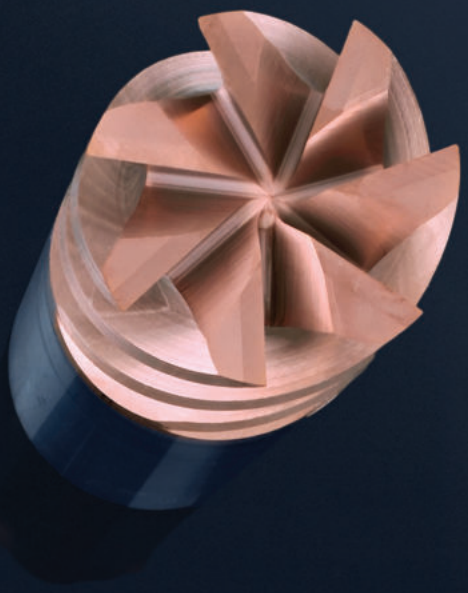
More TOOLING
More APPLICATIONS
More CHIPS



2023 Product Catalog

Helical

Let Helical Impress You

Helical

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 beginning-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

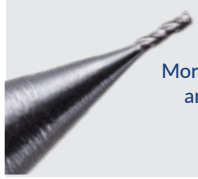
Our team of experienced engineers live and breathe cutting tools and are enthusiastic about maximizing your shop floor productivity. Whether it be in your shop or over the phone, we have **knowledgeable technical field representatives and in-house tool experts** available to help you with tool selection,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

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

HARVEY TOOL

Think Harvey Tool First

More than 27,000 miniature and specialty end mills. Ship today, in your machine tomorrow.

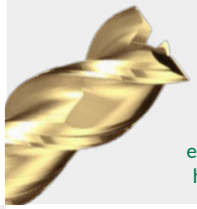


HARVEY PERFORMANCE COMPANY

Helical

Let Helical Impress You

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



MICRO 100

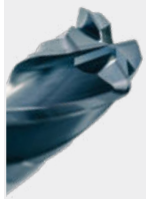
Make More with Micro 100

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

TITAN USA
MADE IN THE U.S.A.

Trust in Titan USA

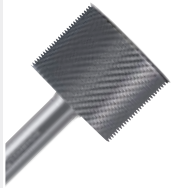
Broad assortment of premium quality fully stocked cutting tools of exceptional value.



COREHOG

Innovative Tools for Innovative Materials

The industry's most innovative and advanced composite and honeycomb core cutting tools.



Let Helical Impress You

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.

Our Tools Deliver

+ Superior Part Finish
+ Extended Tool Life
+ Improved Bottom Line
+ Increased Material Removal Rates

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 **more than 8,800 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 301).

11 End Mills for Aluminum Alloys & Non-Ferrous Materials

75 End Mills for Steels, Tool Steels & Cast Iron

171 End Mills for Stainless Steels & High Temp Alloys

228 End Mills for Nickel Alloys

235 End Mills for Titanium & Titanium Alloys

271 High Feed End Mills

286 Specialty Profiles

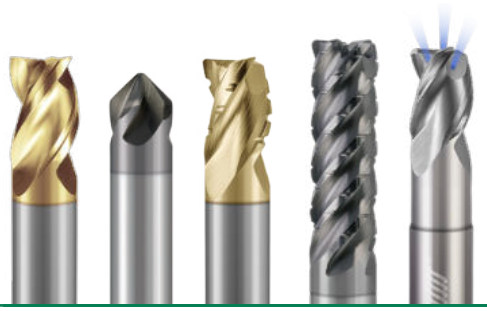
Send Your Shopping Cart Directly to Your Distributor

Did you know that you can place a Helical Solutions order directly to your distributor from our website? After creating your **Helicaltool.com** account, you're able to build and send "shopping carts" directly to your participating distributor to order. Learn more on page 304.

- Shopping Cart
- MAP Connection
- Check Stock
- Table Filtering
- Build a Tool
- Smart-Search

END MILLS FOR ALUMINUM

Aluminum Alloys & Non-Ferrous Materials



ROUGHERS

				PG
H35ALV-C-3	3 Flute	Corner Radius	35° Helix - Chipbreaker Rougher - Variable Pitch	11
H35ALV-C-RN-3	3 Flute	Corner Radius	35° Helix - Chipbreaker Rougher - Variable Pitch - Reduced Neck	14
H45AL-C-3	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher New Items!	16
H45AL-C-RN-3	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher - Reduced Neck New Items!	18
HVAL-C-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - HEM	20

2 FLUTE

				PG
HMG-RN-2	2 Flute	Square	High Balance - Reduced Neck	22
HMG-RN-2	2 Flute	Corner Radius	High Balance - Reduced Neck	23
H45AL-2	2 Flute	Square	45° Helix	25
H45AL-2	2 Flute	Ball	45° Helix	27
H45AL-2	2 Flute	Corner Radius	45° Helix	28
H45AL-RN-2	2 Flute	Square	45° Helix - Reduced Neck	29
H45AL-RN-2	2 Flute	Ball	45° Helix - Reduced Neck	30

3 FLUTE

				PG
HMGC-R N-3	3 Flute	Square	Coolant Through - High Balance - Reduced Neck	32
HMGC-RN-3	3 Flute	Corner Radius	Coolant Through - High Balance - Reduced Neck	33
H35AL-3	3 Flute	Square	35° Helix	35
MH35AL-3	3 Flute	Square	35° Helix Metric	37
H35AL-3	3 Flute	Corner Radius	35° Helix	38
MH35AL-3	3 Flute	Corner Radius	35° Helix Metric	41
H35AL-RN-3	3 Flute	Square	35° Helix - Reduced Neck	42
H35AL-RN-3	3 Flute	Corner Radius	35° Helix - Reduced Neck New!	44
H40ALV-3	3 Flute	Square	40° Helix - Variable Pitch New Items!	46
H40ALV-3	3 Flute	Ball	40° Helix - Variable Pitch New Items!	48
H40ALV-3	3 Flute	Corner Radius	40° Helix - Variable Pitch New Items!	50
H40ALV-RN-3	3 Flute	Square	40° Helix - Variable Pitch - Reduced Neck New Items!	55
H40ALV-RN-3	3 Flute	Ball	40° Helix - Variable Pitch - Reduced Neck New Items!	57
H40ALV-RN-3	3 Flute	Corner Radius	40° Helix - Variable Pitch - Reduced Neck New Items!	59
H45AL-3	3 Flute	Square	45° Helix New Items!	63
H45AL-3	3 Flute	Corner Radius	45° Helix New Items!	65
H45AL-RN-3	3 Flute	Square	45° Helix - Reduced Neck	68

5 FLUTE

				PG
HVAL-5	5 Flute	Corner Radius	Variable Pitch - HEM	70

FINISHERS

				PG
HMAF-AL-3	3 Flute	Lens	Multi-Axis Finisher	72
HMAF-AL-4	4 Flute	Taper	Multi-Axis Finisher	73
HMAF-AL-4	4 Flute	Oval	Multi-Axis Finisher	74

END MILLS FOR STEELS

Steels, Tool Steels, & Cast Iron

ROUGHERS

				PG
HSVR-C-4	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	75
HSVR-C-RN-4	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	77
HEV-C-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	79
HEV-C-RN-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck New Items!	82
HEV-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	84
HEV-C-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	87
HEV-C-RN-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	89
HXVR	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch	91
HXVR-RN	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch - Reduced Neck	92

3 FLUTE

				PG
HSV-3	3 Flute	Square	Variable Pitch	95
HSV-3	3 Flute	Corner Radius	Variable Pitch	96
HST-3	3 Flute	Ball		98
HST-3	3 Flute	Corner Radius		99
HST-RN-3	3 Flute	Ball	Reduced Neck	100
HST-RN-3	3 Flute	Corner Radius	Reduced Neck	101

4 FLUTE

				PG
HSV-4	4 Flute	Square	Variable Pitch	103
MHSV-4	4 Flute	Square	Variable Pitch Metric	105
HSV-4	4 Flute	Ball	Variable Pitch	106
MHSV-4	4 Flute	Ball	Variable Pitch Metric	108
HSV-4	4 Flute	Corner Radius	Variable Pitch	109
MHSV-4	4 Flute	Corner Radius	Variable Pitch Metric	115
HSV-RN-4	4 Flute	Square	Variable Pitch - Reduced Neck	116
HSV-RN-4	4 Flute	Ball	Variable Pitch - Reduced Neck	117
HSV-RN-4	4 Flute	Corner Radius	Variable Pitch - Reduced Neck	119

5 FLUTE

				PG
HEV-5	5 Flute	Square	Variable Pitch	123
MHEV-5	5 Flute	Square	Variable Pitch Metric	125
HEV-5	5 Flute	Corner Radius	Variable Pitch	126
MHEV-5	5 Flute	Corner Radius	Variable Pitch Metric	132
HEV-RN-5	5 Flute	Square	Variable Pitch - Reduced Neck New Items!	133
HEV-RN-5	5 Flute	Corner Radius	Variable Pitch - Reduced Neck	135

END MILLS FOR STEELS Steels, Tool Steels, & Cast Iron (cont.)

6 FLUTE

				PG
HEV-6	6 Flute	Square	Variable Pitch	139
MHEV-6	6 Flute	Square	Variable Pitch Metric	141
HEV-6	6 Flute	Ball	Variable Pitch	142
HEV-6	6 Flute	Corner Radius	Variable Pitch New Items!	143
MHEV-6	6 Flute	Corner Radius	Variable Pitch Metric	148
HEV-RN-6	6 Flute	Square	Variable Pitch - Reduced Neck New Items!	149
HEV-RN-6	6 Flute	Ball	Variable Pitch - Reduced Neck New Items!	150
HEV-RN-6	6 Flute	Corner Radius	Variable Pitch - Reduced Neck	151

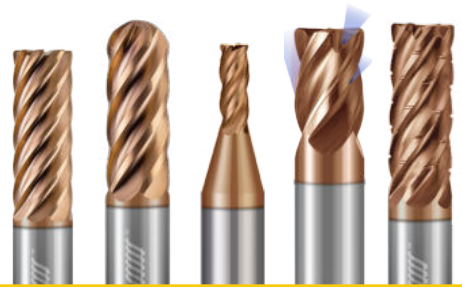
7 FLUTE

				PG
HEV-7	7 Flute	Square	Variable Pitch	153
MHEV-7	7 Flute	Square	Variable Pitch Metric	155
HEV-7	7 Flute	Corner Radius	Variable Pitch New Items!	156
MHEV-7	7 Flute	Corner Radius	Variable Pitch Metric	159
HEV-RN-7	7 Flute	Square	Variable Pitch - Reduced Neck	161
HEV-RN-7	7 Flute	Corner Radius	Variable Pitch - Reduced Neck	162

FINISHERS

				PG
HEF-5	5 Flute	Square	Finisher	164
HSF-7	7 Flute	Square	Finisher	167
HXF	Multi-Flute	Corner Radius	Finisher	169

END MILLS FOR STAINLESS STEELS & HIGH TEMP ALLOYS



ROUGHERS

				PG
HEVC-C-4	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Coolant Through	171
HEV-C-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	173
HEV-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	175
HEVC-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Coolant Through	177
HEV-C-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	178
HXVR	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch	180

4 FLUTE

				PG
HSV-4 / HSM-4	4 Flute	Square	Variable Pitch New Items!	181
HSV-4	4 Flute	Ball	Variable Pitch New Items!	183
HSV-4 / HSM-4	4 Flute	Corner Radius	Variable Pitch New Items!	185
HSV-RN-4	4 Flute	Square	Variable Pitch - Reduced Neck New!	189
HSV-RN-4	4 Flute	Ball	Variable Pitch - Reduced Neck New!	190
HSV-RN-4	4 Flute	Corner Radius	Variable Pitch - Reduced Neck New!	191
HEVC-4	4 Flute	Corner Radius	Variable Pitch - Coolant Through	192

END MILLS FOR STAINLESS STEELS & HIGH TEMP ALLOYS (cont.)

5 FLUTE

				PG
HEV-5 / HSM-5	5 Flute	Square	Variable Pitch New Items!	194
HEV-5 / HSM-5	5 Flute	Corner Radius	Variable Pitch New Items!	196
HEV-RN-5	5 Flute	Square	Variable Pitch - Reduced Neck New!	201
HEV-RN-5	5 Flute	Corner Radius	Variable Pitch - Reduced Neck New!	202

6 FLUTE

				PG
HEV-6	6 Flute	Square	Variable Pitch New Items!	204
HEVC-6	6 Flute	Square	Variable Pitch - Coolant Through	206
HEV-6	6 Flute	Ball	Variable Pitch New Items!	207
HEV-6	6 Flute	Corner Radius	Variable Pitch New Items!	208
HEVC-6	6 Flute	Corner Radius	Variable Pitch - Coolant Through	211
HEV-RN-6	6 Flute	Square	Variable Pitch - Reduced Neck New!	212
HEV-RN-6	6 Flute	Ball	Variable Pitch - Reduced Neck New!	213
HEV-RN-6	6 Flute	Corner Radius	Variable Pitch - Reduced Neck New!	214

7 FLUTE

				PG
HEV-7	7 Flute	Square	Variable Pitch New Items!	215
HEV-7	7 Flute	Corner Radius	Variable Pitch New Items!	216

FINISHERS

				PG
HCF-TN-4	4 Flute	Ball	Contour Finishers - Tapered Neck New!	218
HMAF-FE-4	4 Flute	Lens	Multi-Axis Finisher	220
HMAF-FE-4	4 Flute	Taper	Multi-Axis Finisher New!	221
HMAF-FE-4	4 Flute	Oval	Multi-Axis Finisher New!	222
HMAF-FE-6	6 Flute	Taper	Multi-Axis Finisher	224
HMAF-FE-6	6 Flute	Oval	Multi-Axis Finisher	225
HXF	Multi-Flute	Corner Radius	Finisher	227

END MILLS FOR NICKEL ALLOYS

6 FLUTE

				PG
HVNI-6	6 Flute	Corner Radius	Variable Pitch New Items!	228
HVNIC-6	6 Flute	Corner Radius	Variable Pitch - Coolant Through New!	230

8 FLUTE

				PG
HVNI-8	8 Flute	Corner Radius	Variable Pitch - HEM New Items!	232

END MILLS FOR TITANIUM

Titanium & Titanium Alloys

ROUGHERS

				PG
HEV-C-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	235
HVTI-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - HEM	238
HVTIC-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - HEM - Coolant Through	239
HEV-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	241
HEV-C-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch New Items!	243

5 FLUTE

				PG
HEV-5	5 Flute	Corner Radius	Variable Pitch	245
MHEV-5	5 Flute	Corner Radius	Variable Pitch Metric	251

6 FLUTE

				PG
HVTI-6	6 Flute	Square	Variable Pitch - HEM New Items!	252
HVTI-6	6 Flute	Ball	Variable Pitch - HEM New Items!	253
HVTI-6	6 Flute	Corner Radius	Variable Pitch - HEM New Items!	254
HVTIC-6	6 Flute	Corner Radius	Variable Pitch - HEM - Coolant Through	257
HEV-6	6 Flute	Ball	Variable Pitch	259
HEV-6	6 Flute	Corner Radius	Variable Pitch New Items!	260
MHEV-6	6 Flute	Corner Radius	Variable Pitch Metric	265

7 FLUTE

				PG
HEV-7	7 Flute	Corner Radius	Variable Pitch New Items!	266
MHEV-7	7 Flute	Corner Radius	Variable Pitch Metric	269

FINISHERS

				PG
HXF	Multi-Flute	Corner Radius	Finisher	270

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.

AUTODESK® FUSION 360 · AUTODESK® HSM · ESPRIT CAM System · GibbsCAM® · SolidCAM iMachining – The Revolution in CAM! · Mastercam · CAMWorks

Download Now: harveyperformance.com/tool-libraries

HIGH FEED END MILLS

ALUMINUM

		PG
HFAL-2	Reduced Neck New Items!	271
MHFAL-2	Reduced Neck Metric	272

FOR STEELS UP TO 45 RC

		PG
HFV	Steels Up to 45 Rc - Variable Pitch - Reduced Neck New Items!	274
MHFV	Steels Up to 45 Rc - Variable Pitch - Reduced Neck Metric New Items!	276
HFVC	Steels Up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck	277
MHFVC	Steels Up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck Metric	278

COMBINATION FEED & HEM

			PG
HEVF-C-4	4 Flute	Chipbreaker Rougher - Variable Pitch	280
HEVFC-C-4	4 Flute	Chipbreaker Rougher - Variable Pitch - Coolant Through New!	281
HEVF-C-5	5 Flute	Chipbreaker Rougher - Variable Pitch New Items!	283
HEVFC-C-5	5 Flute	Chipbreaker Rougher - Variable Pitch - Coolant Through New!	284

SPECIALTY PROFILES

TAPERED END MILLS

				PG
HTPR-4	4 Flute	Ball	Variable Pitch	286
HTPR-5	5 Flute	Square	Variable Pitch	288

CHAMFER MILLS

				PG
HCM	2 & 4 Flute	Chamfer	Straight Flute New Items!	290
HPCM	2 & 4 Flute	Chamfer	Helical Flute - High Performance - Pointed	292
HPCM	3 & 5 Flute	Chamfer	Helical Flute - High Performance - Tipped Off New Items!	293

COMBINATION CHAMFER / END MILLS

				PG
HCCM	4 Flute	Combo	Combination Chamfer / End Mill - High Performance	296

CORNER ROUNDING END MILLS

			PG
HPCR	3 & 5 Flute	Corner Rounding End Mills - Helical Flute - High Performance New!	298

TECHNICAL INFORMATION

Custom Tooling	301

OUR COATINGS

	Nplus	Zplus	Tplus	Aplus
Application Benefits	Nplus is specially engineered for optimal performance and extended tool life in aluminum alloys and non-ferrous materials, especially high-silicon aluminums and copper alloys. Its high hardness and excellent edge retention provide improved wear resistance.	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-upedge in softer, gummy alloys.	Tplus is an ideal choice for increased wear resistance and edge strength in stainless steels, high temp alloys, and hardened steels up to 65Rc. Also an excellent choice for increased wear resistance in a wide variety of ferrous materials.	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 and titanium alloys.
Materials	Wrought Aluminum, Cast Aluminum, Graphite, and Other Non-Ferrous Alloys	Wrought Aluminum, Cast Aluminum, Graphite, and Other Non-Ferrous Alloys	Stainless Steels, High Temp Alloys, Hardened Steels	Low Alloy Steels, Medium Alloy Steels, Tool Steels, Cast Iron, and Titanium
Coating Appearance	light grey/silver 	light gold / champagne 	copper 	black / grey 
Max. Usage Temp.	2,012° F	1,110° F	2,192° F	2,012° F
Microhardness (HV 0.05)	4079 (40 GPa)	2243 (22 GPa)	4487 (44 GPa)	4079 (40 GPa)
Coefficient of Friction	0.45	0.40	0.35	0.45

The Advantageous Qualities of Helical Solutions' Nplus Coating

In The Loupe
MACHINISTS BLOG

Is Nplus coating the right option for you, and your next project? Let us answer that question for you in our "In the Loupe" blog post: *The Advantageous Qualities of Helical Solutions' Nplus Coating*." There, we bring you through the many benefits of this unique coating option, but also tell you when Nplus may not be your best option.

www.harveyperformance.com/in-the-loupe/nplus-coating/

SCAN TO READ

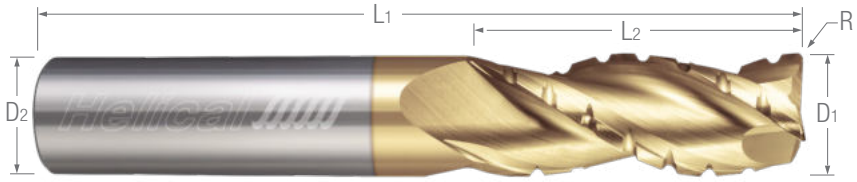
H35ALV-C-3

HEM

3 FLUTE - CORNER RADIUS

35° Helix - Variable Pitch - Chipbreaker Rougher

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	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
	1/8	**.010**	3/8	2	3	**82103**	**82104**	H35ALV-C-030-30125-R.010
	1/8	**.010**	1/2	2-1/2	3	**82105**	**82106**	H35ALV-C-040-30125-R.010
	1/8	**.010**	5/8	2-1/2	3	**84792**	**84793**	H35ALV-C-050-30125-R.010
	1/8	**.010**	3/4	2-1/2	3	**84794**	**84795**	H35ALV-C-060-30125-R.010
	1/8	**.030**	1/4	1-1/2	3	**84796**	**84797**	H35ALV-C-020-30125-R.030
	1/8	**.030**	3/8	2	3	**84798**	**84799**	H35ALV-C-030-30125-R.030
	1/8	**.030**	1/2	2-1/2	3	**84800**	**84801**	H35ALV-C-040-30125-R.030
3/16	3/16	**.010**	5/16	2	3	**82107**	**82108**	H35ALV-C-016-30187-R.010
	3/16	**.010**	7/16	2	3	**84802**	**84803**	H35ALV-C-023-30187-R.010
	3/16	**.010**	9/16	2-1/2	3	**82109**	**82110**	H35ALV-C-030-30187-R.010
	3/16	**.010**	3/4	2-1/2	3	**82111**	**82112**	H35ALV-C-040-30187-R.010
	3/16	**.010**	1	2-1/2	3	**84804**	**84805**	H35ALV-C-053-30187-R.010
	3/16	**.010**	1-3/16	3	3	**84806**	**84807**	H35ALV-C-063-30187-R.010
	3/16	**.030**	5/16	2	3	**84808**	**84809**	H35ALV-C-016-30187-R.030
	3/16	**.030**	9/16	2-1/2	3	**84810**	**84811**	H35ALV-C-030-30187-R.030
	3/16	**.030**	3/4	2-1/2	3	**84812**	**84813**	H35ALV-C-040-30187-R.030
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
	1/4	**.015**	1/2	2-1/2	3	**82115**	**82116**	H35ALV-C-020-30250-R.015
	1/4	**.015**	3/4	2-1/2	3	**82117**	**82118**	H35ALV-C-030-30250-R.015
	1/4	**.020**	1/2	2-1/2	3	**82119**	**82120**	H35ALV-C-020-30250-R.020
	1/4	**.020**	3/4	2-1/2	3	**82121**	**82122**	H35ALV-C-030-30250-R.020
	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
	1/4	**.030**	1	3	3	**82001**	**82002**	H35ALV-C-040-30250-R.030
	1/4	**.030**	1-1/4	3	3	**84814**	**84815**	H35ALV-C-050-30250-R.030

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 15

3 FLUTE - CORNER RADIUS

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

H35ALV-C-3

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
5/16	5/16	.010	7/16	2	3	84816	84817	H35ALV-C-014-30312-R.010
	5/16	.010	3/4	2-1/2	3	84818	84819	H35ALV-C-024-30312-R.010
	5/16	.010	1	3	3	84820	84821	H35ALV-C-032-30312-R.010
	5/16	.030	7/16	2	3	84822	84823	H35ALV-C-014-30312-R.030
	5/16	.030	3/4	2-1/2	3	84824	84825	H35ALV-C-024-30312-R.030
	5/16	.030	1	3	3	84826	84827	H35ALV-C-032-30312-R.030
3/8	3/8	.010	1/2	2	3	82123	82124	H35ALV-C-013-30375-R.010
	3/8	.010	1	3	3	82125	82126	H35ALV-C-026-30375-R.010
	3/8	.010	1-1/4	3-1/2	3	82127	82128	H35ALV-C-033-30375-R.010
	3/8	.010	1-1/2	4	3	84828	84829	H35ALV-C-040-30375-R.010
	3/8	.020	1/2	2	3	82129	82130	H35ALV-C-013-30375-R.020
	3/8	.020	1	3	3	82131	82132	H35ALV-C-026-30375-R.020
	3/8	.020	1-1/4	3-1/2	3	82133	82134	H35ALV-C-033-30375-R.020
	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	.030	1-1/2	4	3	84830	84831	H35ALV-C-040-30375-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
1/2	1/2	.010	5/8	2-1/2	3	82135	82136	H35ALV-C-012-30500-R.010
	1/2	.010	1	3	3	82137	82138	H35ALV-C-020-30500-R.010
	1/2	.010	1-1/4	3	3	82139	82140	H35ALV-C-025-30500-R.010
	1/2	.010	1-5/8	4	3	82141	82142	H35ALV-C-032-30500-R.010
	1/2	.020	5/8	2-1/2	3	82143	82144	H35ALV-C-012-30500-R.020
	1/2	.020	1	3	3	82145	82146	H35ALV-C-020-30500-R.020
	1/2	.020	1-1/4	3	3	82147	82148	H35ALV-C-025-30500-R.020
	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
	1/2	.030	2-1/2	5	3	82151	82152	H35ALV-C-050-30500-R.030
	1/2	.030	3-1/8	6	3	84832	84833	H35ALV-C-062-30500-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
	1/2	.125	5/8	2-1/2	3	84834	84835	H35ALV-C-012-30500-R.125
	1/2	.125	1	3	3	84836	84837	H35ALV-C-020-30500-R.125
	1/2	.125	1-1/4	3	3	84838	84839	H35ALV-C-025-30500-R.125
	1/2	.125	1-5/8	4	3	84840	84841	H35ALV-C-032-30500-R.125

* .0003 max TIR

continued on next page

H35ALV-C-3

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 $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
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
3/4	3/4	**.010**	1-5/8	4	3	**82153**	**82154**	H35ALV-C-021-30750-R.010
	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
	3/4	**.125**	1-5/8	4	3	**82157**	**82158**	H35ALV-C-021-30750-R.125
	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	**.030**	3-1/4	6	3	**84842**	**84843**	H35ALV-C-032-31000-R.030
	1	**.060**	2	5	3	**82057**	**82058**	H35ALV-C-020-31000-R.060
	1	**.060**	3-1/4	6	3	**84844**	**84845**	H35ALV-C-032-31000-R.060
	1	**.125**	2	5	3	**84846**	**84847**	H35ALV-C-020-31000-R.125
	1	**.250**	2	5	3	**84848**	**84849**	H35ALV-C-020-31000-R.250

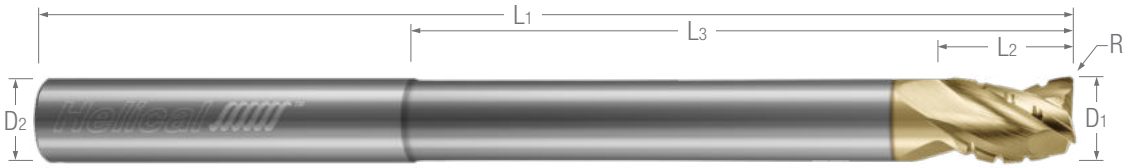
* .0003 max TIR

3 FLUTE - CORNER RADIUS

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

H35ALV-C-RN-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Zplus* Coated	Tool Description
1/8	1/8	.010	5/32	3	1/2	.118	3	84850	84851	H35ALV-C-RN-040-30125-R.010
	1/8	.010	5/32	3	5/8	.118	3	84852	84853	H35ALV-C-RN-050-30125-R.010
	1/8	.010	5/32	3	3/4	.118	3	84854	84855	H35ALV-C-RN-060-30125-R.010
3/16	3/16	.010	7/32	3	3/4	.178	3	84856	84857	H35ALV-C-RN-040-30187-R.010
	3/16	.010	7/32	3	1	.178	3	84858	84859	H35ALV-C-RN-053-30187-R.010
	3/16	.010	7/32	3	1-1/8	.178	3	84860	84861	H35ALV-C-RN-060-30187-R.010
1/4	1/4	.010	3/8	4	3/4	.237	3	84862	84863	H35ALV-C-RN-030-30250-R.010
	1/4	.010	3/8	4	1-1/8	.237	3	82161	82162	H35ALV-C-RN-045-30250-R.010
	1/4	.010	3/8	4	1-5/8	.237	3	82163	82164	H35ALV-C-RN-065-30250-R.010
	1/4	.010	3/8	4	2-1/8	.237	3	82165	82166	H35ALV-C-RN-085-30250-R.010
	1/4	.010	3/8	4	2-1/2	.237	3	82167	82168	H35ALV-C-RN-100-30250-R.010
5/16	5/16	.030	7/16	4	1-7/16	.296	3	84864	84865	H35ALV-C-RN-045-30312-R.030
	5/16	.030	7/16	4	1-3/4	.296	3	84866	84867	H35ALV-C-RN-056-30312-R.030
	5/16	.030	7/16	4	2-1/8	.296	3	84868	84869	H35ALV-C-RN-068-30312-R.030
3/8	3/8	.030	1/2	4	1-1/8	.356	3	82169	82170	H35ALV-C-RN-030-30375-R.030
	3/8	.030	1/2	4	1-5/8	.356	3	82171	82172	H35ALV-C-RN-043-30375-R.030
	3/8	.030	1/2	4	2-1/8	.356	3	82173	82174	H35ALV-C-RN-056-30375-R.030
	3/8	.030	1/2	5	2-1/2	.356	3	82175	82176	H35ALV-C-RN-066-30375-R.030
1/2	1/2	.030	5/8	4	1-3/8	.475	3	82177	82178	H35ALV-C-RN-027-30500-R.030
	1/2	.030	5/8	4	1-3/4	.475	3	82179	82180	H35ALV-C-RN-035-30500-R.030
	1/2	.030	5/8	4	2-1/4	.475	3	82181	82182	H35ALV-C-RN-045-30500-R.030
	1/2	.030	5/8	6	3-3/8	.475	3	82183	82184	H35ALV-C-RN-067-30500-R.030
	1/2	.030	5/8	6	4-1/4	.475	3	82185	82186	H35ALV-C-RN-085-30500-R.030
	1/2	.060	5/8	4	1-3/8	.475	3	82187	82188	H35ALV-C-RN-027-30500-R.060
	1/2	.060	5/8	4	1-3/4	.475	3	82189	82190	H35ALV-C-RN-035-30500-R.060
	1/2	.060	5/8	4	2-1/4	.475	3	82191	82192	H35ALV-C-RN-045-30500-R.060
	1/2	.060	5/8	6	3-3/8	.475	3	82193	82194	H35ALV-C-RN-067-30500-R.060
	1/2	.060	5/8	6	4-1/4	.475	3	82195	82196	H35ALV-C-RN-085-30500-R.060

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 15

H35ALV-C-RN-3

3 FLUTE - CORNER RADIUS

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

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
3/4	3/4	**.030**	1	4	2	.712	3	**82197**	**82198**	H35ALV-C-RN-026-30750-R.030
	3/4	**.030**	1	6	2-1/2	.712	3	**82199**	**82200**	H35ALV-C-RN-033-30750-R.030
	3/4	**.030**	1	6	3	.712	3	**82201**	**82202**	H35ALV-C-RN-040-30750-R.030
	3/4	**.030**	1	6	3-3/8	.712	3	**82203**	**82204**	H35ALV-C-RN-045-30750-R.030
	3/4	**.060**	1	4	2	.712	3	**82205**	**82206**	H35ALV-C-RN-026-30750-R.060
	3/4	**.060**	1	6	2-1/2	.712	3	**82207**	**82208**	H35ALV-C-RN-033-30750-R.060
	3/4	**.060**	1	6	3	.712	3	**82209**	**82210**	H35ALV-C-RN-040-30750-R.060
	3/4	**.060**	1	6	3-3/8	.712	3	**82211**	**82212**	H35ALV-C-RN-045-30750-R.060

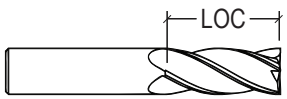
* .0003 max TIR

H35ALV-C-3 / H35ALV-C-RN-3

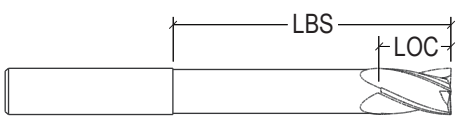
Material Guide		SFM	Inches per Tooth (IPT)													
			1/8		3/16		1/4		3/8		1/2		3/4		1	
			Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0013	.0011	.0020	.0014	.0026	.0021	.0039	.0027	.0051	.0039	.0073	.0050	.0094
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

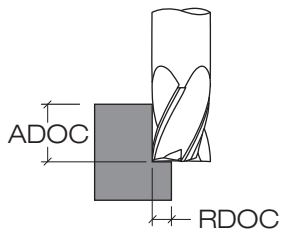
NOTES:
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



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

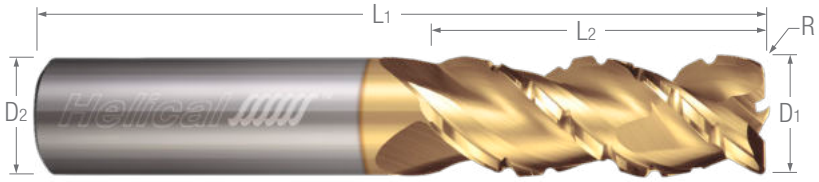
3 FLUTE - CORNER RADIUS

New Items!

45° Helix - Chipbreaker Rougher

H45AL-C-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description	
1/8	1/8	.010	1/4	1-1/2	3	86562	86563	H45AL-C-S-30125-R.010	new
	1/8	.010	3/8	2	3	86564	86565	H45AL-C-SR-30125-R.010	new
	1/8	.010	1/2	2-1/2	3	86566	86567	H45AL-C-R-30125-R.010	new
3/16	3/16	.010	7/16	2	3	86568	86569	H45AL-C-SR-30187-R.010	new
	3/16	.010	9/16	2-1/2	3	86570	86571	H45AL-C-R-30187-R.010	new
	3/16	.010	3/4	2-1/2	3	86572	86573	H45AL-C-M-30187-R.010	new
1/4	1/4	.010	1/2	2-1/2	3	82717	82718	H45AL-C-SR-30250-R.010	
	1/4	.010	3/4	2-1/2	3	82719	82720	H45AL-C-R-30250-R.010	
	1/4	.010	1	3	3	82721	82722	H45AL-C-M-30250-R.010	
	1/4	.010	1-1/4	3	3	86574	86575	H45AL-C-L-30250-R.010	new
	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	13/16	2-1/2	3	29225	29227	H45AL-C-R-30312-R.020	
	5/16	.020	1	3	3	29240	29242	H45AL-C-M-30312-R.020	
	5/16	.020	1-1/4	3	3	86576	86577	H45AL-C-L-30312-R.020	new
3/8	3/8	.010	1/2	2	3	86578	86579	H45AL-C-S-30375-R.010	new
	3/8	.010	3/4	2-1/2	3	86580	86581	H45AL-C-SR-30375-R.010	new
	3/8	.010	1	3	3	86582	86583	H45AL-C-R-30375-R.010	new
	3/8	.010	1-1/4	3-1/2	3	86584	86585	H45AL-C-M-30375-R.010	new
	3/8	.010	1-1/2	4	3	86586	86587	H45AL-C-L-30375-R.010	new
	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	
	3/8	.060	1/2	2	3	82723	82724	H45AL-C-S-30375-R.060	
	3/8	.060	1	3	3	82725	82726	H45AL-C-R-30375-R.060	
	3/8	.060	1-1/4	3-1/2	3	82727	82728	H45AL-C-M-30375-R.060	

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 19

H45AL-C-3

New Items!

3 FLUTE - CORNER RADIUS

45° Helix - Chipbreaker Rougher (cont.)

continued from previous page

	Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
new	1/2	1/2	.010	5/8	2-1/2	3	86588	86589	H45AL-C-S-30500-R.010
		1/2	.010	1	3	3	82729	82730	H45AL-C-SR-30500-R.010
		1/2	.010	1-1/4	3	3	82731	82732	H45AL-C-R-30500-R.010
		1/2	.010	1-5/8	4	3	82733	82734	H45AL-C-M-30500-R.010
		1/2	.010	2	4	3	82735	82736	H45AL-C-L-30500-R.010
new		1/2	.020	5/8	2-1/2	3	86590	86591	H45AL-C-S-30500-R.020
new		1/2	.020	1	3	3	86592	86593	H45AL-C-SR-30500-R.020
new		1/2	.020	1-1/4	3	3	86594	86595	H45AL-C-R-30500-R.020
new		1/2	.020	1-5/8	4	3	86596	86597	H45AL-C-M-30500-R.020
new		1/2	.020	2	4	3	86598	86599	H45AL-C-L-30500-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
new		1/2	.060	5/8	2-1/2	3	86600	86601	H45AL-C-S-30500-R.060
		1/2	.060	1	3	3	82737	82738	H45AL-C-SR-30500-R.060
		1/2	.060	1-1/4	3	3	82739	82740	H45AL-C-R-30500-R.060
		1/2	.060	1-5/8	4	3	82741	82742	H45AL-C-M-30500-R.060
		1/2	.060	2	4	3	82743	82744	H45AL-C-L-30500-R.060
	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
		5/8	.030	2-1/2	5	3	29525	29527	H45AL-C-L-30625-R.030
new		5/8	.060	3/4	3	3	86602	86603	H45AL-C-S-30625-R.060
new		5/8	.060	1-5/8	3-1/2	3	86604	86605	H45AL-C-R-30625-R.060
new		5/8	.060	2-1/8	4	3	86606	86607	H45AL-C-M-30625-R.060
	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
		3/4	.030	4	6-1/2	3	29630	29632	H45AL-C-X-30750-R.030
		3/4	.060	1-5/8	4	3	82745	82746	H45AL-C-R-30750-R.060
		3/4	.060	2-1/4	5	3	82747	82748	H45AL-C-M-30750-R.060
		3/4	.060	3-1/4	6	3	82749	82750	H45AL-C-L-30750-R.060
	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
new		1	.060	2	5	3	86608	86609	H45AL-C-R-31000-R.060
new		1	.060	2-5/8	6	3	86610	86611	H45AL-C-M-31000-R.060
new		1	.060	3-1/4	6	3	86612	86613	H45AL-C-L-31000-R.060

* .0003 max TIR

3 FLUTE - CORNER RADIUS New Items!

45° Helix - Chipbreaker Rougher - Reduced Neck

HEM **H45AL-C-RN-3**

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Zplus* Coated	Tool Description	
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	1-5/8	.237	3	82751	82752	H45AL-C-RN-A-30250-R.020	
	1/4	.020	3/8	4	2-1/8	.237	3	28135	28137	H45AL-C-RN-M-30250-R.020	
	1/4	.020	3/8	4	2-1/2	.237	3	82753	82754	H45AL-C-RN-ML-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	1-5/8	.356	3	82755	82756	H45AL-C-RN-A-30375-R.020	
	3/8	.020	1/2	4	2-1/8	.356	3	28225	28227	H45AL-C-RN-M-30375-R.020	
	3/8	.020	1/2	5	2-1/2	.356	3	82757	82758	H45AL-C-RN-ML-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	5	2-3/4	.475	3	86614	86615	H45AL-C-RN-ML-30500-R.030	new
	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	
	1/2	.060	5/8	4	1-3/8	.475	3	86622	86623	H45AL-C-RN-R-30500-R.060	new
	1/2	.060	5/8	4	1-3/4	.475	3	86624	86625	H45AL-C-RN-A-30500-R.060	new
	1/2	.060	5/8	4	2-1/4	.475	3	86616	86617	H45AL-C-RN-M-30500-R.060	new
	1/2	.060	5/8	5	2-3/4	.475	3	86634	86635	H45AL-C-RN-ML-30500-R.060	new
	1/2	.060	5/8	6	3-3/8	.475	3	86618	86619	H45AL-C-RN-L-30500-R.060	new
	1/2	.060	5/8	6	4-1/4	.475	3	86620	86621	H45AL-C-RN-X-30500-R.060	new
5/8	5/8	.030	3/4	6	2-3/8	.593	3	28360	28362	H45AL-C-RN-M-30625-R.030	new
	5/8	.030	3/4	6	3-3/8	.593	3	28375	28377	H45AL-C-RN-L-30625-R.030	new
	5/8	.030	3/4	6	4-1/8	.593	3	86626	86627	H45AL-C-RN-LX-30625-R.030	new
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	
	3/4	.060	1	4	2	.712	3	86628	86629	H45AL-C-RN-R-30750-R.060	new
	3/4	.060	1	6	2-1/2	.712	3	86630	86631	H45AL-C-RN-M-30750-R.060	new
	3/4	.060	1	6	3-3/8	.712	3	86632	86633	H45AL-C-RN-L-30750-R.060	new

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 19

H45AL-C-RN-3

New Items!

3 FLUTE - CORNER RADIUS

45° Helix - Chipbreaker Rougher - Reduced Neck (cont.)

continued from previous page

	Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Zplus* Coated	Tool Description
new	1	1	**.030**	1-1/4	5	2-5/8	.950	3	**28465**	28467	H45AL-C-RN-R-31000-R.030
new		1	**.030**	1-1/4	6	3-3/8	.950	3	**28480**	28482	H45AL-C-RN-M-31000-R.030
new		1	**.030**	1-1/4	7	4-3/8	.950	3	**28495**	28497	H45AL-C-RN-L-31000-R.030

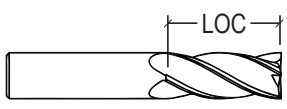
* .0003 max TIR

H45AL-C-3 / H45AL-C-RN-3

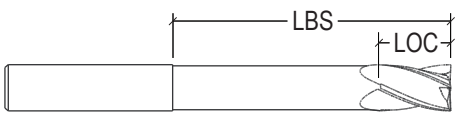
Material Guide		SFM	Inches per Tooth (IPT)													
			1/8		3/16		1/4		3/8		1/2		3/4		1	
			Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0015	.0011	.0022	.0014	.0029	.0021	.0043	.0028	.0056	.0040	.0081	.0051	.0103
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

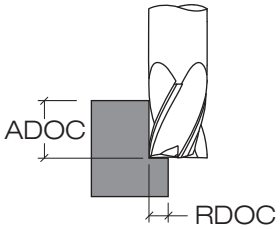
NOTES:
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



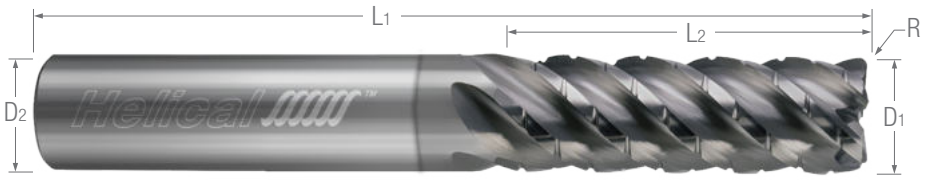
Key: LOC=Length of Cut ADOC=Axial Depth of Cut RDOC=Radial Depth of Cut

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch - For High Efficency Milling

HVAL-C-5

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of aerospace aluminum alloys with excellent performance in other non-ferrous alloys
- Excellent tool life and maximum material removal rates proven through extensive testing
- Engineered with variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- Center cutting
- h6 shank tolerance for high precision tool holders
- N*plus* coating for maximum performance in abrasive aluminums and extended tool life in a wide variety of non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	N*plus* Coated	Tool Description
1/8	1/4	**.010**	1/4	2-1/2	5	**84197**	**84198**	HVAL-C-020-50125-R.010
	1/4	**.010**	3/8	2-1/2	5	**84199**	**84200**	HVAL-C-030-50125-R.010
	1/4	**.010**	1/2	2-1/2	5	**84201**	**84202**	HVAL-C-040-50125-R.010
	1/4	**.030**	1/4	2-1/2	5	**84203**	**84204**	HVAL-C-020-50125-R.030
	1/4	**.030**	3/8	2-1/2	5	**84205**	**84206**	HVAL-C-030-50125-R.030
	1/4	**.030**	1/2	2-1/2	5	**84207**	**84208**	HVAL-C-040-50125-R.030
3/16	1/4	**.010**	3/8	2-1/2	5	**84209**	**84210**	HVAL-C-020-50187-R.010
	1/4	**.010**	3/4	2-1/2	5	**84211**	**84212**	HVAL-C-040-50187-R.010
	1/4	**.010**	1	2-1/2	5	**84213**	**84214**	HVAL-C-053-50187-R.010
	1/4	**.030**	3/8	2-1/2	5	**84215**	**84216**	HVAL-C-020-50187-R.030
	1/4	**.030**	3/4	2-1/2	5	**84217**	**84218**	HVAL-C-040-50187-R.030
	1/4	**.030**	1	2-1/2	5	**84219**	**84220**	HVAL-C-053-50187-R.030
1/4	1/4	**.010**	1/2	2-1/2	5	**84221**	**84222**	HVAL-C-020-50250-R.010
	1/4	**.010**	3/4	2-1/2	5	**84223**	**84224**	HVAL-C-030-50250-R.010
	1/4	**.010**	1	3	5	**84225**	**84226**	HVAL-C-040-50250-R.010
	1/4	**.030**	1/2	2-1/2	5	**84227**	**84228**	HVAL-C-020-50250-R.030
	1/4	**.030**	3/4	2-1/2	5	**84229**	**84230**	HVAL-C-030-50250-R.030
	1/4	**.030**	1	3	5	**84231**	**84232**	HVAL-C-040-50250-R.030
3/8	3/8	**.010**	3/4	2-1/2	5	**84233**	**84234**	HVAL-C-020-50375-R.010
	3/8	**.010**	1	3	5	**84235**	**84236**	HVAL-C-026-50375-R.010
	3/8	**.010**	1-1/2	3-1/2	5	**84237**	**84238**	HVAL-C-040-50375-R.010
	3/8	**.030**	3/4	2-1/2	5	**84239**	**84240**	HVAL-C-020-50375-R.030
	3/8	**.030**	1	3	5	**84241**	**84242**	HVAL-C-026-50375-R.030
	3/8	**.030**	1-1/2	3-1/2	5	**84243**	**84244**	HVAL-C-040-50375-R.030

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 21

HVAL-C-5

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch - For High Efficency Milling (cont.)

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	Uncoated	N*plus* Coated	Tool Description
1/2	1/2	**.010**	1	3	5	**84245**	**84246**	HVAL-C-020-50500-R.010
	1/2	**.010**	1-1/4	3	5	**84247**	**84248**	HVAL-C-025-50500-R.010
	1/2	**.010**	1-5/8	4	5	**84249**	**84250**	HVAL-C-032-50500-R.010
	1/2	**.010**	2	4	5	**84251**	**84252**	HVAL-C-040-50500-R.010
	1/2	**.030**	1	3	5	**84253**	**84254**	HVAL-C-020-50500-R.030
	1/2	**.030**	1-1/4	3	5	**84255**	**84256**	HVAL-C-025-50500-R.030
	1/2	**.030**	1-5/8	4	5	**84257**	**84258**	HVAL-C-032-50500-R.030
	1/2	**.030**	2	4	5	**84259**	**84260**	HVAL-C-040-50500-R.030
	1/2	**.060**	1	3	5	**84261**	**84262**	HVAL-C-020-50500-R.060
	1/2	**.060**	1-1/4	3	5	**84263**	**84264**	HVAL-C-025-50500-R.060
	1/2	**.060**	1-5/8	4	5	**84265**	**84266**	HVAL-C-032-50500-R.060
	1/2	**.060**	2	4	5	**84267**	**84268**	HVAL-C-040-50500-R.060
	1/2	**.125**	1	3	5	**84269**	**84270**	HVAL-C-020-50500-R.125
	1/2	**.125**	1-1/4	3	5	**84271**	**84272**	HVAL-C-025-50500-R.125
	1/2	**.125**	1-5/8	4	5	**84273**	**84274**	HVAL-C-032-50500-R.125
	1/2	**.125**	2	4	5	**84275**	**84276**	HVAL-C-040-50500-R.125
3/4	3/4	**.030**	1-5/8	4	5	**84277**	**84278**	HVAL-C-021-50750-R.030
	3/4	**.030**	2-1/4	5	5	**84279**	**84280**	HVAL-C-030-50750-R.030
	3/4	**.060**	1-5/8	4	5	**84281**	**84282**	HVAL-C-021-50750-R.060
	3/4	**.060**	2-1/4	5	5	**84283**	**84284**	HVAL-C-030-50750-R.060
	3/4	**.125**	1-5/8	4	5	**84285**	**84286**	HVAL-C-021-50750-R.125
	3/4	**.125**	2-1/4	5	5	**84287**	**84288**	HVAL-C-030-50750-R.125

* .0003 max TIR

HVAL-C-5

Material Guide		SFM	Inches per Tooth (IPT)													
			1/8		3/16		1/4		3/8		1/2		3/4		1	
			HEM	Rgh	HEM	Rgh	HEM	Rgh	HEM	Rgh	HEM	Rgh	HEM	Rgh	HEM	Rgh
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0018	.0013	.0023	.0020	.0030	.0026	.0045	.0039	.0059	.0051	.0084	.0073	.0107	.0094
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0023	.0021	.0035	.0031	.0047	.0041	.0070	.0061	.0091	.0080	.0131	.0114	.0167	.0145
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0018	.0014	.0023	.0021	.0031	.0028	.0047	.0041	.0061	.0053	.0087	.0076	.0112	.0097

MILLING PROCESS	ADOC	RDOC
HEM (High Efficiency Milling)	Up to Max LOC	Up to 10% Diameter
Rgh (Traditional Roughing)	125%-200% Diameter	30%-40% Diameter

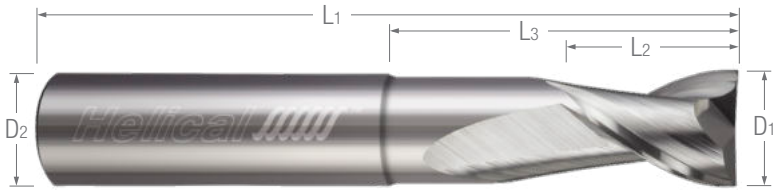
NOTES
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

2 FLUTE - SQUARE

High Balance - Reduced Neck

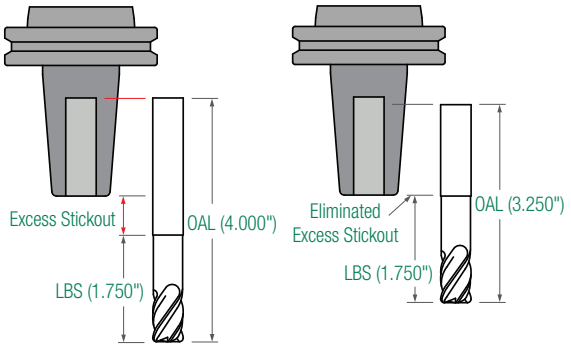
HMG-RN-2

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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.* D_1 (h6)	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	Tool Description
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 24

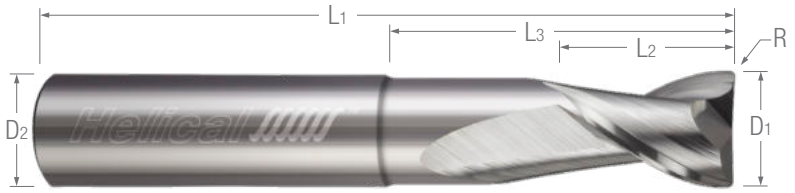
HMG-RN-2

2 FLUTE - CORNER RADIUS

High Balance - Reduced Neck

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 22 for shank length benefits



Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	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
	3/8	.125	3/8	3-1/4	1-3/4	.356	2	84578	HMG-RNS-046-20375-R.125
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
	1/2	.060	5/8	4-1/4	2-3/4	.475	2	59997	HMG-RN-055-20500-R.060
	1/2	.060	5/8	4-3/4	3	.475	2	60000	HMG-RN-060-20500-R.060
	1/2	.125	1/2	4	2-1/2	.475	2	84579	HMG-RNS-050-20500-R.125
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

*.0003 max TIR

continued on next page

Speeds & Feeds on Page 24

2 FLUTE - CORNER RADIUS

High Balance - Reduced Neck (cont.)

HMG-RN-2

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	Tool Description
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

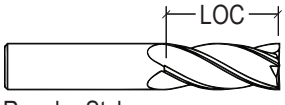
*.0003 max TIR

HMG-RN-2

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

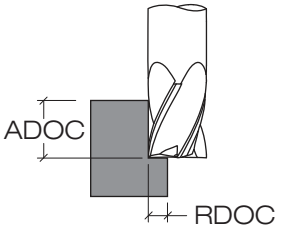
MILLING PROCESS	ADOC	RDOC
Slot (Full Slotting)	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Up to Max LOC	35%-50% Diameter
Fin (Finishing)	Up to Max LOC	4%-6% Diameter

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



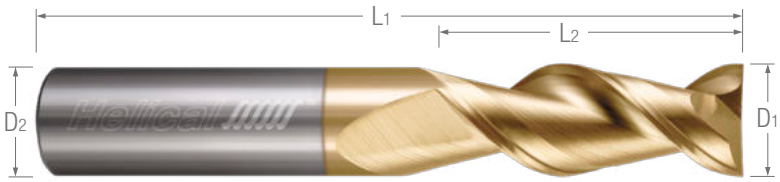
Key: LOC=Length of Cut ADOC=Axial Depth of Cut RDOC=Radial Depth of Cut

H45AL-2

2 FLUTE - SQUARE

45° Helix

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	Uncoated	*Zplus* Coated	Tool Description
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	5/8	2-1/2	2	83405	83406	H45AL-M-20125
	1/8	3/4	2-1/2	2	00060	00062	H45AL-L-20125
	1/8	7/8	2-1/2	2	83407	83408	H45AL-LX-20125
3/16	3/16	5/16	2	2	00090	00092	H45AL-S-20187
	3/16	7/16	2	2	83409	83410	H45AL-SR-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	00302	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
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

* .0003 max TIR

Speeds & Feeds on Page 31

continued on next page

2 FLUTE - SQUARE

45° Helix (cont.)

