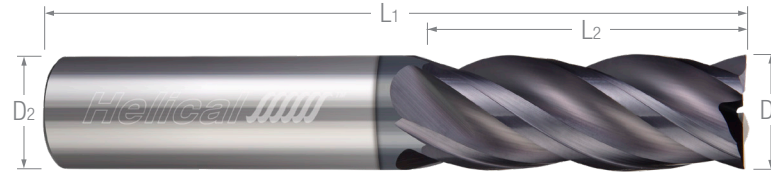
4 FLUTE - SQUARE - METRIC

MHSV-4

METRIC

Variable Pitch

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1^{+0.00}_{-0.05}$ mm	D_2 (h6)	$L_2^{+0.80}_{-0.00}$ mm	$L_1^{+1.60}_{-1.60}$ mm			
6 mm	6.00 mm	9.00 mm	63 mm	4	59458	MHSV-015-40600
	6.00 mm	12.00 mm	63 mm	4	59476	MHSV-020-40600
	6.00 mm	18.00 mm	63 mm	4	59510	MHSV-030-40600
8 mm	8.00 mm	12.00 mm	63 mm	4	59461	MHSV-015-40800
	8.00 mm	16.00 mm	63 mm	4	59479	MHSV-020-40800
	8.00 mm	24.00 mm	75 mm	4	59513	MHSV-030-40800
10 mm	10.00 mm	15.00 mm	63 mm	4	59464	MHSV-015-41000
	10.00 mm	20.00 mm	63 mm	4	59482	MHSV-020-41000
	10.00 mm	25.00 mm	75 mm	4	59496	MHSV-025-41000
12 mm	12.00 mm	18.00 mm	75 mm	4	59467	MHSV-015-41200
	12.00 mm	24.00 mm	75 mm	4	59485	MHSV-020-41200
	12.00 mm	30.00 mm	75 mm	4	59499	MHSV-025-41200
16 mm	16.00 mm	24.00 mm	89 mm	4	59470	MHSV-015-41600
	16.00 mm	32.00 mm	89 mm	4	59488	MHSV-020-41600
	16.00 mm	40.00 mm	89 mm	4	59502	MHSV-025-41600
20 mm	20.00 mm	30.00 mm	89 mm	4	59473	MHSV-015-42000
	20.00 mm	40.00 mm	100 mm	4	59491	MHSV-020-42000
	20.00 mm	50.00 mm	125 mm	4	59505	MHSV-025-42000
25 mm	25.00 mm	50.00 mm	125 mm	4	59494	MHSV-020-42500
	25.00 mm	64.00 mm	125 mm	4	59508	MHSV-025-42500

* .013 mm max TIR

Speeds & Feeds on Page 99



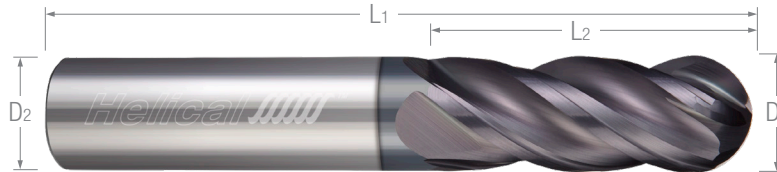
HSV-4

New Items!

4 FLUTE - BALL

Variable Pitch

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D2 \text{ (h6)}$	$L2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$			
1/8	1/8	1/4	1-1/2	4	56017	HSV-S-40125-BN
	1/8	3/8	2	4	81674	HSV-SR-40125-BN
	1/8	1/2	2-1/2	4	56032	HSV-R-40125-BN
	1/8	5/8	2-1/2	4	81675	HSV-A-40125-BN
	1/8	3/4	2-1/2	4	82510	HSV-M-40125-BN
3/16	3/16	5/16	2	4	56077	HSV-S-40187-BN
	3/16	7/16	2	4	82511	HSV-SR-40187-BN
	3/16	5/8	2-1/2	4	56092	HSV-R-40187-BN
	3/16	1	2-1/2	4	81676	HSV-M-40187-BN
1/4	1/4	3/8	2	4	56137	HSV-S-40250-BN
	1/4	1/2	2-1/2	4	56142	HSV-SR-40250-BN
	1/4	3/4	2-1/2	4	56152	HSV-R-40250-BN
	1/4	1	3	4	56167	HSV-M-40250-BN
	1/4	1-1/4	3	4	81677	HSV-L-40250-BN
	1/4	1-1/2	3	4	82512	HSV-LX-40250-BN
5/16	5/16	1/2	2	4	56227	HSV-S-40312-BN
	5/16	3/4	2-1/2	4	56242	HSV-R-40312-BN
	5/16	1	2-1/2	4	81678	HSV-A-40312-BN
	5/16	1-1/4	3	4	56257	HSV-M-40312-BN
	5/16	1-9/16	4	4	82513	HSV-L-40312-BN
3/8	3/8	1/2	2	4	56317	HSV-S-40375-BN
	3/8	7/8	3	4	56332	HSV-SR-40375-BN
	3/8	1	3	4	56337	HSV-R-40375-BN
	3/8	1-1/4	3	4	56347	HSV-M-40375-BN
	3/8	1-1/2	3	4	82514	HSV-L-40375-BN

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 99



4 FLUTE - BALL

New Items!

HSV-4

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D1 $^{+0.000}$ $_{-0.002}$ "	Shank Diameter D2 (h6)	Length of Cut L2 $^{+0.032}$ $_{-0.000}$ "	Overall Length L1 $^{+0.062}$ $_{-0.062}$ "	Flutes	Aplus Coated	Tool Description
7/16	7/16	5/8	2-3/4	4	56407	HSV-S-40437-BN
	7/16	7/8	2-3/4	4	56422	HSV-R-40437-BN
	7/16	1-1/8	3-1/2	4	56437	HSV-M-40437-BN
1/2	1/2	5/8	2-1/2	4	56497	HSV-S-40500-BN
	1/2	1	3	4	56512	HSV-SR-40500-BN
	1/2	1-1/4	3	4	56527	HSV-R-40500-BN
	1/2	1-5/8	4	4	56542	HSV-M-40500-BN
	1/2	2	4	4	81679	HSV-L-40500-BN
5/8	5/8	3/4	3	4	56557	HSV-S-40625-BN
	5/8	1-1/4	3-1/2	4	56572	HSV-SR-40625-BN
	5/8	1-5/8	3-1/2	4	56587	HSV-R-40625-BN
	5/8	2	4	4	56602	HSV-M-40625-BN
	5/8	3-1/4	6	4	56617	HSV-L-40625-BN
3/4	3/4	7/8	3	4	56632	HSV-S-40750-BN
	3/4	1-1/4	4	4	56647	HSV-SR-40750-BN
	3/4	1-5/8	4	4	56662	HSV-R-40750-BN
	3/4	2-1/4	5	4	56677	HSV-M-40750-BN
	3/4	3-1/4	6	4	56692	HSV-L-40750-BN
1	1	1-1/2	4	4	56707	HSV-S-41000-BN
	1	2	4- 1/2	4	56722	HSV-R-41000-BN
	1	2-5/8	5	4	56737	HSV-M-41000-BN
	1	3	6	4	56742	HSV-ML-41000-BN
	1	4-1/4	7	4	56752	HSV-L-41000-BN

*.0005 max TIR



Ball Nose Milling Strategy Guide

Ball nose end mills are ideal for machining 3-dimensional contour shapes typically found in the mold and die industry, the manufacturing of turbine blades, and fulfilling general part radius requirements. Learn the two-step process for properly employing a ball nose end mill (with no tilt angle) and gain the optimal tool life and part finish by reading our "In the Loupe" blog post **Ball Nose Milling Strategy Guide**.

[Read more on helical.blog/intheloupe](http://helical.blog/intheloupe)

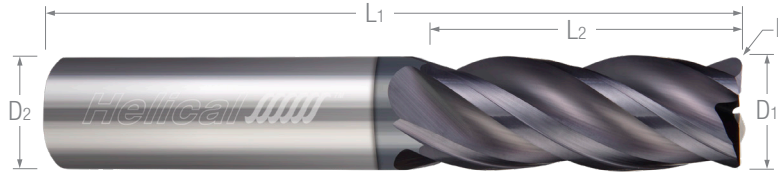
HSV-4

New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	<i>Tplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D2 \text{ (h6)}$	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$					
new 1/8	1/8	.010	1/4	1-1/2	4	31017			HSV-S-40125-R.010
	1/8	.010	3/8	2	4	81648			HSV-SR-40125-R.010
	1/8	.010	1/2	2-1/2	4	31032			HSV-R-40125-R.010
	1/8	.010	5/8	2-1/2	4	81649			HSV-A-40125-R.010
	1/8	.010	3/4	2-1/2	4	81650			HSV-M-40125-R.010
	1/8	.015	1/4	1-1/2	4	81651			HSV-S-40125-R.015
	1/8	.015	3/8	2	4	82276			HSV-SR-40125-R.015
	1/8	.015	1/2	2-1/2	4	81652			HSV-R-40125-R.015
	1/8	.030	1/4	1-1/2	4	43017			HSV-S-40125-R.030
	1/8	.030	3/8	2	4	82277			HSV-SR-40125-R.030
	1/8	.030	1/2	2-1/2	4	43032			HSV-R-40125-R.030
1/8	.030	5/8	2-1/2	4	82278			HSV-A-40125-R.030	
new 5/32	3/16	.010	3/16	2	4	31047			HSV-S-40156-R.010
	3/16	.010	7/16	2-1/2	4	31062			HSV-R-40156-R.010
	3/16	.010	9/16	2-1/2	4	81653			HSV-M-40156-R.010
	3/16	.030	3/16	2	4	82279			HSV-S-40156-R.030
	3/16	.030	7/16	2-1/2	4	82280			HSV-R-40156-R.030
new 3/16	3/16	.010	5/16	2	4	31077			HSV-S-40187-R.010
	3/16	.010	7/16	2	4	81654			HSV-SR-40187-R.010
	3/16	.010	5/8	2-1/2	4	31092			HSV-R-40187-R.010
	3/16	.010	1	2-1/2	4	81655			HSV-M-40187-R.010
	3/16	.030	5/16	2	4	43077			HSV-S-40187-R.030
	3/16	.030	7/16	2	4	82281			HSV-SR-40187-R.030
	3/16	.030	5/8	2-1/2	4	43092			HSV-R-40187-R.030
3/16	.030	1	2-1/2	4	82282			HSV-M-40187-R.030	
new 7/32	1/4	.010	1/4	2	4	31107			HSV-S-40218-R.010
	1/4	.010	7/16	2-1/2	4	31122			HSV-R-40218-R.010
	1/4	.010	5/8	2-1/2	4	82283			HSV-A-40218-R.010
new 1/4	1/4	.010	3/8	2	4	81656			HSV-S-40250-R.010
	1/4	.010	1/2	2-1/2	4	81657			HSV-SR-40250-R.010
	1/4	.010	3/4	2-1/2	4	81658			HSV-R-40250-R.010
	1/4	.010	1	3	4	82284			HSV-M-40250-R.010
	1/4	.010	1-1/4	3	4	82285			HSV-L-40250-R.010
	1/4	.015	3/8	2	4	82286			HSV-S-40250-R.015
	1/4	.015	1/2	2-1/2	4	82287			HSV-SR-40250-R.015
	1/4	.015	3/4	2-1/2	4	82288			HSV-R-40250-R.015
	1/4	.015	1	3	4	82289			HSV-M-40250-R.015
	1/4	.015	1-1/4	3	4	82290			HSV-L-40250-R.015

* .0005 max TIR

Speeds & Feeds on Page 99

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4 FLUTE - CORNER RADIUS

New Items!

HSV-4

Variable Pitch (cont.)

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Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description	
$D_1^{+.000"}_{-.002"}"$	$D_2(h6)$	$R^{+.002"}_{-.002"}"$	$L_2^{+.032"}_{-.000"}"$	$L_1^{+.062"}_{-.062"}"$						
1/4	1/4	.020	3/8	2	4	31137	31137W	82303	HSV-S-40250-R.020	new
	1/4	.020	1/2	2-1/2	4	31142	31142W	82304	HSV-SR-40250-R.020	new
	1/4	.020	3/4	2-1/2	4	31152	31152W	82305	HSV-R-40250-R.020	new
	1/4	.020	1	3	4	31167	31167W	82306	HSV-M-40250-R.020	new
	1/4	.020	1-1/4	3	4	81659			HSV-L-40250-R.020	
	1/4	.030	3/8	2	4	43137			HSV-S-40250-R.030	
	1/4	.030	1/2	2-1/2	4	43142			HSV-SR-40250-R.030	
	1/4	.030	3/4	2-1/2	4	43152			HSV-R-40250-R.030	
	1/4	.030	1	3	4	43167			HSV-M-40250-R.030	
	1/4	.030	1-1/4	3	4	82291			HSV-L-40250-R.030	new
	1/4	.060	3/8	2	4	43138			HSV-S-40250-R.060	
	1/4	.060	1/2	2-1/2	4	43143			HSV-SR-40250-R.060	
	1/4	.060	3/4	2-1/2	4	43153			HSV-R-40250-R.060	
	1/4	.060	1	3	4	43168			HSV-M-40250-R.060	
1/4	.060	1-1/4	3	4	82292			HSV-L-40250-R.060	new	
9/32	5/16	.020	7/16	2	4	31182			HSV-S-40281-R.020	
	5/16	.020	5/8	2-1/2	4	31197			HSV-R-40281-R.020	
	5/16	.020	1	3	4	31212			HSV-M-40281-R.020	
5/16	5/16	.010	1/2	2	4	82293			HSV-S-40312-R.010	new
	5/16	.010	3/4	2-1/2	4	82294			HSV-R-40312-R.010	new
	5/16	.010	1-1/4	3	4	82295			HSV-M-40312-R.010	new
	5/16	.020	1/2	2	4	31227	31227W		HSV-S-40312-R.020	
	5/16	.020	3/4	2-1/2	4	31242			HSV-R-40312-R.020	
	5/16	.020	1	2-1/2	4	81660			HSV-A-40312-R.020	
	5/16	.020	1-1/4	3	4	31257			HSV-M-40312-R.020	
	5/16	.020	1-9/16	4	4	82296			HSV-ML-40312-R.020	new
	5/16	.030	1/2	2	4	43227	43227W		HSV-S-40312-R.030	new
	5/16	.030	3/4	2-1/2	4	43242			HSV-R-40312-R.030	
	5/16	.030	1-1/4	3	4	43257			HSV-M-40312-R.030	
	5/16	.060	1/2	2	4	43228			HSV-S-40312-R.060	
	5/16	.060	3/4	2-1/2	4	43243			HSV-R-40312-R.060	
5/16	.060	1-1/4	3	4	43258			HSV-M-40312-R.060		
3/8	3/8	.010	1/2	2	4	81661			HSV-S-40375-R.010	
	3/8	.010	7/8	3	4	81662			HSV-SR-40375-R.010	
	3/8	.010	1-1/4	3	4	81663			HSV-M-40375-R.010	
	3/8	.020	1/2	2	4	31317	31317W	82307	HSV-S-40375-R.020	new
	3/8	.020	7/8	3	4	31332	31332W	82308	HSV-SR-40375-R.020	new
	3/8	.020	1	3	4	31337	31337W	82309	HSV-R-40375-R.020	new
	3/8	.020	1-1/4	3	4	31347	31347W	82310	HSV-M-40375-R.020	new
	3/8	.020	1-1/2	3	4	81664			HSV-L-40375-R.020	
	3/8	.030	1/2	2	4	43317	43317W	82311	HSV-S-40375-R.030	new
	3/8	.030	7/8	3	4	43332		82312	HSV-SR-40375-R.030	new
	3/8	.030	1	3	4	43337	43337W	82313	HSV-R-40375-R.030	new
	3/8	.030	1-1/4	3	4	43347		82314	HSV-M-40375-R.030	new
	3/8	.060	1/2	2	4	43318	43318W		HSV-S-40375-R.060	new
	3/8	.060	7/8	3	4	43333			HSV-SR-40375-R.060	
	3/8	.060	1	3	4	43338	43338W		HSV-R-40375-R.060	new
	3/8	.060	1-1/4	3	4	43348			HSV-M-40375-R.060	
	3/8	.090	1/2	2	4	43319			HSV-S-40375-R.090	
	3/8	.090	7/8	3	4	43334			HSV-SR-40375-R.090	
	3/8	.090	1	3	4	43339			HSV-R-40375-R.090	
	3/8	.090	1-1/4	3	4	43349			HSV-M-40375-R.090	

* .0005 max TIR

continued on next page

HSV-4

New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	D ₂ (h6)	R $\begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	L ₂ $\begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	L ₁ $\begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$					
13/32	7/16	.020	15/16	2-3/4	4	31377			HSV-R-40406-R.020
	7/16	.020	5/8	2-3/4	4	31407			HSV-S-40437-R.020
7/16	7/16	.020	7/8	2-3/4	4	31422			HSV-R-40437-R.020
	7/16	.020	1-1/8	3-1/2	4	31437			HSV-M-40437-R.020
	7/16	.030	5/8	2-3/4	4	43407			HSV-S-40437-R.030
	7/16	.030	7/8	2-3/4	4	43422			HSV-R-40437-R.030
	7/16	.030	1-1/8	3-1/2	4	43437			HSV-M-40437-R.030
	7/16	.060	5/8	2-3/4	4	43408			HSV-S-40437-R.060
	7/16	.060	7/8	2-3/4	4	43423			HSV-R-40437-R.060
	7/16	.060	1-1/8	3-1/2	4	43438			HSV-M-40437-R.060
	7/16	.090	5/8	2-3/4	4	43409			HSV-S-40437-R.090
	7/16	.090	7/8	2-3/4	4	43424			HSV-R-40437-R.090
	7/16	.090	1-1/8	3-1/2	4	43439			HSV-M-40437-R.090
	15/32	1/2	.030	5/8	2-1/2	4	31452		
1/2		.030	1	3	4	31467			HSV-R-40468-R.030
1/2		.030	1-1/4	3	4	31482			HSV-M-40468-R.030
new	1/2	.010	5/8	2-1/2	4	82297			HSV-S-40500-R.010
	1/2	.010	1	3	4	82298			HSV-SR-40500-R.010
new	1/2	.010	1-1/4	3	4	82299			HSV-R-40500-R.010
	1/2	.015	5/8	2-1/2	4	81665			HSV-S-40500-R.015
new	1/2	.015	1	3	4	81666			HSV-SR-40500-R.015
	1/2	.015	1-1/4	3	4	81667			HSV-R-40500-R.015
new	1/2	.020	5/8	2-1/2	4	43496		82315	HSV-S-40500-R.020
	1/2	.020	1	3	4	43511	43511W	82316	HSV-SR-40500-R.020
new	1/2	.020	1-1/4	3	4	43526	43526W	82317	HSV-R-40500-R.020
	1/2	.020	1-5/8	4	4	43541		82318	HSV-M-40500-R.020
new	1/2	.030	5/8	2-1/2	4	31497	31497W	82319	HSV-S-40500-R.030
	1/2	.030	1	3	4	31512	31512W	82320	HSV-SR-40500-R.030
new	1/2	.030	1-1/4	3	4	31527	31527W	82321	HSV-R-40500-R.030
	1/2	.030	1-5/8	4	4	31542	31542W	82322	HSV-M-40500-R.030
new	1/2	.030	2	4	4	81668			HSV-L-40500-R.030
	1/2	.060	5/8	2-1/2	4	43497		82323	HSV-S-40500-R.060
new	1/2	.060	1	3	4	43512		82324	HSV-SR-40500-R.060
	1/2	.060	1-1/4	3	4	43527	43527W	82325	HSV-R-40500-R.060
new	1/2	.060	1-5/8	4	4	43542	43542W	82326	HSV-M-40500-R.060
	1/2	.060	2	4	4	81669			HSV-L-40500-R.060
new	1/2	.090	5/8	2-1/2	4	43498			HSV-S-40500-R.090
	1/2	.090	1	3	4	43513			HSV-SR-40500-R.090
new	1/2	.090	1-1/4	3	4	43528			HSV-R-40500-R.090
	1/2	.090	1-5/8	4	4	43543			HSV-M-40500-R.090
new	1/2	.125	5/8	2-1/2	4	43499			HSV-S-40500-R.125
	1/2	.125	1	3	4	43514			HSV-SR-40500-R.125
new	1/2	.125	1-1/4	3	4	43529	43529W		HSV-R-40500-R.125
	1/2	.125	1-5/8	4	4	43544			HSV-M-40500-R.125

* .0005 max TIR

continued on next page

4 FLUTE - CORNER RADIUS

New Items!

HSV-4

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D_2 (h6)$	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$					
5/8	5/8	.030	3/4	3	4	31557			HSV-S-40625-R.030
	5/8	.030	1-1/4	3-1/2	4	31572	31572W		HSV-SR-40625-R.030
	5/8	.030	1-5/8	3-1/2	4	31587	31587W		HSV-R-40625-R.030
	5/8	.030	2	4	4	31602	31602W		HSV-M-40625-R.030 new
	5/8	.030	2-1/2	5	4	81670			HSV-ML-40625-R.030
	5/8	.030	3-1/4	6	4	31617			HSV-L-40625-R.030
	5/8	.030	3-3/4	6	4	82300			HSV-LX-40625-R.030 new
	5/8	.060	3/4	3	4	43557			HSV-S-40625-R.060
	5/8	.060	1-1/4	3-1/2	4	43572			HSV-SR-40625-R.060
	5/8	.060	1-5/8	3-1/2	4	43587			HSV-R-40625-R.060
	5/8	.060	2	4	4	43602			HSV-M-40625-R.060
	5/8	.060	3-1/4	6	4	43617			HSV-L-40625-R.060
	5/8	.090	3/4	3	4	43558			HSV-S-40625-R.090
	5/8	.090	1-1/4	3-1/2	4	43573			HSV-SR-40625-R.090
	5/8	.090	1-5/8	3-1/2	4	43588			HSV-R-40625-R.090
	5/8	.090	2	4	4	43603			HSV-M-40625-R.090
	5/8	.090	3-1/4	6	4	43618			HSV-L-40625-R.090
	5/8	.125	3/4	3	4	43559			HSV-S-40625-R.125
	5/8	.125	1-1/4	3-1/2	4	43574			HSV-SR-40625-R.125
	5/8	.125	1-5/8	3-1/2	4	43589			HSV-R-40625-R.125
5/8	.125	2	4	4	43604			HSV-M-40625-R.125	
5/8	.125	3-1/4	6	4	43619			HSV-L-40625-R.125	
3/4	3/4	.015	1-1/4	4	4	81671			HSV-SR-40750-R.015
	3/4	.015	1-5/8	4	4	81672			HSV-R-40750-R.015
	3/4	.030	7/8	3	4	31632	31632W		HSV-S-40750-R.030
	3/4	.030	1-1/4	4	4	31647	31647W		HSV-SR-40750-R.030
	3/4	.030	1-5/8	4	4	31662	31662W	82327	HSV-R-40750-R.030 new
	3/4	.030	2-1/4	5	4	31677	31677W	82328	HSV-M-40750-R.030 new
	3/4	.030	2-3/4	5	4	81673			HSV-ML-40750-R.030
	3/4	.030	3-1/4	6	4	31692	31692W		HSV-L-40750-R.030
	3/4	.030	4	6-1/2	4	82301			HSV-LX-40750-R.030 new
	3/4	.060	7/8	3	4	43632			HSV-S-40750-R.060
	3/4	.060	1-1/4	4	4	43647			HSV-SR-40750-R.060
	3/4	.060	1-5/8	4	4	43662			HSV-R-40750-R.060
	3/4	.060	2-1/4	5	4	43677			HSV-M-40750-R.060
	3/4	.060	3-1/4	6	4	43692			HSV-L-40750-R.060
	3/4	.090	7/8	3	4	43633			HSV-S-40750-R.090
	3/4	.090	1-1/4	4	4	43648			HSV-SR-40750-R.090
	3/4	.090	1-5/8	4	4	43663			HSV-R-40750-R.090
	3/4	.090	2-1/4	5	4	43678			HSV-M-40750-R.090
	3/4	.090	3-1/4	6	4	43693			HSV-L-40750-R.090
	3/4	.125	7/8	3	4	43634			HSV-S-40750-R.125
3/4	.125	1-1/4	4	4	43649			HSV-SR-40750-R.125	
3/4	.125	1-5/8	4	4	43664			HSV-R-40750-R.125	
3/4	.125	2-1/4	5	4	43679			HSV-M-40750-R.125	
3/4	.125	3-1/4	6	4	43694			HSV-L-40750-R.125	

* .0005 max TIR

continued on next page

4 Flute

HSV-4

New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
$D_1^{+.000"}_{-.002"}"$	$D_2(h6)$	$R^{+.002"}_{-.002"}"$	$L_2^{+.032"}_{-.000"}"$	$L_1^{+.062"}_{-.062"}"$					
3/4	3/4	.190	7/8	3	4	43635			HSV-S-40750-R.190
	3/4	.190	1-1/4	4	4	43650			HSV-SR-40750-R.190
	3/4	.190	1-5/8	4	4	43665			HSV-R-40750-R.190
	3/4	.190	2-1/4	5	4	43680			HSV-M-40750-R.190
	3/4	.190	3-1/4	6	4	43695			HSV-L-40750-R.190
	3/4	.250	7/8	3	4	43636			HSV-S-40750-R.250
	3/4	.250	1-1/4	4	4	43651			HSV-SR-40750-R.250
	3/4	.250	1-5/8	4	4	43666			HSV-R-40750-R.250
1	3/4	.250	2-1/4	5	4	43681			HSV-M-40750-R.250
	3/4	.250	3-1/4	6	4	43696			HSV-L-40750-R.250
	1	.030	1-1/2	4	4	31707			HSV-S-41000-R.030
	1	.030	2	4-1/2	4	31722			HSV-R-41000-R.030
	1	.030	2-5/8	5	4	31737			HSV-M-41000-R.030
	1	.030	3	6	4	31742			HSV-ML-41000-R.030
	1	.030	4-1/4	7	4	31752			HSV-L-41000-R.030
	1	.030	5-1/4	9	4	82302			HSV-LX-41000-R.030
	1	.060	1-1/2	4	4	43707			HSV-S-41000-R.060
	1	.060	2	4-1/2	4	43722			HSV-R-41000-R.060
	1	.060	2-5/8	5	4	43737			HSV-M-41000-R.060
	1	.060	3	6	4	43742			HSV-ML-41000-R.060
	1	.060	4-1/4	7	4	43752			HSV-L-41000-R.060
	1	.090	1-1/2	4	4	43708			HSV-S-41000-R.090
	1	.090	2	4-1/2	4	43723			HSV-R-41000-R.090
	1	.090	2-5/8	5	4	43738			HSV-M-41000-R.090
	1	.090	3	6	4	43743			HSV-ML-41000-R.090
	1	.090	4-1/4	7	4	43753			HSV-L-41000-R.090
	1	.125	1-1/2	4	4	43709			HSV-S-41000-R.125
	1	.125	2	4-1/2	4	43724			HSV-R-41000-R.125
	1	.125	2-5/8	5	4	43739			HSV-M-41000-R.125
	1	.125	3	6	4	43744			HSV-ML-41000-R.125
	1	.125	4-1/4	7	4	43754			HSV-L-41000-R.125
	1	.190	1-1/2	4	4	43710			HSV-S-41000-R.190
	1	.190	2	4-1/2	4	43725			HSV-R-41000-R.190
	1	.190	2-5/8	5	4	43740			HSV-M-41000-R.190
	1	.190	3	6	4	43745			HSV-ML-41000-R.190
	1	.190	4-1/4	7	4	43755			HSV-L-41000-R.190
	1	.250	1-1/2	4	4	43711			HSV-S-41000-R.250
	1	.250	2	4-1/2	4	43726			HSV-R-41000-R.250
	1	.250	2-5/8	5	4	43741			HSV-M-41000-R.250
	1	.250	3	6	4	43746			HSV-ML-41000-R.250
1	.250	4-1/4	7	4	43756			HSV-L-41000-R.250	

* .0005 max TIR

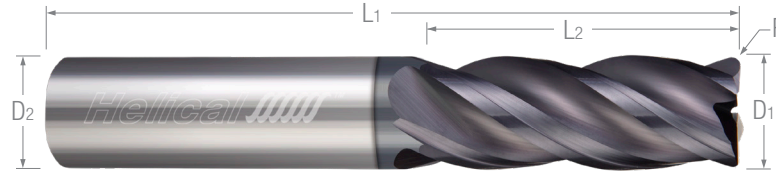
4 FLUTE - CORNER RADIUS - METRIC

MHSV-4

METRIC

Variable Pitch

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA

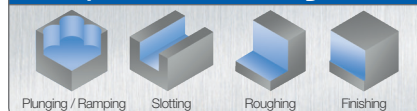


Cutter Dia.* D1 ^{+0.0 mm} -0.05 mm	Shank Diameter D2 (h6)	Corner Radius R ^{+0.05 mm} -0.05 mm	Length of Cut L2 ^{+0.80 mm} -0.00 mm	Overall Length L1 ^{+1.60 mm} -1.60 mm	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	4	59459	MHSV-015-40600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	4	59477	MHSV-020-40600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	4	59511	MHSV-030-40600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	4	59460	MHSV-015-40600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	4	59478	MHSV-020-40600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	4	59512	MHSV-030-40600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	4	59462	MHSV-015-40800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	4	59480	MHSV-020-40800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	4	59514	MHSV-030-40800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	4	59463	MHSV-015-40800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	4	59481	MHSV-020-40800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	4	59515	MHSV-030-40800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	4	59465	MHSV-015-41000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	4	59483	MHSV-020-41000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	4	59497	MHSV-025-41000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	4	59466	MHSV-015-41000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	4	59484	MHSV-020-41000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	4	59498	MHSV-025-41000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	4	59468	MHSV-015-41200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	4	59486	MHSV-020-41200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	4	59500	MHSV-025-41200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	4	59469	MHSV-015-41200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	4	59487	MHSV-020-41200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	4	59501	MHSV-025-41200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	4	59471	MHSV-015-41600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	4	59489	MHSV-020-41600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	4	59503	MHSV-025-41600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	4	59472	MHSV-015-41600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	4	59490	MHSV-020-41600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	4	59504	MHSV-025-41600-R1.00

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 99



MHSV-4

METRIC

4 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* $D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Corner Radius $R \begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Length of Cut $L_2 \begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$	Flutes	Aplus Coated	Tool Description
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	4	59474	MHSV-015-42000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	4	59492	MHSV-020-42000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	4	59506	MHSV-025-42000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	4	59475	MHSV-015-42000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	4	59493	MHSV-020-42000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	4	59507	MHSV-025-42000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	4	59495	MHSV-020-42500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	4	59509	MHSV-025-42500-R1.00

*.013 mm max TIR



8 Ways You're Killing Your End Mill

Are you making these end mill killing mistakes? You could be getting much more use from your tooling! Learn these 8 common ways machinists break their end mills prematurely in our "In the Loupe" blog post [8 Ways You're Killing Your End Mill](#).

[Read more on helical.blog/intheloupe](https://helical.blog/intheloupe)

4 FLUTE - SQUARE

HSV-RN-4

Variable Pitch - Reduced Neck

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



4 Flute

Cutter Dia.* D1 ^{+0.000"} -0.002"	Shank Diameter D2 (h6)	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	5/32	3	3/8	.118	4	52017	HSV-RN-S-40125
	1/8	5/32	3	1/2	.118	4	52032	HSV-RN-R-40125
	1/8	5/32	3	5/8	.118	4	52047	HSV-RN-M-40125
3/16	3/16	7/32	3	1/2	.178	4	52062	HSV-RN-R-40187
	3/16	7/32	3	3/4	.178	4	52077	HSV-RN-M-40187
	3/16	7/32	3	1	.178	4	52092	HSV-RN-L-40187
1/4	1/4	3/8	3	3/4	.237	4	52107	HSV-RN-S-40250
	1/4	3/8	4	1-1/8	.237	4	52122	HSV-RN-R-40250
	1/4	3/8	4	1-5/8	.237	4	81680	HSV-RN-A-40250
	1/4	3/8	4	2-1/8	.237	4	52137	HSV-RN-M-40250
3/8	3/8	1/2	4	1-1/8	.356	4	52152	HSV-RN-S-40375
	3/8	1/2	4	1-5/8	.356	4	81681	HSV-RN-SR-40375
	3/8	1/2	4	2-1/8	.356	4	52167	HSV-RN-R-40375
	3/8	1/2	6	2-1/2	.356	4	81682	HSV-RN-A-40375
	3/8	1/2	6	3-1/8	.356	4	52182	HSV-RN-M-40375
	3/8	1/2	6	4-1/8	.356	4	52197	HSV-RN-L-40375
1/2	1/2	5/8	4	1-1/2	.475	4	52212	HSV-RN-S-40500
	1/2	5/8	4	1-3/4	.475	4	81683	HSV-RN-SR-40500
	1/2	5/8	4	2-1/4	.475	4	52227	HSV-RN-R-40500
	1/2	5/8	5	2-3/4	.475	4	81684	HSV-RN-A-40500
	1/2	5/8	6	3-3/8	.475	4	52242	HSV-RN-M-40500
	1/2	5/8	6	4-1/8	.475	4	52257	HSV-RN-L-40500
5/8	5/8	3/4	4	1-5/8	.593	4	52272	HSV-RN-S-40625
	5/8	3/4	6	2-3/8	.593	4	52287	HSV-RN-R-40625
	5/8	3/4	6	3-3/8	.593	4	52302	HSV-RN-M-40625
	5/8	3/4	6	4-1/8	.593	4	52317	HSV-RN-L-40625
3/4	3/4	1	4	2	.712	4	52332	HSV-RN-S-40750
	3/4	1	6	2-1/2	.712	4	52347	HSV-RN-R-40750
	3/4	1	6	3-3/8	.712	4	52362	HSV-RN-M-40750
	3/4	1	6	4-1/8	.712	4	52377	HSV-RN-L-40750
1	1	1-1/4	4	2-1/4	.950	4	52392	HSV-RN-S-41000
	1	1-1/4	6	2-5/8	.950	4	52407	HSV-RN-R-41000
	1	1-1/4	6	3-3/8	.950	4	52422	HSV-RN-M-41000
	1	1-1/4	6	4-1/8	.950	4	52437	HSV-RN-L-41000

*.0005 max TIR

Speeds & Feeds on Page 99

Plunging / Ramping Slotting Roughing Finishing

HSV-RN-4

New Items! 4 FLUTE - BALL

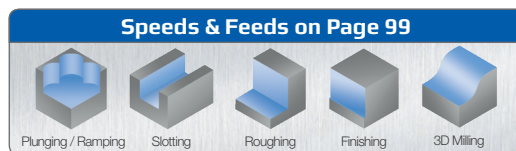
Variable Pitch - Reduced Neck

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.*	Shank Diameter	Length of Cut	Overall Length	Reach (LBS)	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
D1 ^{+0.000} _{-.002} "	D2 (h6)	L2 ^{+0.032} _{-.000} "	L1 ^{+0.062} _{-.062} "	L3				
1/8	1/8	5/32	3	3/8	.118	4	57017	HSV-RN-S-40125-BN
	1/8	5/32	3	1/2	.118	4	57032	HSV-RN-R-40125-BN
	1/8	5/32	3	5/8	.118	4	57047	HSV-RN-M-40125-BN
	1/8	5/32	3	3/4	.118	4	82515	HSV-RN-ML-40125-BN
3/16	3/16	7/32	3	1/2	.178	4	57062	HSV-RN-S-40187-BN
	3/16	7/32	3	3/4	.178	4	57077	HSV-RN-R-40187-BN
	3/16	7/32	3	1	.178	4	57092	HSV-RN-M-40187-BN
	3/16	7/32	3	1-5/16	.178	4	82516	HSV-RN-L-40187-BN
1/4	1/4	3/8	3	3/4	.237	4	57107	HSV-RN-S-40250-BN
	1/4	3/8	4	1-1/8	.237	4	57122	HSV-RN-R-40250-BN
	1/4	3/8	4	1-5/8	.237	4	81694	HSV-RN-A-40250-BN
	1/4	3/8	4	2-1/8	.237	4	57137	HSV-RN-M-40250-BN
	1/4	3/8	4	2-1/2	.237	4	81695	HSV-RN-ML-40250-BN
	1/4	3/8	4-1/2	3	.237	4	82517	HSV-RN-L-40250-BN
3/8	3/8	1/2	4	1-1/8	.356	4	57152	HSV-RN-S-40375-BN
	3/8	1/2	4	1-5/8	.356	4	81696	HSV-RN-SR-40375-BN
	3/8	1/2	4	2-1/8	.356	4	57167	HSV-RN-R-40375-BN
	3/8	1/2	6	2-1/2	.356	4	81697	HSV-RN-A-40375-BN
	3/8	1/2	6	3-1/8	.356	4	57182	HSV-RN-M-40375-BN
	3/8	1/2	6	4-1/8	.356	4	57197	HSV-RN-L-40375-BN
1/2	1/2	5/8	4	1-1/2	.475	4	57212	HSV-RN-S-40500-BN
	1/2	5/8	4	1-3/4	.475	4	81698	HSV-RN-SR-40500-BN
	1/2	5/8	4	2-1/4	.475	4	57227	HSV-RN-R-40500-BN
	1/2	5/8	5	2-3/4	.475	4	81699	HSV-RN-A-40500-BN
	1/2	5/8	6	3-3/8	.475	4	57242	HSV-RN-M-40500-BN
	1/2	5/8	6	3-3/4	.475	4	81700	HSV-RN-ML-40500-BN
	1/2	5/8	6	4-1/8	.475	4	57257	HSV-RN-L-40500-BN
5/8	5/8	3/4	4	1-5/8	.593	4	57272	HSV-RN-S-40625-BN
	5/8	3/4	6	2-3/8	.593	4	57287	HSV-RN-R-40625-BN
	5/8	3/4	6	3-3/8	.593	4	57302	HSV-RN-M-40625-BN
	5/8	3/4	6	4-1/8	.593	4	57317	HSV-RN-L-40625-BN
3/4	3/4	1	4	2	.712	4	57332	HSV-RN-S-40750-BN
	3/4	1	6	2-1/2	.712	4	57347	HSV-RN-R-40750-BN
	3/4	1	6	3-3/8	.712	4	57362	HSV-RN-M-40750-BN
	3/4	1	6	4-1/8	.712	4	57377	HSV-RN-L-40750-BN
1	1	1-1/4	4	2-1/4	.950	4	57392	HSV-RN-S-41000-BN
	1	1-1/4	6	2-5/8	.950	4	57407	HSV-RN-R-41000-BN
	1	1-1/4	6	3-3/8	.950	4	57422	HSV-RN-M-41000-BN
	1	1-1/4	6	4-1/8	.950	4	57437	HSV-RN-L-41000-BN

*.0005 max TIR



4 FLUTE - CORNER RADIUS

HSV-RN-4

Variable Pitch - Reduced Neck

- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Center cutting
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
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- Solid carbide
- CNC ground in the USA



Cutter Dia.* D1 ^{+0.001} / _{-.002} "	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002} / _{-.002} "	LOC L2 ^{+0.032} / _{-.000} "	OAL L1 ^{+0.062} / _{-.062} "	Reach (LBS) L3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	.010	5/32	3	3/8	.118	4	32017	HSV-RN-S-40125-R.010
	1/8	.010	5/32	3	1/2	.118	4	32032	HSV-RN-R-40125-R.010
	1/8	.010	5/32	3	5/8	.118	4	32047	HSV-RN-M-40125-R.010
	1/8	.010	5/32	3	3/4	.118	4	81685	HSV-RN-ML-40125-R.010
	1/8	.030	5/32	3	3/8	.118	4	53017	HSV-RN-S-40125-R.030
	1/8	.030	5/32	3	1/2	.118	4	53032	HSV-RN-R-40125-R.030
	1/8	.030	5/32	3	5/8	.118	4	53047	HSV-RN-M-40125-R.030
3/16	3/16	.010	7/32	3	1/2	.178	4	32062	HSV-RN-S-40187-R.010
	3/16	.010	7/32	3	3/4	.178	4	32077	HSV-RN-R-40187-R.010
	3/16	.010	7/32	3	1	.178	4	32092	HSV-RN-M-40187-R.010
	3/16	.010	7/32	3	1-5/16	.178	4	81686	HSV-RN-L-40187-R.010
	3/16	.030	7/32	3	1/2	.178	4	53062	HSV-RN-S-40187-R.030
	3/16	.030	7/32	3	3/4	.178	4	53077	HSV-RN-R-40187-R.030
	3/16	.030	7/32	3	1	.178	4	53092	HSV-RN-M-40187-R.030
1/4	1/4	.020	3/8	3	3/4	.237	4	32107	HSV-RN-S-40250-R.020
	1/4	.020	3/8	4	1-1/8	.237	4	32122	HSV-RN-R-40250-R.020
	1/4	.020	3/8	4	1-5/8	.237	4	81687	HSV-RN-A-40250-R.020
	1/4	.020	3/8	4	2-1/8	.237	4	32137	HSV-RN-M-40250-R.020
	1/4	.030	3/8	3	3/4	.237	4	53107	HSV-RN-S-40250-R.030
	1/4	.030	3/8	4	1-1/8	.237	4	53122	HSV-RN-R-40250-R.030
	1/4	.030	3/8	4	2-1/8	.237	4	53137	HSV-RN-M-40250-R.030
	1/4	.060	3/8	3	3/4	.237	4	53108	HSV-RN-S-40250-R.060
	1/4	.060	3/8	4	1-1/8	.237	4	53123	HSV-RN-R-40250-R.060
3/8	3/8	.020	1/2	4	1-1/8	.356	4	32152	HSV-RN-S-40375-R.020
	3/8	.020	1/2	4	1-5/8	.356	4	81688	HSV-RN-SR-40375-R.020
	3/8	.020	1/2	4	2-1/8	.356	4	32167	HSV-RN-R-40375-R.020
	3/8	.020	1/2	6	2-1/2	.356	4	81689	HSV-RN-A-40375-R.020
	3/8	.020	1/2	6	3-1/8	.356	4	32182	HSV-RN-M-40375-R.020
	3/8	.020	1/2	6	4-1/8	.356	4	32197	HSV-RN-L-40375-R.020
	3/8	.030	1/2	4	1-1/8	.356	4	53152	HSV-RN-S-40375-R.030
	3/8	.030	1/2	4	2-1/8	.356	4	53167	HSV-RN-R-40375-R.030
	3/8	.030	1/2	6	3-1/8	.356	4	53182	HSV-RN-M-40375-R.030
	3/8	.030	1/2	6	4-1/8	.356	4	53197	HSV-RN-L-40375-R.030
	3/8	.060	1/2	4	1-1/8	.356	4	53153	HSV-RN-S-40375-R.060
	3/8	.060	1/2	4	2-1/8	.356	4	53168	HSV-RN-R-40375-R.060
	3/8	.060	1/2	6	3-1/8	.356	4	53183	HSV-RN-M-40375-R.060
	3/8	.060	1/2	6	4-1/8	.356	4	53198	HSV-RN-L-40375-R.060
	3/8	.090	1/2	4	1-1/8	.356	4	53154	HSV-RN-S-40375-R.090
	3/8	.090	1/2	4	2-1/8	.356	4	53169	HSV-RN-R-40375-R.090
	3/8	.090	1/2	6	3-1/8	.356	4	53184	HSV-RN-M-40375-R.090
	3/8	.090	1/2	6	4-1/8	.356	4	53199	HSV-RN-L-40375-R.090

* .0005 max TIR

HSV-RN-4

4 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.*	Shank Dia.	Corner Radius	LOC	OAL	Reach (LBS)	Neck Dia.	Flutes	Aplus Coated	Tool Description
D1 $^{+.000}$ $_{-.002}$	D2 (h6)	R $^{+.002}$ $_{-.002}$	L2 $^{+.032}$ $_{-.000}$	L1 $^{+.062}$ $_{-.062}$	L3				
1/2	1/2	.020	5/8	4	1-1/2	.475	4	53211	HSV-RN-S-40500-R.020
	1/2	.020	5/8	4	2-1/4	.475	4	53226	HSV-RN-R-40500-R.020
	1/2	.020	5/8	6	3-3/8	.475	4	53241	HSV-RN-M-40500-R.020
	1/2	.020	5/8	6	4-1/8	.475	4	53256	HSV-RN-L-40500-R.020
	1/2	.030	5/8	4	1-1/2	.475	4	32212	HSV-RN-S-40500-R.030
	1/2	.030	5/8	4	1-3/4	.475	4	81690	HSV-RN-SR-40500-R.030
	1/2	.030	5/8	4	2-1/4	.475	4	32227	HSV-RN-R-40500-R.030
	1/2	.030	5/8	5	2-3/4	.475	4	81691	HSV-RN-A-40500-R.030
	1/2	.030	5/8	6	3-3/8	.475	4	32242	HSV-RN-M-40500-R.030
	1/2	.030	5/8	6	3-3/4	.475	4	81692	HSV-RN-ML-40500-R.030
	1/2	.030	5/8	6	4-1/8	.475	4	32257	HSV-RN-L-40500-R.030
	1/2	.060	5/8	4	1-1/2	.475	4	53212	HSV-RN-S-40500-R.060
	1/2	.060	5/8	4	2-1/4	.475	4	53227	HSV-RN-R-40500-R.060
	1/2	.060	5/8	6	3-3/8	.475	4	53242	HSV-RN-M-40500-R.060
	1/2	.060	5/8	6	4-1/8	.475	4	53257	HSV-RN-L-40500-R.060
	1/2	.090	5/8	4	1-1/2	.475	4	53213	HSV-RN-S-40500-R.090
	1/2	.090	5/8	4	2-1/4	.475	4	53228	HSV-RN-R-40500-R.090
	1/2	.090	5/8	6	3-3/8	.475	4	53243	HSV-RN-M-40500-R.090
	1/2	.090	5/8	6	4-1/8	.475	4	53258	HSV-RN-L-40500-R.090
	1/2	.125	5/8	4	1-1/2	.475	4	53214	HSV-RN-S-40500-R.125
1/2	.125	5/8	4	2-1/4	.475	4	53229	HSV-RN-R-40500-R.125	
1/2	.125	5/8	6	3-3/8	.475	4	53244	HSV-RN-M-40500-R.125	
1/2	.125	5/8	6	4-1/8	.475	4	53259	HSV-RN-L-40500-R.125	
5/8	5/8	.030	3/4	4	1-5/8	.593	4	32272	HSV-RN-S-40625-R.030
	5/8	.030	3/4	6	2-3/8	.593	4	32287	HSV-RN-R-40625-R.030
	5/8	.030	3/4	6	3-3/8	.593	4	32302	HSV-RN-M-40625-R.030
	5/8	.030	3/4	6	4-1/8	.593	4	32317	HSV-RN-L-40625-R.030
	5/8	.060	3/4	4	1-5/8	.593	4	53272	HSV-RN-S-40625-R.060
	5/8	.060	3/4	6	2-3/8	.593	4	53287	HSV-RN-R-40625-R.060
	5/8	.060	3/4	6	3-3/8	.593	4	53302	HSV-RN-M-40625-R.060
	5/8	.060	3/4	6	4-1/8	.593	4	53317	HSV-RN-L-40625-R.060
	5/8	.090	3/4	4	1-5/8	.593	4	53273	HSV-RN-S-40625-R.090
	5/8	.090	3/4	6	2-3/8	.593	4	53288	HSV-RN-R-40625-R.090
	5/8	.090	3/4	6	3-3/8	.593	4	53303	HSV-RN-M-40625-R.090
	5/8	.090	3/4	6	4-1/8	.593	4	53318	HSV-RN-L-40625-R.090
	5/8	.125	3/4	4	1-5/8	.593	4	53274	HSV-RN-S-40625-R.125
	5/8	.125	3/4	6	2-3/8	.593	4	53289	HSV-RN-R-40625-R.125
	5/8	.125	3/4	6	3-3/8	.593	4	53304	HSV-RN-M-40625-R.125
	5/8	.125	3/4	6	4-1/8	.593	4	53319	HSV-RN-L-40625-R.125
3/4	3/4	.030	1	4	2	.712	4	32332	HSV-RN-S-40750-R.030
	3/4	.030	1	6	2-1/2	.712	4	32347	HSV-RN-R-40750-R.030
	3/4	.030	1	6	2-7/8	.712	4	81693	HSV-RN-A-40750-R.030
	3/4	.030	1	6	3-3/8	.712	4	32362	HSV-RN-M-40750-R.030
	3/4	.030	1	6	4-1/8	.712	4	32377	HSV-RN-L-40750-R.030
	3/4	.060	1	4	2	.712	4	53332	HSV-RN-S-40750-R.060
	3/4	.060	1	6	2-1/2	.712	4	53347	HSV-RN-R-40750-R.060
	3/4	.060	1	6	3-3/8	.712	4	53362	HSV-RN-M-40750-R.060
	3/4	.060	1	6	4-1/8	.712	4	53377	HSV-RN-L-40750-R.060
	3/4	.090	1	4	2	.712	4	53333	HSV-RN-S-40750-R.090
	3/4	.090	1	6	2-1/2	.712	4	53348	HSV-RN-R-40750-R.090
3/4	.090	1	6	3-3/8	.712	4	53363	HSV-RN-M-40750-R.090	

*.0005 max TIR

continued on next page

4 FLUTE - CORNER RADIUS

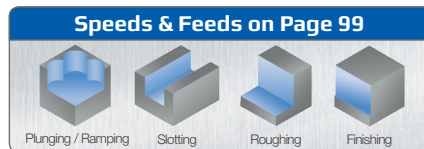
HSV-RN-4

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D1 ^{+0.000"} _{-.002"}	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} _{-.002"}	LOC L2 ^{+0.032"} _{-.000"}	OAL L1 ^{+0.062"} _{-.062"}	Reach (LBS) L3	Neck Dia.	Flutes	Aplus Coated	Tool Description
3/4	3/4	.090	1	6	4-1/8	.712	4	53378	HSV-RN-L-40750-R.090
	3/4	.125	1	4	2	.712	4	53334	HSV-RN-S-40750-R.125
	3/4	.125	1	6	2-1/2	.712	4	53349	HSV-RN-R-40750-R.125
	3/4	.125	1	6	3-3/8	.712	4	53364	HSV-RN-M-40750-R.125
	3/4	.125	1	6	4-1/8	.712	4	53379	HSV-RN-L-40750-R.125
	3/4	.190	1	4	2	.712	4	53335	HSV-RN-S-40750-R.190
	3/4	.190	1	6	2-1/2	.712	4	53350	HSV-RN-R-40750-R.190
	3/4	.190	1	6	3-3/8	.712	4	53365	HSV-RN-M-40750-R.190
	3/4	.190	1	6	4-1/8	.712	4	53380	HSV-RN-L-40750-R.190
	3/4	.250	1	4	2	.712	4	53336	HSV-RN-S-40750-R.250
	3/4	.250	1	6	2-1/2	.712	4	53351	HSV-RN-R-40750-R.250
	3/4	.250	1	6	3-3/8	.712	4	53366	HSV-RN-M-40750-R.250
3/4	.250	1	6	4-1/8	.712	4	53381	HSV-RN-L-40750-R.250	
1	1	.030	1-1/4	4	2-1/4	.950	4	32392	HSV-RN-S-41000-R.030
	1	.030	1-1/4	6	2-5/8	.950	4	32407	HSV-RN-R-41000-R.030
	1	.030	1-1/4	6	3-3/8	.950	4	32422	HSV-RN-M-41000-R.030
	1	.030	1-1/4	6	4-1/8	.950	4	32437	HSV-RN-L-41000-R.030
	1	.060	1-1/4	4	2-1/4	.950	4	53392	HSV-RN-S-41000-R.060
	1	.060	1-1/4	6	2-5/8	.950	4	53407	HSV-RN-R-41000-R.060
	1	.060	1-1/4	6	3-3/8	.950	4	53422	HSV-RN-M-41000-R.060
	1	.060	1-1/4	6	4-1/8	.950	4	53437	HSV-RN-L-41000-R.060
	1	.090	1-1/4	4	2-1/4	.950	4	53393	HSV-RN-S-41000-R.090
	1	.090	1-1/4	6	2-5/8	.950	4	53408	HSV-RN-R-41000-R.090
	1	.090	1-1/4	6	3-3/8	.950	4	53423	HSV-RN-M-41000-R.090
	1	.090	1-1/4	6	4-1/8	.950	4	53438	HSV-RN-L-41000-R.090
	1	.125	1-1/4	4	2-1/4	.950	4	53394	HSV-RN-S-41000-R.125
	1	.125	1-1/4	6	2-5/8	.950	4	53409	HSV-RN-R-41000-R.125
	1	.125	1-1/4	6	3-3/8	.950	4	53424	HSV-RN-M-41000-R.125
	1	.125	1-1/4	6	4-1/8	.950	4	53439	HSV-RN-L-41000-R.125
	1	.190	1-1/4	4	2-1/4	.950	4	53395	HSV-RN-S-41000-R.190
	1	.190	1-1/4	6	2-5/8	.950	4	53410	HSV-RN-R-41000-R.190
	1	.190	1-1/4	6	3-3/8	.950	4	53425	HSV-RN-M-41000-R.190
	1	.190	1-1/4	6	4-1/8	.950	4	53440	HSV-RN-L-41000-R.190
	1	.250	1-1/4	4	2-1/4	.950	4	53396	HSV-RN-S-41000-R.250
	1	.250	1-1/4	6	2-5/8	.950	4	53411	HSV-RN-R-41000-R.250
	1	.250	1-1/4	6	3-3/8	.950	4	53426	HSV-RN-M-41000-R.250
	1	.250	1-1/4	6	4-1/8	.950	4	53441	HSV-RN-L-41000-R.250

* .0005 max TIR



5 FLUTE - SQUARE

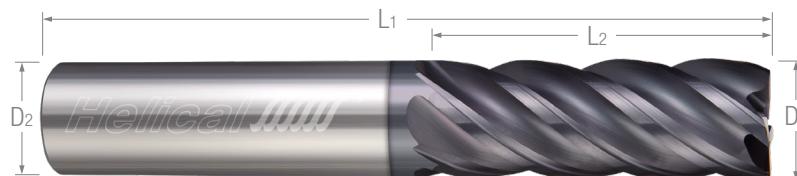
New Items!



HEV-5

Variable Pitch

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D1 ^{+0.000"} / _{-0.002"}	Shank Diameter D2 (h6)	Length of Cut L2 ^{+0.032"} / _{-0.000"}	Overall Length L1 ^{+0.062"} / _{-0.062"}	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	<i>Tplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	5	44017		59833	HEV-S-50125
	1/8	3/8	2	5	81701		82525	HEV-SR-50125 new
	1/8	1/2	2-1/2	5	44032		81840	HEV-R-50125
	1/8	5/8	2-1/2	5	81702		82526	HEV-A-50125 new
	1/8	3/4	2-1/2	5	44047			HEV-M-50125
	1/8	7/8	2-1/2	5	82518			HEV-L-50125 new
5/32	3/16	3/16	2	5	81703			HEV-S-50156
	3/16	7/16	2-1/2	5	81704			HEV-R-50156
	3/16	9/16	2-1/2	5	81705			HEV-M-50156
3/16	3/16	5/16	2	5	44062		59834	HEV-S-50187
	3/16	7/16	2	5	81706		82527	HEV-SR-50187 new
	3/16	9/16	2-1/2	5	44077		59835	HEV-R-50187
	3/16	3/4	2-1/2	5	44092		81841	HEV-M-50187
	3/16	1	2-1/2	5	81707			HEV-ML-50187
	3/16	1-3/16	3	5	82519			HEV-L-50187 new
7/32	1/4	5/16	2	5	81708			HEV-S-50218
	1/4	7/16	2-1/2	5	81709			HEV-R-50218
1/4	1/4	3/8	2	5	44107	44107W	59836	HEV-S-50250 new
	1/4	1/2	2-1/2	5	44122	44122W	59837	HEV-SR-50250 new
	1/4	3/4	2-1/2	5	44137	44137W	59838	HEV-R-50250
	1/4	1	3	5	44152	44152W	81842	HEV-M-50250 new
	1/4	1-1/4	3	5	44157		82528	HEV-L-50250 new
	1/4	1-1/2	3	5	81710			HEV-LX-50250
9/32	5/16	3/4	2-1/2	5	81711			HEV-R-50281
	5/16	1	3	5	81712			HEV-M-50281
5/16	5/16	7/16	2	5	44167		59839	HEV-S-50312
	5/16	13/16	2-1/2	5	44182	44182W	59840	HEV-R-50312
	5/16	1	3	5	44197		59841	HEV-M-50312
	5/16	1-1/4	3	5	81713			HEV-L-50312
	5/16	1-9/16	4	5	82520			HEV-LX-50312 new

*.0005 max TIR

continued on next page

5 Flute

Speeds & Feeds on Page 115

Plunging / Ramping

Slotting

Roughing

Finishing

HEV-5



New Items!

5 FLUTE - SQUARE

Variable Pitch (cont.)

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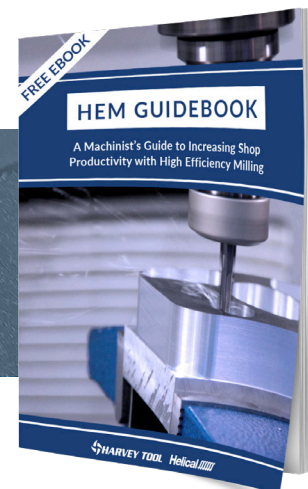
Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
D1 ^{+0.000"} _{-0.002"}	D2 (h6)	L2 ^{+0.032"} _{-0.000"}	L1 ^{+0.062"} _{-0.062"}					
new 3/8	3/8	1/2	2	5	44212	44212W	59842	HEV-S-50375
	3/8	3/4	2-1/2	5	81714	81714W	82529	HEV-SR-50375
	3/8	1	3	5	44227	44227W	59843	HEV-R-50375
	3/8	1-1/4	3	5	44242	44242W	59844	HEV-M-50375
	3/8	1-1/2	3-1/2	5	44247	44247W	81843	HEV-L-50375
	new 3/8	3/8	2	4	5	82521		HEV-LX-50375
new 1/2	1/2	5/8	2-1/2	5	44257	44257W	59845	HEV-S-50500
	1/2	1	3	5	44272	44272W	59846	HEV-SR-50500
	1/2	1-1/4	3	5	44287	44287W	59847	HEV-R-50500
	1/2	1-5/8	4	5	44302	44302W	59848	HEV-M-50500
	1/2	2	4	5	44307	44307W	81844	HEV-L-50500
	1/2	2-1/2	5	5	81715			HEV-LX-50500
	new 1/2	1/2	3-1/8	6	5	82522		HEV-X-50500
	new 1/2	1/2	3-5/8	6	5	82523		HEV-Y-50500
new 5/8	5/8	3/4	3	5	44317	44317W	59849	HEV-S-50625
	5/8	1-1/4	3-1/2	5	44322		59850	HEV-SR-50625
	5/8	1-5/8	3-1/2	5	44332	44332W	59851	HEV-R-50625
	5/8	2-1/8	4	5	44347		81845	HEV-M-50625
	5/8	2-1/2	5	5	44352		81846	HEV-L-50625
	5/8	3-1/4	6	5	82524			HEV-LX-50625
3/4	3/4	1	3	5	44362	44362W	59852	HEV-S-50750
	3/4	1-1/4	4	5	81716			HEV-SR-50750
	3/4	1-5/8	4	5	44377	44377W	59853	HEV-R-50750
	3/4	2-1/4	5	5	44392	44392W	59854	HEV-M-50750
	3/4	2-3/4	5	5	44397	44397W	81847	HEV-L-50750
	3/4	3-1/4	6	5	44402	44402W		HEV-LX-50750
	3/4	4	6-1/2	5	81717			HEV-X-50750
1	1	2	4-1/2	5	44422		81848	HEV-R-51000
	1	2-5/8	5	5	44437		81849	HEV-M-51000
	1	3-1/4	6	5	44442			HEV-L-51000
	1	4-1/4	7	5	44447			HEV-X-51000

* .0005 max TIR

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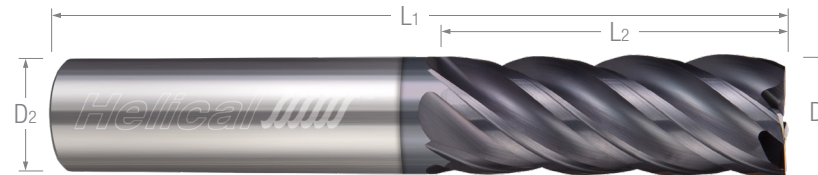
5 FLUTE - SQUARE - METRIC

Variable Pitch



MHEV-5
METRIC

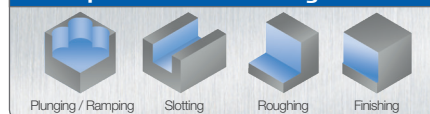
- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D1 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Diameter D2 (h6)	Length of Cut L2 $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length L1 $\begin{smallmatrix} +1.6 \text{ mm} \\ -1.6 \text{ mm} \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	9.00 mm	63 mm	5	59516	MHEV-015-50600
	6.00 mm	12.00 mm	63 mm	5	59534	MHEV-020-50600
	6.00 mm	18.00 mm	63 mm	5	59568	MHEV-030-50600
8 mm	8.00 mm	12.00 mm	63 mm	5	59519	MHEV-015-50800
	8.00 mm	16.00 mm	63 mm	5	59537	MHEV-020-50800
	8.00 mm	24.00 mm	75 mm	5	59571	MHEV-030-50800
10 mm	10.00 mm	15.00 mm	63 mm	5	59522	MHEV-015-51000
	10.00 mm	20.00 mm	63 mm	5	59540	MHEV-020-51000
	10.00 mm	25.00 mm	75 mm	5	59554	MHEV-025-51000
12 mm	12.00 mm	18.00 mm	75 mm	5	59525	MHEV-015-51200
	12.00 mm	24.00 mm	75 mm	5	59543	MHEV-020-51200
	12.00 mm	30.00 mm	75 mm	5	59557	MHEV-025-51200
16 mm	16.00 mm	24.00 mm	89 mm	5	59528	MHEV-015-51600
	16.00 mm	32.00 mm	89 mm	5	59546	MHEV-020-51600
	16.00 mm	40.00 mm	89 mm	5	59560	MHEV-025-51600
20 mm	20.00 mm	30.00 mm	89 mm	5	59531	MHEV-015-52000
	20.00 mm	40.00 mm	100 mm	5	59549	MHEV-020-52000
	20.00 mm	50.00 mm	125 mm	5	59563	MHEV-025-52000
25 mm	25.00 mm	50.00 mm	125 mm	5	59552	MHEV-020-52500
	25.00 mm	64.00 mm	125 mm	5	59566	MHEV-025-52500

* .013 mm max TIR

Speeds & Feeds on Page 115



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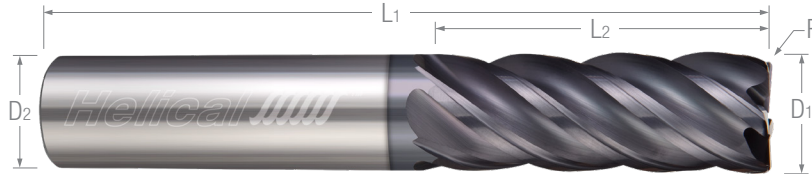


New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch

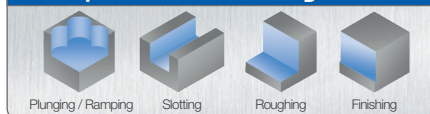
- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D1 ^{+0.000} / _{-.002} "	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002} / _{-.002} "	LOC L2 ^{+0.032} / _{-.000} "	OAL L1 ^{+0.062} / _{-.062} "	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	<i>Tplus</i> Coated	Tool Description
new 1/8	1/8	.010	1/4	1-1/2	5	34017		59855	HEV-S-50125-R.010
	1/8	.010	3/8	2	5	81718			HEV-SR-50125-R.010
	1/8	.010	1/2	2-1/2	5	34032		81850	HEV-R-50125-R.010
	1/8	.010	5/8	2-1/2	5	81719			HEV-A-50125-R.010
	1/8	.010	3/4	2-1/2	5	34047			HEV-M-50125-R.010
	1/8	.015	1/4	1-1/2	5	81720			HEV-S-50125-R.015
	1/8	.015	3/8	2	5	82530			HEV-SR-50125-R.015
	1/8	.015	1/2	2-1/2	5	81721			HEV-R-50125-R.015
	1/8	.030	1/4	1-1/2	5	45017		81851	HEV-S-50125-R.030
	1/8	.030	3/8	2	5	82531			HEV-SR-50125-R.030
	1/8	.030	1/2	2-1/2	5	45032		81852	HEV-R-50125-R.030
	1/8	.030	5/8	2-1/2	5	82532			HEV-A-50125-R.030
1/8	.030	3/4	2-1/2	5	45047			HEV-M-50125-R.030	
5/32	3/16	.010	3/16	2	5	81722			HEV-S-50156-R.010
	3/16	.010	7/16	2-1/2	5	81723			HEV-R-50156-R.010
	3/16	.010	9/16	2-1/2	5	81724			HEV-M-50156-R.010
new 3/16	3/16	.010	5/16	2	5	34062		59856	HEV-S-50187-R.010
	3/16	.010	7/16	2	5	81725			HEV-SR-50187-R.010
	3/16	.010	9/16	2-1/2	5	34077		59857	HEV-R-50187-R.010
	3/16	.010	3/4	2-1/2	5	34092		81853	HEV-M-50187-R.010
	3/16	.010	1	2-1/2	5	81726			HEV-ML-50187-R.010
	3/16	.015	5/16	2	5	81727			HEV-S-50187-R.015
	3/16	.015	7/16	2	5	82533			HEV-SR-50187-R.015
	3/16	.015	9/16	2-1/2	5	81728			HEV-R-50187-R.015
	3/16	.015	3/4	2-1/2	5	82534			HEV-M-50187-R.015
	3/16	.015	1	2-1/2	5	82535			HEV-ML-50187-R.015
	3/16	.030	5/16	2	5	45062		81854	HEV-S-50187-R.030
	3/16	.030	7/16	2	5	81729			HEV-SR-50187-R.030
3/16	.030	9/16	2-1/2	5	45077		81855	HEV-R-50187-R.030	
3/16	.030	3/4	2-1/2	5	45092		81856	HEV-M-50187-R.030	
3/16	.030	1	2-1/2	5	82536			HEV-ML-50187-R.030	
7/32	1/4	.010	5/16	2	5	81730			HEV-S-50218-R.010
	1/4	.010	7/16	2-1/2	5	81731			HEV-R-50218-R.010
new 1/4	1/4	.010	3/8	2	5	81732			HEV-S-50250-R.010
	1/4	.010	1/2	2-1/2	5	81733			HEV-SR-50250-R.010
	1/4	.010	3/4	2-1/2	5	81734			HEV-R-50250-R.010
	1/4	.010	1	3	5	82537			HEV-M-50250-R.010
	1/4	.010	1-1/4	3	5	82538			HEV-L-50250-R.010

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5 FLUTE - CORNER RADIUS

New Items!



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Variable Pitch (cont.)

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Cutter Dia.* D1 ^{+0.001"} / _{-.002"}	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} / _{-.002"}	LOC L2 ^{+0.032"} / _{-.000"}	OAL L1 ^{+0.062"} / _{-.062"}	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
1/4	1/4	.015	3/8	2	5	81735			HEV-S-50250-R.015
	1/4	.015	1/2	2-1/2	5	81736			HEV-SR-50250-R.015
	1/4	.015	3/4	2-1/2	5	81737			HEV-R-50250-R.015
	1/4	.015	1	3	5	82539			HEV-M-50250-R.015
	1/4	.015	1-1/4	3	5	82540			HEV-L-50250-R.015
	1/4	.020	3/8	2	5	34107	34107W	59858	HEV-S-50250-R.020
	1/4	.020	1/2	2-1/2	5	34122	34122W	59859	HEV-SR-50250-R.020
	1/4	.020	3/4	2-1/2	5	34137	34137W	59860	HEV-R-50250-R.020
	1/4	.020	1	3	5	34152	34152W	81857	HEV-M-50250-R.020
	1/4	.020	1-1/4	3	5	34157			HEV-L-50250-R.020
	1/4	.020	1-1/2	3	5	82541			HEV-LX-50250-R.020
	1/4	.030	3/8	2	5	45107		59861	HEV-S-50250-R.030
	1/4	.030	1/2	2-1/2	5	45122		59862	HEV-SR-50250-R.030
	1/4	.030	3/4	2-1/2	5	45137		59863	HEV-R-50250-R.030
	1/4	.030	1	3	5	45152		81858	HEV-M-50250-R.030
	1/4	.030	1-1/4	3	5	45157			HEV-L-50250-R.030
	1/4	.030	1-1/2	3	5	82542			HEV-LX-50250-R.030
	1/4	.060	3/8	2	5	45108		81859	HEV-S-50250-R.060
	1/4	.060	1/2	2-1/2	5	45123		81860	HEV-SR-50250-R.060
	1/4	.060	3/4	2-1/2	5	45138		81861	HEV-R-50250-R.060
1/4	.060	1	3	5	45153		81862	HEV-M-50250-R.060	
1/4	.060	1-1/4	3	5	45158			HEV-L-50250-R.060	
1/4	.060	1-1/2	3	5	82543			HEV-LX-50250-R.060	
9/32	5/16	.020	7/16	2	5	81738			HEV-S-50281-R.020
	5/16	.020	3/4	2-1/2	5	81739			HEV-R-50281-R.020
	5/16	.020	1	3	5	81740			HEV-M-50281-R.020
5/16	5/16	.010	7/16	2	5	81741			HEV-S-50312-R.010
	5/16	.010	13/16	2-1/2	5	81742			HEV-R-50312-R.010
	5/16	.020	7/16	2	5	34167		59864	HEV-S-50312-R.020
	5/16	.020	13/16	2-1/2	5	34182		59865	HEV-R-50312-R.020
	5/16	.020	1	3	5	34197		81863	HEV-M-50312-R.020
	5/16	.020	1-1/4	3	5	81743			HEV-L-50312-R.020
	5/16	.020	1-9/16	4	5	82544			HEV-LX-50312-R.020
	5/16	.030	7/16	2	5	45167			HEV-S-50312-R.030
	5/16	.030	13/16	2-1/2	5	45182			HEV-R-50312-R.030
	5/16	.030	1	3	5	45197			HEV-M-50312-R.030
	5/16	.030	1-1/4	3	5	82545			HEV-L-50312-R.030
	5/16	.060	7/16	2	5	45168			HEV-S-50312-R.060
	5/16	.060	13/16	2-1/2	5	45183			HEV-R-50312-R.060
5/16	.060	1	3	5	45198			HEV-M-50312-R.060	
3/8	3/8	.010	1/2	2	5	81744			HEV-S-50375-R.010
	3/8	.010	3/4	2-1/2	5	82546			HEV-SR-50375-R.010
	3/8	.010	1	3	5	81745			HEV-R-50375-R.010
	3/8	.010	1-1/4	3	5	81746			HEV-M-50375-R.010
	3/8	.010	1-1/2	3-1/2	5	81747			HEV-L-50375-R.010
	3/8	.015	1/2	2	5	81748			HEV-S-50375-R.015
	3/8	.015	3/4	2-1/2	5	82547			HEV-SR-50375-R.015
	3/8	.015	1	3	5	81749			HEV-R-50375-R.015
	3/8	.015	1-1/4	3	5	82548			HEV-M-50375-R.015
	3/8	.020	1/2	2	5	34212	34212W	59866	HEV-S-50375-R.020
	3/8	.020	3/4	2-1/2	5	81750			HEV-SR-50375-R.020
	3/8	.020	1	3	5	34227	34227W	59867	HEV-R-50375-R.020
	3/8	.020	1-1/4	3	5	34242	34242W	59868	HEV-M-50375-R.020
3/8	.020	1-1/2	3-1/2	5	34247		81864	HEV-L-50375-R.020	

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New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

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Cutter Dia.*	Shank Dia.	Corner Radius	LOC	OAL	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description			
D1 ^{+0.000"} _{-.002"}	D2 (h6)	R ^{+0.002"} _{-.002"}	L2 ^{+0.032"} _{-.000"}	L1 ^{+0.062"} _{-.062"}								
new	3/8	3/8	.030	1/2	2	5	45212	45212W	59869	HEV-S-50375-R.030		
		3/8	.030	3/4	2-1/2	5	81751			HEV-SR-50375-R.030		
		3/8	.030	1	3	5	45227	45227W	59870	HEV-R-50375-R.030		
		3/8	.030	1-1/4	3	5	45242	45242W	59871	HEV-M-50375-R.030		
		3/8	.030	1-1/2	3-1/2	5	45247	45247W	81865	HEV-L-50375-R.030		
		3/8	.060	1/2	2	5	45213	45213W	59872	HEV-S-50375-R.060		
		3/8	.060	3/4	2-1/2	5	81752			HEV-SR-50375-R.060		
		3/8	.060	1	3	5	45228	45228W	59873	HEV-R-50375-R.060		
		3/8	.060	1-1/4	3	5	45243	45243W	59874	HEV-M-50375-R.060		
		3/8	.060	1-1/2	3-1/2	5	45248		81866	HEV-L-50375-R.060		
		3/8	.090	1/2	2	5	45214			HEV-S-50375-R.090		
		3/8	.090	1	3	5	45229			HEV-R-50375-R.090		
		3/8	.090	1-1/4	3	5	45244			HEV-M-50375-R.090		
		3/8	.090	1-1/2	3-1/2	5	45249			HEV-L-50375-R.090		
		3/8	.125	1/2	2	5	82549			HEV-S-50375-R.125		
		3/8	.125	1	3	5	82550			HEV-R-50375-R.125		
		3/8	.125	1-1/4	3	5	82551			HEV-M-50375-R.125		
		new	1/2	1/2	.010	5/8	2-1/2	5	81753			HEV-S-50500-R.010
				1/2	.010	1	3	5	81754			HEV-SR-50500-R.010
				1/2	.010	1-1/4	3	5	81755			HEV-R-50500-R.010
1/2	.010			1-5/8	4	5	81756			HEV-M-50500-R.010		
1/2	.010			2	4	5	81757			HEV-L-50500-R.010		
1/2	.015			5/8	2-1/2	5	81758			HEV-S-50500-R.015		
1/2	.015			1	3	5	81759			HEV-SR-50500-R.015		
1/2	.015			1-1/4	3	5	81760			HEV-R-50500-R.015		
1/2	.015			1-5/8	4	5	82552			HEV-M-50500-R.015		
1/2	.015			2	4	5	82553			HEV-L-50500-R.015		
1/2	.020			5/8	2-1/2	5	81761			HEV-S-50500-R.020		
1/2	.020			1	3	5	81762			HEV-SR-50500-R.020		
1/2	.020			1-1/4	3	5	81763			HEV-R-50500-R.020		
1/2	.020			1-5/8	4	5	82554			HEV-M-50500-R.020		
1/2	.020			2	4	5	82555			HEV-L-50500-R.020		
1/2	.030			5/8	2-1/2	5	34257	34257W	59875	HEV-S-50500-R.030		
1/2	.030			1	3	5	34272	34272W	59876	HEV-SR-50500-R.030		
1/2	.030			1-1/4	3	5	34287	34287W	59877	HEV-R-50500-R.030		
1/2	.030			1-5/8	4	5	34302	34302W	59878	HEV-M-50500-R.030		
1/2	.030			2	4	5	34307	34307W	81867	HEV-L-50500-R.030		
1/2	.030			2-1/2	5	5	81764			HEV-LX-50500-R.030		
1/2	.030			3-1/8	6	5	82556			HEV-X-50500-R.030		
1/2	.030			3-5/8	6	5	82557			HEV-Y-50500-R.030		
1/2	.060			5/8	2-1/2	5	45257	45257W	59879	HEV-S-50500-R.060		
1/2	.060			1	3	5	45272	45272W	59880	HEV-SR-50500-R.060		
1/2	.060			1-1/4	3	5	45287	45287W	59881	HEV-R-50500-R.060		
1/2	.060			1-5/8	4	5	45302	45302W	59882	HEV-M-50500-R.060		
1/2	.060			2	4	5	45307	45307W	81868	HEV-L-50500-R.060		
1/2	.060			2-1/2	5	5	81765			HEV-LX-50500-R.060		
1/2	.090			5/8	2-1/2	5	45258		81869	HEV-S-50500-R.090		
1/2	.090			1	3	5	45273		81870	HEV-SR-50500-R.090		
1/2	.090			1-1/4	3	5	45288	45288W	81871	HEV-R-50500-R.090		
1/2	.090	1-5/8	4	5	45303		81872	HEV-M-50500-R.090				
1/2	.090	2	4	5	45308		81873	HEV-L-50500-R.090				
1/2	.090	2-1/2	5	5	82558			HEV-LX-50500-R.090				

*.0005 max TIR

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5 FLUTE - CORNER RADIUS

New Items!



HEV-5

Variable Pitch (cont.)