H45AL-2

continued from previous page

Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
5/8	5/8	3/4	3	2	00555	00557	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	00587	H45AL-M-20625
	5/8	2-1/2	5	2	00600	00602	H45AL-L-20625
	5/8	3-3/4	6	2	00615	00617	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	00752	H45AL-R-21000
	1	2-5/8	6	2	00765	00767	H45AL-M-21000
	1	3-1/4	6	2	00780	00782	H45AL-L-21000
	1	4-1/8	7	2	00795	00797	H45AL-X-21000

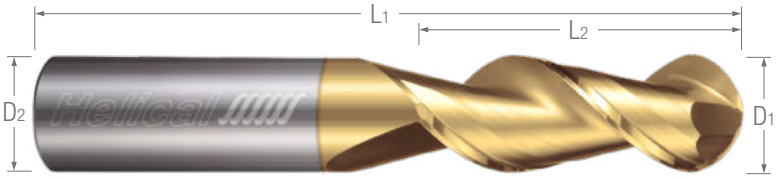
* .0003 max TIR

H45AL-2

2 FLUTE - BALL

45° Helix

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
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	5/8	2-1/2	2	83411	83412	H45AL-M-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	7/16	2	2	83413	83414	H45AL-SR-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
	3/16	1	2-1/2	2	83415	83416	H45AL-ML-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
	1/4	1-1/4	3	2	83417	83418	H45AL-L-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	3/4	2-1/2	2	83419	83420	H45AL-SR-20375-BN
	3/8	1	3	2	17345	17347	H45AL-R-20375-BN
	3/8	1-1/4	3-1/2	2	83421	83422	H45AL-M-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
	1/2	1-5/8	4	2	83423	83424	H45AL-M-20500-BN
	1/2	2	4	2	83425	83426	H45AL-L-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
	3/4	2-1/4	5	2	83427	83428	H45AL-M-20750-BN
1	1	2	5	2	17750	17752	H45AL-R-21000-BN

* .0003 max TIR

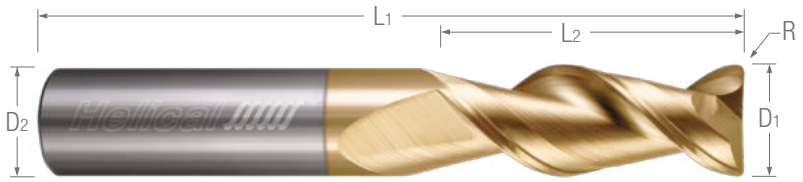
Speeds & Feeds on Page 31

2 FLUTE - CORNER RADIUS

45° Helix

H45AL-2

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Dia* D_1 (h6)	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
1/8	1/8	.010	3/8	2	2	82329	82330	H45AL-SR-20125-R.010
	1/8	.010	1/2	2-1/2	2	82331	82332	H45AL-R-20125-R.010
	1/8	.010	3/4	2-1/2	2	82333	82334	H45AL-L-20125-R.010
3/16	3/16	.010	5/16	2	2	82335	82336	H45AL-S-20187-R.010
	3/16	.010	9/16	2-1/2	2	82337	82338	H45AL-R-20187-R.010
	3/16	.010	3/4	2-1/2	2	82339	82340	H45AL-M-20187-R.010
1/4	1/4	.010	1/2	2-1/2	2	82341	82342	H45AL-SR-20250-R.010
	1/4	.010	3/4	2-1/2	2	82343	82344	H45AL-R-20250-R.010
	1/4	.010	1	3	2	82345	82346	H45AL-M-20250-R.010
	1/4	.030	1/2	2-1/2	2	82347	82348	H45AL-SR-20250-R.030
	1/4	.030	3/4	2-1/2	2	82349	82350	H45AL-R-20250-R.030
	1/4	.030	1	3	2	82351	82352	H45AL-M-20250-R.030
3/8	3/8	.030	1/2	2	2	82353	82354	H45AL-S-20375-R.030
	3/8	.030	1	3	2	82355	82356	H45AL-R-20375-R.030
	3/8	.030	1-1/4	3-1/2	2	82357	82358	H45AL-M-20375-R.030
	3/8	.060	1/2	2	2	82359	82360	H45AL-S-20375-R.060
	3/8	.060	1	3	2	82361	82362	H45AL-R-20375-R.060
	3/8	.060	1-1/4	3-1/2	2	82363	82364	H45AL-M-20375-R.060
1/2	1/2	.030	1	3	2	82365	82366	H45AL-SR-20500-R.030
	1/2	.030	1-1/4	3	2	82367	82368	H45AL-R-20500-R.030
	1/2	.030	1-5/8	4	2	82369	82370	H45AL-M-20500-R.030
	1/2	.030	2	4	2	82371	82372	H45AL-L-20500-R.030
	1/2	.060	1	3	2	82373	82374	H45AL-SR-20500-R.060
	1/2	.060	1-1/4	3	2	82375	82376	H45AL-R-20500-R.060
	1/2	.060	1-5/8	4	2	82377	82378	H45AL-M-20500-R.060
	1/2	.060	2	4	2	82379	82380	H45AL-L-20500-R.060
3/4	3/4	.030	1-5/8	4	2	82381	82382	H45AL-R-20750-R.030
	3/4	.030	2-1/4	5	2	82383	82384	H45AL-M-20750-R.030
	3/4	.060	1-5/8	4	2	82385	82386	H45AL-R-20750-R.060
	3/4	.060	2-1/4	5	2	82387	82388	H45AL-M-20750-R.060

* .0003 max TIR

Speeds & Feeds on Page 31

H45AL-RN-2

2 FLUTE - SQUARE

45° Helix - Reduced Neck

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.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	02167	H45AL-RN-R-20312
	5/16	7/16	4	2-1/8	.296	2	02180	02182	H45AL-RN-M-20312
	5/16	7/16	6	3-1/8	.296	2	02190	02192	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	02347	H45AL-RN-R-20625
3/4	3/4	1	4	2	.712	2	02405	02407	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	02447	H45AL-RN-X-20750
1	1	1-1/4	5	2-5/8	.950	2	02465	02467	H45AL-RN-R-21000
	1	1-1/4	6	3-3/8	.950	2	02480	02482	H45AL-RN-M-21000
	1	1-1/4	7	4-3/8	.950	2	02495	02497	H45AL-RN-L-21000

* .0003 max TIR

Speeds & Feeds on Page 31

2 FLUTE - BALL

45° Helix - Reduced Neck

H45AL-RN-2

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Reach (LBS) L_3	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	18182	H45AL-RN-M-20312-BN
	5/16	7/16	6	3-1/8	.296	2	18190	18192	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	18407	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	18447	H45AL-RN-X-20750-BN
1	1	1-1/4	5	2-5/8	.950	2	18465	18467	H45AL-RN-R-21000-BN
	1	1-1/4	6	3-3/8	.950	2	18480	18482	H45AL-RN-M-21000-BN
	1	1-1/4	7	4-3/8	.950	2	18495	18497	H45AL-RN-L-21000-BN

* .0003 max TIR

Speeds & Feeds on Page 31

H45AL-RN-2

SPEEDS & FEEDS

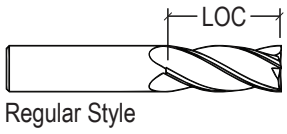
45° Helix

H45AL-2 / H45AL-RN-2

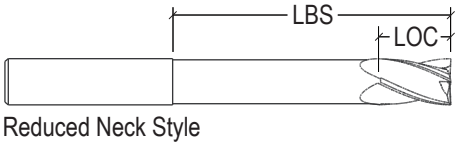
Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0014	.0018	.0010	.0021	.0021	.0014	.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

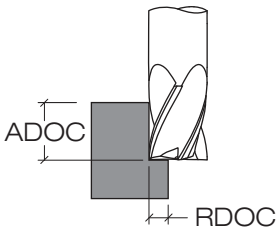
NOTES:
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



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

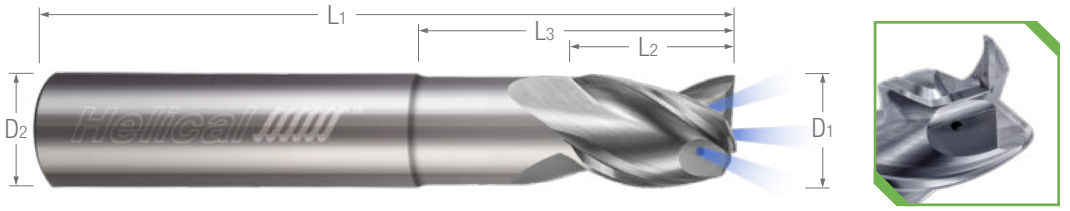
SKU: 82141
Coating: uncoated
Cutter Dia: 1/2"
Length of Cut: 1-5/8"
Radius: .010"

3 FLUTE - SQUARE

Coolant Through - High Balance - Reduced Neck

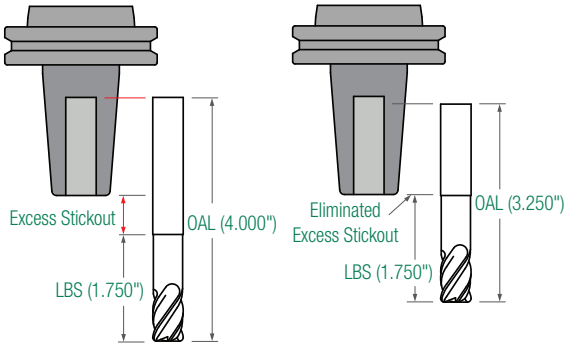
HMGC-RN-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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.* D_1 (h6)	Shank Dia. D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Reach (LBS) L_3	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 34

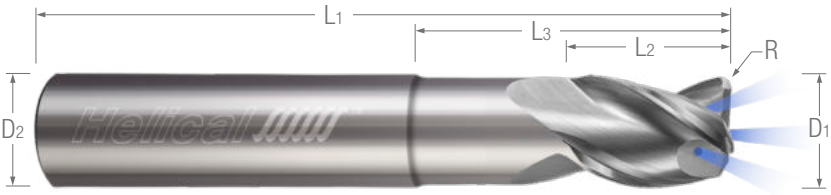
HMGC-RN-3

3 FLUTE - CORNER RADIUS

Coolant Through - High Balance - Reduced Neck

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 32 for shank length benefits



Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	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
	1/2	.060	5/8	4-1/4	2-3/4	.475	3	60051	HMGC-RN-055-30500-R.060
	1/2	.060	5/8	4-3/4	3	.475	3	60054	HMGC-RN-060-30500-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
	3/4	.190	1	4-1/2	3	.712	3	84580	HMGC-RN-040-30750-R.190

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 34

3 FLUTE - CORNER RADIUS

Coolant Through - High Balance - Reduced Neck (cont.)

HMGC-RN-3

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	Tool Description
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
	1	**.120**	1	4-1/4	2	.950	3	**84581**	HMGC-RNS-020-31000-R.120

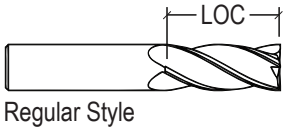
* .0003 max TIR

HMGC-RN-3

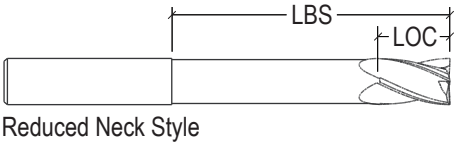
Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0015	.0016	.0011	.0022	.0018	.0014	.0029	.0021	.0021	.0043	.0024	.0028	.0056	.0028	.0040	.0080	.0033	.0051	.0102	.0040
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	.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

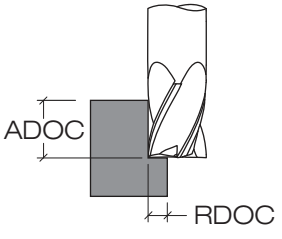
NOTES:
IPT values shown are for 4xD reach tools, and should be adjusted for longer or shorter reaches. For tools with reaches greater than 4xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



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

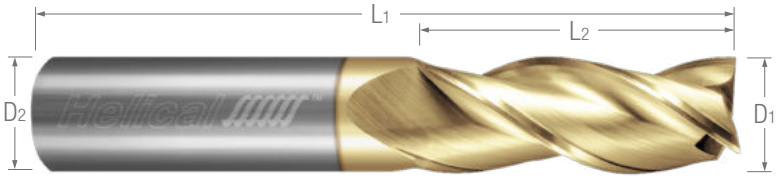
H35AL-3

HEM

3 FLUTE - SQUARE

35° Helix

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	Uncoated	*Zplus* 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
	1/8	7/8	2-1/2	3	**83429**	**83430**	H35AL-LX-30125
3/16	3/16	5/16	2	3	**01090**	**01092**	H35AL-S-30187
	3/16	7/16	2	3	**83431**	**83432**	H35AL-SR-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
	3/16	1-3/16	3	3	**83433**	**83434**	H35AL-LX-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	1-9/16	4	3	**83435**	**83436**	H35AL-LX-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 43

3 FLUTE - SQUARE

35° Helix (cont.)

H35AL-3

continued from previous page

Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	Z*plus* Coated	Tool Description
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
	1/2	3-5/8	6	3	**83437**	**83438**	H35AL-Y-30500
5/8	5/8	3/4	3	3	**01555**	**01557**	H35AL-S-30625
	5/8	1-1/4	3-1/2	3	**83439**	**83440**	H35AL-SR-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

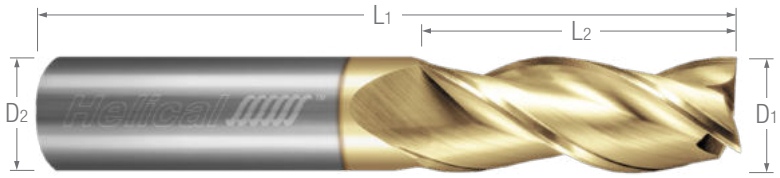
* .0003 max TIR

MH35AL-3
METRIC

HEM

3 FLUTE - SQUARE - METRIC
35° Helix

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	Uncoated	*Zplus* Coated	Tool Description
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

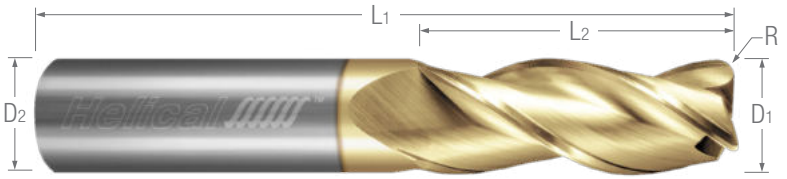
Speeds & Feeds on Page 43

3 FLUTE - CORNER RADIUS

35° Helix

H35AL-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
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	.010	1/2	2-1/2	3	82759	82760	H35AL-R-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	.015	1/2	2-1/2	3	82761	82762	H35AL-R-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	.020	1/2	2-1/2	3	82763	82764	H35AL-R-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
	1/8	.030	1/2	2-1/2	3	82765	82766	H35AL-R-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	.010	3/4	2-1/2	3	82767	82768	H35AL-M-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	.015	3/4	2-1/2	3	82769	82770	H35AL-M-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	.020	3/4	2-1/2	3	82771	82772	H35AL-M-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
	3/16	.030	3/4	2-1/2	3	82773	82774	H35AL-M-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	.010	1-1/4	3	3	82775	82776	H35AL-L-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	.015	1-1/4	3	3	82777	82778	H35AL-L-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	.020	1-1/4	3	3	82779	82780	H35AL-L-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	.030	1-1/4	3	3	82781	82782	H35AL-L-30250-R.030

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 43

H35AL-3

HEM

3 FLUTE - CORNER RADIUS

35° Helix (cont.)

continued from previous page

Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
1/4	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
	1/4	**.060**	1-1/4	3	3	**82783**	**82784**	H35AL-L-30250-R.060
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
	5/16	**.060**	1	3	3	**59078**	**59079**	H35AL-M-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	**.010**	1-1/2	4	3	**82785**	**82786**	H35AL-L-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	**.030**	1-1/2	4	3	**82787**	**82788**	H35AL-L-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
	3/8	**.060**	1-1/2	4	3	**82789**	**82790**	H35AL-L-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	**.020**	2	4	3	**82791**	**82792**	H35AL-L-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	**.030**	2	4	3	**82793**	**82794**	H35AL-L-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	**.060**	2	4	3	**82795**	**82796**	H35AL-L-30500-R.060

* .0003 max TIR

continued on next page

3 FLUTE - CORNER RADIUS

35° Helix (cont.)

H35AL-3

continued from previous page

Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
1/2	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
	1/2	.125	2	4	3	82797	82798	H35AL-L-30500-R.125
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	.030	4	6-1/2	3	82799	82800	H35AL-X-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	.060	4	6-1/2	3	82801	82802	H35AL-X-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	.125	4	6-1/2	3	82803	82804	H35AL-X-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
	3/4	.250	4	6-1/2	3	82805	82806	H35AL-X-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

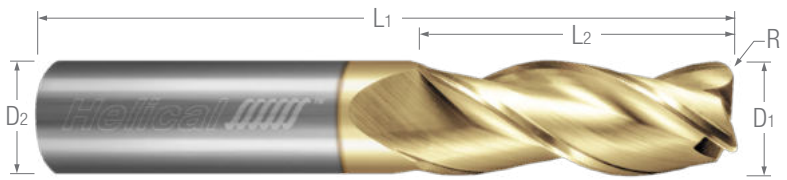
MH35AL-3
METRIC

HEM

3 FLUTE - CORNER RADIUS - METRIC

35° Helix

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Corner Radius R +.05 mm −.05 mm	LOC L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	Uncoated	*Zplus* Coated	Tool Description
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
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

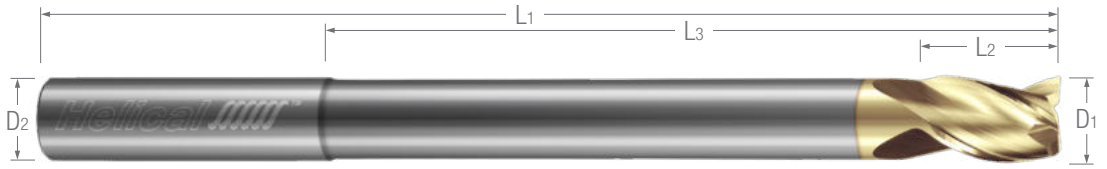
Speeds & Feeds on Page 43

3 FLUTE - SQUARE

35° Helix - Reduced Neck

H35AL-RN-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	LOC L_2 +.032" −.000"	OAL L_1 +.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
	1/8	5/32	3	1-1/4	.118	3	83441	83442	H35AL-RN-LX-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
	3/16	7/32	3	1-5/16	.178	3	83443	83444	H35AL-RN-LX-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
	1/4	3/8	4-1/2	3	.237	3	83445	83446	H35AL-RN-L-30250
5/16	5/16	7/16	4	1-1/8	.296	3	04165	04167	H35AL-RN-R-30312
	5/16	7/16	4	1-3/4	.296	3	83447	83448	H35AL-RN-A-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	3-1/2	.356	3	83449	83450	H35AL-RN-LX-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
	1/2	5/8	7	5	.475	3	83451	83452	H35AL-RN-Y-30500

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 43

H35AL-RN-3

3 FLUTE - SQUARE

35° Helix - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Z*plus Coated	Tool Description
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
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

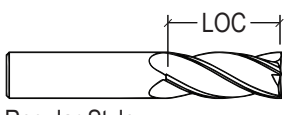
* .0003 max TIR

H35AL-3 / H35AL-RN-3

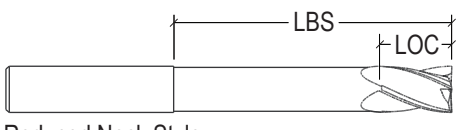
Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0007	.0013	.0016	.0011	.0019	.0018	.0014	.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

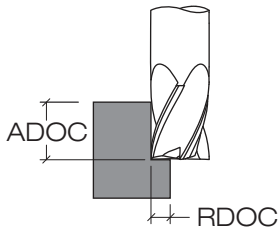
NOTES:
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



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

3 FLUTE - CORNER RADIUS New!

35° Helix - Reduced Neck

H35AL-RN-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- Designed for tough roughing applications with 3 flutes and 35° helix
- Cylindrically ground to maintain edge strength
- 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
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Zplus* Coated	Tool Description	
1/8	1/8	**.010**	5/32	3	1/2	.118	3	86636	86637	H35AL-RN-R-30125-R.010	new
	1/8	**.010**	5/32	3	5/8	.118	3	86638	86639	H35AL-RN-A-30125-R.010	new
	1/8	**.010**	5/32	3	3/4	.118	3	86640	86641	H35AL-RN-M-30125-R.010	new
	1/8	**.010**	5/32	3	1	.118	3	86642	86643	H35AL-RN-L-30125-R.010	new
	1/8	**.030**	5/32	3	1/2	.118	3	86644	86645	H35AL-RN-R-30125-R.030	new
	1/8	**.030**	5/32	3	5/8	.118	3	86646	86647	H35AL-RN-A-30125-R.030	new
	1/8	**.030**	5/32	3	3/4	.118	3	86648	86649	H35AL-RN-M-30125-R.030	new
	1/8	**.030**	5/32	3	1	.118	3	86650	86651	H35AL-RN-L-30125-R.030	new
3/16	3/16	**.010**	7/32	3	1/2	.178	3	86652	86653	H35AL-RN-R-30187-R.010	new
	3/16	**.010**	7/32	3	5/8	.178	3	86654	86655	H35AL-RN-A-30187-R.010	new
	3/16	**.010**	7/32	3	3/4	.178	3	86656	86657	H35AL-RN-M-30187-R.010	new
	3/16	**.010**	7/32	3	1	.178	3	86658	86659	H35AL-RN-ML-30187-R.010	new
	3/16	**.030**	7/32	3	1/2	.178	3	86660	86661	H35AL-RN-R-30187-R.030	new
	3/16	**.030**	7/32	3	5/8	.178	3	86662	86663	H35AL-RN-A-30187-R.030	new
	3/16	**.030**	7/32	3	3/4	.178	3	86664	86665	H35AL-RN-M-30187-R.030	new
	3/16	**.030**	7/32	3	1	.178	3	86666	86667	H35AL-RN-ML-30187-R.030	new
1/4	1/4	**.010**	3/8	4	3/4	.237	3	86668	86669	H35AL-RN-S-30250-R.010	new
	1/4	**.010**	3/8	4	1-1/8	.237	3	86670	86671	H35AL-RN-R-30250-R.010	new
	1/4	**.010**	3/8	4	1-5/8	.237	3	86672	86673	H35AL-RN-A-30250-R.010	new
	1/4	**.010**	3/8	4	2-1/8	.237	3	86674	86675	H35AL-RN-M-30250-R.010	new
	1/4	**.010**	3/8	4	2-1/2	.237	3	86676	86677	H35AL-RN-ML-30250-R.010	new
	1/4	**.030**	3/8	4	3/4	.237	3	86678	86679	H35AL-RN-S-30250-R.030	new
	1/4	**.030**	3/8	4	1-1/8	.237	3	86680	86681	H35AL-RN-R-30250-R.030	new
	1/4	**.030**	3/8	4	1-5/8	.237	3	86682	86683	H35AL-RN-A-30250-R.030	new
	1/4	**.030**	3/8	4	2-1/8	.237	3	86684	86685	H35AL-RN-M-30250-R.030	new
	1/4	**.030**	3/8	4	2-1/2	.237	3	86686	86687	H35AL-RN-ML-30250-R.030	new

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 43

H35AL-RN-3

New!

3 FLUTE - CORNER RADIUS

35° Helix - Reduced Neck (cont.)

continued from previous page

	Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Zplus* Coated	Tool Description
new	3/8	3/8	**.010**	1/2	4	1-1/8	.356	3	86688	86689	H35AL-RN-R-30375-R.010
new		3/8	**.010**	1/2	4	1-5/8	.356	3	86690	86691	H35AL-RN-A-30375-R.010
new		3/8	**.010**	1/2	4	2-1/8	.356	3	86692	86693	H35AL-RN-M-30375-R.010
new		3/8	**.010**	1/2	5	2-1/2	.356	3	86694	86695	H35AL-RN-ML-30375-R.010
new		3/8	**.010**	1/2	6	3-1/8	.356	3	86696	86697	H35AL-RN-L-30375-R.010
new		3/8	**.030**	1/2	4	1-1/8	.356	3	86698	86699	H35AL-RN-R-30375-R.030
new		3/8	**.030**	1/2	4	1-5/8	.356	3	86700	86701	H35AL-RN-A-30375-R.030
new		3/8	**.030**	1/2	4	2-1/8	.356	3	86702	86703	H35AL-RN-M-30375-R.030
new		3/8	**.030**	1/2	5	2-1/2	.356	3	86704	86705	H35AL-RN-ML-30375-R.030
new		3/8	**.030**	1/2	6	3-1/8	.356	3	86706	86707	H35AL-RN-L-30375-R.030
new	1/2	1/2	**.030**	5/8	4	1-3/8	.475	3	86708	86709	H35AL-RN-R-30500-R.030
new		1/2	**.030**	5/8	4	1-3/4	.475	3	86710	86711	H35AL-RN-A-30500-R.030
new		1/2	**.030**	5/8	4	2-1/4	.475	3	86712	86713	H35AL-RN-M-30500-R.030
new		1/2	**.030**	5/8	4-1/2	2-3/4	.475	3	86714	86715	H35AL-RN-ML-30500-R.030
new		1/2	**.030**	5/8	6	3-3/8	.475	3	86716	86717	H35AL-RN-L-30500-R.030
new		1/2	**.030**	5/8	6	4-1/4	.475	3	86718	86719	H35AL-RN-X-30500-R.030
new		1/2	**.060**	5/8	4	1-3/8	.475	3	86720	86721	H35AL-RN-R-30500-R.060
new		1/2	**.060**	5/8	4	1-3/4	.475	3	86722	86723	H35AL-RN-A-30500-R.060
new		1/2	**.060**	5/8	4	2-1/4	.475	3	86724	86725	H35AL-RN-M-30500-R.060
new		1/2	**.060**	5/8	4-1/2	2-3/4	.475	3	86726	86727	H35AL-RN-ML-30500-R.060
new		1/2	**.060**	5/8	6	3-3/8	.475	3	86728	86729	H35AL-RN-L-30500-R.060
new		1/2	**.060**	5/8	6	4-1/4	.475	3	86730	86731	H35AL-RN-X-30500-R.060
new	3/4	3/4	**.030**	1	4	2	.712	3	86732	86733	H35AL-RN-R-30750-R.030
new		3/4	**.030**	1	6	2-1/2	.712	3	86734	86735	H35AL-RN-M-30750-R.030
new		3/4	**.030**	1	6	3-3/8	.712	3	86736	86737	H35AL-RN-L-30750-R.030
new		3/4	**.030**	1	6	4-3/8	.712	3	86738	86739	H35AL-RN-X-30750-R.030
new		3/4	**.060**	1	4	2	.712	3	86740	86741	H35AL-RN-R-30750-R.060
new		3/4	**.060**	1	6	2-1/2	.712	3	86742	86743	H35AL-RN-M-30750-R.060
new		3/4	**.060**	1	6	3-3/8	.712	3	86744	86745	H35AL-RN-L-30750-R.060
new		3/4	**.060**	1	6	4-3/8	.712	3	86746	86747	H35AL-RN-X-30750-R.060

* .0003 max TIR

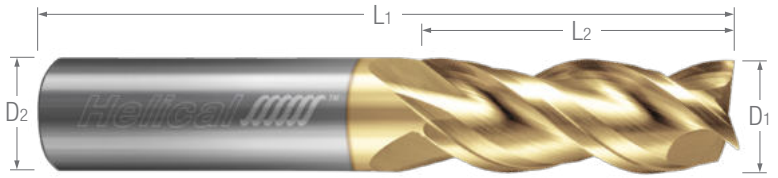
3 FLUTE - SQUARE

New Items!

40° Helix - Variable Pitch

H40ALV-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* 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	
	1/8	3/4	2-1/2	3	81397	81398	H40ALV-L-30125	
	1/8	7/8	2-1/2	3	83521	83522	H40ALV-LX-30125	
	1/8	1	2-1/2	3	86960	86961	H40ALV-X-30125	new
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	1-3/16	3	3	86962	86963	H40ALV-ML-30187	new
	3/16	1-3/8	3	3	82391	82392	H40ALV-L-30187	
	3/16	1-9/16	4	3	86062	86063	H40ALV-LX-30187	
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	
	1/4	1-3/4	4	3	83523	83524	H40ALV-X-30250	
	1/4	2	4	3	86064	86065	H40ALV-Y-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	
	5/16	1-9/16	4	3	86066	86067	H40ALV-LX-30312	
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	
	3/8	2-1/2	5	3	86068	86069	H40ALV-X-30375	

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 62

H40ALV-3

HEM

New Items! **3 FLUTE - SQUARE**

40° Helix - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
	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
		1/2	3-5/8	6	3	86070	86071	H40ALV-Y-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
new		5/8	2-1/2	4	3	86964	86965	H40ALV-ML-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
		3/4	3-1/4	6	3	83525	83526	H40ALV-L-30750
new		3/4	4	6-1/2	3	86966	86967	H40ALV-LX-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
		1	4-1/4	7	3	86072	86073	H40ALV-L-31000

* .0003 max TIR

Attacking Aluminum: A Machining Guide

In The Loupe MACHINISTS BLOG

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.

www.harveyperformance.com/in-the-loupe/aluminum-machining-guide/

SCAN TO READ

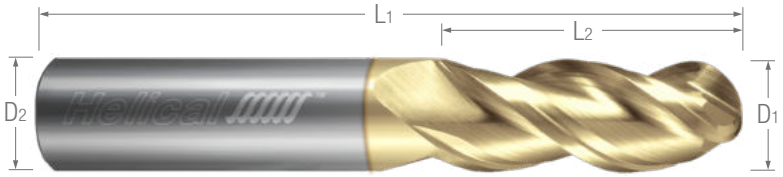
3 FLUTE - BALL New Items!

40° Helix - Variable Pitch

HEM

H40ALV-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Diameter** D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	Uncoated	*Zplus* Coated	Tool Description	
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	
	1/8	3/4	2-1/2	3	81455*	81456*	H40ALV-L-30125-BN	
	1/8	7/8	2-1/2	3	86074*	86075*	H40ALV-LX-30125-BN	
	1/8	1	2-1/2	3	86968*	86969*	H40ALV-X-30125-BN	new
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	1-3/16	3	3	86970*	86971*	H40ALV-ML-30187-BN	new
	3/16	1-3/8	3	3	82455*	82456*	H40ALV-L-30187-BN	
	3/16	1-9/16	4	3	86076*	86077*	H40ALV-LX-30187-BN	
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	
	1/4	1-1/2	3	3	82457	82458	H40ALV-LX-30250-BN	
	1/4	1-3/4	4	3	86078	86079	H40ALV-X-30250-BN	
	1/4	2	4	3	86972	86973	H40ALV-Y-30250-BN	new
5/16	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	
	5/16	1	3	3	82459	82460	H40ALV-M-30312-BN	
	5/16	1-1/4	3	3	86080	86081	H40ALV-L-30312-BN	
	5/16	1-9/16	4	3	86974	86975	H40ALV-LX-30312-BN	new

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

continued on next page

Speeds & Feeds on Page 62

H40ALV-3

New Items! **3 FLUTE - BALL**

40° Helix - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter** D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
	3/8	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
		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
		3/8	2	4	3	82463	82464	H40ALV-LX-30375-BN
		3/8	2-1/2	5	3	86082	86083	H40ALV-X-30375-BN
	1/2	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
		1/2	2-1/2	5	3	82465	82466	H40ALV-LX-30500-BN
new		1/2	3-1/8	6	3	86976	86977	H40ALV-X-30500-BN
	5/8	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
		5/8	1-5/8	4	3	49360	49361	H40ALV-R-30625-BN
new		5/8	2	4	3	86978	86979	H40ALV-M-30625-BN
	3/4	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
		3/4	2-3/4	5	3	82467	82468	H40ALV-ML-30750-BN
		3/4	3-1/4	6	3	86084	86085	H40ALV-L-30750-BN
	1	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	4-1/4	7	3	86086	86087	H40ALV-L-31000-BN

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

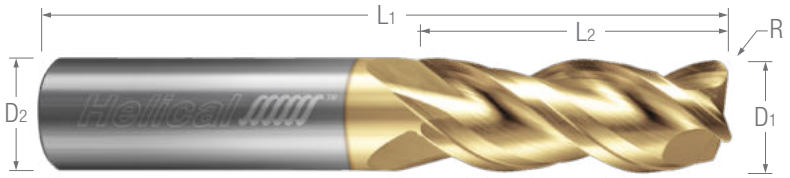
3 FLUTE - CORNER RADIUS

New Items!

40° Helix - Variable Pitch

H40ALV-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description	
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	.010	5/8	2-1/2	3	86088	86089	H40ALV-M-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	.015	3/4	2-1/2	3	86980	86981	H40ALV-L-30125-R.015	new
	1/8	.020	1/4	1-1/2	3	86090	86091	H40ALV-S-30125-R.020	
	1/8	.020	3/8	2	3	86092	86093	H40ALV-SR-30125-R.020	
	1/8	.020	1/2	2-1/2	3	86094	86095	H40ALV-R-30125-R.020	
	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	
	1/8	.030	5/8	2-1/2	3	82409*	82410*	H40ALV-M-30125-R.030	
	1/8	.030	3/4	2-1/2	3	86096*	86097*	H40ALV-L-30125-R.030	
	1/8	.030	7/8	2-1/2	3	86982*	86983*	H40ALV-LX-30125-R.030	new
3/16	3/16	.010	3/8	2	3	86098	86099	H40ALV-S-30187-R.010	
	3/16	.010	3/4	2-1/2	3	86100	86101	H40ALV-R-30187-R.010	
	3/16	.010	1	3	3	86102	86103	H40ALV-M-30187-R.010	
	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	.020	3/8	2	3	86104	86105	H40ALV-S-30187-R.020	
	3/16	.020	3/4	2-1/2	3	86106	86107	H40ALV-R-30187-R.020	
	3/16	.020	1	3	3	86108	86109	H40ALV-M-30187-R.020	
	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	

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

continued on next page

Speeds & Feeds on Page 62

H40ALV-3

HEM

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 +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	Uncoated	Z*plus* Coated	Tool Description
	1/4	1/4	.010	3/8	2	3	82415	82416	H40ALV-S-30250-R.010
		1/4	.010	1/2	2	3	86110	86111	H40ALV-SR-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
new		1/4	.010	1-1/4	3	3	86984	86985	H40ALV-L-30250-R.010
new		1/4	.010	1-1/2	3	3	86986	86987	H40ALV-LX-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
new		1/4	.015	1-1/2	3	3	86988	86989	H40ALV-LX-30250-R.015
		1/4	.020	3/8	2	3	86112	86113	H40ALV-S-30250-R.020
		1/4	.020	1/2	2	3	86114	86115	H40ALV-SR-30250-R.020
		1/4	.020	3/4	2-1/2	3	86116	86117	H40ALV-R-30250-R.020
		1/4	.020	1	3	3	86118	86119	H40ALV-M-30250-R.020
new		1/4	.020	1-1/4	3	3	86990	86991	H40ALV-L-30250-R.020
new		1/4	.020	1-1/2	3	3	86992	86993	H40ALV-LX-30250-R.020
		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
new		1/4	.030	1-1/2	3	3	86994	86995	H40ALV-LX-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
		1/4	.060	1-1/4	3	3	82425*	82426*	H40ALV-L-30250-R.060
new		1/4	.060	1-1/2	3	3	86996*	86997*	H40ALV-LX-30250-R.060
	5/16	5/16	.010	7/16	2	3	86120	86121	H40ALV-S-30312-R.010
		5/16	.010	3/4	2-1/2	3	86122	86123	H40ALV-R-30312-R.010
		5/16	.010	1	3	3	86124	86125	H40ALV-M-30312-R.010
new		5/16	.010	1-1/4	T	3	86998	86999	H40ALV-L-30312-R.010
		5/16	.030	7/16	2	3	86126	86127	H40ALV-S-30312-R.030
		5/16	.030	3/4	2-1/2	3	86128	86129	H40ALV-R-30312-R.030
		5/16	.030	1	3	3	86130	86131	H40ALV-M-30312-R.030
new		5/16	.030	1-1/4	3	3	87000	87001	H40ALV-L-30312-R.030
		5/16	.060	7/16	2	3	86132	86133	H40ALV-S-30312-R.060
		5/16	.060	3/4	2-1/2	3	86134	86135	H40ALV-R-30312-R.060
		5/16	.060	1	3	3	86136	86137	H40ALV-M-30312-R.060
new		5/16	.060	1-1/4	3	3	87002	87003	H40ALV-L-30312-R.060
	3/8	3/8	.010	1/2	2	3	81431	81432	H40ALV-S-30375-R.010
		3/8	.010	3/4	2-1/2	3	83527	83528	H40ALV-SR-30375-R.010
		3/8	.010	1	2-1/2	3	81433	81434	H40ALV-R-30375-R.010
new		3/8	.010	1-1/4	3	3	87004	87005	H40ALV-M-30375-R.010
		3/8	.010	1-1/2	3-1/2	3	81435	81436	H40ALV-L-30375-R.010
new		3/8	.010	2	4	3	87006	87007	H40ALV-LX-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
new		3/8	.015	1-1/4	3	3	87008	87009	H40ALV-M-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

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

continued on next page

3 FLUTE - CORNER RADIUS

New Items!

H40ALV-3

40° Helix - Variable Pitch (cont.)

continued from previous page

Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	Zplus Coated	Tool Description	
3/8	3/8	.020	1/2	2	3	86138	86139	H40ALV-S-30375-R.020	
	3/8	.020	3/4	2-1/2	3	87010	87011	H40ALV-SR-30375-R.020	new
	3/8	.020	1	2-1/2	3	86140	86141	H40ALV-R-30375-R.020	
	3/8	.020	1-1/4	3	3	87012	87013	H40ALV-M-30375-R.020	new
	3/8	.020	1-1/2	3-1/2	3	86142	86143	H40ALV-L-30375-R.020	
	3/8	.020	2	4	3	87014	87015	H40ALV-LX-30375-R.020	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	1-1/4	3	3	87016	87017	H40ALV-M-30375-R.030	new
	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	
	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	1-1/4	3	3	87018	87019	H40ALV-M-30375-R.060	new
	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	
	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	1-1/4	3	3	87020*	87021*	H40ALV-M-30375-R.090	new
	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	
	3/8	.125	1/2	2	3	83529*	83530*	H40ALV-S-30375-R.125	
	3/8	.125	3/4	2-1/2	3	83531*	83532*	H40ALV-SR-30375-R.125	
	3/8	.125	1	2-1/2	3	83533*	83534*	H40ALV-R-30375-R.125	
	3/8	.125	1-1/4	3	3	87022*	87023*	H40ALV-M-30375-R.125	new
	3/8	.125	1-1/2	3-1/2	3	83535*	83536*	H40ALV-L-30375-R.125	
	3/8	.125	2	4	3	83537*	83538*	H40ALV-LX-30375-R.125	
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	.010	2-1/2	5	3	87024	87025	H40ALV-LX-30500-R.010	new
	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	
	1/2	.015	3-1/8	6	3	87028	87029	H40ALV-X-30500-R.015	new
	1/2	.020	5/8	2-1/2	3	83539	83540	H40ALV-S-30500-R.020	
	1/2	.020	1	3	3	83541	83542	H40ALV-SR-30500-R.020	
	1/2	.020	1-1/4	3	3	83543	83544	H40ALV-R-30500-R.020	
	1/2	.020	1-5/8	4	3	83545	83546	H40ALV-M-30500-R.020	
	1/2	.020	2	4	3	83547	83548	H40ALV-L-30500-R.020	
	1/2	.020	2-1/2	5	3	87026	87027	H40ALV-LX-30500-R.020	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 +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	Uncoated	Z*plus* Coated	Tool Description
	1/2	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	.030	3-1/8	6	3	87030	87031	H40ALV-X-30500-R.030
		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	.060	3-1/8	6	3	87032	87033	H40ALV-X-30500-R.060
		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
		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
new		1/2	.125	3-1/8	6	3	87034*	87035*	H40ALV-X-30500-R.125
new	5/8	5/8	.015	3/4	3	3	87036	87037	H40ALV-S-30625-R.015
new		5/8	.015	1-1/4	3-1/2	3	87038	87039	H40ALV-SR-30625-R.015
new		5/8	.015	1-5/8	4	3	87040	87041	H40ALV-R-30625-R.015
new		5/8	.015	2	4	3	87042	87043	H40ALV-M-30625-R.015
		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
new		5/8	.060	2	4	3	87044	87045	H40ALV-M-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
new		5/8	.090	2	4	3	87046	87047	H40ALV-M-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

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

continued on next page

3 FLUTE - CORNER RADIUS

New Items!

H40ALV-3

40° Helix - Variable Pitch (cont.)

continued from previous page

Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	Uncoated	Zplus Coated	Tool Description	
3/4	3/4	.015	1	3	3	83549	83550	H40ALV-S-30750-R.015	
	3/4	.015	1-5/8	4	3	83551	83552	H40ALV-R-30750-R.015	
	3/4	.015	2-1/4	5	3	83553	83554	H40ALV-M-30750-R.015	
	3/4	.015	2-3/4	5	3	87048	87049	H40ALV-ML-30750-R.015	new
	3/4	.020	1	3	3	87050	87051	H40ALV-S-30750-R.020	new
	3/4	.020	1-5/8	4	3	87052	87053	H40ALV-R-30750-R.020	new
	3/4	.020	2-1/4	5	3	87054	87055	H40ALV-M-30750-R.020	new
	3/4	.020	2-3/4	5	3	87056	87057	H40ALV-ML-30750-R.020	new
	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	.060	2-3/4	5	3	86144	86145	H40ALV-ML-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	
	3/4	.250	2-3/4	5	3	87058*	87059*	H40ALV-ML-30750-R.250	new
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

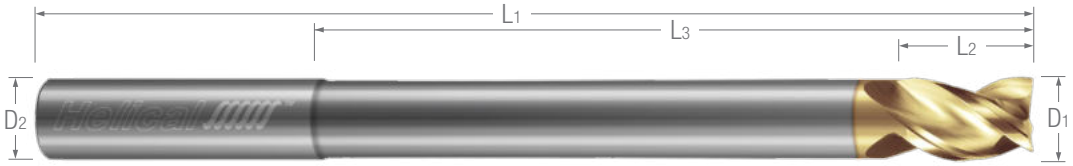
H40ALV-RN-3

New Items!

3 FLUTE - SQUARE

40° Helix - Variable Pitch - Reduced Neck

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



	Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	LOC L_2 +.032" −.000"	Overall Length L_1 +.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
		1/8	5/32	3	1-1/2	.118	3	83555	83556	H40ALV-RN-X-30125
	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
		3/16	7/32	3	1-1/2	.178	3	83557	83558	H40ALV-RN-X-30187
	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
		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
		1/4	3/8	4	2-1/8	.237	3	81473	81474	H40ALV-RN-M-30250
		1/4	3/8	4	2-1/2	.237	3	82477	82478	H40ALV-RN-ML-30250
		1/4	3/8	4-1/2	3	.237	3	83559	83560	H40ALV-RN-L-30250
new	5/16	5/16	7/16	4	1-1/8	.296	3	86500	86501	H40ALV-RN-S-30312
new		5/16	7/16	4	1-3/4	.296	3	86502	86503	H40ALV-RN-R-30312
new		5/16	7/16	4	2-1/8	.296	3	86504	86505	H40ALV-RN-M-30312
	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
		3/8	1/2	6	4	.356	3	83561	83562	H40ALV-RN-X-30375

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 62

3 FLUTE - SQUARE New Items!

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

H40ALV-RN-3

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	LOC L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Z*plus Coated	Tool Description	
1/2	1/2	5/8	3	1-3/8	.475	3	46300	46301	H40ALV-RN-R-30500	
	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	
	1/2	5/8	8	6	.475	3	86506	86507	H40ALV-RN-Z-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	
	5/8	3/4	6	4-1/8	.593	3	83563	83564	H40ALV-RN-X-30625	
3/4	3/4	1	4	2	.712	3	46555	46556	H40ALV-RN-R-30750	
	3/4	1	5	2-1/2	.712	3	81485	81486	H40ALV-RN-A-30750	
	3/4	1	6	3-3/8	.712	3	46590	46591	H40ALV-RN-M-30750	
	3/4	1	7	4-1/8	.712	3	81487	81488	H40ALV-RN-ML-30750	
	3/4	1	7	5	.712	3	46625	46626	H40ALV-RN-L-30750	
	3/4	1	10	6	.712	3	82483	82484	H40ALV-RN-LX-30750	
	3/4	1	10	7-1/2	.712	3	86508	86509	H40ALV-RN-X-30750	new
1	1	1-1/4	5	2-5/8	.950	3	46695	46696	H40ALV-RN-R-31000	
	1	1-1/4	6	3-3/8	.950	3	46730	46731	H40ALV-RN-M-31000	
	1	1-1/4	7	4-3/8	.950	3	46765	46766	H40ALV-RN-L-31000	
	1	1-1/4	9	6	.950	3	46800	46801	H40ALV-RN-LX-31000	
	1	1-1/4	12-1/2	9-1/2	.950	3	86510	86511	H40ALV-RN-X-31000	new

* .0003 max TIR

H40ALV-RN-3

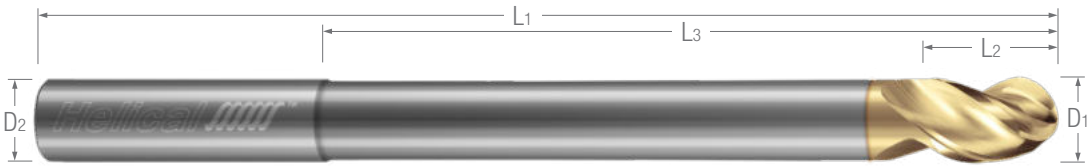
HEM

New Items!

3 FLUTE - BALL

40° Helix - Variable Pitch - Reduced Neck

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



	Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	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	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
		1/8	5/32	3	1-1/2	.118	3	83565*	83566*	H40ALV-RN-X-30125-BN
	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
		3/16	7/32	3	1-1/2	.178	3	83567*	83568*	H40ALV-RN-X-30187-BN
	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
		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
		1/4	3/8	4	2-1/8	.237	3	81539	81540	H40ALV-RN-M-30250-BN
		1/4	3/8	4	2-1/2	.237	3	82493	82494	H40ALV-RN-ML-30250-BN
		1/4	3/8	4-1/2	3	.237	3	83569	83570	H40ALV-RN-L-30250-BN
new	5/16	5/16	7/16	4	1-1/8	.296	3	86512	86513	H40ALV-RN-S-30312-BN
new		5/16	7/16	4	1-3/4	.296	3	86514	86515	H40ALV-RN-R-30312-BN
new		5/16	7/16	4	2-1/8	.296	3	86516	86517	H40ALV-RN-M-30312-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		3/8	1/2	6	4	.356	3	86518	86519	H40ALV-RN-X-30375-BN

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

continued on next page

Speeds & Feeds on Page 62

3 FLUTE - BALL New Items!

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

H40ALV-RN-3

continued from previous page

Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description	
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	
	1/2	5/8	8	6	.475	3	86520	86521	H40ALV-RN-Z-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	5	2-1/2	.712	3	83571	83572	H40ALV-RN-A-30750-BN	
	3/4	1	6	3-3/8	.712	3	47375	47376	H40ALV-RN-M-30750-BN	
	3/4	1	7	4-1/8	.712	3	83573	83574	H40ALV-RN-ML-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 101

In The Loupe MACHINISTS BLOG

Every machinist should know the basics when it comes to speeds and feeds, or the cutting variables used in every milling operation, as proper running parameters are critical to the outcome of your part. In our "In the Loupe" post *Speeds and Feeds 101*, learn how to calculate speeds and feeds, determine your tool's efficiency via Material Removal Rate (MRR), and much more.

www.harveyperformance.com/in-the-loupe/speeds-and-feeds-101/

SCAN TO READ

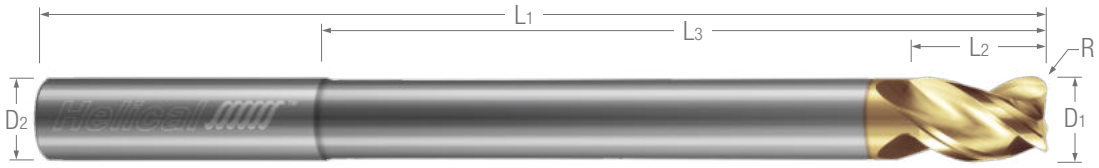
H40ALV-RN-3

New Items!

3 FLUTE - CORNER RADIUS

40° Helix - Variable Pitch - Reduced Neck

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



	Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Zplus* Coated	Tool Description
new		1/8	**.010**	5/32	2-1/2	1/2	.118	3	86522	86523	H40ALV-RN-R-30125-R.010
new		1/8	**.010**	5/32	3	3/4	.118	3	86526	86527	H40ALV-RN-M-30125-R.010
new		1/8	**.010**	5/32	3	1	.118	3	86530	86531	H40ALV-RN-L-30125-R.010
		1/8	**.015**	5/32	2-1/2	1/2	.118	3	46015	46016	H40ALV-RN-R-30125-R.015
	1/8	1/8	**.015**	5/32	3	3/4	.118	3	46025	46026	H40ALV-RN-M-30125-R.015
		1/8	**.015**	5/32	3	1	.118	3	82807	82808	H40ALV-RN-L-30125-R.015
new		1/8	**.030**	5/32	2-1/2	1/2	.118	3	86524*	86525*	H40ALV-RN-R-30125-R.030
new		1/8	**.030**	5/32	3	3/4	.118	3	86528*	86529*	H40ALV-RN-M-30125-R.030
new		1/8	**.030**	5/32	3	1	.118	3	86532*	86533*	H40ALV-RN-L-30125-R.030
new		3/16	**.010**	7/32	2-1/2	1/2	.178	3	86534	86535	H40ALV-RN-R-30187-R.010
new		3/16	**.010**	7/32	3	3/4	.178	3	86536	86537	H40ALV-RN-M-30187-R.010
new		3/16	**.010**	7/32	3	1	.178	3	86538	86539	H40ALV-RN-ML-30187-R.010
		3/16	**.015**	7/32	2-1/2	1/2	.178	3	46050	46051	H40ALV-RN-R-30187-R.015
	3/16	3/16	**.015**	7/32	3	3/4	.178	3	46065	46066	H40ALV-RN-M-30187-R.015
		3/16	**.015**	7/32	3	1	.178	3	82809	82810	H40ALV-RN-ML-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
		3/16	**.030**	7/32	3	1	.178	3	82811	82812	H40ALV-RN-ML-30187-R.030
		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	1-3/8	.237	3	82813	82814	H40ALV-RN-RA-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	1-7/8	.237	3	82815	82816	H40ALV-RN-AM-30250-R.015
		1/4	**.015**	3/8	4	2-1/8	.237	3	81491	81492	H40ALV-RN-M-30250-R.015
	1/4	1/4	**.015**	3/8	4	2-1/2	.237	3	82817	82818	H40ALV-RN-ML-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	1-3/8	.237	3	82819	82820	H40ALV-RN-RA-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	1-7/8	.237	3	82821	82822	H40ALV-RN-AM-30250-R.030
		1/4	**.030**	3/8	4	2-1/8	.237	3	81495	81496	H40ALV-RN-M-30250-R.030
		1/4	**.030**	3/8	4	2-1/2	.237	3	82823	82824	H40ALV-RN-ML-30250-R.030

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

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Speeds & Feeds on Page 62

3 FLUTE - CORNER RADIUS New Items!

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

H40ALV-RN-3

continued from previous page

Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description	
1/4	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	1-3/8	.237	3	82825*	82826*	H40ALV-RN-RA-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	1-7/8	.237	3	82827*	82828*	H40ALV-RN-AM-30250-R.060	
	1/4	.060	3/8	4	2-1/8	.237	3	81499*	81500*	H40ALV-RN-M-30250-R.060	
	1/4	.060	3/8	4	2-1/2	.237	3	82829*	82830*	H40ALV-RN-ML-30250-R.060	
5/16	5/16	.030	7/16	4	1-1/8	.296	3	86540	86541	H40ALV-RN-S-30312-R.030	new
	5/16	.030	7/16	4	1-3/4	.296	3	86544	86545	H40ALV-RN-R-30312-R.030	new
	5/16	.030	7/16	4	2-1/8	.296	3	86548	86549	H40ALV-RN-M-30312-R.030	new
	5/16	.060	7/16	4	1-1/8	.296	3	86542	86543	H40ALV-RN-S-30312-R.060	new
	5/16	.060	7/16	4	1-3/4	.296	3	86546	86547	H40ALV-RN-R-30312-R.060	new
	5/16	.060	7/16	4	2-1/8	.296	3	86550	86551	H40ALV-RN-M-30312-R.060	new
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	.015	1/2	5	2-1/2	.356	3	82831	82832	H40ALV-RN-ML-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	.030	1/2	6	3-1/8	.356	3	86552	86553	H40ALV-RN-LX-30375-R.030	new
	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	.060	1/2	6	3-1/8	.356	3	86554	86555	H40ALV-RN-LX-30375-R.060	new
	3/8	.090	1/2	3	1-1/8	.356	3	46240*	46241*	H40ALV-RN-R-30375-R.090	
	3/8	.090	1/2	3	1-5/8	.356	3	82833*	82834*	H40ALV-RN-A-30375-R.090	
	3/8	.090	1/2	4	2-1/8	.356	3	46265*	46266*	H40ALV-RN-M-30375-R.090	
	3/8	.090	1/2	5	2-1/2	.356	3	82835*	82836*	H40ALV-RN-ML-30375-R.090	
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	3-3/4	.475	3	82837	82838	H40ALV-RN-LX-30500-R.030	
	1/2	.030	5/8	6	4-1/4	.475	3	46400	46401	H40ALV-RN-X-30500-R.030	
	1/2	.030	5/8	7	5	.475	3	82839	82840	H40ALV-RN-Y-30500-R.030	

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

continued on next page

H40ALV-RN-3

New Items!

3 FLUTE - CORNER RADIUS

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

continued from previous page

	Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
	1/2	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	3-3/4	.475	3	82841	82842	H40ALV-RN-LX-30500-R.060
		1/2	.060	5/8	6	4-1/4	.475	3	46405	46406	H40ALV-RN-X-30500-R.060
		1/2	.060	5/8	7	5	.475	3	82843	82844	H40ALV-RN-Y-30500-R.060
		1/2	.090	5/8	3	1-3/8	.475	3	46320	46321	H40ALV-RN-R-30500-R.090
new		1/2	.090	5/8	3-1/2	1-3/4	.475	3	86556	86557	H40ALV-RN-A-30500-R.090
		1/2	.090	5/8	4	2-1/4	.475	3	46350	46351	H40ALV-RN-M-30500-R.090
new		1/2	.090	5/8	4-1/2	2-3/4	.475	3	86558	86559	H40ALV-RN-ML-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	3-3/4	.475	3	82845*	82846*	H40ALV-RN-LX-30500-R.125
		1/2	.125	5/8	6	4-1/4	.475	3	46415*	46416*	H40ALV-RN-X-30500-R.125
		1/2	.125	5/8	7	5	.475	3	82847*	82848*	H40ALV-RN-Y-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
new		3/4	.030	1	10	6	.712	3	86560	86561	H40ALV-RN-LX-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 - CORNER RADIUS

New Items!

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

H40ALV-RN-3

continued from previous page

Cutter Dia.** D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Z*plus 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	6	3-3/8	.950	3	46740	46741	H40ALV-RN-M-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

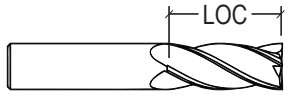
* Wiper flats not included if corner radius exceeds 20% of tool diameter. **.0003 max TIR

H40ALV-3 / H40ALV-RN-3

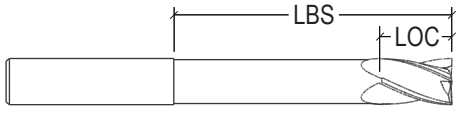
Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0008	.0014	.0017	.0011	.0021	.0019	.0015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

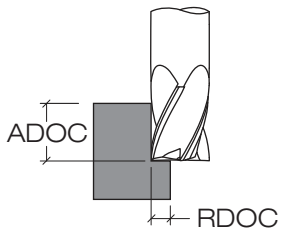
NOTES:
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



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

H45AL-3

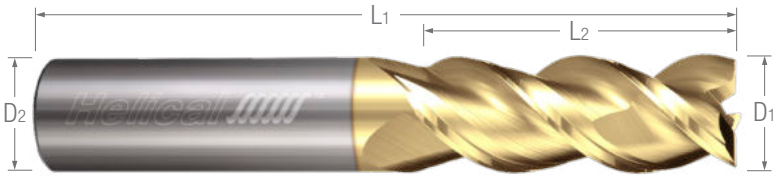
HEM

New Items!

3 FLUTE - SQUARE

45° Helix

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



	Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	Uncoated	*Zplus* 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
		1/8	7/8	2-1/2	3	82849	82850	H45AL-LX-30125
new		1/8	1	2-1/2	3	87060	87061	H45AL-X-30125
	3/16	3/16	5/16	2	3	03090	03092	H45AL-S-30187
new		3/16	7/16	2	3	87062	87063	H45AL-SR-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
		3/16	1-3/16	3	3	82851	82852	H45AL-L-30187
new		3/16	1-3/8	3	3	87064	87065	H45AL-LX-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
		1/4	1-3/4	4	3	03210	03212	H45AL-X-30250
		1/4	2	4	3	82853	82854	H45AL-Y-30250
	5/16	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
		5/16	2-1/8	4	3	03300	03302	H45AL-X-30312
new		5/16	2-1/2	4	3	87066	87067	H45AL-Y-30312

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 69

3 FLUTE - SQUARE New Items!

45° Helix (cont.)

H45AL-3

continued from previous page

Cutter Diameter* D_1 (h6)	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description	
3/8	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	2	4	3	03390	03392	H45AL-LX-30375	
	3/8	2-1/2	5	3	03405	03407	H45AL-X-30375	
	3/8	3	5	3	82855	82856	H45AL-Y-30375	
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	
	1/2	3-5/8	6	3	82857	82858	H45AL-Y-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	
	5/8	3-3/4	6	3	03615	03617	H45AL-X-30625	new
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	
	3/4	4-3/4	7	3	87068	87069	H45AL-Y-30750	new
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	

* .0003 max TIR

H45AL-3

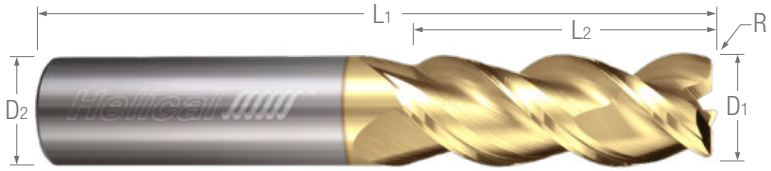
HEM

New Items!

3 FLUTE - CORNER RADIUS

45° Helix

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



	Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	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
		1/8	.010	5/8	2-1/2	3	83575	83576	H45AL-M-30125-R.010
		1/8	.010	3/4	2-1/2	3	83577	83578	H45AL-L-30125-R.010
		1/8	.020	1/4	1-1/2	3	83579	83580	H45AL-S-30125-R.020
		1/8	.020	3/8	2	3	83581	83582	H45AL-SR-30125-R.020
		1/8	.020	1/2	2-1/2	3	83583	83584	H45AL-R-30125-R.020
new		1/8	.020	5/8	2-1/2	3	87070	87071	H45AL-M-30125-R.020
new		1/8	.020	3/4	2-1/2	3	87072	87073	H45AL-L-30125-R.020
		1/8	.030	1/4	1-1/2	3	83585	83586	H45AL-S-30125-R.030
		1/8	.030	3/8	2	3	83587	83588	H45AL-SR-30125-R.030
		1/8	.030	1/2	2-1/2	3	83589	83590	H45AL-R-30125-R.030
new		1/8	.030	5/8	2-1/2	3	87074	87075	H45AL-M-30125-R.030
new		1/8	.030	3/4	2-1/2	3	87076	87077	H45AL-L-30125-R.030
	3/16	3/16	.010	5/16	2	3	83591	83592	H45AL-S-30187-R.010
		3/16	.010	9/16	2-1/2	3	83593	83594	H45AL-R-30187-R.010
		3/16	.010	3/4	2-1/2	3	83595	83596	H45AL-M-30187-R.010
new		3/16	.010	1	2-1/2	3	87078	87079	H45AL-ML-30187-R.010
		3/16	.020	5/16	2	3	83597	83598	H45AL-S-30187-R.020
		3/16	.020	9/16	2-1/2	3	83599	83600	H45AL-R-30187-R.020
		3/16	.020	3/4	2-1/2	3	83601	83602	H45AL-M-30187-R.020
new		3/16	.020	1	2-1/2	3	87080	87081	H45AL-ML-30187-R.020
		3/16	.030	5/16	2	3	83603	83604	H45AL-S-30187-R.030
		3/16	.030	9/16	2-1/2	3	83605	83606	H45AL-R-30187-R.030
		3/16	.030	3/4	2-1/2	3	83607	83608	H45AL-M-30187-R.030
new		3/16	.030	1	2-1/2	3	87082	87083	H45AL-ML-30187-R.030

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 69

3 FLUTE - CORNER RADIUS

New Items!