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Cutter Dia.* D ₁ ^{+0.001"} / _{-0.002"}	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} / _{-0.002"}	LOC L ₂ ^{+0.032"} / _{-0.000"}	OAL L ₁ ^{+0.062"} / _{-0.062"}	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
1/2	1/2	.120	5/8	2-1/2	5	45259		59883	HEV-S-50500-R.120
	1/2	.120	1	3	5	45274		59884	HEV-SR-50500-R.120
	1/2	.120	1-1/4	3	5	45289	45289W	59885	HEV-R-50500-R.120
	1/2	.120	1-5/8	4	5	45304	45304W	59886	HEV-M-50500-R.120
	1/2	.120	2	4	5	45309		81874	HEV-L-50500-R.120
	1/2	.120	2-1/2	5	5	82559			HEV-LX-50500-R.120
	1/2	.125	5/8	2-1/2	5	81766			HEV-S-50500-R.125
	1/2	.125	1	3	5	81767			HEV-SR-50500-R.125
	1/2	.125	1-1/4	3	5	81768			HEV-R-50500-R.125
1/2	.125	1-5/8	4	5	82560			HEV-M-50500-R.125	
5/8	5/8	.030	3/4	3	5	34317		59887	HEV-S-50625-R.030
	5/8	.030	1-1/4	3-1/2	5	34322	34322W	59888	HEV-SR-50625-R.030
	5/8	.030	1-5/8	3-1/2	5	34332	34332W	59889	HEV-R-50625-R.030
	5/8	.030	2-1/8	4	5	34347	34347W	81875	HEV-M-50625-R.030
	5/8	.030	2-1/2	5	5	34352		81876	HEV-L-50625-R.030
	5/8	.030	3-1/4	6	5	82561			HEV-LX-50625-R.030
	5/8	.060	3/4	3	5	45317			HEV-S-50625-R.060
	5/8	.060	1-1/4	3-1/2	5	45322		81877	HEV-SR-50625-R.060
	5/8	.060	1-5/8	3-1/2	5	45332		81878	HEV-R-50625-R.060
	5/8	.060	2-1/8	4	5	45347		81879	HEV-M-50625-R.060
	5/8	.060	2-1/2	5	5	45352			HEV-L-50625-R.060
	5/8	.090	3/4	3	5	45318			HEV-S-50625-R.090
	5/8	.090	1-1/4	3-1/2	5	45323			HEV-SR-50625-R.090
	5/8	.090	1-5/8	3-1/2	5	45333			HEV-R-50625-R.090
	5/8	.090	2-1/8	4	5	45348			HEV-M-50625-R.090
	5/8	.090	2-1/2	5	5	45353			HEV-L-50625-R.090
	5/8	.120	3/4	3	5	45319			HEV-S-50625-R.120
	5/8	.120	1-1/4	3-1/2	5	45324			HEV-SR-50625-R.120
	5/8	.120	1-5/8	3-1/2	5	45334			HEV-R-50625-R.120
	5/8	.120	2-1/8	4	5	45349			HEV-M-50625-R.120
5/8	.120	2-1/2	5	5	45354			HEV-L-50625-R.120	
5/8	.120	3-1/4	6	5	82562			HEV-LX-50625-R.120	
3/4	3/4	.010	1	3	5	81769			HEV-S-50750-R.010
	3/4	.010	1-5/8	4	5	81770			HEV-R-50750-R.010
	3/4	.010	2-1/4	5	5	81771			HEV-M-50750-R.010
	3/4	.015	1	3	5	81772			HEV-S-50750-R.015
	3/4	.015	1-5/8	4	5	81773			HEV-R-50750-R.015
	3/4	.015	2-1/4	5	5	81774			HEV-M-50750-R.015
	3/4	.020	1	3	5	81775			HEV-S-50750-R.020
	3/4	.020	1-5/8	4	5	81776			HEV-R-50750-R.020
	3/4	.020	2-1/4	5	5	81777			HEV-M-50750-R.020
	3/4	.030	1	3	5	34362	34362W	59890	HEV-S-50750-R.030
	3/4	.030	1-1/4	4	5	81778			HEV-SR-50750-R.030
	3/4	.030	1-5/8	4	5	34377	34377W	59891	HEV-R-50750-R.030
	3/4	.030	2-1/4	5	5	34392	34392W	59892	HEV-M-50750-R.030
	3/4	.030	2-3/4	5	5	34397		81880	HEV-L-50750-R.030
	3/4	.030	3-1/4	6	5	34402			HEV-LX-50750-R.030
	3/4	.030	4	6-1/2	5	82563			HEV-X-50750-R.030

*.0005 max TIR

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New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.*	Shank Dia.	Corner Radius	LOC	OAL	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tplus Coated	Tool Description
D1 $\begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	D2 (h6)	R $\begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	L2 $\begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	L1 $\begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$					
3/4	3/4	.060	1	3	5	45362		59893	HEV-S-50750-R.060
	3/4	.060	1-1/4	4	5	81779			HEV-SR-50750-R.060
	3/4	.060	1-5/8	4	5	45377	45377W	59894	HEV-R-50750-R.060
	3/4	.060	2-1/4	5	5	45392	45392W	59895	HEV-M-50750-R.060
	3/4	.060	2-3/4	5	5	45397			HEV-L-50750-R.060
	3/4	.060	3-1/4	6	5	45402			HEV-LX-50750-R.060
	3/4	.060	4	6-1/2	5	82564			HEV-X-50750-R.060
	3/4	.090	1	3	5	45363			HEV-S-50750-R.090
	3/4	.090	1-5/8	4	5	45378	45378W	81881	HEV-R-50750-R.090
	3/4	.090	2-1/4	5	5	45393			HEV-M-50750-R.090
	3/4	.090	2-3/4	5	5	45398			HEV-L-50750-R.090
	3/4	.090	3-1/4	6	5	45403			HEV-LX-50750-R.090
	3/4	.120	1	3	5	45364		59896	HEV-S-50750-R.120
	3/4	.120	1-1/4	4	5	81780			HEV-SR-50750-R.120
	3/4	.120	1-5/8	4	5	45379	45379W	59897	HEV-R-50750-R.120
	3/4	.120	2-1/4	5	5	45394	45394W	59898	HEV-M-50750-R.120
	3/4	.120	2-3/4	5	5	45399			HEV-L-50750-R.120
	3/4	.120	3-1/4	6	5	45404			HEV-LX-50750-R.120
	3/4	.190	1	3	5	45365			HEV-S-50750-R.190
	3/4	.190	1-5/8	4	5	45380	45380W	81882	HEV-R-50750-R.190
	3/4	.190	2-1/4	5	5	45395			HEV-M-50750-R.190
	3/4	.190	2-3/4	5	5	45400			HEV-L-50750-R.190
	3/4	.190	3-1/4	6	5	45405			HEV-LX-50750-R.190
	3/4	.250	1	3	5	45366			HEV-S-50750-R.250
	3/4	.250	1-5/8	4	5	45381	45381W	81883	HEV-R-50750-R.250
	3/4	.250	2-1/4	5	5	45396			HEV-M-50750-R.250
	3/4	.250	2-3/4	5	5	45401			HEV-L-50750-R.250
	3/4	.250	3-1/4	6	5	45406			HEV-LX-50750-R.250
1	1	.030	1-1/4	4	5	34407		59899	HEV-S-51000-R.030
	1	.030	2	4-1/2	5	34422		59900	HEV-R-51000-R.030
	1	.030	2-5/8	5	5	34437		59901	HEV-M-51000-R.030
	1	.030	3-1/4	6	5	34442		81884	HEV-L-51000-R.030
	1	.030	4-1/4	7	5	34447			HEV-X-51000-R.030
	1	.060	1-1/4	4	5	45407		81885	HEV-S-51000-R.060
	1	.060	2	4-1/2	5	45422		81886	HEV-R-51000-R.060
	1	.060	2-5/8	5	5	45437		81887	HEV-M-51000-R.060
	1	.060	3-1/4	6	5	45442			HEV-L-51000-R.060
	1	.060	4-1/4	7	5	45447			HEV-X-51000-R.060
	1	.120	1-1/4	4	5	45409		81888	HEV-S-51000-R.120
	1	.120	2	4-1/2	5	45424		81889	HEV-R-51000-R.120
	1	.120	2-5/8	5	5	45439		81890	HEV-M-51000-R.120
	1	.120	3-1/4	6	5	45444			HEV-L-51000-R.120
	1	.120	4-1/4	7	5	45449			HEV-X-51000-R.120
	1	.190	2	4-1/2	5	45425			HEV-R-51000-R.190
	1	.190	3-1/4	6	5	45445			HEV-L-51000-R.190
	1	.190	4-1/4	7	5	45450			HEV-X-51000-R.190
	1	.250	1-1/4	4	5	45411		81891	HEV-S-51000-R.250
	1	.250	2	4-1/2	5	45426		81892	HEV-R-51000-R.250
1	.250	2-5/8	5	5	45441		81893	HEV-M-51000-R.250	
1	.250	3-1/4	6	5	45446			HEV-L-51000-R.250	
1	.250	4-1/4	7	5	45451			HEV-X-51000-R.250	

*.0005 max TIR

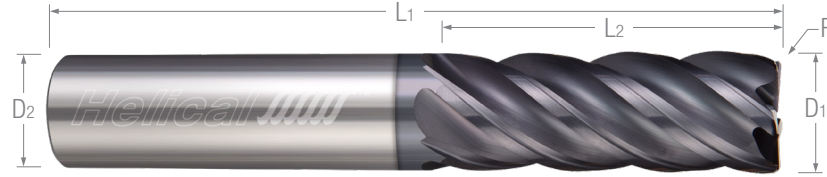
5 FLUTE - CORNER RADIUS - METRIC



MHEV-5
METRIC

Variable Pitch

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA

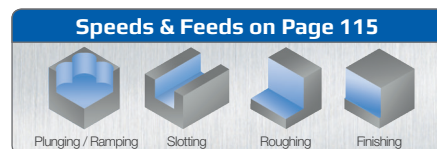


Cutter Dia.* D1 ^{+0.00 mm} / _{-.05 mm}	Shank Dia. D2 (h6)	Corner Radius R ^{+0.05 mm} / _{-.05 mm}	Length of Cut L2 ^{+0.80 mm} / _{-.00 mm}	Overall Length L1 ^{+1.60 mm} / _{-1.60 mm}	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	5	59517	MHEV-015-50600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	5	59535	MHEV-020-50600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	5	59569	MHEV-030-50600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	5	59518	MHEV-015-50600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	5	59536	MHEV-020-50600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	5	59570	MHEV-030-50600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	5	59520	MHEV-015-50800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	5	59538	MHEV-020-50800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	5	59572	MHEV-030-50800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	5	59521	MHEV-015-50800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	5	59539	MHEV-020-50800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	5	59573	MHEV-030-50800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	5	59523	MHEV-015-51000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	5	59541	MHEV-020-51000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	5	59555	MHEV-025-51000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	5	59524	MHEV-015-51000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	5	59542	MHEV-020-51000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	5	59556	MHEV-025-51000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	5	59526	MHEV-015-51200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	5	59544	MHEV-020-51200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	5	59558	MHEV-025-51200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	5	59527	MHEV-015-51200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	5	59545	MHEV-020-51200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	5	59559	MHEV-025-51200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	5	59529	MHEV-015-51600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	5	59547	MHEV-020-51600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	5	59561	MHEV-025-51600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	5	59530	MHEV-015-51600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	5	59548	MHEV-020-51600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	5	59562	MHEV-025-51600-R1.00

* .013 mm max TIR

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5 Flute



MHEV-5
METRIC

5 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)

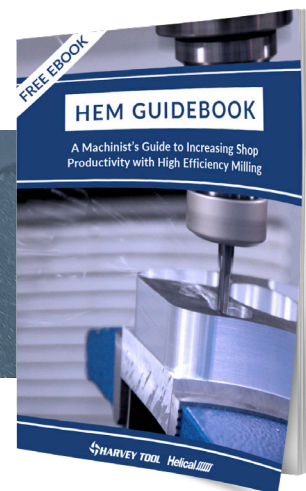
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Cutter Dia.* $D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Dia. $D_2 \text{ (h6)}$	Corner Radius $R \begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Length of Cut $L_2 \begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$	Flutes	Aplus Coated	Tool Description
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	5	59532	MHEV-015-52000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	5	59550	MHEV-020-52000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	5	59564	MHEV-025-52000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	5	59533	MHEV-015-52000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	5	59551	MHEV-020-52000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	5	59565	MHEV-025-52000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	5	59553	MHEV-020-52500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	5	59567	MHEV-025-52500-R1.00

*.013 mm max TIR

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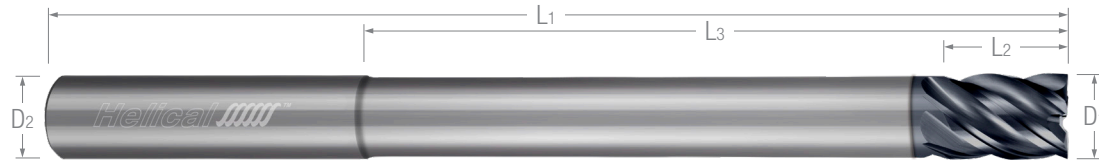
5 FLUTE - SQUARE



HEV-RN-5

Variable Pitch - Reduced Neck

- Excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA




Cutter Dia.* D1 ^{+0.000"} / _{-.002"}	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} / _{-.000"}	Overall Length L1 ^{+0.062"} / _{-.062"}	Reach (LBS) L3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	5/32	2	3/8	.118	5	50017	HEV-RN-S-50125
	1/8	5/32	2	1/2	.118	5	50032	HEV-RN-R-50125
	1/8	5/32	2-1/2	3/4	.118	5	50047	HEV-RN-M-50125
	1/8	5/32	2-1/2	1	.118	5	81781	HEV-RN-L-50125
3/16	3/16	7/32	2	1/2	.178	5	50062	HEV-RN-R-50187
	3/16	7/32	2-1/2	3/4	.178	5	50077	HEV-RN-M-50187
	3/16	7/32	2-1/2	1-1/8	.178	5	50092	HEV-RN-L-50187
1/4	1/4	3/8	4	3/4	.237	5	50107	HEV-RN-S-50250
	1/4	3/8	4	1-1/8	.237	5	50122	HEV-RN-R-50250
	1/4	3/8	4	1-5/8	.237	5	81782	HEV-RN-A-50250
	1/4	3/8	4	2-1/8	.237	5	50137	HEV-RN-M-50250
	1/4	3/8	4	2-1/2	.237	5	81783	HEV-RN-ML-50250
3/8	3/8	1/2	4	1-1/8	.356	5	50152	HEV-RN-S-50375
	3/8	1/2	4	1-5/8	.356	5	81784	HEV-RN-SR-50375
	3/8	1/2	4	2-1/8	.356	5	50167	HEV-RN-R-50375
	3/8	1/2	6	2-1/2	.356	5	81785	HEV-RN-A-50375
	3/8	1/2	6	3-1/8	.356	5	50197	HEV-RN-M-50375
	3/8	1/2	6	4-1/8	.356	5	50212	HEV-RN-L-50375
1/2	1/2	5/8	4	1-1/2	.475	5	50227	HEV-RN-S-50500
	1/2	5/8	4	1-3/4	.475	5	81786	HEV-RN-SR-50500
	1/2	5/8	4	2-1/4	.475	5	50242	HEV-RN-R-50500
	1/2	5/8	5	2-3/4	.475	5	81787	HEV-RN-A-50500
	1/2	5/8	6	3-3/8	.475	5	50272	HEV-RN-M-50500
	1/2	5/8	6	4-1/8	.475	5	50287	HEV-RN-L-50500
5/8	5/8	3/4	4	1-5/8	.593	5	50302	HEV-RN-S-50625
	5/8	3/4	6	2-3/8	.593	5	50317	HEV-RN-R-50625
	5/8	3/4	6	3-3/8	.593	5	50332	HEV-RN-M-50625
	5/8	3/4	6	4-1/8	.593	5	50347	HEV-RN-L-50625

*.0005 max TIR


continued on next page

5 Flute


Speeds & Feeds on Page 115




Plunging/Ramping



Slotting



Roughing



Finishing

HEV-RN-5



5 FLUTE - SQUARE

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D1 $^{+.000}$ $_{-.002}$ "	Shank Dia. D2 (h6)	Length of Cut L2 $^{+.032}$ $_{-.000}$ "	Overall Length L1 $^{+.062}$ $_{-.062}$ "	Reach (LBS) L3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
3/4	3/4	1	4	2	.712	5	50362	HEV-RN-S-50750
	3/4	1	6	2-1/2	.712	5	50377	HEV-RN-R-50750
	3/4	1	6	2-7/8	.712	5	81788	HEV-RN-A-50750
	3/4	1	6	3-3/8	.712	5	50392	HEV-RN-M-50750
	3/4	1	6	4-1/8	.712	5	50407	HEV-RN-L-50750
1	1	1-1/4	6	2-5/8	.950	5	50437	HEV-RN-R-51000
	1	1-1/4	6	3-3/8	.950	5	50452	HEV-RN-M-51000
	1	1-1/4	6	4-1/8	.950	5	50467	HEV-RN-L-51000

*.0005 max TIR

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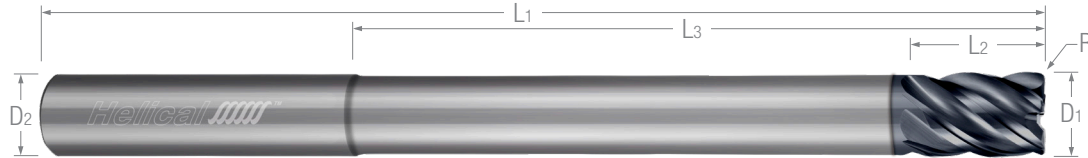
5 FLUTE - CORNER RADIUS



HEV-RN-5

Variable Pitch - Reduced Neck

- Excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA

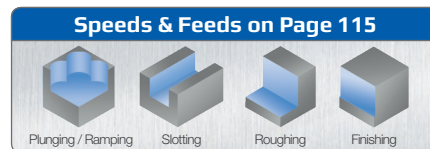


Cutter Dia.* D1 ^{+0.000"} / _{-0.002"}	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} / _{-0.002"}	LOC L2 ^{+0.032"} / _{-0.000"}	OAL L1 ^{+0.062"} / _{-0.062"}	Reach (LBS) L3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	.010	5/32	2	3/8	.118	5	35017	HEV-RN-S-50125-R.010
	1/8	.010	5/32	2	1/2	.118	5	35032	HEV-RN-R-50125-R.010
	1/8	.010	5/32	2-1/2	3/4	.118	5	35047	HEV-RN-M-50125-R.010
	1/8	.010	5/32	2-1/2	1	.118	5	81789	HEV-RN-L-50125-R.010
	1/8	.030	5/32	2	3/8	.118	5	51017	HEV-RN-S-50125-R.030
	1/8	.030	5/32	2	1/2	.118	5	51032	HEV-RN-R-50125-R.030
	1/8	.030	5/32	2-1/2	3/4	.118	5	51047	HEV-RN-M-50125-R.030
3/16	3/16	.010	7/32	2	1/2	.178	5	35062	HEV-RN-R-50187-R.010
	3/16	.010	7/32	2-1/2	3/4	.178	5	35077	HEV-RN-M-50187-R.010
	3/16	.010	7/32	2-1/2	1-1/8	.178	5	35092	HEV-RN-L-50187-R.010
	3/16	.010	7/32	2-1/2	1-5/16	.178	5	81790	HEV-RN-LX-50187-R.010
	3/16	.030	7/32	2	1/2	.178	5	51062	HEV-RN-R-50187-R.030
	3/16	.030	7/32	2-1/2	3/4	.178	5	51077	HEV-RN-M-50187-R.030
	3/16	.030	7/32	2-1/2	1-1/8	.178	5	51092	HEV-RN-L-50187-R.030
1/4	1/4	.020	3/8	4	3/4	.237	5	35107	HEV-RN-S-50250-R.020
	1/4	.020	3/8	4	1-1/8	.237	5	35122	HEV-RN-R-50250-R.020
	1/4	.020	3/8	4	1-5/8	.237	5	81792	HEV-RN-A-50250-R.020
	1/4	.020	3/8	4	2-1/8	.237	5	35137	HEV-RN-M-50250-R.020
	1/4	.020	3/8	4	2-1/2	.237	5	81793	HEV-RN-ML-50250-R.020
	1/4	.030	3/8	4	3/4	.237	5	51107	HEV-RN-S-50250-R.030
	1/4	.030	3/8	4	1-1/8	.237	5	51122	HEV-RN-R-50250-R.030
	1/4	.030	3/8	4	2-1/8	.237	5	51137	HEV-RN-M-50250-R.030
	1/4	.060	3/8	4	3/4	.237	5	51108	HEV-RN-S-50250-R.060
	1/4	.060	3/8	4	1-1/8	.237	5	51123	HEV-RN-R-50250-R.060
1/4	.060	3/8	4	2-1/8	.237	5	51138	HEV-RN-M-50250-R.060	

* .0005 max TIR

continued on next page

5 Flute



HEV-RN-5



5 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (H6)	Corner Radius R ^{+0.002"} -0.002"	LOC L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	Aplus Coated	Tool Description
3/8	3/8	.020	1/2	4	1-1/8	.356	5	35152	HEV-RN-S-50375-R.020
	3/8	.020	1/2	4	1-5/8	.356	5	81794	HEV-RN-SR-50375-R.020
	3/8	.020	1/2	4	2-1/8	.356	5	35167	HEV-RN-R-50375-R.020
	3/8	.020	1/2	6	2-1/2	.356	5	81795	HEV-RN-A-50375-R.020
	3/8	.020	1/2	6	3-1/8	.356	5	35197	HEV-RN-M-50375-R.020
	3/8	.030	1/2	4	1-1/8	.356	5	51152	HEV-RN-S-50375-R.030
	3/8	.030	1/2	4	1-5/8	.356	5	81796	HEV-RN-SR-50375-R.030
	3/8	.030	1/2	4	2-1/8	.356	5	51167	HEV-RN-R-50375-R.030
	3/8	.030	1/2	6	2-1/2	.356	5	81797	HEV-RN-A-50375-R.030
	3/8	.030	1/2	6	3-1/8	.356	5	51197	HEV-RN-M-50375-R.030
	3/8	.030	1/2	6	4-1/8	.356	5	51212	HEV-RN-L-50375-R.030
	3/8	.060	1/2	4	1-1/8	.356	5	51153	HEV-RN-S-50375-R.060
	3/8	.060	1/2	4	2-1/8	.356	5	51168	HEV-RN-R-50375-R.060
	3/8	.060	1/2	6	3-1/8	.356	5	51198	HEV-RN-M-50375-R.060
	3/8	.090	1/2	4	1-1/8	.356	5	51154	HEV-RN-S-50375-R.090
	3/8	.090	1/2	4	2-1/8	.356	5	51169	HEV-RN-R-50375-R.090
3/8	.090	1/2	6	3-1/8	.356	5	51199	HEV-RN-M-50375-R.090	
1/2	1/2	.030	5/8	4	1-1/2	.475	5	35227	HEV-RN-S-50500-R.030
	1/2	.030	5/8	4	1-3/4	.475	5	81798	HEV-RN-SR-50500-R.030
	1/2	.030	5/8	4	2-1/4	.475	5	35242	HEV-RN-R-50500-R.030
	1/2	.030	5/8	5	2-3/4	.475	5	81799	HEV-RN-A-50500-R.030
	1/2	.030	5/8	6	3-3/8	.475	5	35272	HEV-RN-M-50500-R.030
	1/2	.030	5/8	6	4-1/8	.475	5	35287	HEV-RN-L-50500-R.030
	1/2	.060	5/8	4	1-1/2	.475	5	51227	HEV-RN-S-50500-R.060
	1/2	.060	5/8	4	2-1/4	.475	5	51242	HEV-RN-R-50500-R.060
	1/2	.060	5/8	6	3-3/8	.475	5	51272	HEV-RN-M-50500-R.060
	1/2	.090	5/8	4	1-1/2	.475	5	51228	HEV-RN-S-50500-R.090
	1/2	.090	5/8	4	2-1/4	.475	5	51243	HEV-RN-R-50500-R.090
	1/2	.120	5/8	4	1-1/2	.475	5	51229	HEV-RN-S-50500-R.120
	1/2	.120	5/8	4	2-1/4	.475	5	51244	HEV-RN-R-50500-R.120
	1/2	.120	5/8	6	3-3/8	.475	5	51274	HEV-RN-M-50500-R.120
	1/2	.120	5/8	6	4-1/8	.475	5	51289	HEV-RN-L-50500-R.120
	5/8	5/8	.030	3/4	4	1-5/8	.593	5	35302
5/8		.030	3/4	6	2-3/8	.593	5	35317	HEV-RN-R-50625-R.030
5/8		.030	3/4	6	3-3/8	.593	5	35332	HEV-RN-M-50625-R.030
5/8		.030	3/4	6	4-1/8	.593	5	35347	HEV-RN-L-50625-R.030
5/8		.120	3/4	4	1-5/8	.593	5	51304	HEV-RN-S-50625-R.120
5/8		.120	3/4	6	2-3/8	.593	5	51319	HEV-RN-R-50625-R.120

*.0005 max TIR

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5 FLUTE - CORNER RADIUS



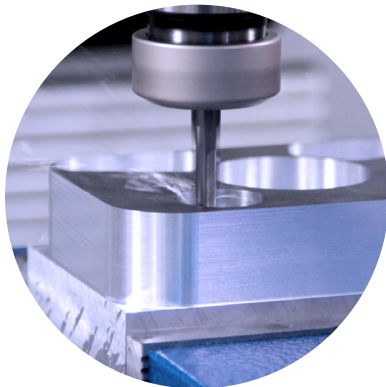
HEV-RN-5

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D1 ^{+0.000*} -0.002*	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002*} -0.002*	LOC L2 ^{+0.032*} -0.000*	OAL L1 ^{+0.062*} -0.062*	Reach (LBS) L3	Neck Dia.	Flutes	Aplus Coated	Tool Description
3/4	3/4	.030	1	4	2	.712	5	35362	HEV-RN-S-50750-R.030
	3/4	.030	1	6	2-1/2	.712	5	35377	HEV-RN-R-50750-R.030
	3/4	.030	1	6	2-7/8	.712	5	81800	HEV-RN-A-50750-R.030
	3/4	.030	1	6	3-3/8	.712	5	35392	HEV-RN-M-50750-R.030
	3/4	.030	1	6	4-1/8	.712	5	35407	HEV-RN-L-50750-R.030
	3/4	.060	1	4	2	.712	5	51362	HEV-RN-S-50750-R.060
	3/4	.060	1	6	2-1/2	.712	5	51377	HEV-RN-R-50750-R.060
	3/4	.060	1	6	3-3/8	.712	5	51392	HEV-RN-M-50750-R.060
	3/4	.060	1	6	4-1/8	.712	5	51407	HEV-RN-L-50750-R.060
	3/4	.090	1	4	2	.712	5	51363	HEV-RN-S-50750-R.090
	3/4	.090	1	6	4-1/8	.712	5	51408	HEV-RN-L-50750-R.090
	3/4	.120	1	4	2	.712	5	51364	HEV-RN-S-50750-R.120
	3/4	.120	1	6	2-1/2	.712	5	51379	HEV-RN-R-50750-R.120
	3/4	.120	1	6	3-3/8	.712	5	51394	HEV-RN-M-50750-R.120
	3/4	.120	1	6	4-1/8	.712	5	51409	HEV-RN-L-50750-R.120
	3/4	.190	1	4	2	.712	5	51365	HEV-RN-S-50750-R.190
	3/4	.190	1	6	4-1/8	.712	5	51410	HEV-RN-L-50750-R.190
	3/4	.250	1	4	2	.712	5	51366	HEV-RN-S-50750-R.250
	3/4	.250	1	6	2-1/2	.712	5	51381	HEV-RN-R-50750-R.250
	3/4	.250	1	6	2-7/8	.712	5	81801	HEV-RN-A-50750-R.250
3/4	.250	1	6	3-3/8	.712	5	51396	HEV-RN-M-50750-R.250	
3/4	.250	1	6	4-1/8	.712	5	51411	HEV-RN-L-50750-R.250	
1	1	.030	1-1/4	4	2-1/4	.950	5	35422	HEV-RN-S-51000-R.030
	1	.030	1-1/4	6	2-5/8	.950	5	35437	HEV-RN-R-51000-R.030
	1	.030	1-1/4	6	3-3/8	.950	5	35452	HEV-RN-M-51000-R.030
	1	.030	1-1/4	6	4-1/8	.950	5	35467	HEV-RN-L-51000-R.030

*.0005 max TIR



Avoiding 4 Major Types of Tool Wear

Excessive tool wear will show inconsistencies and have unwanted effects on your workpiece. Learn how to steer clear of tool wear in our “In the Loupe” blog post [How to Avoid 4 Major Types of Tool Wear](#).

[Read more on helical.blog/intheloupe](http://helical.blog/intheloupe)

HEV-5



SPEEDS & FEEDS

5 Flute - Variable Pitch

HEV-5 / HEV-RN-5

Material Guide		Hardness	SFM	Inches per Tooth (IPT)																							
				1/8			3/16			1/4			3/8			1/2			3/4			1					
				Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin			
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0009	.0015	.0018	.0014	.0021	.0020	.0018	.0029	.0022	.0027	.0043	.0026	.0035	.0056	.0030	.0051	.0080	.0036	.0065	.0102	.0044			
		75 - 98 HRB	445	.0007	.0011	.0015	.0010	.0015	.0017	.0013	.0021	.0019	.0020	.0031	.0022	.0026	.0041	.0026	.0037	.0059	.0031	.0047	.0075	.0037			
		21 - 36 HRC	400	.0004	.0007	.0012	.0007	.0010	.0014	.0009	.0014	.0015	.0013	.0020	.0018	.0017	.0026	.0021	.0024	.0038	.0025	.0031	.0048	.0030			
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0006	.0009	.0014	.0009	.0013	.0016	.0012	.0018	.0018	.0017	.0027	.0021	.0022	.0035	.0024	.0032	.0051	.0029	.0041	.0065	.0035			
		21 - 36 HRC	340	.0004	.0007	.0012	.0007	.0010	.0013	.0009	.0013	.0015	.0013	.0020	.0018	.0017	.0026	.0021	.0024	.0038	.0025	.0030	.0048	.0030			
		36 - 50 HRC	260	.0004	.0006	.0011	.0006	.0009	.0013	.0008	.0012	.0014	.0011	.0017	.0017	.0015	.0023	.0019	.0021	.0033	.0023	.0027	.0042	.0028			
		> 50 HRC	155	.0003	.0005	.0010	.0005	.0007	.0011	.0006	.0009	.0013	.0009	.0014	.0015	.0011	.0018	.0017	.0017	.0026	.0020	.0021	.0033	.0025			
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0006	.0009	.0014	.0009	.0013	.0016	.0012	.0018	.0018	.0017	.0027	.0021	.0022	.0035	.0024	.0032	.0051	.0029	.0041	.0065	.0035			
		21 - 36 HRC	250	.0005	.0007	.0012	.0007	.0011	.0014	.0009	.0015	.0016	.0014	.0022	.0018	.0018	.0028	.0021	.0026	.0040	.0025	.0033	.0051	.0031			
		36 - 50 HRC	145	.0004	.0006	.0011	.0005	.0008	.0012	.0007	.0011	.0014	.0011	.0017	.0016	.0014	.0022	.0019	.0020	.0031	.0023	.0026	.0040	.0027			
		> 50 HRC	85	.0003	.0005	.0010	.0005	.0007	.0011	.0006	.0009	.0013	.0009	.0014	.0015	.0011	.0018	.0017	.0017	.0026	.0020	.0021	.0033	.0025			
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0008	.0012	.0016	.0011	.0018	.0018	.0015	.0024	.0020	.0023	.0035	.0024	.0029	.0046	.0028	.0042	.0066	.0033	.0054	.0085	.0040			
		75 - 98 HRB	255	.0005	.0008	.0013	.0008	.0012	.0015	.0010	.0016	.0017	.0015	.0024	.0019	.0020	.0032	.0023	.0029	.0045	.0027	.0037	.0058	.0033			
		21 - 36 HRC	175	.0005	.0008	.0013	.0007	.0011	.0014	.0009	.0015	.0016	.0014	.0022	.0019	.0018	.0029	.0021	.0026	.0041	.0026	.0033	.0052	.0031			
		36 - 50 HRC	150	.0004	.0007	.0012	.0006	.0010	.0013	.0008	.0013	.0015	.0012	.0019	.0017	.0016	.0026	.0020	.0023	.0037	.0024	.0030	.0046	.0030			
		> 50 HRC	55	.0003	.0004	.0009	.0004	.0006	.0010	.0005	.0008	.0012	.0008	.0012	.0014	.0010	.0016	.0016	.0014	.0022	.0019	.0018	.0029	.0023			
AUSTENITIC & FERRITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0006	.0009	.0014	.0009	.0013	.0016	.0011	.0018	.0018	.0017	.0026	.0020	.0022	.0034	.0024	.0031	.0049	.0028	.0040	.0063	.0034			
		21 - 36 HRC	225	.0005	.0008	.0013	.0008	.0012	.0015	.0010	.0016	.0017	.0015	.0024	.0019	.0020	.0031	.0023	.0028	.0044	.0027	.0036	.0057	.0033			
		36 - 50 HRC	180	.0004	.0007	.0012	.0006	.0009	.0013	.0008	.0013	.0015	.0012	.0019	.0017	.0016	.0025	.0020	.0023	.0036	.0024	.0029	.0045	.0029			
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0006	.0009	.0014	.0009	.0013	.0016	.0012	.0018	.0018	.0017	.0027	.0021	.0023	.0035	.0024	.0032	.0051	.0029	.0041	.0065	.0035			
		21 - 36 HRC	280	.0005	.0008	.0013	.0008	.0012	.0015	.0010	.0016	.0017	.0015	.0024	.0019	.0020	.0031	.0022	.0028	.0044	.0027	.0036	.0056	.0033			
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0004	.0007	.0012	.0006	.0010	.0013	.0009	.0013	.0015	.0013	.0020	.0018	.0017	.0026	.0021	.0024	.0037	.0025	.0030	.0048	.0030			
		36 - 50 HRC	145	.0004	.0006	.0011	.0006	.0009	.0013	.0007	.0012	.0014	.0011	.0017	.0016	.0014	.0023	.0019	.0021	.0032	.0023	.0026	.0041	.0028			
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0010	.0015	.0018	.0014	.0022	.0020	.0019	.0029	.0023	.0028	.0044	.0026	.0036	.0057	.0030	.0052	.0082	.0037	.0066	.0104	.0044			
		21 - 36 HRC	370	.0005	.0008	.0013	.0008	.0012	.0015	.0010	.0016	.0017	.0015	.0024	.0019	.0020	.0031	.0022	.0028	.0045	.0027	.0036	.0057	.0033			
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0006	.0010	.0014	.0009	.0014	.0016	.0012	.0019	.0018	.0018	.0028	.0021	.0023	.0036	.0024	.0033	.0052	.0029	.0042	.0066	.0035			
		21 - 36 HRC	335	.0005	.0008	.0013	.0008	.0012	.0015	.0010	.0016	.0017	.0015	.0024	.0019	.0020	.0031	.0022	.0029	.0045	.0027	.0036	.0057	.0033			
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0006	.0010	.0015	.0009	.0014	.0016	.0012	.0020	.0018	.0018	.0029	.0021	.0024	.0038	.0025	.0034	.0054	.0029	.0044	.0069	.0036			
		21 - 36 HRC	260	.0004	.0007	.0012	.0006	.0010	.0013	.0008	.0013	.0015	.0012	.0019	.0017	.0016	.0025	.0020	.0023	.0036	.0024	.0029	.0046	.0029			
		36 - 50 HRC	135	.0003	.0004	.0009	.0004	.0006	.0010	.0005	.0008	.0012	.0008	.0012	.0014	.0010	.0016	.0016	.0014	.0023	.0019	.0018	.0029	.0023			
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0008	.0013	.0017	.0012	.0018	.0019	.0016	.0025	.0021	.0024	.0037	.0024	.0031	.0049	.0028	.0044	.0070	.0034	.0056	.0089	.0041			
		75 - 98 HRB	250	.0007	.0011	.0015	.0010	.0015	.0017	.0013	.0021	.0019	.0020	.0031	.0022	.0026	.0041	.0026	.0037	.0058	.0031	.0047	.0074	.0037			
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0004	.0006	.0012	.0006	.0009	.0013	.0008	.0013	.0015	.0012	.0019	.0017	.0016	.0025	.0020	.0023	.0035	.0024	.0029	.0045	.0029			
		21 - 36 HRC	75	.0004	.0006	.0012	.0006	.0009	.0013	.0008	.0012	.0015	.0012	.0018	.0017	.0015	.0024	.0020	.0022	.0034	.0023	.0028	.0043	.0028			
		36 - 50 HRC	70	.0003	.0005	.0010	.0005	.0008	.0012	.0007	.0010	.0014	.0010	.0015	.0015	.0013	.0020	.0018	.0019	.0029	.0022	.0023	.0037	.0026			
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0011	.0017	.0019	.0017	.0025	.0022	.0022	.0035	.0025	.0033	.0051	.0028	.0043	.0067	.0033	.0061	.0096	.0039	.0078	.0122	.0048			
		75 - 98 HRB	275	.0009	.0015	.0018	.0014	.0021	.0020	.0018	.0029	.0023	.0027	.0043	.0026	.0036	.0056	.0030	.0051	.0081	.0036	.0065	.0103	.0044			
		21 - 36 HRC	250	.0007	.0011	.0015	.0010	.0016	.0017	.0014	.0022	.0020	.0021	.0032	.0022	.0027	.0042	.0026	.0038	.0060	.0031	.0049	.0077	.0038			
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0006	.0009	.0014	.0008	.0013	.0015	.0011	.0017	.0017	.0016	.0025	.0020	.0021	.0033	.0023	.0030	.0048	.0028	.0039	.0061	.0034			
		36 - 50 HRC	160	.0005	.0008	.0013	.0008	.0012	.0015	.0010	.0016	.0017	.0015	.0023	.0019	.0019	.0030	.0022	.0028	.0043	.0027	.0035	.0055	.0032			
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0005	.0007	.0012	.0007	.0011	.0014	.0009	.0015	.0016	.0014	.0021	.0018	.0018	.0028	.0022	.0026	.0040	.0026	.0032	.0051	.0031			
		21 - 36 HRC	170	.0005	.0007	.0012	.0007	.0010	.0014	.0009	.0014	.0016	.0013	.0021	.0018	.0017	.0027	.0021	.0025	.0039	.0025	.0031	.0050	.0030			
		36 - 50 HRC	65	.0003	.0005	.0010	.0005	.0007	.0011	.0006	.0010	.0013	.0009	.0014	.0015	.0012	.0018	.0017	.0017	.0026	.0021	.0021	.0034	.0025			

Milling Process	Hardness	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	30%-75% Diameter	100% Diameter
	≥ 35 HRC	25%-50% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	15%-30% Diameter
	≥ 35 HRC	Up to Max LOC	10%-20% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.

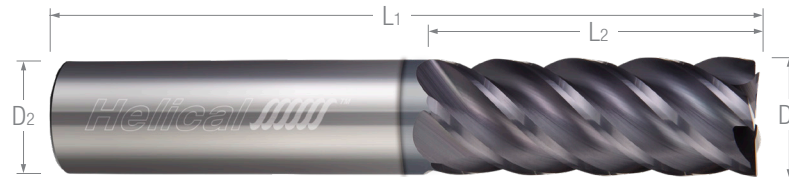
5 FLUTE - SQUARE



HEF-5

Finisher

- Designed with 5 flutes for excellent performance in roughing, High Efficiency Milling (HEM), and finishing (including thin wall applications)
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D1 $\begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter D2 (h6)	Length of Cut L2 $\begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length L1 $\begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	5	05007	HEF-S-50125
	1/8	3/8	2	5	81802	HEF-SR-50125
	1/8	1/2	2-1/2	5	05022	HEF-R-50125
	1/8	5/8	2-1/2	5	81803	HEF-M-50125
	1/8	3/4	2-1/2	5	05037	HEF-L-50125
3/16	3/16	5/16	2	5	05067	HEF-S-50187
	3/16	7/16	2	5	81804	HEF-SR-50187
	3/16	9/16	2-1/2	5	05082	HEF-R-50187
	3/16	3/4	2-1/2	5	05097	HEF-M-50187
	3/16	1	2-1/2	5	81805	HEF-ML-50187
1/4	1/4	3/8	2	5	05127	HEF-S-50250
	1/4	1/2	2-1/2	5	05132	HEF-SR-50250
	1/4	3/4	2-1/2	5	05142	HEF-R-50250
	1/4	1	3	5	05157	HEF-M-50250
	1/4	1-1/4	3	5	05172	HEF-L-50250
	1/4	1-3/4	4	5	05182	HEF-X-50250
5/16	5/16	7/16	2	5	05202	HEF-S-50312
	5/16	13/16	2-1/2	5	05217	HEF-R-50312
	5/16	1	3	5	05232	HEF-M-50312
	5/16	1-1/4	3	5	05247	HEF-L-50312
	5/16	2-1/8	4	5	05262	HEF-X-50312
3/8	3/8	1/2	2	5	05292	HEF-S-50375
	3/8	3/4	2-1/2	5	81806	HEF-SR-50375
	3/8	1	3	5	05307	HEF-R-50375
	3/8	1-1/4	3	5	05322	HEF-M-50375
	3/8	1-1/2	3-1/2	5	05337	HEF-L-50375
	3/8	2	4	5	05352	HEF-LX-50375
	3/8	2-1/2	5	5	05367	HEF-X-50375
7/16	7/16	9/16	2-3/4	5	05397	HEF-S-50437
	7/16	1	2-3/4	5	05412	HEF-R-50437
	7/16	2	4	5	05427	HEF-L-50437

* .0005 max TIR

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Speeds & Feeds on Page 118



HEF-5



5 FLUTE - SQUARE

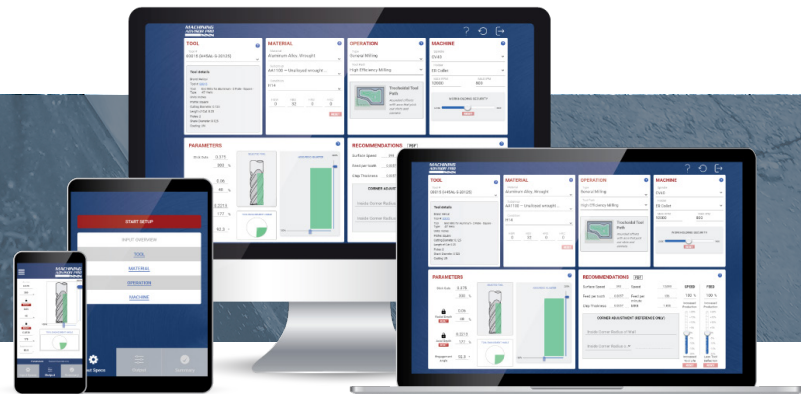
Finisher (cont.)

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Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D2 (h6)$	$L2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
1/2	1/2	5/8	2-1/2	5	05457	HEF-S-50500
	1/2	1	3	5	05472	HEF-SR-50500
	1/2	1-1/4	3	5	05487	HEF-R-50500
	1/2	1-5/8	4	5	05502	HEF-M-50500
	1/2	2	4	5	05517	HEF-L-50500
	1/2	2-1/2	5	5	05532	HEF-LX-50500
	1/2	3-1/8	6	5	05547	HEF-X-50500
5/8	5/8	3/4	3	5	05607	HEF-S-50625
	5/8	1-5/8	3-1/2	5	05622	HEF-R-50625
	5/8	2-1/8	4	5	05637	HEF-M-50625
	5/8	2-1/2	5	5	05652	HEF-L-50625
	5/8	3-1/4	6	5	05662	HEF-LX-50625
	5/8	4	6	5	05667	HEF-X-50625
3/4	3/4	1	3	5	05697	HEF-S-50750
	3/4	1-5/8	4	5	05712	HEF-R-50750
	3/4	2-1/4	5	5	05727	HEF-M-50750
	3/4	2-3/4	5	5	05742	HEF-ML-50750
	3/4	3-1/2	6	5	05757	HEF-L-50750
	3/4	4	6	5	05772	HEF-X-50750
1	1	1-1/4	4	5	05862	HEF-S-51000
	1	2	4-1/2	5	05877	HEF-R-51000
	1	2-5/8	5	5	05892	HEF-M-51000
	1	3-1/4	6	5	05907	HEF-L-51000
	1	4-1/8	7	5	05922	HEF-X-51000

* .0005 max TIR

Access customized running parameters for your specific setup and material at www.machiningadvisorpro.com



SPEEDS & FEEDS

5 Flute - Finisher



HEF-5

HEF-5																	
Material Guide		Hardness	SFM	Inches Per Tooth (IPT)													
				1/8		3/16		1/4		3/8		1/2		3/4		1	
				Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0016	.0019	.0023	.0022	.0031	.0024	.0046	.0028	.0061	.0033	.0087	.0039	.0111	.0047
		75 - 98 HRB	445	.0012	.0016	.0017	.0018	.0023	.0021	.0034	.0024	.0044	.0028	.0064	.0033	.0081	.0040
		21 - 36 HRC	400	.0008	.0013	.0011	.0015	.0015	.0017	.0022	.0019	.0029	.0022	.0041	.0027	.0053	.0033
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0010	.0015	.0015	.0017	.0020	.0019	.0029	.0022	.0038	.0026	.0055	.0031	.0070	.0038
		21 - 36 HRC	340	.0008	.0013	.0011	.0014	.0015	.0017	.0022	.0019	.0029	.0023	.0041	.0027	.0052	.0033
		36 - 50 HRC	260	.0007	.0012	.0009	.0014	.0013	.0016	.0019	.0018	.0025	.0021	.0036	.0025	.0046	.0030
		> 50 HRC	155	.0005	.0011	.0007	.0012	.0010	.0014	.0015	.0016	.0020	.0019	.0028	.0022	.0036	.0027
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0010	.0015	.0015	.0017	.0020	.0019	.0029	.0022	.0038	.0026	.0055	.0031	.0070	.0038
		21 - 36 HRC	250	.0008	.0014	.0012	.0015	.0016	.0017	.0023	.0020	.0031	.0023	.0044	.0028	.0056	.0034
		36 - 50 HRC	145	.0006	.0012	.0009	.0013	.0012	.0015	.0018	.0017	.0024	.0020	.0034	.0024	.0044	.0029
		> 50 HRC	85	.0005	.0011	.0008	.0012	.0010	.0014	.0015	.0016	.0020	.0019	.0028	.0022	.0036	.0027
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0013	.0017	.0019	.0020	.0026	.0022	.0038	.0026	.0050	.0030	.0072	.0035	.0092	.0043
		75 - 98 HRB	255	.0009	.0014	.0013	.0016	.0018	.0018	.0026	.0021	.0035	.0025	.0050	.0029	.0063	.0036
		21 - 36 HRC	175	.0008	.0014	.0012	.0015	.0016	.0018	.0024	.0020	.0031	.0023	.0044	.0028	.0057	.0034
		36 - 50 HRC	150	.0007	.0013	.0011	.0014	.0014	.0017	.0021	.0019	.0028	.0022	.0040	.0026	.0051	.0032
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0010	.0015	.0014	.0017	.0019	.0019	.0029	.0022	.0037	.0026	.0054	.0031	.0069	.0037
		21 - 36 HRC	225	.0009	.0014	.0013	.0016	.0017	.0018	.0026	.0021	.0034	.0024	.0048	.0029	.0062	.0035
		36 - 50 HRC	180	.0007	.0013	.0010	.0014	.0014	.0016	.0021	.0019	.0027	.0022	.0039	.0026	.0050	.0032
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0010	.0015	.0015	.0017	.0020	.0019	.0030	.0022	.0039	.0026	.0055	.0031	.0071	.0038
		21 - 36 HRC	280	.0009	.0014	.0013	.0016	.0017	.0018	.0026	.0021	.0034	.0024	.0048	.0029	.0062	.0035
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0007	.0013	.0011	.0014	.0015	.0017	.0022	.0019	.0028	.0022	.0041	.0026	.0052	.0032
		36 - 50 HRC	145	.0006	.0012	.0009	.0014	.0013	.0016	.0019	.0018	.0024	.0021	.0035	.0025	.0045	.0030
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0016	.0019	.0024	.0022	.0032	.0024	.0048	.0028	.0062	.0033	.0089	.0039	.0114	.0048
		21 - 36 HRC	370	.0009	.0014	.0013	.0016	.0017	.0018	.0026	.0021	.0034	.0025	.0048	.0029	.0062	.0035
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0010	.0015	.0015	.0017	.0020	.0020	.0030	.0023	.0040	.0026	.0057	.0031	.0073	.0038
		21 - 36 HRC	335	.0009	.0014	.0013	.0016	.0017	.0018	.0026	.0021	.0034	.0025	.0049	.0029	.0062	.0035
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0011	.0016	.0016	.0017	.0021	.0020	.0031	.0023	.0041	.0027	.0059	.0032	.0075	.0039
		21 - 36 HRC	260	.0007	.0013	.0010	.0014	.0014	.0016	.0021	.0019	.0027	.0022	.0039	.0026	.0050	.0032
		36 - 50 HRC	135	.0005	.0010	.0007	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0025	.0021	.0032	.0025
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0014	.0018	.0020	.0020	.0027	.0023	.0040	.0026	.0053	.0030	.0076	.0036	.0097	.0044
		75 - 98 HRB	250	.0012	.0016	.0017	.0018	.0023	.0021	.0034	.0024	.0044	.0028	.0063	.0033	.0081	.0040
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0007	.0013	.0010	.0014	.0014	.0016	.0021	.0019	.0027	.0022	.0039	.0026	.0049	.0031
		21 - 36 HRC	75	.0007	.0012	.0010	.0014	.0013	.0016	.0020	.0018	.0026	.0021	.0037	.0025	.0047	.0031
		36 - 50 HRC	70	.0006	.0011	.0008	.0013	.0011	.0015	.0017	.0017	.0022	.0020	.0032	.0023	.0041	.0028
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0019	.0021	.0028	.0024	.0037	.0027	.0056	.0031	.0073	.0036	.0104	.0043	.0134	.0052
		75 - 98 HRB	275	.0016	.0019	.0023	.0022	.0032	.0024	.0047	.0028	.0061	.0033	.0087	.0039	.0112	.0048
		21 - 36 HRC	250	.0012	.0017	.0017	.0019	.0024	.0021	.0035	.0024	.0046	.0028	.0066	.0034	.0084	.0041
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0009	.0015	.0014	.0017	.0019	.0019	.0028	.0022	.0036	.0025	.0052	.0030	.0066	.0037
		36 - 50 HRC	160	.0009	.0014	.0012	.0016	.0017	.0018	.0025	.0021	.0033	.0024	.0047	.0029	.0060	.0035
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0008	.0013	.0012	.0015	.0016	.0017	.0023	.0020	.0031	.0023	.0044	.0028	.0056	.0034
		21 - 36 HRC	170	.0008	.0013	.0011	.0015	.0015	.0017	.0023	.0019	.0029	.0023	.0042	.0027	.0054	.0033
		36 - 50 HRC	65	.0005	.0011	.0008	.0012	.0010	.0014	.0015	.0016	.0020	.0019	.0029	.0023	.0037	.0027

5 Flute

Milling Process	Hardness	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	15%-25% Diameter
	≥ 35 HRC	Up to Max LOC	10%-20% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

HEV-6

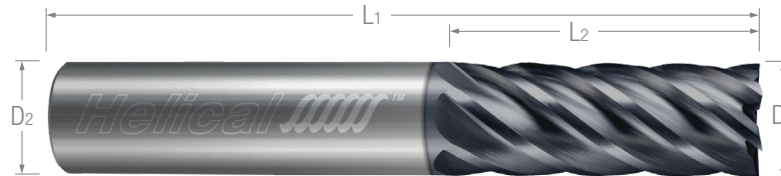


New Items!

6 FLUTE - SQUARE

Variable Pitch

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Tplus</i> Coated	Tool Description
$D_1^{+0.000}_{-0.002}$	D_2 (h6)	$L_2^{+0.032}_{-0.000}$	$L_1^{+0.062}_{-0.062}$				
1/4	1/4	3/8	2	6	59250	59902	HEV-S-60250
	1/4	1/2	2-1/2	6	59251	59903	HEV-SR-60250
	1/4	3/4	2-1/2	6	59252	59904	HEV-R-60250
	1/4	1	3	6	59253	81894	HEV-M-60250
	1/4	1-1/4	3	6	59254		HEV-L-60250
	1/4	1-1/2	3	6	82565		HEV-LX-60250
5/16	5/16	7/16	2	6	59255		HEV-S-60312
	5/16	3/4	2-1/2	6	59256		HEV-R-60312
	5/16	1	3	6	59257		HEV-M-60312
3/8	3/8	1/2	2	6	59258	59905	HEV-S-60375
	3/8	3/4	2-1/2	6	82566		HEV-SR-60375
	3/8	1	3	6	59259	59906	HEV-R-60375
	3/8	1-1/4	3	6	59260	59907	HEV-M-60375
	3/8	1-1/2	3-1/2	6	59261	81895	HEV-L-60375
	3/8	2	4	6	82567		HEV-LX-60375
1/2	1/2	5/8	2-1/2	6	59262	59908	HEV-S-60500
	1/2	1	3	6	59263	59909	HEV-SR-60500
	1/2	1-1/4	3	6	59264	59910	HEV-R-60500
	1/2	1-5/8	4	6	59265	59911	HEV-M-60500
	1/2	2	4	6	59266	81896	HEV-L-60500
	1/2	2-1/2	5	6	82568		HEV-LX-60500
5/8	5/8	3/4	3	6	59267		HEV-S-60625
	5/8	1-1/4	3-1/2	6	59268		HEV-SR-60625
	5/8	1-5/8	3-1/2	6	59269		HEV-R-60625
	5/8	2	4	6	59270		HEV-M-60625
	5/8	2-1/2	5	6	59271		HEV-L-60625
3/4	3/4	1	3	6	59272		HEV-S-60750
	3/4	1-5/8	4	6	59273	81897	HEV-R-60750
	3/4	2-1/4	5	6	59274	81898	HEV-M-60750
	3/4	2-3/4	5	6	59275	81899	HEV-L-60750
	3/4	3-1/4	6	6	59276		HEV-LX-60750
1	1	2	4-1/2	6	59277		HEV-R-61000
	1	2-5/8	5	6	59278		HEV-M-61000
	1	3-1/4	6	6	59279		HEV-L-61000

* .0005 max TIR



6 FLUTE - SQUARE - METRIC

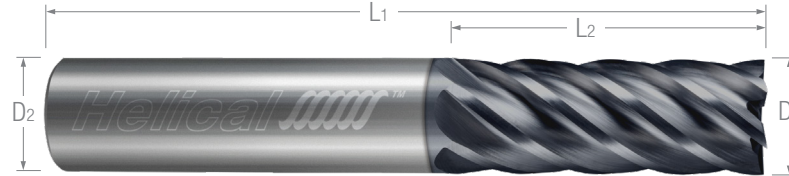


MHEV-6

METRIC

Variable Pitch

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D ₁ ^{+0.00 mm} _{-0.05 mm}	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.80 mm} _{-0.00 mm}	Overall Length L ₁ ^{+1.60 mm} _{-1.60 mm}	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	9.00 mm	63 mm	6	59574	MHEV-015-60600
	6.00 mm	12.00 mm	63 mm	6	59592	MHEV-020-60600
	6.00 mm	18.00 mm	63 mm	6	59626	MHEV-030-60600
8 mm	8.00 mm	12.00 mm	63 mm	6	59577	MHEV-015-60800
	8.00 mm	16.00 mm	63 mm	6	59595	MHEV-020-60800
	8.00 mm	24.00 mm	75 mm	6	59629	MHEV-030-60800
10 mm	10.00 mm	15.00 mm	63 mm	6	59580	MHEV-015-61000
	10.00 mm	20.00 mm	63 mm	6	59598	MHEV-020-61000
	10.00 mm	25.00 mm	75 mm	6	59612	MHEV-025-61000
12 mm	12.00 mm	18.00 mm	75 mm	6	59583	MHEV-015-61200
	12.00 mm	24.00 mm	75 mm	6	59601	MHEV-020-61200
	12.00 mm	30.00 mm	75 mm	6	59615	MHEV-025-61200
16 mm	16.00 mm	24.00 mm	89 mm	6	59586	MHEV-015-61600
	16.00 mm	32.00 mm	89 mm	6	59604	MHEV-020-61600
	16.00 mm	40.00 mm	89 mm	6	59618	MHEV-025-61600
20 mm	20.00 mm	30.00 mm	89 mm	6	59589	MHEV-015-62000
	20.00 mm	40.00 mm	100 mm	6	59607	MHEV-020-62000
	20.00 mm	50.00 mm	125 mm	6	59621	MHEV-025-62000
25 mm	25.00 mm	50.00 mm	125 mm	6	59610	MHEV-020-62500
	25.00 mm	64.00 mm	125 mm	6	59624	MHEV-025-62500

*.013 mm max TIR

Speeds & Feeds on Page 130



HEV-6

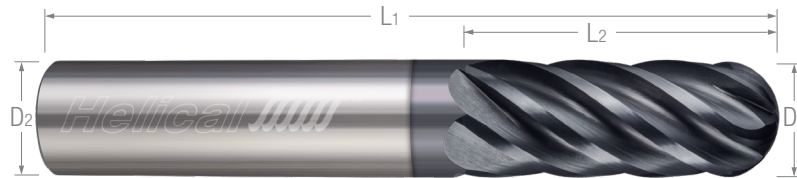


New Items!

6 FLUTE - BALL

Variable Pitch

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Tplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D2 \text{ (h6)}$	$L2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$				
new 1/4	1/4	3/8	2	6	59434	81924	HEV-S-60250-BN
	1/4	1/2	2-1/2	6	59435	81925	HEV-SR-60250-BN
	1/4	3/4	2-1/2	6	59436	81926	HEV-R-60250-BN
	1/4	1	3	6	59437	81927	HEV-M-60250-BN
	1/4	1-1/4	3	6	59438	82595	HEV-L-60250-BN
5/16	5/16	7/16	2	6	59439		HEV-S-60312-BN
	5/16	3/4	2-1/2	6	59440		HEV-R-60312-BN
	5/16	1	3	6	59441		HEV-M-60312-BN
new 3/8	3/8	1/2	2	6	59442	81928	HEV-S-60375-BN
	3/8	3/4	2-1/2	6	82592		HEV-SR-60375-BN
	3/8	1	3	6	59443	81929	HEV-R-60375-BN
	3/8	1-1/4	3	6	59444	81930	HEV-M-60375-BN
	3/8	1-1/2	3-1/2	6	59445	82596	HEV-L-60375-BN
new 1/2	1/2	5/8	2-1/2	6	59446	81931	HEV-S-60500-BN
	1/2	1	3	6	59447	81932	HEV-SR-60500-BN
	1/2	1-1/4	3	6	59448	81933	HEV-R-60500-BN
	1/2	1-5/8	4	6	59449	81934	HEV-M-60500-BN
	1/2	2	4	6	59450	81935	HEV-L-60500-BN
	1/2	2-1/2	5	6	82593		HEV-LX-60500-BN
5/8	5/8	3/4	3	6	59451		HEV-S-60625-BN
	5/8	1-1/4	3-1/2	6	59452		HEV-SR-60625-BN
	5/8	1-5/8	3-1/2	6	59453		HEV-R-60625-BN
3/4	3/4	1	3	6	59454	81936	HEV-S-60750-BN
	3/4	1-5/8	4	6	59455	81937	HEV-R-60750-BN
	3/4	2-1/4	5	6	59456		HEV-M-60750-BN
new 1	1	2	4-1/2	6	59457	81938	HEV-R-61000-BN
	1	2-5/8	5	6	82594		HEV-M-61000-BN

* .0005 max TIR

Speeds & Feeds on Page 130



6 FLUTE - CORNER RADIUS

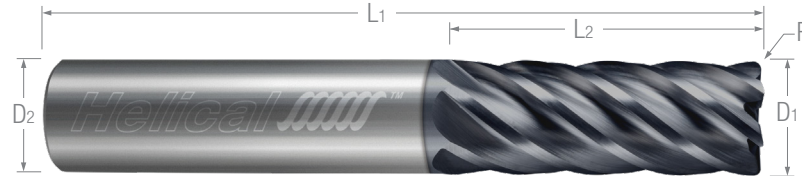
New Items!



HEV-6

Variable Pitch

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Tplus</i> Coated	Tool Description
D1 ^{+0.000"} / _{-.002"}	D2 (h6)	R ^{+0.002"} / _{-.002"}	L2 ^{+0.032"} / _{-.000"}	L1 ^{+0.062"} / _{-.062"}				
1/4	1/4	.020	3/8	2	6	59280	59912	HEV-S-60250-R.020
	1/4	.020	1/2	2-1/2	6	59283	59913	HEV-SR-60250-R.020
	1/4	.020	3/4	2-1/2	6	59286	59914	HEV-R-60250-R.020
	1/4	.020	1	3	6	59289	81900	HEV-M-60250-R.020
	1/4	.020	1-1/4	3	6	59292		HEV-L-60250-R.020
	1/4	.020	1-1/2	3	6	82569		HEV-LX-60250-R.020 new
	1/4	.030	3/8	2	6	59281	59915	HEV-S-60250-R.030
	1/4	.030	1/2	2-1/2	6	59284	59916	HEV-SR-60250-R.030
	1/4	.030	3/4	2-1/2	6	59287	59917	HEV-R-60250-R.030
	1/4	.030	1	3	6	59290	81901	HEV-M-60250-R.030
	1/4	.030	1-1/4	3	6	59293		HEV-L-60250-R.030
	1/4	.060	3/8	2	6	59282	81902	HEV-S-60250-R.060
	1/4	.060	1/2	2-1/2	6	59285	81903	HEV-SR-60250-R.060
	1/4	.060	3/4	2-1/2	6	59288	81904	HEV-R-60250-R.060
	1/4	.060	1	3	6	59291	81905	HEV-M-60250-R.060
	1/4	.060	1-1/4	3	6	59294		HEV-L-60250-R.060
1/4	.060	1-1/2	3	6	82570		HEV-LX-60250-R.060 new	
5/16	5/16	.020	7/16	2	6	59295	82587	HEV-S-60312-R.020 new
	5/16	.020	3/4	2-1/2	6	59298		HEV-R-60312-R.020
	5/16	.020	1	3	6	59301		HEV-M-60312-R.020
	5/16	.030	7/16	2	6	59296	82588	HEV-S-60312-R.030 new
	5/16	.030	3/4	2-1/2	6	59299		HEV-R-60312-R.030
	5/16	.030	1	3	6	59302		HEV-M-60312-R.030
	5/16	.060	7/16	2	6	59297		HEV-S-60312-R.060
	5/16	.060	3/4	2-1/2	6	59300		HEV-R-60312-R.060
	5/16	.060	1	3	6	59303		HEV-M-60312-R.060
3/8	3/8	.020	1/2	2	6	59304	59918	HEV-S-60375-R.020
	3/8	.020	3/4	2-1/2	6	82571		HEV-SR-60375-R.020 new
	3/8	.020	1	3	6	59308	59919	HEV-R-60375-R.020
	3/8	.020	1-1/4	3	6	59312	59920	HEV-M-60375-R.020
	3/8	.020	1-1/2	3-1/2	6	59316		HEV-L-60375-R.020

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 130



HEV-6



New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tplus Coated	Tool Description
	D1 ^{+0.001"} _{-.002"}	D2 (h6)	R ^{+0.002"} _{-.002"}	L2 ^{+0.032"} _{-.000"}	L1 ^{+0.062"} _{-.062"}				
new	3/8	3/8	.030	1/2	2	6	59305	59921	HEV-S-60375-R.030
		3/8	.030	3/4	2-1/2	6	82572		HEV-SR-60375-R.030
		3/8	.030	1	3	6	59309	59922	HEV-R-60375-R.030
		3/8	.030	1-1/4	3	6	59313	59923	HEV-M-60375-R.030
		3/8	.030	1-1/2	3-1/2	6	59317		HEV-L-60375-R.030
		3/8	.030	2	4	6	82573		HEV-LX-60375-R.030
		3/8	.060	1/2	2	6	59306	59924	HEV-S-60375-R.060
		3/8	.060	3/4	2-1/2	6	82574		HEV-SR-60375-R.060
		3/8	.060	1	3	6	59310	59925	HEV-R-60375-R.060
		3/8	.060	1-1/4	3	6	59314	59926	HEV-M-60375-R.060
		3/8	.060	1-1/2	3-1/2	6	59318		HEV-L-60375-R.060
		3/8	.060	2	4	6	82575		HEV-LX-60375-R.060
		3/8	.090	1/2	2	6	59307	81906	HEV-S-60375-R.090
		3/8	.090	3/4	2-1/2	6	82576		HEV-SR-60375-R.090
		3/8	.090	1	3	6	59311	81907	HEV-R-60375-R.090
		3/8	.090	1-1/4	3	6	59315		HEV-M-60375-R.090
3/8	.090	1-1/2	3-1/2	6	59319		HEV-L-60375-R.090		
3/8	.090	2	4	6	82577		HEV-LX-60375-R.090		
new	1/2	1/2	.010	1	3	6	82578		HEV-SR-60500-R.010
		1/2	.010	1-1/4	3	6	82579		HEV-R-60500-R.010
		1/2	.015	1	3	6	82580		HEV-SR-60500-R.015
		1/2	.015	1-1/4	3	6	82581		HEV-R-60500-R.015
		1/2	.020	1	3	6	82582		HEV-SR-60500-R.020
		1/2	.020	1-1/4	3	6	82583		HEV-R-60500-R.020
		1/2	.030	5/8	2-1/2	6	59320	59927	HEV-S-60500-R.030
		1/2	.030	1	3	6	59324	59928	HEV-SR-60500-R.030
		1/2	.030	1-1/4	3	6	59328	59929	HEV-R-60500-R.030
		1/2	.030	1-5/8	4	6	59332	59930	HEV-M-60500-R.030
		1/2	.030	2	4	6	59336	81908	HEV-L-60500-R.030
		1/2	.030	2-1/2	5	6	82584		HEV-LX-60500-R.030
		1/2	.060	5/8	2-1/2	6	59321	59931	HEV-S-60500-R.060
		1/2	.060	1	3	6	59325	59932	HEV-SR-60500-R.060
		1/2	.060	1-1/4	3	6	59329	59933	HEV-R-60500-R.060
		1/2	.060	1-5/8	4	6	59333	59934	HEV-M-60500-R.060
		1/2	.060	2	4	6	59337	81909	HEV-L-60500-R.060
		1/2	.060	2-1/2	5	6	82585		HEV-LX-60500-R.060
		1/2	.090	5/8	2-1/2	6	59322		HEV-S-60500-R.090
		1/2	.090	1	3	6	59326		HEV-SR-60500-R.090
		1/2	.090	1-1/4	3	6	59330	82589	HEV-R-60500-R.090
		1/2	.090	1-5/8	4	6	59334	82590	HEV-M-60500-R.090
		1/2	.090	2	4	6	59338	82591	HEV-L-60500-R.090
		1/2	.090	2-1/2	5	6	82586		HEV-LX-60500-R.090
		1/2	.125	5/8	2-1/2	6	59323	59935	HEV-S-60500-R.125
		1/2	.125	1	3	6	59327	59936	HEV-SR-60500-R.125
		1/2	.125	1-1/4	3	6	59331	59937	HEV-R-60500-R.125
		1/2	.125	1-5/8	4	6	59335	59938	HEV-M-60500-R.125
		1/2	.125	2	4	6	59339	81910	HEV-L-60500-R.125

*.0005 max TIR

continued on next page

6 FLUTE - CORNER RADIUS New Items!

HEV-6

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D1 ^{+0.000} _{-.002} "	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002} _{-.002} "	Length of Cut L2 ^{+0.032} _{-.000} "	Overall Length L1 ^{+0.062} _{-.062} "	Flutes	Aplus Coated	Tplus Coated	Tool Description
5/8	5/8	.030	3/4	3	6	59340		HEV-S-60625-R.030
	5/8	.030	1-1/4	3-1/2	6	59341		HEV-SR-60625-R.030
	5/8	.030	1-5/8	3-1/2	6	59345		HEV-R-60625-R.030
	5/8	.030	2	4	6	59349		HEV-M-60625-R.030
	5/8	.030	2-1/2	5	6	59353		HEV-L-60625-R.030
	5/8	.060	1-1/4	3-1/2	6	59342		HEV-SR-60625-R.060
	5/8	.060	1-5/8	3-1/2	6	59346		HEV-R-60625-R.060
	5/8	.060	2	4	6	59350		HEV-M-60625-R.060
	5/8	.090	1-1/4	3-1/2	6	59343		HEV-SR-60625-R.090
	5/8	.090	1-5/8	3-1/2	6	59347		HEV-R-60625-R.090
	5/8	.090	2	4	6	59351		HEV-M-60625-R.090
	5/8	.125	1-1/4	3-1/2	6	59344		HEV-SR-60625-R.125
5/8	.125	1-5/8	3-1/2	6	59348		HEV-R-60625-R.125	
5/8	.125	2	4	6	59352		HEV-M-60625-R.125	
3/4	3/4	.030	1	3	6	59354		HEV-S-60750-R.030
	3/4	.030	1-5/8	4	6	59360	81911	HEV-R-60750-R.030
	3/4	.030	2-1/4	5	6	59366	81912	HEV-M-60750-R.030
	3/4	.030	2-3/4	5	6	59372	81913	HEV-L-60750-R.030
	3/4	.030	3-1/4	6	6	59378		HEV-LX-60750-R.030
	3/4	.060	1	3	6	59355		HEV-S-60750-R.060
	3/4	.060	1-5/8	4	6	59361	81914	HEV-R-60750-R.060
	3/4	.060	2-1/4	5	6	59367	81915	HEV-M-60750-R.060
3/4	.060	2-3/4	5	6	59373	81916	HEV-L-60750-R.060	
3/4	3/4	.090	1	3	6	59356	81989	HEV-S-60750-R.090
	3/4	.090	1-5/8	4	6	59362	81917	HEV-R-60750-R.090
	3/4	.090	2-1/4	5	6	59368	81918	HEV-M-60750-R.090
	3/4	.090	2-3/4	5	6	59374	81919	HEV-L-60750-R.090
	3/4	.125	1	3	6	59357		HEV-S-60750-R.125
	3/4	.125	1-5/8	4	6	59363		HEV-R-60750-R.125
	3/4	.125	2-1/4	5	6	59369		HEV-M-60750-R.125
	3/4	.125	2-3/4	5	6	59375		HEV-L-60750-R.125
	3/4	.190	1	3	6	59358	81990	HEV-S-60750-R.190
	3/4	.190	1-5/8	4	6	59364		HEV-R-60750-R.190
	3/4	.190	2-1/4	5	6	59370		HEV-M-60750-R.190
	3/4	.190	2-3/4	5	6	59376		HEV-L-60750-R.190
	3/4	.250	1	3	6	59359		HEV-S-60750-R.250
	3/4	.250	1-5/8	4	6	59365		HEV-R-60750-R.250
3/4	.250	2-1/4	5	6	59371		HEV-M-60750-R.250	
3/4	.250	2-3/4	5	6	59377		HEV-L-60750-R.250	
1	1	.030	2	4-1/2	6	59379	81920	HEV-R-61000-R.030
	1	.030	2-5/8	5	6	59383	81921	HEV-M-61000-R.030
	1	.030	3-1/4	6	6	59387		HEV-L-61000-R.030
	1	.060	2	4-1/2	6	59380	81922	HEV-R-61000-R.060
	1	.060	2-5/8	5	6	59384	81923	HEV-M-61000-R.060
	1	.060	3-1/4	6	6	59388		HEV-L-61000-R.060
	1	.125	2	4-1/2	6	59381		HEV-R-61000-R.125
	1	.125	2-5/8	5	6	59385		HEV-M-61000-R.125
	1	.125	3-1/4	6	6	59389		HEV-L-61000-R.125
	1	.250	2	4-1/2	6	59382		HEV-R-61000-R.250
1	.250	2-5/8	5	6	59386		HEV-M-61000-R.250	
1	.250	3-1/4	6	6	59390		HEV-L-61000-R.250	

*.0005 max TIR

MHEV-6

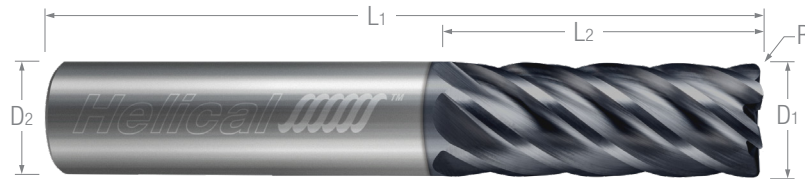
METRIC



6 FLUTE - CORNER RADIUS - METRIC

Variable Pitch

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1^{+.00 \text{ mm} / -.05 \text{ mm}}$	$D_2 \text{ (h6)}$	$R^{+.05 \text{ mm} / -.05 \text{ mm}}$	$L_2^{+.80 \text{ mm} / -.00 \text{ mm}}$	$L_1^{+1.6 \text{ mm} / -1.6 \text{ mm}}$			
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	6	59575	MHEV-015-60600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	6	59593	MHEV-020-60600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	6	59627	MHEV-030-60600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	6	59576	MHEV-015-60600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	6	59594	MHEV-020-60600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	6	59628	MHEV-030-60600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	6	59578	MHEV-015-60800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	6	59596	MHEV-020-60800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	6	59630	MHEV-030-60800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	6	59579	MHEV-015-60800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	6	59597	MHEV-020-60800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	6	59631	MHEV-030-60800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	6	59581	MHEV-015-61000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	6	59599	MHEV-020-61000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	6	59613	MHEV-025-61000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	6	59582	MHEV-015-61000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	6	59600	MHEV-020-61000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	6	59614	MHEV-025-61000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	6	59584	MHEV-015-61200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	6	59602	MHEV-020-61200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	6	59616	MHEV-025-61200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	6	59585	MHEV-015-61200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	6	59603	MHEV-020-61200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	6	59617	MHEV-025-61200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	6	59587	MHEV-015-61600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	6	59605	MHEV-020-61600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	6	59619	MHEV-025-61600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	6	59588	MHEV-015-61600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	6	59606	MHEV-020-61600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	6	59620	MHEV-025-61600-R1.00

* .013 mm max TIR

continued on next page



6 FLUTE - CORNER RADIUS - METRIC



MHEV-6

METRIC

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	$L_1 \begin{smallmatrix} +1.6 \text{ mm} \\ -1.6 \text{ mm} \end{smallmatrix}$			
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	6	59590	MHEV-015-62000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	6	59608	MHEV-020-62000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	6	59622	MHEV-025-62000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	6	59591	MHEV-015-62000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	6	59609	MHEV-020-62000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	6	59623	MHEV-025-62000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	6	59611	MHEV-020-62500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	6	59625	MHEV-025-62500-R1.00

* .013 mm max TIR



5 Questions to Ask Before Selecting an End Mill

Few steps in the machining process are as important as selecting the best tooling option for your job. Before making a decision on an end mill, read our "In the Loupe" blog post and learn **5 Questions to Ask Before Selecting an End Mill** to feel confident that you're choosing right.

[Read more on helical.blog/intheloupe](https://www.helical.com/blog/intheloupe)

HEV-RN-6



New!

6 FLUTE - SQUARE

Variable Pitch - Reduced Neck

- Designed with 6 flutes for excellent results in light profiling, High Efficiency Milling (HEM), and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



	Cutter Dia.* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Dia. D_2 (h6)	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Reach (LBS) L_3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
new	1/4	1/4	3/8	4	3/4	.237	6	82597	HEV-RN-S-60250
new		1/4	3/8	4	1-1/8	.237	6	82598	HEV-RN-R-60250
new		1/4	3/8	4	2-1/8	.237	6	82599	HEV-RN-M-60250
new	3/8	3/8	1/2	4	1-1/8	.356	6	82600	HEV-RN-S-60375
new		3/8	1/2	4	2-1/8	.356	6	82601	HEV-RN-R-60375
new		3/8	1/2	6	3-1/8	.356	6	82602	HEV-RN-M-60375
new	1/2	1/2	5/8	4	1-1/2	.475	6	82603	HEV-RN-S-60500
new		1/2	5/8	4	2-1/4	.475	6	82604	HEV-RN-R-60500
new		1/2	5/8	6	3-3/8	.475	6	82605	HEV-RN-M-60500
new		1/2	5/8	6	4-1/8	.475	6	82606	HEV-RN-L-60500
new	3/4	3/4	1	4	2	.712	6	82607	HEV-RN-S-60750
new		3/4	1	6	2-1/2	.712	6	82608	HEV-RN-R-60750
new		3/4	1	6	3-3/8	.712	6	82609	HEV-RN-M-60750

*.0005 max TIR

Speeds & Feeds on Page 130



Plunging / Ramping



Roughing



Finishing

6 FLUTE - BALL New!



HEV-RN-6

Variable Pitch - Reduced Neck

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D1 ^{+0.001"} / _{-.002"}	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} / _{-.000"}	Overall Length L1 ^{+0.062"} / _{-.062"}	Reach (LBS) L3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	3/8	4	3/4	.237	6	82634	HEV-RN-S-60250-BN	new
	1/4	3/8	4	1-1/8	.237	6	82635	HEV-RN-R-60250-BN	new
	1/4	3/8	4	2-1/8	.237	6	82636	HEV-RN-M-60250-BN	new
3/8	3/8	1/2	4	1-1/8	.356	6	82637	HEV-RN-S-60375-BN	new
	3/8	1/2	4	2-1/8	.356	6	82638	HEV-RN-R-60375-BN	new
	3/8	1/2	6	3-1/8	.356	6	82639	HEV-RN-M-60375-BN	new
1/2	1/2	5/8	4	1-1/2	.475	6	82640	HEV-RN-S-60500-BN	new
	1/2	5/8	4	2-1/4	.475	6	82641	HEV-RN-R-60500-BN	new
	1/2	5/8	6	3-3/8	.475	6	82642	HEV-RN-M-60500-BN	new
	1/2	5/8	6	4-1/8	.475	6	82643	HEV-RN-L-60500-BN	new
3/4	3/4	1	4	2	.712	6	82644	HEV-RN-S-60750-BN	new
	3/4	1	6	2-1/2	.712	6	82645	HEV-RN-R-60750-BN	new
	3/4	1	6	3-3/8	.712	6	82646	HEV-RN-M-60750-BN	new

* .0005 max TIR


Speeds & Feeds on Page 130



Plunging / Ramping



Roughing



Finishing



3D Milling

HEV-RN-6



New!