45° Helix (cont.)

H45AL-3

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	Uncoated	Z*plus* Coated	Tool Description	
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	.010	1-1/4	3	3	83609	83610	H45AL-L-30250-R.010	
	1/4	.020	1/2	2-1/2	3	83611	83612	H45AL-SR-30250-R.020	
	1/4	.020	3/4	2-1/2	3	83613	83614	H45AL-R-30250-R.020	
	1/4	.020	1	3	3	83615	83616	H45AL-M-30250-R.020	
	1/4	.020	1-1/4	3	3	87084	87085	H45AL-L-30250-R.020	new
	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	
	1/4	.030	1-1/4	3	3	83617	83618	H45AL-L-30250-R.030	
	1/4	.060	1/2	2-1/2	3	83619	83620	H45AL-SR-30250-R.060	
	1/4	.060	3/4	2-1/2	3	83621	83622	H45AL-R-30250-R.060	
	1/4	.060	1	3	3	83623	83624	H45AL-M-30250-R.060	
	1/4	.060	1-1/4	3	3	87086	87087	H45AL-L-30250-R.060	new
5/16	5/16	.010	7/16	2	3	83625	83626	H45AL-S-30312-R.010	
	5/16	.010	13/16	2-1/2	3	83627	83628	H45AL-R-30312-R.010	
	5/16	.010	1	3	3	83629	83630	H45AL-M-30312-R.010	
	5/16	.030	7/16	2	3	83631	83632	H45AL-S-30312-R.030	
	5/16	.030	13/16	2-1/2	3	83633	83634	H45AL-R-30312-R.030	
	5/16	.030	1	3	3	83635	83636	H45AL-M-30312-R.030	
	5/16	.060	7/16	2	3	83637	83638	H45AL-S-30312-R.060	
	5/16	.060	13/16	2-1/2	3	83639	83640	H45AL-R-30312-R.060	
	5/16	.060	1	3	3	83641	83642	H45AL-M-30312-R.060	
3/8	3/8	.010	1/2	2	3	83643	83644	H45AL-S-30375-R.010	
	3/8	.010	1	3	3	83645	83646	H45AL-R-30375-R.010	
	3/8	.010	1-1/4	3-1/2	3	83647	83648	H45AL-M-30375-R.010	
	3/8	.010	1-1/2	4	3	87088	87089	H45AL-L-30375-R.010	new
	3/8	.010	2	4	3	87090	87091	H45AL-LX-30375-R.010	new
	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	.030	1-1/2	4	3	83649	83650	H45AL-L-30375 -R.030	
	3/8	.030	2	4	3	87092	87093	H45AL-LX-30375-R.030	new
	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	
	3/8	.060	1-1/2	4	3	83651	83652	H45AL-L-30375 -R.060	
	3/8	.060	2	4	3	87094	87095	H45AL-LX-30375-R.060	new
	3/8	.125	1/2	2	3	87096	87097	H45AL-S-30375-R.125	new
	3/8	.125	1	3	3	87098	87099	H45AL-R-30375-R.125	new
	3/8	.125	1-1/4	3-1/2	3	87100	87101	H45AL-M-30375-R.125	new

* .0003 max TIR

continued on next page

H45AL-3

HEM

New Items!

3 FLUTE - CORNER RADIUS

45° Helix (cont.)

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Uncoated	*Zplus* Coated	Tool Description
1/2	1/2	**.010**	1	3	3	**83653**	**83654**	H45AL-SR-30500-R.010
	1/2	**.010**	1-1/4	3	3	**83655**	**83656**	H45AL-R-30500-R.010
	1/2	**.010**	1-5/8	4	3	**83657**	**83658**	H45AL-M-30500-R.010
	1/2	**.010**	2	4	3	**83659**	**83660**	H45AL-L-30500-R.010
	1/2	**.020**	1	3	3	**83661**	**83662**	H45AL-SR-30500-R.020
	1/2	**.020**	1-1/4	3	3	**83663**	**83664**	H45AL-R-30500-R.020
	1/2	**.020**	1-5/8	4	3	**83665**	**83666**	H45AL-M-30500-R.020
	1/2	**.020**	2	4	3	**83667**	**83668**	H45AL-L-30500-R.020
	1/2	**.030**	5/8	2-1/2	3	**83669**	**83670**	H45AL-S-30500-R.030
	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	**.030**	2-1/2	5	3	**83671**	**83672**	H45AL-LX-30500-R.030
	1/2	**.060**	5/8	2-1/2	3	**83673**	**83674**	H45AL-S-30500-R.060
	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
	1/2	**.060**	2-1/2	5	3	**83675**	**83676**	H45AL-LX-30500-R.060
	1/2	**.125**	1	3	3	**83677**	**83678**	H45AL-SR-30500-R.125
	1/2	**.125**	1-1/4	3	3	**83679**	**83680**	H45AL-R-30500-R.125
	1/2	**.125**	1-5/8	4	3	**83681**	**83682**	H45AL-M-30500-R.125
	1/2	**.125**	2	4	3	**83683**	**83684**	H45AL-L-30500-R.125
5/8	5/8	**.030**	1-5/8	3-1/2	3	**83685**	**83686**	H45AL-R-30625-R.030
	5/8	**.030**	2-1/8	4	3	**83687**	**83688**	H45AL-M-30625-R.030
	5/8	**.030**	2-1/2	5	3	**83689**	**83690**	H45AL-L-30625-R.030
	5/8	**.060**	1-5/8	3-1/2	3	**83691**	**83692**	H45AL-R-30625-R.060
	5/8	**.060**	2-1/8	4	3	**83693**	**83694**	H45AL-M-30625-R.060
	5/8	**.060**	2-1/2	5	3	**83695**	**83696**	H45AL-L-30625-R.060
	5/8	**.125**	1-5/8	3-1/2	3	**83697**	**83698**	H45AL-R-30625-R.125
	5/8	**.125**	2-1/8	4	3	**83699**	**83700**	H45AL-M-30625-R.125
	5/8	**.125**	2-1/2	5	3	**83701**	**83702**	H45AL-L-30625-R.125
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
	3/4	**.125**	1-5/8	4	3	**83703**	**83704**	H45AL-R-30750-R.125
	3/4	**.125**	2-1/4	5	3	**83705**	**83706**	H45AL-M-30750-R.125

* .0003 max TIR

3 FLUTE - SQUARE

45° Helix - Reduced Neck

H45AL-RN-3

- Designed for outstanding performance and accelerated material removal rates in aluminum and non-ferrous materials
- 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 offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.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	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
	1/8	5/32	3	1-1/4	.118	3	83707	83708	H45AL-RN-LX-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
	3/16	7/32	3	1-5/16	.178	3	83709	83710	H45AL-RN-LX-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
	1/4	3/8	4-1/2	3	.237	3	83711	83712	H45AL-RN-L-30250
5/16	5/16	7/16	4	1-1/8	.296	3	19165	19167	H45AL-RN-R-30312
	5/16	7/16	4	1-3/4	.296	3	83713	83714	H45AL-RN-A-30312
	5/16	7/16	4	2-1/8	.296	3	19180	19182	H45AL-RN-M-30312
	5/16	7/16	6	3-1/8	.296	3	19190	19192	H45AL-RN-L-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	5	2-1/2	.356	3	83715	83716	H45AL-RN-ML-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	3-3/4	.475	3	83717	83718	H45AL-RN-LX-30500
	1/2	5/8	6	4-1/4	.475	3	19325	19327	H45AL-RN-X-30500

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 69

H45AL-3

HEM

3 FLUTE - SQUARE

45° Helix - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D_1 (h6)	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Uncoated	*Zplus* Coated	Tool Description
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

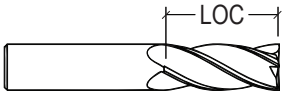
* .0003 max TIR

H45AL-3 / H45AL-RN-3

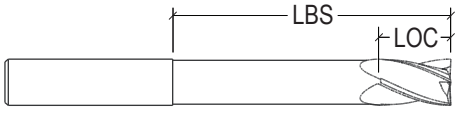
Material Guide		SFM	Inches per Tooth (IPT)																			
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin	Slot	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0008	.0016	.0018	.0012	.0023	.0021	.0016	.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

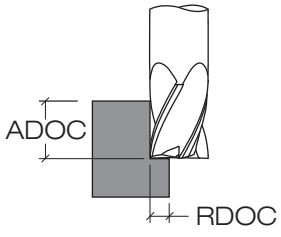
NOTES:
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



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

5 FLUTE - CORNER RADIUS

Variable Pitch - For High Efficiency Milling

HVAL-5

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of aerospace aluminum alloys with excellent performance in other non-ferrous alloys
- Excellent tool life and maximum material removal rates proven through extensive testing
- Engineered with variable pitch for minimized harmonics and reduced tool pressure
- Center cutting
- h6 shank tolerance for high precision tool holders
- N*plus* coating for maximum performance in abrasive aluminums and extended tool life in a wide variety of non-ferrous alloys
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	Uncoated	N*plus* Coated	Tool Description
1/8	1/4	**.010**	1/4	2-1/2	5	**84105**	**84106**	HVAL-020-50125-R.010
	1/4	**.010**	3/8	2-1/2	5	**84107**	**84108**	HVAL-030-50125-R.010
	1/4	**.010**	1/2	2-1/2	5	**84109**	**84110**	HVAL-040-50125-R.010
	1/4	**.030**	1/4	2-1/2	5	**84111**	**84112**	HVAL-020-50125-R.030
	1/4	**.030**	3/8	2-1/2	5	**84113**	**84114**	HVAL-030-50125-R.030
	1/4	**.030**	1/2	2-1/2	5	**84115**	**84116**	HVAL-040-50125-R.030
3/16	1/4	**.010**	3/8	2-1/2	5	**84117**	**84118**	HVAL-020-50187-R.010
	1/4	**.010**	3/4	2-1/2	5	**84119**	**84120**	HVAL-040-50187-R.010
	1/4	**.010**	1	2-1/2	5	**84121**	**84122**	HVAL-053-50187-R.010
	1/4	**.030**	3/8	2-1/2	5	**84123**	**84124**	HVAL-020-50187-R.030
	1/4	**.030**	3/4	2-1/2	5	**84125**	**84126**	HVAL-040-50187-R.030
	1/4	**.030**	1	2-1/2	5	**84127**	**84128**	HVAL-053-50187-R.030
1/4	1/4	**.010**	1/2	2-1/2	5	**84129**	**84130**	HVAL-020-50250-R.010
	1/4	**.010**	3/4	2-1/2	5	**84131**	**84132**	HVAL-030-50250-R.010
	1/4	**.010**	1	3	5	**84133**	**84134**	HVAL-040-50250-R.010
	1/4	**.030**	1/2	2-1/2	5	**84135**	**84136**	HVAL-020-50250-R.030
	1/4	**.030**	3/4	2-1/2	5	**84137**	**84138**	HVAL-030-50250-R.030
	1/4	**.030**	1	3	5	**84139**	**84140**	HVAL-040-50250-R.030
3/8	3/8	**.010**	3/4	2-1/2	5	**84141**	**84142**	HVAL-020-50375-R.010
	3/8	**.010**	1	3	5	**84143**	**84144**	HVAL-026-50375-R.010
	3/8	**.010**	1-1/2	3-1/2	5	**84145**	**84146**	HVAL-040-50375-R.010
	3/8	**.030**	3/4	2-1/2	5	**84147**	**84148**	HVAL-020-50375-R.030
	3/8	**.030**	1	3	5	**84149**	**84150**	HVAL-026-50375-R.030
	3/8	**.030**	1-1/2	3-1/2	5	**84151**	**84152**	HVAL-040-50375-R.030

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 71

HVAL-5

5 FLUTE - CORNER RADIUS

Variable Pitch - For High Efficiency Milling (cont.)

continued from previous page

Cutter Dia.* D_1 +.000" –.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" –.002"	Length of Cut L_2 +.032" –.000"	Overall Length L_1 +.062" –.062"	Flutes	Uncoated	Nplus Coated	Tool Description
1/2	1/2	.010	1	3	5	84153	84154	HVAL-020-50500-R.010
	1/2	.010	1-1/4	3	5	84155	84156	HVAL-025-50500-R.010
	1/2	.010	1-5/8	4	5	84157	84158	HVAL-032-50500-R.010
	1/2	.010	2	4	5	84159	84160	HVAL-040-50500-R.010
	1/2	.030	1	3	5	84161	84162	HVAL-020-50500-R.030
	1/2	.030	1-1/4	3	5	84163	84164	HVAL-025-50500-R.030
	1/2	.030	1-5/8	4	5	84165	84166	HVAL-032-50500-R.030
	1/2	.030	2	4	5	84167	84168	HVAL-040-50500-R.030
	1/2	.060	1	3	5	84169	84170	HVAL-020-50500-R.060
	1/2	.060	1-1/4	3	5	84171	84172	HVAL-025-50500-R.060
	1/2	.060	1-5/8	4	5	84173	84174	HVAL-032-50500-R.060
	1/2	.060	2	4	5	84175	84176	HVAL-040-50500-R.060
	1/2	.125	1	3	5	84177	84178	HVAL-020-50500-R.125
	1/2	.125	1-1/4	3	5	84179	84180	HVAL-025-50500-R.125
	1/2	.125	1-5/8	4	5	84181	84182	HVAL-032-50500-R.125
	1/2	.125	2	4	5	84183	84184	HVAL-040-50500-R.125
3/4	3/4	.030	1-5/8	4	5	84185	84186	HVAL-021-50750-R.030
	3/4	.030	2-1/4	5	5	84187	84188	HVAL-030-50750-R.030
	3/4	.060	1-5/8	4	5	84189	84190	HVAL-021-50750-R.060
	3/4	.060	2-1/4	5	5	84191	84192	HVAL-030-50750-R.060
	3/4	.125	1-5/8	4	5	84193	84194	HVAL-021-50750-R.125
	3/4	.125	2-1/4	5	5	84195	84196	HVAL-030-50750-R.125

* .0003 max TIR

HVAL-5

Material Guide		SFM	Inches per Tooth (IPT)																				
			1/8			3/16			1/4			3/8			1/2			3/4			1		
			HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0018	.0013	.0018	.0023	.0020	.0020	.0030	.0026	.0023	.0045	.0039	.0027	.0059	.0051	.0031	.0084	.0073	.0037	.0107	.0094	.0045
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0023	.0021	.0023	.0035	.0031	.0025	.0047	.0041	.0029	.0070	.0061	.0033	.0091	.0080	.0039	.0131	.0114	.0046	.0167	.0145	.0056
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0018	.0014	.0018	.0023	.0021	.0021	.0031	.0028	.0024	.0047	.0041	.0027	.0061	.0053	.0032	.0087	.0076	.0038	.0112	.0097	.0046

MILLING PROCESS	ADOC	RDOC
HEM (High Efficiency Milling)	Up to Max LOC	Up to 10% Diameter
Rgh (Traditional Roughing)	125%-200% Diameter	30%-40% 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.

MULTI-AXIS FINISHERS - 3 FLUTE

Lens Form

HMAF-AL-3

- Specially defined profile for massive reductions in cycle time and vastly improved surface finish
- Lens form with two tangential radii for finishing floors
- 3 flute geometry specifically designed for finishing in aluminum and non-ferrous alloys
- Center cutting
- h6 shank tolerance for high precision tool holders
- N*plus* coating for maximum performance in abrasive aluminums and extended tool life in a wide variety of non-ferrous alloys
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Major Radius R_1	Corner Radius R_3	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	N*plus* Coated	Tool Description
3/8	3/8	**3/4**	.020	3/8	2-1/2	3	2x	**86314**	HMAF-AL-30375-02-LNS
1/2	1/2	**1**	.030	1/2	3	3	2x	**86315**	HMAF-AL-30500-02-LNS
5/8	5/8	**1-1/4**	.035	5/8	3-1/2	3	2x	**86316**	HMAF-AL-30625-02-LNS
3/4	3/4	**1-1/2**	.045	3/4	4	3	2x	**86317**	HMAF-AL-30750-02-LNS

* .0005 max TIR

Multi-Axis Finishers - Technical Information - pg 220

When switching from a traditional ball end mill, the unique geometries of Multi-Axis Finishers allow for dramatically improved surface finish, while significantly reducing cycle times. Learn more about the Benefit Multiple, profile options, and how these superior tools can pay dividends at the spindle.

scan the QR code to read online

Finishers

HMAF-AL-3

Material Guide		SFM	Inches per Tooth (IPT)						
			1/8	3/16	1/4	3/8	1/2	3/4	1
			Fin	Fin	Fin	Fin	Fin	Fin	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0016	.0018	.0020	.0023	.0027	.0033	.0039
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0020	.0022	.0025	.0029	.0034	.0040	.0049
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0016	.0018	.0021	.0024	.0028	.0033	.0040

STYLE	TOOLPATH	ADOC (STOCK REMOVAL)	RDOC (STEPOVER PER PASS)
HMAF-AL-3 Lens	Finishing (Fin)	.005"-.010"	.025 x Dia x Benefit Multiple

NOTE:
ADOC and RDOC are recommended starting values, and should be adjusted according to your finish requirements.
If converting from a ball end mill, the benefit multiple can be used to recalculate stepover pass-to-pass.

HMAF-AL-4

MULTI-AXIS FINISHERS - 4 FLUTE
Taper Form

- Specially defined profile for massive reductions in cycle time and vastly improved surface finish
- Taper form with three tangential radii offered in a variety of angles for maximum performance and optimal clearance angle for any workpiece
- 4 flute geometry specifically designed for finishing in aluminum and non-ferrous alloys
- Center cutting
- h6 shank tolerance for high precision tool holders
- N*plus* coating for maximum performance in abrasive aluminums and extended tool life in a wide variety of non-ferrous alloys
- Solid carbide
- CNC ground in the USA

Ang. Per Side A_1 $^{+0°30'}_{-0°30'}$	Shank Dia. D_2 (h6)	Major Radius R_1	Tip Radius R_2	Corner Radius R_3	Length of Cut L_2	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	N*plus* Coated	Tool Description
15°	3/8	**12**	3/64	3/16	.5901	2-1/2	4	8x	**86279**	HMAF-AL-40375-08-T15
	3/8	**27**	3/64	3/16	.5902	2-1/2	4	12x	**86284**	HMAF-AL-40375-12-T15
	1/2	**16**	1/16	1/4	.7868	3	4	8x	**86287**	HMAF-AL-40500-08-T15
	1/2	**36**	1/16	1/4	.7869	3	4	12x	**86292**	HMAF-AL-40500-12-T15
	5/8	**20**	5/64	5/16	.9834	3	4	8x	**86295**	HMAF-AL-40625-08-T15
	5/8	**45**	5/64	5/16	.9836	3	4	12x	**86300**	HMAF-AL-40625-12-T15
	3/4	**24**	3/32	3/8	1.1801	4	4	8x	**86303**	HMAF-AL-40750-08-T15
	3/4	**54**	3/32	3/8	1.1803	4	4	12x	**86308**	HMAF-AL-40750-12-T15
30°	3/8	**12**	3/64	3/16	.3281	2-1/2	4	8x	**86280**	HMAF-AL-40375-08-T30
	3/8	**27**	3/64	3/16	.3281	2-1/2	4	12x	**86285**	HMAF-AL-40375-12-T30
	1/2	**16**	1/16	1/4	.4375	3	4	8x	**86288**	HMAF-AL-40500-08-T30
	1/2	**36**	1/16	1/4	.4375	3	4	12x	**86293**	HMAF-AL-40500-12-T30
	5/8	**20**	5/64	5/16	.5469	3	4	8x	**86296**	HMAF-AL-40625-08-T30
	5/8	**45**	5/64	5/16	.5469	3	4	12x	**86301**	HMAF-AL-40625-12-T30
	3/4	**24**	3/32	3/8	.6562	4	4	8x	**86304**	HMAF-AL-40750-08-T30
	3/4	**54**	3/32	3/8	.6562	4	4	12x	**86309**	HMAF-AL-40750-12-T30
45°	3/8	**12**	3/64	3/64	.1875	2-1/2	4	8x	**86281**	HMAF-AL-40375-08-T45
	3/8	**27**	3/64	3/64	.1875	2-1/2	4	12x	**86286**	HMAF-AL-40375-12-T45
	1/2	**16**	1/16	1/16	.2500	3	4	8x	**86289**	HMAF-AL-40500-08-T45
	1/2	**36**	1/16	1/16	.2500	3	4	12x	**86294**	HMAF-AL-40500-12-T45
	5/8	**20**	5/64	5/64	.3125	3	4	8x	**86297**	HMAF-AL-40625-08-T45
	5/8	**45**	5/64	5/64	.3125	3	4	12x	**86302**	HMAF-AL-40625-12-T45
	3/4	**24**	3/32	3/32	.3750	4	4	8x	**86305**	HMAF-AL-40750-08-T45
	3/4	**54**	3/32	3/32	.3750	4	4	12x	**86310**	HMAF-AL-40750-12-T45

* .0005 max TIR

Multi-Axis Finishers - Technical Information - pg 220

When switching from a traditional ball end mill, the unique geometries of Multi-Axis Finishers allow for dramatically improved surface finish, while significantly reducing cycle times. Learn more about the Benefit Multiple, profile options, and how these superior tools can pay dividends at the spindle.

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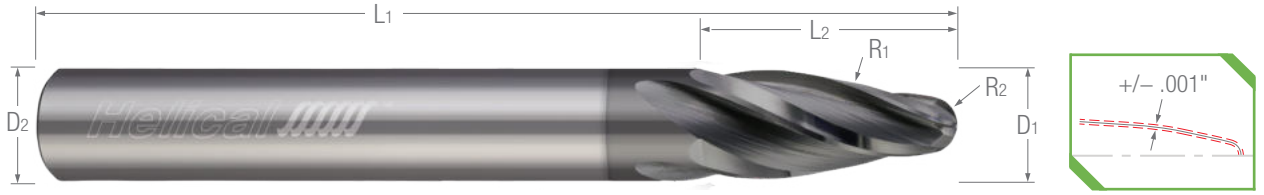
Speeds & Feeds on Page 74

MULTI-AXIS FINISHERS - 4 FLUTE

Oval Form

HMAF-AL-4

- Specially defined profile for massive reductions in cycle time and vastly improved surface finish
- Oval form with two tangential radii for versatility in angle of approach and clearance in tight spaces
- 4 flute geometry specifically designed for finishing in aluminum and non-ferrous alloys
- Center cutting
- h6 shank tolerance for high precision tool holders
- N*plus* coating for maximum performance in abrasive aluminums and extended tool life in a wide variety of non-ferrous alloys
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Major Radius R_1	Tip Radius R_2	Length of Cut L_2	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	N*plus* Coated	Tool Description
3/8	3/8	**3**	3/32	.8260	2-1/2	4	4x	**86267**	HMAF-AL-40375-04-0VL
1/2	1/2	**4**	1/8	1.1013	3	4	4x	**86268**	HMAF-AL-40500-04-0VL
5/8	5/8	**5**	5/32	1.3766	3-1/2	4	4x	**86269**	HMAF-AL-40625-04-0VL
3/4	3/4	**6**	3/16	1.6519	4	4	4x	**86270**	HMAF-AL-40750-04-0VL

* .0005 max TIR

Multi-Axis Finishers - Technical Information - pg 220

When switching from a traditional ball end mill, the unique geometries of Multi-Axis Finishers allow for dramatically improved surface finish, while significantly reducing cycle times. Learn more about the Benefit Multiple, profile options, and how these superior tools can pay dividends at the spindle.

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HMAF-AL-4

Material Guide		SFM	Inches per Tooth (IPT)						
			1/8	3/16	1/4	3/8	1/2	3/4	1
			Fin	Fin	Fin	Fin	Fin	Fin	Fin
WROUGHT ALUMINUM ALLOY	2014, 5062, 6061, 7050, 7075, 7475	2100	.0024	.0027	.0030	.0035	.0041	.0050	.0059
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0030	.0033	.0038	.0044	.0051	.0060	.0074
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0024	.0027	.0032	.0036	.0042	.0050	.0060

STYLE	TOOLPATH	ADOC (STOCK REMOVAL)	RDOC (STEPOVER PER PASS)
HMAF-AL-4 Oval	Finishing (Fin)	.005"-.010"	.025 x Dia x Benefit Multiple
HMAF-AL-4 Taper	Finishing (Fin)	.005"-.010"	.025 x Dia x Benefit Multiple

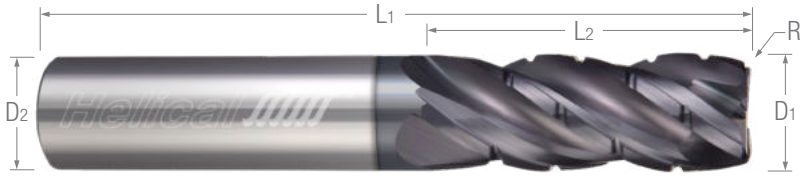
NOTE
ADOC and RDOC are recommended starting values, and should be adjusted according to your finish requirements
If converting from a ball end mill, the benefit multiple can be used to recalculate stepover pass-to-pass

HSVR-C-4

4 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
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
	1/8	**.010**	1/2	2-1/2	4	**33032**		HSVR-C-R-40125-R.010
	1/8	**.010**	5/8	2-1/2	4	**82500**		HSVR-C-A-40125-R.010
	1/8	**.030**	1/4	1-1/2	4	**83453**		HSVR-C-S-40125-R.030
	1/8	**.030**	1/2	2-1/2	4	**83454**		HSVR-C-R-40125-R.030
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
	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
	3/16	**.030**	5/16	2	4	**83455**		HSVR-C-S-40187-R.030
	3/16	**.030**	5/8	2-1/2	4	**83456**		HSVR-C-R-40187-R.030
1/4	1/4	**.010**	3/8	2	4	**83457**		HSVR-C-S-40250-R.010
	1/4	**.010**	1/2	2-1/2	4	**83458**		HSVR-C-SR-40250-R.010
	1/4	**.010**	3/4	2-1/2	4	**83459**		HSVR-C-R-40250-R.010
	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
	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
	1/4	**.030**	3/8	2	4	**83460**		HSVR-C-S-40250-R.030
	1/4	**.030**	1/2	2-1/2	4	**83461**		HSVR-C-SR-40250-R.030
	1/4	**.030**	3/4	2-1/2	4	**83462**		HSVR-C-R-40250-R.030
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
	5/16	**.020**	1-1/4	3	4	**33257**		HSVR-C-M-40312-R.020

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 78

4 FLUTE - CORNER RADIUS

HSVR-C-4

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
3/8	3/8	.010	1/2	2	4	83463		HSVR-C-S-40375-R.010
	3/8	.010	7/8	3	4	83464		HSVR-C-SR-40375-R.010
	3/8	.010	1	3	4	83465		HSVR-C-R-40375-R.010
	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
	3/8	.030	1/2	2	4	83466		HSVR-C-S-40375-R.030
	3/8	.030	7/8	3	4	83467		HSVR-C-SR-40375-R.030
	3/8	.030	1	3	4	83468		HSVR-C-R-40375-R.030
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	.010	5/8	2-1/2	4	83469		HSVR-C-S-40500-R.010
	1/2	.010	1	3	4	83470		HSVR-C-SR-40500-R.010
	1/2	.010	1-1/4	3	4	83471		HSVR-C-R-40500-R.010
	1/2	.010	1-5/8	4	4	83472		HSVR-C-M-40500-R.010
	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
	1/2	.030	2-1/2	4	4	82507		HSVR-C-LX-40500-R.030
	1/2	.060	5/8	2-1/2	4	83473		HSVR-C-S-40500-R.060
	1/2	.060	1	3	4	83474		HSVR-C-SR-40500-R.060
	1/2	.060	1-1/4	3	4	83475		HSVR-C-R-40500-R.060
	1/2	.060	1-5/8	4	4	83476		HSVR-C-M-40500-R.060
5/8	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
	5/8	.060	1-1/4	3-1/2	4	83477		HSVR-C-SR-40625-R.060
	5/8	.060	1-5/8	3-1/2	4	83478		HSVR-C-R-40625-R.060
	5/8	.060	2	4	4	83479		HSVR-C-M-40625-R.060
3/4	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
	3/4	.060	1-5/8	4	4	83480		HSVR-C-R-40750-R.060
	3/4	.060	2-1/4	5	4	83481		HSVR-C-M-40750-R.060
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-R-41000-R.030
	1	.030	2-5/8	5	4	33737	33737W	HSVR-C-M-41000-R.030
	1	.030	3	6	4	33742	33742W	HSVR-C-ML-41000-R.030
	1	.030	4-1/4	7	4	33752		HSVR-C-L-41000-R.030

* .0005 max TIR

HSVR-C-RN-4

4 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	*Aplus* Coated	Tool Description
1/4	1/4	**.020**	3/8	4	3/4	.237	4	**82876**	HSVR-C-RN-S-40250-R.020
	1/4	**.020**	3/8	4	1-1/8	.237	4	**82877**	HSVR-C-RN-R-40250-R.020
	1/4	**.020**	3/8	4	2-1/8	.237	4	**82878**	HSVR-C-RN-M-40250-R.020
3/8	3/8	**.020**	1/2	4	1-1/8	.356	4	**82879**	HSVR-C-RN-S-40375-R.020
	3/8	**.020**	1/2	4	2-1/8	.356	4	**82880**	HSVR-C-RN-R-40375-R.020
	3/8	**.020**	1/2	6	3-1/8	.356	4	**82881**	HSVR-C-RN-M-40375-R.020
1/2	1/2	**.030**	5/8	4	1-1/2	.475	4	**82882**	HSVR-C-RN-S-40500-R.030
	1/2	**.030**	5/8	4	2-1/4	.475	4	**82883**	HSVR-C-RN-R-40500-R.030
	1/2	**.030**	5/8	6	3-3/8	.475	4	**82884**	HSVR-C-RN-M-40500-R.030
	1/2	**.030**	5/8	6	4-1/8	.475	4	**82885**	HSVR-C-RN-L-40500-R.030
3/4	3/4	**.030**	1	4	2	.712	4	**82886**	HSVR-C-RN-S-40750-R.030
	3/4	**.030**	1	6	2-1/2	.712	4	**82887**	HSVR-C-RN-R-40750-R.030
	3/4	**.030**	1	6	3-3/8	.712	4	**82888**	HSVR-C-RN-M-40750-R.030

* .0005 max TIR

Speeds & Feeds on Page 78

SPEEDS & FEEDS

4 Flute - Chipbreaker Rougher - Variable Pitch

HSVR-C-4

HSVR-C-4 / HSVR-C-RN-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	455	.0008	.0013	.0012	.0019	.0015	.0025	.0023	.0037	.0030	.0048	.0042	.0069	.0054	.0088
		75 - 98 HRB	445	.0006	.0009	.0008	.0014	.0011	.0018	.0017	.0027	.0022	.0035	.0031	.0051	.0040	.0065
		21 - 36 HRC	400	.0004	.0006	.0005	.0009	.0007	.0012	.0011	.0017	.0014	.0023	.0020	.0033	.0026	.0042
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0005	.0008	.0007	.0012	.0010	.0016	.0014	.0023	.0019	.0031	.0027	.0044	.0034	.0056
		21 - 36 HRC	340	.0004	.0006	.0005	.0009	.0007	.0012	.0011	.0017	.0014	.0023	.0020	.0033	.0025	.0042
		36 - 50 HRC	260	.0003	.0005	.0005	.0008	.0006	.0010	.0009	.0015	.0012	.0020	.0018	.0029	.0022	.0036
		> 50 HRC	155	.0003	.0004	.0004	.0006	.0005	.0008	.0007	.0012	.0010	.0016	.0014	.0023	.0017	.0029
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0005	.0008	.0007	.0012	.0010	.0016	.0014	.0023	.0019	.0031	.0027	.0044	.0034	.0056
		21 - 36 HRC	250	.0004	.0006	.0006	.0009	.0008	.0013	.0011	.0019	.0015	.0024	.0021	.0035	.0027	.0045
		36 - 50 HRC	145	.0003	.0005	.0005	.0007	.0006	.0010	.0009	.0015	.0012	.0019	.0017	.0027	.0021	.0035
		> 50 HRC	85	.0003	.0004	.0004	.0006	.0005	.0008	.0007	.0012	.0010	.0016	.0014	.0022	.0017	.0028
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0006	.0011	.0010	.0015	.0013	.0021	.0019	.0031	.0025	.0040	.0035	.0058	.0045	.0073
		75 - 98 HRB	255	.0005	.0007	.0007	.0011	.0009	.0014	.0013	.0021	.0017	.0028	.0024	.0040	.0031	.0050
		21 - 36 HRC	175	.0004	.0007	.0006	.0010	.0008	.0013	.0012	.0019	.0015	.0025	.0022	.0035	.0028	.0045
		36 - 50 HRC	150	.0004	.0006	.0005	.0009	.0007	.0011	.0010	.0017	.0014	.0022	.0019	.0032	.0025	.0040
		> 50 HRC	55	.0002	.0004	.0003	.0005	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0019	.0015	.0025
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0005	.0008	.0007	.0011	.0009	.0015	.0014	.0023	.0018	.0030	.0026	.0043	.0033	.0054
		21 - 36 HRC	225	.0004	.0007	.0006	.0010	.0008	.0014	.0013	.0021	.0016	.0027	.0024	.0039	.0030	.0049
		36 - 50 HRC	180	.0003	.0006	.0005	.0008	.0007	.0011	.0010	.0016	.0013	.0022	.0019	.0031	.0024	.0039
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0005	.0008	.0007	.0012	.0010	.0016	.0014	.0024	.0019	.0031	.0027	.0044	.0034	.0056
		21 - 36 HRC	280	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0020	.0016	.0027	.0023	.0038	.0030	.0049
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0004	.0006	.0005	.0009	.0007	.0012	.0011	.0017	.0014	.0023	.0020	.0032	.0025	.0041
		36 - 50 HRC	145	.0003	.0005	.0005	.0008	.0006	.0010	.0009	.0015	.0012	.0020	.0017	.0028	.0022	.0036
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
		36 - 50 HRC	135	.0002	.0004	.0003	.0005	.0004	.0007	.0007	.0011	.0009	.0014	.0012	.0020	.0015	.0025
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	.0106
		75 - 98 HRB	275	.0008	.0013	.0012	.0019	.0015	.0025	.0023	.0037	.0030	.0049	.0043	.0070	.0054	.0089
		21 - 36 HRC	250	.0006	.0010	.0009	.0014	.0012	.0019	.0017	.0028	.0022	.0037	.0032	.0052	.0041	.0067
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	.0053
		36 - 50 HRC	160	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0020	.0016	.0026	.0023	.0038	.0029	.0048
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. 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.

HEV-C-5

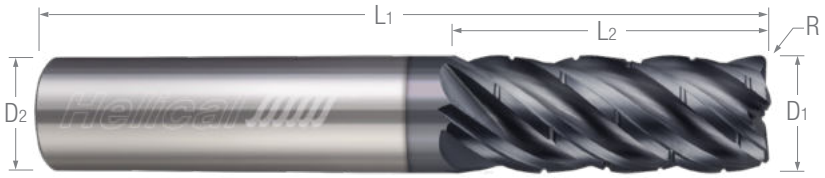
New Items!

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 173 for T*plus* coating



	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
	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
		1/8	**.010**	3/4	2-1/2	5	**83068**	HEV-C-M-50125-R.010
new		1/8	**.020**	1/4	1-1/2	5	**87343**	HEV-C-S-50125-R.020
new		1/8	**.020**	3/8	2	5	**87344**	HEV-C-SR-50125-R.020
new		1/8	**.020**	1/2	2-1/2	5	**87345**	HEV-C-R-50125-R.020
new		1/8	**.020**	5/8	2-1/2	5	**87346**	HEV-C-A-50125-R.020
new		1/8	**.020**	3/4	2-1/2	5	**87347**	HEV-C-M-50125-R.020
new		1/8	**.030**	1/4	1-1/2	5	**87348**	HEV-C-S-50125-R.030
new		1/8	**.030**	3/8	2	5	**87349**	HEV-C-SR-50125-R.030
new		1/8	**.030**	1/2	2-1/2	5	**87350**	HEV-C-R-50125-R.030
new		1/8	**.030**	5/8	2-1/2	5	**87351**	HEV-C-A-50125-R.030
new		1/8	**.030**	3/4	2-1/2	5	**87352**	HEV-C-M-50125-R.030
	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
		3/16	**.010**	1	2-1/2	5	**83069**	HEV-C-ML-50187-R.010
new		3/16	**.020**	5/16	2	5	**87353**	HEV-C-S-50187-R.020
new		3/16	**.020**	7/16	2	5	**87354**	HEV-C-SR-50187-R.020
new		3/16	**.020**	9/16	2-1/2	5	**87355**	HEV-C-R-50187-R.020
new		3/16	**.020**	3/4	2-1/2	5	**87356**	HEV-C-M-50187-R.020
new		3/16	**.020**	1	2-1/2	5	**87357**	HEV-C-ML-50187-R.020
		3/16	**.030**	5/16	2	5	**83070**	HEV-C-S-50187-R.030
		3/16	**.030**	7/16	2	5	**83071**	HEV-C-SR-50187-R.030
		3/16	**.030**	9/16	2-1/2	5	**83072**	HEV-C-R-50187-R.030
		3/16	**.030**	3/4	2-1/2	5	**83073**	HEV-C-M-50187-R.030
new		3/16	**.030**	1	2-1/2	5	**87358**	HEV-C-ML-50187-R.030

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 83

5 FLUTE - CORNER RADIUS New Items!

Chipbreaker Rougher - Variable Pitch (cont.)

HEM **HEV-C-5**

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
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	
	1/4	.020	1-1/2	3	5	83074	HEV-C-LX-50250-R.020	
	1/4	.030	3/8	2	5	83075	HEV-C-S-50250-R.030	
	1/4	.030	1/2	2-1/2	5	83076	HEV-C-SR-50250-R.030	
	1/4	.030	3/4	2-1/2	5	83077	HEV-C-R-50250-R.030	
	1/4	.030	1	3	5	83078	HEV-C-M-50250-R.030	
	1/4	.060	3/8	2	5	87359	HEV-C-S-50250-R.060	new
	1/4	.060	1/2	2-1/2	5	87360	HEV-C-SR-50250-R.060	new
	1/4	.060	3/4	2-1/2	5	87361	HEV-C-R-50250-R.060	new
	1/4	.060	1	3	5	87362	HEV-C-M-50250-R.060	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	
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	
	3/8	.020	2	4	5	83079	HEV-C-LX-50375-R.020	
	3/8	.030	1/2	2	5	83080	HEV-C-S-50375-R.030	
	3/8	.030	3/4	2-1/2	5	83081	HEV-C-SR-50375-R.030	
	3/8	.030	1	3	5	83082	HEV-C-R-50375-R.030	
	3/8	.030	1-1/4	3	5	83083	HEV-C-M-50375-R.030	
	3/8	.060	1/2	2	5	87363	HEV-C-S-50375-R.060	new
	3/8	.060	3/4	2-1/2	5	87364	HEV-C-SR-50375-R.060	new
	3/8	.060	1	3	5	87365	HEV-C-R-50375-R.060	new
	3/8	.060	1-1/4	3	5	87366	HEV-C-M-50375-R.060	new
1/2	1/2	.010	5/8	2-1/2	5	83084	HEV-C-S-50500-R.010	
	1/2	.010	1	3	5	83085	HEV-C-SR-50500-R.010	
	1/2	.010	1-1/4	3	5	83086	HEV-C-R-50500-R.010	
	1/2	.010	1-5/8	4	5	83087	HEV-C-M-50500-R.010	
	1/2	.010	2	4	5	83088	HEV-C-L-50500-R.010	
	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	
	1/2	.030	3-5/8	6	5	82219	HEV-C-Y-50500-R.030	

* .0005 max TIR

continued on next page

HEV-C-5

New Items!

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description
	1/2	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
		1/2	**.060**	3-1/8	6	5	**83089**	HEV-C-X-50500-R.060
new		1/2	**.125**	5/8	2-1/2	5	**87367**	HEV-C-S-50500-R.125
new		1/2	**.125**	1	3	5	**87368**	HEV-C-SR-50500-R.125
new		1/2	**.125**	1-1/4	3	5	**87369**	HEV-C-R-50500-R.125
new		1/2	**.125**	1-5/8	4	5	**87370**	HEV-C-M-50500-R.125
	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
		5/8	**.030**	3-1/4	6	5	**82221**	HEV-C-LX-50625-R.030
		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
		5/8	**.060**	2-1/8	4	5	**81969**	HEV-C-M-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
		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
		3/4	**.060**	3-1/4	6	5	**81974**	HEV-C-LX-50750-R.060
new		3/4	**.125**	1-5/8	4	5	**87371**	HEV-C-R-50750-R.125
new		3/4	**.125**	2-1/4	5	5	**87372**	HEV-C-M-50750-R.125
new		3/4	**.125**	2-3/4	5	5	**87373**	HEV-C-L-50750-R.125
new		3/4	**.125**	3-1/4	6	5	**87374**	HEV-C-LX-50750-R.125
	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

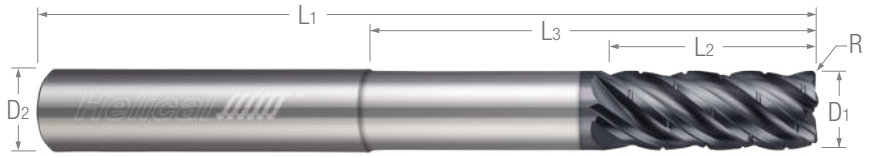
* .0005 max TIR

5 FLUTE - CORNER RADIUS New Items!

HEM **HEV-C-RN-5**

Chipbreaker Rougher - Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in deep pocket High Efficiency Milling (HEM) applications
- 5 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, reduced harmonics, and reduced tool pressure
- Center cutting
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- *Aplus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	*Aplus* Coated	Tool Description	
1/8	1/8	.010	5/32	2	3/8	.118	5	87395	HEV-C-RN-S-50125-R.010	new
	1/8	.010	5/32	2	1/2	.118	5	87396	HEV-C-RN-SR-50125-R.010	new
	1/8	.010	5/32	2-1/2	3/4	.118	5	87397	HEV-C-RN-R-50125-R.010	new
	1/8	.010	5/32	2-1/2	1	.118	5	87398	HEV-C-RN-M-50125-R.010	new
3/16	3/16	.010	7/32	2	1/2	.178	5	87399	HEV-C-RN-S-50187-R.010	new
	3/16	.010	7/32	2-1/2	3/4	.178	5	87400	HEV-C-RN-SR-50187-R.010	new
	3/16	.010	7/32	2-1/2	1-1/8	.178	5	87401	HEV-C-RN-R-50187-R.010	new
	3/16	.010	7/32	2-1/2	1-5/16	.178	5	87402	HEV-C-RN-M-50187-R.010	new
1/4	1/4	.020	3/8	4	3/4	.237	5	82889	HEV-C-RN-S-50250-R.020	
	1/4	.020	3/8	4	1-1/8	.237	5	82890	HEV-C-RN-R-50250-R.020	
	1/4	.020	3/4	4	1-1/8	.237	5	82891	HEV-C-RNR-R-50250-R.020	
	1/4	.020	3/8	4	2-1/8	.237	5	82892	HEV-C-RN-M-50250-R.020	
	1/4	.020	3/4	4	2-1/8	.237	5	82893	HEV-C-RNR-M-50250-R.020	
3/8	3/8	.020	1/2	4	1-1/8	.356	5	82894	HEV-C-RN-S-50375-R.020	
	3/8	.020	1/2	4	2-1/8	.356	5	82895	HEV-C-RN-R-50375-R.020	
	3/8	.020	1	4	2-1/8	.356	5	82896	HEV-C-RNR-R-50375-R.020	
	3/8	.020	1/2	6	3-1/8	.356	5	82897	HEV-C-RN-M-50375-R.020	
	3/8	.020	1	6	3-1/8	.356	5	82898	HEV-C-RNR-M-50375-R.020	
1/2	1/2	.030	5/8	4	1-1/2	.475	5	82899	HEV-C-RN-S-50500-R.030	
	1/2	.030	5/8	4	2-1/4	.475	5	82900	HEV-C-RN-R-50500-R.030	
	1/2	.030	1-1/4	4	2-1/4	.475	5	82901	HEV-C-RNR-R-50500-R.030	
	1/2	.030	5/8	6	3-3/8	.475	5	82902	HEV-C-RN-M-50500-R.030	
	1/2	.030	1-1/4	6	3-3/8	.475	5	82903	HEV-C-RNR-M-50500-R.030	
	1/2	.030	5/8	6	4-1/8	.475	5	82904	HEV-C-RN-L-50500-R.030	
	1/2	.030	1-1/4	6	4-1/8	.475	5	82905	HEV-C-RNR-L-50500-R.030	
3/4	3/4	.030	1	4	2	.712	5	82906	HEV-C-RN-S-50750-R.030	
	3/4	.030	1	6	2-1/2	.712	5	82907	HEV-C-RN-R-50750-R.030	
	3/4	.030	1-5/8	6	2-1/2	.712	5	82908	HEV-C-RNR-R-50750-R.030	
	3/4	.030	1	6	3-3/8	.712	5	82909	HEV-C-RN-M-50750-R.030	
	3/4	.030	1-5/8	6	3-3/8	.712	5	82910	HEV-C-RNR-M-50750-R.030	

* .0005 max TIR

Speeds & Feeds on Page 83

HEV-C-5

SPEEDS & FEEDS

5 Flute - Chipbreaker Rougher - Variable Pitch

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

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	10%-30% Diameter
	≥ 35 HRC	Up to Max LOC	10%-30% 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.

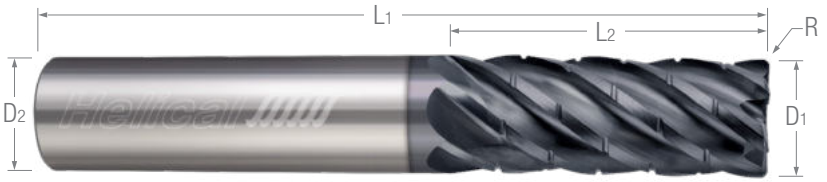
6 FLUTE - CORNER RADIUS New Items!

Chipbreaker Rougher - Variable Pitch

HEM **HEV-C-6**

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 175 for T*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	A*plus* Coated	Tool Description	
1/8	1/8	**.010**	1/4	1-1/2	6	**84374**	HEV-C-S-60125-R.010	
	1/8	**.010**	3/8	2	6	**84375**	HEV-C-SR-60125-R.010	
	1/8	**.010**	1/2	2-1/2	6	**84376**	HEV-C-R-60125-R.010	
	1/8	**.010**	5/8	2-1/2	6	**84377**	HEV-C-A-60125-R.010	
3/16	3/16	**.010**	5/16	2	6	**84378**	HEV-C-S-60187-R.010	
	3/16	**.010**	7/16	2	6	**84379**	HEV-C-SR-60187-R.010	
	3/16	**.010**	9/16	2-1/2	6	**84380**	HEV-C-R-60187-R.010	
	3/16	**.010**	3/4	2-1/2	6	**84381**	HEV-C-M-60187-R.010	
1/4	1/4	**.010**	3/8	2	6	**83125**	HEV-C-S-60250-R.010	
	1/4	**.010**	1/2	2-1/2	6	**83126**	HEV-C-SR-60250-R.010	
	1/4	**.010**	3/4	2-1/2	6	**83127**	HEV-C-R-60250-R.010	
	1/4	**.010**	1	3	6	**83128**	HEV-C-M-60250-R.010	
	1/4	**.020**	3/8	2	6	**82223**	HEV-C-S-60250-R.020	
	1/4	**.020**	1/2	2-1/2	6	**82224**	HEV-C-SR-60250-R.020	
	1/4	**.020**	3/4	2-1/2	6	**82225**	HEV-C-R-60250-R.020	
	1/4	**.020**	1	3	6	**82226**	HEV-C-M-60250-R.020	
	1/4	**.030**	3/8	2	6	**87403**	HEV-C-S-60250-R.030	new
	1/4	**.030**	1/2	2-1/2	6	**87404**	HEV-C-SR-60250-R.030	new
	1/4	**.030**	3/4	2-1/2	6	**87405**	HEV-C-R-60250-R.030	new
	1/4	**.030**	1	3	6	**87406**	HEV-C-M-60250-R.030	new
	1/4	**.060**	3/8	2	6	**87407**	HEV-C-S-60250-R.060	new
	1/4	**.060**	1/2	2-1/2	6	**87408**	HEV-C-SR-60250-R.060	new
	1/4	**.060**	3/4	2-1/2	6	**87409**	HEV-C-R-60250-R.060	new
	1/4	**.060**	1	3	6	**87410**	HEV-C-M-60250-R.060	new
3/8	3/8	**.010**	1/2	2	6	**83129**	HEV-C-S-60375-R.010	
	3/8	**.010**	3/4	2-1/2	6	**83130**	HEV-C-SR-60375-R.010	
	3/8	**.010**	1	3	6	**83131**	HEV-C-R-60375-R.010	
	3/8	**.010**	1-1/4	3	6	**83132**	HEV-C-M-60375-R.010	
	3/8	**.020**	1/2	2	6	**87411**	HEV-C-S-60375-R.020	new
	3/8	**.020**	3/4	2-1/2	6	**87412**	HEV-C-SR-60375-R.020	new
	3/8	**.020**	1	3	6	**87413**	HEV-C-R-60375-R.020	new
	3/8	**.020**	1-1/4	3	6	**87414**	HEV-C-M-60375-R.020	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 86

HEV-C-6

New Items! **6 FLUTE - CORNER RADIUS**

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description
	3/8	3/8	.030	1/2	2	6	82227	HEV-C-S-60375-R.030
		3/8	.030	3/4	2-1/2	6	82228	HEV-C-SR-60375-R.030
		3/8	.030	1	3	6	82229	HEV-C-R-60375-R.030
		3/8	.030	1-1/4	3	6	82230	HEV-C-M-60375-R.030
new		3/8	.060	1/2	2	6	87415	HEV-C-S-60375-R.060
new		3/8	.060	3/4	2-1/2	6	87416	HEV-C-SR-60375-R.060
new		3/8	.060	1	3	6	87417	HEV-C-R-60375-R.060
new		3/8	.060	1-1/4	3	6	87418	HEV-C-M-60375-R.060
	1/2	1/2	.010	5/8	2-1/2	6	83133	HEV-C-S-60500-R.010
		1/2	.010	1	3	6	83134	HEV-C-SR-60500-R.010
		1/2	.010	1-1/4	3	6	83135	HEV-C-R-60500-R.010
		1/2	.010	1-5/8	4	6	83136	HEV-C-M-60500-R.010
		1/2	.010	2	4	6	83137	HEV-C-L-60500-R.010
		1/2	.010	2-1/2	5	6	83138	HEV-C-LX-60500-R.010
		1/2	.030	5/8	2-1/2	6	82231	HEV-C-S-60500-R.030
		1/2	.030	1	3	6	82232	HEV-C-SR-60500-R.030
		1/2	.030	1-1/4	3	6	82233	HEV-C-R-60500-R.030
		1/2	.030	1-5/8	4	6	82234	HEV-C-M-60500-R.030
		1/2	.030	2	4	6	82235	HEV-C-L-60500-R.030
		1/2	.030	2-1/2	5	6	82236	HEV-C-LX-60500-R.030
		1/2	.060	5/8	2-1/2	6	82237	HEV-C-S-60500-R.060
		1/2	.060	1	3	6	82238	HEV-C-SR-60500-R.060
		1/2	.060	1-1/4	3	6	82239	HEV-C-R-60500-R.060
		1/2	.060	1-5/8	4	6	82240	HEV-C-M-60500-R.060
		1/2	.060	2	4	6	82241	HEV-C-L-60500-R.060
		1/2	.060	2-1/2	5	6	82242	HEV-C-LX-60500-R.060
new		1/2	.125	5/8	2-1/2	6	87419	HEV-C-S-60500-R.125
new		1/2	.125	1	3	6	87420	HEV-C-SR-60500-R.125
new		1/2	.125	1-1/4	3	6	87421	HEV-C-R-60500-R.125
new		1/2	.125	1-5/8	4	6	87422	HEV-C-M-60500-R.125
	5/8	5/8	.030	1-1/4	3-1/2	6	83139	HEV-C-SR-60625-R.030
		5/8	.030	1-5/8	3-1/2	6	83140	HEV-C-R-60625-R.030
		5/8	.030	2	4	6	83141	HEV-C-M-60625-R.030
		5/8	.060	1-1/4	3-1/2	6	82243	HEV-C-SR-60625-R.060
		5/8	.060	1-5/8	3-1/2	6	82244	HEV-C-R-60625-R.060
		5/8	.060	2	4	6	82245	HEV-C-M-60625-R.060
	3/4	3/4	.030	1-5/8	4	6	83142	HEV-C-R-60750-R.030
		3/4	.030	2-1/4	5	6	83143	HEV-C-M-60750-R.030
		3/4	.030	2-3/4	5	6	83144	HEV-C-L-60750-R.030
		3/4	.060	1-5/8	4	6	82246	HEV-C-R-60750-R.060
		3/4	.060	2-1/4	5	6	82247	HEV-C-M-60750-R.060
		3/4	.060	2-3/4	5	6	82248	HEV-C-L-60750-R.060
new		3/4	.125	1-5/8	4	6	87423	HEV-C-R-60750-R.125
new		3/4	.125	2-1/4	5	6	87424	HEV-C-M-60750-R.125
new		3/4	.125	2-3/4	5	6	87425	HEV-C-L-60750-R.125

* .0005 max TIR

SPEEDS & FEEDS

6 Flute - Chipbreaker Rougher - Variable Pitch

HEV-C-6

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 27-7MO, 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.

HEV-C-7

New Items!

7 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 178 for T*plus* coating

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* 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
		1/4	**.020**	1-1/4	3	7	**83163**	HEV-C-L-70250-R.020
new		1/4	**.030**	3/8	2	7	**87174**	HEV-C-S-70250-R.030
new		1/4	**.030**	1/2	2	7	**87175**	HEV-C-SR-70250-R.030
new		1/4	**.030**	3/4	2-1/2	7	**87176**	HEV-C-R-70250-R.030
	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		3/8	**.030**	1/2	2	7	**87177**	HEV-C-S-70375-R.030
new		3/8	**.030**	3/4	2-1/2	7	**87178**	HEV-C-SR-70375-R.030
new		3/8	**.030**	1	2-1/2	7	**87179**	HEV-C-R-70375-R.030
		3/8	**.060**	1/2	2	7	**83164**	HEV-C-S-70375-R.060
		3/8	**.060**	3/4	2-1/2	7	**83165**	HEV-C-SR-70375-R.060
		3/8	**.060**	1	2-1/2	7	**83166**	HEV-C-R-70375-R.060
new	1/2	1/2	**.010**	5/8	2-1/2	7	**87180**	HEV-C-S-70500-R.010
new		1/2	**.010**	1	3	7	**87181**	HEV-C-SR-70500-R.010
new		1/2	**.010**	1-1/4	3	7	**87182**	HEV-C-R-70500-R.010
new		1/2	**.010**	1-5/8	4	7	**87183**	HEV-C-M-70500-R.010
new		1/2	**.010**	2	4	7	**87184**	HEV-C-L-70500-R.010
		1/2	**.020**	5/8	2-1/2	7	**83167**	HEV-C-S-70500-R.020
		1/2	**.020**	1	3	7	**83168**	HEV-C-SR-70500-R.020
		1/2	**.020**	1-1/4	3	7	**83169**	HEV-C-R-70500-R.020
		1/2	**.020**	1-5/8	4	7	**83170**	HEV-C-M-70500-R.020
		1/2	**.020**	2	4	7	**83171**	HEV-C-L-70500-R.020
		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
		1/2	**.030**	3-1/8	6	7	**82252**	HEV-C-X-70500-R.030

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 90

7 FLUTE - CORNER RADIUS

New Items!