6 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck

- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.*	Shank Dia.	Corner Radius	LOC	OAL	Reach (LBS)	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	D_2 (h6)	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	L_3				
new 1/8	1/4	.020	3/8	4	3/4	.237	6	82610	HEV-RN-S-60250-R.020
	1/4	.020	3/8	4	1-1/8	.237	6	82611	HEV-RN-R-60250-R.020
	1/4	.020	3/8	4	2-1/8	.237	6	82612	HEV-RN-M-60250-R.020
new 3/8	3/8	.020	1/2	4	1-1/8	.356	6	82613	HEV-RN-S-60375-R.020
	3/8	.020	1/2	4	2-1/8	.356	6	82614	HEV-RN-R-60375-R.020
	3/8	.020	1/2	6	3-1/8	.356	6	82615	HEV-RN-M-60375-R.020
new 1/2	1/2	.030	5/8	4	1-1/2	.475	6	82616	HEV-RN-S-60500-R.030
	1/2	.030	5/8	4	2-1/4	.475	6	82617	HEV-RN-R-60500-R.030
	1/2	.030	5/8	6	3-3/8	.475	6	82618	HEV-RN-M-60500-R.030
	1/2	.030	5/8	6	4-1/8	.475	6	82619	HEV-RN-L-60500-R.030
	1/2	.060	5/8	4	1-1/2	.475	6	82620	HEV-RN-S-60500-R.060
	1/2	.060	5/8	4	2-1/4	.475	6	82621	HEV-RN-R-60500-R.060
	1/2	.060	5/8	6	3-3/8	.475	6	82622	HEV-RN-M-60500-R.060
	1/2	.060	5/8	6	4-1/8	.475	6	82623	HEV-RN-L-60500-R.060
	1/2	.125	5/8	4	1-1/2	.475	6	82624	HEV-RN-S-60500-R.125
	1/2	.125	5/8	4	2-1/4	.475	6	82625	HEV-RN-R-60500-R.125
	1/2	.125	5/8	6	3-3/8	.475	6	82626	HEV-RN-M-60500-R.125
	1/2	.125	5/8	6	4-1/8	.475	6	82627	HEV-RN-L-60500-R.125
new 3/4	3/4	.030	1	4	2	.712	6	82628	HEV-RN-S-60750-R.030
	3/4	.030	1	6	2-1/2	.712	6	82629	HEV-RN-R-60750-R.030
	3/4	.030	1	6	3-3/8	.712	6	82630	HEV-RN-M-60750-R.030
	3/4	.060	1	4	2	.712	6	82631	HEV-RN-S-60750-R.060
	3/4	.060	1	6	2-1/2	.712	6	82632	HEV-RN-R-60750-R.060
	3/4	.060	1	6	3-3/8	.712	6	82633	HEV-RN-M-60750-R.060

*.0005 max TIR

Speeds & Feeds on Page 130



Plunging / Ramping



Roughing



Finishing

SPEEDS & FEEDS

6 Flute - Variable Pitch



HEV-6

HEV-6 / HEV-RN-6

Material Guide		Hardness	SFM														
				1/8		3/16		1/4		3/8		1/2		3/4		1	
				Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0014	.0017	.0020	.0019	.0028	.0022	.0041	.0025	.0054	.0029	.0077	.0034	.0099	.0042
		75 - 98 HRB	445	.0010	.0014	.0015	.0016	.0020	.0018	.0030	.0021	.0039	.0025	.0056	.0029	.0072	.0036
		21 - 36 HRC	400	.0007	.0012	.0010	.0013	.0013	.0015	.0020	.0017	.0025	.0020	.0036	.0024	.0047	.0029
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0009	.0013	.0013	.0015	.0018	.0017	.0026	.0020	.0034	.0023	.0049	.0027	.0063	.0033
		21 - 36 HRC	340	.0007	.0011	.0010	.0013	.0013	.0015	.0019	.0017	.0025	.0020	.0036	.0023	.0047	.0028
		36 - 50 HRC	260	.0006	.0011	.0008	.0012	.0011	.0014	.0017	.0016	.0022	.0018	.0032	.0022	.0041	.0027
		> 50 HRC	155	.0005	.0010	.0007	.0011	.0009	.0012	.0013	.0014	.0017	.0016	.0025	.0019	.0032	.0024
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0009	.0013	.0013	.0015	.0018	.0017	.0026	.0020	.0034	.0023	.0049	.0027	.0063	.0033
		21 - 36 HRC	250	.0007	.0012	.0010	.0013	.0014	.0015	.0021	.0017	.0027	.0020	.0039	.0024	.0050	.0029
		36 - 50 HRC	145	.0006	.0011	.0008	.0012	.0011	.0014	.0016	.0015	.0021	.0018	.0030	.0022	.0039	.0026
		> 50 HRC	85	.0005	.0010	.0007	.0011	.0009	.0012	.0013	.0014	.0017	.0016	.0025	.0019	.0032	.0023
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0012	.0015	.0017	.0017	.0023	.0020	.0034	.0022	.0045	.0026	.0064	.0031	.0082	.0038
		75 - 98 HRB	255	.0008	.0013	.0012	.0014	.0016	.0016	.0023	.0019	.0031	.0022	.0044	.0026	.0056	.0031
		21 - 36 HRC	175	.0007	.0012	.0010	.0013	.0014	.0015	.0021	.0018	.0027	.0020	.0039	.0025	.0051	.0030
		36 - 50 HRC	150	.0006	.0011	.0009	.0013	.0013	.0014	.0019	.0017	.0025	.0019	.0035	.0023	.0045	.0028
		> 50 HRC	55	.0004	.0009	.0006	.0010	.0008	.0011	.0012	.0013	.0015	.0015	.0022	.0018	.0028	.0022
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0009	.0013	.0013	.0015	.0017	.0017	.0025	.0019	.0033	.0023	.0048	.0027	.0061	.0033
		21 - 36 HRC	225	.0008	.0013	.0011	.0014	.0015	.0016	.0023	.0018	.0030	.0021	.0043	.0026	.0055	.0031
		36 - 50 HRC	180	.0006	.0011	.0009	.0012	.0012	.0014	.0018	.0016	.0024	.0019	.0034	.0023	.0044	.0028
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0009	.0013	.0013	.0015	.0018	.0017	.0026	.0020	.0034	.0023	.0049	.0027	.0063	.0033
		21 - 36 HRC	280	.0008	.0013	.0011	.0014	.0015	.0016	.0023	.0018	.0030	.0021	.0043	.0025	.0055	.0031
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0007	.0011	.0010	.0013	.0013	.0015	.0019	.0017	.0025	.0020	.0036	.0023	.0046	.0028
		36 - 50 HRC	145	.0006	.0011	.0008	.0012	.0011	.0014	.0017	.0016	.0022	.0018	.0031	.0022	.0040	.0027
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0014	.0017	.0021	.0019	.0029	.0022	.0042	.0025	.0055	.0029	.0079	.0035	.0102	.0042
		21 - 36 HRC	370	.0008	.0013	.0011	.0014	.0015	.0016	.0023	.0018	.0030	.0021	.0043	.0025	.0055	.0031
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0009	.0014	.0013	.0015	.0018	.0017	.0027	.0020	.0035	.0023	.0050	.0028	.0065	.0034
		21 - 36 HRC	335	.0008	.0013	.0011	.0014	.0016	.0016	.0023	.0018	.0030	.0021	.0043	.0026	.0056	.0031
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0009	.0014	.0014	.0015	.0019	.0018	.0028	.0020	.0036	.0024	.0052	.0028	.0067	.0034
		21 - 36 HRC	260	.0006	.0011	.0009	.0013	.0012	.0014	.0019	.0017	.0024	.0019	.0035	.0023	.0044	.0028
		36 - 50 HRC	135	.0004	.0009	.0006	.0010	.0008	.0011	.0012	.0013	.0015	.0015	.0022	.0018	.0028	.0022
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0012	.0016	.0018	.0018	.0024	.0020	.0036	.0023	.0047	.0027	.0067	.0032	.0086	.0039
		75 - 98 HRB	250	.0010	.0014	.0015	.0016	.0020	.0018	.0030	.0021	.0039	.0025	.0056	.0029	.0072	.0036
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0006	.0011	.0009	.0013	.0012	.0014	.0018	.0016	.0024	.0019	.0034	.0023	.0044	.0028
		21 - 36 HRC	75	.0006	.0011	.0009	.0012	.0012	.0014	.0017	.0016	.0023	.0019	.0033	.0023	.0042	.0027
		36 - 50 HRC	70	.0005	.0010	.0007	.0011	.0010	.0013	.0015	.0015	.0020	.0017	.0028	.0021	.0036	.0025
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0017	.0019	.0024	.0021	.0033	.0024	.0049	.0027	.0065	.0032	.0093	.0038	.0119	.0046
		75 - 98 HRB	275	.0014	.0017	.0021	.0019	.0028	.0022	.0041	.0025	.0054	.0029	.0078	.0035	.0100	.0042
		21 - 36 HRC	250	.0011	.0015	.0015	.0017	.0021	.0019	.0031	.0022	.0041	.0025	.0058	.0030	.0075	.0036
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0009	.0013	.0012	.0015	.0017	.0017	.0024	.0019	.0032	.0022	.0046	.0027	.0059	.0032
		36 - 50 HRC	160	.0008	.0012	.0011	.0014	.0015	.0016	.0022	.0018	.0029	.0021	.0042	.0025	.0054	.0031
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0007	.0012	.0010	.0013	.0014	.0015	.0021	.0018	.0027	.0021	.0039	.0024	.0050	.0030
		21 - 36 HRC	170	.0007	.0012	.0010	.0013	.0014	.0015	.0020	.0017	.0026	.0020	.0038	.0024	.0048	.0029
		36 - 50 HRC	65	.0005	.0010	.0007	.0011	.0009	.0012	.0014	.0014	.0018	.0017	.0025	.0020	.0033	.0024

6 Flute

Milling Process	Hardness	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	15%-25% Diameter
	≥ 35 HRC	Up to Max LOC	10%-20% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.

7 FLUTE - SQUARE

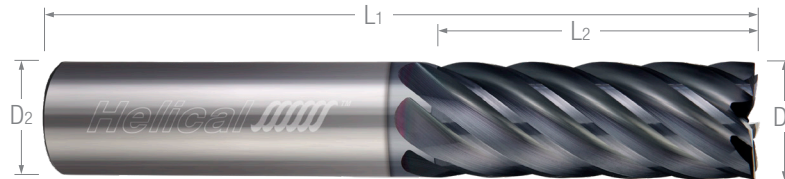
New Items!



HEV-7

Variable Pitch

- Engineered for excellent performance in High Efficiency Milling (HEM)
- 7 flute variable pitch design for reduced harmonics and increased feed rates
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Tplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D2 \text{ (h6)}$	$L2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$				
1/4	1/4	3/8	2	7	26107	59939	HEV-S-70250
	1/4	1/2	2	7	26122	59940	HEV-SR-70250
	1/4	3/4	2-1/2	7	26137	59941	HEV-R-70250
	1/4	1	3	7	26152		HEV-M-70250
	1/4	1-1/4	3	7	82647		HEV-L-70250
5/16	5/16	7/16	2	7	82648		HEV-S-70312
	5/16	3/4	2-1/2	7	82649		HEV-R-70312
	5/16	1	3	7	82650		HEV-M-70312
3/8	3/8	1/2	2	7	26212	59942	HEV-S-70375
	3/8	3/4	2-1/2	7	26227	59943	HEV-SR-70375
	3/8	1	2-1/2	7	26242	59944	HEV-R-70375
	3/8	1-1/2	3-1/2	7	26247	81939	HEV-L-70375
	3/8	2	4	7	82651		HEV-LX-70375
1/2	1/2	5/8	2-1/2	7	26257	59945	HEV-S-70500
	1/2	1	3	7	26272	59946	HEV-SR-70500
	1/2	1-1/4	3	7	26287	59947	HEV-R-70500
	1/2	1-5/8	4	7	26302	59948	HEV-M-70500
	1/2	2	4	7	26307	81940	HEV-L-70500
	1/2	2-1/2	5	7	82652		HEV-LX-70500
	1/2	3-1/8	6	7	82653		HEV-X-70500
5/8	5/8	3/4	3	7	26317	81941	HEV-S-70625
	5/8	1-1/4	3-1/2	7	26322	81942	HEV-SR-70625
	5/8	1-5/8	4	7	26332	81943	HEV-R-70625
	5/8	2-1/8	4	7	26347		HEV-M-70625
3/4	3/4	1	3	7	26362		HEV-S-70750
	3/4	1-1/4	3-1/2	7	26367		HEV-SR-70750
	3/4	1-5/8	4	7	26377	81944	HEV-R-70750
	3/4	2-1/4	5	7	26392	81945	HEV-M-70750
	3/4	3-1/4	6	7	82654		HEV-LX-70750
1	1	1-1/4	4	7	26407		HEV-S-71000
	1	2	5	7	26422	81946	HEV-R-71000
	1	3-1/4	6	7	26442		HEV-L-71000

* .0005 max TIR

Speeds & Feeds on Page 137



Roughing

Finishing

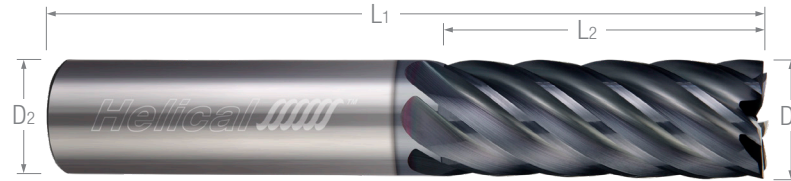
7 FLUTE - SQUARE - METRIC



MHEV-7
METRIC

Variable Pitch

- Engineered for excellent performance in High Efficiency Milling (HEM)
- 7 flute variable pitch design for reduced harmonics and increased feed rates
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$D_2 \text{ (h6)}$	$L_2 \begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	$L_1 \begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$			
6 mm	6.00 mm	9.00 mm	63 mm	7	59632	MHEV-015-70600
	6.00 mm	12.00 mm	63 mm	7	59650	MHEV-020-70600
	6.00 mm	18.00 mm	63 mm	7	59684	MHEV-030-70600
8 mm	8.00 mm	12.00 mm	63 mm	7	59635	MHEV-015-70800
	8.00 mm	16.00 mm	63 mm	7	59653	MHEV-020-70800
	8.00 mm	24.00 mm	75 mm	7	59687	MHEV-030-70800
10 mm	10.00 mm	15.00 mm	63 mm	7	59638	MHEV-015-71000
	10.00 mm	20.00 mm	63 mm	7	59656	MHEV-020-71000
	10.00 mm	25.00 mm	75 mm	7	59670	MHEV-025-71000
12 mm	12.00 mm	18.00 mm	75 mm	7	59641	MHEV-015-71200
	12.00 mm	24.00 mm	75 mm	7	59659	MHEV-020-71200
	12.00 mm	30.00 mm	75 mm	7	59673	MHEV-025-71200
16 mm	16.00 mm	24.00 mm	89 mm	7	59644	MHEV-015-71600
	16.00 mm	32.00 mm	89 mm	7	59662	MHEV-020-71600
	16.00 mm	40.00 mm	89 mm	7	59676	MHEV-025-71600
20 mm	20.00 mm	30.00 mm	89 mm	7	59647	MHEV-015-72000
	20.00 mm	40.00 mm	100 mm	7	59665	MHEV-020-72000
	20.00 mm	50.00 mm	125 mm	7	59679	MHEV-025-72000
25 mm	25.00 mm	50.00 mm	125 mm	7	59668	MHEV-020-72500
	25.00 mm	64.00 mm	125 mm	7	59682	MHEV-025-72500

* .013 mm max TIR

Speeds & Feeds on Page 137



HEV-7



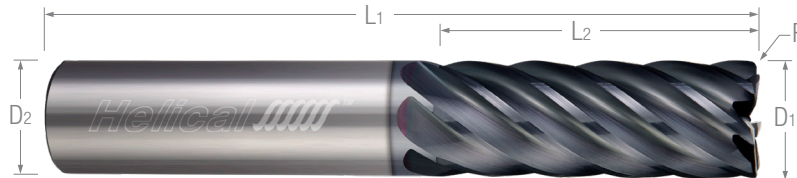
New Items!

7 FLUTE - CORNER RADIUS

Variable Pitch

- Engineered for excellent performance in High Efficiency Milling (HEM)
- 7 flute variable pitch design for reduced harmonics and increased feed rates
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders

- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Tplus</i> Coated	Tool Description
$D_1^{+.000" / -.002"}$	$D_2 (h6)$	$R^{+.002" / -.002"}$	$L_2^{+.032" / -.000"}$	$L_1^{+.062" / -.062"}$				
new 1/4	1/4	.020	3/8	2	7	27107	59949	HEV-S-70250-R.020
	1/4	.020	1/2	2	7	27122	59950	HEV-SR-70250-R.020
	1/4	.020	3/4	2-1/2	7	27137	59951	HEV-R-70250-R.020
	1/4	.020	1	3	7	27152		HEV-M-70250-R.020
	1/4	.020	1-1/4	3	7	82655		HEV-L-70250-R.020
	1/4	.060	3/8	2	7	81807		HEV-S-70250-R.060
	1/4	.060	1/2	2	7	81808		HEV-SR-70250-R.060
	1/4	.060	3/4	2-1/2	7	81809		HEV-R-70250-R.060
new 3/8	3/8	.020	1/2	2	7	27212	59952	HEV-S-70375-R.020
	3/8	.020	3/4	2-1/2	7	27227	59953	HEV-SR-70375-R.020
	3/8	.020	1	2-1/2	7	27242	59954	HEV-R-70375-R.020
	3/8	.020	1-1/2	3-1/2	7	27247	81947	HEV-L-70375-R.020
	3/8	.020	2	4	7	82656		HEV-LX-70375-R.020
	3/8	.060	1/2	2	7	81811		HEV-S-70375-R.060
	3/8	.060	3/4	2-1/2	7	81812		HEV-SR-70375-R.060
	3/8	.060	1	2-1/2	7	81813		HEV-R-70375-R.060
new new 1/2	1/2	.020	5/8	2-1/2	7	81814		HEV-S-70500-R.020
	1/2	.020	1	3	7	81815		HEV-SR-70500-R.020
	1/2	.020	1-1/4	3	7	81816		HEV-R-70500-R.020
	1/2	.020	1-5/8	4	7	81817		HEV-M-70500-R.020
	1/2	.020	2	4	7	81818		HEV-L-70500-R.020
	1/2	.030	5/8	2-1/2	7	27257	59955	HEV-S-70500-R.030
	1/2	.030	1	3	7	27272	59956	HEV-SR-70500-R.030
	1/2	.030	1-1/4	3	7	27287	59957	HEV-R-70500-R.030
	1/2	.030	1-5/8	4	7	27302	59958	HEV-M-70500-R.030
	1/2	.030	2	4	7	27307	81948	HEV-L-70500-R.030
	1/2	.030	2-1/2	5	7	82657		HEV-LX-70500-R.030
	1/2	.030	3-1/8	6	7	82658		HEV-X-70500-R.030
	1/2	.060	5/8	2-1/2	7	81819		HEV-S-70500-R.060
	1/2	.060	1	3	7	81820		HEV-SR-70500-R.060
	1/2	.060	1-1/4	3	7	81821		HEV-R-70500-R.060
	1/2	.060	1-5/8	4	7	81822		HEV-M-70500-R.060
1/2	.060	2	4	7	81823		HEV-L-70500-R.060	

*.0005 max TIR

Speeds & Feeds on Page 137

continued on next page



7 FLUTE - CORNER RADIUS

New Items!



HEV-7

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D_2 (h6)$	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$				
5/8	5/8	.030	3/4	3	7	27317	81949	HEV-S-70625-R.030
	5/8	.030	1-1/4	3-1/2	7	27322	81950	HEV-SR-70625-R.030
	5/8	.030	1-5/8	4	7	27332	81951	HEV-R-70625-R.030
	5/8	.030	2-1/8	4	7	27347		HEV-M-70625-R.030
	5/8	.030	2-1/2	5	7	82659		HEV-L-70625-R.030
	5/8	.060	1-1/4	3-1/2	7	81824		HEV-SR-70625-R.060
	5/8	.060	1-5/8	4	7	81825		HEV-R-70625-R.060
3/4	3/4	.030	1	3	7	27362	81952	HEV-S-70750-R.030
	3/4	.030	1-1/4	3-1/2	7	27367	81953	HEV-SR-70750-R.030
	3/4	.030	1-5/8	4	7	27377	81954	HEV-R-70750-R.030
	3/4	.030	2-1/4	5	7	27392	81955	HEV-M-70750-R.030
	3/4	.030	2-3/4	5	7	82660		HEV-L-70750-R.030
	3/4	.030	3-1/4	6	7	82661		HEV-LX-70750-R.030
	3/4	.060	1	3	7	81826		HEV-S-70750-R.060
	3/4	.060	1-5/8	4	7	81827		HEV-R-70750-R.060
1	1	.030	1-1/4	4	7	27407		HEV-S-71000-R.030
	1	.030	2	5	7	27422		HEV-R-71000-R.030
	1	.030	3-1/4	6	7	27442		HEV-L-71000-R.030

new

new

new

*.0005 max TIR



Why Flute Count Matters

7 Flutes? Is that really necessary? Yes! Our “In the Loupe” blog post **Why Flute Count Matters** walks readers through the importance of the tool’s core diameter size, and why flute count plays a pivotal role in speeds and feeds calculations.

[Read more on helical.blog/intheloupe](http://helical.blog/intheloupe)

MHEV-7

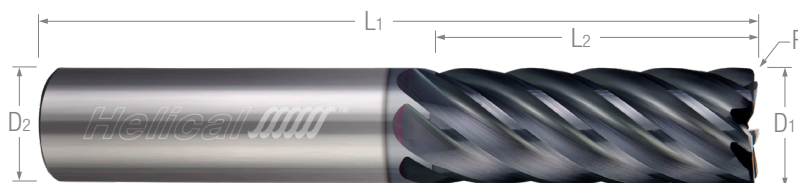
METRIC



7 FLUTE - CORNER RADIUS - METRIC

Variable Pitch

- Engineered for excellent performance in High Efficiency Milling (HEM)
- 7 flute variable pitch design for reduced harmonics and increased feed rates
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D1 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Diameter D2 (h6)	Corner Radius R $\begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Length of Cut L2 $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length L1 $\begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	7	59633	MHEV-015-70600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	7	59651	MHEV-020-70600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	7	59685	MHEV-030-70600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	7	59634	MHEV-015-70600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	7	59652	MHEV-020-70600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	7	59686	MHEV-030-70600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	7	59636	MHEV-015-70800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	7	59654	MHEV-020-70800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	7	59688	MHEV-030-70800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	7	59637	MHEV-015-70800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	7	59655	MHEV-020-70800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	7	59689	MHEV-030-70800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	7	59639	MHEV-015-71000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	7	59657	MHEV-020-71000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	7	59671	MHEV-025-71000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	7	59640	MHEV-015-71000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	7	59658	MHEV-020-71000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	7	59672	MHEV-025-71000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	7	59642	MHEV-015-71200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	7	59660	MHEV-020-71200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	7	59674	MHEV-025-71200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	7	59643	MHEV-015-71200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	7	59661	MHEV-020-71200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	7	59675	MHEV-025-71200-R1.00

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 137



7 FLUTE - CORNER RADIUS - METRIC



MHEV-7
METRIC

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	$L_1 \begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$			
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	7	59645	MHEV-015-71600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	7	59663	MHEV-020-71600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	7	59677	MHEV-025-71600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	7	59646	MHEV-015-71600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	7	59664	MHEV-020-71600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	7	59678	MHEV-025-71600-R1.00
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	7	59648	MHEV-015-72000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	7	59666	MHEV-020-72000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	7	59680	MHEV-025-72000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	7	59649	MHEV-015-72000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	7	59667	MHEV-020-72000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	7	59681	MHEV-025-72000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	7	59669	MHEV-020-72500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	7	59683	MHEV-025-72500-R1.00

* .013 mm max TIR

Access customized running parameters for your specific setup and material at www.machiningadvisorpro.com



HEV-7



SPEEDS & FEEDS

7 Flute - Variable Pitch

HEV-7

Material Guide		Hardness	SFM	1/8		3/16		1/4		3/8		1/2		3/4		1	
				Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin
				CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB 75 - 98 HRB 21 - 36 HRC	455 445 400	.0016 .0011 .0007	.0017 .0015 .0012	.0024 .0017 .0011	.0019 .0016 .0013	.0031 .0023 .0015	.0022 .0019 .0015	.0047 .0034 .0022	.0025 .0022 .0017	.0060 .0044 .0028	.0029 .0025 .0020
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	390 340 260 155	.0010 .0007 .0006 .0005	.0014 .0012 .0011 .0010	.0015 .0011 .0010 .0008	.0015 .0013 .0012 .0011	.0020 .0015 .0013 .0010	.0018 .0015 .0014 .0013	.0030 .0022 .0019 .0015	.0020 .0017 .0016 .0014	.0038 .0028 .0025 .0020	.0023 .0020 .0019 .0017	.0055 .0041 .0036 .0028	.0028 .0024 .0023 .0020	.0070 .0052 .0046 .0036	.0034 .0029 .0027 .0024
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	340 250 145 85	.0010 .0008 .0006 .0005	.0014 .0012 .0011 .0010	.0015 .0012 .0009 .0008	.0015 .0013 .0012 .0011	.0020 .0016 .0012 .0010	.0018 .0016 .0014 .0012	.0030 .0023 .0018 .0015	.0020 .0018 .0016 .0014	.0038 .0030 .0024 .0019	.0023 .0021 .0019 .0016	.0055 .0044 .0034 .0028	.0028 .0025 .0022 .0020	.0070 .0056 .0044 .0036	.0034 .0030 .0027 .0024
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB 75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	290 255 175 150 55	.0013 .0009 .0008 .0007 .0004	.0016 .0013 .0012 .0011 .0009	.0020 .0014 .0012 .0011 .0007	.0018 .0014 .0014 .0013 .0010	.0026 .0018 .0016 .0015 .0009	.0020 .0017 .0016 .0015 .0012	.0039 .0027 .0024 .0021 .0013	.0023 .0019 .0018 .0017 .0013	.0050 .0034 .0031 .0027 .0017	.0027 .0022 .0021 .0020 .0016	.0072 .0050 .0045 .0040 .0025	.0032 .0027 .0025 .0024 .0020	.0092 .0063 .0057 .0051 .0031	.0039 .0032 .0030 .0029 .0022
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	265 225 180	.0010 .0009 .0007	.0013 .0013 .0012	.0015 .0013 .0011	.0015 .0015 .0013	.0019 .0017 .0014	.0017 .0016 .0015	.0029 .0026 .0021	.0020 .0019 .0017	.0037 .0033 .0027	.0023 .0022 .0020	.0054 .0048 .0039	.0028 .0026 .0023	.0069 .0062 .0049	.0034 .0032 .0028
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB 21 - 36 HRC	300 280	.0010 .0009	.0014 .0013	.0015 .0013	.0015 .0014	.0020 .0017	.0018 .0016	.0030 .0026	.0020 .0019	.0038 .0033	.0023 .0022	.0055 .0048	.0028 .0026	.0071 .0061	.0034 .0032
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC 36 - 50 HRC	200 145	.0007 .0006	.0012 .0011	.0011 .0010	.0013 .0012	.0015 .0013	.0015 .0014	.0022 .0019	.0017 .0016	.0028 .0024	.0020 .0019	.0041 .0035	.0024 .0022	.0052 .0045	.0029 .0027
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB 21 - 36 HRC	410 370	.0016 .0009	.0017 .0013	.0024 .0013	.0020 .0014	.0032 .0017	.0022 .0016	.0048 .0026	.0026 .0019	.0062 .0033	.0030 .0022	.0090 .0049	.0036 .0026	.0114 .0062	.0043 .0032
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB 21 - 36 HRC	345 335	.0010 .0009	.0014 .0013	.0015 .0013	.0015 .0014	.0020 .0017	.0018 .0016	.0030 .0026	.0020 .0019	.0039 .0034	.0024 .0022	.0057 .0049	.0028 .0026	.0072 .0062	.0034 .0032
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	310 260 135	.0011 .0007 .0005	.0014 .0011 .0009	.0016 .0011 .0007	.0016 .0013 .0010	.0021 .0014 .0009	.0018 .0015 .0012	.0032 .0021 .0013	.0021 .0017 .0014	.0041 .0027 .0017	.0024 .0020 .0016	.0059 .0039 .0025	.0029 .0023 .0019	.0075 .0050 .0032	.0035 .0028 .0023
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB 75 - 98 HRB	285 250	.0014 .0011	.0016 .0015	.0021 .0017	.0018 .0016	.0027 .0023	.0020 .0019	.0041 .0034	.0023 .0021	.0052 .0044	.0027 .0025	.0076 .0064	.0033 .0030	.0097 .0081	.0040 .0036
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	80 75 70	.0007 .0007 .0006	.0011 .0011 .0010	.0011 .0012 .0008	.0013 .0013 .0011	.0014 .0013 .0011	.0015 .0014 .0013	.0021 .0020 .0017	.0018 .0016 .0015	.0032 .0025 .0022	.0021 .0019 .0018	.0041 .0037 .0032	.0024 .0023 .0021	.0049 .0047 .0040	.0028 .0028 .0026
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB 75 - 98 HRB 21 - 36 HRC	300 275 250	.0019 .0016 .0012	.0019 .0017 .0015	.0028 .0024 .0018	.0021 .0019 .0017	.0037 .0031 .0023	.0024 .0022 .0019	.0056 .0047 .0035	.0028 .0025 .0022	.0072 .0060 .0045	.0032 .0030 .0026	.0105 .0088 .0066	.0039 .0035 .0031	.0134 .0112 .0084	.0047 .0043 .0037
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC 36 - 50 HRC	180 160	.0009 .0009	.0013 .0013	.0014 .0013	.0015 .0014	.0018 .0017	.0017 .0016	.0028 .0025	.0020 .0019	.0036 .0033	.0023 .0022	.0052 .0047	.0027 .0026	.0066 .0060	.0033 .0031
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	210 170 65	.0008 .0008 .0005	.0012 .0012 .0010	.0012 .0012 .0008	.0014 .0013 .0011	.0016 .0015 .0010	.0016 .0015 .0013	.0023 .0023 .0015	.0018 .0017 .0014	.0030 .0029 .0020	.0021 .0020 .0017	.0044 .0042 .0029	.0025 .0024 .0020	.0056 .0054 .0037	.0030 .0030 .0024

Milling Process	Hardness	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	10%-15% Diameter
	≥ 35 HRC	Up to Max LOC	10%-15% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPV values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

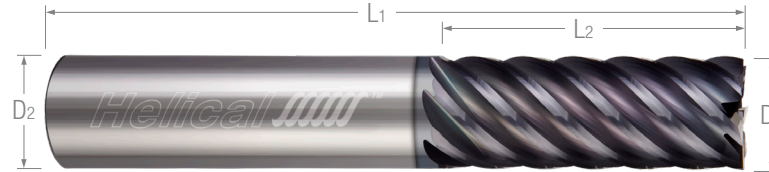
7 FLUTE - SQUARE



HSF-7

Finisher

- Excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D1^{+0.0001}_{-0.002}$	$D2$ (h6)	$L2^{+0.032}_{-0.000}$	$L1^{+0.062}_{-0.062}$			
1/4	1/4	3/8	2	7	24017	HSF-S-70250
	1/4	1/2	2-1/2	7	24022	HSF-SR-70250
	1/4	3/4	2-1/2	7	24032	HSF-R-70250
	1/4	1-1/4	3	7	24047	HSF-L-70250
	1/4	1-3/4	4	7	24062	HSF-X-70250
5/16	5/16	7/16	2	7	24092	HSF-S-70312
	5/16	13/16	2-1/2	7	24107	HSF-R-70312
	5/16	1-3/8	3-1/2	7	24122	HSF-L-70312
	5/16	2	4	7	24137	HSF-X-70312
3/8	3/8	1/2	2	7	24167	HSF-S-70375
	3/8	7/8	2-1/2	7	24182	HSF-SR-70375
	3/8	1	3	7	24187	HSF-R-70375
	3/8	1-1/2	3-1/2	7	24197	HSF-L-70375
	3/8	2-1/2	5	7	24212	HSF-X-70375
7/16	7/16	9/16	2-3/4	7	24242	HSF-S-70437
	7/16	1	2-3/4	7	24257	HSF-R-70437
	7/16	1-1/2	3-1/2	7	24272	HSF-M-70437
1/2	1/2	3/4	2-1/2	7	24317	HSF-S-70500
	1/2	1	2-1/2	7	81829	HSF-SR-70500
	1/2	1-1/4	3	7	24332	HSF-R-70500
	1/2	1-5/8	3-1/2	7	81830	HSF-M-70500
	1/2	2	4	7	24347	HSF-L-70500
	1/2	2-1/2	5	7	81831	HSF-LX-70500
5/8	5/8	3/4	3	7	24392	HSF-S-70625
	5/8	1-5/8	4	7	24407	HSF-R-70625
	5/8	2	4	7	24422	HSF-M-70625
3/4	3/4	1	3	7	24467	HSF-S-70750
	3/4	1-5/8	4	7	24482	HSF-R-70750
	3/4	2-1/4	5	7	24497	HSF-M-70750
	3/4	3-1/4	6	7	24512	HSF-L-70750
1	1	1-1/4	4	7	24542	HSF-S-71000
	1	2	4-1/2	7	24557	HSF-R-71000
	1	3-1/4	6	7	24572	HSF-ML-71000
	1	4-1/8	7	7	24587	HSF-X-71000
1-1/4	1-1/4	2	4-1/2	7	24617	HSF-R-71250
	1-1/4	2-5/8	5-1/2	7	24632	HSF-M-71250
	1-1/4	3-1/4	6	7	24647	HSF-L-71250
	1-1/4	5	7-1/2	7	24662	HSF-X-71250

* .0005 max TIR

Speeds & Feeds on Page 139



HSF-7



SPEEDS & FEEDS

7 Flute - Finisher

Material Guide		Hardness	SFM	Inches Per Tooth (IPT)													
				1/8		3/16		1/4		3/8		1/2		3/4		1	
				Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0017	.0019	.0026	.0022	.0034	.0024	.0052	.0028	.0067	.0033	.0097	.0039	.0123	.0047
		75 - 98 HRB	445	.0013	.0016	.0019	.0018	.0025	.0021	.0038	.0024	.0049	.0028	.0071	.0033	.0090	.0040
		21 - 36 HRC	400	.0008	.0013	.0013	.0015	.0016	.0017	.0024	.0019	.0031	.0022	.0046	.0027	.0058	.0033
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0011	.0015	.0017	.0017	.0022	.0019	.0033	.0022	.0042	.0026	.0061	.0031	.0078	.0038
		21 - 36 HRC	340	.0008	.0013	.0012	.0014	.0016	.0017	.0024	.0019	.0031	.0023	.0046	.0027	.0058	.0033
		36 - 50 HRC	260	.0007	.0012	.0011	.0014	.0014	.0016	.0021	.0018	.0027	.0021	.0040	.0025	.0051	.0030
		> 50 HRC	155	.0006	.0011	.0009	.0012	.0011	.0014	.0014	.0017	.0016	.0022	.0019	.0032	.0022	.0040
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0011	.0015	.0017	.0017	.0022	.0019	.0033	.0022	.0042	.0026	.0061	.0031	.0078	.0038
		21 - 36 HRC	250	.0009	.0014	.0013	.0015	.0017	.0017	.0026	.0020	.0033	.0023	.0049	.0028	.0062	.0034
		36 - 50 HRC	145	.0007	.0012	.0010	.0013	.0014	.0015	.0020	.0017	.0026	.0020	.0038	.0024	.0049	.0029
		> 50 HRC	85	.0006	.0011	.0008	.0012	.0011	.0014	.0014	.0017	.0016	.0022	.0019	.0031	.0022	.0040
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0014	.0017	.0022	.0020	.0028	.0022	.0043	.0026	.0055	.0030	.0080	.0035	.0102	.0043
		75 - 98 HRB	255	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0038	.0025	.0055	.0029	.0070	.0036
		21 - 36 HRC	175	.0009	.0014	.0013	.0015	.0018	.0018	.0026	.0020	.0034	.0023	.0049	.0028	.0063	.0034
		36 - 50 HRC	150	.0008	.0013	.0012	.0014	.0016	.0017	.0024	.0019	.0031	.0022	.0044	.0026	.0056	.0032
		> 50 HRC	55	.0005	.0010	.0007	.0011	.0010	.0013	.0015	.0015	.0019	.0017	.0027	.0021	.0035	.0025
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0011	.0015	.0016	.0017	.0021	.0019	.0032	.0022	.0041	.0026	.0060	.0031	.0076	.0037
		21 - 36 HRC	225	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0024	.0054	.0029	.0069	.0035
		36 - 50 HRC	180	.0008	.0013	.0012	.0014	.0015	.0016	.0023	.0019	.0030	.0022	.0043	.0026	.0055	.0032
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0011	.0015	.0017	.0017	.0022	.0019	.0033	.0022	.0042	.0026	.0061	.0031	.0078	.0038
		21 - 36 HRC	280	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0024	.0053	.0029	.0068	.0035
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0008	.0013	.0012	.0014	.0016	.0017	.0024	.0019	.0031	.0022	.0045	.0026	.0057	.0032
		36 - 50 HRC	145	.0007	.0012	.0011	.0014	.0014	.0016	.0021	.0018	.0027	.0021	.0039	.0025	.0050	.0030
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0018	.0019	.0027	.0022	.0035	.0024	.0053	.0028	.0068	.0033	.0099	.0039	.0127	.0048
		21 - 36 HRC	370	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0025	.0054	.0029	.0069	.0035
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0011	.0015	.0017	.0017	.0022	.0020	.0034	.0023	.0043	.0026	.0063	.0031	.0080	.0038
		21 - 36 HRC	335	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0025	.0054	.0029	.0069	.0035
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0012	.0016	.0018	.0017	.0023	.0020	.0035	.0023	.0045	.0027	.0065	.0032	.0083	.0039
		21 - 36 HRC	260	.0008	.0013	.0012	.0014	.0015	.0016	.0023	.0019	.0030	.0022	.0043	.0026	.0055	.0032
		36 - 50 HRC	135	.0005	.0010	.0008	.0011	.0010	.0013	.0015	.0015	.0019	.0017	.0028	.0021	.0035	.0025
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0015	.0018	.0023	.0020	.0030	.0023	.0045	.0026	.0058	.0030	.0084	.0036	.0107	.0044
		75 - 98 HRB	250	.0013	.0016	.0019	.0018	.0025	.0021	.0038	.0024	.0048	.0028	.0071	.0033	.0090	.0040
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0008	.0013	.0012	.0014	.0015	.0016	.0023	.0019	.0029	.0022	.0043	.0026	.0055	.0031
		21 - 36 HRC	75	.0007	.0012	.0011	.0014	.0015	.0016	.0022	.0018	.0028	.0021	.0041	.0025	.0052	.0031
		36 - 50 HRC	70	.0006	.0011	.0009	.0013	.0013	.0015	.0019	.0017	.0024	.0020	.0035	.0023	.0045	.0028
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0021	.0021	.0032	.0024	.0041	.0027	.0062	.0031	.0080	.0036	.0116	.0043	.0148	.0052
		75 - 98 HRB	275	.0018	.0019	.0027	.0022	.0035	.0024	.0052	.0028	.0067	.0033	.0097	.0039	.0124	.0048
		21 - 36 HRC	250	.0013	.0017	.0020	.0019	.0026	.0021	.0039	.0024	.0050	.0028	.0073	.0034	.0093	.0041
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0010	.0015	.0016	.0017	.0020	.0019	.0031	.0022	.0040	.0025	.0058	.0030	.0073	.0037
		36 - 50 HRC	160	.0010	.0014	.0014	.0016	.0019	.0018	.0028	.0021	.0036	.0024	.0053	.0029	.0067	.0035
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0009	.0013	.0013	.0015	.0017	.0017	.0026	.0020	.0033	.0023	.0049	.0028	.0062	.0034
		21 - 36 HRC	170	.0009	.0013	.0013	.0015	.0017	.0017	.0025	.0019	.0033	.0023	.0047	.0027	.0060	.0033
		36 - 50 HRC	65	.0006	.0011	.0009	.0012	.0011	.0014	.0017	.0016	.0022	.0019	.0032	.0023	.0041	.0027

Milling Process	Hardness	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	10%-15% Diameter
	≥ 35 HRC	Up to Max LOC	10%-15% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

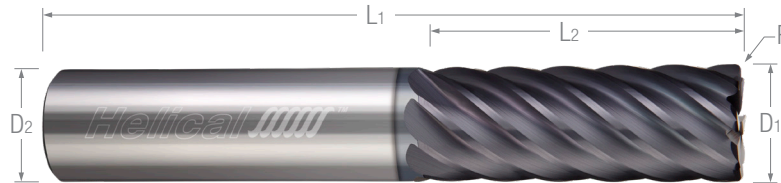
MULTI-FLUTE - CORNER RADIUS



HXF

Finisher

- Designed with high flute count for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Tplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D2 \text{ (h6)}$	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$				
1/4	1/4	.020	3/8	2	7	36016	59959	HXF-S-070250-R.020
	1/4	.020	1/2	2	7	81832		HXF-SR-070250-R.020
	1/4	.020	3/4	2-1/2	7	36031	59960	HXF-R-070250-R.020
3/8	3/8	.020	1/2	2	7	36046	59961	HXF-S-070375-R.020
	3/8	.020	3/4	2-1/2	7	81833		HXF-SR-070375-R.020
	3/8	.020	1	3	7	36061	59962	HXF-R-070375-R.020
	3/8	.020	1-1/4	3	7	81834		HXF-M-070375-R.020
1/2	1/2	.030	5/8	2-1/2	8	36076	59963	HXF-S-080500-R.030
	1/2	.030	1	3	8	36091	59964	HXF-SR-080500-R.030
	1/2	.030	1-1/4	3	8	36106	59965	HXF-R-080500-R.030
	1/2	.030	1-5/8	3-1/2	8	81835		HXF-M-080500-R.030
	1/2	.030	2	3-1/2	8	81836		HXF-L-080500-R.030
5/8	5/8	.060	3/4	3	10	36121		HXF-S-100625-R.060
	5/8	.060	1-5/8	3-1/2	10	36136		HXF-R-100625-R.060
3/4	3/4	.060	1	3	12	36151	59966	HXF-S-120750-R.060
	3/4	.060	1-5/8	4	12	36166	59967	HXF-R-120750-R.060
	3/4	.060	2	4	12	81837		HXF-M-120750-R.060
1	1	.060	1-1/4	4	14	36181		HXF-S-141000-R.060

* .0005 max TIR

Speeds & Feeds on Page 141



Roughing

Finishing

HXF



SPEEDS & FEEDS

Multi-Flute - Finisher

Material Guide		Hardness	SFM	Inches Per Tooth (IPT)													
				1/8		3/16		1/4		3/8		1/2		3/4		1	
				Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0017	.0018	.0026	.0020	.0034	.0022	.0051	.0026	.0066	.0030	.0097	.0036	.0123	.0044
		75 - 98 HRB	445	.0012	.0015	.0019	.0017	.0025	.0019	.0038	.0022	.0048	.0026	.0071	.0031	.0090	.0037
		21 - 36 HRC	400	.0008	.0012	.0012	.0014	.0016	.0015	.0024	.0018	.0031	.0021	.0046	.0025	.0058	.0030
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0011	.0014	.0017	.0016	.0021	.0018	.0033	.0021	.0041	.0024	.0061	.0029	.0078	.0035
		21 - 36 HRC	340	.0008	.0012	.0012	.0013	.0016	.0015	.0024	.0018	.0031	.0021	.0045	.0025	.0058	.0030
		36 - 50 HRC	260	.0007	.0011	.0011	.0013	.0014	.0014	.0021	.0017	.0027	.0019	.0040	.0023	.0050	.0028
		> 50 HRC	155	.0006	.0010	.0009	.0011	.0011	.0013	.0017	.0015	.0021	.0017	.0031	.0020	.0040	.0025
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0011	.0014	.0017	.0016	.0021	.0018	.0033	.0021	.0041	.0024	.0061	.0029	.0078	.0035
		21 - 36 HRC	250	.0009	.0012	.0013	.0014	.0017	.0016	.0026	.0018	.0033	.0021	.0049	.0025	.0062	.0031
		36 - 50 HRC	145	.0007	.0011	.0010	.0012	.0013	.0014	.0020	.0016	.0026	.0019	.0038	.0023	.0048	.0027
		> 50 HRC	85	.0006	.0010	.0008	.0011	.0011	.0013	.0017	.0015	.0021	.0017	.0031	.0020	.0039	.0025
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0014	.0016	.0022	.0018	.0028	.0020	.0043	.0024	.0054	.0028	.0080	.0033	.0102	.0040
		75 - 98 HRB	255	.0010	.0013	.0015	.0015	.0019	.0017	.0029	.0019	.0037	.0023	.0055	.0027	.0070	.0033
		21 - 36 HRC	175	.0009	.0013	.0013	.0014	.0017	.0016	.0026	.0019	.0034	.0021	.0049	.0026	.0063	.0031
		36 - 50 HRC	150	.0008	.0012	.0012	.0013	.0015	.0015	.0023	.0017	.0030	.0020	.0044	.0024	.0056	.0030
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-TMO, 316, 316L, 321, 347	75 - 98 HRB	265	.0011	.0014	.0016	.0016	.0021	.0018	.0032	.0020	.0040	.0024	.0060	.0028	.0076	.0034
		21 - 36 HRC	225	.0010	.0013	.0015	.0015	.0019	.0017	.0029	.0019	.0036	.0023	.0054	.0027	.0068	.0033
		36 - 50 HRC	180	.0008	.0012	.0012	.0013	.0015	.0015	.0023	.0017	.0029	.0020	.0043	.0024	.0055	.0029
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0011	.0014	.0017	.0016	.0021	.0018	.0033	.0021	.0042	.0024	.0061	.0029	.0078	.0035
		21 - 36 HRC	280	.0010	.0013	.0014	.0015	.0019	.0017	.0029	.0019	.0036	.0022	.0053	.0027	.0068	.0033
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0008	.0012	.0012	.0013	.0016	.0015	.0024	.0018	.0031	.0021	.0045	.0025	.0057	.0030
		36 - 50 HRC	145	.0007	.0011	.0011	.0013	.0014	.0014	.0021	.0016	.0027	.0019	.0039	.0023	.0049	.0028
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0018	.0018	.0027	.0020	.0035	.0023	.0053	.0026	.0067	.0030	.0099	.0037	.0126	.0044
		21 - 36 HRC	370	.0009	.0013	.0015	.0015	.0019	.0017	.0029	.0019	.0037	.0022	.0054	.0027	.0068	.0033
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0011	.0014	.0017	.0016	.0022	.0018	.0034	.0021	.0043	.0024	.0063	.0029	.0080	.0035
		21 - 36 HRC	335	.0010	.0013	.0015	.0015	.0019	.0017	.0029	.0019	.0037	.0022	.0054	.0027	.0069	.0033
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0012	.0015	.0018	.0016	.0023	.0018	.0035	.0021	.0044	.0025	.0065	.0029	.0083	.0036
		21 - 36 HRC	260	.0008	.0012	.0012	.0013	.0015	.0015	.0023	.0017	.0029	.0020	.0043	.0024	.0055	.0029
		36 - 50 HRC	135	.0005	.0009	.0008	.0010	.0010	.0012	.0015	.0014	.0019	.0016	.0027	.0019	.0035	.0023
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0015	.0017	.0023	.0019	.0029	.0021	.0045	.0024	.0057	.0028	.0084	.0034	.0107	.0041
		75 - 98 HRB	250	.0013	.0015	.0019	.0017	.0025	.0019	.0037	.0022	.0048	.0026	.0070	.0031	.0089	.0037
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0008	.0012	.0012	.0013	.0015	.0015	.0023	.0017	.0029	.0020	.0043	.0024	.0054	.0029
		21 - 36 HRC	75	.0007	.0012	.0011	.0013	.0014	.0015	.0022	.0017	.0028	.0020	.0041	.0023	.0052	.0028
		36 - 50 HRC	70	.0006	.0010	.0010	.0012	.0012	.0014	.0019	.0015	.0024	.0018	.0035	.0022	.0044	.0026
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0020	.0019	.0031	.0022	.0041	.0025	.0062	.0028	.0079	.0033	.0116	.0039	.0147	.0048
		75 - 98 HRB	275	.0017	.0018	.0026	.0020	.0034	.0023	.0052	.0026	.0066	.0030	.0097	.0036	.0123	.0044
		21 - 36 HRC	250	.0013	.0015	.0020	.0017	.0025	.0020	.0039	.0022	.0050	.0026	.0073	.0031	.0093	.0038
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0010	.0014	.0016	.0015	.0020	.0017	.0031	.0020	.0039	.0023	.0057	.0028	.0073	.0034
		36 - 50 HRC	160	.0009	.0013	.0014	.0015	.0018	.0017	.0028	.0019	.0036	.0022	.0052	.0027	.0067	.0032
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0009	.0012	.0013	.0014	.0017	.0016	.0026	.0018	.0033	.0022	.0049	.0026	.0062	.0031
		21 - 36 HRC	170	.0008	.0012	.0013	.0014	.0017	.0016	.0025	.0018	.0032	.0021	.0047	.0025	.0060	.0030
		36 - 50 HRC	65	.0006	.0010	.0009	.0011	.0011	.0013	.0017	.0015	.0022	.0017	.0032	.0021	.0040	.0025

Milling Process	Hardness	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	8%-10% Diameter
	≥ 35 HRC	Up to Max LOC	8%-10% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

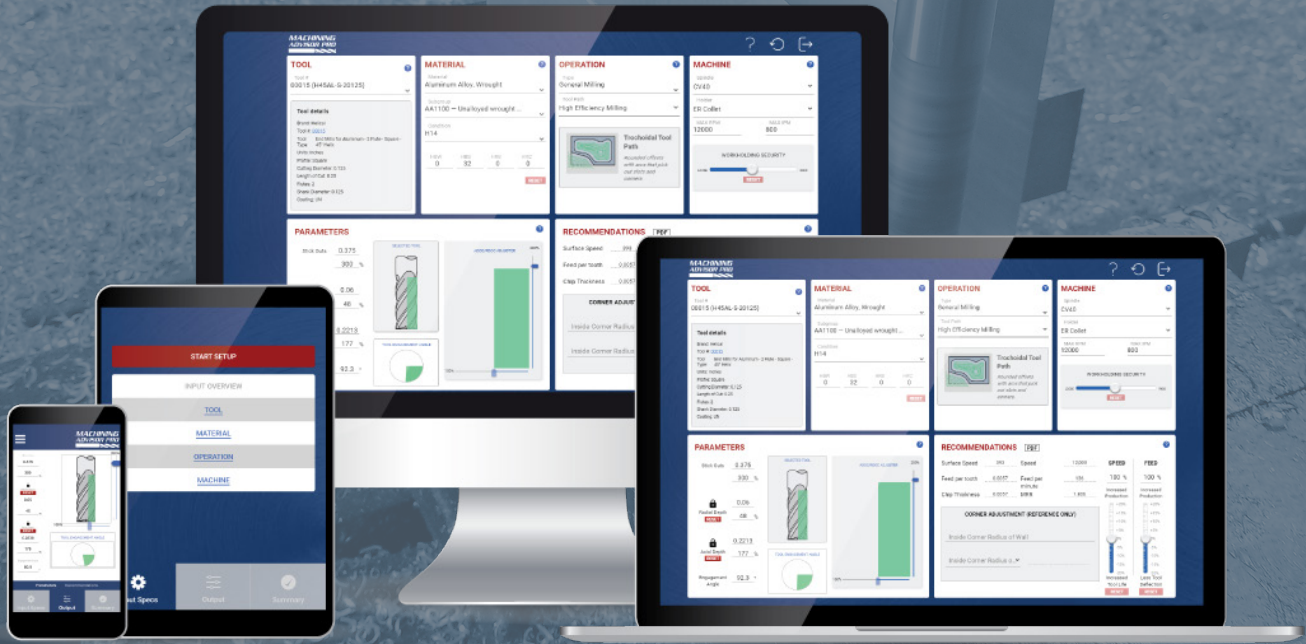
NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

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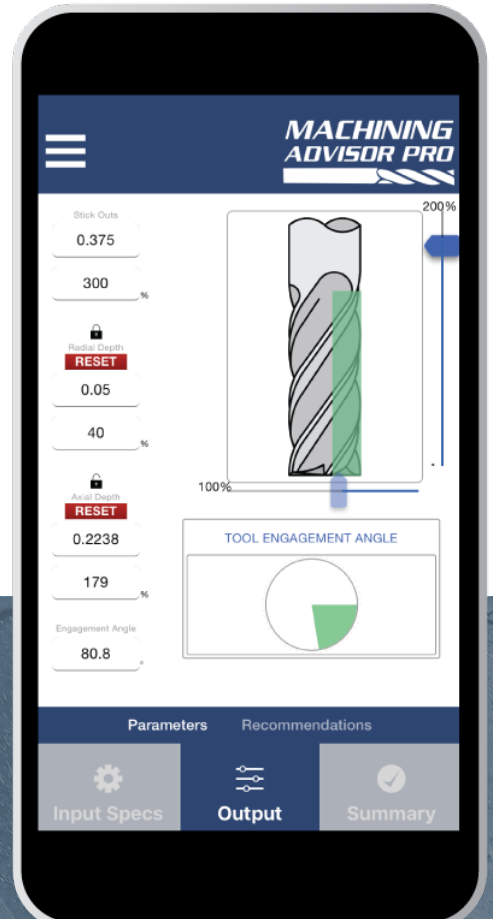
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END MILLS FOR TITANIUM

High Efficiency Milling (HEM)

The HVTI-6 is designed and optimized specifically for use in High Efficiency Milling operations in Titanium alloys. Extensive testing in Ti 6-4 has proven its excellence in extending tool life and elevating part quality. Specifically engineered geometry makes this tool an unbeatable workhorse for HEM in Titanium.

6 FLUTE

PG

new 6 Flute Corner Radius Variable Pitch - For High Efficiency Milling 144

For additional applications and operations in Titanium, please see our End Mills for Steels, High Temp Alloys, & Titanium section on page 59.

Helical's new HVTI-6 is specifically engineered for use in HEM toolpaths in titanium, but did you know that tooling found in this catalog's End Mills for Steels section also performs excellently in titanium? Optimized for steels, high-temp alloys, and titanium, our fully stocked offering of End Mills for Steels includes 3 flute end mills, multi-flute finishers, and everything in between. For years, our customers have relied on these tools to tackle titanium with strength, precision, and durability.



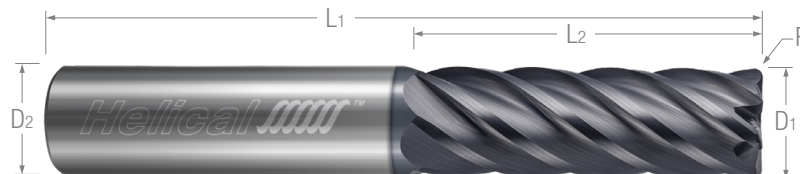
6 FLUTE - CORNER RADIUS New!



HVTI-6

Variable Pitch - For High Efficiency Milling

- Engineered for optimal performance in High Efficiency Milling (HEM)
- Optimized design for Titanium 6Al4V and other titanium alloys
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Not for use in traditional slotting and roughing toolpaths
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA




Cutter Diameter* D1 ^{+0.000"} / _{-.002"}	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} / _{-.002"}	Length of Cut L2 ^{+0.032"} / _{-.000"}	Overall Length L1 ^{+0.062"} / _{-.062"}	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	.010	1/2	2-1/2	6	82059	HVTI-020-60250-R.010	new
	1/4	.010	3/4	2-1/2	6	82060	HVTI-030-60250-R.010	new
	1/4	.010	1	3	6	82061	HVTI-040-60250-R.010	new
	1/4	.030	1/2	2-1/2	6	82062	HVTI-020-60250-R.030	new
	1/4	.030	3/4	2-1/2	6	82063	HVTI-030-60250-R.030	new
	1/4	.030	1	3	6	82064	HVTI-040-60250-R.030	new
3/8	3/8	.010	1	3	6	82065	HVTI-026-60375-R.010	new
	3/8	.010	1-1/4	3	6	82066	HVTI-033-60375-R.010	new
	3/8	.010	1-1/2	3-1/2	6	82067	HVTI-040-60375-R.010	new
	3/8	.030	1	3	6	82068	HVTI-026-60375-R.030	new
	3/8	.030	1-1/4	3	6	82069	HVTI-033-60375-R.030	new
	3/8	.030	1-1/2	3-1/2	6	82070	HVTI-040-60375-R.030	new
1/2	1/2	.010	1	3	6	82071	HVTI-020-60500-R.010	new
	1/2	.010	1-1/4	3	6	82072	HVTI-025-60500-R.010	new
	1/2	.010	1-5/8	4	6	82073	HVTI-032-60500-R.010	new
	1/2	.010	2	4	6	82074	HVTI-040-60500-R.010	new
	1/2	.030	1	3	6	82075	HVTI-020-60500-R.030	new
	1/2	.030	1-1/4	3	6	82076	HVTI-025-60500-R.030	new
	1/2	.030	1-5/8	4	6	82077	HVTI-032-60500-R.030	new
	1/2	.030	2	4	6	82078	HVTI-040-60500-R.030	new
	1/2	.060	1	3	6	82079	HVTI-020-60500-R.060	new
	1/2	.060	1-1/4	3	6	82080	HVTI-025-60500-R.060	new
	1/2	.060	1-5/8	4	6	82081	HVTI-032-60500-R.060	new
	1/2	.060	2	4	6	82082	HVTI-040-60500-R.060	new
	1/2	.120	1	3	6	82083	HVTI-020-60500-R.120	new
	1/2	.120	1-1/4	3	6	82084	HVTI-025-60500-R.120	new
1/2	.120	1-5/8	4	6	82085	HVTI-032-60500-R.120	new	
1/2	.120	2	4	6	82086	HVTI-040-60500-R.120	new	


* .0005 max TIR

continued on next page


Speeds & Feeds on Page 146



Plunging / Ramping



HEM Roughing



Finishing

HVTI-6



New!

6 FLUTE - CORNER RADIUS

Variable Pitch - For High Efficiency Milling (cont.)

6 Flute

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
	$D1^{+0.000}_{-0.002}$ "	$D2 (h6)$	$R^{+0.002}_{-0.002}$ "	$L2^{+0.032}_{-0.000}$ "	$L1^{+0.062}_{-0.062}$ "			
new	3/4	3/4	.030	1-5/8	4	6	82087	HVTI-021-60750-R.030
new		3/4	.030	2-1/4	5	6	82088	HVTI-030-60750-R.030
new		3/4	.060	1-5/8	4	6	82089	HVTI-021-60750-R.060
new		3/4	.060	2-1/4	5	6	82090	HVTI-030-60750-R.060
new		3/4	.090	1-5/8	4	6	82091	HVTI-021-60750-R.090
new		3/4	.090	2-1/4	5	6	82092	HVTI-030-60750-R.090
new		3/4	.120	1-5/8	4	6	82093	HVTI-021-60750-R.120
new		3/4	.120	2-1/4	5	6	82094	HVTI-030-60750-R.120
new	1	1	.030	2	4-1/2	6	82095	HVTI-020-61000-R.030
new		1	.030	2-5/8	5	6	82096	HVTI-026-61000-R.030
new		1	.060	2	4-1/2	6	82097	HVTI-020-61000-R.060
new		1	.060	2-5/8	5	6	82098	HVTI-026-61000-R.060
new		1	.120	2	4-1/2	6	82099	HVTI-020-61000-R.120
new		1	.120	2-5/8	5	6	82100	HVTI-026-61000-R.120

* .0005 max TIR

Access customized running parameters for your specific setup and material at www.machiningadvisorpro.com





HVTI-6

SPEEDS & FEEDS

6 Flute - Variable Pitch - For High Efficiency Milling

6 Flute

HVTI-6													
Material Guide		Hardness	SFM	Inches Per Tooth (IPT)									
				1/4		3/8		1/2		3/4		1	
				HEM	Fin	HEM	Fin	HEM	Fin	HEM	Fin	HEM	Fin
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0029	.0021	.0045	.0024	.0057	.0028	.0084	.0034	.0107	.0041
		75 - 98 HRB	250	.0025	.0019	.0037	.0022	.0048	.0026	.0070	.0031	.0089	.0037
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0015	.0015	.0023	.0017	.0029	.0020	.0043	.0024	.0054	.0029
		21 - 36 HRC	75	.0014	.0015	.0022	.0017	.0028	.0020	.0041	.0023	.0052	.0028
		36 - 50 HRC	70	.0012	.0014	.0019	.0015	.0024	.0018	.0035	.0022	.0044	.0026
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0041	.0025	.0062	.0028	.0079	.0033	.0116	.0039	.0147	.0048
		75 - 98 HRB	275	.0034	.0023	.0052	.0026	.0066	.0030	.0097	.0036	.0123	.0044
		21 - 36 HRC	250	.0025	.0020	.0039	.0022	.0050	.0026	.0073	.0031	.0093	.0038
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0020	.0017	.0031	.0020	.0039	.0023	.0057	.0028	.0073	.0034
		36 - 50 HRC	160	.0018	.0017	.0028	.0019	.0036	.0022	.0052	.0027	.0067	.0032
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0017	.0016	.0026	.0018	.0033	.0022	.0049	.0026	.0062	.0031
		21 - 36 HRC	170	.0017	.0016	.0025	.0018	.0032	.0021	.0047	.0025	.0060	.0030
		36 - 50 HRC	65	.0011	.0013	.0017	.0015	.0022	.0017	.0032	.0021	.0040	.0025

Milling Process	ADOC	RDOC
HEM (High Efficiency Milling)	Up to Max LOC	Up to 10% Diameter
Fin (Finishing)	Up to Max LOC	4%-6% Diameter

NOTES:

IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

HIGH FEED END MILLS

Designed for high feed applications, Helical's High Feed End Mills take advantage of chip thinning with a specifically engineered end profile to increase machining efficiencies. Similar to High Efficiency Milling (HEM) techniques, the milling technique for these tools allows for drastically increased feed rates to maximize chip thickness and keep radial forces low. Helical's High Feed End Mills are engineered for Steels up to 45 Rc, stocked with *Tplus* coating, and offered in coolant through styles.

HIGH FEED END MILLS

PG

new	<u>Steels Up to 45 Rc - Variable Pitch - Reduced Neck</u>	<u>148</u>
new	<u>Steels Up to 45 Rc - Metric - Variable Pitch - Reduced Neck</u>	<u>149</u>
new	<u>Steels Up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck</u>	<u>150</u>
new	<u>Steels Up to 45 Rc - Metric - Variable Pitch - Coolant Through - Reduced Neck</u>	<u>151</u>

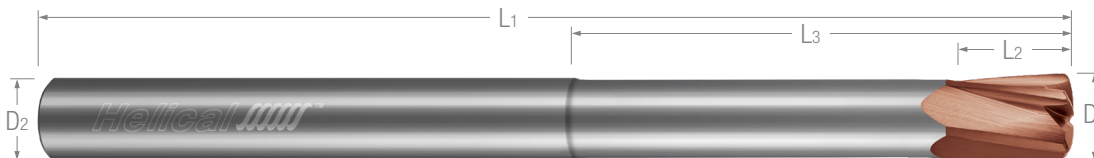


HIGH FEED END MILLS New!

HFV

Steels Up to 45 Rc - Variable Pitch - Reduced Neck

- Specifically engineered end profile for optimal tool engagement and reduced cutting forces
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Geometry proven to achieve maximum feed rates in steels up to 45 Rc
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
- Solid carbide
- CNC ground in the USA

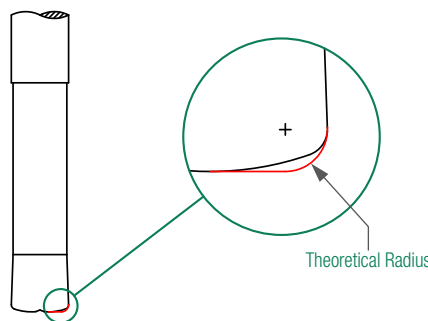


Cutter Dia.*	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Dia.	Flutes	Theoretical Radius**	<i>Tplus</i> Coated	Tool Description	
$D_1^{+.000^*}_{-.002^*}$	$D_2(h6)$	$L_2^{+.032^*}_{-.000^*}$	$L_1^{+.062^*}_{-.062^*}$	L_3						
1/8	1/8	1/8	2	1/4	.110	4	.0157	82663	HFV-RN-020-40125	new
	1/8	1/8	2	1/2	.110	4	.0157	82664	HFV-RN-040-40125	new
	1/8	1/8	2	3/4	.110	4	.0157	82665	HFV-RN-060-40125	new
3/16	3/16	3/16	2-1/2	3/8	.165	4	.0235	82666	HFV-RN-020-40187	new
	3/16	3/16	2-1/2	3/4	.165	4	.0235	82667	HFV-RN-040-40187	new
	3/16	3/16	2-1/2	1-1/8	.165	4	.0235	82668	HFV-RN-060-40187	new
1/4	1/4	1/4	3	1/2	.220	5	.0314	82669	HFV-RN-020-50250	new
	1/4	1/4	3	1	.220	5	.0314	82670	HFV-RN-040-50250	new
	1/4	1/4	3	1-1/2	.220	5	.0314	82671	HFV-RN-060-50250	new
3/8	3/8	3/8	4	3/4	.330	5	.0471	82672	HFV-RN-020-50375	new
	3/8	3/8	4	1-1/2	.330	5	.0471	82673	HFV-RN-040-50375	new
	3/8	3/8	4	2-1/4	.330	5	.0471	82674	HFV-RN-060-50375	new
1/2	1/2	1/2	5	1	.440	5	.0628	82675	HFV-RN-020-50500	new
	1/2	1/2	5	2	.440	5	.0628	82676	HFV-RN-040-50500	new
	1/2	1/2	5	3	.440	5	.0628	82677	HFV-RN-060-50500	new

*.0005 max TIR **Theoretical radius for use when programming in CAM software

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In the absence of a Simulation File, use the Theoretical Radius to approximate Helical's feed mills as corner radius end mills within your CAM software.



Speeds & Feeds on Page 152

Slotting

Roughing

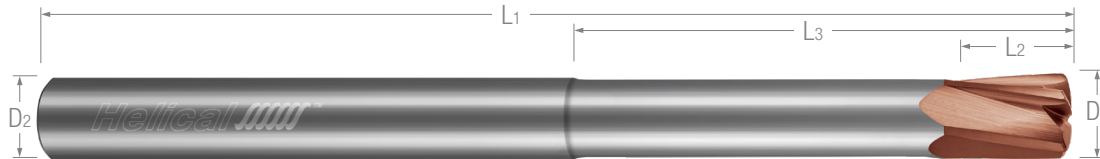
3D Milling

MHFV
METRIC

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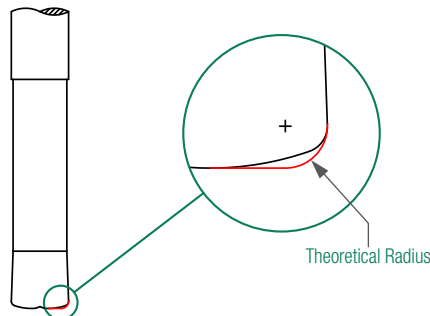


	Cutter Dia.*	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Dia.	Flutes	Theoretical Radius**	Tplus Coated	Tool Description
	$D_1^{+0.00/-0.05}$ mm	D_2 (h6)	$L_2^{+0.80/-0.00}$ mm	$L_1^{+1.60/-1.60}$ mm	L_3					
new	3 mm	3.00 mm	3.00 mm	50 mm	6.00 mm	2.64 mm	4	.377 mm	82678	MHFV-RN-020-40300
new		3.00 mm	3.00 mm	50 mm	12.00 mm	2.64 mm	4	.377 mm	82679	MHFV-RN-040-40300
new		3.00 mm	3.00 mm	50 mm	18.00 mm	2.64 mm	4	.377 mm	82680	MHFV-RN-060-40300
new	4 mm	4.00 mm	4.00 mm	63 mm	8.00 mm	3.52 mm	4	.502 mm	82681	MHFV-RN-020-40400
new		4.00 mm	4.00 mm	63 mm	16.00 mm	3.52 mm	4	.502 mm	82682	MHFV-RN-040-40400
new		4.00 mm	4.00 mm	63 mm	24.00 mm	3.52 mm	4	.502 mm	82683	MHFV-RN-060-40400
new	6 mm	6.00 mm	6.00 mm	75 mm	12.00 mm	5.28 mm	5	.754 mm	82684	MHFV-RN-020-50600
new		6.00 mm	6.00 mm	75 mm	24.00 mm	5.28 mm	5	.754 mm	82685	MHFV-RN-040-50600
new		6.00 mm	6.00 mm	75 mm	36.00 mm	5.28 mm	5	.754 mm	82686	MHFV-RN-060-50600
new	8 mm	8.00 mm	8.00 mm	100 mm	16.00 mm	7.04 mm	5	1.005 mm	82687	MHFV-RN-020-50800
new		8.00 mm	8.00 mm	100 mm	32.00 mm	7.04 mm	5	1.005 mm	82688	MHFV-RN-040-50800
new		8.00 mm	8.00 mm	100 mm	48.00 mm	7.04 mm	5	1.005 mm	82689	MHFV-RN-060-50800
new	10 mm	10.00 mm	10.00 mm	125 mm	20.00 mm	8.80 mm	5	1.257 mm	82690	MHFV-RN-020-51000
new		10.00 mm	10.00 mm	125 mm	40.00 mm	8.80 mm	5	1.257 mm	82691	MHFV-RN-040-51000
new		10.00 mm	10.00 mm	125 mm	60.00 mm	8.80 mm	5	1.257 mm	82692	MHFV-RN-060-51000
new	12 mm	12.00 mm	12.00 mm	125 mm	24.00 mm	10.55 mm	5	1.508 mm	82693	MHFV-RN-020-51200
new		12.00 mm	12.00 mm	125 mm	48.00 mm	10.55 mm	5	1.508 mm	82694	MHFV-RN-040-51200
new		12.00 mm	12.00 mm	125 mm	72.00 mm	10.55 mm	5	1.508 mm	82695	MHFV-RN-060-51200

*.013 mm max TIR **Theoretical radius for use when programming in CAM software

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Speeds & Feeds on Page 152

Slotting

Roughing

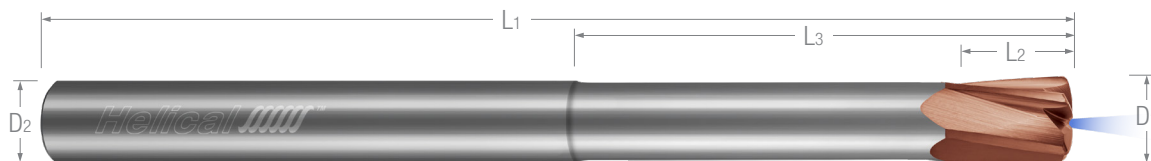
3D Milling

HIGH FEED END MILLS New!

HFVC

Steels up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck

- Specifically engineered end profile for optimal tool engagement and reduced cutting forces
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- *Tplus* coating offers high hardness for extended tool life in high temp alloys and ferrous metals including stainless steel
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- CNC ground in the USA

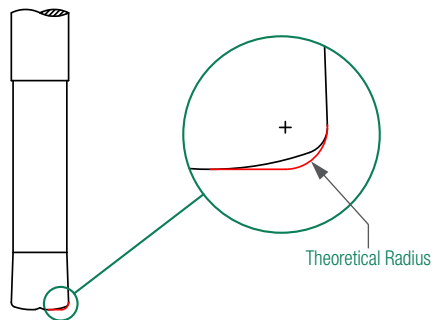


Cutter Dia.*	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Dia.	Flutes	Theoretical Radius**	<i>Tplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	D2 (h6)	$L2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	L3					
1/4	1/4	1/4	3	1/2	.220	5	.0314	82696	HFVC-RN-020-50250 new
	1/4	1/4	3	1	.220	5	.0314	82697	HFVC-RN-040-50250 new
	1/4	1/4	3	1-1/2	.220	5	.0314	82698	HFVC-RN-060-50250 new
3/8	3/8	3/8	4	3/4	.330	5	.0471	82699	HFVC-RN-020-50375 new
	3/8	3/8	4	1-1/2	.330	5	.0471	82700	HFVC-RN-040-50375 new
	3/8	3/8	4	2-1/4	.330	5	.0471	82701	HFVC-RN-060-50375 new
1/2	1/2	1/2	5	1	.440	5	.0628	82702	HFVC-RN-020-50500 new
	1/2	1/2	5	2	.440	5	.0628	82703	HFVC-RN-040-50500 new
	1/2	1/2	5	3	.440	5	.0628	82704	HFVC-RN-060-50500 new

*.0005 max TIR **Theoretical radius for use when programming in CAM software

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Speeds & Feeds on Page 152

Slotting

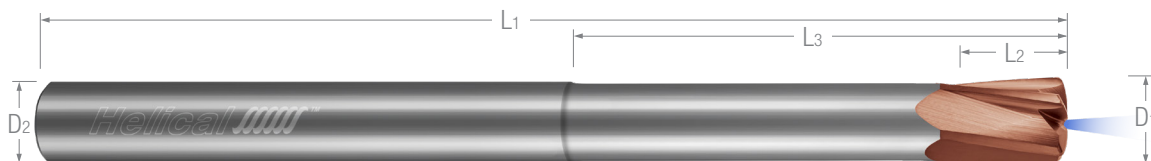
Roughing

3D Milling

MHFVC
METRIC

New! HIGH FEED END MILLS
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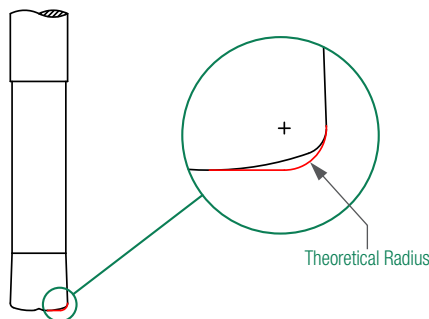


Cutter Dia.*	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Diameter	Flutes	Theoretical Radius**	Tplus Coated	Tool Description
D1 ^{+0.00 mm} / _{-0.05 mm}	D2 (h6)	L2 ^{+0.80 mm} / _{-0.00 mm}	L1 ^{+1.60 mm} / _{-1.60 mm}	L3					
new 6 mm	6.00 mm	6.00 mm	75 mm	12.00 mm	5.28 mm	5	.734 mm	82705	MHFVC-RN-020-50600
	6.00 mm	6.00 mm	75 mm	24.00 mm	5.28 mm	5	.734 mm	82706	MHFVC-RN-040-50600
	6.00 mm	6.00 mm	75 mm	36.00 mm	5.28 mm	5	.734 mm	82707	MHFVC-RN-060-50600
new 8 mm	8.00 mm	8.00 mm	100 mm	16.00 mm	7.04 mm	5	.979 mm	82708	MHFVC-RN-020-50800
	8.00 mm	8.00 mm	100 mm	32.00 mm	7.04 mm	5	.979 mm	82709	MHFVC-RN-040-50800
	8.00 mm	8.00 mm	100 mm	48.00 mm	7.04 mm	5	.979 mm	82710	MHFVC-RN-060-50800
new 10 mm	10.00 mm	10.00 mm	125 mm	20.00 mm	8.80 mm	5	1.224 mm	82711	MHFVC-RN-020-51000
	10.00 mm	10.00 mm	125 mm	40.00 mm	8.80 mm	5	1.224 mm	82712	MHFVC-RN-040-51000
	10.00 mm	10.00 mm	125 mm	60.00 mm	8.80 mm	5	1.224 mm	82713	MHFVC-RN-060-51000
new 12 mm	12.00 mm	12.00 mm	125 mm	24.00 mm	10.55 mm	5	1.469 mm	82714	MHFVC-RN-020-51200
	12.00 mm	12.00 mm	125 mm	48.00 mm	10.55 mm	5	1.469 mm	82715	MHFVC-RN-040-51200
	12.00 mm	12.00 mm	125 mm	72.00 mm	10.55 mm	5	1.469 mm	82716	MHFVC-RN-060-51200

*.013 mm max TIR **Theoretical radius for use when programming in CAM software

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Speeds & Feeds on Page 152

Slotting

Roughing

3D Milling

SPEEDS & FEEDS

High Feed End Mills

HFV

Feed Mills

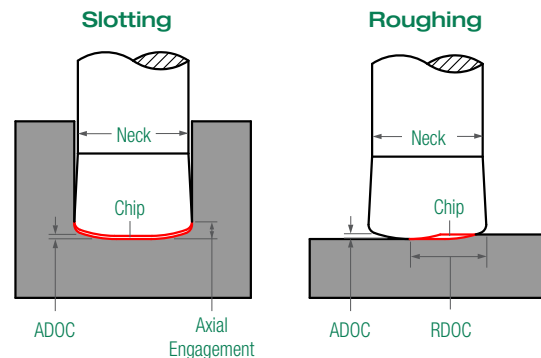
Material Guide		Hardness	SFM	Inches Per Tooth (IPT)									
				1/8		3/16		1/4		3/8		1/2	
				Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	800	.0027	.0057	.0040	.0085	.0053	.0113	.0080	.0140	.0107	.0187
		75 - 98 HRB	750	.0020	.0037	.0030	.0055	.0040	.0073	.0060	.0110	.0080	.0147
		21 - 36 HRC	700	.0013	.0025	.0020	.0038	.0027	.0050	.0040	.0075	.0053	.0100
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	600	.0027	.0057	.0040	.0085	.0053	.0113	.0080	.0140	.0107	.0187
		21 - 36 HRC	550	.0027	.0047	.0040	.0070	.0053	.0093	.0080	.0140	.0107	.0187
		36 - 50 HRC	400	.0020	.0033	.0030	.0050	.0040	.0067	.0060	.0100	.0080	.0133
TOOL STEEL	A2, H13, L6, P20, S7	> 50 HRC	350	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
		75 - 98 HRB	550	.0027	.0057	.0040	.0085	.0053	.0113	.0080	.0140	.0107	.0187
		21 - 36 HRC	500	.0027	.0047	.0040	.0070	.0053	.0093	.0080	.0140	.0107	.0187
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	36 - 50 HRC	450	.0020	.0033	.0030	.0050	.0040	.0067	.0060	.0100	.0080	.0133
		> 50 HRC	400	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
		75 - 98 HRB	450	.0027	.0067	.0040	.0100	.0053	.0133	.0080	.0140	.0107	.0187
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	21 - 36 HRC	450	.0027	.0047	.0040	.0070	.0053	.0093	.0080	.0140	.0107	.0187
		75 - 98 HRB	500	.0027	.0053	.0040	.0080	.0053	.0107	.0080	.0140	.0107	.0187
		36 - 50 HRC	400	.0022	.0040	.0033	.0060	.0043	.0080	.0065	.0120	.0087	.0160
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	750	.0025	.0037	.0038	.0055	.0050	.0073	.0075	.0110	.0100	.0147
		21 - 36 HRC	650	.0027	.0053	.0040	.0080	.0053	.0107	.0080	.0140	.0107	.0187
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	450	.0025	.0037	.0038	.0055	.0050	.0073	.0075	.0110	.0100	.0147
		36 - 50 HRC	400	.0020	.0033	.0030	.0050	.0040	.0067	.0060	.0100	.0080	.0133
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	600	.0027	.0083	.0040	.0125	.0053	.0140	.0080	.0140	.0107	.0187
		21 - 36 HRC	550	.0027	.0063	.0040	.0095	.0053	.0127	.0080	.0140	.0107	.0187
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	550	.0027	.0056	.0040	.0084	.0053	.0111	.0080	.0140	.0107	.0187
		21 - 36 HRC	450	.0027	.0040	.0040	.0060	.0053	.0080	.0080	.0120	.0107	.0160
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	500	.0027	.0056	.0040	.0084	.0053	.0111	.0080	.0140	.0107	.0187
		21 - 36 HRC	450	.0027	.0040	.0040	.0060	.0053	.0080	.0080	.0120	.0107	.0160
PURE NICKEL	Nickel 200, Nickel 201	75 - 98 HRB	600	.0027	.0047	.0040	.0070	.0053	.0094	.0080	.0140	.0107	.0187
		36 - 50 HRC	550	.0027	.0043	.0040	.0065	.0053	.0087	.0080	.0130	.0107	.0172
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	200	.0027	.0038	.0040	.0056	.0053	.0075	.0080	.0113	.0107	.0150
		21 - 36 HRC	180	.0027	.0033	.0040	.0049	.0053	.0066	.0080	.0098	.0107	.0130
		36 - 50 HRC	150	.0022	.0028	.0033	.0042	.0043	.0056	.0065	.0084	.0087	.0112
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	350	.0027	.0047	.0040	.0070	.0053	.0094	.0080	.0140	.0107	.0187
		75 - 98 HRB	400	.0027	.0042	.0040	.0063	.0053	.0084	.0080	.0127	.0107	.0168
		21 - 36 HRC	325	.0027	.0040	.0040	.0060	.0053	.0080	.0080	.0120	.0107	.0158
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	300	.0027	.0033	.0040	.0049	.0053	.0066	.0080	.0098	.0107	.0130
		36 - 50 HRC	250	.0025	.0023	.0038	.0035	.0050	.0047	.0075	.0070	.0100	.0093
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	225	.0020	.0023	.0030	.0035	.0040	.0047	.0060	.0070	.0080	.0093
		21 - 36 HRC	150	.0027	.0035	.0040	.0053	.0053	.0070	.0080	.0105	.0107	.0140
		36 - 50 HRC	90	.0020	.0023	.0030	.0035	.0040	.0047	.0060	.0070	.0080	.0093

Milling Process	Hardness	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	3.00%-5.00% Diameter	100% Diameter
	≥ 35 HRC	2.50%-4.00% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	3.00%-5.00% Diameter	Up to 65% Diameter
	≥ 35 HRC	2.75%-4.25% Diameter	Up to 65% Diameter

NOTES:

IPT values shown are for 3xD reach tools, and should be adjusted for longer or shorter reaches. For tools with reaches greater than 3xD, IPT should be reduced.