HEM

HEV-C-7

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description	
1/2	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	
	1/2	**.060**	2-1/2	5	7	**83172**	HEV-C-LX-70500-R.060	
5/8	5/8	**.030**	3/4	3	7	**83173**	HEV-C-S-70625-R.030	
	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**	1-1/4	3-1/2	7	**83174**	HEV-C-SR-70750-R.030	
	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	**.030**	3-1/4	6	7	**83175**	HEV-C-LX-70750-R.030	
	3/4	**.030**	4	6-1/2	7	**87185**	HEV-C-X-70750-R.030	new
	3/4	**.060**	1-1/4	3-1/2	7	**83176**	HEV-C-SR-70750-R.060	
	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	
	3/4	**.060**	3-1/4	6	7	**87186**	HEV-C-LX-70750-R.060	new
	3/4	**.060**	4	6-1/2	7	**87187**	HEV-C-X-70750-R.060	new
1	1	**.030**	2-5/8	5	7	**87188**	HEV-C-M-71000-R.030	new
	1	**.030**	3-1/4	6	7	**87189**	HEV-C-L-71000-R.030	new
	1	**.030**	4-1/8	7	7	**87190**	HEV-C-X-71000-R.030	new

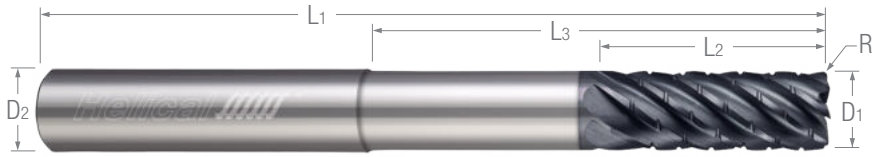
* .0005 max TIR

HEV-C-RN-7

7 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch- Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in deep pocket High Efficiency Milling (HEM) applications
- 7 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, reduced harmonics, and reduced tool pressure
- End cutting geometry (non-center cutting)
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	A*plus* Coated	Tool Description
1/4	1/4	**.020**	3/4	4	1-1/8	.237	7	**82927**	HEV-C-RNR-R-70250-R.020
	1/4	**.020**	3/4	4	2-1/8	.237	7	**82928**	HEV-C-RNR-M-70250-R.020
3/8	3/8	**.020**	1	4	2-1/8	.356	7	**82929**	HEV-C-RNR-R-70375-R.020
	3/8	**.020**	1	6	3-1/8	.356	7	**82930**	HEV-C-RNR-M-70375-R.020
1/2	1/2	**.030**	1-1/4	4	2-1/4	.475	7	**82931**	HEV-C-RNR-R-70500-R.030
	1/2	**.030**	1-1/4	6	3-3/8	.475	7	**82932**	HEV-C-RNR-M-70500-R.030
	1/2	**.030**	1-1/4	6	4-1/8	.475	7	**82933**	HEV-C-RNR-L-70500-R.030
	1/2	**.060**	1-1/4	4	2-1/4	.475	7	**82934**	HEV-C-RNR-R-70500-R.060
	1/2	**.060**	1-1/4	6	3-3/8	.475	7	**82935**	HEV-C-RNR-M-70500-R.060
	1/2	**.060**	1-1/4	6	4-1/8	.475	7	**82936**	HEV-C-RNR-L-70500-R.060
3/4	3/4	**.030**	1-5/8	6	2-1/2	.712	7	**82937**	HEV-C-RNR-R-70750-R.030
	3/4	**.030**	1-5/8	6	3-3/8	.712	7	**82938**	HEV-C-RNR-M-70750-R.030
	3/4	**.060**	1-5/8	6	2-1/2	.712	7	**82939**	HEV-C-RNR-R-70750-R.060
	3/4	**.060**	1-5/8	6	3-3/8	.712	7	**82940**	HEV-C-RNR-M-70750-R.060

* .0005 max TIR

Speeds & Feeds on Page 90

SPEEDS & FEEDS

7 Flute - Chipbreaker Rougher - Variable Pitch

HEV-C-7

HEV-C-7 / HEV-C-RN-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. 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.

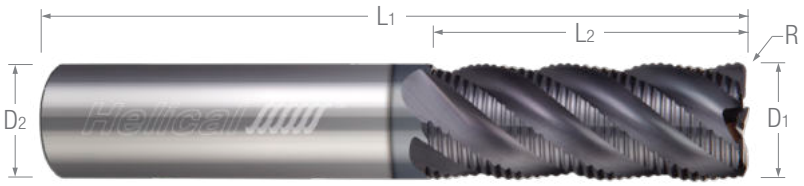
HXVR

MULTI-FLUTE - CORNER RADIUS

Knuckle Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 180 for T*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	A*plus* Coated	A*plus* Coated + Weldon Flat	Tool Description
1/4	1/4	.030	3/8	2	4	54017	54017W	HXVR-S-40250-R.030
	1/4	.030	1/2	2-1/2	4	82859		HXVR-SR-40250-R.030
	1/4	.030	3/4	2-1/2	4	54047	54047W	HXVR-R-40250-R.030
	1/4	.030	1	3	4	82860		HXVR-M-40250-R.030
3/8	3/8	.040	1/2	2	4	54092	54092W	HXVR-S-40375-R.040
	3/8	.040	1/2	2	5	55092	55092W	HXVR-S-50375-R.040
	3/8	.040	3/4	2-1/2	4	82861		HXVR-SR-40375-R.040
	3/8	.040	3/4	2-1/2	5	82862		HXVR-SR-50375-R.040
	3/8	.040	1	3	4	54107	54107W	HXVR-R-40375-R.040
	3/8	.040	1	3	5	55107	55107W	HXVR-R-50375-R.040
	3/8	.040	1-1/4	3	4	82863		HXVR-M-40375-R.040
	3/8	.040	1-1/4	3	5	82864		HXVR-M-50375-R.040
1/2	1/2	.040	5/8	2-1/2	4	54152	54152W	HXVR-S-40500-R.040
	1/2	.040	5/8	2-1/2	5	55152	55152W	HXVR-S-50500-R.040
	1/2	.040	1	3	4	82865		HXVR-SR-40500-R.040
	1/2	.040	1	3	5	82866		HXVR-SR-50500-R.040
	1/2	.040	1-1/4	3	4	54182	54182W	HXVR-R-40500-R.040
	1/2	.040	1-1/4	3	5	55182	55182W	HXVR-R-50500-R.040
	1/2	.040	1-5/8	4	4	82867		HXVR-M-40500-R.040
	1/2	.040	1-5/8	4	5	82868		HXVR-M-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
	5/8	.060	2	4	5	82869		HXVR-M-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	54317W	HXVR-R-40750-R.060
	3/4	.060	1-5/8	4	5	55317	55317W	HXVR-R-50750-R.060
	3/4	.060	2-1/4	5	5	82870		HXVR-M-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

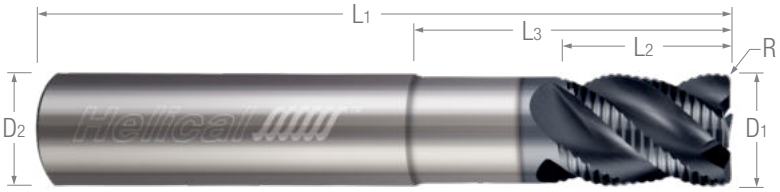
Speeds & Feeds on Page 93-94

MULTI-FLUTE - CORNER RADIUS

HXVR-RN

Knuckle Rougher - Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	*Aplus* Coated	Tool Description
1/4	1/4	**.030**	3/8	2-1/2	1-1/8	.237	4	**64032**	HXVR-RN-R-40250-R.030
	1/4	**.030**	3/8	3	1-3/8	.237	4	**82871**	HXVR-RN-A-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
	3/8	**.040**	1/2	4	1-5/8	.356	5	**82872**	HXVR-RN-A-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
	1/2	**.040**	5/8	4	2-1/4	.475	4	**82873**	HXVR-RN-M-40500-R.040
	1/2	**.040**	5/8	4	2-1/4	.475	5	**82874**	HXVR-RN-M-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
	3/4	**.060**	1	6	2-1/2	.712	5	**82875**	HXVR-RN-A-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

Climb Milling vs. Conventional Milling

In The Loupe
MACHINISTS BLOG

There are two distinct ways to cut materials when milling: Conventional Milling (Up) and Climb Milling (Down). The difference between these two techniques is the relationship of the rotation of the cutter to the direction of feed. Using the right approach may prolong your tool's life. Learn which way of machining is right for you by reading our "In the Loupe" post *Climb Milling vs. Conventional Milling.*

www.harveyperformance.com/in-the-loupe/conventional-vs-climb-milling/

SCAN TO READ

Speeds & Feeds on Page 93-94

HXVR-4

SPEEDS & FEEDS

4 Flute - Knuckle Rougher - Variable Pitch

HXVR / HXVR-RN (4 Flute)

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	455	.0007	.0010	.0010	.0015	.0015	.0023	.0022	.0034	.0028	.0044	.0040	.0063	.0051	.0081
		75 - 98 HRB	445	.0005	.0009	.0008	.0013	.0012	.0019	.0018	.0028	.0024	.0037	.0034	.0053	.0043	.0067
		21 - 36 HRC	400	.0004	.0006	.0005	.0008	.0008	.0012	.0012	.0018	.0015	.0024	.0022	.0034	.0028	.0043
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0005	.0007	.0007	.0011	.0011	.0016	.0016	.0024	.0020	.0032	.0029	.0045	.0037	.0058
		21 - 36 HRC	340	.0004	.0006	.0005	.0008	.0008	.0012	.0012	.0018	.0015	.0024	.0022	.0034	.0028	.0043
		36 - 50 HRC	260	.0003	.0005	.0005	.0007	.0007	.0011	.0010	.0016	.0013	.0021	.0019	.0030	.0024	.0038
		> 50 HRC	155	.0003	.0004	.0004	.0006	.0005	.0008	.0008	.0013	.0010	.0016	.0015	.0023	.0019	.0030
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0005	.0007	.0007	.0011	.0011	.0016	.0016	.0024	.0020	.0032	.0029	.0045	.0037	.0058
		21 - 36 HRC	250	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0019	.0016	.0025	.0023	.0036	.0029	.0046
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0007	.0010	.0010	.0015	.0013	.0020	.0018	.0028	.0023	.0036
		> 50 HRC	85	.0002	.0004	.0004	.0006	.0005	.0008	.0008	.0012	.0010	.0016	.0015	.0023	.0019	.0029
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0003	.0005	.0005	.0008	.0008	.0012	.0011	.0018	.0015	.0023	.0021	.0034	.0027	.0043
		75 - 98 HRB	255	.0005	.0008	.0008	.0012	.0011	.0018	.0017	.0026	.0022	.0035	.0032	.0050	.0040	.0063
		21 - 36 HRC	175	.0003	.0004	.0004	.0006	.0006	.0009	.0009	.0014	.0011	.0018	.0016	.0025	.0021	.0032
		36 - 50 HRC	150	.0003	.0005	.0005	.0008	.0008	.0012	.0011	.0018	.0015	.0023	.0021	.0033	.0027	.0042
		> 50 HRC	55	.0002	.0003	.0003	.0005	.0005	.0007	.0007	.0011	.0009	.0014	.0013	.0020	.0016	.0026
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0005	.0008	.0008	.0012	.0012	.0019	.0018	.0027	.0023	.0036	.0033	.0051	.0042	.0065
		21 - 36 HRC	225	.0004	.0006	.0006	.0009	.0009	.0014	.0013	.0020	.0017	.0026	.0024	.0038	.0031	.0048
		36 - 50 HRC	180	.0003	.0005	.0005	.0007	.0007	.0010	.0010	.0016	.0013	.0020	.0019	.0029	.0024	.0037
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0005	.0007	.0007	.0011	.0011	.0016	.0016	.0024	.0020	.0032	.0029	.0046	.0037	.0058
		21 - 36 HRC	280	.0004	.0006	.0006	.0009	.0009	.0014	.0014	.0021	.0018	.0028	.0025	.0040	.0032	.0051
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0003	.0005	.0005	.0008	.0008	.0012	.0011	.0018	.0015	.0023	.0021	.0034	.0027	.0043
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0006	.0010	.0010	.0015	.0012	.0019	.0018	.0028	.0023	.0036
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0008	.0012	.0011	.0018	.0017	.0026	.0025	.0039	.0033	.0052	.0047	.0074	.0060	.0094
		21 - 36 HRC	370	.0004	.0007	.0006	.0010	.0009	.0014	.0014	.0021	.0018	.0028	.0026	.0040	.0033	.0051
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0005	.0008	.0007	.0011	.0011	.0017	.0016	.0025	.0021	.0033	.0030	.0047	.0038	.0060
		21 - 36 HRC	335	.0004	.0007	.0006	.0010	.0009	.0015	.0014	.0022	.0018	.0028	.0026	.0040	.0033	.0051
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0005	.0008	.0008	.0012	.0011	.0017	.0017	.0026	.0022	.0034	.0031	.0049	.0040	.0062
		21 - 36 HRC	260	.0003	.0005	.0005	.0008	.0007	.0012	.0011	.0017	.0014	.0023	.0021	.0032	.0026	.0041
		36 - 50 HRC	135	.0002	.0003	.0003	.0005	.0005	.0007	.0007	.0011	.0009	.0014	.0013	.0020	.0017	.0026
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0007	.0010	.0010	.0015	.0014	.0022	.0021	.0033	.0028	.0044	.0040	.0063	.0051	.0080
		75 - 98 HRB	250	.0005	.0009	.0008	.0013	.0012	.0019	.0018	.0028	.0023	.0037	.0033	.0052	.0043	.0067
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0004	.0006	.0005	.0008	.0008	.0013	.0012	.0019	.0016	.0025	.0022	.0035	.0028	.0045
		21 - 36 HRC	75	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0019	.0016	.0025	.0023	.0036	.0029	.0046
		36 - 50 HRC	70	.0003	.0005	.0004	.0007	.0007	.0010	.0010	.0015	.0013	.0020	.0018	.0029	.0023	.0036
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0009	.0014	.0013	.0021	.0020	.0031	.0029	.0046	.0039	.0060	.0055	.0086	.0070	.0110
		75 - 98 HRB	275	.0008	.0012	.0011	.0017	.0017	.0026	.0025	.0039	.0032	.0051	.0046	.0072	.0059	.0092
		21 - 36 HRC	250	.0006	.0009	.0008	.0013	.0012	.0020	.0019	.0029	.0024	.0038	.0035	.0054	.0044	.0069
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0004	.0007	.0007	.0010	.0010	.0015	.0015	.0023	.0019	.0030	.0027	.0043	.0035	.0054
		36 - 50 HRC	160	.0004	.0006	.0006	.0009	.0009	.0014	.0013	.0021	.0017	.0027	.0025	.0039	.0032	.0050
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0019	.0016	.0025	.0023	.0036	.0030	.0046
		21 - 36 HRC	170	.0004	.0006	.0005	.0008	.0008	.0013	.0012	.0019	.0016	.0025	.0022	.0035	.0028	.0045
		36 - 50 HRC	65	.0003	.0004	.0004	.0006	.0005	.0009	.0008	.0013	.0011	.0017	.0015	.0024	.0019	.0030

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	20%-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. 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.

SPEEDS & FEEDS

5 Flute - Knuckle Rougher - Variable Pitch

HXVR-5

HXVR / HXVR-RN (5 Flute)

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	455	.0007	.0010	.0010	.0015	.0015	.0023	.0022	.0034	.0029	.0045	.0041	.0064	.0052	.0082
		75 - 98 HRB	445	.0006	.0009	.0008	.0013	.0012	.0019	.0018	.0028	.0024	.0037	.0034	.0053	.0043	.0068
		21 - 36 HRC	400	.0004	.0006	.0005	.0008	.0008	.0012	.0012	.0018	.0015	.0024	.0022	.0035	.0028	.0044
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0005	.0008	.0007	.0011	.0011	.0017	.0016	.0025	.0021	.0032	.0029	.0046	.0038	.0059
		21 - 36 HRC	340	.0004	.0006	.0005	.0008	.0008	.0012	.0012	.0018	.0015	.0024	.0022	.0034	.0028	.0044
		36 - 50 HRC	260	.0003	.0005	.0005	.0007	.0007	.0011	.0010	.0016	.0013	.0021	.0019	.0030	.0024	.0038
		> 50 HRC	155	.0003	.0004	.0004	.0006	.0005	.0009	.0008	.0013	.0011	.0017	.0015	.0024	.0019	.0030
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0005	.0008	.0007	.0011	.0011	.0017	.0016	.0025	.0021	.0032	.0029	.0046	.0038	.0059
		21 - 36 HRC	250	.0004	.0006	.0006	.0009	.0008	.0013	.0013	.0020	.0016	.0026	.0023	.0037	.0030	.0047
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0007	.0010	.0010	.0015	.0013	.0020	.0018	.0029	.0023	.0036
		> 50 HRC	85	.0002	.0004	.0004	.0006	.0005	.0008	.0008	.0013	.0010	.0016	.0015	.0023	.0019	.0030
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0004	.0006	.0005	.0008	.0008	.0012	.0012	.0018	.0015	.0024	.0022	.0034	.0028	.0043
		75 - 98 HRB	255	.0005	.0008	.0008	.0012	.0011	.0018	.0017	.0027	.0022	.0035	.0032	.0050	.0041	.0064
		21 - 36 HRC	175	.0003	.0004	.0004	.0006	.0006	.0009	.0009	.0014	.0012	.0018	.0017	.0026	.0021	.0033
		36 - 50 HRC	150	.0004	.0005	.0005	.0008	.0008	.0012	.0011	.0018	.0015	.0023	.0021	.0033	.0027	.0042
		> 50 HRC	55	.0002	.0003	.0003	.0005	.0005	.0007	.0007	.0011	.0009	.0014	.0013	.0020	.0017	.0026
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0005	.0008	.0008	.0012	.0012	.0019	.0018	.0028	.0023	.0036	.0033	.0052	.0042	.0066
		21 - 36 HRC	225	.0004	.0006	.0006	.0009	.0009	.0014	.0013	.0021	.0017	.0027	.0025	.0038	.0031	.0049
		36 - 50 HRC	180	.0003	.0005	.0005	.0007	.0007	.0011	.0010	.0016	.0013	.0021	.0019	.0030	.0024	.0038
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0005	.0008	.0007	.0011	.0011	.0017	.0016	.0025	.0021	.0032	.0030	.0046	.0038	.0059
		21 - 36 HRC	280	.0004	.0007	.0006	.0010	.0009	.0014	.0014	.0021	.0018	.0028	.0026	.0040	.0033	.0051
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0004	.0006	.0005	.0008	.0008	.0012	.0012	.0018	.0015	.0024	.0022	.0034	.0028	.0043
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0007	.0010	.0010	.0015	.0013	.0020	.0018	.0028	.0023	.0036
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0008	.0012	.0012	.0018	.0017	.0027	.0025	.0040	.0033	.0052	.0048	.0075	.0061	.0095
		21 - 36 HRC	370	.0004	.0007	.0006	.0010	.0009	.0015	.0014	.0022	.0018	.0028	.0026	.0041	.0033	.0052
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0005	.0008	.0007	.0011	.0011	.0017	.0016	.0025	.0021	.0033	.0030	.0047	.0039	.0061
		21 - 36 HRC	335	.0004	.0007	.0006	.0010	.0009	.0015	.0014	.0022	.0018	.0029	.0026	.0041	.0033	.0052
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0005	.0008	.0008	.0012	.0011	.0018	.0017	.0026	.0022	.0034	.0032	.0049	.0040	.0063
		21 - 36 HRC	260	.0003	.0005	.0005	.0008	.0008	.0012	.0011	.0017	.0015	.0023	.0021	.0033	.0027	.0042
		36 - 50 HRC	135	.0002	.0003	.0003	.0005	.0005	.0007	.0007	.0011	.0009	.0015	.0013	.0021	.0017	.0026
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0007	.0010	.0010	.0015	.0015	.0023	.0022	.0034	.0028	.0044	.0041	.0063	.0052	.0081
		75 - 98 HRB	250	.0005	.0009	.0008	.0013	.0012	.0019	.0018	.0028	.0024	.0037	.0034	.0053	.0043	.0068
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0019	.0016	.0025	.0023	.0036	.0029	.0045
		21 - 36 HRC	75	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0019	.0016	.0025	.0023	.0036	.0030	.0046
		36 - 50 HRC	70	.0003	.0005	.0005	.0007	.0007	.0010	.0010	.0016	.0013	.0020	.0019	.0029	.0024	.0037
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0009	.0014	.0014	.0021	.0020	.0032	.0030	.0047	.0039	.0061	.0056	.0088	.0071	.0112
		75 - 98 HRB	275	.0008	.0012	.0011	.0018	.0017	.0026	.0025	.0039	.0033	.0051	.0047	.0073	.0060	.0094
		21 - 36 HRC	250	.0006	.0009	.0009	.0013	.0013	.0020	.0019	.0029	.0025	.0038	.0035	.0055	.0045	.0070
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0005	.0007	.0007	.0010	.0010	.0016	.0015	.0023	.0019	.0030	.0028	.0043	.0035	.0055
		36 - 50 HRC	160	.0004	.0007	.0006	.0009	.0009	.0014	.0013	.0021	.0018	.0028	.0025	.0039	.0032	.0050
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0020	.0016	.0026	.0023	.0037	.0030	.0047
		21 - 36 HRC	170	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0019	.0016	.0025	.0023	.0035	.0029	.0045
		36 - 50 HRC	65	.0003	.0004	.0004	.0006	.0006	.0009	.0008	.0013	.0011	.0017	.0015	.0024	.0020	.0031

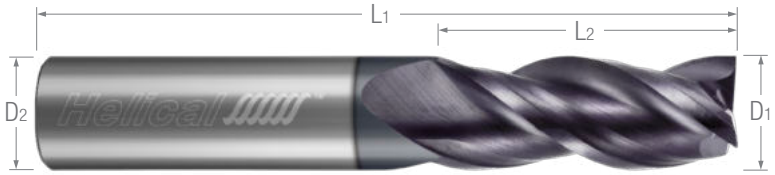
MILLING PROCESS	HARDNESS	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	30%-60% Diameter	100% Diameter
	≥ 35 HRC	30%-60% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	10%-30% Diameter
	≥ 35 HRC	Up to Max LOC	10%-30% Diameter

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.

HSV-3

3 FLUTE - SQUARE
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* 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

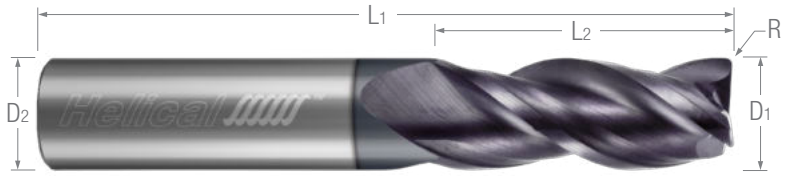
Speeds & Feeds on Page 97

3 FLUTE - CORNER RADIUS

Variable Pitch

HSV-3

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
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 97

HSV-3

SPEEDS & FEEDS
3 Flute - Variable Pitch

HSV-3

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	455	.0007	.0012	.0010	.0018	.0013	.0023	.0020	.0035	.0026	.0045	.0037	.0066	.0047	.0084
		75 - 98 HRB	445	.0005	.0009	.0007	.0013	.0010	.0017	.0014	.0026	.0019	.0033	.0027	.0048	.0034	.0062
		21 - 36 HRC	400	.0003	.0006	.0005	.0008	.0006	.0011	.0009	.0017	.0012	.0021	.0017	.0031	.0022	.0040
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0004	.0008	.0006	.0011	.0008	.0015	.0012	.0022	.0016	.0029	.0023	.0042	.0030	.0053
		21 - 36 HRC	340	.0003	.0006	.0005	.0009	.0006	.0011	.0009	.0017	.0012	.0021	.0017	.0031	.0022	.0040
		36 - 50 HRC	260	.0003	.0005	.0004	.0007	.0005	.0010	.0008	.0014	.0011	.0019	.0015	.0027	.0019	.0035
		> 50 HRC	155	.0002	.0004	.0003	.0006	.0004	.0008	.0006	.0011	.0008	.0015	.0012	.0021	.0015	.0027
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0004	.0008	.0006	.0011	.0008	.0015	.0012	.0022	.0016	.0029	.0023	.0042	.0030	.0053
		21 - 36 HRC	250	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0018	.0013	.0023	.0019	.0033	.0023	.0042
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0005	.0009	.0008	.0014	.0010	.0018	.0014	.0026	.0018	.0033
		> 50 HRC	85	.0002	.0004	.0003	.0006	.0004	.0008	.0006	.0011	.0008	.0015	.0012	.0021	.0015	.0027
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0006	.0010	.0008	.0015	.0011	.0019	.0016	.0029	.0021	.0038	.0031	.0055	.0039	.0070
		75 - 98 HRB	255	.0004	.0007	.0006	.0010	.0008	.0013	.0011	.0020	.0015	.0026	.0021	.0038	.0027	.0048
		21 - 36 HRC	175	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0018	.0013	.0023	.0019	.0034	.0024	.0043
		36 - 50 HRC	150	.0003	.0005	.0005	.0008	.0006	.0011	.0009	.0016	.0012	.0021	.0017	.0030	.0021	.0039
		> 50 HRC	55	.0002	.0003	.0003	.0005	.0004	.0007	.0005	.0010	.0007	.0013	.0010	.0019	.0013	.0024
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0004	.0007	.0006	.0011	.0008	.0014	.0012	.0022	.0016	.0028	.0023	.0041	.0029	.0052
		21 - 36 HRC	225	.0004	.0007	.0006	.0010	.0007	.0013	.0011	.0020	.0014	.0025	.0020	.0037	.0026	.0047
		36 - 50 HRC	180	.0003	.0005	.0004	.0008	.0006	.0011	.0009	.0016	.0011	.0020	.0016	.0030	.0021	.0038
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0004	.0008	.0006	.0011	.0008	.0015	.0013	.0022	.0016	.0029	.0023	.0042	.0030	.0054
		21 - 36 HRC	280	.0004	.0007	.0006	.0010	.0007	.0013	.0011	.0020	.0014	.0025	.0020	.0036	.0026	.0047
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0003	.0006	.0005	.0008	.0006	.0011	.0009	.0016	.0012	.0021	.0017	.0031	.0022	.0039
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0005	.0010	.0008	.0014	.0010	.0018	.0015	.0027	.0019	.0034
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0007	.0012	.0010	.0018	.0013	.0024	.0020	.0036	.0026	.0047	.0038	.0068	.0048	.0087
		21 - 36 HRC	370	.0004	.0007	.0006	.0010	.0007	.0013	.0011	.0020	.0014	.0025	.0021	.0037	.0026	.0047
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0004	.0008	.0007	.0012	.0009	.0015	.0013	.0023	.0017	.0030	.0024	.0043	.0030	.0055
		21 - 36 HRC	335	.0004	.0007	.0006	.0010	.0007	.0013	.0011	.0020	.0014	.0025	.0021	.0037	.0026	.0047
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0005	.0008	.0007	.0012	.0009	.0016	.0013	.0024	.0017	.0031	.0025	.0045	.0032	.0057
		21 - 36 HRC	260	.0003	.0005	.0005	.0008	.0006	.0011	.0009	.0016	.0012	.0020	.0016	.0030	.0021	.0038
		36 - 50 HRC	135	.0002	.0003	.0003	.0005	.0004	.0007	.0006	.0010	.0007	.0013	.0010	.0019	.0013	.0024
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0006	.0010	.0009	.0016	.0012	.0020	.0017	.0031	.0022	.0039	.0032	.0057	.0041	.0073
		75 - 98 HRB	250	.0005	.0009	.0007	.0013	.0010	.0017	.0014	.0026	.0019	.0033	.0027	.0048	.0034	.0061
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0003	.0005	.0004	.0008	.0006	.0010	.0009	.0016	.0011	.0020	.0016	.0029	.0021	.0037
		21 - 36 HRC	75	.0003	.0005	.0004	.0008	.0006	.0010	.0008	.0015	.0011	.0019	.0016	.0028	.0020	.0036
		36 - 50 HRC	70	.0003	.0004	.0004	.0007	.0005	.0008	.0007	.0013	.0009	.0016	.0013	.0024	.0017	.0031
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0008	.0014	.0012	.0022	.0016	.0028	.0024	.0042	.0031	.0055	.0044	.0079	.0056	.0101
		75 - 98 HRB	275	.0007	.0012	.0010	.0018	.0013	.0024	.0020	.0035	.0026	.0046	.0037	.0066	.0047	.0085
		21 - 36 HRC	250	.0005	.0009	.0008	.0014	.0010	.0018	.0015	.0027	.0019	.0034	.0028	.0050	.0035	.0064
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0004	.0007	.0006	.0011	.0008	.0014	.0012	.0021	.0015	.0027	.0022	.0039	.0028	.0050
		36 - 50 HRC	160	.0004	.0006	.0005	.0010	.0007	.0013	.0011	.0019	.0014	.0025	.0020	.0036	.0025	.0046
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0018	.0013	.0023	.0019	.0033	.0024	.0042
		21 - 36 HRC	170	.0003	.0006	.0005	.0009	.0006	.0011	.0010	.0017	.0012	.0022	.0018	.0032	.0023	.0041
		36 - 50 HRC	65	.0002	.0004	.0003	.0006	.0004	.0008	.0007	.0012	.0008	.0015	.0012	.0022	.0015	.0028

MILLING PROCESS	HARDNESS	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	100%-150% Diameter	100% Diameter
	≥ 35 HRC	100%-125% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	Up to 50% Diameter
	≥ 35 HRC	Up to Max LOC	Up to 50% 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.

3 FLUTE - BALL

HST-3

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
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

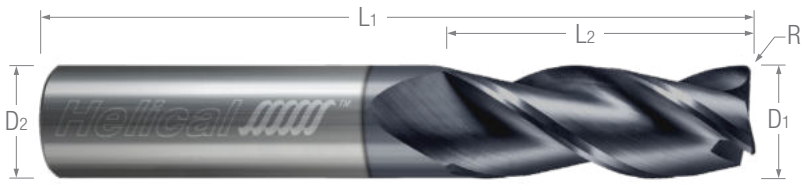
* .0005 max TIR

Speeds & Feeds on Page 102

HST-3

3 FLUTE - CORNER RADIUS

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	A*plus* Coated	Tool Description
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

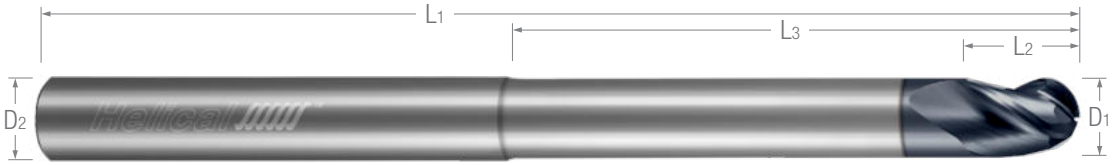
Speeds & Feeds on Page 102

3 FLUTE - BALL

Reduced Neck

HST-RN-3

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	A*plus* Coated	Tool Description
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

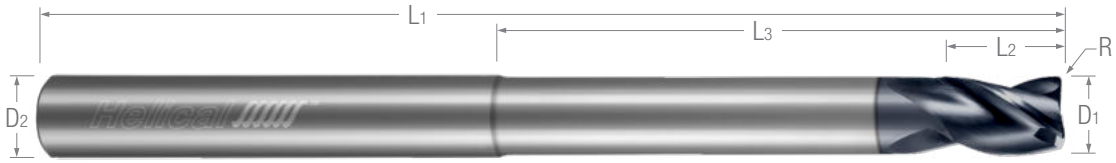
* .0005 max TIR

Speeds & Feeds on Page 102

HST-RN-3

3 FLUTE - CORNER RADIUS
Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	A*plus* 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	1/4	**.020**	3/8	4	3/4	.237	3	**10112**	HST-RN-S-30250-R.020
	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	5/16	**.020**	7/16	4	1-1/8	.296	3	**10157**	HST-RN-R-30312-R.020
	5/16	**.020**	7/16	4	2-1/8	.296	3	**10167**	HST-RN-M-30312-R.020
3/8	3/8	**.020**	1/2	4	1-1/8	.356	3	**10197**	HST-RN-R-30375-R.020
	3/8	**.020**	1/2	6	2-3/8	.356	3	**10212**	HST-RN-M-30375-R.020
1/2	1/2	**.030**	5/8	4	1-3/8	.475	3	**10302**	HST-RN-R-30500-R.030
	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

* .0005 max TIR

Speeds & Feeds on Page 102

SPEEDS & FEEDS

3 Flute

HST-3

HST-3 / HST-RN-3

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	455	.0007	.0011	.0010	.0017	.0013	.0023	.0019	.0034	.0025	.0044	.0036	.0064	.0045	.0082
		75 - 98 HRB	445	.0005	.0009	.0007	.0013	.0009	.0017	.0014	.0025	.0018	.0032	.0026	.0047	.0033	.0060
		21 - 36 HRC	400	.0003	.0006	.0005	.0008	.0006	.0011	.0009	.0016	.0012	.0021	.0017	.0030	.0021	.0039
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0004	.0007	.0006	.0011	.0008	.0015	.0012	.0022	.0016	.0028	.0023	.0041	.0029	.0052
		21 - 36 HRC	340	.0003	.0005	.0005	.0008	.0006	.0011	.0009	.0016	.0012	.0021	.0017	.0030	.0021	.0039
		36 - 50 HRC	260	.0003	.0005	.0004	.0007	.0005	.0009	.0008	.0014	.0010	.0018	.0015	.0026	.0019	.0034
		> 50 HRC	155	.0002	.0004	.0003	.0006	.0004	.0007	.0006	.0011	.0008	.0014	.0012	.0021	.0015	.0027
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0004	.0007	.0006	.0011	.0008	.0015	.0012	.0022	.0016	.0028	.0023	.0041	.0029	.0052
		21 - 36 HRC	250	.0003	.0006	.0005	.0009	.0007	.0011	.0010	.0017	.0013	.0022	.0018	.0032	.0023	.0041
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0005	.0009	.0008	.0014	.0010	.0017	.0014	.0025	.0018	.0032
		> 50 HRC	85	.0002	.0004	.0003	.0006	.0004	.0007	.0006	.0011	.0008	.0014	.0012	.0021	.0015	.0026
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0006	.0010	.0008	.0015	.0011	.0019	.0016	.0029	.0021	.0037	.0030	.0053	.0038	.0068
		75 - 98 HRB	255	.0004	.0007	.0006	.0010	.0007	.0013	.0011	.0020	.0014	.0025	.0020	.0037	.0026	.0047
		21 - 36 HRC	175	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0017	.0013	.0023	.0018	.0033	.0023	.0042
		36 - 50 HRC	150	.0003	.0005	.0004	.0008	.0006	.0011	.0009	.0016	.0011	.0020	.0016	.0029	.0021	.0038
		> 50 HRC	55	.0002	.0003	.0003	.0005	.0004	.0007	.0005	.0010	.0007	.0012	.0010	.0018	.0013	.0023
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0004	.0007	.0006	.0011	.0008	.0014	.0012	.0021	.0015	.0027	.0022	.0040	.0028	.0051
		21 - 36 HRC	225	.0004	.0006	.0006	.0010	.0007	.0013	.0011	.0019	.0014	.0025	.0020	.0036	.0025	.0046
		36 - 50 HRC	180	.0003	.0005	.0004	.0008	.0006	.0010	.0009	.0015	.0011	.0020	.0016	.0029	.0020	.0037
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0004	.0007	.0006	.0011	.0008	.0015	.0012	.0022	.0016	.0028	.0023	.0041	.0029	.0052
		21 - 36 HRC	280	.0004	.0006	.0005	.0010	.0007	.0013	.0011	.0019	.0014	.0024	.0020	.0035	.0025	.0045
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0003	.0005	.0005	.0008	.0006	.0011	.0009	.0016	.0012	.0021	.0017	.0030	.0021	.0038
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0005	.0009	.0008	.0014	.0010	.0018	.0014	.0026	.0018	.0033
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0007	.0012	.0010	.0018	.0013	.0023	.0020	.0035	.0026	.0045	.0037	.0066	.0047	.0084
		21 - 36 HRC	370	.0004	.0006	.0005	.0010	.0007	.0013	.0011	.0019	.0014	.0025	.0020	.0036	.0025	.0046
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0004	.0008	.0006	.0011	.0008	.0015	.0012	.0022	.0016	.0029	.0023	.0042	.0030	.0054
		21 - 36 HRC	335	.0004	.0007	.0005	.0010	.0007	.0013	.0011	.0019	.0014	.0025	.0020	.0036	.0026	.0046
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0005	.0008	.0007	.0012	.0009	.0015	.0013	.0023	.0017	.0030	.0024	.0043	.0031	.0056
		21 - 36 HRC	260	.0003	.0005	.0004	.0008	.0006	.0010	.0009	.0015	.0011	.0020	.0016	.0029	.0020	.0037
		36 - 50 HRC	135	.0002	.0003	.0003	.0005	.0004	.0007	.0005	.0010	.0007	.0013	.0010	.0018	.0013	.0023
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0006	.0010	.0008	.0015	.0011	.0020	.0017	.0030	.0022	.0038	.0031	.0056	.0040	.0072
		75 - 98 HRB	250	.0005	.0008	.0007	.0013	.0009	.0017	.0014	.0025	.0018	.0032	.0026	.0047	.0033	.0060
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0003	.0005	.0004	.0008	.0006	.0010	.0008	.0015	.0011	.0020	.0016	.0029	.0020	.0036
		21 - 36 HRC	75	.0003	.0005	.0004	.0007	.0006	.0010	.0008	.0015	.0011	.0019	.0015	.0027	.0019	.0035
		36 - 50 HRC	70	.0002	.0004	.0004	.0006	.0005	.0008	.0007	.0013	.0009	.0016	.0013	.0023	.0017	.0030
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0008	.0014	.0012	.0021	.0015	.0027	.0023	.0041	.0030	.0053	.0043	.0077	.0055	.0099
		75 - 98 HRB	275	.0007	.0012	.0010	.0018	.0013	.0023	.0019	.0034	.0025	.0045	.0036	.0065	.0046	.0083
		21 - 36 HRC	250	.0005	.0009	.0007	.0013	.0010	.0017	.0014	.0026	.0019	.0033	.0027	.0049	.0034	.0062
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0004	.0007	.0006	.0010	.0008	.0014	.0011	.0020	.0015	.0026	.0021	.0038	.0027	.0049
		36 - 50 HRC	160	.0004	.0006	.0005	.0009	.0007	.0012	.0010	.0019	.0014	.0024	.0019	.0035	.0025	.0045
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0017	.0013	.0022	.0018	.0032	.0023	.0041
		21 - 36 HRC	170	.0003	.0006	.0005	.0009	.0006	.0011	.0009	.0017	.0012	.0022	.0017	.0031	.0022	.0040
		36 - 50 HRC	65	.0002	.0004	.0003	.0006	.0004	.0008	.0006	.0011	.0008	.0015	.0012	.0021	.0015	.0027

MILLING PROCESS	HARDNESS	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	100%-150% Diameter	100% Diameter
	≥ 35 HRC	100%-125% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	Up to 50% Diameter
	≥ 35 HRC	Up to Max LOC	Up to 50% Diameter

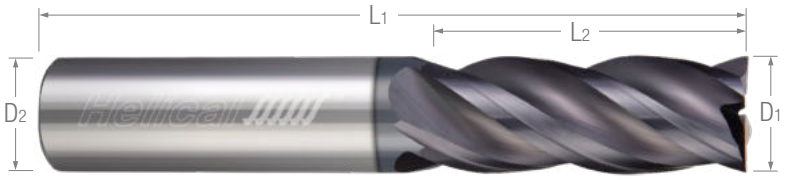
NOTES:
Hardness Scales: HRB = Rockwell B
HRC = Rockwell C
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running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

HSV-4

4 FLUTE - SQUARE
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 181 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	A*plus* Coated + Weldon Flat	Tool Description
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
	1/8	1	2-1/2	4	84685		HSV-LX-40125
5/32	3/16	3/16	2	4	30047		HSV-S-40156
	3/16	5/16	2	4	84686		HSV-SR-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
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
	3/16	1-3/8	3	4	84687		HSV-LX-40187
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
1/4	1/4	3/8	2	4	30137	30137W	HSV-S-40250
	1/4	1/2	2-1/2	4	30142	30142W	HSV-SR-40250
	1/4	3/4	2-1/2	4	30152	30152W	HSV-R-40250
	1/4	1	3	4	30167	30167W	HSV-M-40250
	1/4	1-1/4	3	4	81641		HSV-L-40250
	1/4	1-1/2	3	4	81642		HSV-LX-40250
	1/4	1-3/4	4	4	83182		HSV-X-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
	5/16	1-1/2	3	4	84688		HSV-L-40281

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

4 FLUTE - SQUARE

Variable Pitch (cont.)

HSV-4

continued from previous page

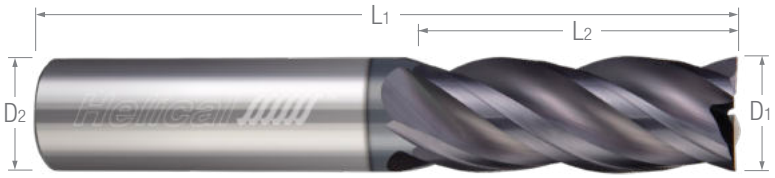
Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/16	5/16	1/2	2	4	30227	30227W	HSV-S-40312
	5/16	3/4	2-1/2	4	30242	30242W	HSV-R-40312
	5/16	1	2-1/2	4	81643		HSV-A-40312
	5/16	1-1/4	3	4	30257	30257W	HSV-M-40312
	5/16	1-9/16	4	4	82257		HSV-L-40312
3/8	3/8	1/2	2	4	30317	30317W	HSV-S-40375
	3/8	7/8	3	4	30332	30332W	HSV-SR-40375
	3/8	1	3	4	30337	30337W	HSV-R-40375
	3/8	1-1/4	3	4	30347	30347W	HSV-M-40375
	3/8	1-1/2	3	4	81644		HSV-L-40375
	3/8	2	4	4	82258		HSV-LX-40375
	3/8	2-1/2	5	4	84689		HSV-X-40375
13/32	7/16	1/2	2-3/4	4	30362		HSV-S-40406
	7/16	15/16	2-3/4	4	30377		HSV-R-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
	7/16	1-5/8	3-1/2	4	84690		HSV-ML-40437
1/2	1/2	5/8	2-1/2	4	30497	30497W	HSV-S-40500
	1/2	1	3	4	30512	30512W	HSV-SR-40500
	1/2	1-1/4	3	4	30527	30527W	HSV-R-40500
	1/2	1-5/8	4	4	30542	30542W	HSV-M-40500
	1/2	2	4	4	81645	81645W	HSV-L-40500
	1/2	2-1/2	5	4	81646		HSV-LX-40500
	1/2	3-1/8	6	4	82259		HSV-X-40500
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	30602W	HSV-M-40625
	5/8	2-1/2	5	4	82260		HSV-ML-40625
	5/8	3-1/4	6	4	30617		HSV-L-40625
	5/8	3-3/4	6	4	84691		HSV-LX-40625
3/4	3/4	7/8	3	4	30632		HSV-S-40750
	3/4	1-1/4	4	4	30647	30647W	HSV-SR-40750
	3/4	1-5/8	4	4	30662	30662W	HSV-R-40750
	3/4	2-1/4	5	4	30677	30677W	HSV-M-40750
	3/4	2-3/4	5	4	81647		HSV-ML-40750
	3/4	3-1/4	6	4	30692	30692W	HSV-L-40750
	3/4	4	6-1/2	4	82261		HSV-LX-40750
	3/4	4-3/4	7	4	84692		HSV-X-40750
1	1	1-1/2	4	4	30707		HSV-S-41000
	1	2	4-1/2	4	30722	30722W	HSV-R-41000
	1	2-5/8	5	4	30737	30737W	HSV-M-41000
	1	3	6	4	30742		HSV-ML-41000
	1	4-1/4	7	4	30752		HSV-L-41000

* .0005 max TIR

MHSV-4
METRIC

4 FLUTE - SQUARE - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.00\ mm}_{-.05\ mm}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.80\ mm}_{-.00\ mm}$	Overall Length L_1 $^{+1.60\ mm}_{-1.60\ mm}$	Flutes	*Aplus* Coated	Tool Description
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 122

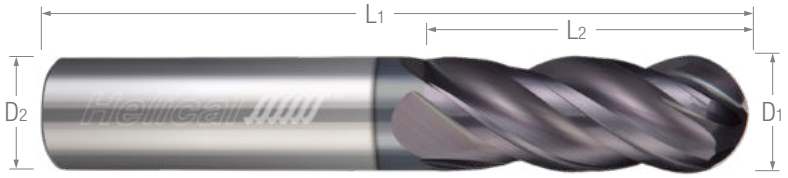
4 FLUTE - BALL

Variable Pitch

HSV-4

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 183 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
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
	1/8	7/8	2-1/2	4	**84742**	HSV-L-40125-BN
5/32	3/16	3/16	2	4	**83941**	HSV-S-40156-BN
	3/16	7/16	2-1/2	4	**83942**	HSV-R-40156-BN
	3/16	9/16	2-1/2	4	**83943**	HSV-M-40156-BN
	3/16	3/4	2-1/2	4	**84743**	HSV-ML-40156-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
	3/16	1-3/16	3	4	**83273**	HSV-L-40187-BN
7/32	1/4	1/4	2	4	**83944**	HSV-S-40218-BN
	1/4	7/16	2-1/2	4	**83945**	HSV-R-40218-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
	1/4	1-3/4	4	4	**84744**	HSV-X-40250-BN
9/32	5/16	7/16	2	4	**83946**	HSV-S-40281-BN
	5/16	5/8	2-1/2	4	**83947**	HSV-R-40281-BN
	5/16	1	3	4	**84745**	HSV-M-40281-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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

HSV-4

4 FLUTE - BALL
Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
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
	3/8	2	4	4	**84746**	HSV-LX-40375-BN
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
	1/2	2-1/2	5	4	**83274**	HSV-LX-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	2-1/2	5	4	**84747**	HSV-ML-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	2-3/4	5	4	**84748**	HSV-ML-40750-BN
	3/4	3-1/4	6	4	**56692**	HSV-L-40750-BN
	3/4	4	6-1/2	4	**84749**	HSV-LX-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

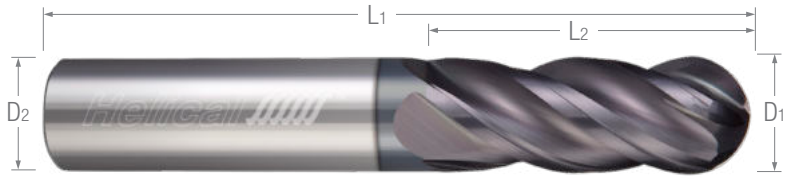
* .0005 max TIR

4 FLUTE - BALL - METRIC

Variable Pitch

MHSV-4
METRIC

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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 offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.00\ mm}_{-.05\ mm}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.80\ mm}_{-.00\ mm}$	Overall Length L_1 $^{+1.60\ mm}_{-1.60\ mm}$	Flutes	*Aplus* Coated	Tool Description
6 mm	6.00 mm	9.00 mm	63 mm	4	**84960**	MHSV-015-40600-BN
	6.00 mm	12.00 mm	63 mm	4	**84961**	MHSV-020-40600-BN
	6.00 mm	18.00 mm	63 mm	4	**84962**	MHSV-030-40600-BN
8 mm	8.00 mm	12.00 mm	63 mm	4	**84963**	MHSV-015-40800-BN
	8.00 mm	16.00 mm	63 mm	4	**84964**	MHSV-020-40800-BN
	8.00 mm	24.00 mm	75 mm	4	**84965**	MHSV-030-40800-BN
10 mm	10.00 mm	15.00 mm	63 mm	4	**84966**	MHSV-015-41000-BN
	10.00 mm	20.00 mm	63 mm	4	**84967**	MHSV-020-41000-BN
	10.00 mm	25.00 mm	75 mm	4	**84968**	MHSV-025-41000-BN
12 mm	12.00 mm	18.00 mm	75 mm	4	**84969**	MHSV-015-41200-BN
	12.00 mm	24.00 mm	75 mm	4	**84970**	MHSV-020-41200-BN
	12.00 mm	30.00 mm	75 mm	4	**84971**	MHSV-025-41200-BN
16 mm	16.00 mm	24.00 mm	89 mm	4	**84972**	MHSV-015-41600-BN
	16.00 mm	32.00 mm	89 mm	4	**84973**	MHSV-020-41600-BN
	16.00 mm	40.00 mm	89 mm	4	**84974**	MHSV-025-41600-BN
20 mm	20.00 mm	30.00 mm	89 mm	4	**84975**	MHSV-015-42000-BN
	20.00 mm	40.00 mm	100 mm	4	**84976**	MHSV-020-42000-BN
	20.00 mm	50.00 mm	125 mm	4	**84977**	MHSV-025-42000-BN
25 mm	25.00 mm	50.00 mm	125 mm	4	**84978**	MHSV-020-42500-BN
	25.00 mm	64.00 mm	125 mm	4	**84979**	MHSV-026-42500-BN

* .013 mm max TIR

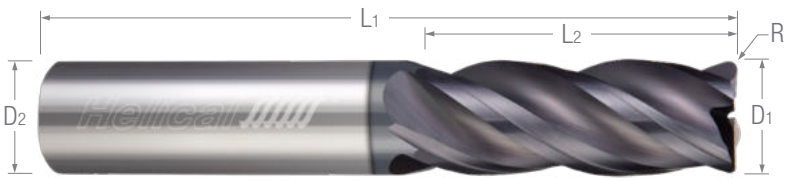
Speeds & Feeds on Page 122

HSV-4

4 FLUTE - CORNER RADIUS
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 185 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	A*plus* Coated + Weldon Flat	Tool Description
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	**.010**	7/8	2-1/2	4	**83212**		HSV-L-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	**.015**	5/8	2-1/2	4	**83213**		HSV-A-40125-R.015
	1/8	**.020**	1/4	1-1/2	4	**83214**		HSV-S-40125-R.020
	1/8	**.020**	3/8	2	4	**83215**		HSV-SR-40125-R.020
	1/8	**.020**	1/2	2-1/2	4	**83216**		HSV-R-40125-R.020
	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
	1/8	**.030**	3/4	2-1/2	4	**84697**		HSV-M-40125-R.030
5/32	3/16	**.010**	3/16	2	4	**31047**		HSV-S-40156-R.010
	3/16	**.010**	5/16	2	4	**84698**		HSV-SR-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**	5/16	2	4	**84699**		HSV-SR-40156-R.030
	3/16	**.030**	7/16	2-1/2	4	**82280**		HSV-R-40156-R.030
	3/16	**.030**	9/16	2-1/2	4	**84700**		HSV-M-40156-R.030
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	**.010**	1-3/16	3	4	**83217**		HSV-L-40187-R.010
	3/16	**.015**	5/16	2	4	**83218**		HSV-S-40187-R.015
	3/16	**.015**	7/16	2	4	**83219**		HSV-SR-40187-R.015
	3/16	**.015**	5/8	2-1/2	4	**83220**		HSV-R-40187-R.015
	3/16	**.020**	5/16	2	4	**83221**		HSV-S-40187-R.020
	3/16	**.020**	7/16	2	4	**83222**		HSV-SR-40187-R.020
	3/16	**.020**	5/8	2-1/2	4	**83223**		HSV-R-40187-R.020

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HSV-4

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
3/16	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
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
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
	1/4	.020	3/8	2	4	31137	31137W	HSV-S-40250-R.020
	1/4	.020	1/2	2-1/2	4	31142	31142W	HSV-SR-40250-R.020
	1/4	.020	3/4	2-1/2	4	31152	31152W	HSV-R-40250-R.020
	1/4	.020	1	3	4	31167	31167W	HSV-M-40250-R.020
	1/4	.020	1-1/4	3	4	81659		HSV-L-40250-R.020
	1/4	.020	1-1/2	3	4	83224		HSV-LX-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	43142W	HSV-SR-40250-R.030
	1/4	.030	3/4	2-1/2	4	43152	43152W	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
	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
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
	5/16	.010	3/4	2-1/2	4	82294		HSV-R-40312-R.010
	5/16	.010	1	2-1/2	4	84701		HSV-A-40312-R.010
	5/16	.010	1-1/4	3	4	82295		HSV-M-40312-R.010
	5/16	.020	1/2	2	4	31227	31227W	HSV-S-40312-R.020
	5/16	.020	3/4	2-1/2	4	31242	31242W	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	31257W	HSV-M-40312-R.020
	5/16	.020	1-9/16	4	4	82296		HSV-ML-40312-R.020
	5/16	.030	1/2	2	4	43227	43227W	HSV-S-40312-R.030
	5/16	.030	3/4	2-1/2	4	43242		HSV-R-40312-R.030
	5/16	.030	1	2-1/2	4	84702		HSV-A-40312-R.030
	5/16	.030	1-1/4	3	4	43257		HSV-M-40312-R.030
	5/16	.030	1-9/16	4	4	84703		HSV-ML-40312-R.030

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continued on next page

HSV-4

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/16	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	2-1/2	4	84704		HSV-A-40312-R.060
	5/16	.060	1-1/4	3	4	43258		HSV-M-40312-R.060
	5/16	.060	1-9/16	4	4	84705		HSV-ML-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	.010	1-1/2	3	4	83225		HSV-L-40375-R.010
	3/8	.015	1/2	2	4	83226		HSV-S-40375-R.015
	3/8	.015	7/8	3	4	83227		HSV-SR-40375-R.015
	3/8	.015	1-1/4	3	4	83228		HSV-M-40375-R.015
	3/8	.020	1/2	2	4	31317	31317W	HSV-S-40375-R.020
	3/8	.020	7/8	3	4	31332	31332W	HSV-SR-40375-R.020
	3/8	.020	1	3	4	31337	31337W	HSV-R-40375-R.020
	3/8	.020	1-1/4	3	4	31347	31347W	HSV-M-40375-R.020
	3/8	.020	1-1/2	3	4	81664		HSV-L-40375-R.020
	3/8	.030	1/2	2	4	43317	43317W	HSV-S-40375-R.030
	3/8	.030	7/8	3	4	43332	43332W	HSV-SR-40375-R.030
	3/8	.030	1	3	4	43337	43337W	HSV-R-40375-R.030
	3/8	.030	1-1/4	3	4	43347	43347W	HSV-M-40375-R.030
	3/8	.030	1-1/2	3	4	83229		HSV-L-40375-R.030
	3/8	.060	1/2	2	4	43318	43318W	HSV-S-40375-R.060
	3/8	.060	7/8	3	4	43333	43333W	HSV-SR-40375-R.060
	3/8	.060	1	3	4	43338	43338W	HSV-R-40375-R.060
	3/8	.060	1-1/4	3	4	43348	43348W	HSV-M-40375-R.060
	3/8	.060	1-1/2	3	4	83230		HSV-L-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
13/32	7/16	.020	1/2	2-3/4	4	31362		HSV-S-40406-R.020
	7/16	.020	15/16	2-3/4	4	31377		HSV-R-40406-R.020
7/16	7/16	.020	5/8	2-3/4	4	31407		HSV-S-40437-R.020
	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		HSV-S-40468-R.030
	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

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continued on next page

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HSV-4

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
1/2	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
	1/2	**.010**	1-1/4	3	4	**82299**		HSV-R-40500-R.010
	1/2	**.010**	1-5/8	4	4	**83231**		HSV-M-40500-R.010
	1/2	**.010**	2	4	4	**84706**		HSV-L-40500-R.010
	1/2	**.015**	5/8	2-1/2	4	**81665**		HSV-S-40500-R.015
	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
	1/2	**.015**	1-5/8	4	4	**83232**		HSV-M-40500-R.015
	1/2	**.015**	2	4	4	**83233**		HSV-L-40500-R.015
	1/2	**.020**	5/8	2-1/2	4	**43496**	**43496W**	HSV-S-40500-R.020
	1/2	**.020**	1	3	4	**43511**	**43511W**	HSV-SR-40500-R.020
	1/2	**.020**	1-1/4	3	4	**43526**	**43526W**	HSV-R-40500-R.020
	1/2	**.020**	1-5/8	4	4	**43541**		HSV-M-40500-R.020
	1/2	**.020**	2	4	4	**83234**		HSV-L-40500-R.020
	1/2	**.030**	5/8	2-1/2	4	**31497**	**31497W**	HSV-S-40500-R.030
	1/2	**.030**	1	3	4	**31512**	**31512W**	HSV-SR-40500-R.030
	1/2	**.030**	1-1/4	3	4	**31527**	**31527W**	HSV-R-40500-R.030
	1/2	**.030**	1-5/8	4	4	**31542**	**31542W**	HSV-M-40500-R.030
	1/2	**.030**	2	4	4	**81668**	**81668W**	HSV-L-40500-R.030
	1/2	**.030**	2-1/2	5	4	**83235**		HSV-LX-40500-R.030
	1/2	**.060**	5/8	2-1/2	4	**43497**	**43497W**	HSV-S-40500-R.060
	1/2	**.060**	1	3	4	**43512**	**43512W**	HSV-SR-40500-R.060
	1/2	**.060**	1-1/4	3	4	**43527**	**43527W**	HSV-R-40500-R.060
	1/2	**.060**	1-5/8	4	4	**43542**	**43542W**	HSV-M-40500-R.060
	1/2	**.060**	2	4	4	**81669**		HSV-L-40500-R.060
	1/2	**.060**	2-1/2	5	4	**83236**		HSV-LX-40500-R.060
	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
	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
	1/2	**.125**	5/8	2-1/2	4	**43499**		HSV-S-40500-R.125
	1/2	**.125**	1	3	4	**43514**	**43514W**	HSV-SR-40500-R.125
	1/2	**.125**	1-1/4	3	4	**43529**	**43529W**	HSV-R-40500-R.125
	1/2	**.125**	1-5/8	4	4	**43544**	**43544W**	HSV-M-40500-R.125
	1/2	**.125**	2	4	4	**83237**		HSV-L-40500-R.125
5/8	5/8	**.015**	1-1/4	3-1/2	4	**84707**		HSV-SR-40625-R.015
	5/8	**.015**	1-5/8	3-1/2	4	**84708**		HSV-R-40625-R.015
	5/8	**.015**	2	4	4	**84709**		HSV-M-40625-R.015
	5/8	**.020**	1-1/4	3-1/2	4	**84710**		HSV-SR-40625-R.020
	5/8	**.020**	1-5/8	3-1/2	4	**84711**		HSV-R-40625-R.020
	5/8	**.020**	2	4	4	**84712**		HSV-M-40625-R.020
	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
	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

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continued on next page

HSV-4

4 FLUTE - CORNER RADIUS
Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/8	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	**.015**	2-1/4	5	4	**84713**		HSV-M-40750-R.015
	3/4	**.020**	1-1/4	4	4	**84714**		HSV-SR-40750-R.020
	3/4	**.020**	1-5/8	4	4	**84715**		HSV-R-40750-R.020
	3/4	**.020**	2-1/4	5	4	**84716**		HSV-M-40750-R.020
	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**	HSV-R-40750-R.030
	3/4	**.030**	2-1/4	5	4	**31677**	**31677W**	HSV-M-40750-R.030
	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
	3/4	**.030**	4-3/4	7	4	**84717**		HSV-X-40750-R.030
	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
	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

* .0005 max TIR

continued on next page

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HSV-4

continued from previous page

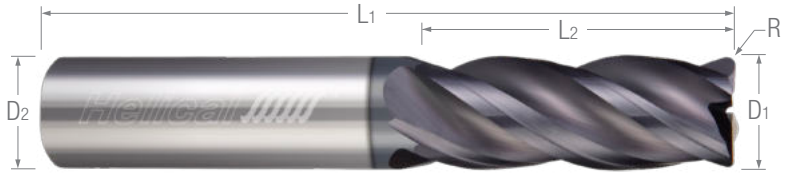
Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
3/4	3/4	**.250**	7/8	3	4	**43636**		HSV-S-40750-R.250
	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
	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	1	**.030**	1-1/2	4	4	**31707**		HSV-S-41000-R.030
	1	**.030**	2	4-1/2	4	**31722**	**31722W**	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**	**43722W**	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

MHSV-4
METRIC

4 FLUTE - CORNER RADIUS - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.00\ mm}_{-.05\ mm}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.05\ mm}_{-.05\ mm}$	Length of Cut L_2 $^{+.80\ mm}_{-.00\ mm}$	Overall Length L_1 $^{+1.60\ mm}_{-1.60\ mm}$	Flutes	*Aplus* 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
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

Speeds & Feeds on Page 122

4 FLUTE - SQUARE

Variable Pitch - Reduced Neck

HSV-RN-4

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 189 for T*plus* coating

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	A*plus* 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
	1/8	5/32	3	3/4	.118	4	**83496**	HSV-RN-ML-40125
	1/8	5/32	3	1	.118	4	**83497**	HSV-RN-LX-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
	3/16	7/32	3	1-5/16	.178	4	**83498**	HSV-RN-X-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
	1/4	3/8	4	2-1/2	.237	4	**83499**	HSV-RN-ML-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	3-3/4	.475	4	**83500**	HSV-RN-ML-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 122

HSV-RN-4

4 FLUTE - BALL
Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 190 for T*plus* coating

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	A*plus* Coated	Tool Description
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
	1/8	5/32	3	1	.118	4	**83512**	HSV-RN-LX-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
	3/16	7/32	3	1-1/2	.178	4	**83513**	HSV-RN-LX-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	3-5/8	.356	4	**83514**	HSV-RN-ML-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
	1/2	5/8	7	5	.475	4	**83515**	HSV-RN-X-40500-BN

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

4 FLUTE - BALL

Variable Pitch - Reduced Neck (cont.)