Please note for slotting applications, axial engagement will increase while axial stepdown (ADOC) remains the same.



CHAMFER MILLS

Straight & Helical Flutes

Designed for improved finish and increased tool life, Helical's chamfer cutters are offered in two forms. Our straight flute chamfer cutters, available with 2 or 4 flutes, are perfect for high quality results in standard chamfering operations. Our unique helically fluted design is stocked in 3 and 5 flutes and is an ideal choice for achieving maximum finish quality in materials up to 55 Rc.

STRAIGHT FLUTE

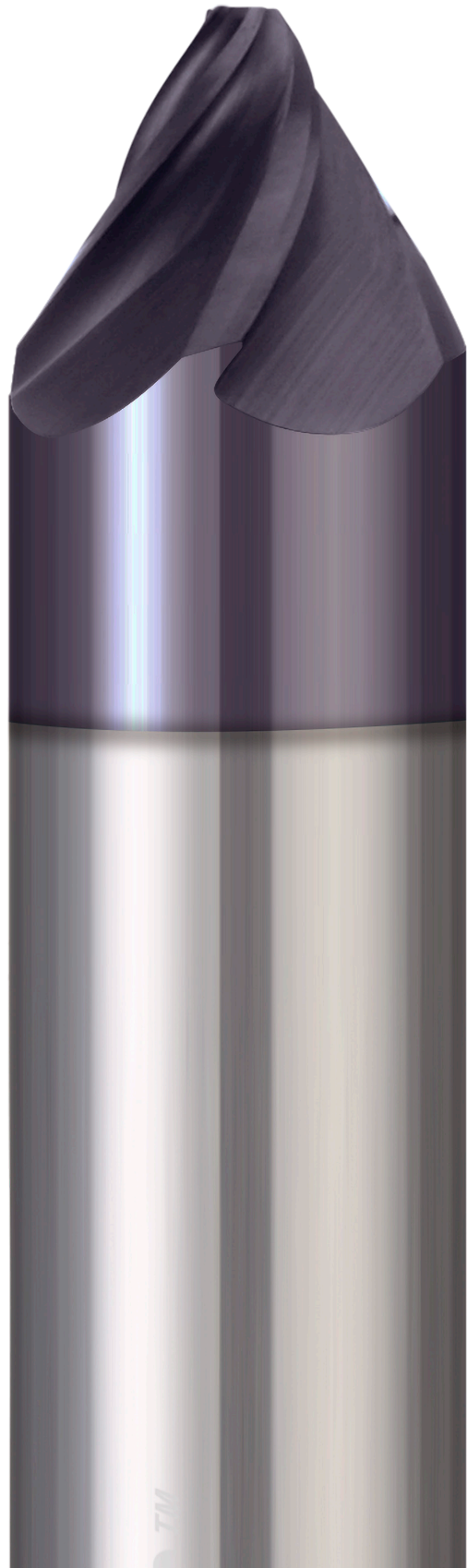
PG

2 & 4 Flute	Chamfer	Straight Flute	154
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HELICAL FLUTE

PG

<small>new</small> 3 & 5 Flute	Chamfer	Helical Flute - High Performance	156
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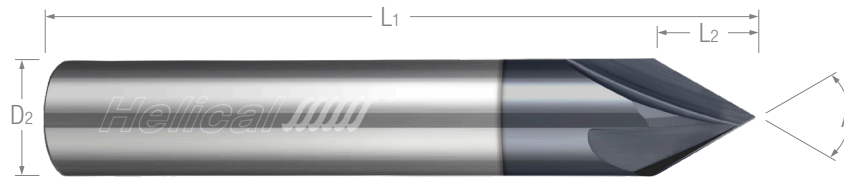
CHAMFER MILLS - STRAIGHT FLUTE

HCM

2 & 4 Flute

Straight Flute

- Designed for universal chamfering applications
- Offered with 2 and 4 flutes for soft and hard materials
- Ground with positive axial rake and clearance for optimal performance
- h6 shank tolerance for high precision tool holders
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Included Angle A $\begin{matrix} +0^{\circ}30' \\ -0^{\circ}30' \end{matrix}$	Shank Diameter* D ₂ (h6)	Web Thickness (MAX)	Length of Cut L ₂	Overall Length L ₁ $\begin{matrix} +.062'' \\ -.062'' \end{matrix}$	Flutes	Uncoated	<i>Aplus</i> Coated	Tool Description
60°	1/8	.015	.108	2	2	06225	06228	HCM60-20125
	3/16	.018	.162	2	2	06240	06243	HCM60-20187
	3/16	.018	.162	2	4	06330	06333	HCM60-40187
	1/4	.020	.216	2-1/2	2	06255	06258	HCM60-20250
	1/4	.020	.216	2-1/2	4	06345	06348	HCM60-40250
	3/8	.035	.324	2-1/2	2	06270	06273	HCM60-20375
	3/8	.035	.324	2-1/2	4	06360	06363	HCM60-40375
	1/2	.040	.433	3	2	06285	06288	HCM60-20500
	1/2	.040	.433	3	4	06375	06378	HCM60-40500
3/4	.045	.649	3	4	06390	06393	HCM60-40750	
90°	1/8	.015	.062	2	2	06015	06018	HCM90-20125
	3/16	.018	.093	2	2	06030	06033	HCM90-20187
	3/16	.018	.093	2	4	06120	06123	HCM90-40187
	1/4	.020	.125	2-1/2	2	06045	06048	HCM90-20250
	1/4	.020	.125	2-1/2	4	06135	06138	HCM90-40250
	3/8	.035	.187	2-1/2	2	06060	06063	HCM90-20375
	3/8	.035	.187	2-1/2	4	06150	06153	HCM90-40375
	1/2	.040	.250	3	2	06075	06078	HCM90-20500
	1/2	.040	.250	3	4	06165	06168	HCM90-40500
3/4	.045	.375	3	4	06180	06183	HCM90-40750	
120°	1/8	.015	.037	2	2	06405	06408	HCM120-20125
	3/16	.018	.056	2	2	06420	06423	HCM120-20187
	3/16	.018	.056	2	4	06480	06483	HCM120-40187
	1/4	.020	.075	2-1/2	2	06435	06438	HCM120-20250
	1/4	.020	.075	2-1/2	4	06495	06498	HCM120-40250
	3/8	.035	.112	2-1/2	2	06450	06453	HCM120-20375
	3/8	.035	.112	2-1/2	4	06510	06513	HCM120-40375
	1/2	.040	.150	3	2	06465	06468	HCM120-20500
	1/2	.040	.150	3	4	06525	06528	HCM120-40500
3/4	.045	.225	3	4	06540	06543	HCM120-40750	

* .0005 max TIR

HCM

SPEEDS & FEEDS

Chamfer Mills - Straight Flute

Straight Flute

Material Guide		Hardness	SFM	Inches per Tooth (IPT)									
				Effective Cutting Diameter (Deff)									
				< .125	≥ .125 < .1875	≥ .1875 < .25	≥ .25 < .3125	≥ .3125 < .375	≥ .375 < .5	≥ .5 < .625	≥ .625 < .75	≥ .75	
WROUGHT ALUMINUM ALLOY	2014, 5052, 6061	< 120 HBS	2200	.0009	.0018	.0028	.0035	.0045	.0055	.0070	.0090	.0110	
	7050, 7075, 7475	≥ 120 HBS	2200	.0006	.0012	.0018	.0022	.0028	.0035	.0045	.0055	.0070	
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0	< 120 HBS	1800	.0012	.0025	.0040	.0050	.0060	.0080	.0100	.0130	.0150	
	360.0, 380.0, 383.0 390.0, 520.0, 535.0	≥ 120 HBS	1600	.0010	.0020	.0030	.0040	.0050	.0060	.0080	.0100	.0120	
COPPER ALLOY	Cu-ETP, CuBe2 CuZn30, CuZn36Pb3 CuZn10, CuSn5	< 75 HRB	600	.0007	.0015	.0022	.0030	.0035	.0045	.0060	.0070	.0090	
		75 - 98 HRB	450	.0007	.0015	.0022	.0028	.0035	.0045	.0055	.0070	.0090	
CARBON STEEL	10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	< 75 HRB	450	.0010	.0020	.0030	.0040	.0050	.0060	.0080	.0100	.0120	
		75 - 98 HRB	450	.0007	.0015	.0020	.0028	.0035	.0040	.0055	.0070	.0080	
		21 - 36 HRC	400	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	
LOW ALLOY STEEL	13XX, 41XX, 43XX 51XX, 86XX, 93XX	75 - 98 HRB	400	.0006	.0012	.0018	.0025	.0030	.0035	.0050	.0060	.0070	
		21 - 36 HRC	350	.0005	.0009	.0015	.0018	.0022	.0028	.0035	.0045	.0055	
		36 - 50 HRC	200	.0003	.0006	.0010	.0012	.0015	.0020	.0025	.0030	.0040	
		> 50 HRC	90	.0002	.0005	.0007	.0010	.0012	.0015	.0020	.0025	.0030	
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	325	.0005	.0011	.0018	.0022	.0028	.0035	.0045	.0055	.0070	
		21 - 36 HRC	250	.0005	.0009	.0015	.0018	.0022	.0028	.0035	.0045	.0055	
		36 - 50 HRC	150	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040	
		> 50 HRC	50	.0002	.0005	.0007	.0010	.0012	.0015	.0020	.0025	.0030	
SPECIALTY STEEL	300M, Invar 36, Kovar Maraging 200 Maraging 250 Maraging 300 Maraging 350	< 75 HRB	350	.0006	.0012	.0020	.0025	.0030	.0040	.0050	.0060	.0080	
		75 - 98 HRB	400	.0005	.0011	.0015	.0020	.0028	.0030	.0040	.0055	.0060	
		21 - 36 HRC	225	.0004	.0009	.0012	.0018	.0022	.0025	.0035	.0045	.0050	
		36 - 50 HRC	140	.0004	.0008	.0012	.0015	.0020	.0022	.0030	.0040	.0045	
		> 50 HRC	45	.0002	.0005	.0007	.0010	.0012	.0015	.0020	.0025	.0030	
AUSTENITIC STAINLESS STEEL	Nitronic 50 Nitronic 60, 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	75 - 98 HRB	250	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055	
		21 - 36 HRC	225	.0004	.0009	.0012	.0018	.0022	.0025	.0035	.0045	.0050	
		36 - 50 HRC	175	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040	
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420 440, 430, 446	75 - 98 HRB	325	.0004	.0008	.0012	.0018	.0020	.0025	.0035	.0040	.0050	
		21 - 36 HRC	300	.0005	.0011	.0018	.0022	.0028	.0035	.0045	.0055	.0070	
PH STAINLESS STEEL	15-5, 17-4 Carpenter 450 Carpenter 465	21 - 36 HRC	225	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055	
		36 - 50 HRC	120	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040	
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	450	.0011	.0022	.0035	.0045	.0055	.0070	.0090	.0110	.0130	
		21 - 36 HRC	400	.0008	.0015	.0022	.0030	.0040	.0045	.0060	.0080	.0090	
MALLEABLE CAST IRON	ASTM A47, ASTM A220 ASTM A602	75 - 98 HRB	350	.0007	.0012	.0020	.0028	.0035	.0040	.0055	.0070	.0080	
		21 - 36 HRC	300	.0005	.0009	.0015	.0020	.0022	.0028	.0040	.0045	.0055	
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	325	.0007	.0012	.0020	.0028	.0035	.0040	.0055	.0070	.0080	
		21 - 36 HRC	275	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	
		36 - 50 HRC	160	.0002	.0005	.0007	.0010	.0012	.0015	.0020	.0025	.0030	
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	450	.0008	.0015	.0022	.0030	.0040	.0045	.0060	.0080	.0090	
		75 - 98 HRB	450	.0007	.0015	.0020	.0028	.0035	.0040	.0055	.0070	.0080	
NICKEL ALLOY	Hastelloy C-22 Inconel 625, Waspaloy René 41, Inconel 718 Incoloy 20	75 - 98 HRB	175	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055	
		21 - 36 HRC	150	.0004	.0008	.0012	.0015	.0020	.0025	.0030	.0040	.0050	
		36 - 50 HRC	80	.0004	.0007	.0011	.0015	.0018	.0020	.0028	.0035	.0040	
PURE TITANIUM	Ti Grade 1, Ti Grade 2 Ti Grade 3, Ti Grade 4 Ti Grade 7, Ti Grade 12	< 75 HRB	350	.0009	.0018	.0028	.0035	.0045	.0055	.0070	.0090	.0110	
		75 - 98 HRB	400	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060	
		21 - 36 HRC	350	.0005	.0011	.0015	.0022	.0028	.0030	.0045	.0055	.0060	
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	21 - 36 HRC	200	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055	
		36 - 50 HRC	140	.0004	.0007	.0010	.0015	.0018	.0022	.0030	.0035	.0045	
COBALT ALLOY	ASTM F562, ASTM F90 ASTM F75, ASTM F799	75 - 98 HRB	225	.0003	.0006	.0008	.0010	.0015	.0018	.0022	.0028	.0035	
		21 - 36 HRC	150	.0004	.0008	.0012	.0018	.0020	.0025	.0035	.0040	.0050	
		36 - 50 HRC	80	.0003	.0006	.0010	.0012	.0015	.0020	.0025	.0030	.0040	

NOTES:

Speed (SFM) and feed (IPT) numbers shown in the table above are considered to be average values. Use a tolerance of ± 25% as needed.

Hardness Scales: HBS = Brinell (500-kgf steel ball)

HRB = Rockwell B

HRC = Rockwell C

CHAMFER MILLS - HELICAL FLUTE

New Item!

HPCM

3 & 5 Flute - High Performance

- Helically ground with positive axial rake and clearance for high performance chamfering
- Helical flute geometry results in superior part finish
- Flat tip diameter for programming accuracy and increased strength
- h6 shank tolerance for high precision tool holders
- *Zplus* coating for maximum performance in aluminum and non-ferrous alloys
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Helical Flute

Incl. Angle	Shank Dia.*	LOC	Overall Length	Theoretical Tip Length	Tip Diameter	Flutes	Zplus Coated	Aplus Coated	Tool Description
A $+0^{\circ}30'$ $-0^{\circ}30'$	D ₂ (h6)	L ₂	L ₁ $+0.062''$ $-0.062''$	L ₃	D ₃ $+0.002''$ $-0.002''$				
60°	1/4	.164	2-1/2	.052	.060	3	59815	07001	HPCM60-30250
	1/4	.164	2-1/2	.052	.060	5		59806	HPCM60-50250
	3/8	.264	2-1/2	.061	.070	3	59816	07002	HPCM60-30375
	3/8	.264	2-1/2	.061	.070	5		07022	HPCM60-50375
	1/2	.364	3	.069	.080	3	59817	07003	HPCM60-30500
	1/2	.364	3	.069	.080	5		07023	HPCM60-50500
	5/8	.463	3	.078	.090	3	59818	07004	HPCM60-30625
	5/8	.463	3	.078	.090	5		07024	HPCM60-50625
	3/4	.562	3	.087	.100	3	59819	07005	HPCM60-30750
3/4	.562	3	.087	.100	5		07025	HPCM60-50750	
90°	1/4	.095	2-1/2	.030	.060	3	59820	07008	HPCM90-30250
	1/4	.095	2-1/2	.030	.060	5		59807	HPCM90-50250
	3/8	.153	2-1/2	.035	.070	3	59821	07009	HPCM90-30375
	3/8	.153	2-1/2	.035	.070	5		07028	HPCM90-50375
	3/8	.153	4	.035	.070	5		81838	HPCM90-50375
	1/2	.210	3	.040	.080	3	59822	07010	HPCM90-30500
	1/2	.210	3	.040	.080	5		07029	HPCM90-50500
	1/2	.210	6	.040	.080	5		81839	HPCM90-50500
	5/8	.268	3	.045	.090	3	59823	07011	HPCM90-30625
	5/8	.268	3	.045	.090	5		07030	HPCM90-50625
	3/4	.325	3	.050	.100	3	59824	07012	HPCM90-30750
3/4	.325	3	.050	.100	5		07031	HPCM90-50750	
1	.440	4	.060	.120	5		82662	HPCM90-51000 new	
100°	1/4	.080	2-1/2	.025	.060	3	59825	59809	HPCM100-30250
	1/4	.080	2-1/2	.025	.060	5		59812	HPCM100-50250
	3/8	.128	2-1/2	.029	.070	3	59826	59810	HPCM100-30375
	3/8	.128	2-1/2	.029	.070	5		59813	HPCM100-50375
	1/2	.176	3	.034	.080	3	59827	59811	HPCM100-30500
	1/2	.176	3	.034	.080	5		59814	HPCM100-50500
120°	1/4	.057	2-1/2	.017	.060	3	59828	07015	HPCM120-30250
	1/4	.057	2-1/2	.017	.060	5		59808	HPCM120-50250
	3/8	.091	2-1/2	.020	.070	3	59829	07016	HPCM120-30375
	3/8	.091	2-1/2	.020	.070	5		07034	HPCM120-50375
	1/2	.126	3	.023	.080	3	59830	07017	HPCM120-30500
	1/2	.126	3	.023	.080	5		07035	HPCM120-50500
	5/8	.157	3	.026	.090	3	59831	07018	HPCM120-30625
	5/8	.157	3	.026	.090	5		07036	HPCM120-50625
	3/4	.195	3	.029	.100	3	59832	07019	HPCM120-30750
3/4	.195	3	.029	.100	5		07037	HPCM120-50750	

*.0005 max TIR

HPCM

SPEEDS & FEEDS
Chamfer Mills - Helical Flute

Helical Flute

Material Guide		Hardness	SFM	Inches per Tooth (IPT)								
				Effective Cutting Diameter (Deff)								
				< .125	≥ .125 < .1875	≥ .1875 < .25	≥ .25 < .3125	≥ .3125 < .375	≥ .375 < .5	≥ .5 < .625	≥ .625 < .75	≥ .75
WROUGHT ALUMINUM ALLOY	2014, 5052, 6061 7050, 7075, 7475	< 120 HBS ≥ 120 HBS	2200	.0009	.0018	.0028	.0035	.0045	.0055	.0070	.0090	.0110
			2200	.0006	.0012	.0018	.0022	.0030	.0035	.0045	.0060	.0070
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0 360.0, 380.0, 383.0 390.0, 520.0, 535.0	< 120 HBS ≥ 120 HBS	1800	.0012	.0028	.0040	.0055	.0070	.0080	.0110	.0130	.0160
			1600	.0011	.0022	.0030	.0045	.0055	.0060	.0090	.0110	.0130
COPPER ALLOY	Cu-ETP, CuBe2 CuZn30, CuZn36Pb3 CuZn10, CuSn5	< 75 HRB 75 - 98 HRB	600	.0008	.0015	.0022	.0030	.0040	.0045	.0060	.0080	.0090
			450	.0007	.0015	.0022	.0030	.0035	.0045	.0060	.0070	.0090
CARBON STEEL	10XX, 11XX, 12XX 12LXX, ASTM A27 ASTM A36	< 75 HRB 75 - 98 HRB 21 - 36 HRC	450	.0010	.0020	.0030	.0040	.0050	.0060	.0080	.0100	.0120
			450	.0007	.0015	.0022	.0028	.0035	.0045	.0055	.0070	.0090
			400	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060
LOW ALLOY STEEL	13XX, 41XX, 43XX 51XX, 86XX, 93XX	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	400	.0006	.0012	.0020	.0025	.0030	.0040	.0050	.0060	.0080
			350	.0005	.0010	.0015	.0020	.0025	.0028	.0040	.0050	.0055
			200	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	325	.0006	.0010	.0018	.0022	.0028	.0035	.0045	.0055	.0070
			250	.0005	.0010	.0015	.0020	.0025	.0028	.0040	.0050	.0055
			150	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040
			50	.0002	.0005	.0007	.0010	.0012	.0015	.0020	.0025	.0030
SPECIALTY STEEL	300M, Invar 36, Kovar Maraging 200 Maraging 250 Maraging 300 Maraging 350	< 75 HRB 75 - 98 HRB 21 - 36 HRC 36 - 50 HRC > 50 HRC	350	.0006	.0012	.0020	.0025	.0030	.0040	.0050	.0060	.0080
			400	.0005	.0011	.0018	.0022	.0028	.0035	.0045	.0055	.0070
			225	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
			140	.0004	.0008	.0012	.0015	.0020	.0025	.0030	.0040	.0050
			45	.0003	.0005	.0008	.0010	.0012	.0015	.0020	.0025	.0030
AUSTENITIC STAINLESS STEEL	Nitronic 50 Nitronic 60, 301, 303 304, 304L Incoloy 27-TMO, 316 316L, 321, 347	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	250	.0005	.0009	.0015	.0018	.0022	.0028	.0035	.0045	.0055
			225	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
			175	.0004	.0007	.0011	.0015	.0018	.0020	.0028	.0035	.0040
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420 440, 430, 446	75 - 98 HRB 21 - 36 HRC	325	.0004	.0009	.0012	.0018	.0022	.0025	.0035	.0045	.0050
			300	.0006	.0012	.0018	.0022	.0028	.0035	.0045	.0055	.0070
PH STAINLESS STEEL	15-5, 17-4 Carpenter 450 Carpenter 465	21 - 36 HRC 36 - 50 HRC	225	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
			120	.0003	.0007	.0010	.0015	.0018	.0020	.0028	.0035	.0040
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB 21 - 36 HRC	450	.0012	.0022	.0035	.0045	.0055	.0070	.0090	.0110	.0140
			400	.0008	.0015	.0025	.0030	.0040	.0050	.0060	.0080	.0100
MALLEABLE CAST IRON	ASTM A47, ASTM A220 ASTM A602	75 - 98 HRB 21 - 36 HRC	350	.0007	.0012	.0020	.0028	.0035	.0040	.0055	.0070	.0080
			300	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	325	.0007	.0015	.0020	.0028	.0035	.0040	.0055	.0070	.0080
			275	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060
			160	.0003	.0005	.0008	.0010	.0012	.0015	.0020	.0025	.0030
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB 75 - 98 HRB	450	.0008	.0015	.0022	.0030	.0040	.0045	.0060	.0080	.0090
			450	.0007	.0015	.0022	.0030	.0035	.0045	.0060	.0070	.0090
NICKEL ALLOY	Hastelloy C-22 Inconel 625, Waspaloy René 41, Inconel 718 Incoloy 20	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	175	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
			150	.0004	.0008	.0012	.0018	.0020	.0025	.0035	.0040	.0050
			80	.0004	.0007	.0011	.0015	.0018	.0022	.0030	.0035	.0045
PURE TITANIUM	Ti Grade 1, Ti Grade 2 Ti Grade 3, Ti Grade 4 Ti Grade 7, Ti Grade 12	< 75 HRB 75 - 98 HRB 21 - 36 HRC	350	.0009	.0020	.0028	.0040	.0045	.0055	.0080	.0090	.0110
			400	.0005	.0011	.0015	.0020	.0028	.0030	.0040	.0055	.0060
			350	.0006	.0010	.0018	.0022	.0028	.0035	.0045	.0055	.0070
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	21 - 36 HRC 36 - 50 HRC	200	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
			140	.0004	.0008	.0012	.0015	.0020	.0022	.0030	.0040	.0045
COBALT ALLOY	ASTM F562, ASTM F90 ASTM F75, ASTM F799	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	225	.0003	.0006	.0009	.0012	.0015	.0018	.0022	.0030	.0035
			150	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
			80	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040

NOTES:

Speed (SFM) and feed (IPT) numbers shown in the table above are considered to be average values. Use a tolerance of ± 25% as needed.

Hardness Scales: HBS = Brinell (500-kgf steel ball)

HRB = Rockwell B

HRC = Rockwell C



IN THE LOUPE

Your Source for Machining Solutions

Our technical blog, In the Loupe, is dedicated to machining how-tos, technical tips, and tool selection guides. Access helpful resources at any time and share them easily with fellow machinists at helical.blog/intheloupe.



How to Avoid Common Part Finish Problems



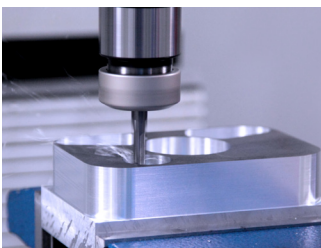
Optimize Roughing with Chipbreaker Tooling



Why Flute Count Matters



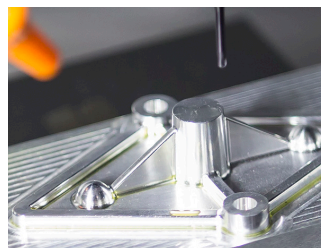
Titanium Machining Guide



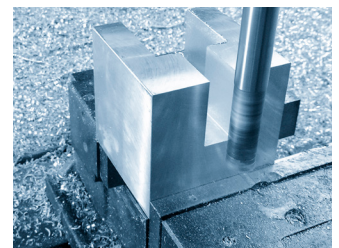
How to Avoid 4 Major Types of Tool Wear



Ball Nose Milling Strategy



Corner Engagement: How to Machine Corners



Introduction to High Efficiency Milling

SUBSCRIBE NOW

helical.blog/intheloupe

TECHNICAL INFORMATION

Programs, Resources, & More

The following section contains information about our products, programs, and services as well as useful technical guides for optimizing your tool performance. Go to www.helicaltool.com/resources for more technical information, resources, and case studies.

PROGRAMS & SERVICES	PG
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The easiest way to order tools is by the 5-digit EDP number found in the product table.

OUR PART NUMBERS

EDP Number

The most accurate way to order our product is by the 5-digit EDP number found within all of our product tables. The EDP number will ensure you receive the correct coating and tool configuration.

Programs

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tplus Coated	Tool Description	
D1 ^{+0.000"} / _{-.002"}	D2 (h6)	R ^{+0.002"} / _{-.002"}	L2 ^{+0.032"} / _{-.000"}	L1 ^{+0.062"} / _{-.062"}					
5/16	5/16	.020	7/16	2	6	59295	82587	HEV-S-60312-R.020	new
	5/16	.020	3/4	2-1/2	6	59298		HEV-R-60312-R.020	
	5/16	.020	1	3	6	59301		HEV-M-60312-R.020	
	5/16	.030	7/16	2	6	59296	82588	HEV-S-60312-R.030	new
	5/16	.030	3/4	2-1/2	6	59299		HEV-R-60312-R.030	
	5/16	.030	1	3	6	59302		HEV-M-60312-R.030	
	5/16	.060	7/16	2	6	59297		HEV-S-60312-R.060	
	5/16	.060	3/4	2-1/2	6	59300		HEV-R-60312-R.060	
	5/16	.060	1	3	6	59303		HEV-M-60312-R.060	

Tool Description

Our tool description is an informative part number that can aid in tool identification. This part number is for informational purposes only and not for ordering tools. You will find these descriptions on tool shanks and packaging.

Not applicable to square corner tools.

M	H	35	AL	C	RN	S or 040	3	0500	R.010
Metric	Helical	Helix Angle	Material Type Part Family	Chipbreaker	Reduced Neck	Length of Cut or LBS (Reach)	Number of Flutes	Cutter Diameter (0.000" or 00.00 mm)	Corner Radius / Profile
			AL - Aluminum ALV - Aluminum Variable Pitch CM - Chamfer Mill EF - Exotic Finisher EV - Exotic Variable Pitch FV - Feed Mill Variable Pitch FVC - Feed Mill Variable Pitch Coolant-Through MG - High Balance MGC - High Balance Coolant-Through SF - Steel Finisher SV - Steel Variable Pitch SVR - Steel Variable Rougher VTI - Variable Pitch Titanium XF - Multi-Flute Finisher XVR - Multi-Flute Variable Pitch Rougher			S - Stub SR - Stub Regular R - Regular A - Regular/Medium M - Medium ML - Medium Long L - Long LX - Long/Extra Long X - Xtra Long Multiple 015 = 1.5x 040 = 4x 120 = 12x		R.010 - .010 Corner Radius R.015 - .015 Corner Radius R.030 - .030 Corner Radius R.060 - .060 Corner Radius R.090 - .090 Corner Radius R.120 - .120 Corner Radius R.190 - .190 Corner Radius R.250 - .250 Corner Radius R0.50 - 0.50 mm Corner Radius R1.00 - 1.00 mm Corner Radius BN - Ball Nose	

SQUARE

1/2" Diameter, 40° Helix,
3-Flute, Regular Length,
Square End

EDP# 48396
H40ALV-R-30500

BALL

1/2" Diameter, 40° Helix,
3-Flute, Regular Length,
Ball Nose

EDP# 49286
H40ALV-R-30500-BN

CORNER RADIUS

1/2" Diameter, 40° Helix,
3-Flute, Regular Length,
.030 Corner Radius

EDP# 48406
H40ALV-R-30500-R.030

CHOOSING THE RIGHT HELIX ANGLE

Within our aluminum product lines, we offer three helix configurations that can handle any aluminum application. Below is a guideline that can be used to help direct you to the correct helix angle for your job.

35° Helix

(Noted throughout our catalog as H35AL & H35ALV)



Slower helix design ensures:

- The highest overall tool strength within our aluminum tool offering
- Elevated feed rates due to increased tool strength
- Decreased axial forces and cutting aggressiveness
- Reduced chance of tool pull-out
- Much higher corner strength
- An ideal tool for demanding roughing applications

40° Helix

(Noted throughout our catalog as H40ALV)

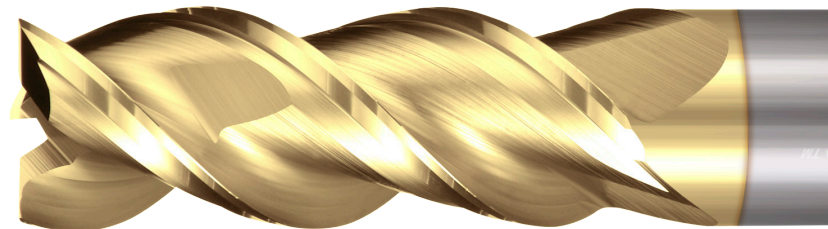


Medium helix design ensures:

- Moderate tool strength
- Elevated speed and feed rates utilizing its variable pitch design
- Moderate shear angle and cutting aggressiveness
- Excellent for both roughing & finishing assignments
- More chip clearance and chip management control
- A good combination of both optimum roughing and finishing characteristics

45° Helix

(Noted throughout our catalog as H45AL)



Higher helix design ensures:

- Superior surface finish results
- A high shear angle and overall cutting aggressiveness
- Lower tool strength, subject to torsional deflection as load is applied
- Good adaptation to high speed machining with low RDOC's
- Heightened probability of tool pull-out (depending on holder type being used)
- An ideal tool for the most demanding finishing applications

CUSTOM TOOLS

How We Are Different

Our custom tools consistently outperform competition in even the most difficult-to-machine materials because we adopt a unique "end-to-end" approach to our custom tool program.

We start by gaining a detailed understanding of your requirements. We design your tool by utilizing our proprietary geometries, coatings, and edge prep technology. Your tool is then manufactured to your exact standards. After you receive your custom design, our engineers are on standby to provide technical support and the ideal running parameters for your tool.

Our Capabilities

Our specials are ground from Solid carbide on state-of-the-art CNC equipment. We manufacture configurations that our competitors won't even quote, including end mills up to 6" in diameter and up to 27" in overall length.

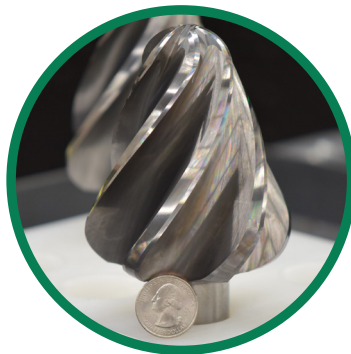
While we specialize in end mills, our team of professional engineers regularly design and manufacture form tools, drills, coolant-fed tooling, step drills, Christmas tree cutters, end mills, and more.

We are committed to providing turnkey solutions for our customers, and we pay attention to the intricate details of every tool to certify its quality and performance.

We Provide

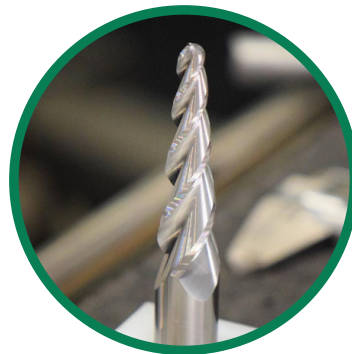
- ✓ Expert knowledge
- ✓ Quick quoting
- ✓ Unbeatable service
- ✓ Fast lead times
- ✓ Quality tooling
- ✓ Machining assistance

Our Custom Tool Process



Detailed Understanding of Your Requirements

During the quoting process, **we set ourselves apart** with a team of engineers eager to understand every aspect of your project, from work material and part envelope to machine capabilities and other critical factors.



Designs Optimized for Your Specific Application

Our objective is to return a quote **within 48 hours** that includes tool design, dimensions, and expected lead time. We will also provide a copy of your quote to your preferred distributor at a **very competitive price**.



Outstanding Quality & Reliable Lead Times

After you receive your tool within our reliable lead time windows, our engineers will provide running parameters that assure your tool delivers **ideal performance** while providing accuracy, strength, and **impressive results**.

1-866-543-5422

helicaltech@harveyperformance.com

TOOL MODIFICATIONS

What We Offer

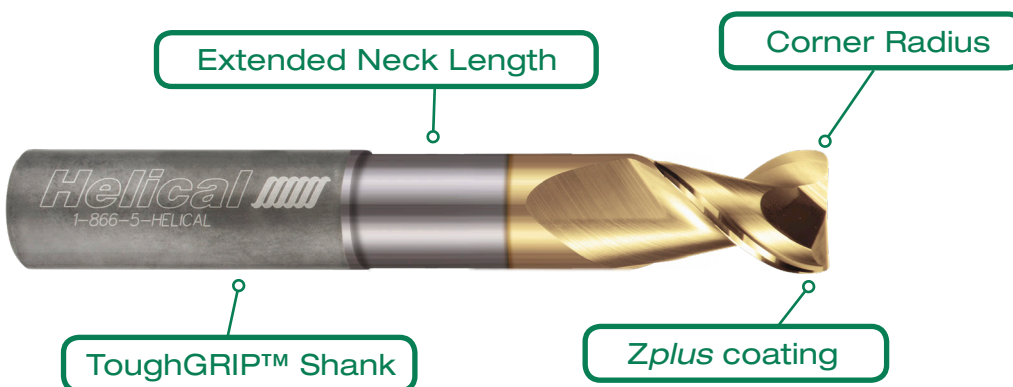
Custom tool needs can often be accommodated by modifying one of our standard tools. Upon receiving a custom tool RFQ, we will evaluate each modification request to confirm optimal performance. Should we feel a full custom tool design is warranted, we'll quote accordingly.

BEFORE



We deliver modifications quickly and encourage you to call your preferred distributor with your needs.

AFTER



Possible Modifications Include

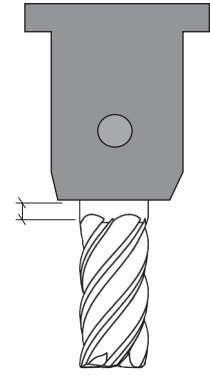
- Corner radii
- Haimer Safe-Lock™ shanks
- Neck lengthening (or additions)
- Surface treatments (coatings)
- Wiper flats
- ToughGRIP shank™
- Overall length adjustments
- Shank coolant grooves
- Weldon flats / set screw flats
- Whistle notch
- Chipbreakers

Please see pages 164-165 for our Shank Modifications

SHANK MODIFICATIONS

Types of Modifications

At Helical, all tools come standard with precision cylindrically ground shanks that meet or exceed h6 shrink fit specifications. If you need a flat, it must be requested at the time of the order. The following shank modifications can be requested:



- Weldon Flats
- Straight Flats
- Coolant Grooves
- Whistle Notch
- HAIMER Safe-Lock™
- ToughGRIP™

Factory-ground flats have several key advantages:

- Flats are ground parallel with centerline of tool
- Flats are consistently level for the entire length of the flat
- Flats are accurately ground with no excess runout

Our “flat location procedure” ensures:

- Flutes will not end up inside of holder, avoiding chip compaction
- Tool “stick out” is minimal in order to achieve optimum tool strength

Weldon Flat Specifications

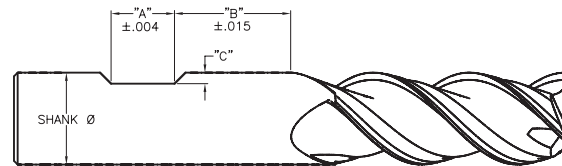
Weldon Flat specifications are typically based on NAS 986, a high speed steel tool standard, and are measured from the shank end. Currently, there is no standardized specification for high performance Solid carbide end mills. All flats will be ground using the dimensional chart (Figure 1.1) unless specified otherwise at the time of quote/order. Some tool holding systems on the market are designed to the exact NAS 986 standard, and may not be directly compatible with the Helical Solutions Weldon dimensions outlined here.

[Figure 1.1]

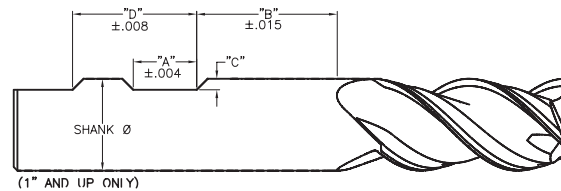
Shank Dia.	“A”	“B”	“C”	“D”
.1250	.155	.500	.012 +.005/-.000	-
.1875	.155	.500	.015 +.005/-.000	-
.250	.155	.500	.017 +.005/-.000	-
.3125	.295	.750	.020 +.005/-.000	-
.375	.295	.750	.050 +.015/-.000	-
.4375	.345	.835	.060 +.015/-.000	-
.500	.345	.835	.060 +.015/-.000	-
.625	.415	.900	.065 +.015/-.000	-
.750	.470	.900	.075 +.015/-.000	-
1.0000	.530	1.000	.075 +.015/-.000	.900*
1.2500	.530	1.000	.095 +.015/-.000	.900*

*Note: Not applicable to 1" dia. tools with ≤4 OAL.