HSV-RN-4

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	*Aplus* Coated	Tool Description
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	3-3/4	.712	4	**83516**	HSV-RN-ML-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

HSV-RN-4

4 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 191 for T*plus* coating

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	A*plus* 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	**.010**	5/32	3	1	.118	4	**83501**	HSV-RN-LX-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
	1/8	**.030**	5/32	3	3/4	.118	4	**83502**	HSV-RN-ML-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	**.010**	7/32	3	1-1/2	.178	4	**83503**	HSV-RN-LX-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
	3/16	**.030**	7/32	3	1-5/16	.178	4	**83504**	HSV-RN-L-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	**.020**	3/8	4	2-1/2	.237	4	**83505**	HSV-RN-ML-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	1-5/8	.237	4	**83506**	HSV-RN-A-40250-R.030
	1/4	**.030**	3/8	4	2-1/8	.237	4	**53137**	HSV-RN-M-40250-R.030
	1/4	**.030**	3/8	4	2-1/2	.237	4	**83507**	HSV-RN-ML-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
	1/4	**.060**	3/8	4	2-1/8	.237	4	**53138**	HSV-RN-M-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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

4 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

HSV-RN-4

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	*Aplus* Coated	Tool Description
3/8	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
1/2	1/2	**.010**	5/8	4	1-1/2	.475	4	**83508**	HSV-RN-S-40500-R.010
	1/2	**.010**	5/8	4	2-1/4	.475	4	**83509**	HSV-RN-R-40500-R.010
	1/2	**.010**	5/8	6	3-3/8	.475	4	**83510**	HSV-RN-M-40500-R.010
	1/2	**.010**	5/8	6	4-1/8	.475	4	**83511**	HSV-RN-L-40500-R.010
	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

* .0005 max TIR

continued on next page

HSV-RN-4

4 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	*Aplus* Coated	Tool Description
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
	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

SPEEDS & FEEDS

4 Flute - Variable Pitch

HSV-4

HSV-4 / HSV-RN-4

Material Guide		Hardness	SFM	Inches per Tooth (IPT)																								
				1/16			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	Slot	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0004	.0006	.0008	.0007	.0012	.0016	.0010	.0018	.0019	.0014	.0024	.0021	.0020	.0036	.0024	.0027	.0047	.0028	.0038	.0067	.0034	.0049	.0086	.0041
		75 - 98 HRB	445	.0003	.0005	.0007	.0005	.0009	.0014	.0008	.0013	.0016	.0010	.0018	.0018	.0015	.0026	.0021	.0020	.0034	.0024	.0028	.0049	.0029	.0036	.0063	.0035
		21 - 36 HRC	400	.0002	.0003	.0006	.0003	.0006	.0011	.0005	.0009	.0013	.0007	.0011	.0014	.0010	.0017	.0017	.0013	.0022	.0019	.0018	.0032	.0023	.0023	.0041	.0028
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0003	.0004	.0007	.0005	.0008	.0013	.0007	.0011	.0015	.0009	.0015	.0017	.0013	.0023	.0019	.0017	.0030	.0023	.0024	.0043	.0027	.0031	.0054	.0033
		21 - 36 HRC	340	.0002	.0003	.0006	.0003	.0006	.0011	.0005	.0009	.0013	.0007	.0012	.0014	.0010	.0017	.0017	.0013	.0022	.0019	.0018	.0032	.0023	.0023	.0040	.0028
		36 - 50 HRC	260	.0002	.0003	.0006	.0003	.0005	.0011	.0004	.0007	.0012	.0006	.0010	.0013	.0008	.0015	.0016	.0011	.0019	.0018	.0016	.0028	.0022	.0020	.0035	.0026
		> 50 HRC	155	.0001	.0002	.0005	.0002	.0004	.0009	.0003	.0006	.0010	.0005	.0008	.0012	.0007	.0012	.0014	.0009	.0015	.0016	.0012	.0022	.0019	.0016	.0028	.0023
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0003	.0004	.0007	.0005	.0008	.0013	.0007	.0011	.0015	.0009	.0015	.0017	.0013	.0023	.0019	.0017	.0030	.0023	.0024	.0043	.0027	.0031	.0054	.0033
		21 - 36 HRC	250	.0002	.0003	.0006	.0004	.0006	.0012	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0018	.0017	.0013	.0024	.0020	.0019	.0034	.0024	.0025	.0043	.0029
		36 - 50 HRC	145	.0002	.0003	.0005	.0003	.0005	.0010	.0004	.0007	.0012	.0005	.0010	.0013	.0008	.0014	.0015	.0010	.0019	.0018	.0015	.0027	.0021	.0019	.0034	.0026
		> 50 HRC	85	.0001	.0002	.0005	.0002	.0004	.0009	.0003	.0006	.0010	.0005	.0008	.0012	.0007	.0012	.0014	.0009	.0015	.0016	.0012	.0022	.0019	.0016	.0028	.0023
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0003	.0005	.0008	.0006	.0010	.0015	.0009	.0015	.0017	.0011	.0020	.0019	.0017	.0030	.0022	.0022	.0039	.0026	.0032	.0056	.0031	.0040	.0071	.0037
		75 - 98 HRB	255	.0002	.0004	.0006	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0014	.0016	.0012	.0021	.0018	.0015	.0027	.0021	.0022	.0038	.0025	.0028	.0049	.0031
		21 - 36 HRC	175	.0002	.0003	.0006	.0004	.0006	.0012	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0018	.0017	.0014	.0024	.0020	.0020	.0034	.0024	.0025	.0044	.0029
		36 - 50 HRC	150	.0002	.0003	.0006	.0003	.0006	.0011	.0005	.0008	.0012	.0006	.0011	.0014	.0009	.0016	.0016	.0012	.0021	.0019	.0017	.0031	.0023	.0022	.0039	.0028
		> 50 HRC	55	.0001	.0002	.0005	.0002	.0004	.0009	.0003	.0005	.0010	.0004	.0007	.0011	.0006	.0010	.0013	.0008	.0013	.0015	.0011	.0019	.0018	.0014	.0024	.0022
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0002	.0004	.0007	.0004	.0008	.0013	.0006	.0011	.0015	.0009	.0015	.0017	.0013	.0022	.0019	.0017	.0029	.0022	.0024	.0042	.0026	.0030	.0053	.0032
		21 - 36 HRC	225	.0002	.0004	.0006	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0014	.0016	.0011	.0020	.0018	.0015	.0026	.0021	.0021	.0038	.0025	.0027	.0048	.0030
		36 - 50 HRC	180	.0002	.0003	.0006	.0003	.0006	.0011	.0005	.0008	.0012	.0006	.0011	.0014	.0009	.0016	.0016	.0012	.0021	.0019	.0017	.0030	.0023	.0022	.0038	.0027
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0003	.0004	.0007	.0005	.0008	.0013	.0007	.0011	.0015	.0009	.0016	.0017	.0013	.0023	.0019	.0017	.0030	.0023	.0024	.0043	.0027	.0031	.0055	.0033
		21 - 36 HRC	280	.0002	.0004	.0006	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0013	.0016	.0011	.0020	.0018	.0015	.0026	.0021	.0021	.0037	.0025	.0027	.0047	.0030
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0002	.0003	.0006	.0003	.0006	.0011	.0005	.0008	.0012	.0006	.0011	.0014	.0010	.0017	.0016	.0012	.0022	.0019	.0018	.0031	.0023	.0023	.0040	.0028
		36 - 50 HRC	145	.0002	.0003	.0006	.0003	.0005	.0011	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0014	.0015	.0011	.0019	.0018	.0016	.0027	.0021	.0020	.0035	.0026
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0004	.0007	.0009	.0007	.0013	.0017	.0011	.0019	.0019	.0014	.0025	.0021	.0021	.0037	.0025	.0027	.0048	.0029	.0039	.0069	.0034	.0050	.0088	.0042
		21 - 36 HRC	370	.0002	.0004	.0006	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0013	.0016	.0011	.0020	.0018	.0015	.0026	.0021	.0021	.0038	.0025	.0027	.0048	.0031
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0003	.0004	.0007	.0005	.0008	.0013	.0007	.0012	.0015	.0009	.0016	.0017	.0013	.0023	.0019	.0017	.0031	.0023	.0025	.0044	.0027	.0032	.0056	.0033
		21 - 36 HRC	335	.0002	.0004	.0006	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0014	.0016	.0011	.0020	.0018	.0015	.0026	.0021	.0021	.0038	.0025	.0027	.0048	.0031
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0003	.0004	.0007	.0005	.0008	.0014	.0007	.0012	.0015	.0009	.0016	.0017	.0014	.0024	.0020	.0018	.0032	.0023	.0026	.0046	.0028	.0033	.0058	.0034
		21 - 36 HRC	260	.0002	.0003	.0006	.0003	.0006	.0011	.0005	.0008	.0012	.0006	.0011	.0014	.0009	.0016	.0016	.0012	.0021	.0019	.0017	.0030	.0023	.0022	.0039	.0027
		36 - 50 HRC	135	.0001	.0002	.0005	.0002	.0004	.0009	.0003	.0005	.0010	.0004	.0007	.0011	.0006	.0010	.0013	.0008	.0013	.0015	.0011	.0019	.0018	.0014	.0024	.0022
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0003	.0006	.0008	.0006	.0011	.0015	.0009	.0016	.0017	.0012	.0021	.0020	.0018	.0031	.0023	.0023	.0041	.0026	.0033	.0059	.0031	.0042	.0075	.0038
		75 - 98 HRB	250	.0003	.0005	.0007	.0005	.0009	.0014	.0008	.0013	.0016	.0010	.0018	.0018	.0015	.0026	.0021	.0019	.0034	.0024	.0028	.0049	.0029	.0035	.0063	.0035
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0002	.0003	.0006	.0003	.0005	.0011	.0005	.0008	.0012	.0006	.0011	.0014	.0009	.0016	.0016	.0012	.0021	.0019	.0017	.0030	.0023	.0022	.0038	.0027
		21 - 36 HRC	75	.0002	.0003	.0006	.0003	.0005	.0011	.0004	.0008	.0012	.0006	.0010	.0014	.0009	.0015	.0016	.0011	.0020	.0018	.0016	.0029	.0022	.0021	.0036	.0027
		36 - 50 HRC	70	.0002	.0003	.0005	.0003	.0005	.0010	.0004	.0007	.0011	.0005	.0009	.0013	.0007	.0013	.0015	.0010	.0017	.0017	.0014	.0025	.0020	.0018	.0031	.0025
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0004	.0008	.0009	.0008	.0015	.0018	.0013	.0022	.0020	.0017	.0029	.0023	.0025	.0043	.0027	.0032	.0057	.0031	.0046	.0081	.0037	.0059	.0103	.0045
		75 - 98 HRB	275	.0004	.0006	.0009	.0007	.0012	.0017	.0010	.0018	.0019	.0014	.0024	.0021	.0021	.0036	.0024	.0027	.0047	.0028	.0039	.0068	.0034	.0049	.0087	.0041
		21 - 36 HRC	250	.0003	.0005	.0007	.0005	.0009	.0014	.0008	.0014	.0016	.0010	.0018	.0018	.0015	.0027	.0021	.0020	.0036	.0025	.0029	.0051	.0029	.0037	.0065	.0036
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0002	.0004	.0007	.0004	.0007	.0013	.0006	.0011	.0014	.0008	.0014	.0016	.0012	.0021	.0019	.0016	.0028	.0022	.0023	.0040	.0026	.0029	.0051	.0031
		36 - 50 HRC	160	.0002	.0004	.0006	.0004	.0007	.0012	.0006	.0010	.0014	.0007	.0013	.0016	.0011	.0020	.0018	.0015	.0026	.0021	.0021	.0037	.0025	.0026	.0047	.0030
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0002	.0003	.0006	.0004	.0006	.0012	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0018	.0017	.0013	.0024	.0020	.0019	.0034	.0024	.0025	.0043	.0029
		21 - 36 HRC	170	.0002	.0003	.0006	.0003	.0006	.0011	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0017	.0017	.0013	.0023	.0020	.0019	.0033	.0023	.0024	.0042	.0028
		36 - 50 HRC	65	.0001	.0002	.0005	.0002	.0004	.0009	.0003	.0006	.0011	.0005	.0008	.0012	.0007	.0012	.0014	.0009	.0016	.0016	.0013	.0022	.0019	.0016	.0028	.0023

MILLING PROCESS	HARDNESS	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	75%-125% Diameter	100% Diameter
	≥ 35 HRC	60%-100% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	25%-35% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

For all diameters, please go to HelicalTool.com

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

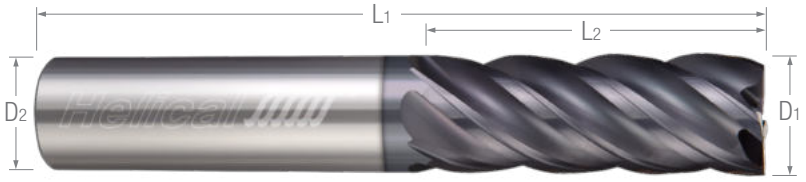
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.

HEV-5

5 FLUTE - SQUARE
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 194 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	A*plus* Coated + Weldon Flat	Tool Description
1/8	1/8	1/4	1-1/2	5	**44017**		HEV-S-50125
	1/8	3/8	2	5	**81701**		HEV-SR-50125
	1/8	1/2	2-1/2	5	**44032**		HEV-R-50125
	1/8	5/8	2-1/2	5	**81702**		HEV-A-50125
	1/8	3/4	2-1/2	5	**44047**		HEV-M-50125
	1/8	7/8	2-1/2	5	**82518**		HEV-L-50125
	1/8	1	2-1/2	5	**84626**		HEV-LX-50125
5/32	3/16	3/16	2	5	**81703**		HEV-S-50156
	3/16	5/16	2	5	**84627**		HEV-SR-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	3/4	2-1/2	5	**84628**		HEV-ML-50156
3/16	3/16	5/16	2	5	**44062**		HEV-S-50187
	3/16	7/16	2	5	**81706**		HEV-SR-50187
	3/16	9/16	2-1/2	5	**44077**		HEV-R-50187
	3/16	3/4	2-1/2	5	**44092**		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
	3/16	1-3/8	3	5	**84629**		HEV-LX-50187
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	5/8	2-1/2	5	**84630**		HEV-M-50218
1/4	1/4	3/8	2	5	**44107**	**44107W**	HEV-S-50250
	1/4	3/8	4	5	**82941**		HEV-S-50250
	1/4	1/2	2-1/2	5	**44122**	**44122W**	HEV-SR-50250
	1/4	3/4	2-1/2	5	**44137**	**44137W**	HEV-R-50250
	1/4	3/4	4	5	**82942**		HEV-R-50250
	1/4	1	3	5	**44152**	**44152W**	HEV-M-50250
	1/4	1-1/4	3	5	**44157**	**44157W**	HEV-L-50250
	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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 138

5 FLUTE - SQUARE

Variable Pitch (cont.)

HEM **HEV-5**

continued from previous page

Cutter Diameter* $D1^{+.000"}_{-.002"}$	Shank Diameter $D2$ (h6)	Length of Cut $L2^{+.032"}_{-.000"}$	Overall Length $L1^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/16	5/16	7/16	2	5	**44167**	**44167W**	HEV-S-50312
	5/16	5/8	2-1/2	5	**84631**		HEV-SR-50312
	5/16	13/16	2-1/2	5	**44182**	**44182W**	HEV-R-50312
	5/16	1	3	5	**44197**	**44197W**	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
3/8	3/8	1/2	2	5	**44212**	**44212W**	HEV-S-50375
	3/8	1/2	4	5	**82943**		HEV-S-50375
	3/8	3/4	2-1/2	5	**81714**	**81714W**	HEV-SR-50375
	3/8	1	3	5	**44227**	**44227W**	HEV-R-50375
	3/8	1	6	5	**82944**		HEV-R-50375
	3/8	1-1/4	3	5	**44242**	**44242W**	HEV-M-50375
	3/8	1-1/2	3-1/2	5	**44247**	**44247W**	HEV-L-50375
	3/8	2	4	5	**82521**		HEV-LX-50375
	3/8	2-1/2	5	5	**84632**		HEV-X-50375
1/2	1/2	5/8	2-1/2	5	**44257**	**44257W**	HEV-S-50500
	1/2	5/8	4	5	**82945**		HEV-S-50500
	1/2	1	3	5	**44272**	**44272W**	HEV-SR-50500
	1/2	1-1/4	3	5	**44287**	**44287W**	HEV-R-50500
	1/2	1-1/4	6	5	**82946**		HEV-R-50500
	1/2	1-5/8	4	5	**44302**	**44302W**	HEV-M-50500
	1/2	2	4	5	**44307**	**44307W**	HEV-L-50500
	1/2	2-1/2	5	5	**81715**	**81715W**	HEV-LX-50500
	1/2	3-1/8	6	5	**82522**		HEV-X-50500
	1/2	3-5/8	6	5	**82523**		HEV-Y-50500
5/8	5/8	3/4	3	5	**44317**	**44317W**	HEV-S-50625
	5/8	1-1/4	3-1/2	5	**44322**	**44322W**	HEV-SR-50625
	5/8	1-5/8	3-1/2	5	**44332**	**44332W**	HEV-R-50625
	5/8	2-1/8	4	5	**44347**	**44347W**	HEV-M-50625
	5/8	2-1/2	5	5	**44352**	**44352W**	HEV-L-50625
	5/8	3-1/4	6	5	**82524**		HEV-LX-50625
3/4	3/4	1	3	5	**44362**	**44362W**	HEV-S-50750
	3/4	1	6	5	**82947**		HEV-S-50750
	3/4	1-1/4	4	5	**81716**		HEV-SR-50750
	3/4	1-5/8	4	5	**44377**	**44377W**	HEV-R-50750
	3/4	1-5/8	6	5	**82948**		HEV-R-50750
	3/4	2-1/4	5	5	**44392**	**44392W**	HEV-M-50750
	3/4	2-3/4	5	5	**44397**	**44397W**	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	1-1/4	4	5	**44407**		HEV-S-51000
	1	2	4-1/2	5	**44422**	**44422W**	HEV-R-51000
	1	2-5/8	5	5	**44437**	**44437W**	HEV-M-51000
	1	3-1/4	6	5	**44442**	**44442W**	HEV-L-51000
	1	4-1/4	7	5	**44447**	**44447W**	HEV-X-51000
1-1/4	1-1/4	2	4-1/2	5	**44467**		HEV-R-51250
	1-1/4	2-5/8	5-1/2	5	**44482**		HEV-M-51250
	1-1/4	3-1/4	6	5	**44497**		HEV-L-51250
	1-1/4	4-1/2	7	5	**44512**		HEV-LX-51250

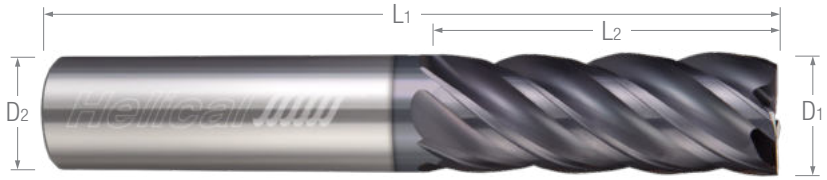
* .0005 max TIR

MHEV-5
METRIC

HEM

5 FLUTE - SQUARE - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.00\ mm}_{-.05\ mm}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.80\ mm}_{-.00\ mm}$	Overall Length L_1 $^{+1.6\ mm}_{-1.6\ mm}$	Flutes	A*plus* 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 138

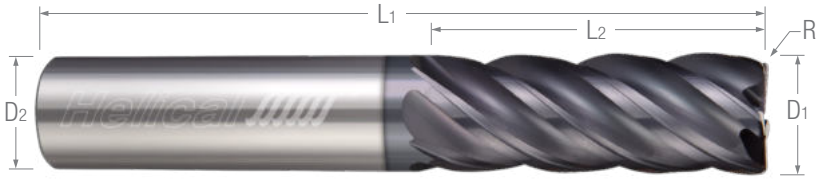
5 FLUTE - CORNER RADIUS

Variable Pitch

HEV-5

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 196 for T*plus* coating



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	A*plus* Coated + Weldon Flat	Tool Description
1/8	1/8	.010	1/4	1-1/2	5	34017		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		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	.010	7/8	2-1/2	5	84636		HEV-L-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	.015	5/8	2-1/2	5	84637		HEV-A-50125-R.015
	1/8	.020	1/4	1-1/2	5	84638		HEV-S-50125-R.020
	1/8	.020	3/8	2	5	84639		HEV-SR-50125-R.020
	1/8	.020	1/2	2-1/2	5	84640		HEV-R-50125-R.020
	1/8	.030	1/4	1-1/2	5	45017		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		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
	1/8	.030	7/8	2-1/2	5	84641		HEV-L-50125-R.030
5/32	3/16	.010	3/16	2	5	81722		HEV-S-50156-R.010
	3/16	.010	5/16	2	5	84642		HEV-SR-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
	3/16	.010	3/4	2-1/2	5	84643		HEV-ML-50156-R.010
3/16	3/16	.010	5/16	2	5	34062		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		HEV-R-50187-R.010
	3/16	.010	3/4	2-1/2	5	34092		HEV-M-50187-R.010
	3/16	.010	1	2-1/2	5	81726		HEV-ML-50187-R.010
	3/16	.010	1-3/16	3	5	84644		HEV-L-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	.020	5/16	2	5	84645		HEV-S-50187-R.020

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 138

HEV-5

5 FLUTE - CORNER RADIUS
Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
3/16	3/16	.020	7/16	2	5	84646		HEV-SR-50187-R.020
	3/16	.020	9/16	2-1/2	5	84647		HEV-R-50187-R.020
	3/16	.030	5/16	2	5	45062		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		HEV-R-50187-R.030
	3/16	.030	3/4	2-1/2	5	45092		HEV-M-50187-R.030
	3/16	.030	1	2-1/2	5	82536		HEV-ML-50187-R.030
	3/16	.030	1-3/16	3	5	84648		HEV-L-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
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
	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	HEV-S-50250-R.020
	1/4	.020	3/8	4	5	82958		HEV-S-50250-R.020
	1/4	.020	1/2	2-1/2	5	34122	34122W	HEV-SR-50250-R.020
	1/4	.020	3/4	2-1/2	5	34137	34137W	HEV-R-50250-R.020
	1/4	.020	3/4	4	5	82959		HEV-R-50250-R.020
	1/4	.020	1	3	5	34152	34152W	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	45107W	HEV-S-50250-R.030
	1/4	.030	1/2	2-1/2	5	45122	45122W	HEV-SR-50250-R.030
	1/4	.030	3/4	2-1/2	5	45137	45137W	HEV-R-50250-R.030
	1/4	.030	1	3	5	45152	45152W	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	45108W	HEV-S-50250-R.060
	1/4	.060	1/2	2-1/2	5	45123	45123W	HEV-SR-50250-R.060
	1/4	.060	3/4	2-1/2	5	45138	45138W	HEV-R-50250-R.060
	1/4	.060	1	3	5	45153	45153W	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	.010	1	3	5	84649		HEV-M-50312-R.010
	5/16	.015	7/16	2	5	84650		HEV-S-50312-R.015
	5/16	.015	13/16	2-1/2	5	84651		HEV-R-50312-R.015
	5/16	.015	1	3	5	84652		HEV-M-50312-R.015
	5/16	.020	7/16	2	5	34167	34167W	HEV-S-50312-R.020
	5/16	.020	5/8	2-1/2	5	84653		HEV-SR-50312-R.020

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HEV-5

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/16	5/16	**.020**	13/16	2-1/2	5	**34182**	**34182W**	HEV-R-50312-R.020
	5/16	**.020**	1	3	5	**34197**	**34197W**	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**	**45167W**	HEV-S-50312-R.030
	5/16	**.030**	5/8	2-1/2	5	**84654**		HEV-SR-50312-R.030
	5/16	**.030**	13/16	2-1/2	5	**45182**	**45182W**	HEV-R-50312-R.030
	5/16	**.030**	1	3	5	**45197**	**45197W**	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**	HEV-S-50375-R.020
	3/8	**.020**	1/2	4	5	**82960**		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**	HEV-R-50375-R.020
	3/8	**.020**	1	6	5	**82961**		HEV-R-50375-R.020
	3/8	**.020**	1-1/4	3	5	**34242**	**34242W**	HEV-M-50375-R.020
	3/8	**.020**	1-1/2	3-1/2	5	**34247**		HEV-L-50375-R.020
	3/8	**.020**	2	4	5	**84655**		HEV-LX-50375-R.020
	3/8	**.030**	1/2	2	5	**45212**	**45212W**	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**	HEV-R-50375-R.030
	3/8	**.030**	1-1/4	3	5	**45242**	**45242W**	HEV-M-50375-R.030
	3/8	**.030**	1-1/2	3-1/2	5	**45247**	**45247W**	HEV-L-50375-R.030
	3/8	**.030**	2	4	5	**84656**		HEV-LX-50375-R.030
	3/8	**.060**	1/2	2	5	**45213**	**45213W**	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**	HEV-R-50375-R.060
	3/8	**.060**	1-1/4	3	5	**45243**	**45243W**	HEV-M-50375-R.060
	3/8	**.060**	1-1/2	3-1/2	5	**45248**		HEV-L-50375-R.060
	3/8	**.060**	2	4	5	**84657**		HEV-LX-50375-R.060
	3/8	**.090**	1/2	2	5	**45214**		HEV-S-50375-R.090
	3/8	**.090**	3/4	2-1/2	5	**84658**		HEV-SR-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**	3/4	2-1/2	5	**84659**		HEV-SR-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
	3/8	**.125**	1-1/2	3-1/2	5	**84660**		HEV-L-50375-R.125

*.0005 max TIR

continued on next page

HEV-5

5 FLUTE - CORNER RADIUS
Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
1/2	1/2	**.010**	5/8	2-1/2	5	**81753**	**81753W**	HEV-S-50500-R.010
	1/2	**.010**	1	3	5	**81754**	**81754W**	HEV-SR-50500-R.010
	1/2	**.010**	1-1/4	3	5	**81755**	**81755W**	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	**.010**	2-1/2	5	5	**84661**		HEV-LX-50500-R.010
	1/2	**.015**	5/8	2-1/2	5	**81758**	**81758W**	HEV-S-50500-R.015
	1/2	**.015**	1	3	5	**81759**	**81759W**	HEV-SR-50500-R.015
	1/2	**.015**	1-1/4	3	5	**81760**	**81760W**	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**	**81761W**	HEV-S-50500-R.020
	1/2	**.020**	1	3	5	**81762**	**81762W**	HEV-SR-50500-R.020
	1/2	**.020**	1-1/4	3	5	**81763**	**81763W**	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**	HEV-S-50500-R.030
	1/2	**.030**	5/8	4	5	**82962**		HEV-S-50500-R.030
	1/2	**.030**	1	3	5	**34272**	**34272W**	HEV-SR-50500-R.030
	1/2	**.030**	1-1/4	3	5	**34287**	**34287W**	HEV-R-50500-R.030
	1/2	**.030**	1-1/4	6	5	**82963**		HEV-R-50500-R.030
	1/2	**.030**	1-5/8	4	5	**34302**	**34302W**	HEV-M-50500-R.030
	1/2	**.030**	2	4	5	**34307**	**34307W**	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**	HEV-S-50500-R.060
	1/2	**.060**	5/8	4	5	**82964**		HEV-S-50500-R.060
	1/2	**.060**	1	3	5	**45272**	**45272W**	HEV-SR-50500-R.060
	1/2	**.060**	1-1/4	3	5	**45287**	**45287W**	HEV-R-50500-R.060
	1/2	**.060**	1-1/4	6	5	**82965**		HEV-R-50500-R.060
	1/2	**.060**	1-5/8	4	5	**45302**	**45302W**	HEV-M-50500-R.060
	1/2	**.060**	2	4	5	**45307**	**45307W**	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**	**45258W**	HEV-S-50500-R.090
	1/2	**.090**	1	3	5	**45273**	**45273W**	HEV-SR-50500-R.090
	1/2	**.090**	1-1/4	3	5	**45288**	**45288W**	HEV-R-50500-R.090
	1/2	**.090**	1-5/8	4	5	**45303**		HEV-M-50500-R.090
	1/2	**.090**	2	4	5	**45308**		HEV-L-50500-R.090
	1/2	**.090**	2-1/2	5	5	**82558**		HEV-LX-50500-R.090
	1/2	**.120**	5/8	2-1/2	5	**45259**	**45259W**	HEV-S-50500-R.120
	1/2	**.120**	1	3	5	**45274**	**45274W**	HEV-SR-50500-R.120
	1/2	**.120**	1-1/4	3	5	**45289**	**45289W**	HEV-R-50500-R.120
	1/2	**.120**	1-5/8	4	5	**45304**	**45304W**	HEV-M-50500-R.120
	1/2	**.120**	2	4	5	**45309**	**45309W**	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

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HEV-5

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/8	5/8	.015	1-1/4	3-1/2	5	84662		HEV-SR-50625-R.015
	5/8	.015	1-5/8	3-1/2	5	84663		HEV-R-50625-R.015
	5/8	.015	2-1/8	4	5	84664		HEV-M-50625-R.015
	5/8	.030	3/4	3	5	34317		HEV-S-50625-R.030
	5/8	.030	1-1/4	3-1/2	5	34322	34322W	HEV-SR-50625-R.030
	5/8	.030	1-5/8	3-1/2	5	34332	34332W	HEV-R-50625-R.030
	5/8	.030	2-1/8	4	5	34347	34347W	HEV-M-50625-R.030
	5/8	.030	2-1/2	5	5	34352		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		HEV-SR-50625-R.060
	5/8	.060	1-5/8	3-1/2	5	45332		HEV-R-50625-R.060
	5/8	.060	2-1/8	4	5	45347		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	HEV-S-50750-R.030
	3/4	.030	1	6	5	82966		HEV-S-50750-R.030
	3/4	.030	1-1/4	4	5	81778	81778W	HEV-SR-50750-R.030
	3/4	.030	1-5/8	4	5	34377	34377W	HEV-R-50750-R.030
	3/4	.030	1-5/8	6	5	82967		HEV-R-50750-R.030
	3/4	.030	2-1/4	5	5	34392	34392W	HEV-M-50750-R.030
	3/4	.030	2-3/4	5	5	34397	34397W	HEV-L-50750-R.030
	3/4	.030	3-1/4	6	5	34402	34402W	HEV-LX-50750-R.030
	3/4	.030	4	6-1/2	5	82563		HEV-X-50750-R.030
	3/4	.060	1	3	5	45362	45362W	HEV-S-50750-R.060
	3/4	.060	1	6	5	82968		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	HEV-R-50750-R.060
	3/4	.060	1-5/8	6	5	82969		HEV-R-50750-R.060
	3/4	.060	2-1/4	5	5	45392	45392W	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

*.0005 max TIR

continued on next page

HEV-5

5 FLUTE - CORNER RADIUS
Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
3/4	3/4	.090	1	3	5	45363		HEV-S-50750-R.090
	3/4	.090	1-1/4	4	5	84665		HEV-SR-50750-R.090
	3/4	.090	1-5/8	4	5	45378	45378W	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		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	HEV-R-50750-R.120
	3/4	.120	2-1/4	5	5	45394	45394W	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	1-1/4	4	5	84666		HEV-SR-50750-R.190
	3/4	.190	1-5/8	4	5	45380	45380W	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	1-1/4	4	5	84667		HEV-SR-50750-R.250
	3/4	.250	1-5/8	4	5	45381	45381W	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	45401W	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	34407W	HEV-S-51000-R.030
	1	.030	2	4-1/2	5	34422	34422W	HEV-R-51000-R.030
	1	.030	2-5/8	5	5	34437	34437W	HEV-M-51000-R.030
	1	.030	3-1/4	6	5	34442	34442W	HEV-L-51000-R.030
	1	.030	4-1/4	7	5	34447	34447W	HEV-X-51000-R.030
	1	.030	5-1/4	9	5	84668		HEV-Y-51000-R.030
	1	.060	1-1/4	4	5	45407		HEV-S-51000-R.060
	1	.060	2	4-1/2	5	45422		HEV-R-51000-R.060
	1	.060	2-5/8	5	5	45437		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	.090	1-1/4	4	5	45408		HEV-S-51000-R.090
	1	.090	2	4-1/2	5	45423		HEV-R-51000-R.090
	1	.090	2-5/8	5	5	45438		HEV-M-51000-R.090
	1	.120	1-1/4	4	5	45409		HEV-S-51000-R.120
	1	.120	2	4-1/2	5	45424		HEV-R-51000-R.120
	1	.120	2-5/8	5	5	45439		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		HEV-S-51000-R.250
	1	.250	2	4-1/2	5	45426		HEV-R-51000-R.250
	1	.250	2-5/8	5	5	45441		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
1-1/4	1-1/4	.060	2	4-1/2	5	34467		HEV-R-51250-R.060
	1-1/4	.060	2-5/8	5-1/2	5	34482		HEV-M-51250-R.060
	1-1/4	.060	3-1/4	6	5	34497		HEV-L-51250-R.060
	1-1/4	.060	4-1/2	7	5	34512		HEV-LX-51250-R.060

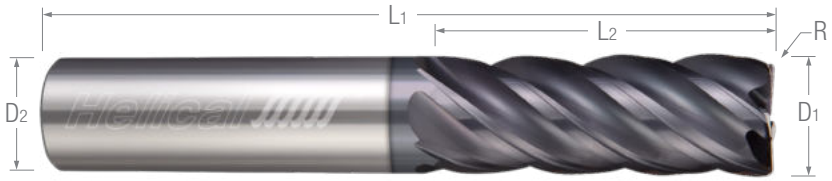
*.0005 max TIR

5 FLUTE - CORNER RADIUS - METRIC

Variable Pitch

MHEV-5
METRIC

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 +.00 mm −.05 mm	Shank Dia. D_2 (h6)	Corner Radius R +.05 mm −.05 mm	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	A*plus* 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
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

Speeds & Feeds on Page 138

HEV-RN-5

HEM

New Items!

5 FLUTE - SQUARE
Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- Longer lengths of cut available for excellent performance in deep pocket High Efficiency Milling (HEM) applications
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 201 for T*plus* coating

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	A*plus* 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
	1/8	5/32	2-1/2	1-1/4	.118	5	**83014**	HEV-RN-LX-50125
	1/8	5/32	3	1-1/2	.118	5	**86372**	HEV-RN-X-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
	3/16	7/32	2-1/2	1-5/16	.178	5	**83015**	HEV-RN-LX-50187
	3/16	7/32	3	1-1/2	.178	5	**86373**	HEV-RN-X-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	3/4	4	1-1/8	.237	5	**83016**	HEV-RNR-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	3/4	4	2-1/8	.237	5	**83017**	HEV-RNR-M-50250
	1/4	3/8	4	2-1/2	.237	5	**81783**	HEV-RN-ML-50250
new	1/4	3/4	4	2-1/2	.237	5	87533	HEV-RNR-ML-50250
	1/4	3/8	4-1/2	3	.237	5	**83018**	HEV-RN-L-50250
new	1/4	3/4	4-1/2	3	.237	5	87534	HEV-RNR-L-50250
5/16	5/16	7/16	4	1-1/8	.296	5	**86374**	HEV-RN-R-50312
	5/16	7/16	4	1-3/4	.296	5	**86375**	HEV-RN-M-50312
	5/16	7/16	4	2-1/8	.296	5	**86376**	HEV-RN-ML-50312

* .0005 max TIR

continued on next page

5 Flute

Speeds & Feeds on Page 138

5 FLUTE - SQUARE New Items!

Variable Pitch - Reduced Neck (cont.)

HEV-RN-5

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	*Aplus* Coated	Tool Description	
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	4	1-5/8	.356	5	**87535**	HEV-RNR-SR-50375	new
	3/8	1/2	4	2-1/8	.356	5	**50167**	HEV-RN-R-50375	
	3/8	1	4	2-1/8	.356	5	**83019**	HEV-RNR-R-50375	
	3/8	1/2	6	2-1/2	.356	5	**81785**	HEV-RN-A-50375	
	3/8	1	6	2-1/2	.356	5	**87536**	HEV-RNR-A-50375	new
	3/8	1/2	6	3-1/8	.356	5	**50197**	HEV-RN-M-50375	
	3/8	1	6	3-1/8	.356	5	**83020**	HEV-RNR-M-50375	
	3/8	1/2	6	3-5/8	.356	5	**86377**	HEV-RN-ML-50375	
	3/8	1/2	6	4-1/8	.356	5	**50212**	HEV-RN-L-50375	
	3/8	1	6	4-1/8	.356	5	**87537**	HEV-RNR-L-50375	new
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	1-1/4	4	2-1/4	.475	5	**83021**	HEV-RNR-R-50500	
	1/2	5/8	5	2-3/4	.475	5	**81787**	HEV-RN-A-50500	
	1/2	1-1/4	5	2-3/4	.475	5	**86378**	HEV-RNR-A-50500	
	1/2	5/8	6	3-3/8	.475	5	**50272**	HEV-RN-M-50500	
	1/2	1-1/4	6	3-3/8	.475	5	**83022**	HEV-RNR-M-50500	
	1/2	5/8	6	4-1/8	.475	5	**50287**	HEV-RN-L-50500	
	1/2	1-1/4	6	4-1/8	.475	5	**83023**	HEV-RNR-L-50500	
	1/2	5/8	7	5	.475	5	**83024**	HEV-RN-X-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	
3/4	3/4	1	4	2	.712	5	**50362**	HEV-RN-S-50750	
	3/4	1-5/8	4	2	.712	5	**86379**	HEV-RNR-S-50750	
	3/4	1	6	2-1/2	.712	5	**50377**	HEV-RN-R-50750	
	3/4	1-5/8	6	2-1/2	.712	5	**83025**	HEV-RNR-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	1-5/8	6	3-3/8	.712	5	**83026**	HEV-RNR-M-50750	
	3/4	1	6	4-1/8	.712	5	**50407**	HEV-RN-L-50750	
	3/4	1-5/8	6	4-1/8	.712	5	**86380**	HEV-RNR-L-50750	
	3/4	1	7	4-3/4	.712	5	**86381**	HEV-RN-LX-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

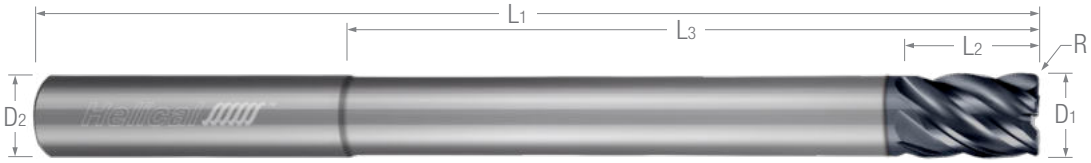
HEV-RN-5

5 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- Longer lengths of cut available for excellent performance in deep pocket High Efficiency Milling (HEM) applications
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 202 for T*plus* coating



Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	A*plus* 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	**.010**	5/32	2-1/2	1-1/4	.118	5	**83027**	HEV-RN-LX-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
	1/8	**.030**	5/32	2-1/2	1	.118	5	**83028**	HEV-RN-L-50125-R.030
	1/8	**.030**	5/32	2-1/2	1-1/4	.118	5	**86382**	HEV-RN-LX-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	**.010**	7/32	3	1-1/2	.178	5	**83029**	HEV-RN-X-50187-R.010
	3/16	**.010**	7/32	4	1-7/8	.178	5	**86383**	HEV-RN-Y-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
	3/16	**.030**	7/32	2-1/2	1-5/16	.178	5	**81791**	HEV-RN-LX-50187-R.030
	3/16	**.030**	7/32	3	1-1/2	.178	5	**83030**	HEV-RN-X-50187-R.030
	3/16	**.030**	7/32	4	1-7/8	.178	5	**86384**	HEV-RN-Y-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**	3/4	4	1-1/8	.237	5	**83031**	HEV-RNR-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**	3/4	4	1-5/8	.237	5	**86386**	HEV-RNR-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**	3/4	4	2-1/8	.237	5	**83032**	HEV-RNR-M-50250-R.020
	1/4	**.020**	3/8	4	2-1/2	.237	5	**81793**	HEV-RN-ML-50250-R.020
	1/4	**.020**	3/8	4-1/2	3	.237	5	**83033**	HEV-RN-L-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**	3/4	4	1-1/8	.237	5	**86387**	HEV-RNR-R-50250-R.030

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 138

5 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

HEV-RN-5

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	*Aplus* Coated	Tool Description
1/4	1/4	.030	3/8	4	2-1/8	.237	5	51137	HEV-RN-M-50250-R.030
	1/4	.030	3/4	4	2-1/8	.237	5	86388	HEV-RNR-M-50250-R.030
	1/4	.030	3/8	4	2-1/2	.237	5	83034	HEV-RN-ML-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
	1/4	.060	3/8	4	2-1/2	.237	5	86389	HEV-RN-ML-50250-R.060
5/16	5/16	.030	7/16	4	1-1/8	.296	5	86390	HEV-RN-R-50312-R.030
	5/16	.030	7/16	4	1-3/4	.296	5	86391	HEV-RN-M-50312-R.030
	5/16	.030	7/16	4	2-1/8	.296	5	86392	HEV-RN-ML-50312-R.030
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	4	2-1/8	.356	5	83035	HEV-RNR-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	.020	1	6	3-1/8	.356	5	83036	HEV-RNR-M-50375-R.020
	3/8	.020	1/2	6	3-5/8	.356	5	86394	HEV-RN-ML-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	3-5/8	.356	5	86395	HEV-RN-ML-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	1-5/8	.356	5	86396	HEV-RN-SR-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	2-1/2	.356	5	86397	HEV-RN-A-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	1-1/4	4	1-3/4	.475	5	86398	HEV-RNR-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	1-1/4	4	2-1/4	.475	5	83037	HEV-RNR-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	1-1/4	5	2-3/4	.475	5	86399	HEV-RNR-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	1-1/4	6	3-3/8	.475	5	83038	HEV-RNR-M-50500-R.030
	1/2	.030	5/8	6	4-1/8	.475	5	35287	HEV-RN-L-50500-R.030
	1/2	.030	1-1/4	6	4-1/8	.475	5	83039	HEV-RNR-L-50500-R.030
	1/2	.030	5/8	7	5	.475	5	83040	HEV-RN-X-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	1-3/4	.475	5	86400	HEV-RN-SR-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	5	2-3/4	.475	5	86401	HEV-RN-A-50500-R.060
	1/2	.060	5/8	6	3-3/8	.475	5	51272	HEV-RN-M-50500-R.060
	1/2	.060	5/8	6	4-1/8	.475	5	51287	HEV-RN-L-50500-R.060

* .0005 max TIR

continued on next page

HEV-RN-5

5 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Dia.	Flutes	*Aplus* Coated	Tool Description
1/2	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	**.090**	5/8	6	3-3/8	.475	5	**51273**	HEV-RN-M-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	1-3/4	.475	5	**86402**	HEV-RN-SR-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	5	2-3/4	.475	5	**86403**	HEV-RN-A-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**	HEV-RN-S-50625-R.030
	5/8	**.030**	3/4	4	2	.593	5	**86404**	HEV-RN-SR-50625-R.030
	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	3-3/4	.593	5	**86405**	HEV-RN-ML-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
	5/8	**.120**	3/4	6	3-3/8	.593	5	**86406**	HEV-RN-M-50625-R.120
3/4	3/4	**.030**	1	4	2	.712	5	**35362**	HEV-RN-S-50750-R.030
	3/4	**.030**	1-5/8	4	2	.712	5	**86407**	HEV-RNR-S-50750-R.030
	3/4	**.030**	1	6	2-1/2	.712	5	**35377**	HEV-RN-R-50750-R.030
	3/4	**.030**	1-5/8	6	2-1/2	.712	5	**83043**	HEV-RNR-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**	1-5/8	6	3-3/8	.712	5	**83044**	HEV-RNR-M-50750-R.030
	3/4	**.030**	1	6	4-1/8	.712	5	**35407**	HEV-RN-L-50750-R.030
	3/4	**.030**	1-5/8	6	4-1/8	.712	5	**86408**	HEV-RNR-L-50750-R.030
	3/4	**.030**	1	7	4-3/4	.712	5	**86409**	HEV-RN-LX-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	2-7/8	.712	5	**86410**	HEV-RN-A-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	2-7/8	.712	5	**86411**	HEV-RN-A-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

SPEEDS & FEEDS

5 Flute - Variable Pitch

HEV-5 / HSM-5

HEV-5 / HEV-RN-5 / HSM-5

Material Guide		Hardness	SFM	Inches per Tooth (IPT)																							
				1/16			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	Slot	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0005	.0008	.0009	.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	.0004	.0006	.0008	.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	.0002	.0004	.0006	.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	.0003	.0005	.0007	.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	.0002	.0004	.0006	.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	.0002	.0003	.0006	.0004	.0006	.0011	.0006	.0009	.0013	.0008	.0012	.0014	.0011	.0017	.0017	.0015	.0023	.0019	.0021	.0033	.0023	.0027	.0042	.0028
		> 50 HRC	155	.0002	.0003	.0005	.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	.0003	.0005	.0007	.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	.0003	.0004	.0006	.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	.0002	.0003	.0006	.0004	.0006	.0011	.0005	.0008	.0012	.0007	.0011	.0014	.0011	.0017	.0016	.0014	.0022	.0019	.0020	.0031	.0023	.0026	.0040	.0027
		> 50 HRC	85	.0002	.0003	.0005	.0003	.0005	.0010	.0005	.0007	.0011	.0006	.0009	.0013	.0009	.0014	.0015	.0011	.0018	.0017	.0016	.0026	.0020	.0021	.0033	.0025
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0004	.0006	.0008	.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	.0003	.0004	.0007	.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	.0003	.0004	.0007	.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	.0002	.0004	.0006	.0004	.0007	.0012	.0006	.0010	.0013	.0008	.0013	.0015	.0012	.0019	.0017	.0016	.0026	.0020	.0023	.0037	.0024	.0030	.0046	.0030
		> 50 HRC	55	.0002	.0002	.0005	.0003	.0004	.0009	.0004	.0006	.0010	.0005	.0008	.0012	.0008	.0012	.0014	.0010	.0016	.0016	.0014	.0022	.0019	.0018	.0029	.0023
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0003	.0005	.0007	.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	.0003	.0004	.0007	.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	.0002	.0004	.0006	.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	.0003	.0005	.0007	.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	.0003	.0004	.0007	.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	.0002	.0004	.0006	.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	.0002	.0003	.0006	.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	.0005	.0008	.0009	.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	.0003	.0004	.0007	.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	.0003	.0005	.0007	.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	.0003	.0004	.0007	.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	.0003	.0005	.0008	.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	.0002	.0004	.0006	.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	.0002	.0002	.0005	.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	.0004	.0007	.0009	.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	.0004	.0006	.0008	.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	.0002	.0003	.0006	.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	.0002	.0003	.0006	.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	.0002	.0003	.0005	.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	.0006	.0009	.0010	.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	.0005	.0008	.0009	.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	.0004	.0006	.0008	.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	.0003	.0005	.0007	.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	.0003	.0004	.0007	.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	.0003	.0004	.0006	.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	.0003	.0004	.0006	.0005	.0007	.0012	.0007	.0010	.0014	.0009	.0014	.0016	.0013	.0021	.0018	.0017	.0027	.0021	.0025	.0039	.0025	.0031	.0050	.0030
			65	.0002	.0003	.0005	.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

For diameters, please go to HelicalTool.com

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

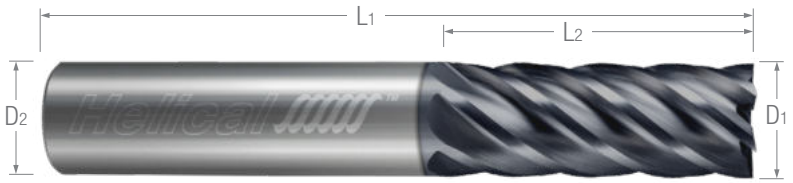
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.

HEV-6

6 FLUTE - SQUARE
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 204 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
1/8	1/8	1/4	1-1/2	6	84382	HEV-S-60125
	1/8	3/8	2	6	84383	HEV-SR-60125
	1/8	1/2	2-1/2	6	84384	HEV-R-60125
	1/8	5/8	2-1/2	6	84385	HEV-A-60125
3/16	3/16	5/16	2	6	84386	HEV-S-60187
	3/16	7/16	2	6	84387	HEV-SR-60187
	3/16	9/16	2-1/2	6	84388	HEV-R-60187
	3/16	3/4	2-1/2	6	84389	HEV-M-60187
1/4	1/4	3/8	2	6	59250	HEV-S-60250
	1/4	1/2	2-1/2	6	59251	HEV-SR-60250
	1/4	3/4	2-1/2	6	59252	HEV-R-60250
	1/4	1	3	6	59253	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	HEV-S-60375
	3/8	3/4	2-1/2	6	82566	HEV-SR-60375
	3/8	1	3	6	59259	HEV-R-60375
	3/8	1-1/4	3	6	59260	HEV-M-60375
	3/8	1-1/2	3-1/2	6	59261	HEV-L-60375
	3/8	2	4	6	82567	HEV-LX-60375
1/2	1/2	5/8	2-1/2	6	59262	HEV-S-60500
	1/2	1	3	6	59263	HEV-SR-60500
	1/2	1-1/4	3	6	59264	HEV-R-60500
	1/2	1-5/8	4	6	59265	HEV-M-60500
	1/2	2	4	6	59266	HEV-L-60500
	1/2	2-1/2	5	6	82568	HEV-LX-60500
	1/2	3-1/8	6	6	84986	HEV-X-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
	5/8	3-1/4	6	6	84987	HEV-LX-60625

continued on next page

Speeds & Feeds on Page 152

6 FLUTE - SQUARE

Variable Pitch (cont.)

HEM **HEV-6**

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
3/4	3/4	1	3	6	**59272**	HEV-S-60750
	3/4	1-5/8	4	6	**59273**	HEV-R-60750
	3/4	2-1/4	5	6	**59274**	HEV-M-60750
	3/4	2-3/4	5	6	**59275**	HEV-L-60750
	3/4	3-1/4	6	6	**59276**	HEV-LX-60750
	3/4	4	6-1/2	6	**84988**	HEV-X-60750
1	1	1-1/4	4	6	**84989**	HEV-S-61000
	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
	1	4-1/4	7	6	**84990**	HEV-X-61000

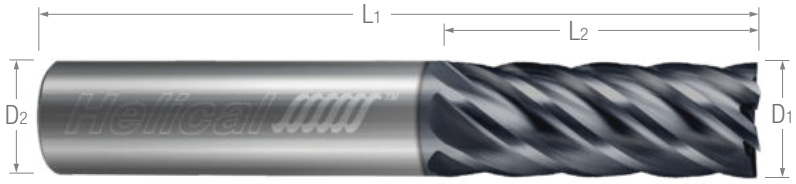
* .0005 max TIR

MHEV-6
METRIC

HEM

6 FLUTE - SQUARE - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.00 mm −.05 mm	Shank Diameter D_2 (h6)	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	*Aplus* 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

6 Flute

Speeds & Feeds on Page 152

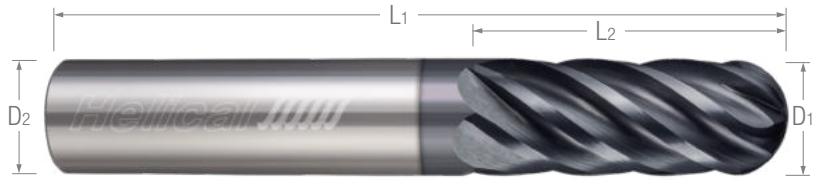
6 FLUTE - BALL

Variable Pitch

HEV-6

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 207 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
1/8	1/8	1/4	1-1/2	6	84406	HEV-S-60125-BN
	1/8	3/8	2	6	84407	HEV-SR-60125-BN
	1/8	1/2	2-1/2	6	84408	HEV-R-60125-BN
	1/8	5/8	2-1/2	6	84409	HEV-A-60125-BN
3/16	3/16	5/16	2	6	84410	HEV-S-60187-BN
	3/16	7/16	2	6	84411	HEV-SR-60187-BN
	3/16	9/16	2-1/2	6	84412	HEV-R-60187-BN
	3/16	3/4	2-1/2	6	84413	HEV-M-60187-BN
1/4	1/4	3/8	2	6	59434	HEV-S-60250-BN
	1/4	1/2	2-1/2	6	59435	HEV-SR-60250-BN
	1/4	3/4	2-1/2	6	59436	HEV-R-60250-BN
	1/4	1	3	6	59437	HEV-M-60250-BN
	1/4	1-1/4	3	6	59438	HEV-L-60250-BN
	1/4	1-1/2	3	6	83361	HEV-LX-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
3/8	3/8	1/2	2	6	59442	HEV-S-60375-BN
	3/8	3/4	2-1/2	6	82592	HEV-SR-60375-BN
	3/8	1	3	6	59443	HEV-R-60375-BN
	3/8	1-1/4	3	6	59444	HEV-M-60375-BN
	3/8	1-1/2	3-1/2	6	59445	HEV-L-60375-BN
	3/8	2	4	6	83362	HEV-LX-60375-BN
1/2	1/2	5/8	2-1/2	6	59446	HEV-S-60500-BN
	1/2	1	3	6	59447	HEV-SR-60500-BN
	1/2	1-1/4	3	6	59448	HEV-R-60500-BN
	1/2	1-5/8	4	6	59449	HEV-M-60500-BN
	1/2	2	4	6	59450	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	HEV-S-60750-BN
	3/4	1-5/8	4	6	59455	HEV-R-60750-BN
	3/4	2-1/4	5	6	59456	HEV-M-60750-BN
	3/4	2-3/4	5	6	83363	HEV-L-60750-BN
1	1	2	4-1/2	6	59457	HEV-R-61000-BN
	1	2-5/8	5	6	82594	HEV-M-61000-BN

* .0005 max TIR

Speeds & Feeds on Page 152

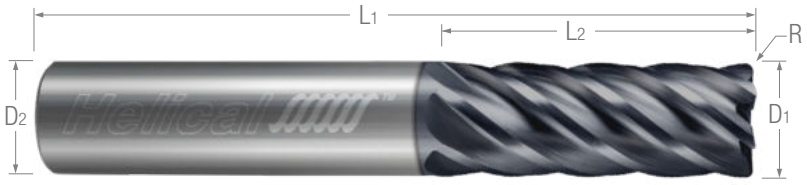
HEV-6

New Items!

6 FLUTE - CORNER RADIUS
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 208 for T*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	A*plus* Coated	Tool Description
1/8	1/8	**.010**	1/4	1-1/2	6	**84390**	HEV-S-60125-R.010
	1/8	**.010**	3/8	2	6	**84391**	HEV-SR-60125-R.010
	1/8	**.010**	1/2	2-1/2	6	**84392**	HEV-R-60125-R.010
	1/8	**.010**	5/8	2-1/2	6	**84393**	HEV-A-60125-R.010
	1/8	**.030**	1/4	1-1/2	6	**84394**	HEV-S-60125-R.030
	1/8	**.030**	3/8	2	6	**84395**	HEV-SR-60125-R.030
	1/8	**.030**	1/2	2-1/2	6	**84396**	HEV-R-60125-R.030
	1/8	**.030**	5/8	2-1/2	6	**84397**	HEV-A-60125-R.030
3/16	3/16	**.010**	5/16	2	6	**84398**	HEV-S-60187-R.010
	3/16	**.010**	7/16	2	6	**84399**	HEV-SR-60187-R.010
	3/16	**.010**	9/16	2-1/2	6	**84400**	HEV-R-60187-R.010
	3/16	**.010**	3/4	2-1/2	6	**84401**	HEV-M-60187-R.010
	3/16	**.030**	5/16	2	6	**84402**	HEV-S-60187-R.030
	3/16	**.030**	7/16	2	6	**84403**	HEV-SR-60187-R.030
	3/16	**.030**	9/16	2-1/2	6	**84404**	HEV-R-60187-R.030
	3/16	**.030**	3/4	2-1/2	6	**84405**	HEV-M-60187-R.030
1/4	1/4	**.010**	3/8	2	6	**84995**	HEV-S-60250-R.010
	1/4	**.010**	1/2	2-1/2	6	**84996**	HEV-SR-60250-R.010
	1/4	**.010**	3/4	2-1/2	6	**84997**	HEV-R-60250-R.010
new	1/4	**.010**	1	3	6	**87550**	HEV-M-60250-R.010
new	1/4	**.010**	1-1/4	3	6	**87551**	HEV-L-60250-R.010
new	1/4	**.010**	1-1/2	3	6	**87552**	HEV-LX-60250-R.010
	1/4	**.020**	3/8	2	6	**59280**	HEV-S-60250-R.020
	1/4	**.020**	1/2	2-1/2	6	**59283**	HEV-SR-60250-R.020
	1/4	**.020**	3/4	2-1/2	6	**59286**	HEV-R-60250-R.020
	1/4	**.020**	1	3	6	**59289**	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
	1/4	**.030**	3/8	2	6	**59281**	HEV-S-60250-R.030
	1/4	**.030**	1/2	2-1/2	6	**59284**	HEV-SR-60250-R.030
	1/4	**.030**	3/4	2-1/2	6	**59287**	HEV-R-60250-R.030
	1/4	**.030**	1	3	6	**59290**	HEV-M-60250-R.030
	1/4	**.030**	1-1/4	3	6	**59293**	HEV-L-60250-R.030
new	1/4	**.030**	1-1/2	3	6	**87553**	HEV-LX-60250-R.030

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 152

6 FLUTE - CORNER RADIUS New Items!

Variable Pitch (cont.)

HEM **HEV-6**

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
1/4	1/4	.060	3/8	2	6	59282	HEV-S-60250-R.060	
	1/4	.060	1/2	2-1/2	6	59285	HEV-SR-60250-R.060	
	1/4	.060	3/4	2-1/2	6	59288	HEV-R-60250-R.060	
	1/4	.060	1	3	6	59291	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	
5/16	5/16	.010	7/16	2	6	87554	HEV-S-60312-R.010	new
	5/16	.010	3/4	2-1/2	6	87555	HEV-R-60312-R.010	new
	5/16	.010	1	3	6	87556	HEV-M-60312-R.010	new
	5/16	.020	7/16	2	6	59295	HEV-S-60312-R.020	
	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	HEV-S-60312-R.030	
	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	.010	1/2	2	6	84998	HEV-S-60375-R.010	
	3/8	.010	3/4	2-1/2	6	84999	HEV-SR-60375-R.010	
	3/8	.010	1	3	6	86000	HEV-R-60375-R.010	
	3/8	.010	1-1/4	3	6	86001	HEV-M-60375-R.010	
	3/8	.010	1-1/2	3-1/2	6	87557	HEV-L-60375-R.010	new
	3/8	.010	2	4	6	87558	HEV-LX-60375-R.010	new
	3/8	.020	1/2	2	6	59304	HEV-S-60375-R.020	
	3/8	.020	3/4	2-1/2	6	82571	HEV-SR-60375-R.020	
	3/8	.020	1	3	6	59308	HEV-R-60375-R.020	
	3/8	.020	1-1/4	3	6	59312	HEV-M-60375-R.020	
	3/8	.020	1-1/2	3-1/2	6	59316	HEV-L-60375-R.020	
	3/8	.020	2	4	6	83318	HEV-LX-60375-R.020	
	3/8	.030	1/2	2	6	59305	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	HEV-R-60375-R.030	
	3/8	.030	1-1/4	3	6	59313	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	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	HEV-R-60375-R.060	
	3/8	.060	1-1/4	3	6	59314	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	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	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	

* .0005 max TIR

continued on next page

HEV-6

New Items!

6 FLUTE - CORNER RADIUS
Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
new	3/8	3/8	.125	1/2	2	6	87559	HEV-S-60375-R.125
new		3/8	.125	3/4	2-1/2	6	87560	HEV-SR-60375-R.125
new		3/8	.125	1	3	6	87561	HEV-R-60375-R.125
new		3/8	.125	1-1/4	3	6	87562	HEV-M-60375-R.125
	1/2	1/2	.010	5/8	2-1/2	6	83319	HEV-S-60500-R.010
		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	.010	1-5/8	4	6	86002	HEV-M-60500-R.010
new		1/2	.010	2	4	6	87563	HEV-L-60500-R.010
new		1/2	.010	2-1/2	5	6	87564	HEV-LX-60500-R.010
		1/2	.015	5/8	2-1/2	6	83320	HEV-S-60500-R.015
		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	.015	1-5/8	4	6	86003	HEV-M-60500-R.015
new		1/2	.015	2	4	6	87565	HEV-L-60500-R.015
new		1/2	.015	2-1/2	5	6	87566	HEV-LX-60500-R.015
new		1/2	.020	5/8	2-1/2	6	87567	HEV-S-60500-R.020
		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
new		1/2	.020	2	4	6	87568	HEV-L-60500-R.020
new		1/2	.020	2-1/2	5	6	87569	HEV-LX-60500-R.020
		1/2	.030	5/8	2-1/2	6	59320	HEV-S-60500-R.030
		1/2	.030	1	3	6	59324	HEV-SR-60500-R.030
		1/2	.030	1-1/4	3	6	59328	HEV-R-60500-R.030
		1/2	.030	1-5/8	4	6	59332	HEV-M-60500-R.030
		1/2	.030	2	4	6	59336	HEV-L-60500-R.030
		1/2	.030	2-1/2	5	6	82584	HEV-LX-60500-R.030
		1/2	.030	3-1/8	6	6	86004	HEV-X-60500-R.030
		1/2	.060	5/8	2-1/2	6	59321	HEV-S-60500-R.060
		1/2	.060	1	3	6	59325	HEV-SR-60500-R.060
		1/2	.060	1-1/4	3	6	59329	HEV-R-60500-R.060
		1/2	.060	1-5/8	4	6	59333	HEV-M-60500-R.060
		1/2	.060	2	4	6	59337	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	HEV-R-60500-R.090
		1/2	.090	1-5/8	4	6	59334	HEV-M-60500-R.090
		1/2	.090	2	4	6	59338	HEV-L-60500-R.090
		1/2	.090	2-1/2	5	6	82586	HEV-LX-60500-R.090
new		1/2	.120	5/8	2-1/2	6	87570	HEV-S-60500-R.120
new		1/2	.120	1	3	6	87571	HEV-SR-60500-R.120
new		1/2	.120	1-1/4	3	6	87572	HEV-R-60500-R.120
new		1/2	.120	1-5/8	4	6	87573	HEV-M-60500-R.120
		1/2	.125	5/8	2-1/2	6	59323	HEV-S-60500-R.125
		1/2	.125	1	3	6	59327	HEV-SR-60500-R.125
		1/2	.125	1-1/4	3	6	59331	HEV-R-60500-R.125
		1/2	.125	1-5/8	4	6	59335	HEV-M-60500-R.125
		1/2	.125	2	4	6	59339	HEV-L-60500-R.125
		1/2	.125	2-1/2	5	6	83321	HEV-LX-60500-R.125

* .0005 max TIR

continued on next page

6 FLUTE - CORNER RADIUS New Items!

Variable Pitch (cont.)

HEM **HEV-6**

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* 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	3/4	3	6	87574	HEV-S-60625-R.060	new
	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	.060	2-1/2	5	6	87575	HEV-L-60625-R.060	new
	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	3/4	3	6	87576	HEV-S-60625-R.125	new
	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	
	5/8	.125	2-1/2	5	6	86005	HEV-L-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	HEV-R-60750-R.030	
	3/4	.030	2-1/4	5	6	59366	HEV-M-60750-R.030	
	3/4	.030	2-3/4	5	6	59372	HEV-L-60750-R.030	
	3/4	.030	3-1/4	6	6	59378	HEV-LX-60750-R.030	
	3/4	.030	4	6-1/2	6	86006	HEV-X-60750-R.030	
	3/4	.060	1	3	6	59355	HEV-S-60750-R.060	
	3/4	.060	1-5/8	4	6	59361	HEV-R-60750-R.060	
	3/4	.060	2-1/4	5	6	59367	HEV-M-60750-R.060	
	3/4	.060	2-3/4	5	6	59373	HEV-L-60750-R.060	
	3/4	.060	3-1/4	6	6	83322	HEV-LX-60750-R.060	
	3/4	.090	1	3	6	59356	HEV-S-60750-R.090	
	3/4	.090	1-5/8	4	6	59362	HEV-R-60750-R.090	
	3/4	.090	2-1/4	5	6	59368	HEV-M-60750-R.090	
	3/4	.090	2-3/4	5	6	59374	HEV-L-60750-R.090	
	3/4	.120	1	3	6	87577	HEV-S-60750-R.120	new
	3/4	.120	1-5/8	4	6	87578	HEV-R-60750-R.120	new
	3/4	.120	2-1/4	5	6	87579	HEV-M-60750-R.120	new
	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	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	
	3/4	.250	3-1/4	6	6	83323	HEV-LX-60750-R.250	

* .0005 max TIR

continued on next page

HEV-6

New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
1	1	**.030**	2	4-1/2	6	**59379**	HEV-R-61000-R.030
	1	**.030**	2-5/8	5	6	**59383**	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**	HEV-R-61000-R.060
	1	**.060**	2-5/8	5	6	**59384**	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

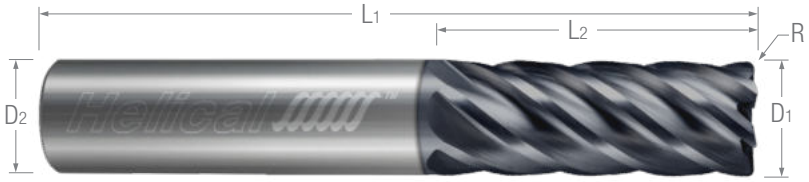
* .0005 max TIR

6 FLUTE - CORNER RADIUS - METRIC

Variable Pitch

MHEV-6
METRIC

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.00 mm −.05 mm	Shank Diameter D_2 (h6)	Corner Radius R +.05 mm −.05 mm	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.6 mm −1.6 mm	Flutes	*Aplus* Coated	Tool Description
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
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

Speeds & Feeds on Page 152

HEV-RN-6

HEM

New Items!

6 FLUTE - SQUARE
Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 212 for T*plus* coating

	Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	A*plus* Coated	Tool Description
new	1/8	1/8	5/32	2	3/8	.118	6	87596	HEV-RN-S-60125
new		1/8	5/32	2	5/8	.118	6	87597	HEV-RN-R-60125
new		1/8	5/32	2-1/2	1	.118	6	87598	HEV-RN-M-60125
new	3/16	3/16	7/32	2	1/2	.178	6	87599	HEV-RN-S-60187
new		3/16	7/32	2-1/2	1	.178	6	87600	HEV-RN-R-60187
new		3/16	7/32	3	1-1/2	.178	6	87601	HEV-RN-M-60187
	1/4	1/4	3/8	4	3/4	.237	6	82597	HEV-RN-S-60250
		1/4	3/8	4	1-1/8	.237	6	82598	HEV-RN-R-60250
		1/4	3/8	4	2-1/8	.237	6	82599	HEV-RN-M-60250
	3/8	3/8	1/2	4	1-1/8	.356	6	82600	HEV-RN-S-60375
		3/8	1/2	4	2-1/8	.356	6	82601	HEV-RN-R-60375
		3/8	1/2	6	3-1/8	.356	6	82602	HEV-RN-M-60375
	1/2	1/2	5/8	4	1-1/2	.475	6	82603	HEV-RN-S-60500
		1/2	5/8	4	2-1/4	.475	6	82604	HEV-RN-R-60500
		1/2	5/8	6	3-3/8	.475	6	82605	HEV-RN-M-60500
		1/2	5/8	6	4-1/8	.475	6	82606	HEV-RN-L-60500
	3/4	3/4	1	4	2	.712	6	82607	HEV-RN-S-60750
		3/4	1	6	2-1/2	.712	6	82608	HEV-RN-R-60750
		3/4	1	6	3-3/8	.712	6	82609	HEV-RN-M-60750

* .0005 max TIR

Speeds & Feeds on Page 152

6 FLUTE - BALL New Items!

Variable Pitch - Reduced Neck

HEM

HEV-RN-6

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 213 for T*plus* coating

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	A*plus* Coated	Tool Description	
1/8	1/8	5/32	2	3/8	.118	6	87602	HEV-RN-S-60125-BN	new
	1/8	5/32	2	5/8	.118	6	87603	HEV-RN-R-60125-BN	new
	1/8	5/32	2-1/2	1	.118	6	87604	HEV-RN-M-60125-BN	new
3/16	3/16	7/32	2	1/2	.178	6	87605	HEV-RN-S-60187-BN	new
	3/16	7/32	2-1/2	1	.178	6	87606	HEV-RN-R-60187-BN	new
	3/16	7/32	3	1-1/2	.178	6	87607	HEV-RN-M-60187-BN	new
1/4	1/4	3/8	4	3/4	.237	6	82634	HEV-RN-S-60250-BN	
	1/4	3/8	4	1-1/8	.237	6	82635	HEV-RN-R-60250-BN	
	1/4	3/8	4	2-1/8	.237	6	82636	HEV-RN-M-60250-BN	
3/8	3/8	1/2	4	1-1/8	.356	6	82637	HEV-RN-S-60375-BN	
	3/8	1/2	4	2-1/8	.356	6	82638	HEV-RN-R-60375-BN	
	3/8	1/2	6	3-1/8	.356	6	82639	HEV-RN-M-60375-BN	
1/2	1/2	5/8	4	1-1/2	.475	6	82640	HEV-RN-S-60500-BN	
	1/2	5/8	4	2-1/4	.475	6	82641	HEV-RN-R-60500-BN	
	1/2	5/8	6	3-3/8	.475	6	82642	HEV-RN-M-60500-BN	
	1/2	5/8	6	4-1/8	.475	6	82643	HEV-RN-L-60500-BN	
3/4	3/4	1	4	2	.712	6	82644	HEV-RN-S-60750-BN	
	3/4	1	6	2-1/2	.712	6	82645	HEV-RN-R-60750-BN	
	3/4	1	6	3-3/8	.712	6	82646	HEV-RN-M-60750-BN	

* .0005 max TIR

Speeds & Feeds on Page 152

HEV-RN-6

HEM

6 FLUTE - CORNER RADIUS
Variable Pitch - Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 214 for T*plus* coating

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	A*plus* Coated	Tool Description
1/4	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
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
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
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 152

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

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

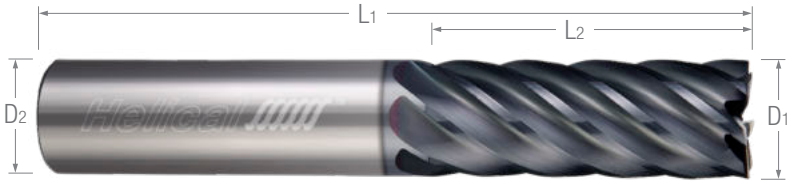
NOTES:
Hardness Scales: HRB = Rockwell B
HRC = Rockwell C
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running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

HEV-7

7 FLUTE - SQUARE
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 215 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Decription
1/8	1/8	1/4	1-1/2	7	**84414**	HEV-S-70125
	1/8	3/8	2	7	**84415**	HEV-SR-70125
	1/8	1/2	2-1/2	7	**84416**	HEV-R-70125
	1/8	5/8	2-1/2	7	**84417**	HEV-A-70125
3/16	3/16	5/16	2	7	**84418**	HEV-S-70187
	3/16	7/16	2	7	**84419**	HEV-SR-70187
	3/16	9/16	2-1/2	7	**84420**	HEV-R-70187
	3/16	3/4	2-1/2	7	**84421**	HEV-M-70187
1/4	1/4	3/8	2	7	**26107**	HEV-S-70250
	1/4	1/2	2	7	**26122**	HEV-SR-70250
	1/4	3/4	2-1/2	7	**26137**	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**	HEV-S-70375
	3/8	3/4	2-1/2	7	**26227**	HEV-SR-70375
	3/8	1	2-1/2	7	**26242**	HEV-R-70375
	3/8	1-1/2	3-1/2	7	**26247**	HEV-L-70375
	3/8	2	4	7	**82651**	HEV-LX-70375
1/2	1/2	5/8	2-1/2	7	**26257**	HEV-S-70500
	1/2	1	3	7	**26272**	HEV-SR-70500
	1/2	1-1/4	3	7	**26287**	HEV-R-70500
	1/2	1-5/8	4	7	**26302**	HEV-M-70500
	1/2	2	4	7	**26307**	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**	HEV-S-70625
	5/8	1-1/4	3-1/2	7	**26322**	HEV-SR-70625
	5/8	1-5/8	4	7	**26332**	HEV-R-70625
	5/8	2-1/8	4	7	**26347**	HEV-M-70625
	5/8	2-1/2	5	7	**83373**	HEV-L-70625

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 163

7 FLUTE - SQUARE

Variable Pitch (cont.)

HEV-7

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Decription
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**	HEV-R-70750
	3/4	2-1/4	5	7	**26392**	HEV-M-70750
	3/4	2-3/4	5	7	**83374**	HEV-L-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**	HEV-R-71000
	1	3-1/4	6	7	**26442**	HEV-L-71000

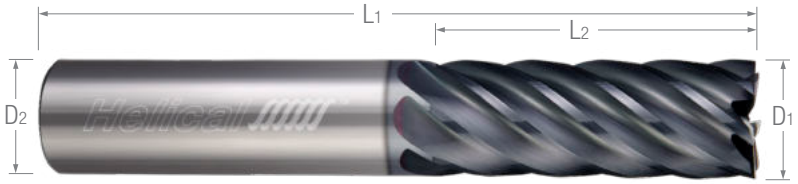
* .0005 max TIR

MHEV-7
METRIC

HEM

7 FLUTE - SQUARE - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.00\ mm}_{-.05\ mm}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.80\ mm}_{-.00\ mm}$	Overall Length L_1 $^{+1.60\ mm}_{-1.60\ mm}$	Flutes	*Aplus* Coated	Tool Description
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 163

7 FLUTE - CORNER RADIUS

New Items!

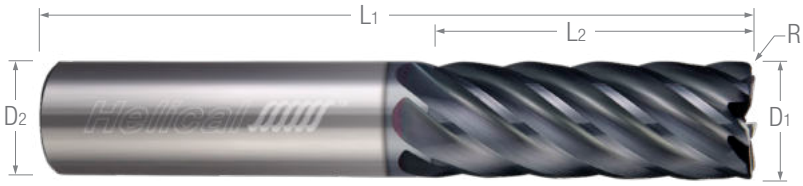
Variable Pitch

HEM

HEV-7

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 216 for T*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description	
1/8	1/8	**.010**	1/4	1-1/2	7	**84422**	HEV-S-70125-R.010	
	1/8	**.010**	3/8	2	7	**84423**	HEV-SR-70125-R.010	
	1/8	**.010**	1/2	2-1/2	7	**84424**	HEV-R-70125-R.010	
	1/8	**.010**	5/8	2-1/2	7	**84425**	HEV-A-70125-R.010	
	1/8	**.030**	1/4	1-1/2	7	**84426**	HEV-S-70125-R.030	
	1/8	**.030**	3/8	2	7	**84427**	HEV-SR-70125-R.030	
	1/8	**.030**	1/2	2-1/2	7	**84428**	HEV-R-70125-R.030	
	1/8	**.030**	5/8	2-1/2	7	**84429**	HEV-A-70125-R.030	
3/16	3/16	**.010**	5/16	2	7	**84430**	HEV-S-70187-R.010	
	3/16	**.010**	7/16	2	7	**84431**	HEV-SR-70187-R.010	
	3/16	**.010**	9/16	2-1/2	7	**84432**	HEV-R-70187-R.010	
	3/16	**.010**	3/4	2-1/2	7	**84433**	HEV-M-70187-R.010	
	3/16	**.030**	5/16	2	7	**84434**	HEV-S-70187-R.030	
	3/16	**.030**	7/16	2	7	**84435**	HEV-SR-70187-R.030	
	3/16	**.030**	9/16	2-1/2	7	**84436**	HEV-R-70187-R.030	
	3/16	**.030**	3/4	2-1/2	7	**84437**	HEV-M-70187-R.030	
1/4	1/4	**.010**	3/8	2	7	**83376**	HEV-S-70250-R.010	
	1/4	**.010**	1/2	2	7	**83377**	HEV-SR-70250-R.010	
	1/4	**.010**	3/4	2-1/2	7	**83378**	HEV-R-70250-R.010	
	1/4	**.010**	1	3	7	**83379**	HEV-M-70250-R.010	
	1/4	**.010**	1-1/4	3	7	**86040**	HEV-L-70250-R.010	
	1/4	**.020**	3/8	2	7	**27107**	HEV-S-70250-R.020	
	1/4	**.020**	1/2	2	7	**27122**	HEV-SR-70250-R.020	
	1/4	**.020**	3/4	2-1/2	7	**27137**	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	**.020**	1-1/2	3	7	**86041**	HEV-LX-70250-R.020	
	1/4	**.030**	3/8	2	7	**87106**	HEV-S-70250-R.030	new
	1/4	**.030**	1/2	2	7	**87107**	HEV-SR-70250-R.030	new
	1/4	**.030**	3/4	2-1/2	7	**87108**	HEV-R-70250-R.030	new
	1/4	**.030**	1	3	7	**87109**	HEV-M-70250-R.030	new
	1/4	**.030**	1-1/4	3	7	**87110**	HEV-L-70250-R.030	new
	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	
	1/4	**.060**	1	3	7	**81810**	HEV-M-70250-R.060	
	1/4	**.060**	1-1/4	3	7	**87111**	HEV-L-70250-R.060	new

* .0005 max TIR

continued on next page

HEV-7

New Items!

7 FLUTE - CORNER RADIUS
Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description
	3/8	3/8	**.010**	1/2	2	7	**83380**	HEV-S-70375-R.010
		3/8	**.010**	3/4	2-1/2	7	**83381**	HEV-SR-70375-R.010
		3/8	**.010**	1	2-1/2	7	**83382**	HEV-R-70375-R.010
		3/8	**.010**	1-1/4	3	7	**86042**	HEV-M-70375-R.010
		3/8	**.010**	1-1/2	3-1/2	7	**83383**	HEV-L-70375-R.010
		3/8	**.020**	1/2	2	7	**27212**	HEV-S-70375-R.020
		3/8	**.020**	3/4	2-1/2	7	**27227**	HEV-SR-70375-R.020
		3/8	**.020**	1	2-1/2	7	**27242**	HEV-R-70375-R.020
new		3/8	**.020**	1-1/4	3	7	**87112**	HEV-M-70375-R.020
		3/8	**.020**	1-1/2	3-1/2	7	**27247**	HEV-L-70375-R.020
		3/8	**.020**	2	4	7	**82656**	HEV-LX-70375-R.020
new		3/8	**.030**	1/2	2	7	**87113**	HEV-S-70375-R.030
new		3/8	**.030**	3/4	2-1/2	7	**87114**	HEV-SR-70375-R.030
new	3/8	3/8	**.030**	1	2-1/2	7	**87115**	HEV-R-70375-R.030
new		3/8	**.030**	1-1/4	3	7	**87116**	HEV-M-70375-R.030
new		3/8	**.030**	1-1/2	3-1/2	7	**87117**	HEV-L-70375-R.030
		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		3/8	**.060**	1-1/4	3	7	**87118**	HEV-M-70375-R.060
new		3/8	**.060**	1-1/2	3-1/2	7	**87119**	HEV-L-70375-R.060
new		3/8	**.125**	1/2	2	7	**87120**	HEV-S-70375-R.125
new		3/8	**.125**	3/4	2-1/2	7	**87121**	HEV-SR-70375-R.125
new		3/8	**.125**	1	2-1/2	7	**87122**	HEV-R-70375-R.125
new		3/8	**.125**	1-1/4	3	7	**87123**	HEV-M-70375-R.125
new		3/8	**.125**	1-1/2	3-1/2	7	**87124**	HEV-L-70375-R.125
	1/2	1/2	**.010**	5/8	2-1/2	7	**83384**	HEV-S-70500-R.010
		1/2	**.010**	1	3	7	**83385**	HEV-SR-70500-R.010
		1/2	**.010**	1-1/4	3	7	**83386**	HEV-R-70500-R.010
		1/2	**.010**	1-5/8	4	7	**83387**	HEV-M-70500-R.010
		1/2	**.010**	2	4	7	**83388**	HEV-L-70500-R.010
new		1/2	**.010**	2-1/2	5	7	**87125**	HEV-LX-70500-R.010
		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	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
new		1/2	**.020**	2-1/2	5	7	**87126**	HEV-LX-70500-R.020
		1/2	**.030**	5/8	2-1/2	7	**27257**	HEV-S-70500-R.030
		1/2	**.030**	1	3	7	**27272**	HEV-SR-70500-R.030
		1/2	**.030**	1-1/4	3	7	**27287**	HEV-R-70500-R.030
		1/2	**.030**	1-5/8	4	7	**27302**	HEV-M-70500-R.030
		1/2	**.030**	2	4	7	**27307**	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

* .0005 max TIR

continued on next page

7 Flute

Speeds & Feeds on Page 163

7 FLUTE - CORNER RADIUS

New Items!

HEM HEV-7

Variable Pitch (cont.)

continued from previous page

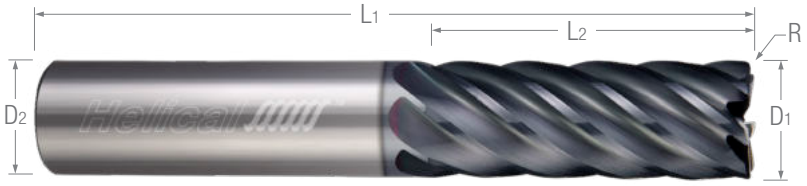
Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
1/2	1/2	.060	5/8	2-1/2	7	81819	HEV-S-70500-R.060	
	1/2	.060	1	3	7	81820	HEV-SR-70500-R.060	
	1/2	.060	1-1/4	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	
	1/2	.060	2-1/2	5	7	87127	HEV-LX-70500-R.060	new
	1/2	.125	5/8	2-1/2	7	87128	HEV-S-70500-R.125	new
	1/2	.125	1	3	7	87129	HEV-SR-70500-R.125	new
	1/2	.125	1-1/4	3	7	87130	HEV-R-70500-R.125	new
	1/2	.125	1-5/8	4	7	87131	HEV-M-70500-R.125	new
	1/2	.125	2	4	7	87132	HEV-L-70500-R.125	new
5/8	5/8	.010	3/4	3	7	87133	HEV-S-70625-R.010	new
	5/8	.010	1-1/4	3-1/2	7	87134	HEV-SR-70625-R.010	new
	5/8	.010	1-5/8	4	7	87135	HEV-R-70625-R.010	new
	5/8	.010	2-1/8	4	7	87136	HEV-M-70625-R.010	new
	5/8	.030	3/4	3	7	27317	HEV-S-70625-R.030	
	5/8	.030	1-1/4	3-1/2	7	27322	HEV-SR-70625-R.030	
	5/8	.030	1-5/8	4	7	27332	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	3/4	3	7	86043	HEV-S-70625-R.060	
	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	
	5/8	.060	2-1/8	4	7	86044	HEV-M-70625-R.060	
3/4	3/4	.030	1	3	7	27362	HEV-S-70750-R.030	
	3/4	.030	1-1/4	3-1/2	7	27367	HEV-SR-70750-R.030	
	3/4	.030	1-5/8	4	7	27377	HEV-R-70750-R.030	
	3/4	.030	2-1/4	5	7	27392	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	
	3/4	.060	2-1/4	5	7	81828	HEV-M-70750-R.060	
	3/4	.060	2-3/4	5	7	86045	HEV-L-70750-R.060	
	3/4	.060	3-1/4	6	7	87137	HEV-LX-70750-R.060	new
	3/4	.125	1	3	7	87138	HEV-S-70750-R.125	new
	3/4	.125	1-5/8	4	7	87139	HEV-R-70750-R.125	new
	3/4	.125	2-1/4	5	7	87140	HEV-M-70750-R.125	new
	3/4	.250	1	3	7	87141	HEV-S-70750-R.250	new
	3/4	.250	1-5/8	4	7	87142	HEV-R-70750-R.250	new
	3/4	.250	2-1/4	5	7	87143	HEV-M-70750-R.250	new
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	2-5/8	5	7	86046	HEV-M-71000-R.030	
	1	.030	3-1/4	6	7	27442	HEV-L-71000-R.030	
	1	.030	4-1/4	7	7	86047	HEV-X-71000-R.030	

* .0005 max TIR

MHEV-7
METRIC

7 FLUTE - CORNER RADIUS - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.00 mm −.05 mm	Shank Diameter D_2 (h6)	Corner Radius R +.05 mm −.05 mm	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	A*plus* 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
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

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 163

7 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)

MHEV-7
METRIC

continued from previous page

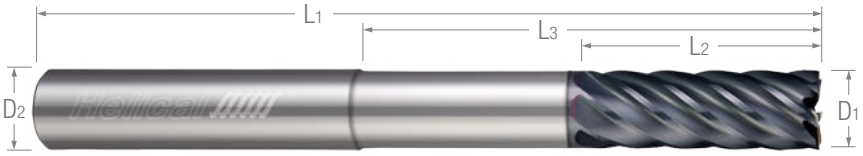
Cutter Diameter* D_1 +.00 mm −.05 mm	Shank Diameter D_2 (h6)	Corner Radius R +.05 mm −.05 mm	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	*Aplus* Coated	Tool Description
20 mm	20.00 mm	**.50 mm**	30.00 mm	89 mm	7	**59648**	MHEV-015-72000-R0.50
	20.00 mm	**.50 mm**	40.00 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

HEV-RN-7

7 FLUTE - SQUARE
Variable Pitch – Reduced Neck

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in deep pocket High Efficiency Milling (HEM) applications
- 7 flute variable pitch design for reduced harmonics and increased feed rates
- End cutting geometry (non-center cutting)
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	A*plus* Coated	Tool Description
1/4	1/4	3/4	4	1-1/8	.237	7	**83045**	HEV-RNR-R-70250
	1/4	3/4	4	2-1/8	.237	7	**83046**	HEV-RNR-M-70250
3/8	3/8	1	4	2-1/8	.356	7	**83047**	HEV-RNR-R-70375
	3/8	1	6	3-1/8	.356	7	**83048**	HEV-RNR-M-70375
1/2	1/2	1-1/4	4	2-1/4	.475	7	**83049**	HEV-RNR-R-70500
	1/2	1-1/4	6	3-3/8	.475	7	**83050**	HEV-RNR-M-70500
	1/2	1-1/4	6	4-1/8	.475	7	**83051**	HEV-RNR-L-70500
3/4	3/4	1-5/8	6	2-1/2	.712	7	**83052**	HEV-RNR-R-70750
	3/4	1-5/8	6	3-3/8	.712	7	**83053**	HEV-RNR-M-70750

* .0005 max TIR

Speeds & Feeds on Page 163

7 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck

HEV-RN-7

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in deep pocket High Efficiency Milling (HEM) applications
- 7 flute variable pitch design for reduced harmonics and increased feed rates
- End cutting geometry (non-center cutting)
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	A*plus* Coated	Tool Description
1/4	1/4	**.020**	3/4	4	1-1/8	.237	7	**83054**	HEV-RNR-R-70250-R.020
	1/4	**.020**	3/4	4	2-1/8	.237	7	**83055**	HEV-RNR-M-70250-R.020
3/8	3/8	**.020**	1	4	2-1/8	.356	7	**83056**	HEV-RNR-R-70375-R.020
	3/8	**.020**	1	6	3-1/8	.356	7	**83057**	HEV-RNR-M-70375-R.020
1/2	1/2	**.030**	1-1/4	4	2-1/4	.475	7	**83058**	HEV-RNR-R-70500-R.030
	1/2	**.030**	1-1/4	6	3-3/8	.475	7	**83059**	HEV-RNR-M-70500-R.030
	1/2	**.030**	1-1/4	6	4-1/8	.475	7	**83060**	HEV-RNR-L-70500-R.030
	1/2	**.060**	1-1/4	4	2-1/4	.475	7	**83061**	HEV-RNR-R-70500-R.060
	1/2	**.060**	1-1/4	6	3-3/8	.475	7	**83062**	HEV-RNR-M-70500-R.060
	1/2	**.060**	1-1/4	6	4-1/8	.475	7	**83063**	HEV-RNR-L-70500-R.060
3/4	3/4	**.030**	1-5/8	6	2-1/2	.712	7	**83064**	HEV-RNR-R-70750-R.030
	3/4	**.030**	1-5/8	6	3-3/8	.712	7	**83065**	HEV-RNR-M-70750-R.030
	3/4	**.060**	1-5/8	6	2-1/2	.712	7	**83066**	HEV-RNR-R-70750-R.060
	3/4	**.060**	1-5/8	6	3-3/8	.712	7	**83067**	HEV-RNR-M-70750-R.060

* .0005 max TIR

Speeds & Feeds on Page 163

HEV-7

SPEEDS & FEEDS

7 Flute - Variable Pitch

HEV-7 / HEV-RN-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	455	.0016	.0017	.0024	.0019	.0031	.0022	.0047	.0025	.0060	.0029	.0087	.0035	.0111	.0043
		75 - 98 HRB	445	.0011	.0015	.0017	.0016	.0023	.0019	.0034	.0022	.0044	.0025	.0064	.0030	.0081	.0036
		21 - 36 HRC	400	.0007	.0012	.0011	.0013	.0015	.0015	.0022	.0017	.0028	.0020	.0041	.0024	.0053	.0029
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0010	.0014	.0015	.0015	.0020	.0018	.0030	.0020	.0038	.0023	.0055	.0028	.0070	.0034
		21 - 36 HRC	340	.0007	.0012	.0011	.0013	.0015	.0015	.0022	.0017	.0028	.0020	.0041	.0024	.0052	.0029
		36 - 50 HRC	260	.0006	.0011	.0010	.0012	.0013	.0014	.0019	.0016	.0025	.0019	.0036	.0023	.0046	.0027
		> 50 HRC	155	.0005	.0010	.0008	.0011	.0010	.0013	.0015	.0014	.0020	.0017	.0028	.0020	.0036	.0024
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0010	.0014	.0015	.0015	.0020	.0018	.0030	.0020	.0038	.0023	.0055	.0028	.0070	.0034
		21 - 36 HRC	250	.0008	.0012	.0012	.0013	.0016	.0016	.0023	.0018	.0030	.0021	.0044	.0025	.0056	.0030
		36 - 50 HRC	145	.0006	.0011	.0009	.0012	.0012	.0014	.0018	.0016	.0024	.0019	.0034	.0022	.0044	.0027
		> 50 HRC	85	.0005	.0010	.0008	.0011	.0010	.0012	.0015	.0014	.0019	.0016	.0028	.0020	.0036	.0024
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0013	.0016	.0020	.0018	.0026	.0020	.0039	.0023	.0050	.0027	.0072	.0032	.0092	.0039
		75 - 98 HRB	255	.0009	.0013	.0014	.0014	.0018	.0017	.0027	.0019	.0034	.0022	.0050	.0027	.0063	.0032
		21 - 36 HRC	175	.0008	.0012	.0012	.0014	.0016	.0016	.0024	.0018	.0031	.0021	.0045	.0025	.0057	.0030
		36 - 50 HRC	150	.0007	.0011	.0011	.0013	.0014	.0015	.0021	.0017	.0027	.0020	.0040	.0024	.0051	.0029
		> 50 HRC	55	.0004	.0009	.0007	.0010	.0009	.0012	.0013	.0013	.0017	.0016	.0025	.0018	.0031	.0022
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0010	.0013	.0015	.0015	.0019	.0017	.0029	.0020	.0037	.0023	.0054	.0028	.0069	.0034
		21 - 36 HRC	225	.0009	.0013	.0013	.0015	.0017	.0016	.0026	.0019	.0033	.0022	.0048	.0026	.0062	.0032
		36 - 50 HRC	180	.0007	.0012	.0011	.0013	.0014	.0015	.0021	.0017	.0027	.0020	.0039	.0023	.0049	.0028
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0010	.0014	.0015	.0015	.0020	.0018	.0030	.0020	.0038	.0023	.0055	.0028	.0071	.0034
		21 - 36 HRC	280	.0009	.0013	.0013	.0014	.0017	.0016	.0026	.0019	.0033	.0022	.0048	.0026	.0061	.0032
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0007	.0012	.0011	.0013	.0015	.0015	.0022	.0017	.0028	.0020	.0041	.0024	.0052	.0029
		36 - 50 HRC	145	.0006	.0011	.0010	.0012	.0013	.0014	.0019	.0016	.0024	.0019	.0035	.0022	.0045	.0027
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0016	.0017	.0024	.0020	.0032	.0022	.0048	.0026	.0062	.0030	.0090	.0036	.0114	.0043
		21 - 36 HRC	370	.0009	.0013	.0013	.0014	.0017	.0016	.0026	.0019	.0033	.0022	.0049	.0026	.0062	.0032
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0010	.0014	.0015	.0015	.0020	.0018	.0030	.0020	.0039	.0024	.0057	.0028	.0072	.0034
		21 - 36 HRC	335	.0009	.0013	.0013	.0014	.0017	.0016	.0026	.0019	.0034	.0022	.0049	.0026	.0062	.0032
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0011	.0014	.0016	.0016	.0021	.0018	.0032	.0021	.0041	.0024	.0059	.0029	.0075	.0035
		21 - 36 HRC	260	.0007	.0011	.0011	.0013	.0014	.0015	.0021	.0017	.0027	.0020	.0039	.0023	.0050	.0028
		36 - 50 HRC	135	.0005	.0009	.0007	.0010	.0009	.0012	.0013	.0014	.0017	.0016	.0025	.0019	.0032	.0023
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0014	.0016	.0021	.0018	.0027	.0020	.0041	.0023	.0052	.0027	.0076	.0033	.0097	.0040
		75 - 98 HRB	250	.0011	.0015	.0017	.0016	.0023	.0019	.0034	.0021	.0044	.0025	.0064	.0030	.0081	.0036
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0007	.0011	.0011	.0013	.0014	.0015	.0021	.0017	.0027	.0020	.0039	.0023	.0049	.0028
		21 - 36 HRC	75	.0007	.0011	.0010	.0012	.0013	.0014	.0020	.0016	.0025	.0019	.0037	.0023	.0047	.0028
		36 - 50 HRC	70	.0006	.0010	.0008	.0011	.0011	.0013	.0017	.0015	.0022	.0018	.0032	.0021	.0040	.0026
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0019	.0019	.0028	.0021	.0037	.0024	.0056	.0028	.0072	.0032	.0105	.0039	.0134	.0047
		75 - 98 HRB	275	.0016	.0017	.0024	.0019	.0031	.0022	.0047	.0025	.0060	.0030	.0088	.0035	.0112	.0043
		21 - 36 HRC	250	.0012	.0015	.0018	.0017	.0023	.0019	.0035	.0022	.0045	.0026	.0066	.0031	.0084	.0037
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0009	.0013	.0014	.0015	.0018	.0017	.0028	.0020	.0036	.0023	.0052	.0027	.0066	.0033
		36 - 50 HRC	160	.0009	.0013	.0013	.0014	.0017	.0016	.0025	.0019	.0033	.0022	.0047	.0026	.0060	.0031
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0008	.0012	.0012	.0014	.0016	.0016	.0023	.0018	.0030	.0021	.0044	.0025	.0056	.0030
		21 - 36 HRC	170	.0008	.0012	.0012	.0013	.0015	.0015	.0023	.0017	.0029	.0020	.0042	.0024	.0054	.0030
		36 - 50 HRC	65	.0005	.0010	.0008	.0011	.0010	.0013	.0015	.0014	.0020	.0017	.0029	.0020	.0037	.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

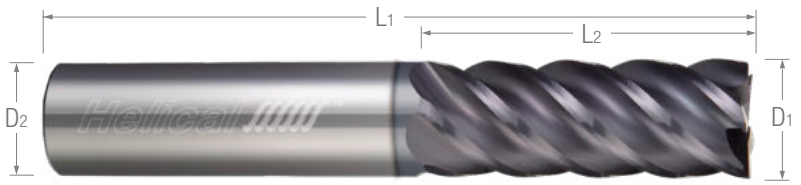
NOTES:
Hardness Scales: HRB = Rockwell B
HRC = Rockwell C
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running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

5 FLUTE - SQUARE

Finisher

HEF-5

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* 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

continued on next page

Speeds & Feeds on Page 166

HEF-5

5 FLUTE - SQUARE
Finisher (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
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

SPEEDS & FEEDS

5 Flute - Finisher

HEM **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

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

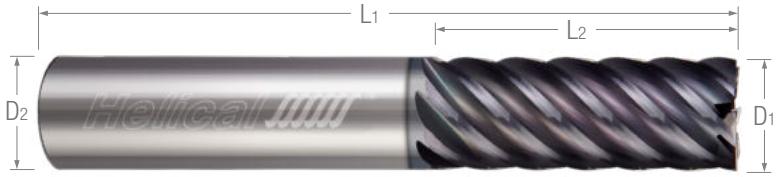
NOTES:
Hardness Scales: HRB = Rockwell B
HRC = Rockwell C
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

HSF-7

HEM

7 FLUTE - SQUARE
Finisher

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
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
	1/2	3-1/4	6	7	24362	HSF-X-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 168

SPEEDS & FEEDS

7 Flute - Finisher

HSF-7

HSF-7

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	.0017	.0016	.0022	.0019	.0032	.0022	.0040	.0027
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	.0017	.0016	.0022	.0019	.0031	.0022	.0040	.0027
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
AUSTEN-ITIC 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.

HXF

HEM

MULTI-FLUTE - CORNER RADIUS

Finisher

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

For increased wear resistance, see page 227 for T*plus* coating

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
1/4	1/4	**.020**	3/8	2	7	**36016**	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**	HXF-R-070250-R.020
3/8	3/8	**.020**	1/2	2	7	**36046**	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**	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**	HXF-S-080500-R.030
	1/2	**.030**	1	3	8	**36091**	HXF-SR-080500-R.030
	1/2	**.030**	1-1/4	3	8	**36106**	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**	HXF-S-120750-R.060
	3/4	**.060**	1-5/8	4	12	**36166**	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
	1	**.060**	2	4-1/2	14	**36196**	HXF-R-141000-R.060

* .0005 max TIR

Speeds & Feeds on Page 170

SPEEDS & FEEDS

Multi-Flute - Corner Radius - Finisher

HXF

HXF																	
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
		> 50 HRC	55	.0005	.0009	.0007	.0010	.0009	.0012	.0014	.0014	.0018	.0016	.0027	.0019	.0034	.0023
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 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

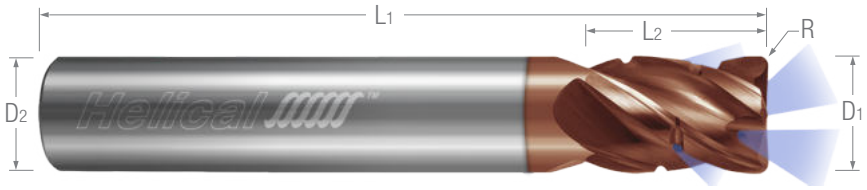
NOTES:
Hardness Scales: HRB = Rockwell B
HRC = Rockwell C
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. For more accurate running parameters, please refer to Machining Advisor Pro.

HEVC-C-4

4 FLUTE - CORNER RADIUS

Coolant Through - Chipbreaker Rougher - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- 4 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
1/4	1/4	**.020**	1/2	2-1/2	4	**84328**	HEVC-C-020-40250-R.020
	1/4	**.020**	3/4	2-1/2	4	**84329**	HEVC-C-030-40250-R.020
	1/4	**.030**	1/2	2-1/2	4	**84330**	HEVC-C-020-40250-R.030
	1/4	**.030**	3/4	2-1/2	4	**84331**	HEVC-C-030-40250-R.030
3/8	3/8	**.020**	1/2	2	4	**84332**	HEVC-C-013-40375-R.020
	3/8	**.020**	1	3	4	**84333**	HEVC-C-026-40375-R.020
	3/8	**.030**	1/2	2	4	**84334**	HEVC-C-013-40375-R.030
	3/8	**.030**	1	3	4	**84335**	HEVC-C-026-40375-R.030
1/2	1/2	**.030**	1	3	4	**84336**	HEVC-C-020-40500-R.030
	1/2	**.030**	1-1/4	3	4	**84337**	HEVC-C-025-40500-R.030
	1/2	**.030**	1-5/8	4	4	**84338**	HEVC-C-032-40500-R.030
	1/2	**.060**	1	3	4	**84339**	HEVC-C-020-40500-R.060
	1/2	**.060**	1-1/4	3	4	**84340**	HEVC-C-025-40500-R.060
	1/2	**.060**	1-5/8	4	4	**84341**	HEVC-C-032-40500-R.060
3/4	3/4	**.030**	1-5/8	4	4	**84342**	HEVC-C-021-40750-R.030
	3/4	**.030**	2-1/4	5	4	**84343**	HEVC-C-030-40750-R.030

* .0005 max TIR

Speeds & Feeds on Page 172

SPEEDS & FEEDS

HEVC-C-4

4 Flute - Corner Radius Coolant Through - Chipbreaker Rougher - Variable Pitch

HEVC-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	455	.0007	.0013	.0011	.0019	.0014	.0025	.0021	.0037	.0028	.0049	.0040	.0070	.0050	.0089
		75 - 98 HRB	445	.0005	.0009	.0008	.0014	.0010	.0018	.0016	.0027	.0020	.0036	.0029	.0051	.0037	.0065
		21 - 36 HRC	400	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0018	.0013	.0023	.0019	.0033	.0024	.0042
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0005	.0008	.0007	.0012	.0009	.0016	.0013	.0024	.0017	.0031	.0025	.0044	.0032	.0056
		21 - 36 HRC	340	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0018	.0013	.0023	.0019	.0033	.0024	.0042
		36 - 50 HRC	260	.0003	.0005	.0005	.0008	.0006	.0010	.0009	.0015	.0011	.0020	.0016	.0029	.0021	.0036
		> 50 HRC	155	.0002	.0004	.0004	.0006	.0005	.0008	.0007	.0012	.0009	.0016	.0013	.0023	.0016	.0029
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0005	.0008	.0007	.0012	.0009	.0016	.0013	.0024	.0017	.0031	.0025	.0044	.0032	.0056
		21 - 36 HRC	250	.0004	.0006	.0005	.0009	.0007	.0013	.0011	.0019	.0014	.0025	.0020	.0035	.0025	.0045
		36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0006	.0010	.0008	.0015	.0011	.0019	.0016	.0028	.0020	.0035
		> 50 HRC	85	.0002	.0004	.0003	.0006	.0005	.0008	.0007	.0012	.0009	.0016	.0013	.0022	.0016	.0029
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0006	.0011	.0009	.0015	.0012	.0021	.0018	.0031	.0023	.0040	.0033	.0058	.0042	.0074
		75 - 98 HRB	255	.0004	.0007	.0006	.0011	.0008	.0014	.0012	.0021	.0016	.0028	.0023	.0040	.0029	.0051
		21 - 36 HRC	175	.0004	.0007	.0006	.0010	.0007	.0013	.0011	.0019	.0014	.0025	.0020	.0036	.0026	.0046
		36 - 50 HRC	150	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0017	.0013	.0022	.0018	.0032	.0023	.0041
		> 50 HRC	55	.0002	.0004	.0003	.0005	.0004	.0007	.0006	.0010	.0008	.0014	.0011	.0020	.0014	.0025
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0004	.0008	.0007	.0012	.0009	.0016	.0013	.0023	.0017	.0030	.0024	.0043	.0031	.0055
		21 - 36 HRC	225	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0021	.0015	.0027	.0022	.0039	.0028	.0049
		36 - 50 HRC	180	.0003	.0006	.0005	.0008	.0006	.0011	.0009	.0017	.0012	.0022	.0018	.0031	.0023	.0040
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0005	.0008	.0007	.0012	.0009	.0016	.0013	.0024	.0018	.0031	.0025	.0044	.0032	.0057
		21 - 36 HRC	280	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0021	.0015	.0027	.0022	.0039	.0028	.0049
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0017	.0013	.0023	.0018	.0033	.0024	.0041
		36 - 50 HRC	145	.0003	.0005	.0004	.0008	.0006	.0010	.0009	.0015	.0011	.0020	.0016	.0028	.0020	.0036
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0007	.0013	.0011	.0019	.0015	.0026	.0022	.0038	.0028	.0050	.0041	.0072	.0052	.0091
		21 - 36 HRC	370	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0021	.0015	.0027	.0022	.0039	.0028	.0050
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0005	.0008	.0007	.0012	.0009	.0016	.0014	.0024	.0018	.0032	.0026	.0045	.0033	.0058
		21 - 36 HRC	335	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0021	.0016	.0027	.0022	.0039	.0028	.0050
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0005	.0009	.0007	.0013	.0010	.0017	.0014	.0025	.0019	.0033	.0027	.0047	.0034	.0060
		21 - 36 HRC	260	.0003	.0006	.0005	.0008	.0006	.0011	.0010	.0017	.0012	.0022	.0018	.0031	.0023	.0040
		36 - 50 HRC	135	.0002	.0004	.0003	.0005	.0004	.0007	.0006	.0011	.0008	.0014	.0011	.0020	.0014	.0025
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0006	.0011	.0009	.0016	.0012	.0022	.0018	.0032	.0024	.0042	.0035	.0061	.0044	.0077
		75 - 98 HRB	250	.0005	.0009	.0008	.0014	.0010	.0018	.0015	.0027	.0020	.0036	.0029	.0051	.0037	.0065
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0003	.0006	.0005	.0008	.0006	.0011	.0009	.0017	.0012	.0022	.0018	.0031	.0022	.0039
		21 - 36 HRC	75	.0003	.0005	.0005	.0008	.0006	.0011	.0009	.0016	.0012	.0021	.0017	.0030	.0021	.0038
		36 - 50 HRC	70	.0003	.0005	.0004	.0007	.0005	.0009	.0008	.0014	.0010	.0018	.0014	.0025	.0018	.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	.0013	.0022	.0017	.0030	.0025	.0045	.0033	.0059	.0048	.0084	.0061	.0107
		75 - 98 HRB	275	.0007	.0013	.0011	.0019	.0014	.0025	.0021	.0038	.0028	.0049	.0040	.0070	.0051	.0090
		21 - 36 HRC	250	.0006	.0010	.0008	.0014	.0011	.0019	.0016	.0028	.0021	.0037	.0030	.0053	.0038	.0067
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0004	.0008	.0006	.0011	.0009	.0015	.0013	.0022	.0016	.0029	.0024	.0042	.0030	.0053
		36 - 50 HRC	160	.0004	.0007	.0006	.0010	.0008	.0014	.0011	.0020	.0015	.0026	.0022	.0038	.0027	.0048
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0004	.0006	.0006	.0009	.0007	.0013	.0011	.0019	.0014	.0025	.0020	.0035	.0025	.0045
		21 - 36 HRC	170	.0004	.0006	.0005	.0009	.0007	.0012	.0010	.0018	.0013	.0024	.0019	.0034	.0025	.0043
		36 - 50 HRC	65	.0002	.0004	.0004	.0006	.0005	.0008	.0007	.0012	.0009	.0016	.0013	.0023	.0017	.0029

MILLING PROCESS	HARDNESS	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	75%-125% Diameter	100% Diameter
	≥ 35 HRC	60%-100% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	25%-35% 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.

HEV-C-5

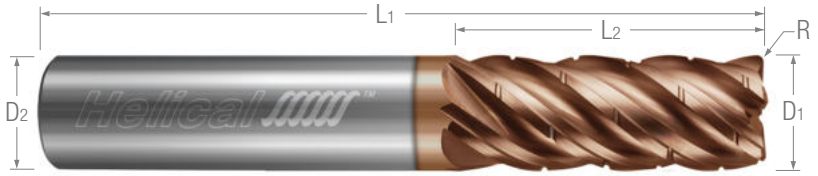
New Items!