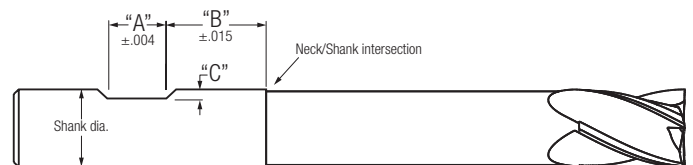
Hand-ground flats are not recommended, as they may cause higher tool runout, a susceptible area of breakage, and inconsistent alignment. Factory warranty is voided with hand-ground flats.



Single Weldon



Double Weldon



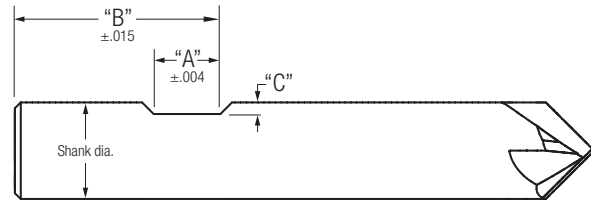
Single Weldon Reduced Neck

In reduced neck tooling, weldon flats are measured from neck/shank intersection.

SHANK MODIFICATIONS

Chamfer Mill with Weldon Flat Specifications

Shank Dia.	"A"	"B"	"C"
.1250	.155	.928	.012 +.005/- .000
.1875	.155	.928	.015 +.005/- .000
.2500	.155	.928	.017 +.005/- .000
.3750	.295	.928	.050 +.015/- .000
.5000	.345	1.064	.060 +.015/- .000
.7500	.470	1.250	.075 +.015/- .000



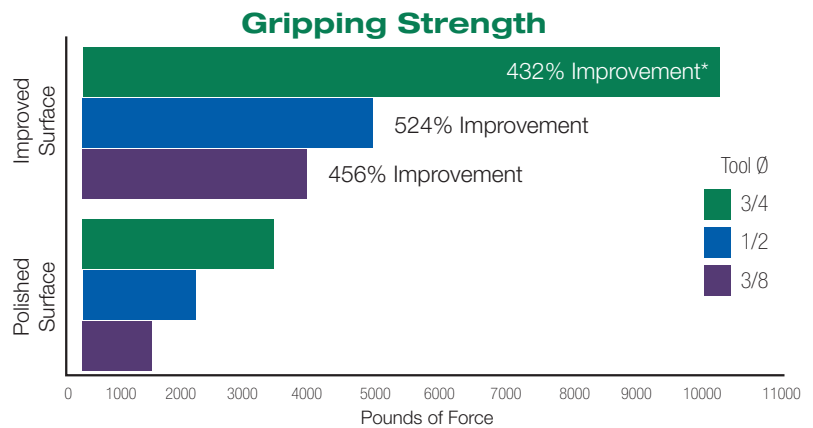
ToughGRIP™ Shank

The mirror finish provided on most shanks does not always allow the friction needed for superior gripping strength. Helical's ToughGRIP™ shank was designed to solve this problem, giving you peace of mind while machining to ensure your tool and part remain undamaged.



- Maintains shank concentricity and h6 shrink-fit tolerance
- 30 +/- 3 Ra surface roughness, consistent within 2 Ra

ToughGRIP™ shanks provide increased friction for superior gripping strength.



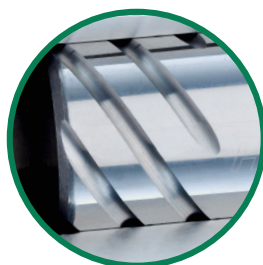
Based on independent laboratory testing. All tests were completed utilizing Command Tooling Systems' line of HYDRO-GRIP™ HD Hydraulic tool holders by ETP Transmission.

* Improved surface finish from the ToughGRIP™ exceeded laboratory testing equipment.

Haimer Safe-Lock™ System

As the first Haimer Safe-Lock licensee, we've been manufacturing this shank configuration successfully since 2008. The added groove modification on the cutting shank works opposite the cutting direction of the flutes, assuring the proper gripping on the cutting tool.

- Drive keys in the chuck and grooves in the tool shank prevent pull-out
- Accurate clamping due to shrink fit technology
- Can accommodate the following diameters: 1/2", 5/8", 3/4", 1", 1-1/4", and 1-1/2".



- ✓ Minimizes run out
- ✓ Up to 5x the tool life
- ✓ No pull-out or spinning



TOOL RENEWAL

The Program

What It Is

Some of the world's largest manufacturers working in the industry's most demanding applications rely on Helical's renewal services. We take our role in maximizing our end users' bottom line very seriously and work hard to ensure that our Tool Renewal Program results in cost savings over new tools without sacrificing any aspects of the original design. Our proven process ensures that our end users will continue to experience outstanding productivity post-renewal.

When a tool is simply resharpened, only the cutting portion of the tool is addressed; the tool's critical features such as helix angle, rake, relief, and gash are left unrestored. At Helical, **we do not resharpen tools**. Rather, we entirely restore your tools to their original geometry with our Tool Reconditioning and Remanufacturing services.

How It Works

We will review the condition of your used tool and return the cutting edge to its original sharpness and strength. Using the same talented staff and state-of-the-art machines that designed and manufactured the original tool, we grind the tool form – including rake, relief, and clearance angle – onto your cutting edge. Additionally, the renewed tool follows the same inspection, edge prep, and coating process we follow for our new tools.

Renewal Benefits

- ✓ Cost savings
- ✓ Proven performance
- ✓ Better ROI
- ✓ Same running parameters

How To Get Started

Our Tool Renewal Program is unique to the industry because of our extensive attention to detail. Both our Tool Reconditioning and Tool Remanufacturing services follow more than a dozen steps to return a tool's geometry to its original state.

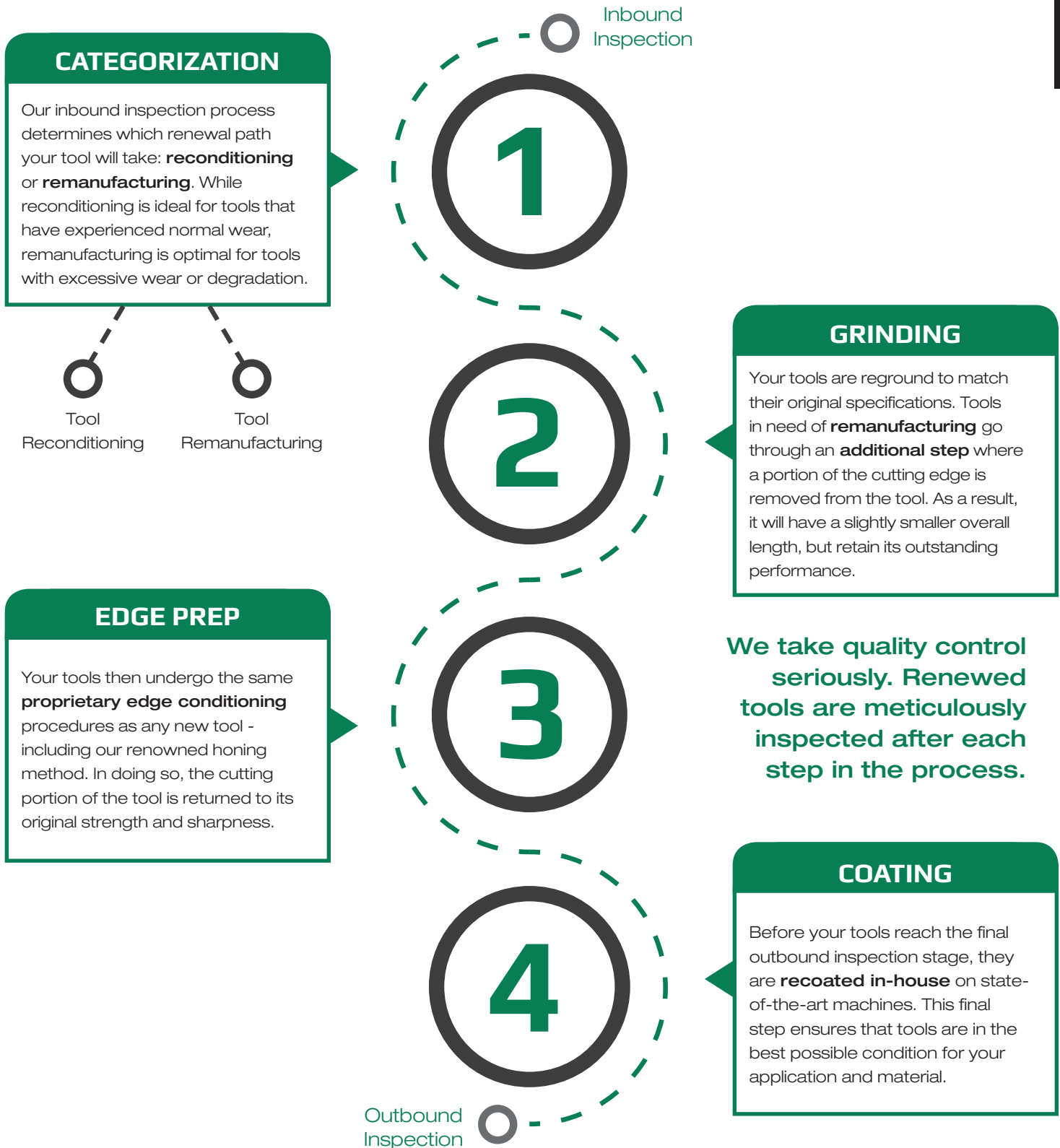
We have found that the cost savings our end users experience when choosing whether or not to recondition a set of tools is highly correlated to the number of tools and their diameters. We have established minimum renewal lot sizes by diameter that enable us to provide outstanding renewal services at a great value.



Tools like our HEV-5 are a popular choice for our Renewal Program, as they are often used in long production runs and high-volume jobs.

TOOL RENEWAL

The Process



TYPES OF TOOL ENTRY



Pre-Drilled Hole

Pre-drilling a hole to full pocket depth (and 5-10% larger than the end mill diameter) is the safest practice of dropping your end mill into a pocket.

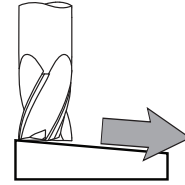
This method ensures the least amount of end work abuse and premature tool wear.



Helical Interpolation

A very common and safe practice with ferrous materials. Employing corner radius end mills during this operation will decrease tool wear and lessen corner breakdown.

We recommend a programmed helix diameter >110-120% of tool diameter.



Ramping-In

This type of operation can be very successful, but institutes many different torsional forces the cutter must withstand. Finding a corner radius tool with good core strength plus room for proper chip evacuation is key.

For soft/non-ferrous materials, start with a 3° - 10° ramp angle. For hard/ferrous materials, start at a 1° - 3° angle.

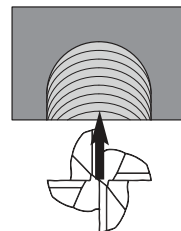
Download Machining Advisor Pro at www.machiningadvisorpro.com to get real-time Helical Interpolation information for your specific application.



Straight Plunge

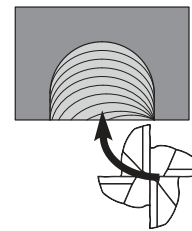
The least preferred method and one that can easily break a tool. The tool must be center cutting. End milling incorporates a flat entry point making chip evacuation tough, tool pressure very high and success random at best.

Drill bits are intended for straight plunging and we highly recommend this type of tool for this operation.



Straight Entry

Straight entry into the part takes a toll on the cutter. Until the cutter is fully engaged, the feed rate upon entry is recommended to be reduced by at least 50%.



Roll-In Entry

Rolling into the cut ensures a cutter to work its way to full engagement and naturally acquire proper chip thickness. The feed rate in this scenario should be reduced by 50%.

For side entry operations, corner radius tooling will yield the best results.

ANGLE OF ENGAGEMENT & CHIP THINNING

Tool Engagement Angle

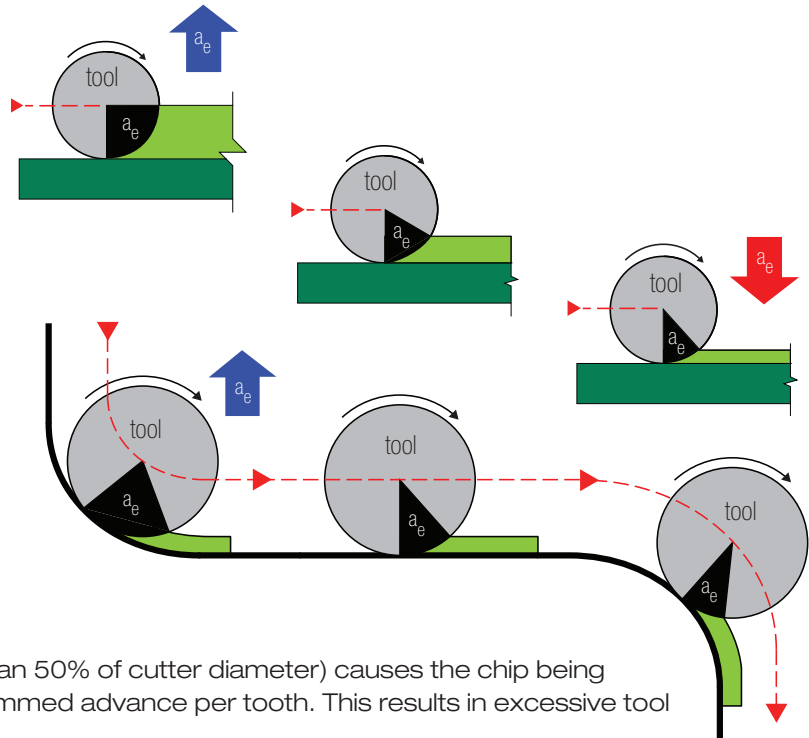
Tool Engagement Angle (a_e) is an angular measurement about the periphery of the cutter that is in contact with the material being removed and directly related to the radial chip thickness.

An **Increasing** a_e can result in:

- Higher horsepower requirement
- Increased tool deflection
- Higher spindle load (wear/tear)
- Decreased feed rates

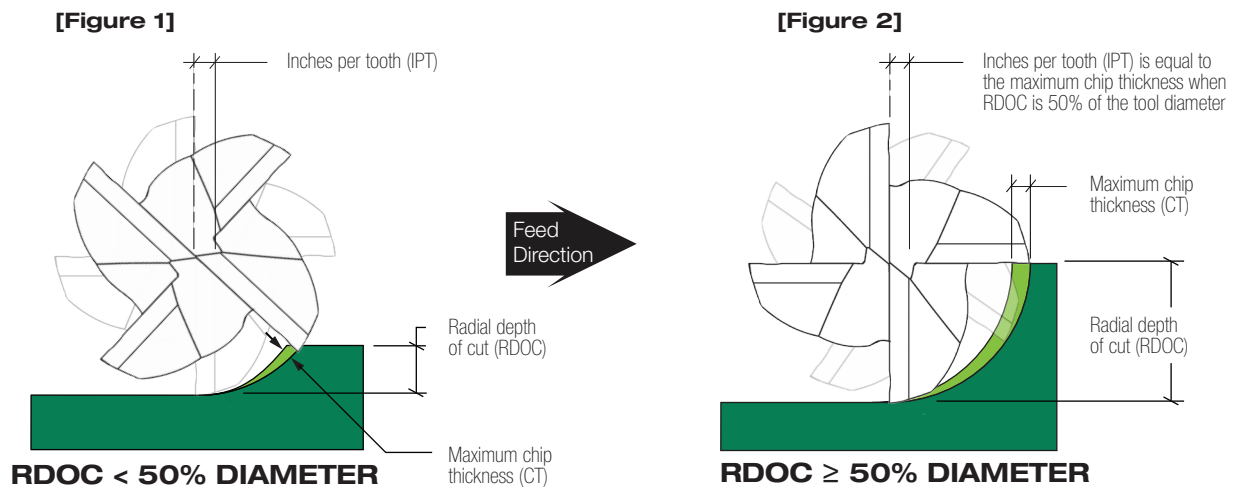
A **decreasing** a_e can result in:

- Lower horsepower requirement
- Decreased tool deflection
- Lower spindle load (wear/tear)
- Increased Feed Rates



Chip Thinning

Milling with a light radial depth of cut (less than 50% of cutter diameter) causes the chip being formed to be much thinner than the programmed advance per tooth. This results in excessive tool “rubbing” and premature tool wear/life.



When programming a radial depth of cut (RDOC) less than 1/2 the tool diameter (Figure 1), employ the chip thinning calculation (Figure 3). A chip-thinning adjustment will prolong tool life and help reduce cycle time.

This feed rate adjustment needs to consider drastic tool engagement and angle increases when milling into corners. Significant feed rate reductions in these areas still apply and will need attention.

$$IPT = \frac{CT \times D}{2 \times \sqrt{(D \times RDOC) - RDOC^2}}$$

[Figure 3]

FREE HEM GUIDEBOOK

A Machinist's Guide to Increasing Shop Productivity with High Efficiency Milling

HEM Defined

Decode the ins and outs of high efficiency milling, high speed machining, and how to take advantage of HEM techniques with miniature tooling.

Best Practices

Learn how to increase your shop's efficiency with strategies that shorten cycle times, enhance part finish, and avoid premature tool wear.

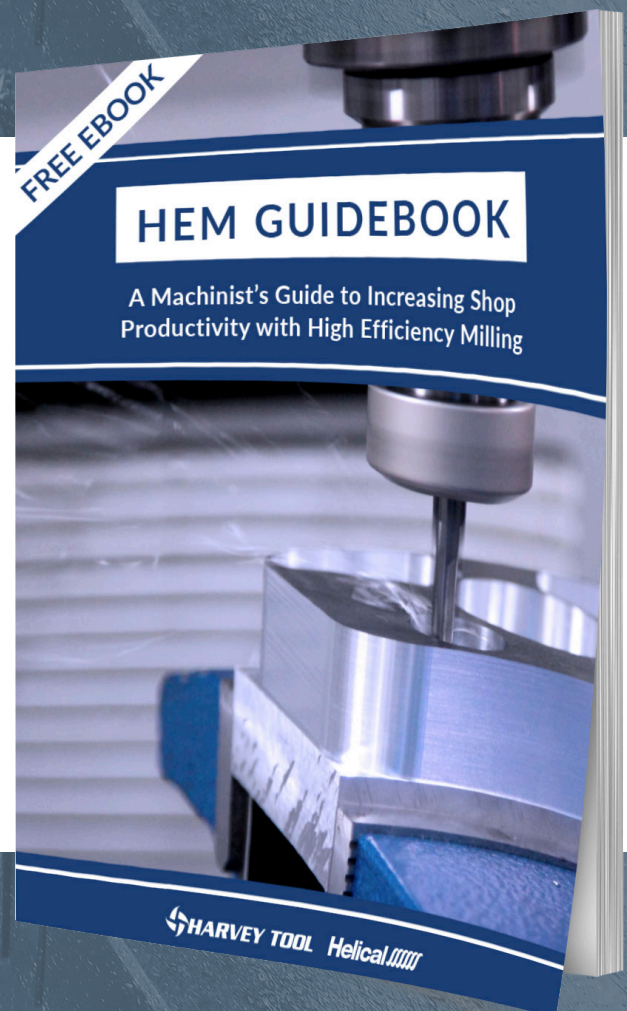
Pro Tips

Access exclusive HEM tips, milling insights, and case studies from professional machinists with real experience utilizing HEM practices.

Helical Solutions and Harvey Tool have teamed up to provide a free ebook on High Efficiency Milling techniques.

The HEM Guidebook is jam-packed with over 50 pages of milling strategies, best practices, and pro tips relevant to any machinist aiming to boost their shop's efficiency. High Efficiency Milling, also referred to as dynamic milling or high efficiency machining, is proven to improve productivity, decrease cycle times, and increase tool life.

Download your copy today and let High Efficiency Milling lead the way to a more profitable, productive shop.



www.helicaltool.com/hem

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EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG
00015	22	00482	23	01285	32	01750	33	03032	54	03497	55	04202	40	05337	116
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00062	22	00555	23	01347	32	01797	33	03105	54	03570	55	04245	40	05472	117
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00092	22	00572	23	01362	32	02017	26	03120	54	03585	55	04285	40	05502	117
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00107	22	00600	23	01377	32	02032	26	03150	54	03600	55	04300	40	05532	117
00120	22	00602	23	01390	32	02060	26	03152	54	03602	55	04302	40	05547	117
00122	22	00615	23	01392	32	02062	26	03155	54	03610	55	04315	40	05607	117
00150	22	00645	23	01405	32	02075	26	03157	54	03612	55	04317	40	05622	117
00152	22	00647	23	01407	32	02077	26	03165	54	03645	55	04325	40	05637	117
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00180	22	00690	23	01465	33	02135	26	03197	54	03677	55	04362	40	05712	117
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00287	22	01047	32	01572	33	02285	26	03330	54	04015	40	04495	41	06033	154
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00467	23	01270	32	01735	33	03017	54	03482	55	04192	40	05307	116	06240	154
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06270	154	07031	156	12212	77	17555	24	19062	57	23122	75	24317	138
06273	154	07034	156	12227	77	17557	24	19075	57	23130	74	24332	138
06285	154	07035	156	12317	77	17645	24	19077	57	23132	75	24347	138
06288	154	07036	156	12332	77	17647	24	19105	57	23140	74	24362	138
06330	154	07037	156	12347	77	17660	24	19107	57	23142	75	24392	138
06333	154	08017	78	12407	77	17662	24	19120	57	23150	74	24407	138
06345	154	08032	78	12467	77	17750	24	19122	57	23152	75	24422	138
06348	154	08062	78	12482	77	17752	24	19135	57	23160	74	24467	138
06360	154	08077	78	12527	77	18015	27	19137	57	23162	75	24482	138
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06375	154	08112	78	13017	79	18030	27	19167	57	23172	75	24512	138
06378	154	08122	78	13032	79	18032	27	19180	57	23190	74	24542	138
06390	154	08137	78	13047	79	18060	27	19182	57	23193	75	24557	138
06393	154	08167	78	13077	79	18062	27	19210	57	23200	74	24572	138
06405	154	08182	78	13092	79	18075	27	19212	57	23203	75	24587	138
06408	154	08192	78	13112	79	18077	27	19225	57	23210	74	24617	138
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06423	154	08227	78	13137	79	18107	27	19235	57	23220	74	24647	138
06435	154	08242	78	13157	79	18120	27	19237	57	23223	75	24662	138
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06480	154	08407	78	13302	79	18180	27	19302	57	23263	75	26227	131
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06495	154	08437	78	13332	79	18210	27	19317	57	23273	75	26247	131
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06540	154	08557	78	17045	24	18245	27	19422	57	23313	75	26317	131
06543	154	10017	80	17047	24	18247	27	19435	57	23330	74	26322	131
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07005	156	10137	80	17150	24	18315	27	19497	57	23353	75	26377	131
07008	156	10157	80	17152	24	18317	27	23010	74	24017	138	26392	131
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07016	156	10332	80	17242	24	18435	27	23050	74	24107	138	27137	133
07017	156	10347	80	17255	24	18437	27	23051	75	24122	138	27152	133
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07019	156	12032	77	17330	24	18465	27	23072	75	24167	138	27227	133
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27367	134	27377	134	27392	134	27407	134	27422	134	27442	134	28105	17
28107	17	28120	17	28122	17	28135	17	28137	17	28165	17	28167	17
28180	17	28182	17	28210	17	28212	17	28225	17	28227	17	28285	17
28287	17	28300	17	28302	17	28315	17	28317	17	28325	17	28327	17
28405	17	28407	17	28420	17	28422	17	28435	17	28437	17	28445	17
28447	17	28465	17	28480	17	28495	17	29120	16	29122	16	29135	16
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29287	16	30137W	82	31032	87	31647W	90	33317W	60	34152W	104	35242	113	43338	88
29300	16	30142	82	31047	87	31662	90	33332	60	34157	104	35272	113	43338W	88
29302	16	30142W	82	31062	87	31662W	90	33332W	60	34167	104	35287	113	43339	88
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29317	16	30152W	82	31092	87	31677W	90	33337W	60	34197	104	35317	113	43348	88
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29347	16	30197	82	31137W	88	31722	91	33422	60	34227W	104	35377	114	43409	89
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29377	16	30227	83	31142W	88	31742	91	33497W	60	34242W	104	35407	114	43423	89
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29407	16	30257	83	31167W	88	32047	96	33527W	60	34272	105	35467	114	43439	89
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29452	16	30337W	83	31242	88	32137	96	33572W	61	34307	105	36091	140	43511W	89
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29480	16	30362	83	31317W	88	32182	96	33602	61	34322	106	36136	140	43514	89
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29587	16	30527W	83	31422	89	32317	97	33677	61	34377	106	43138	88	43542	89
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29617	16	30572	83	31482	89	32377	97	33707	61	34397	106	43153	88	43557	90
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30032	82	30692	83	31587	90	33142W	60	34092	103	35092	112	43318	88	43617	90
30047	82	30692W	83	31587W	90	33152	60	34107	104	35107	112	43318W	88	43618	90
30062	82	30707	83	31602	90	33152W	60	34107W	104	35122	112	43319	88	43619	90
30077	82	30722	83	31602W	90	33167	60	34122	104	35137	112	43332	88	43632	90
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43647	90	44152	100	45138	104	45323	106	45447	107	46261	51	46485	52	46731	49
43648	90	44152W	100	45152	104	45324	106	45449	107	46265	51	46486	52	46735	53
43649	90	44157	100	45153	104	45332	106	45450	107	46266	51	46490	52	46736	53
43650	91	44167	100	45157	104	45333	106	45451	107	46300	48	46491	52	46750	53
43651	91	44182	100	45158	104	45334	106	46010	48	46301	48	46495	48	46751	53
43662	90	44182W	100	45167	104	45347	106	46011	48	46305	52	46496	48	46760	53
43663	90	44197	100	45168	104	45348	106	46015	51	46306	52	46500	52	46761	53
43664	90	44212	101	45182	104	45349	106	46016	51	46310	52	46501	52	46765	49
43665	91	44212W	101	45183	104	45352	106	46020	48	46311	52	46555	49	46766	49
43666	91	44227	101	45197	104	45353	106	46021	48	46315	52	46556	49	46770	53
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43692	90	44257	101	45214	105	45366	107	46051	51	46330	48	46571	52	46795	53
43693	90	44257W	101	45227	105	45377	107	46055	51	46331	48	46575	52	46796	53
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43696	91	44287	101	45228W	105	45378W	107	46061	48	46340	52	46581	52	46805	53
43707	91	44287W	101	45229	105	45379	107	46065	51	46341	52	46585	52	46806	53
43708	91	44302	101	45242	105	45379W	107	46066	51	46345	52	46586	52	46820	53
43709	91	44302W	101	45242W	105	45380	107	46070	51	46346	52	46590	49	46821	53
43710	91	44307	101	45243	105	45380W	107	46071	51	46350	52	46591	49	46830	53
43711	91	44307W	101	45243W	105	45381	107	46075	48	46351	52	46595	52	46831	53
43722	91	44317	101	45244	105	45381W	107	46076	48	46355	52	46596	52	47040	50
43723	91	44317W	101	45247	105	45392	107	46080	51	46356	52	46600	52	47041	50
43724	91	44322	101	45247W	105	45392W	107	46081	51	46360	48	46601	52	47045	50
43725	91	44332	101	45248	105	45393	107	46085	51	46361	48	46605	52	47046	50
43726	91	44332W	101	45249	105	45394	107	46086	51	46365	52	46606	52	47060	50
43737	91	44347	101	45257	105	45394W	107	46090	51	46366	52	46610	52	47061	50
43738	91	44352	101	45257W	105	45395	107	46091	51	46370	52	46611	52	47065	50
43739	91	44362	101	45258	105	45396	107	46095	48	46371	52	46615	52	47066	50
43740	91	44362W	101	45259	106	45397	107	46096	48	46375	52	46616	52	47075	50
43741	91	44377	101	45272	105	45398	107	46100	51	46376	52	46620	52	47076	50
43742	91	44377W	101	45272W	105	45399	107	46101	51	46380	52	46621	52	47090	50
43743	91	44392	101	45273	105	45400	107	46105	51	46381	52	46625	49	47091	50
43744	91	44392W	101	45274	106	45401	107	46106	51	46385	52	46626	49	47180	50
43745	91	44397	101	45287	105	45402	107	46110	51	46386	52	46630	52	47181	50
43746	91	44397W	101	45287W	105	45403	107	46111	51	46390	48	46631	52	47195	50
43752	91	44402	101	45288	105	45404	107	46220	48	46391	48	46635	52	47196	50
43753	91	44402W	101	45288W	105	45405	107	46221	48	46395	52	46636	52	47225	50
43754	91	44422	101	45289	106	45406	107	46225	51	46396	52	46645	52	47226	50
43755	91	44437	101	45289W	106	45407	107	46226	51	46400	52	46646	52	47240	50
43756	91	44442	101	45302	105	45409	107	46230	51	46401	52	46655	52	47241	50
44017	100	44447	101	45302W	105	45411	107	46231	51	46405	52	46656	52	47255	50
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44047	100	45032	103	45304	106	45424	107	46236	51	46410	52	46696	49	47270	50
44062	100	45047	103	45304W	106	45425	107	46240	51	46411	52	46700	53	47271	50
44077	100	45062	103	45307	105	45426	107	46241	51	46415	52	46701	53	47300	50
44092	100	45077	103	45307W	105	45437	107	46245	48	46416	52	46705	53	47301	50
44107	100	45092	103	45308	105	45439	107	46246	48	46470	48	46706	53	47315	50
44107W	100	45107	104	45309	106	45441	107	46250	51	46471	48	46715	53	47316	50
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47376	50	48126	45	48371	46	48511	43	48676	47	49211	44	50437	111	52077	94
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47391	50	48131	45	48376	46	48516	47	48681	47	49241	44	50467	111	52107	94
47420	50	48135	42	48380	46	48520	47	48685	47	49255	44	51017	112	52122	94
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47435	50	48140	45	48385	46	48525	47	48690	43	49270	44	51047	112	52152	94
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47450	50	48145	45	48390	47	48530	47	48695	47	49285	44	51077	112	52182	94
47451	50	48146	45	48391	47	48531	47	48696	47	49286	44	51092	112	52197	94
47465	50	48150	45	48395	43	48535	43	48700	47	49300	44	51107	112	52212	94
47466	50	48151	45	48396	43	48536	43	48701	47	49301	44	51108	112	52227	94
47480	50	48235	42	48400	46	48540	47	48710	47	49315	44	51122	112	52242	94
47481	50	48236	42	48401	46	48541	47	48711	47	49316	44	51123	112	52257	94
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53228	97	53426	98	56647	86	59018	35	59074	36	59130	36	59186	37
53229	97	53437	98	56662	86	59019	35	59075	36	59131	36	59187	37
53241	97	53438	98	56677	86	59020	35	59076	36	59132	36	59188	37
53242	97	53439	98	56692	86	59021	35	59077	36	59133	36	59189	37
53243	97	53440	98	56707	86	59022	35	59078	36	59134	36	59190	37
53244	97	53441	98	56722	86	59023	35	59079	36	59135	36	59191	37
53256	97	54017	70	56737	86	59024	35	59080	36	59136	36	59192	37
53257	97	54047	70	56742	86	59025	35	59081	36	59137	36	59193	37
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53259	97	54107	70	57017	95	59027	35	59083	36	59139	36	59195	37
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53274	97	54227	70	57062	95	59030	35	59086	36	59142	36	59198	37
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53288	97	54302	70	57092	95	59032	35	59088	36	59144	36	59200	37
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59745	34	59802	38	59859	104	59916	122	59973	20	60030	30	81304	17	81361	32
59746	38	59803	38	59860	104	59917	122	59974	19	60031	29	81305	16	81362	32
59747	38	59804	38	59861	104	59918	122	59975	20	60032	30	81306	16	81363	32
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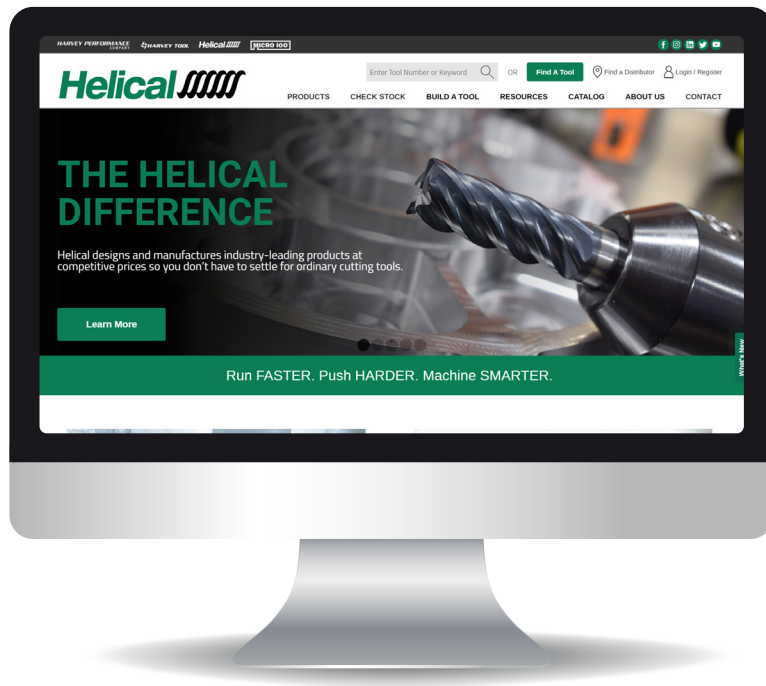
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82357	25	82406	45	82455	44	82504	60	82553	105	82602	127	82651	131
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82367	25	82416	45	82465	44	82514	85	82563	106	82612	129	82661	134
82368	25	82417	45	82466	44	82515	95	82564	107	82613	129	82662	156
82369	25	82418	45	82467	44	82516	95	82565	119	82614	129	82663	148
82370	25	82419	45	82468	44	82517	95	82566	119	82615	129	82664	148
82371	25	82420	45	82469	48	82518	100	82567	119	82616	129	82665	148
82372	25	82421	45	82470	48	82519	100	82568	119	82617	129	82666	148
82373	25	82422	45	82471	48	82520	100	82569	122	82618	129	82667	148
82374	25	82423	45	82472	48	82521	101	82570	122	82619	129	82668	148
82375	25	82424	45	82473	48	82522	101	82571	122	82620	129		

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A New Helicaltool.com



We're proud to announce the launch of a new Helicaltool.com, your home of the industry's highest performing carbide end mills. Along with an impressive new look, we've created several web features that will forever change the way you shop for cutting tools.

EXCITING NEW WEBSITE FEATURES



Shopping Cart Functionality

NEW: Once logged in, create your own personalized Shopping Carts of Helical tools you're most interested in, then send it directly to a participating distributor, or share it with a colleague or purchasing agent.



Product Table Filtering

NEW: Find the perfect Helical Solutions tool for your job quickly and easily by using new filtering functionality on each product table, sorting through an expansive and always growing product offering.



"Smart-Search" Feature

NEW: Simply and quickly search for a Helical Solutions tool, then receive results for its product page, as well as for every technical resource relevant to that tool, presented in one click to save you valuable time and money.



Build a Tool

NEW: Design your perfect custom tool directly on our "Build a Tool" page, and even attach a blueprint or napkin drawing to better explain its key properties.



Expansive Stock Check

NEW: Check real-time availability of as many as 50 tools at once to simplify the order planning process and spend more time where it counts: at the spindle.



Direct MAP Connection

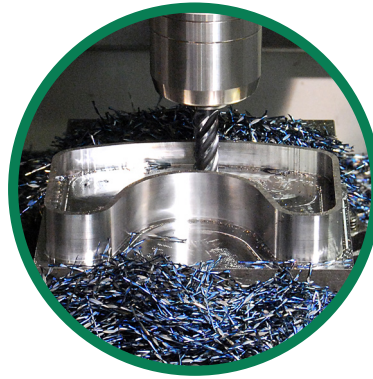
NEW: Once you've found a tool, and are ready to run it, open Machining Advisor Pro (MAP) to automatically and seamlessly generate its running parameters.

Let Helical Impress You



RUN FASTER

Helical end mills are meticulously designed for maximum rigidity to support aggressive speeds and feeds. Use Machining Advisor Pro (page 54) to optimize your running parameters.



PUSH HARDER

Engineered for optimal performance in non-ferrous and ferrous materials, our unique geometries ensure extended tool life and significantly higher metal removal rates.



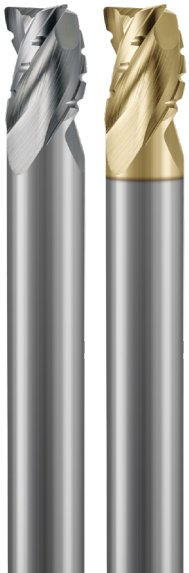
MACHINE SMARTER

Unlike most of the industry's end mills, Helical's products are specifically built to withstand and take full advantage of high efficiency milling techniques.

New Products

Helical's new 2020 Product Catalog features nearly 700 new and fully stocked tools, each specially engineered to boost your shop's productivity and profitability.

**Reduced Neck
35° Helix
Rougher for
Aluminum**



**2 Flute
45° Helix
Corner Radius
for Aluminum**



**6 Flute
Chipbreaker
for Steels**



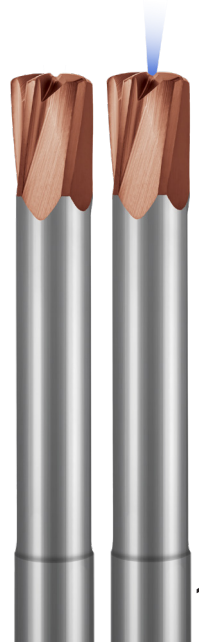
**6 Flute
Reduced Neck
for Steels**



**6 Flute
End Mills
for HEM in
Titanium**



**High Feed
End Mills**



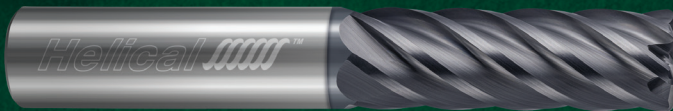
HARVEY PERFORMANCE COMPANY



Harvey Performance Company brings together the leading Harvey Tool, Helical Solutions, and Micro 100 brands to offer the industry's most comprehensive selection of stocked cutting tools guaranteed to increase your shop's productivity.

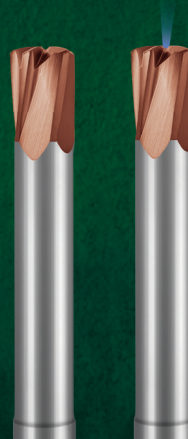
New Helical Products

End Mills for Titanium pg 143



Specifically engineered for use in high efficiency milling (HEM) operations in titanium alloys, Helical's new line of End Mills for Titanium feature 6 flutes and variable pitch geometry, resulting in minimized chatter and harmonics and a higher quality final part.

High Feed End Mills pg 147



Helical's new line of Feed Mills are engineered specifically for optimal tool engagement, and to reduce cutting forces, as its specialized geometry is proven to achieve maximum feed rates in steels up to 45 Rc.

Experience the new Helicaltool.com pg 182



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