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 79 for A*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
1/8	1/8	.010	1/4	1-1/2	5	83090	HEV-C-S-50125-R.010
	1/8	.010	3/8	2	5	86146	HEV-C-SR-50125-R.010
	1/8	.010	1/2	2-1/2	5	83091	HEV-C-R-50125-R.010
	1/8	.010	5/8	2-1/2	5	86147	HEV-C-A-50125-R.010
3/16	3/16	.010	5/16	2	5	83092	HEV-C-S-50187-R.010
	3/16	.010	7/16	2	5	83093	HEV-C-SR-50187-R.010
	3/16	.010	9/16	2-1/2	5	83094	HEV-C-R-50187-R.010
	3/16	.010	3/4	2-1/2	5	83095	HEV-C-M-50187-R.010
	3/16	.010	1	2-1/2	5	86148	HEV-C-ML-50187-R.010
1/4	1/4	.020	3/8	2	5	83096	HEV-C-S-50250-R.020
	1/4	.020	1/2	2-1/2	5	83097	HEV-C-SR-50250-R.020
	1/4	.020	3/4	2-1/2	5	83098	HEV-C-R-50250-R.020
	1/4	.020	1	3	5	83099	HEV-C-M-50250-R.020
	1/4	.020	1-1/4	3	5	86149	HEV-C-L-50250-R.020
new	1/4	.030	3/8	2	5	87375	HEV-C-S-50250-R.030
new	1/4	.030	1/2	2-1/2	5	87376	HEV-C-SR-50250-R.030
new	1/4	.030	3/4	2-1/2	5	87377	HEV-C-R-50250-R.030
new	1/4	.030	1	3	5	87378	HEV-C-M-50250-R.030
5/16	5/16	.020	7/16	2	5	86150	HEV-C-S-50312-R.020
	5/16	.020	13/16	2-1/2	5	86151	HEV-C-R-50312-R.020
	5/16	.020	1-1/4	3	5	86152	HEV-C-L-50312-R.020
3/8	3/8	.020	1/2	2	5	83100	HEV-C-S-50375-R.020
	3/8	.020	3/4	2-1/2	5	83101	HEV-C-SR-50375-R.020
	3/8	.020	1	3	5	83102	HEV-C-R-50375-R.020
	3/8	.020	1-1/4	3	5	83103	HEV-C-M-50375-R.020
	3/8	.020	1-1/2	3-1/2	5	86153	HEV-C-L-50375-R.020
new	3/8	.030	1/2	2	5	87379	HEV-C-S-50375-R.030
new	3/8	.030	3/4	2-1/2	5	87380	HEV-C-SR-50375-R.030
new	3/8	.030	1	3	5	87381	HEV-C-R-50375-R.030
new	3/8	.030	1-1/4	3	5	87382	HEV-C-M-50375-R.030

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 83

5 FLUTE - CORNER RADIUS New Items!

Chipbreaker Rougher - Variable Pitch (cont.)

HEV-C-5

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description	
1/2	1/2	**.030**	5/8	2-1/2	5	**83104**	HEV-C-S-50500-R.030	
	1/2	**.030**	1	3	5	**83105**	HEV-C-SR-50500-R.030	
	1/2	**.030**	1-1/4	3	5	**83106**	HEV-C-R-50500-R.030	
	1/2	**.030**	1-5/8	4	5	**83107**	HEV-C-M-50500-R.030	
	1/2	**.030**	2	4	5	**83108**	HEV-C-L-50500-R.030	
	1/2	**.030**	2-1/2	5	5	**83109**	HEV-C-LX-50500-R.030	
	1/2	**.030**	3-1/8	6	5	**86154**	HEV-C-X-50500-R.030	
	1/2	**.060**	5/8	2-1/2	5	**83110**	HEV-C-S-50500-R.060	
	1/2	**.060**	1	3	5	**83111**	HEV-C-SR-50500-R.060	
	1/2	**.060**	1-1/4	3	5	**83112**	HEV-C-R-50500-R.060	
	1/2	**.060**	1-5/8	4	5	**83113**	HEV-C-M-50500-R.060	
	1/2	**.060**	2	4	5	**83114**	HEV-C-L-50500-R.060	
	1/2	**.060**	2-1/2	5	5	**83115**	HEV-C-LX-50500-R.060	
	1/2	**.125**	5/8	2-1/2	5	**87383**	HEV-C-S-50500-R.125	new
	1/2	**.125**	1	3	5	**87384**	HEV-C-SR-50500-R.125	new
	1/2	**.125**	1-1/4	3	5	**87385**	HEV-C-R-50500-R.125	new
	1/2	**.125**	1-5/8	4	5	**87386**	HEV-C-M-50500-R.125	new
	1/2	**.125**	2	4	5	**87387**	HEV-C-L-50500-R.125	new
5/8	5/8	**.030**	3/4	3	5	**83116**	HEV-C-S-50625-R.030	
	5/8	**.030**	1-1/4	3-1/2	5	**83117**	HEV-C-SR-50625-R.030	
	5/8	**.030**	1-5/8	3-1/2	5	**83118**	HEV-C-R-50625-R.030	
	5/8	**.030**	2-1/8	4	5	**83119**	HEV-C-M-50625-R.030	
	5/8	**.030**	2-1/2	5	5	**86155**	HEV-C-L-50625-R.030	
	5/8	**.060**	1-1/4	3-1/2	5	**87388**	HEV-C-SR-50625-R.060	new
	5/8	**.060**	1-5/8	3-1/2	5	**87389**	HEV-C-R-50625-R.060	new
	5/8	**.060**	2-1/8	4	5	**87390**	HEV-C-M-50625-R.060	new
3/4	3/4	**.030**	1	3	5	**83120**	HEV-C-S-50750-R.030	
	3/4	**.030**	1-5/8	4	5	**83121**	HEV-C-R-50750-R.030	
	3/4	**.030**	2-1/4	5	5	**83122**	HEV-C-M-50750-R.030	
	3/4	**.030**	2-3/4	5	5	**83123**	HEV-C-L-50750-R.030	
	3/4	**.030**	3-1/4	6	5	**83124**	HEV-C-LX-50750-R.030	
	3/4	**.030**	4	6-1/2	5	**86156**	HEV-C-X-50750-R.030	
	3/4	**.060**	1	3	5	**87391**	HEV-C-S-50750-R.060	new
	3/4	**.060**	1-5/8	4	5	**87392**	HEV-C-R-50750-R.060	new
	3/4	**.060**	2-1/4	5	5	**87393**	HEV-C-M-50750-R.060	new
	3/4	**.060**	2-3/4	5	5	**87394**	HEV-C-L-50750-R.060	new

* .0005 max TIR

HEV-C-6

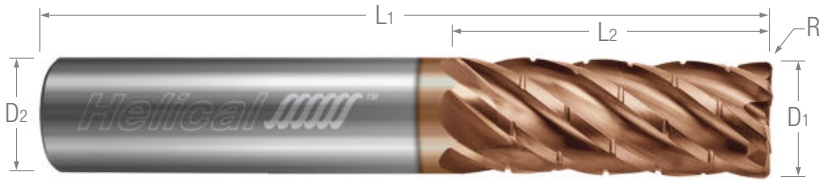
New Items!

6 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 84 for A*plus* coating



	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
new	1/8	1/8	**.010**	1/4	1-1/2	6	87426	HEV-C-S-60125-R.010
new		1/8	**.010**	3/8	2	6	87427	HEV-C-SR-60125-R.010
new		1/8	**.010**	1/2	2-1/2	6	87428	HEV-C-R-60125-R.010
new		1/8	**.010**	5/8	2-1/2	6	87429	HEV-C-A-60125-R.010
new	3/16	3/16	**.010**	5/16	2	6	87430	HEV-C-S-60187-R.010
new		3/16	**.010**	7/16	2	6	87431	HEV-C-SR-60187-R.010
new		3/16	**.010**	9/16	2-1/2	6	87432	HEV-C-R-60187-R.010
new		3/16	**.010**	3/4	2-1/2	6	87433	HEV-C-M-60187-R.010
new	1/4	1/4	**.010**	3/8	2	6	87434	HEV-C-S-60250-R.010
new		1/4	**.010**	1/2	2-1/2	6	87435	HEV-C-SR-60250-R.010
new		1/4	**.010**	3/4	2-1/2	6	87436	HEV-C-R-60250-R.010
new		1/4	**.010**	1	3	6	87437	HEV-C-M-60250-R.010
		1/4	**.020**	3/8	2	6	83145	HEV-C-S-60250-R.020
		1/4	**.020**	1/2	2-1/2	6	83146	HEV-C-SR-60250-R.020
		1/4	**.020**	3/4	2-1/2	6	83147	HEV-C-R-60250-R.020
		1/4	**.020**	1	3	6	83148	HEV-C-M-60250-R.020
new		1/4	**.030**	3/8	2	6	87438	HEV-C-S-60250-R.030
new		1/4	**.030**	1/2	2-1/2	6	87439	HEV-C-SR-60250-R.030
new		1/4	**.030**	3/4	2-1/2	6	87440	HEV-C-R-60250-R.030
new		1/4	**.030**	1	3	6	87441	HEV-C-M-60250-R.030
new		1/4	**.060**	3/8	2	6	87442	HEV-C-S-60250-R.060
new		1/4	**.060**	1/2	2-1/2	6	87443	HEV-C-SR-60250-R.060
new		1/4	**.060**	3/4	2-1/2	6	87444	HEV-C-R-60250-R.060
new		1/4	**.060**	1	3	6	87445	HEV-C-M-60250-R.060
new	3/8	3/8	**.010**	1/2	2	6	87446	HEV-C-S-60375-R.010
new		3/8	**.010**	3/4	2-1/2	6	87447	HEV-C-SR-60375-R.010
new		3/8	**.010**	1	3	6	87448	HEV-C-R-60375-R.010
new		3/8	**.010**	1-1/4	3	6	87449	HEV-C-M-60375-R.010
new		3/8	**.010**	1-1/2	3-1/2	6	87450	HEV-C-L-60375-R.010
new		3/8	**.020**	1/2	2	6	87451	HEV-C-S-60375-R.020
new		3/8	**.020**	3/4	2-1/2	6	87452	HEV-C-SR-60375-R.020
new		3/8	**.020**	1	3	6	87453	HEV-C-R-60375-R.020
new		3/8	**.020**	1-1/4	3	6	87454	HEV-C-M-60375-R.020
new		3/8	**.020**	1-1/2	3-1/2	6	87455	HEV-C-L-60375-R.020

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 86

6 FLUTE - CORNER RADIUS

New Items!

HEM

HEV-C-6

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*T plus* Coated	Tool Description	
3/8	3/8	.030	1/2	2	6	83149	HEV-C-S-60375-R.030	
	3/8	.030	3/4	2-1/2	6	83150	HEV-C-SR-60375-R.030	
	3/8	.030	1	3	6	83151	HEV-C-R-60375-R.030	
	3/8	.030	1-1/4	3	6	83152	HEV-C-M-60375-R.030	
	3/8	.030	1-1/2	3-1/2	6	86157	HEV-C-L-60375-R.030	
	3/8	.060	1/2	2	6	87456	HEV-C-S-60375-R.060	new
	3/8	.060	3/4	2-1/2	6	87457	HEV-C-SR-60375-R.060	new
	3/8	.060	1	3	6	87458	HEV-C-R-60375-R.060	new
	3/8	.060	1-1/4	3	6	87459	HEV-C-M-60375-R.060	new
	3/8	.060	1-1/2	3-1/2	6	87460	HEV-C-L-60375-R.060	new
1/2	1/2	.030	5/8	2-1/2	6	83153	HEV-C-S-60500-R.030	
	1/2	.030	1	3	6	83154	HEV-C-SR-60500-R.030	
	1/2	.030	1-1/4	3	6	83155	HEV-C-R-60500-R.030	
	1/2	.030	1-5/8	4	6	83156	HEV-C-M-60500-R.030	
	1/2	.030	2	4	6	83157	HEV-C-L-60500-R.030	
	1/2	.060	5/8	2-1/2	6	83158	HEV-C-S-60500-R.060	
	1/2	.060	1	3	6	83159	HEV-C-SR-60500-R.060	
	1/2	.060	1-1/4	3	6	83160	HEV-C-R-60500-R.060	
	1/2	.060	1-5/8	4	6	83161	HEV-C-M-60500-R.060	
	1/2	.060	2	4	6	83162	HEV-C-L-60500-R.060	
	1/2	.125	5/8	2-1/2	6	87461	HEV-C-S-60500-R.125	new
	1/2	.125	1	3	6	87462	HEV-C-SR-60500-R.125	new
	1/2	.125	1-1/4	3	6	87463	HEV-C-R-60500-R.125	new
	1/2	.125	1-5/8	4	6	87464	HEV-C-M-60500-R.125	new
	1/2	.125	2	4	6	87465	HEV-C-L-60500-R.125	new
5/8	5/8	.060	1-1/4	3-1/2	6	86162	HEV-C-SR-60625-R.060	
	5/8	.060	1-5/8	3-1/2	6	86163	HEV-C-R-60625-R.060	
	5/8	.060	2	4	6	86164	HEV-C-M-60625-R.060	
3/4	3/4	.030	1-5/8	4	6	87466	HEV-C-R-60750-R.030	new
	3/4	.030	2-1/4	5	6	87467	HEV-C-M-60750-R.030	new
	3/4	.030	2-3/4	5	6	87468	HEV-C-L-60750-R.030	new
	3/4	.060	1-5/8	4	6	86165	HEV-C-R-60750-R.060	
	3/4	.060	2-1/4	5	6	86166	HEV-C-M-60750-R.060	
	3/4	.060	2-3/4	5	6	86167	HEV-C-L-60750-R.060	
	3/4	.250	1-5/8	4	6	87469	HEV-C-R-60750-R.250	new
	3/4	.250	2-1/4	5	6	87470	HEV-C-M-60750-R.250	new
	3/4	.250	2-3/4	5	6	87471	HEV-C-L-60750-R.250	new

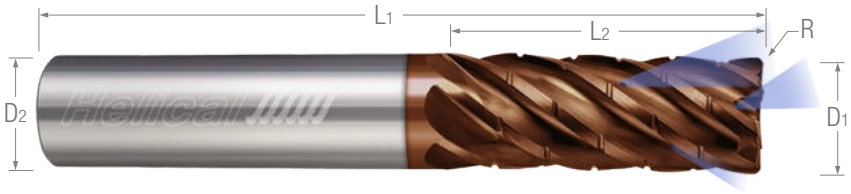
* .0005 max TIR

HEVC-C-6

6 FLUTE - CORNER RADIUS

Coolant Through - Chipbreaker Rougher - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Engineered for excellent performance in High Efficiency Milling (HEM)
- 6 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
1/4	1/4	**.020**	3/8	2	6	**84344**	HEVC-C-015-60250-R.020
	1/4	**.020**	1/2	2-1/2	6	**84345**	HEVC-C-020-60250-R.020
3/8	3/8	**.020**	1/2	2	6	**84346**	HEVC-C-013-60375-R.020
	3/8	**.020**	1	3	6	**84347**	HEVC-C-026-60375-R.020
	3/8	**.030**	1/2	2	6	**84348**	HEVC-C-013-60375-R.030
	3/8	**.030**	1	3	6	**84349**	HEVC-C-026-60375-R.030
1/2	1/2	**.030**	1	3	6	**84350**	HEVC-C-020-60500-R.030
	1/2	**.030**	1-1/4	3	6	**84351**	HEVC-C-025-60500-R.030
	1/2	**.030**	1-5/8	4	6	**84352**	HEVC-C-032-60500-R.030
	1/2	**.060**	1	3	6	**84353**	HEVC-C-020-60500-R.060
	1/2	**.060**	1-1/4	3	6	**84354**	HEVC-C-025-60500-R.060
	1/2	**.060**	1-5/8	4	6	**84355**	HEVC-C-032-60500-R.060
3/4	3/4	**.060**	1-5/8	4	6	**84356**	HEVC-C-021-60750-R.060
	3/4	**.060**	2-1/4	5	6	**84357**	HEVC-C-030-60750-R.060

* .0005 max TIR

Speeds & Feeds on Page 86

7 FLUTE - CORNER RADIUS

New Items!

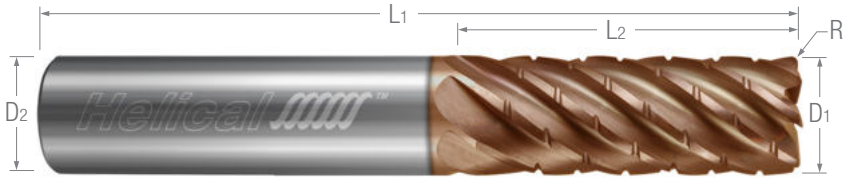
HEM

HEV-C-7

Chipbreaker Rougher - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 87 for A*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description	
1/4	1/4	.020	3/8	2	7	86168	HEV-C-S-70250-R.020	
	1/4	.020	1/2	2	7	82911	HEV-C-SR-70250-R.020	
	1/4	.020	3/4	2-1/2	7	82912	HEV-C-R-70250-R.020	
	1/4	.020	1	3	7	86169	HEV-C-M-70250-R.020	
	1/4	.030	3/8	2	7	87191	HEV-C-S-70250-R.030	new
	1/4	.030	1/2	2	7	87192	HEV-C-SR-70250-R.030	new
	1/4	.030	3/4	2-1/2	7	87193	HEV-C-R-70250-R.030	new
5/16	5/16	.020	7/16	2	7	86170	HEV-C-S-70312-R.020	
	5/16	.020	3/4	2-1/2	7	86171	HEV-C-R-70312-R.020	
	5/16	.020	1	3	7	86172	HEV-C-M-70312-R.020	
3/8	3/8	.020	1/2	2	7	82913	HEV-C-S-70375-R.020	
	3/8	.020	3/4	2-1/2	7	82914	HEV-C-SR-70375-R.020	
	3/8	.020	1	2-1/2	7	82915	HEV-C-R-70375-R.020	
	3/8	.020	1-1/2	3-1/2	7	86173	HEV-C-L-70375-R.020	
	3/8	.030	1/2	2	7	87194	HEV-C-S-70375-R.030	new
	3/8	.030	3/4	2-1/2	7	87195	HEV-C-SR-70375-R.030	new
	3/8	.030	1	2-1/2	7	87196	HEV-C-R-70375-R.030	new
1/2	1/2	.010	5/8	2-1/2	7	87197	HEV-C-S-70500-R.010	new
	1/2	.010	1	3	7	87198	HEV-C-SR-70500-R.010	new
	1/2	.010	1-1/4	3	7	87199	HEV-C-R-70500-R.010	new
	1/2	.010	1-5/8	4	7	87200	HEV-C-M-70500-R.010	new
	1/2	.010	2	4	7	87201	HEV-C-L-70500-R.010	new
	1/2	.030	5/8	2-1/2	7	82916	HEV-C-S-70500-R.030	
	1/2	.030	1	3	7	82917	HEV-C-SR-70500-R.030	
	1/2	.030	1-1/4	3	7	82918	HEV-C-R-70500-R.030	
	1/2	.030	1-5/8	4	7	82919	HEV-C-M-70500-R.030	
	1/2	.030	2	4	7	82920	HEV-C-L-70500-R.030	
	1/2	.030	2-1/2	5	7	86174	HEV-C-LX-70500-R.030	
	1/2	.060	5/8	2-1/2	7	83177	HEV-C-S-70500-R.060	
	1/2	.060	1	3	7	83178	HEV-C-SR-70500-R.060	
	1/2	.060	1-1/4	3	7	83179	HEV-C-R-70500-R.060	
	1/2	.060	1-5/8	4	7	83180	HEV-C-M-70500-R.060	
	1/2	.060	2	4	7	83181	HEV-C-L-70500-R.060	

continued on next page

Speeds & Feeds on Page 90

HEV-C-7

New Items! 7 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
	5/8	5/8	**.030**	1-1/4	3-1/2	7	**82921**	HEV-C-SR-70625-R.030
		5/8	**.030**	1-5/8	4	7	**82922**	HEV-C-R-70625-R.030
		5/8	**.030**	2-1/8	4	7	**86175**	HEV-C-M-70625-R.030
	3/4	3/4	**.030**	1-5/8	4	7	**82923**	HEV-C-R-70750-R.030
		3/4	**.030**	2-1/4	5	7	**82924**	HEV-C-M-70750-R.030
		3/4	**.030**	2-3/4	5	7	**86176**	HEV-C-L-70750-R.030
new		3/4	**.030**	3-1/4	6	7	**87202**	HEV-C-LX-70750-R.030
new		3/4	**.030**	4	6-1/2	7	**87203**	HEV-C-X-70750-R.030
		3/4	**.060**	1-5/8	4	7	**82925**	HEV-C-R-70750-R.060
		3/4	**.060**	2-1/4	5	7	**82926**	HEV-C-M-70750-R.060
		3/4	**.060**	2-3/4	5	7	**86177**	HEV-C-L-70750-R.060
new		3/4	**.060**	3-1/4	6	7	**87204**	HEV-C-LX-70750-R.060
new		3/4	**.060**	4	6-1/2	7	**87205**	HEV-C-X-70750-R.060
new	1	1	**.030**	2-5/8	5	7	**87206**	HEV-C-M-71000-R.030
new		1	**.030**	3-1/4	6	7	**87207**	HEV-C-L-71000-R.030
new		1	**.030**	4-1/8	7	7	**87208**	HEV-C-X-71000-R.030

* .0005 max TIR

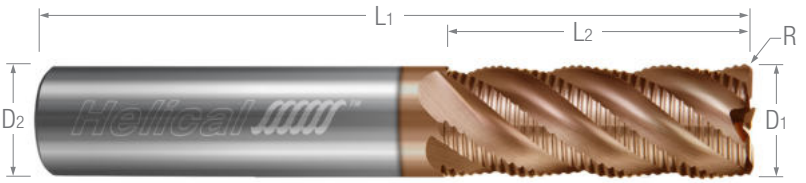
MULTI-FLUTE - CORNER RADIUS

HXVR

Knuckle Rougher - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 91 for A*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
1/4	1/4	.030	3/8	2	4	83482	HXVR-S-40250-R.030
	1/4	.030	3/4	2-1/2	4	83483	HXVR-R-40250-R.030
3/8	3/8	.040	1/2	2	4	83484	HXVR-S-40375-R.040
	3/8	.040	1/2	2	5	83485	HXVR-S-50375-R.040
	3/8	.040	1	3	4	83486	HXVR-R-40375-R.040
	3/8	.040	1	3	5	83487	HXVR-R-50375-R.040
1/2	1/2	.040	5/8	2-1/2	4	83488	HXVR-S-40500-R.040
	1/2	.040	5/8	2-1/2	5	83489	HXVR-S-50500-R.040
	1/2	.040	1-1/4	3	4	83490	HXVR-R-40500-R.040
	1/2	.040	1-1/4	3	5	83491	HXVR-R-50500-R.040
3/4	3/4	.060	1	3	4	83492	HXVR-S-40750-R.060
	3/4	.060	1	3	5	83493	HXVR-S-50750-R.060
	3/4	.060	1-5/8	4	4	83494	HXVR-R-40750-R.060
	3/4	.060	1-5/8	4	5	83495	HXVR-R-50750-R.060

* .0005 max TIR

Speeds & Feeds on Page 93-94

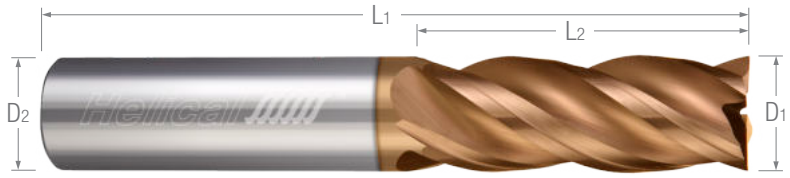
HSV-4 / HSM-4

New Items!

4 FLUTE - SQUARE
Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- CNC ground in the USA

For steel applications, see page 103 for A*plus* coating




HSM series feature enlarged shanks for added strength

Cutter Diameter* D_1 $^{+.0005"}_{-.0005"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.010"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
1/32	1/4	3/32	2-1/2	4	84040		HSM-030-40031
	1/4	5/32	2-1/2	4	84041		HSM-050-40031
3/64	1/4	5/32	2-1/2	4	84042		HSM-033-40047
	1/4	1/4	2-1/2	4	84043		HSM-053-40047
1/16	1/4	3/16	2-1/2	4	84044		HSM-030-40062
	1/4	5/16	2-1/2	4	84045		HSM-050-40062
5/64	1/4	1/4	2-1/2	4	84046		HSM-032-40078
	1/4	3/8	2-1/2	4	84047		HSM-048-40078
3/32	1/4	9/32	2-1/2	4	84048		HSM-030-40093
	1/4	1/2	2-1/2	4	84049		HSM-053-40093

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
1/8	1/8	1/4	1-1/2	4	83183		HSV-S-40125
	1/4	1/4	2-1/2	4	84050		HSM-020-40125
	1/8	3/8	2	4	83184		HSV-SR-40125
	1/4	3/8	2-1/2	4	84051		HSM-030-40125
	1/8	1/2	2-1/2	4	83185		HSV-R-40125
	1/4	1/2	2-1/2	4	84052		HSM-040-40125
	1/8	5/8	2-1/2	4	83186		HSV-A-40125
	1/8	3/4	2-1/2	4	83187		HSV-M-40125
	1/8	7/8	2-1/2	4	84693		HSV-L-40125
new	1/8	1	2-1/2	4	87472		HSV-LX-40125
5/32	3/16	3/16	2	4	83188		HSV-S-40156
	3/16	5/16	2	4	84694		HSV-SR-40156
	3/16	7/16	2-1/2	4	83189		HSV-R-40156
	3/16	9/16	2-1/2	4	83190		HSV-M-40156
	3/16	3/4	2-1/2	4	84695		HSV-ML-40156
3/16	3/16	5/16	2	4	83191		HSV-S-40187
	1/4	5/16	2-1/2	4	84053		HSM-016-40187
	3/16	7/16	2	4	83192		HSV-SR-40187
	1/4	7/16	2-1/2	4	84054		HSM-023-40187
	1/4	9/16	2-1/2	4	84055		HSM-029-40187

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

4 FLUTE - SQUARE New Items!

Variable Pitch (cont.)

HSV-4 / HSM-4

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description	
3/16	3/16	5/8	2-1/2	4	83193		HSV-R-40187	
	3/16	3/4	2-1/2	4	87473		HSV-A-40187	new
	1/4	3/4	2-1/2	4	84056		HSM-040-40187	
	3/16	1	2-1/2	4	83194		HSV-M-40187	
	3/16	1-3/16	3	4	87474		HSV-L-40187	new
7/32	1/4	1/4	2	4	87475		HSV-S-40218	new
	1/4	7/16	2-1/2	4	87476		HSV-R-40218	new
	1/4	5/8	2-1/2	4	87477		HSV-A-40218	new
1/4	1/4	3/8	2	4	82262	82262W	HSV-S-40250	
	1/4	1/2	2-1/2	4	82263	82263W	HSV-SR-40250	
	1/4	3/4	2-1/2	4	82264	82264W	HSV-R-40250	
	1/4	1	3	4	82265	82265W	HSV-M-40250	
	1/4	1-1/4	3	4	83195		HSV-L-40250	
	1/4	1-1/2	3	4	83196		HSV-LX-40250	
	1/4	1-3/4	4	4	87478		HSV-X-40250	new
5/16	5/16	1/2	2	4	83197		HSV-S-40312	
	5/16	3/4	2-1/2	4	83198		HSV-R-40312	
	5/16	1	2-1/2	4	83199		HSV-A-40312	
	5/16	1-1/4	3	4	83200		HSV-M-40312	
	5/16	1-9/16	4	4	87479		HSV-L-40312	new
3/8	3/8	1/2	2	4	82266	82266W	HSV-S-40375	
	3/8	7/8	3	4	82267	82267W	HSV-SR-40375	
	3/8	1	3	4	82268	82268W	HSV-R-40375	
	3/8	1-1/4	3	4	82269	82269W	HSV-M-40375	
	3/8	1-1/2	3	4	83201		HSV-L-40375	
	3/8	2	4	4	87480		HSV-LX-40375	new
1/2	1/2	5/8	2-1/2	4	82270	82270W	HSV-S-40500	
	1/2	1	3	4	82271	82271W	HSV-SR-40500	
	1/2	1-1/4	3	4	82272	82272W	HSV-R-40500	
	1/2	1-5/8	4	4	82273	82273W	HSV-M-40500	
	1/2	2	4	4	83202		HSV-L-40500	
	1/2	2-1/2	5	4	83203		HSV-LX-40500	
	1/2	3-1/8	6	4	84696		HSV-X-40500	
5/8	5/8	3/4	3	4	83204		HSV-S-40625	
	5/8	1-1/4	3-1/2	4	83205		HSV-SR-40625	
	5/8	1-5/8	3-1/2	4	83206		HSV-R-40625	
	5/8	2	4	4	83207		HSV-M-40625	
	5/8	2-1/2	5	4	87481		HSV-ML-40625	new
	5/8	3-1/4	6	4	87482		HSV-L-40625	new
3/4	3/4	7/8	3	4	83208		HSV-S-40750	
	3/4	1-1/4	4	4	83209		HSV-SR-40750	
	3/4	1-5/8	4	4	82274		HSV-R-40750	
	3/4	2-1/4	5	4	82275		HSV-M-40750	
	3/4	2-3/4	5	4	83210		HSV-ML-40750	
	3/4	3-1/4	6	4	83211		HSV-L-40750	
	3/4	4	6-1/2	4	87483		HSV-LX-40750	new

* .0005 max TIR

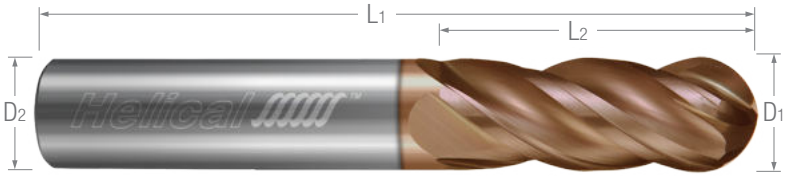
HSV-4

New Items!

4 FLUTE - BALL
Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 106 for A*plus* coating



	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
	1/8	1/8	1/4	1-1/2	4	83275	HSV-S-40125-BN
		1/8	3/8	2	4	83276	HSV-SR-40125-BN
		1/8	1/2	2-1/2	4	83277	HSV-R-40125-BN
		1/8	5/8	2-1/2	4	83278	HSV-A-40125-BN
		1/8	3/4	2-1/2	4	84750	HSV-M-40125-BN
		1/8	7/8	2-1/2	4	84751	HSV-L-40125-BN
new		1/8	1	2-1/2	4	87484	HSV-LX-40125-BN
	5/32	3/16	3/16	2	4	84752	HSV-S-40156-BN
		3/16	7/16	2-1/2	4	84753	HSV-R-40156-BN
		3/16	9/16	2-1/2	4	84754	HSV-M-40156-BN
		3/16	3/4	2-1/2	4	84755	HSV-ML-40156-BN
	3/16	3/16	5/16	2	4	83279	HSV-S-40187-BN
		3/16	7/16	2	4	84756	HSV-SR-40187-BN
		3/16	5/8	2-1/2	4	83280	HSV-R-40187-BN
		3/16	1	2-1/2	4	83281	HSV-M-40187-BN
		3/16	1-3/16	3	4	84757	HSV-L-40187-BN
new		3/16	1-3/8	3	4	87485	HSV-LX-40187-BN
new	7/32	1/4	1/4	2	4	87486	HSV-S-40218-BN
new		1/4	7/16	2-1/2	4	87487	HSV-R-40218-BN
new		1/4	5/8	2-1/2	4	87488	HSV-A-40218-BN
	1/4	1/4	3/8	2	4	83282	HSV-S-40250-BN
		1/4	1/2	2-1/2	4	83283	HSV-SR-40250-BN
		1/4	3/4	2-1/2	4	83284	HSV-R-40250-BN
		1/4	1	3	4	83285	HSV-M-40250-BN
		1/4	1-1/4	3	4	83286	HSV-L-40250-BN
		1/4	1-1/2	3	4	84758	HSV-LX-40250-BN
		1/4	1-3/4	4	4	84759	HSV-X-40250-BN
	5/16	5/16	1/2	2	4	83287	HSV-S-40312-BN
		5/16	3/4	2-1/2	4	83288	HSV-R-40312-BN
		5/16	1	2-1/2	4	83289	HSV-A-40312-BN
		5/16	1-1/4	3	4	83290	HSV-M-40312-BN
		5/16	1-9/16	4	4	84760	HSV-L-40312-BN

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

4 FLUTE - BALL New Items!

Variable Pitch (cont.)

HSV-4

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description	
3/8	3/8	1/2	2	4	83291	HSV-S-40375-BN	
	3/8	7/8	3	4	83292	HSV-SR-40375-BN	
	3/8	1	3	4	83293	HSV-R-40375-BN	
	3/8	1-1/4	3	4	83294	HSV-M-40375-BN	
	3/8	1-1/2	3	4	84761	HSV-L-40375-BN	
	3/8	2	4	4	84762	HSV-LX-40375-BN	
	3/8	2-1/2	5	4	87489	HSV-X-40375-BN	new
7/16	7/16	5/8	2-3/4	4	84763	HSV-S-40437-BN	
	7/16	7/8	2-3/4	4	84764	HSV-R-40437-BN	
	7/16	1-1/8	3-1/2	4	84765	HSV-M-40437-BN	
1/2	1/2	5/8	2-1/2	4	83295	HSV-S-40500-BN	
	1/2	1	3	4	83296	HSV-SR-40500-BN	
	1/2	1-1/4	3	4	83297	HSV-R-40500-BN	
	1/2	1-5/8	4	4	83298	HSV-M-40500-BN	
	1/2	2	4	4	83299	HSV-L-40500-BN	
	1/2	2-1/2	5	4	84766	HSV-LX-40500-BN	
	1/2	3-1/8	6	4	87490	HSV-X-40500-BN	new
5/8	5/8	1-1/4	3-1/2	4	84767	HSV-SR-40625-BN	
	5/8	1-5/8	3-1/2	4	84768	HSV-R-40625-BN	
	5/8	2	4	4	84769	HSV-M-40625-BN	
	5/8	2-1/2	5	4	87491	HSV-ML-40625-BN	new
	5/8	3-1/4	6	4	87492	HSV-L-40625-BN	new
3/4	3/4	7/8	3	4	83300	HSV-S-40750-BN	
	3/4	1-1/4	4	4	83301	HSV-SR-40750-BN	
	3/4	1-5/8	4	4	83302	HSV-R-40750-BN	
	3/4	2-1/4	5	4	87493	HSV-M-40750-BN	new
	3/4	2-3/4	5	4	87494	HSV-ML-40750-BN	new
1	1	1-1/2	4	4	84770	HSV-S-41000-BN	
	1	2	4-1/2	4	84771	HSV-R-41000-BN	
	1	2-5/8	5	4	87495	HSV-M-41000-BN	new

* .0005 max TIR

HSV-4 / HSM-4

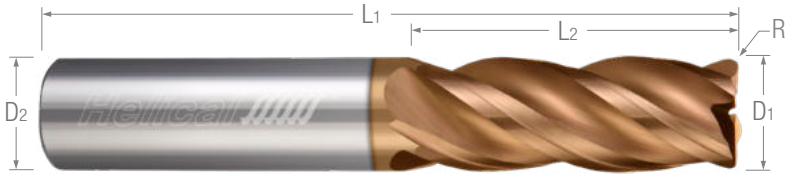
New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 109 for A*plus* coating



Cutter Diameter* D_1 +.0005" −.0005"	Shank Diameter D_2 (h6)	Corner Radius R +.001" −.001"	Length of Cut L_2 +.010" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
1/32	1/4	.005	3/32	2-1/2	4	84016		HSM-030-40031-R.005
	1/4	.005	5/32	2-1/2	4	84017		HSM-050-40031-R.005
3/64	1/4	.010	5/32	2-1/2	4	84018		HSM-033-40047-R.010
	1/4	.010	1/4	2-1/2	4	84019		HSM-053-40047-R.010
1/16	1/4	.010	3/16	2-1/2	4	84020		HSM-030-40062-R.010
	1/4	.010	5/16	2-1/2	4	84021		HSM-050-40062-R.010
5/64	1/4	.010	1/4	2-1/2	4	84022		HSM-032-40078-R.010
	1/4	.010	3/8	2-1/2	4	84023		HSM-048-40078-R.010
3/32	1/4	.010	9/32	2-1/2	4	84024		HSM-030-40093-R.010
	1/4	.010	1/2	2-1/2	4	84025		HSM-053-40093-R.010

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
	1/8	1/8	.010	1/4	1-1/2	4	83238		HSV-S-40125-R.010
		1/4	.010	1/4	2-1/2	4	84026		HSM-020-40125-R.010
		1/8	.010	3/8	2	4	84718		HSV-SR-40125-R.010
		1/4	.010	3/8	2-1/2	4	84027		HSM-030-40125-R.010
		1/8	.010	1/2	2-1/2	4	83239		HSV-R-40125-R.010
		1/4	.010	1/2	2-1/2	4	84028		HSM-040-40125-R.010
		1/8	.010	5/8	2-1/2	4	84719		HSV-A-40125-R.010
		1/8	.015	1/4	1-1/2	4	84720		HSV-S-40125-R.015
new		1/8	.015	3/8	2	4	87683		HSV-SR-40125-R.015
		1/8	.015	1/2	2-1/2	4	84721		HSV-R-40125-R.015
new		1/8	.020	1/4	1-1/2	4	87684		HSV-S-40125-R.020
new		1/8	.020	3/8	2	4	87685		HSV-SR-40125-R.020
new		1/8	.020	1/2	2-1/2	4	87686		HSV-R-40125-R.020
		1/8	.030	1/4	1-1/2	4	83240		HSV-S-40125-R.030
		1/4	.030	1/4	2-1/2	4	84033		HSM-020-40125-R.030
		1/8	.030	3/8	2	4	84722		HSV-SR-40125-R.030
		1/4	.030	3/8	2-1/2	4	84034		HSM-030-40125-R.030
		1/8	.030	1/2	2-1/2	4	83241		HSV-R-40125-R.030
		1/4	.030	1/2	2-1/2	4	84035		HSM-040-40125-R.030
		1/8	.030	5/8	2-1/2	4	84723		HSV-A-40125-R.030

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 122

4 FLUTE - CORNER RADIUS New Items!

HSV-4 / HSM-4

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description	
5/32	3/16	.010	3/16	2	4	87687		HSV-S-40156-R.010	new
	3/16	.010	5/16	2	4	87688		HSV-SR-40156-R.010	new
	3/16	.010	7/16	2-1/2	4	87689		HSV-R-40156-R.010	new
	3/16	.010	9/16	2-1/2	4	87690		HSV-M-40156-R.010	new
	3/16	.030	3/16	2	4	87691		HSV-S-40156-R.030	new
	3/16	.030	5/16	2	4	87692		HSV-SR-40156-R.030	new
	3/16	.030	7/16	2-1/2	4	87693		HSV-R-40156-R.030	new
	3/16	.030	9/16	2-1/2	4	87694		HSV-M-40156-R.030	new
3/16	3/16	.010	5/16	2	4	83242		HSV-S-40187-R.010	
	1/4	.010	5/16	2-1/2	4	84029		HSM-016-40187-R.010	
	1/4	.010	7/16	2-1/2	4	84030		HSM-023-40187-R.010	
	1/4	.010	9/16	2-1/2	4	84031		HSM-029-40187-R.010	
	3/16	.010	5/8	2-1/2	4	83243		HSV-R-40187-R.010	
	1/4	.010	3/4	2-1/2	4	84032		HSM-040-40187-R.010	
	3/16	.015	5/16	2	4	87695		HSV-S-40187-R.015	new
	3/16	.015	7/16	2	4	87696		HSV-SR-40187-R.015	new
	3/16	.015	5/8	2-1/2	4	87697		HSV-R-40187-R.015	new
	3/16	.020	5/16	2	4	87698		HSV-S-40187-R.020	new
	3/16	.020	7/16	2	4	87699		HSV-SR-40187-R.020	new
	3/16	.020	5/8	2-1/2	4	87700		HSV-R-40187-R.020	new
	3/16	.030	5/16	2	4	83244		HSV-S-40187-R.030	
	1/4	.030	5/16	2-1/2	4	84036		HSM-016-40187-R.030	
	1/4	.030	7/16	2-1/2	4	84037		HSM-023-40187-R.030	
	1/4	.030	9/16	2-1/2	4	84038		HSM-029-40187-R.030	
	3/16	.030	5/8	2-1/2	4	83245		HSV-R-40187-R.030	
	1/4	.030	3/4	2-1/2	4	84039		HSM-040-40187-R.030	
	3/16	.030	1	2-1/2	4	84724		HSV-M-40187-R.030	
1/4	1/4	.010	3/8	2	4	83246		HSV-S-40250-R.010	
	1/4	.010	1/2	2-1/2	4	83247		HSV-SR-40250-R.010	
	1/4	.010	3/4	2-1/2	4	83248		HSV-R-40250-R.010	
	1/4	.010	1	3	4	84725		HSV-M-40250-R.010	
	1/4	.015	3/8	2	4	87701		HSV-S-40250-R.015	new
	1/4	.015	1/2	2-1/2	4	87702		HSV-SR-40250-R.015	new
	1/4	.015	3/4	2-1/2	4	87703		HSV-R-40250-R.015	new
	1/4	.015	1	3	4	87704		HSV-M-40250-R.015	new
	1/4	.020	3/8	2	4	82303	82303W	HSV-S-40250-R.020	
	1/4	.020	1/2	2-1/2	4	82304	82304W	HSV-SR-40250-R.020	
	1/4	.020	3/4	2-1/2	4	82305	82305W	HSV-R-40250-R.020	
	1/4	.020	1	3	4	82306		HSV-M-40250-R.020	
	1/4	.020	1-1/4	3	4	84726		HSV-L-40250-R.020	
	1/4	.030	3/8	2	4	83249		HSV-S-40250-R.030	
	1/4	.030	1/2	2-1/2	4	83250		HSV-SR-40250-R.030	
	1/4	.030	3/4	2-1/2	4	83251		HSV-R-40250-R.030	
	1/4	.030	1	3	4	83252		HSV-M-40250-R.030	
	1/4	.030	1-1/4	3	4	84727		HSV-L-40250-R.030	
	1/4	.060	3/8	2	4	83253		HSV-S-40250-R.060	
	1/4	.060	1/2	2-1/2	4	83254		HSV-SR-40250-R.060	
	1/4	.060	3/4	2-1/2	4	83255		HSV-R-40250-R.060	
	1/4	.060	1	3	4	83256		HSV-M-40250-R.060	
	1/4	.060	1-1/4	3	4	84728		HSV-L-40250-R.060	

* .0005 max TIR

continued on next page

HSV-4 / HSM-4

New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
new	5/16	5/16	.010	1/2	2	4	87705		HSV-S-40312-R.010
new		5/16	.010	3/4	2-1/2	4	87706		HSV-R-40312-R.010
new		5/16	.010	1	2-1/2	4	87707		HSV-A-40312-R.010
new		5/16	.010	1-1/4	3	4	87708		HSV-M-40312-R.010
		5/16	.020	1/2	2	4	84729		HSV-S-40312-R.020
		5/16	.020	3/4	2-1/2	4	84730		HSV-R-40312-R.020
		5/16	.020	1	2-1/2	4	84731		HSV-A-40312-R.020
		5/16	.020	1-1/4	3	4	84732		HSV-M-40312-R.020
new		5/16	.030	1/2	2	4	87709		HSV-S-40312-R.030
new		5/16	.030	3/4	2-1/2	4	87710		HSV-R-40312-R.030
new		5/16	.030	1	2-1/2	4	87711		HSV-A-40312-R.030
new		5/16	.030	1-1/4	3	4	87712		HSV-M-40312-R.030
new	3/8	3/8	.010	1/2	2	4	87713		HSV-S-40375-R.010
new		3/8	.010	7/8	3	4	87714		HSV-SR-40375-R.010
new		3/8	.010	1	3	4	87715		HSV-R-40375-R.010
new		3/8	.010	1-1/4	3	4	87716		HSV-M-40375-R.010
		3/8	.020	1/2	2	4	82307	82307W	HSV-S-40375-R.020
		3/8	.020	7/8	3	4	82308	82308W	HSV-SR-40375-R.020
		3/8	.020	1	3	4	82309		HSV-R-40375-R.020
		3/8	.020	1-1/4	3	4	82310		HSV-M-40375-R.020
		3/8	.030	1/2	2	4	82311		HSV-S-40375-R.030
		3/8	.030	7/8	3	4	82312		HSV-SR-40375-R.030
		3/8	.030	1	3	4	82313		HSV-R-40375-R.030
		3/8	.030	1-1/4	3	4	82314		HSV-M-40375-R.030
		3/8	.060	1/2	2	4	83257		HSV-S-40375-R.060
		3/8	.060	7/8	3	4	83258		HSV-SR-40375-R.060
		3/8	.060	1	3	4	83259		HSV-R-40375-R.060
new		3/8	.060	1-1/4	3	4	87717		HSV-M-40375-R.060
	1/2	1/2	.010	5/8	2-1/2	4	84733		HSV-S-40500-R.010
		1/2	.010	1	3	4	84734		HSV-SR-40500-R.010
		1/2	.010	1-1/4	3	4	84735		HSV-R-40500-R.010
		1/2	.015	5/8	2-1/2	4	83260		HSV-S-40500-R.015
		1/2	.015	1	3	4	83261		HSV-SR-40500-R.015
		1/2	.015	1-1/4	3	4	83262		HSV-R-40500-R.015
		1/2	.020	5/8	2-1/2	4	82315		HSV-S-40500-R.020
		1/2	.020	1	3	4	82316		HSV-SR-40500-R.020
		1/2	.020	1-1/4	3	4	82317		HSV-R-40500-R.020
		1/2	.020	1-5/8	4	4	82318		HSV-M-40500-R.020
		1/2	.030	5/8	2-1/2	4	82319	82319W	HSV-S-40500-R.030
		1/2	.030	1	3	4	82320	82320W	HSV-SR-40500-R.030
		1/2	.030	1-1/4	3	4	82321	82321W	HSV-R-40500-R.030
		1/2	.030	1-5/8	4	4	82322	82322W	HSV-M-40500-R.030
		1/2	.030	2	4	4	84736		HSV-L-40500-R.030
		1/2	.060	5/8	2-1/2	4	82323		HSV-S-40500-R.060
		1/2	.060	1	3	4	82324		HSV-SR-40500-R.060
		1/2	.060	1-1/4	3	4	82325		HSV-R-40500-R.060
		1/2	.060	1-5/8	4	4	82326		HSV-M-40500-R.060
		1/2	.060	2	4	4	84737		HSV-L-40500-R.060
		1/2	.090	5/8	2-1/2	4	84738		HSV-S-40500-R.090
		1/2	.090	1	3	4	84739		HSV-SR-40500-R.090
		1/2	.090	1-1/4	3	4	84740		HSV-R-40500-R.090

* .0005 max TIR

continued on next page

4 FLUTE - CORNER RADIUS

New Items!

HSV-4 / HSM-4

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description	
1/2	1/2	.125	5/8	2-1/2	4	83263		HSV-S-40500-R.125	
	1/2	.125	1	3	4	83264		HSV-SR-40500-R.125	
	1/2	.125	1-1/4	3	4	83265		HSV-R-40500-R.125	
	1/2	.125	1-5/8	4	4	83266		HSV-M-40500-R.125	
	1/2	.125	2	4	4	84741		HSV-L-40500-R.125	
5/8	5/8	.030	1-1/4	3-1/2	4	83267		HSV-SR-40625-R.030	
	5/8	.030	1-5/8	3-1/2	4	83268		HSV-R-40625-R.030	
	5/8	.030	2	4	4	83269		HSV-M-40625-R.030	
3/4	3/4	.030	7/8	3	4	83270		HSV-S-40750-R.030	
	3/4	.030	1-1/4	4	4	83271		HSV-SR-40750-R.030	
	3/4	.030	1-5/8	4	4	82327		HSV-R-40750-R.030	
	3/4	.030	2-1/4	5	4	82328		HSV-M-40750-R.030	
	3/4	.030	3-1/4	6	4	83272		HSV-L-40750-R.030	
	3/4	.060	7/8	3	4	87718		HSV-S-40750-R.060	new
	3/4	.060	1-1/4	4	4	87719		HSV-SR-40750-R.060	new
	3/4	.060	1-5/8	4	4	87720		HSV-R-40750-R.060	new
	3/4	.060	2-1/4	5	4	87721		HSV-M-40750-R.060	new
	3/4	.060	3-1/4	6	4	87722		HSV-L-40750-R.060	new
	3/4	.125	7/8	3	4	87723		HSV-S-40750-R.125	new
	3/4	.125	1-1/4	4	4	87724		HSV-SR-40750-R.125	new
	3/4	.125	1-5/8	4	4	87725		HSV-R-40750-R.125	new
	3/4	.125	2-1/4	5	4	87726		HSV-M-40750-R.125	new
	3/4	.125	3-1/4	6	4	87727		HSV-L-40750-R.125	new

* .0005 max TIR

HSV-RN-4

New! **4 FLUTE - SQUARE**

Variable Pitch - Reduced Neck

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 116 for A*plus* coating

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description
new	1/8	1/8	5/32	3	3/8	.118	4	86935	HSV-RN-S-40125
new		1/8	5/32	3	1/2	.118	4	86936	HSV-RN-R-40125
new		1/8	5/32	3	5/8	.118	4	86937	HSV-RN-M-40125
new		1/8	5/32	3	3/4	.118	4	86938	HSV-RN-ML-40125
new		1/8	5/32	3	1	.118	4	86939	HSV-RN-LX-40125
new	3/16	3/16	7/32	3	1/2	.178	4	86940	HSV-RN-S-40187
new		3/16	7/32	3	3/4	.178	4	86941	HSV-RN-R-40187
new		3/16	7/32	3	1	.178	4	86942	HSV-RN-M-40187
new		3/16	7/32	3	1-5/16	.178	4	86943	HSV-RN-L-40187
new	1/4	1/4	3/8	3	3/4	.237	4	86944	HSV-RN-S-40250
new		1/4	3/8	4	1-1/8	.237	4	86945	HSV-RN-R-40250
new		1/4	3/8	4	1-5/8	.237	4	86946	HSV-RN-A-40250
new		1/4	3/8	4	2-1/8	.237	4	86947	HSV-RN-M-40250
new	3/8	3/8	1/2	4	1-1/8	.356	4	86948	HSV-RN-S-40375
new		3/8	1/2	4	1-5/8	.356	4	86949	HSV-RN-SR-40375
new		3/8	1/2	4	2-1/8	.356	4	86950	HSV-RN-R-40375
new		3/8	1/2	6	2-1/2	.356	4	86951	HSV-RN-A-40375
new	1/2	1/2	5/8	4	1-1/2	.475	4	86952	HSV-RN-S-40500
new		1/2	5/8	4	1-3/4	.475	4	86953	HSV-RN-SR-40500
new		1/2	5/8	4	2-1/4	.475	4	86954	HSV-RN-R-40500
new		1/2	5/8	5	2-3/4	.475	4	86955	HSV-RN-A-40500
new		1/2	5/8	6	3-3/8	.475	4	86956	HSV-RN-M-40500
new	3/4	3/4	1	6	2-1/2	.712	4	86957	HSV-RN-R-40750
new		3/4	1	6	3-3/8	.712	4	86958	HSV-RN-M-40750
new		3/4	1	6	4-1/8	.712	4	86959	HSV-RN-L-40750

* .0005 max TIR

Speeds & Feeds on Page 122

4 FLUTE - BALL New!

Variable Pitch - Reduced Neck

HSV-RN-4

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 117 for A*plus* coating

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description	
1/8	1/8	5/32	3	3/8	.118	4	86875	HSV-RN-S-40125-BN	new
	1/8	5/32	3	1/2	.118	4	86876	HSV-RN-R-40125-BN	new
	1/8	5/32	3	5/8	.118	4	86877	HSV-RN-M-40125-BN	new
	1/8	5/32	3	3/4	.118	4	86878	HSV-RN-ML-40125-BN	new
	1/8	5/32	3	1	.118	4	86879	HSV-RN-LX-40125-BN	new
3/16	3/16	7/32	3	1/2	.178	4	86880	HSV-RN-S-40187-BN	new
	3/16	7/32	3	3/4	.178	4	86881	HSV-RN-R-40187-BN	new
	3/16	7/32	3	1	.178	4	86882	HSV-RN-M-40187-BN	new
	3/16	7/32	3	1-5/16	.178	4	86883	HSV-RN-L-40187-BN	new
1/4	1/4	3/8	3	3/4	.237	4	86884	HSV-RN-S-40250-BN	new
	1/4	3/8	4	1-1/8	.237	4	86885	HSV-RN-R-40250-BN	new
	1/4	3/8	4	1-5/8	.237	4	86886	HSV-RN-A-40250-BN	new
	1/4	3/8	4	2-1/8	.237	4	86887	HSV-RN-M-40250-BN	new
3/8	3/8	1/2	4	1-1/8	.356	4	86888	HSV-RN-S-40375-BN	new
	3/8	1/2	4	1-5/8	.356	4	86889	HSV-RN-SR-40375-BN	new
	3/8	1/2	4	2-1/8	.356	4	86890	HSV-RN-R-40375-BN	new
	3/8	1/2	6	2-1/2	.356	4	86891	HSV-RN-A-40375-BN	new
1/2	1/2	5/8	4	1-1/2	.475	4	86892	HSV-RN-S-40500-BN	new
	1/2	5/8	4	1-3/4	.475	4	86893	HSV-RN-SR-40500-BN	new
	1/2	5/8	4	2-1/4	.475	4	86894	HSV-RN-R-40500-BN	new
	1/2	5/8	5	2-3/4	.475	4	86895	HSV-RN-A-40500-BN	new
	1/2	5/8	6	3-3/8	.475	4	86896	HSV-RN-M-40500-BN	new
3/4	3/4	1	6	2-1/2	.712	4	86897	HSV-RN-R-40750-BN	new
	3/4	1	6	3-3/8	.712	4	86898	HSV-RN-M-40750-BN	new
	3/4	1	6	4-1/8	.712	4	86899	HSV-RN-L-40750-BN	new

* .0005 max TIR

Speeds & Feeds on Page 122

HSV-RN-4

New!

4 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 119 for A*plus* coating

	Cutter Dia. * D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description
new	1/8	1/8	**.010**	5/32	3	3/8	.118	4	86900	HSV-RN-S-40125-R.010
new		1/8	**.010**	5/32	3	1/2	.118	4	86901	HSV-RN-R-40125-R.010
new		1/8	**.010**	5/32	3	5/8	.118	4	86902	HSV-RN-M-40125-R.010
new		1/8	**.010**	5/32	3	3/4	.118	4	86903	HSV-RN-ML-40125-R.010
new	3/16	3/16	**.010**	7/32	3	1/2	.178	4	86904	HSV-RN-S-40187-R.010
new		3/16	**.010**	7/32	3	3/4	.178	4	86905	HSV-RN-R-40187-R.010
new		3/16	**.010**	7/32	3	1	.178	4	86906	HSV-RN-M-40187-R.010
new		3/16	**.010**	7/32	3	1-5/16	.178	4	86907	HSV-RN-L-40187-R.010
new	1/4	1/4	**.020**	3/8	3	3/4	.237	4	86908	HSV-RN-S-40250-R.020
new		1/4	**.020**	3/8	4	1-1/8	.237	4	86909	HSV-RN-R-40250-R.020
new		1/4	**.020**	3/8	4	1-5/8	.237	4	86910	HSV-RN-A-40250-R.020
new		1/4	**.020**	3/8	4	2-1/8	.237	4	86911	HSV-RN-M-40250-R.020
new		1/4	**.030**	3/8	3	3/4	.237	4	86912	HSV-RN-S-40250-R.030
new		1/4	**.030**	3/8	4	1-1/8	.237	4	86913	HSV-RN-R-40250-R.030
new		1/4	**.030**	3/8	4	1-5/8	.237	4	86914	HSV-RN-A-40250-R.030
new		1/4	**.030**	3/8	4	2-1/8	.237	4	86915	HSV-RN-M-40250-R.030
new	3/8	3/8	**.020**	1/2	4	1-1/8	.356	4	86916	HSV-RN-S-40375-R.020
new		3/8	**.020**	1/2	4	2-1/8	.356	4	86917	HSV-RN-R-40375-R.020
new		3/8	**.020**	1/2	6	3-1/8	.356	4	86918	HSV-RN-M-40375-R.020
new		3/8	**.020**	1/2	6	4-1/8	.356	4	86919	HSV-RN-L-40375-R.020
new		3/8	**.030**	1/2	4	1-1/8	.356	4	86920	HSV-RN-S-40375-R.030
new		3/8	**.030**	1/2	4	2-1/8	.356	4	86921	HSV-RN-R-40375-R.030
new		3/8	**.030**	1/2	6	3-1/8	.356	4	86922	HSV-RN-M-40375-R.030
new		3/8	**.030**	1/2	6	4-1/8	.356	4	86923	HSV-RN-L-40375-R.030
new	1/2	1/2	**.030**	5/8	4	1-1/2	.475	4	86924	HSV-RN-S-40500-R.030
new		1/2	**.030**	5/8	4	2-1/4	.475	4	86925	HSV-RN-R-40500-R.030
new		1/2	**.030**	5/8	6	3-3/8	.475	4	86926	HSV-RN-M-40500-R.030
new		1/2	**.030**	5/8	6	4-1/8	.475	4	86927	HSV-RN-L-40500-R.030
new		1/2	**.060**	5/8	4	1-1/2	.475	4	86928	HSV-RN-S-40500-R.060
new		1/2	**.060**	5/8	4	2-1/4	.475	4	86929	HSV-RN-R-40500-R.060
new		1/2	**.060**	5/8	6	3-3/8	.475	4	86930	HSV-RN-M-40500-R.060
new		1/2	**.060**	5/8	6	4-1/8	.475	4	86931	HSV-RN-L-40500-R.060
new	3/4	3/4	**.030**	1	6	2-1/2	.712	4	86932	HSV-RN-R-40750-R.030
new		3/4	**.030**	1	6	3-3/8	.712	4	86933	HSV-RN-M-40750-R.030
new		3/4	**.030**	1	6	4-1/8	.712	4	86934	HSV-RN-L-40750-R.030

* .0005 max TIR

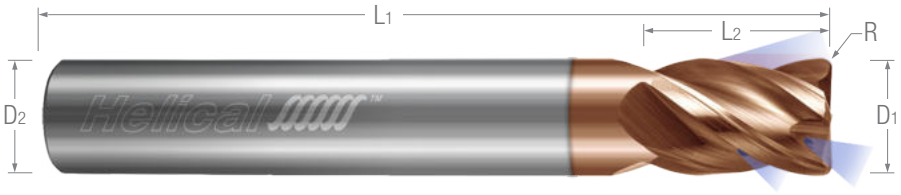
Speeds & Feeds on Page 122

4 FLUTE - CORNER RADIUS

HEVC-4

Coolant Through - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- 4 flute variable pitch design for reduced harmonics and increased feed rates
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
1/4	1/4	**.020**	1/2	2-1/2	4	**84289**	HEVC-020-40250-R.020
	1/4	**.020**	3/4	2-1/2	4	**84290**	HEVC-030-40250-R.020
	1/4	**.030**	1/2	2-1/2	4	**84291**	HEVC-020-40250-R.030
	1/4	**.030**	3/4	2-1/2	4	**84292**	HEVC-030-40250-R.030
3/8	3/8	**.020**	1/2	2	4	**84293**	HEVC-013-40375-R.020
	3/8	**.020**	1	3	4	**84294**	HEVC-026-40375-R.020
	3/8	**.030**	1/2	2	4	**84295**	HEVC-013-40375-R.030
	3/8	**.030**	1	3	4	**84296**	HEVC-026-40375-R.030
1/2	1/2	**.030**	1	3	4	**84297**	HEVC-020-40500-R.030
	1/2	**.030**	1-1/4	3	4	**84298**	HEVC-025-40500-R.030
	1/2	**.030**	1-5/8	4	4	**84299**	HEVC-032-40500-R.030
	1/2	**.060**	1	3	4	**84300**	HEVC-020-40500-R.060
	1/2	**.060**	1-1/4	3	4	**84301**	HEVC-025-40500-R.060
	1/2	**.060**	1-5/8	4	4	**84302**	HEVC-032-40500-R.060
3/4	3/4	**.030**	1-5/8	4	4	**84303**	HEVC-021-40750-R.030
	3/4	**.030**	2-1/4	5	4	**84304**	HEVC-030-40750-R.030

* .0005 max TIR

Speeds & Feeds on Page 193

HEVC-4

SPEEDS & FEEDS

4 Flute - Corner Radius - Coolant Through - Variable Pitch

HEVC-4

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	.0007	.0013	.0017	.0011	.0019	.0019	.0014	.0025	.0022	.0021	.0037	.0025	.0028	.0049	.0029	.0040	.0070	.0034	.0050	.0089	.0042
		75 - 98 HRB	445	.0005	.0009	.0014	.0008	.0014	.0016	.0010	.0018	.0018	.0016	.0027	.0021	.0020	.0036	.0025	.0029	.0051	.0029	.0037	.0065	.0036
		21 - 36 HRC	400	.0003	.0006	.0012	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0018	.0017	.0013	.0023	.0020	.0019	.0033	.0024	.0024	.0042	.0029
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0005	.0008	.0014	.0007	.0012	.0015	.0009	.0016	.0017	.0013	.0024	.0020	.0017	.0031	.0023	.0025	.0044	.0027	.0032	.0056	.0033
		21 - 36 HRC	340	.0003	.0006	.0012	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0018	.0017	.0013	.0023	.0020	.0019	.0033	.0024	.0024	.0042	.0029
		36 - 50 HRC	260	.0003	.0005	.0011	.0005	.0008	.0012	.0006	.0010	.0014	.0009	.0015	.0016	.0011	.0020	.0019	.0016	.0029	.0022	.0021	.0036	.0027
		> 50 HRC	155	.0002	.0004	.0010	.0004	.0006	.0011	.0005	.0008	.0012	.0007	.0012	.0014	.0009	.0016	.0017	.0013	.0023	.0020	.0016	.0029	.0024
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0005	.0008	.0014	.0007	.0012	.0015	.0009	.0016	.0017	.0013	.0024	.0020	.0017	.0031	.0023	.0025	.0044	.0027	.0032	.0056	.0033
		21 - 36 HRC	250	.0004	.0006	.0012	.0005	.0009	.0013	.0007	.0013	.0015	.0011	.0019	.0017	.0014	.0025	.0020	.0020	.0035	.0024	.0025	.0045	.0029
		36 - 50 HRC	145	.0003	.0005	.0011	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0015	.0015	.0011	.0019	.0018	.0016	.0028	.0022	.0020	.0035	.0026
		> 50 HRC	85	.0002	.0004	.0010	.0003	.0006	.0011	.0005	.0008	.0012	.0007	.0012	.0014	.0009	.0016	.0016	.0013	.0022	.0019	.0016	.0029	.0023
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0006	.0011	.0015	.0009	.0015	.0017	.0012	.0021	.0020	.0018	.0031	.0023	.0023	.0040	.0026	.0033	.0058	.0032	.0042	.0074	.0038
		75 - 98 HRB	255	.0004	.0007	.0013	.0006	.0011	.0014	.0008	.0014	.0016	.0012	.0021	.0019	.0016	.0028	.0022	.0023	.0040	.0026	.0029	.0051	.0031
		21 - 36 HRC	175	.0004	.0007	.0012	.0006	.0010	.0013	.0007	.0013	.0015	.0011	.0019	.0018	.0014	.0025	.0021	.0020	.0036	.0025	.0026	.0046	.0030
		36 - 50 HRC	150	.0003	.0006	.0011	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0017	.0017	.0013	.0022	.0019	.0018	.0032	.0023	.0023	.0041	.0028
		> 50 HRC	55	.0002	.0004	.0009	.0003	.0005	.0010	.0004	.0007	.0011	.0006	.0010	.0013	.0008	.0014	.0015	.0011	.0020	.0018	.0014	.0025	.0022
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0004	.0008	.0013	.0007	.0012	.0015	.0009	.0016	.0017	.0013	.0023	.0019	.0017	.0030	.0023	.0024	.0043	.0027	.0031	.0055	.0033
		21 - 36 HRC	225	.0004	.0007	.0013	.0006	.0010	.0014	.0008	.0014	.0016	.0012	.0021	.0018	.0015	.0027	.0021	.0022	.0039	.0026	.0028	.0049	.0031
		36 - 50 HRC	180	.0003	.0006	.0011	.0005	.0008	.0012	.0006	.0011	.0014	.0009	.0017	.0017	.0012	.0022	.0019	.0018	.0031	.0023	.0023	.0040	.0028
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0005	.0008	.0013	.0007	.0012	.0015	.0009	.0016	.0017	.0013	.0024	.0020	.0018	.0031	.0023	.0025	.0044	.0027	.0032	.0057	.0033
		21 - 36 HRC	280	.0004	.0007	.0013	.0006	.0010	.0014	.0008	.0014	.0016	.0012	.0021	.0018	.0015	.0027	.0021	.0022	.0039	.0025	.0028	.0049	.0031
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0003	.0006	.0011	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0017	.0017	.0013	.0023	.0020	.0018	.0033	.0023	.0024	.0041	.0028
		36 - 50 HRC	145	.0003	.0005	.0011	.0004	.0008	.0012	.0006	.0010	.0014	.0009	.0015	.0016	.0011	.0020	.0018	.0016	.0028	.0022	.0020	.0036	.0027
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0007	.0013	.0017	.0011	.0019	.0019	.0015	.0026	.0022	.0022	.0038	.0025	.0028	.0050	.0029	.0041	.0072	.0035	.0052	.0091	.0043
		21 - 36 HRC	370	.0004	.0007	.0013	.0006	.0010	.0014	.0008	.0014	.0016	.0012	.0021	.0018	.0015	.0027	.0022	.0022	.0039	.0026	.0028	.0050	.0031
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0005	.0008	.0014	.0007	.0012	.0015	.0009	.0016	.0017	.0014	.0024	.0020	.0018	.0032	.0023	.0026	.0045	.0028	.0033	.0058	.0034
		21 - 36 HRC	335	.0004	.0007	.0013	.0006	.0010	.0014	.0008	.0014	.0016	.0012	.0021	.0019	.0016	.0027	.0022	.0022	.0039	.0026	.0028	.0050	.0031
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0005	.0009	.0014	.0007	.0013	.0015	.0010	.0017	.0018	.0014	.0025	.0020	.0019	.0033	.0024	.0027	.0047	.0028	.0034	.0060	.0034
		21 - 36 HRC	260	.0003	.0006	.0011	.0005	.0008	.0013	.0006	.0011	.0014	.0010	.0017	.0017	.0012	.0022	.0019	.0018	.0031	.0023	.0023	.0040	.0028
		36 - 50 HRC	135	.0002	.0004	.0009	.0003	.0005	.0010	.0004	.0007	.0011	.0006	.0011	.0013	.0008	.0014	.0015	.0011	.0020	.0018	.0014	.0025	.0022
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0006	.0011	.0016	.0009	.0016	.0018	.0012	.0022	.0020	.0018	.0032	.0023	.0024	.0042	.0027	.0035	.0061	.0032	.0044	.0077	.0039
		75 - 98 HRB	250	.0005	.0009	.0014	.0008	.0014	.0016	.0010	.0018	.0018	.0015	.0027	.0021	.0020	.0036	.0025	.0029	.0051	.0029	.0037	.0065	.0036
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0003	.0006	.0011	.0005	.0008	.0013	.0006	.0011	.0014	.0009	.0017	.0017	.0012	.0022	.0019	.0018	.0031	.0023	.0022	.0039	.0028
		21 - 36 HRC	75	.0003	.0005	.0011	.0005	.0008	.0012	.0006	.0011	.0014	.0009	.0016	.0016	.0012	.0021	.0019	.0017	.0030	.0023	.0021	.0038	.0027
		36 - 50 HRC	70	.0003	.0005	.0010	.0004	.0007	.0011	.0005	.0009	.0013	.0008	.0014	.0015	.0010	.0018	.0017	.0014	.0025	.0021	.0018	.0032	.0025
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	.0019	.0013	.0022	.0021	.0017	.0030	.0024	.0025	.0045	.0027	.0033	.0059	.0032	.0048	.0084	.0038	.0061	.0107	.0046
		75 - 98 HRB	275	.0007	.0013	.0017	.0011	.0019	.0019	.0014	.0025	.0022	.0021	.0038	.0025	.0028	.0049	.0029	.0040	.0070	.0035	.0051	.0090	.0042
		21 - 36 HRC	250	.0006	.0010	.0015	.0008	.0014	.0017	.0011	.0019	.0019	.0016	.0028	.0022	.0021	.0037	.0025	.0030	.0053	.0030	.0038	.0067	.0036
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0004	.0008	.0013	.0006	.0011	.0015	.0009	.0015	.0017	.0013	.0022	.0019	.0016	.0029	.0022	.0024	.0042	.0027	.0030	.0053	.0032
		36 - 50 HRC	160	.0004	.0007	.0012	.0006	.0010	.0014	.0008	.0014	.0016	.0011	.0020	.0018	.0015	.0026	.0021	.0022	.0038	.0025	.0027	.0048	.0031
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0004	.0006	.0012	.0006	.0009	.0014	.0007	.0013	.0015	.0011	.0019	.0018	.0014	.0025	.0021	.0020	.0035	.0024	.0025	.0045	.0030
		21 - 36 HRC	170	.0004	.0006	.0012	.0005	.0009	.0013	.0007	.0012	.0015	.0010	.0018	.0017	.0013	.0024	.0020	.0019	.0034	.0024	.0025	.0043	.0029
		36 - 50 HRC	65	.0002	.0004	.0010	.0004	.0006	.0011	.0005	.0008	.0012	.0007	.0012	.0014	.0009	.0016	.0017	.0013	.0023	.0020	.0017	.0029	.0024

MILLING PROCESS	HARDNESS	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	75%-125% Diameter	100% Diameter
	≥ 35 HRC	60%-100% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	25%-35% 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. For more accurate running parameters, please refer to Machining Advisor Pro.

5 FLUTE - SQUARE

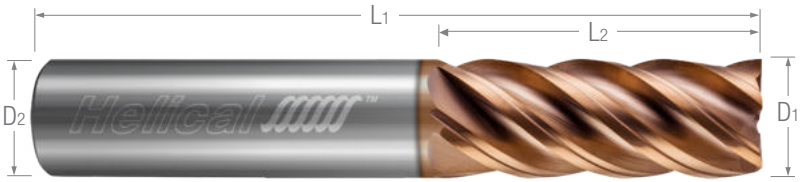
New Items!

Variable Pitch

HEV-5 / HSM-5

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 123 for A*plus* coating



HSM series feature enlarged shanks for added strength

Cutter Diameter* D_1 $^{+.0005"}_{-.0005"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.010"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
1/32	1/4	3/32	2-1/2	5	84081		HSM-030-50031
	1/4	5/32	2-1/2	5	84082		HSM-050-50031
3/64	1/4	5/32	2-1/2	5	84083		HSM-033-50047
	1/4	1/4	2-1/2	5	84084		HSM-053-50047
1/16	1/4	3/16	2-1/2	5	84085		HSM-030-50062
	1/4	5/16	2-1/2	5	84086		HSM-050-50062
5/64	1/4	1/4	2-1/2	5	84087		HSM-032-50078
	1/4	3/8	2-1/2	5	84088		HSM-048-50078
3/32	1/4	9/32	2-1/2	5	84089		HSM-030-50093
	1/4	1/2	2-1/2	5	84090		HSM-053-50093

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description	
1/8	1/8	1/4	1-1/2	5	59833		HEV-S-50125	
	1/4	1/4	2-1/2	5	84091		HSM-020-50125	
	1/8	3/8	2	5	82525		HEV-SR-50125	
	1/4	3/8	2-1/2	5	84092		HSM-030-50125	
	1/8	1/2	2-1/2	5	81840		HEV-R-50125	
	1/4	1/2	2-1/2	5	84093		HSM-040-50125	
	1/8	5/8	2-1/2	5	82526		HEV-A-50125	
	1/8	3/4	2-1/2	5	82949		HEV-M-50125	
	1/8	1	2-1/2	5	87496		HEV-LX-50125	new
5/32	3/16	3/16	2	5	82950		HEV-S-50156	
	3/16	5/16	2	5	84633		HEV-SR-50156	
	3/16	7/16	2-1/2	5	82951		HEV-R-50156	
	3/16	9/16	2-1/2	5	82952		HEV-M-50156	
3/16	3/16	5/16	2	5	59834		HEV-S-50187	
	1/4	5/16	2-1/2	5	84094		HSM-016-50187	
	3/16	7/16	2	5	82527		HEV-SR-50187	
	1/4	7/16	2-1/2	5	84095		HSM-023-50187	
	3/16	9/16	2-1/2	5	59835		HEV-R-50187	
	1/4	9/16	2-1/2	5	84096		HSM-029-50187	
	3/16	3/4	2-1/2	5	81841		HEV-M-50187	
	1/4	3/4	2-1/2	5	84097		HSM-040-50187	
	3/16	1	2-1/2	5	82953		HEV-ML-50187	

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 138

HEV-5 / HSM-5

New Items!

5 FLUTE - SQUARE
Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* $D1^{+.000"}_{-.002"}$	Shank Diameter $D2$ (h6)	Length of Cut $L2^{+.032"}_{-.000"}$	Overall Length $L1^{+.062"}_{-.062"}$	Flutes	Tplus Coated	Tplus Coated + Weldon Flat	Tool Description
	7/32	1/4	5/16	2	5	82954		HEV-S-50218
		1/4	7/16	2-1/2	5	82955		HEV-R-50218
	1/4	1/4	3/8	2	5	59836		HEV-S-50250
		1/4	1/2	2-1/2	5	59837		HEV-SR-50250
		1/4	3/4	2-1/2	5	59838		HEV-R-50250
		1/4	1	3	5	81842		HEV-M-50250
		1/4	1-1/4	3	5	82528		HEV-L-50250
		1/4	1-1/2	3	5	82956		HEV-LX-50250
new		1/4	1-3/4	4	5	87497		HEV-X-50250
	5/16	5/16	7/16	2	5	59839		HEV-S-50312
		5/16	13/16	2-1/2	5	59840		HEV-R-50312
		5/16	1	3	5	59841		HEV-M-50312
new		5/16	1-1/4	3	5	87498		HEV-L-50312
	3/8	3/8	1/2	2	5	59842	59842W	HEV-S-50375
		3/8	3/4	2-1/2	5	82529		HEV-SR-50375
		3/8	1	3	5	59843	59843W	HEV-R-50375
		3/8	1-1/4	3	5	59844		HEV-M-50375
		3/8	1-1/2	3-1/2	5	81843		HEV-L-50375
new		3/8	2	4	5	87499		HEV-LX-50375
	1/2	1/2	5/8	2-1/2	5	59845	59845W	HEV-S-50500
		1/2	1	3	5	59846	59846W	HEV-SR-50500
		1/2	1-1/4	3	5	59847	59847W	HEV-R-50500
		1/2	1-5/8	4	5	59848		HEV-M-50500
		1/2	2	4	5	81844		HEV-L-50500
		1/2	2-1/2	5	5	84634		HEV-LX-50500
		1/2	3-1/8	6	5	84635		HEV-X-50500
	5/8	5/8	3/4	3	5	59849	59849W	HEV-S-50625
		5/8	1-1/4	3-1/2	5	59850		HEV-SR-50625
		5/8	1-5/8	3-1/2	5	59851	59851W	HEV-R-50625
		5/8	2-1/8	4	5	81845		HEV-M-50625
		5/8	2-1/2	5	5	81846		HEV-L-50625
	3/4	3/4	1	3	5	59852		HEV-S-50750
		3/4	1-5/8	4	5	59853	59853W	HEV-R-50750
		3/4	2-1/4	5	5	59854	59854W	HEV-M-50750
		3/4	2-3/4	5	5	81847		HEV-L-50750
		3/4	3-1/4	6	5	82957		HEV-LX-50750
	1	1	2	4-1/2	5	81848		HEV-R-51000
		1	2-5/8	5	5	81849		HEV-M-51000

* .0005 max TIR

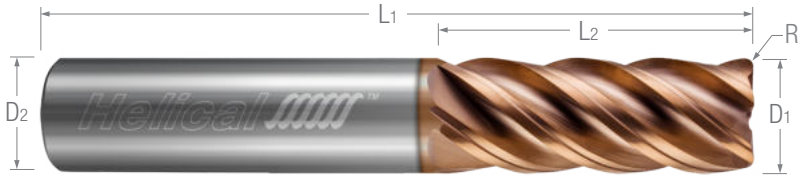
5 FLUTE - CORNER RADIUS New Items!

Variable Pitch

HEV-5 / HSM-5

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 126 for A*plus* coating




HSM series feature enlarged shanks for added strength

Cutter Dia.* D_1 $^{+.0005"}_{-.0005"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.001"}_{-.001"}$	LOC L_2 $^{+.010"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
1/32	1/4	.005	3/32	2-1/2	5	84057		HSM-030-50031-R.005
	1/4	.005	5/32	2-1/2	5	84058		HSM-050-50031-R.005
3/64	1/4	.010	5/32	2-1/2	5	84059		HSM-033-50047-R.010
	1/4	.010	1/4	2-1/2	5	84060		HSM-053-50047-R.010
1/16	1/4	.010	3/16	2-1/2	5	84061		HSM-030-50062-R.010
	1/4	.010	5/16	2-1/2	5	84062		HSM-050-50062-R.010
5/64	1/4	.010	1/4	2-1/2	5	84063		HSM-032-50078-R.010
	1/4	.010	3/8	2-1/2	5	84064		HSM-048-50078-R.010
3/32	1/4	.010	9/32	2-1/2	5	84065		HSM-030-50093-R.010
	1/4	.010	1/2	2-1/2	5	84066		HSM-053-50093-R.010

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description	
1/8	1/8	.010	1/4	1-1/2	5	59855		HEV-S-50125-R.010	
	1/4	.010	1/4	2-1/2	5	84067		HSM-020-50125-R.010	
	1/8	.010	3/8	2	5	82970		HEV-SR-50125-R.010	
	1/4	.010	3/8	2-1/2	5	84068		HSM-030-50125-R.010	
	1/8	.010	1/2	2-1/2	5	81850		HEV-R-50125-R.010	
	1/4	.010	1/2	2-1/2	5	84069		HSM-040-50125-R.010	
	1/8	.010	5/8	2-1/2	5	84669		HEV-A-50125-R.010	
	1/8	.010	3/4	2-1/2	5	82971		HEV-M-50125-R.010	
	1/8	.015	1/4	1-1/2	5	82972		HEV-S-50125-R.015	
	1/8	.015	3/8	2	5	84670		HEV-SR-50125-R.015	
	1/8	.015	1/2	2-1/2	5	82973		HEV-R-50125-R.015	
	1/8	.015	5/8	2-1/2	5	87500		HEV-A-50125-R.015	new
	1/8	.015	3/4	2-1/2	5	87501		HEV-M-50125-R.015	new
	1/8	.020	1/4	1-1/2	5	87502		HEV-S-50125-R.020	new
	1/8	.020	3/8	2	5	87503		HEV-SR-50125-R.020	new
	1/8	.020	1/2	2-1/2	5	87504		HEV-R-50125-R.020	new
	1/8	.020	5/8	2-1/2	5	87505		HEV-A-50125-R.020	new

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 138

HEV-5 / HSM-5

New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	Tplus Coated	Tplus Coated + Weldon Flat	Tool Description
1/8	1/8	.030	1/4	1-1/2	5	81851		HEV-S-50125-R.030
	1/4	.030	1/4	2-1/2	5	84074		HSM-020-50125-R.030
	1/8	.030	3/8	2	5	84671		HEV-SR-50125-R.030
	1/4	.030	3/8	2-1/2	5	84075		HSM-030-50125-R.030
	1/8	.030	1/2	2-1/2	5	81852		HEV-R-50125-R.030
	1/4	.030	1/2	2-1/2	5	84076		HSM-040-50125-R.030
	1/8	.030	5/8	2-1/2	5	84672		HEV-A-50125-R.030
	1/8	.030	3/4	2-1/2	5	82974		HEV-M-50125-R.030
3/16	3/16	.010	5/16	2	5	59856		HEV-S-50187-R.010
	1/4	.010	5/16	2-1/2	5	84070		HSM-016-50187-R.010
	3/16	.010	7/16	2	5	82975		HEV-SR-50187-R.010
	1/4	.010	7/16	2-1/2	5	84071		HSM-023-50187-R.010
	3/16	.010	9/16	2-1/2	5	59857		HEV-R-50187-R.010
	1/4	.010	9/16	2-1/2	5	84072		HSM-029-50187-R.010
	3/16	.010	3/4	2-1/2	5	81853		HEV-M-50187-R.010
	1/4	.010	3/4	2-1/2	5	84073		HSM-040-50187-R.010
	3/16	.010	1	2-1/2	5	84673		HEV-ML-50187-R.010
	3/16	.015	5/16	2	5	82976		HEV-S-50187-R.015
	3/16	.015	9/16	2-1/2	5	82977		HEV-R-50187-R.015
	3/16	.030	5/16	2	5	81854		HEV-S-50187-R.030
	1/4	.030	5/16	2-1/2	5	84077		HSM-016-50187-R.030
	3/16	.030	7/16	2	5	84674		HEV-SR-50187-R.030
	1/4	.030	7/16	2-1/2	5	84078		HSM-023-50187-R.030
	3/16	.030	9/16	2-1/2	5	81855		HEV-R-50187-R.030
	1/4	.030	9/16	2-1/2	5	84079		HSM-029-50187-R.030
	3/16	.030	3/4	2-1/2	5	81856		HEV-M-50187-R.030
	1/4	.030	3/4	2-1/2	5	84080		HSM-040-50187-R.030
	3/16	.030	1	2-1/2	5	84675		HEV-ML-50187-R.030
1/4	1/4	.010	3/8	2	5	82978		HEV-S-50250-R.010
	1/4	.010	1/2	2-1/2	5	82979		HEV-SR-50250-R.010
	1/4	.010	3/4	2-1/2	5	82980		HEV-R-50250-R.010
new	1/4	.010	1	3	5	87506		HEV-M-50250-R.010
new	1/4	.010	1-1/4	3	5	87507		HEV-L-50250-R.010
	1/4	.015	3/8	2	5	82981		HEV-S-50250-R.015
	1/4	.015	1/2	2-1/2	5	82982		HEV-SR-50250-R.015
	1/4	.015	3/4	2-1/2	5	82983		HEV-R-50250-R.015
new	1/4	.015	1	3	5	87508		HEV-M-50250-R.015
new	1/4	.015	1-1/4	3	5	87509		HEV-L-50250-R.015
	1/4	.020	3/8	2	5	59858		HEV-S-50250-R.020
	1/4	.020	1/2	2-1/2	5	59859		HEV-SR-50250-R.020
	1/4	.020	3/4	2-1/2	5	59860		HEV-R-50250-R.020
	1/4	.020	1	3	5	81857		HEV-M-50250-R.020
	1/4	.020	1-1/4	3	5	82984		HEV-L-50250-R.020
	1/4	.030	3/8	2	5	59861		HEV-S-50250-R.030
	1/4	.030	1/2	2-1/2	5	59862		HEV-SR-50250-R.030
	1/4	.030	3/4	2-1/2	5	59863		HEV-R-50250-R.030
	1/4	.030	1	3	5	81858		HEV-M-50250-R.030
	1/4	.030	1-1/4	3	5	82985		HEV-L-50250-R.030
	1/4	.060	3/8	2	5	81859		HEV-S-50250-R.060
	1/4	.060	1/2	2-1/2	5	81860		HEV-SR-50250-R.060
	1/4	.060	3/4	2-1/2	5	81861		HEV-R-50250-R.060
	1/4	.060	1	3	5	81862		HEV-M-50250-R.060
	1/4	.060	1-1/4	3	5	82986		HEV-L-50250-R.060

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS New Items!

Variable Pitch (cont.)

HEV-5 / HSM-5

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description	
5/16	5/16	.010	7/16	2	5	84676		HEV-S-50312-R.010	
	5/16	.010	13/16	2-1/2	5	84677		HEV-R-50312-R.010	
	5/16	.010	1-1/4	3	5	87510		HEV-M-50312-R.010	new
	5/16	.020	7/16	2	5	59864		HEV-S-50312-R.020	
	5/16	.020	13/16	2-1/2	5	59865		HEV-R-50312-R.020	
	5/16	.020	1	3	5	81863		HEV-M-50312-R.020	
	5/16	.030	7/16	2	5	82987		HEV-S-50312-R.030	
	5/16	.030	13/16	2-1/2	5	82988		HEV-R-50312-R.030	
	5/16	.030	1	3	5	82989		HEV-M-50312-R.030	
3/8	3/8	.010	1/2	2	5	82990		HEV-S-50375-R.010	
	3/8	.010	3/4	2-1/2	5	84678		HEV-SR-50375-R.010	
	3/8	.010	1	3	5	82991		HEV-R-50375-R.010	
	3/8	.010	1-1/4	3	5	87511		HEV-M-50375-R.010	new
	3/8	.015	1	3	5	82992		HEV-R-50375-R.015	
	3/8	.015	1-1/4	3	5	87512		HEV-M-50375-R.015	new
	3/8	.020	1/2	2	5	59866	59866W	HEV-S-50375-R.020	
	3/8	.020	3/4	2-1/2	5	84679		HEV-SR-50375-R.020	
	3/8	.020	1	3	5	59867	59867W	HEV-R-50375-R.020	
	3/8	.020	1-1/4	3	5	59868		HEV-M-50375-R.020	
	3/8	.020	1-1/2	3-1/2	5	81864		HEV-L-50375-R.020	
	3/8	.030	1/2	2	5	59869	59869W	HEV-S-50375-R.030	
	3/8	.030	3/4	2-1/2	5	82993		HEV-SR-50375-R.030	
	3/8	.030	1	3	5	59870	59870W	HEV-R-50375-R.030	
	3/8	.030	1-1/4	3	5	59871		HEV-M-50375-R.030	
	3/8	.030	1-1/2	3-1/2	5	81865	81865W	HEV-L-50375-R.030	
	3/8	.030	2	4	5	84680		HEV-LX-50375-R.030	
	3/8	.060	1/2	2	5	59872		HEV-S-50375-R.060	
	3/8	.060	3/4	2-1/2	5	82994		HEV-SR-50375-R.060	
	3/8	.060	1	3	5	59873		HEV-R-50375-R.060	
	3/8	.060	1-1/4	3	5	59874		HEV-M-50375-R.060	
	3/8	.060	1-1/2	3-1/2	5	81866		HEV-L-50375-R.060	
	3/8	.090	1/2	2	5	82995		HEV-S-50375-R.090	
	3/8	.090	1	3	5	82996		HEV-R-50375-R.090	
	3/8	.090	1-1/4	3	5	87513		HEV-M-50375-R.090	new
1/2	1/2	.010	5/8	2-1/2	5	82997		HEV-S-50500-R.010	
	1/2	.010	1	3	5	82998		HEV-SR-50500-R.010	
	1/2	.010	1-1/4	3	5	82999		HEV-R-50500-R.010	
	1/2	.010	1-5/8	4	5	87514		HEV-M-50500-R.010	new
	1/2	.010	2	4	5	87515		HEV-L-50500-R.010	new
	1/2	.015	5/8	2-1/2	5	83000		HEV-S-50500-R.015	
	1/2	.015	1	3	5	83001		HEV-SR-50500-R.015	
	1/2	.015	1-1/4	3	5	83002		HEV-R-50500-R.015	
	1/2	.015	1-5/8	4	5	87516		HEV-M-50500-R.015	new
	1/2	.015	2	4	5	87517		HEV-L-50500-R.015	new
	1/2	.020	5/8	2-1/2	5	83003		HEV-S-50500-R.020	
	1/2	.020	1	3	5	83004		HEV-SR-50500-R.020	
	1/2	.020	1-1/4	3	5	83005		HEV-R-50500-R.020	
	1/2	.020	1-5/8	4	5	87518		HEV-M-50500-R.020	new
	1/2	.020	2	4	5	87519		HEV-L-50500-R.020	new

*.0005 max TIR

continued on next page

HEV-5 / HSM-5

New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
	1/2	1/2	**.030**	5/8	2-1/2	5	**59875**	**59875W**	HEV-S-50500-R.030
		1/2	**.030**	1	3	5	**59876**	**59876W**	HEV-SR-50500-R.030
		1/2	**.030**	1-1/4	3	5	**59877**	**59877W**	HEV-R-50500-R.030
		1/2	**.030**	1-5/8	4	5	**59878**	**59878W**	HEV-M-50500-R.030
		1/2	**.030**	2	4	5	**81867**		HEV-L-50500-R.030
		1/2	**.030**	2-1/2	5	5	**83006**		HEV-LX-50500-R.030
		1/2	**.060**	5/8	2-1/2	5	**59879**	**59879W**	HEV-S-50500-R.060
		1/2	**.060**	1	3	5	**59880**	**59880W**	HEV-SR-50500-R.060
		1/2	**.060**	1-1/4	3	5	**59881**	**59881W**	HEV-R-50500-R.060
		1/2	**.060**	1-5/8	4	5	**59882**	**59882W**	HEV-M-50500-R.060
		1/2	**.060**	2	4	5	**81868**		HEV-L-50500-R.060
		1/2	**.090**	5/8	2-1/2	5	**81869**		HEV-S-50500-R.090
		1/2	**.090**	1	3	5	**81870**		HEV-SR-50500-R.090
		1/2	**.090**	1-1/4	3	5	**81871**		HEV-R-50500-R.090
		1/2	**.090**	1-5/8	4	5	**81872**		HEV-M-50500-R.090
		1/2	**.090**	2	4	5	**81873**		HEV-L-50500-R.090
		1/2	**.120**	5/8	2-1/2	5	**59883**		HEV-S-50500-R.120
		1/2	**.120**	1	3	5	**59884**		HEV-SR-50500-R.120
		1/2	**.120**	1-1/4	3	5	**59885**		HEV-R-50500-R.120
		1/2	**.120**	1-5/8	4	5	**59886**		HEV-M-50500-R.120
		1/2	**.120**	2	4	5	**81874**		HEV-L-50500-R.120
		1/2	**.120**	2-1/2	5	5	**84681**		HEV-LX-50500-R.120
new		1/2	**.125**	5/8	2-1/2	5	**87520**		HEV-S-50500-R.125
new		1/2	**.125**	1	3	5	**87521**		HEV-SR-50500-R.125
new		1/2	**.125**	1-1/4	3	5	**87522**		HEV-R-50500-R.125
new		1/2	**.125**	1-5/8	4	5	**87523**		HEV-M-50500-R.125
new		1/2	**.125**	2	4	5	**87524**		HEV-L-50500-R.125
new	5/8	5/8	**.015**	3/4	3	5	**87525**		HEV-S-50625-R.015
new		5/8	**.015**	1-1/4	3-1/2	5	**87526**		HEV-SR-50625-R.015
new		5/8	**.015**	1-5/8	3-1/2	5	**87527**		HEV-R-50625-R.015
new		5/8	**.015**	2-1/8	4	5	**87528**		HEV-M-50625-R.015
		5/8	**.030**	3/4	3	5	**59887**	**59887W**	HEV-S-50625-R.030
		5/8	**.030**	1-1/4	3-1/2	5	**59888**		HEV-SR-50625-R.030
		5/8	**.030**	1-5/8	3-1/2	5	**59889**	**59889W**	HEV-R-50625-R.030
		5/8	**.030**	2-1/8	4	5	**81875**		HEV-M-50625-R.030
		5/8	**.030**	2-1/2	5	5	**81876**		HEV-L-50625-R.030
		5/8	**.060**	1-1/4	3-1/2	5	**81877**		HEV-SR-50625-R.060
		5/8	**.060**	1-5/8	3-1/2	5	**81878**		HEV-R-50625-R.060
		5/8	**.060**	2-1/8	4	5	**81879**		HEV-M-50625-R.060
		5/8	**.120**	1-5/8	3-1/2	5	**83007**		HEV-R-50625-R.120
		5/8	**.120**	2-1/8	4	5	**83008**		HEV-M-50625-R.120
new	3/4	3/4	**.015**	1	3	5	**87529**		HEV-S-50750-R.015
new		3/4	**.015**	1-1/4	4	5	**87530**		HEV-SR-50750-R.015
new		3/4	**.015**	1-5/8	4	5	**87531**		HEV-R-50750-R.015
new		3/4	**.015**	2-1/4	5	5	**87532**		HEV-M-50750-R.015

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS New Items!

Variable Pitch (cont.)

HEV-5 / HSM-5

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	T*plus* Coated	T*plus* Coated + Weldon Flat	Tool Description
3/4	3/4	**.030**	1	3	5	**59890**	**59890W**	HEV-S-50750-R.030
	3/4	**.030**	1-1/4	4	5	**83009**		HEV-SR-50750-R.030
	3/4	**.030**	1-5/8	4	5	**59891**	**59891W**	HEV-R-50750-R.030
	3/4	**.030**	2-1/4	5	5	**59892**	**59892W**	HEV-M-50750-R.030
	3/4	**.030**	2-3/4	5	5	**81880**		HEV-L-50750-R.030
	3/4	**.030**	3-1/4	6	5	**83010**		HEV-LX-50750-R.030
	3/4	**.060**	1	3	5	**59893**		HEV-S-50750-R.060
	3/4	**.060**	1-1/4	4	5	**83011**		HEV-SR-50750-R.060
	3/4	**.060**	1-5/8	4	5	**59894**		HEV-R-50750-R.060
	3/4	**.060**	2-1/4	5	5	**59895**		HEV-M-50750-R.060
	3/4	**.060**	2-3/4	5	5	**83012**		HEV-L-50750-R.060
	3/4	**.060**	3-1/4	6	5	**83013**		HEV-LX-50750-R.060
	3/4	**.090**	1-5/8	4	5	**81881**		HEV-R-50750-R.090
	3/4	**.090**	2-1/4	5	5	**84682**		HEV-M-50750-R.090
	3/4	**.120**	1	3	5	**59896**		HEV-S-50750-R.120
	3/4	**.120**	1-5/8	4	5	**59897**		HEV-R-50750-R.120
	3/4	**.120**	2-1/4	5	5	**59898**		HEV-M-50750-R.120
	3/4	**.190**	1-5/8	4	5	**81882**		HEV-R-50750-R.190
	3/4	**.190**	2-1/4	5	5	**84683**		HEV-M-50750-R.190
	3/4	**.250**	1-5/8	4	5	**81883**		HEV-R-50750-R.250
	3/4	**.250**	2-1/4	5	5	**84684**		HEV-M-50750-R.250
1	1	**.030**	1-1/4	4	5	**59899**		HEV-S-51000-R.030
	1	**.030**	2	4-1/2	5	**59900**		HEV-R-51000-R.030
	1	**.030**	2-5/8	5	5	**59901**		HEV-M-51000-R.030
	1	**.030**	3-1/4	6	5	**81884**		HEV-L-51000-R.030
	1	**.060**	1-1/4	4	5	**81885**		HEV-S-51000-R.060
	1	**.060**	2	4-1/2	5	**81886**		HEV-R-51000-R.060
	1	**.060**	2-5/8	5	5	**81887**		HEV-M-51000-R.060
	1	**.120**	1-1/4	4	5	**81888**		HEV-S-51000-R.120
	1	**.120**	2	4-1/2	5	**81889**		HEV-R-51000-R.120
	1	**.120**	2-5/8	5	5	**81890**		HEV-M-51000-R.120
	1	**.250**	1-1/4	4	5	**81891**		HEV-S-51000-R.250
	1	**.250**	2	4-1/2	5	**81892**		HEV-R-51000-R.250
	1	**.250**	2-5/8	5	5	**81893**		HEV-M-51000-R.250

*.0005 max TIR

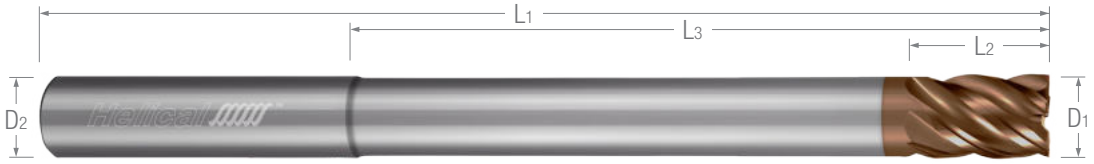
HEV-RN-5

New!

5 FLUTE - SQUARE
Variable Pitch - Reduced Neck

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 133 for A*plus* coating



	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description
new	1/8	1/8	5/32	2	3/8	.118	5	86798	HEV-RN-S-50125
new		1/8	5/32	2	1/2	.118	5	86799	HEV-RN-R-50125
new		1/8	5/32	2-1/2	3/4	.118	5	86800	HEV-RN-M-50125
new		1/8	5/32	2-1/2	1	.118	5	86801	HEV-RN-L-50125
new	3/16	3/16	7/32	2	1/2	.178	5	86802	HEV-RN-R-50187
new		3/16	7/32	2-1/2	3/4	.178	5	86803	HEV-RN-M-50187
new		3/16	7/32	2-1/2	1-1/8	.178	5	86804	HEV-RN-L-50187
new	1/4	1/4	3/8	4	3/4	.237	5	86805	HEV-RN-S-50250
new		1/4	3/8	4	1-1/8	.237	5	86806	HEV-RN-R-50250
new		1/4	3/8	4	1-5/8	.237	5	86807	HEV-RN-A-50250
new		1/4	3/8	4	2-1/8	.237	5	86808	HEV-RN-M-50250
new		1/4	3/8	4	2-1/2	.237	5	86809	HEV-RN-ML-50250
new	3/8	3/8	1/2	4	1-1/8	.356	5	86810	HEV-RN-S-50375
new		3/8	1/2	4	1-5/8	.356	5	86811	HEV-RN-SR-50375
new		3/8	1/2	4	2-1/8	.356	5	86812	HEV-RN-R-50375
new		3/8	1/2	6	2-1/2	.356	5	86813	HEV-RN-A-50375
new		3/8	1/2	6	3-1/8	.356	5	86814	HEV-RN-M-50375
new	1/2	1/2	5/8	4	1-1/2	.475	5	86815	HEV-RN-S-50500
new		1/2	5/8	4	1-3/4	.475	5	86816	HEV-RN-SR-50500
new		1/2	5/8	4	2-1/4	.475	5	86817	HEV-RN-R-50500
new		1/2	5/8	5	2-3/4	.475	5	86818	HEV-RN-A-50500
new		1/2	5/8	6	3-3/8	.475	5	86819	HEV-RN-M-50500
new	3/4	3/4	1	4	2	.712	5	86820	HEV-RN-S-50750
new		3/4	1	6	2-1/2	.712	5	86821	HEV-RN-R-50750
new		3/4	1	6	2-7/8	.712	5	86822	HEV-RN-A-50750
new		3/4	1	6	3-3/8	.712	5	86823	HEV-RN-M-50750
new		3/4	1	6	4-1/8	.712	5	86824	HEV-RN-L-50750

* .0005 max TIR

Speeds & Feeds on Page 138

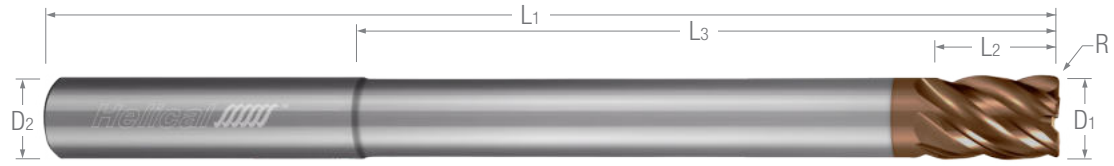
5 FLUTE - CORNER RADIUS New!

Variable Pitch - Reduced Neck

HEM **HEV-RN-5**

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 135 for A*plus* coating



Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description	
1/8	1/8	**.010**	5/32	2	3/8	.118	5	86748	HEV-RN-S-50125-R.010	new
	1/8	**.010**	5/32	2	1/2	.118	5	86749	HEV-RN-R-50125-R.010	new
	1/8	**.010**	5/32	2-1/2	3/4	.118	5	86750	HEV-RN-M-50125-R.010	new
	1/8	**.010**	5/32	2-1/2	1	.118	5	86751	HEV-RN-L-50125-R.010	new
3/16	3/16	**.010**	7/32	2	1/2	.178	5	86752	HEV-RN-R-50187-R.010	new
	3/16	**.010**	7/32	2-1/2	3/4	.178	5	86753	HEV-RN-M-50187-R.010	new
	3/16	**.010**	7/32	2-1/2	1-1/8	.178	5	86754	HEV-RN-L-50187-R.010	new
	3/16	**.010**	7/32	2-1/2	1-5/16	.178	5	86755	HEV-RN-LX-50187-R.010	new
	3/16	**.030**	7/32	2	1/2	.178	5	86756	HEV-RN-R-50187-R.030	new
	3/16	**.030**	7/32	2-1/2	3/4	.178	5	86757	HEV-RN-M-50187-R.030	new
	3/16	**.030**	7/32	2-1/2	1-1/8	.178	5	86758	HEV-RN-L-50187-R.030	new
	3/16	**.030**	7/32	2-1/2	1-5/16	.178	5	86759	HEV-RN-LX-50187-R.030	new
1/4	1/4	**.020**	3/8	4	3/4	.237	5	86760	HEV-RN-S-50250-R.020	new
	1/4	**.020**	3/8	4	1-1/8	.237	5	86761	HEV-RN-R-50250-R.020	new
	1/4	**.020**	3/8	4	1-5/8	.237	5	86762	HEV-RN-A-50250-R.020	new
	1/4	**.020**	3/8	4	2-1/8	.237	5	86763	HEV-RN-M-50250-R.020	new
	1/4	**.030**	3/8	4	3/4	.237	5	86764	HEV-RN-S-50250-R.030	new
	1/4	**.030**	3/8	4	1-1/8	.237	5	86765	HEV-RN-R-50250-R.030	new
	1/4	**.030**	3/8	4	1-5/8	.237	5	86766	HEV-RN-A-50250-R.030	new
	1/4	**.030**	3/8	4	2-1/8	.237	5	86767	HEV-RN-M-50250-R.030	new
3/8	3/8	**.020**	1/2	4	1-1/8	.356	5	86768	HEV-RN-S-50375-R.020	new
	3/8	**.020**	1/2	4	1-5/8	.356	5	86769	HEV-RN-SR-50375-R.020	new
	3/8	**.020**	1/2	4	2-1/8	.356	5	86770	HEV-RN-R-50375-R.020	new
	3/8	**.030**	1/2	4	1-1/8	.356	5	86771	HEV-RN-S-50375-R.030	new
	3/8	**.030**	1/2	4	1-5/8	.356	5	86772	HEV-RN-SR-50375-R.030	new
	3/8	**.030**	1/2	4	2-1/8	.356	5	86773	HEV-RN-R-50375-R.030	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 138

HEV-RN-5

New! **5 FLUTE - CORNER RADIUS**

Variable Pitch - Reduced Neck (cont.)

continued from previous page

	Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description
new	1/2	1/2	**.030**	5/8	4	1-1/2	.475	5	86774	HEV-RN-S-50500-R.030
new		1/2	**.030**	5/8	4	1-3/4	.475	5	86775	HEV-RN-SR-50500-R.030
new		1/2	**.030**	5/8	4	2-1/4	.475	5	86776	HEV-RN-R-50500-R.030
new		1/2	**.030**	5/8	5	2-3/4	.475	5	86777	HEV-RN-A-50500-R.030
new		1/2	**.030**	5/8	6	3-3/8	.475	5	86778	HEV-RN-M-50500-R.030
new		1/2	**.060**	5/8	4	1-1/2	.475	5	86779	HEV-RN-S-50500-R.060
new		1/2	**.060**	5/8	4	1-3/4	.475	5	86780	HEV-RN-SR-50500-R.060
new		1/2	**.060**	5/8	4	2-1/4	.475	5	86781	HEV-RN-R-50500-R.060
new		1/2	**.060**	5/8	5	2-3/4	.475	5	86782	HEV-RN-A-50500-R.060
new		1/2	**.060**	5/8	6	3-3/8	.475	5	86783	HEV-RN-M-50500-R.060
new	5/8	5/8	**.030**	3/4	4	1-5/8	.593	5	86784	HEV-RN-S-50625-R.030
new		5/8	**.030**	3/4	6	2-3/8	.593	5	86785	HEV-RN-R-50625-R.030
new		5/8	**.030**	3/4	6	3-3/8	.593	5	86786	HEV-RN-M-50625-R.030
new		5/8	**.030**	3/4	6	4-1/8	.593	5	86787	HEV-RN-L-50625-R.030
new	3/4	3/4	**.030**	1	4	2	.712	5	86788	HEV-RN-S-50750-R.030
new		3/4	**.030**	1	6	2-1/2	.712	5	86789	HEV-RN-R-50750-R.030
new		3/4	**.030**	1	6	2-7/8	.712	5	86790	HEV-RN-A-50750-R.030
new		3/4	**.030**	1	6	3-3/8	.712	5	86791	HEV-RN-M-50750-R.030
new		3/4	**.030**	1	6	4-1/8	.712	5	86792	HEV-RN-L-50750-R.030
new		3/4	**.120**	1	4	2	.712	5	86793	HEV-RN-S-50750-R.120
new		3/4	**.120**	1	6	2-1/2	.712	5	86794	HEV-RN-R-50750-R.120
new		3/4	**.120**	1	6	2-7/8	.712	5	86795	HEV-RN-A-50750-R.120
new		3/4	**.120**	1	6	3-3/8	.712	5	86796	HEV-RN-M-50750-R.120
new		3/4	**.120**	1	6	4-1/8	.712	5	86797	HEV-RN-L-50750-R.120

* .0005 max TIR

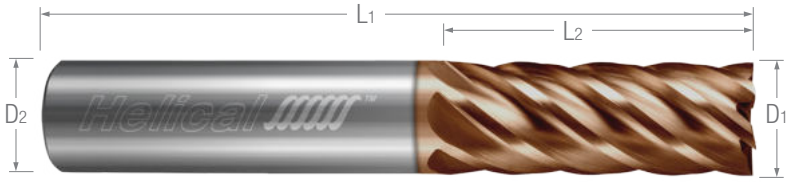
6 FLUTE - SQUARE New Items!

Variable Pitch

HEM **HEV-6**

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 139 for A*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description	
1/8	1/8	1/4	1-1/2	6	87538	HEV-S-60125	new
	1/8	3/8	2	6	87539	HEV-SR-60125	new
	1/8	1/2	2-1/2	6	87540	HEV-R-60125	new
	1/8	5/8	2-1/2	6	87541	HEV-A-60125	new
3/16	3/16	5/16	2	6	87542	HEV-S-60187	new
	3/16	7/16	2	6	87543	HEV-SR-60187	new
	3/16	9/16	2-1/2	6	87544	HEV-R-60187	new
	3/16	3/4	2-1/2	6	87545	HEV-M-60187	new
1/4	1/4	3/8	2	6	59902	HEV-S-60250	
	1/4	1/2	2-1/2	6	59903	HEV-SR-60250	
	1/4	3/4	2-1/2	6	59904	HEV-R-60250	
	1/4	1	3	6	81894	HEV-M-60250	
	1/4	1-1/4	3	6	83303	HEV-L-60250	
	1/4	1-1/2	3	6	83304	HEV-LX-60250	
5/16	5/16	7/16	2	6	83305	HEV-S-60312	
	5/16	3/4	2-1/2	6	83306	HEV-R-60312	
	5/16	1	3	6	83307	HEV-M-60312	
	5/16	1-1/4	3	6	84991	HEV-ML-60312	
3/8	3/8	1/2	2	6	59905	HEV-S-60375	
	3/8	3/4	2-1/2	6	83308	HEV-SR-60375	
	3/8	1	3	6	59906	HEV-R-60375	
	3/8	1-1/4	3	6	59907	HEV-M-60375	
	3/8	1-1/2	3-1/2	6	81895	HEV-L-60375	
	3/8	2	4	6	83309	HEV-LX-60375	
1/2	1/2	5/8	2-1/2	6	59908	HEV-S-60500	
	1/2	1	3	6	59909	HEV-SR-60500	
	1/2	1-1/4	3	6	59910	HEV-R-60500	
	1/2	1-5/8	4	6	59911	HEV-M-60500	
	1/2	2	4	6	81896	HEV-L-60500	
	1/2	2-1/2	5	6	83310	HEV-LX-60500	

continued on next page

Speeds & Feeds on Page 152

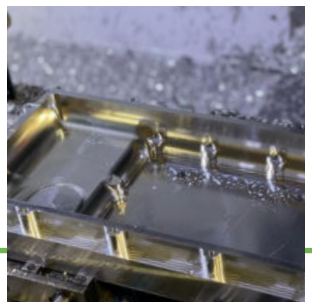
HEV-6

New Items! 6 FLUTE - SQUARE
Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
5/8	5/8	3/4	3	6	**83311**	HEV-S-60625
	5/8	1-1/4	3-1/2	6	**83312**	HEV-SR-60625
	5/8	1-5/8	3-1/2	6	**83313**	HEV-R-60625
	5/8	2	4	6	**83314**	HEV-M-60625
	5/8	2-1/2	5	6	**83315**	HEV-L-60625
3/4	3/4	1	3	6	**83316**	HEV-S-60750
	3/4	1-5/8	4	6	**81897**	HEV-R-60750
	3/4	2-1/4	5	6	**81898**	HEV-M-60750
	3/4	2-3/4	5	6	**81899**	HEV-L-60750
	3/4	3-1/4	6	6	**83317**	HEV-LX-60750
1	1	2	4-1/2	6	**84992**	HEV-R-61000
	1	2-5/8	5	6	**84993**	HEV-M-61000
	1	3-1/4	6	6	**84994**	HEV-L-61000

* .0005 max TIR



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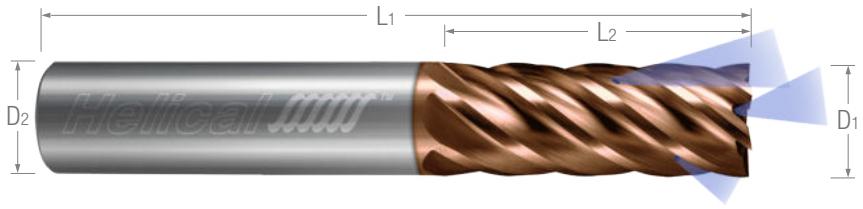
Made with a Custom Tool: See more about our Custom Tools on pg 301

6 FLUTE - SQUARE

Coolant Through - Variable Pitch

HEVC-6

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- 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
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
1/4	1/4	3/8	2	6	**84305**	HEVC-015-60250
	1/4	1/2	2-1/2	6	**84306**	HEVC-020-60250
3/8	3/8	1/2	2	6	**84307**	HEVC-013-60375
	3/8	1	3	6	**84308**	HEVC-026-60375
1/2	1/2	1	3	6	**84309**	HEVC-020-60500
	1/2	1-1/4	3	6	**84310**	HEVC-025-60500
	1/2	1-5/8	4	6	**84311**	HEVC-032-60500
3/4	3/4	1-5/8	4	6	**84312**	HEVC-021-60750
	3/4	2-1/4	5	6	**84313**	HEVC-030-60750

* .0005 max TIR

Speeds & Feeds on Page 152

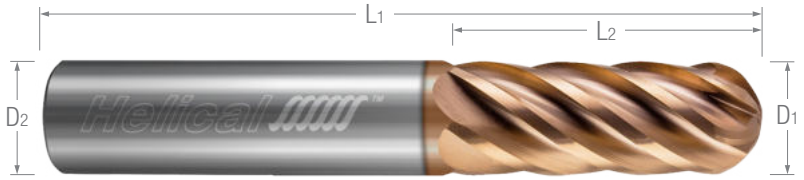
HEV-6

New Items!

6 FLUTE - BALL
Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 142 for A*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
1/4	1/4	3/8	2	6	81924	HEV-S-60250-BN
	1/4	1/2	2-1/2	6	81925	HEV-SR-60250-BN
	1/4	3/4	2-1/2	6	81926	HEV-R-60250-BN
	1/4	1	3	6	81927	HEV-M-60250-BN
	1/4	1-1/4	3	6	82595	HEV-L-60250-BN
	1/4	1-1/2	3	6	86024	HEV-LX-60250-BN
5/16	5/16	7/16	2	6	83364	HEV-S-60312-BN
	5/16	3/4	2-1/2	6	83365	HEV-R-60312-BN
	5/16	1	3	6	83366	HEV-M-60312-BN
	5/16	1-1/4	3	6	86025	HEV-ML-60312-BN
3/8	3/8	1/2	2	6	81928	HEV-S-60375-BN
	3/8	3/4	2-1/2	6	83367	HEV-SR-60375-BN
	3/8	1	3	6	81929	HEV-R-60375-BN
	3/8	1-1/4	3	6	81930	HEV-M-60375-BN
	3/8	1-1/2	3-1/2	6	82596	HEV-L-60375-BN
	3/8	2	4	6	86026	HEV-LX-60375-BN
1/2	1/2	5/8	2-1/2	6	81931	HEV-S-60500-BN
	1/2	1	3	6	81932	HEV-SR-60500-BN
	1/2	1-1/4	3	6	81933	HEV-R-60500-BN
	1/2	1-5/8	4	6	81934	HEV-M-60500-BN
	1/2	2	4	6	81935	HEV-L-60500-BN
	1/2	2-1/2	5	6	83368	HEV-LX-60500-BN
	1/2	3-1/8	6	6	86027	HEV-X-60500-BN
5/8	5/8	3/4	3	6	83369	HEV-S-60625-BN
	5/8	1-1/4	3-1/2	6	83370	HEV-SR-60625-BN
	5/8	1-5/8	3-1/2	6	83371	HEV-R-60625-BN
new	5/8	2	4	6	87546	HEV-M-60625-BN
3/4	3/4	1	3	6	81936	HEV-S-60750-BN
	3/4	1-5/8	4	6	81937	HEV-R-60750-BN
	3/4	2-1/4	5	6	83372	HEV-M-60750-BN
new	3/4	2-3/4	5	6	87547	HEV-L-60750-BN
new	3/4	3-1/4	6	6	87548	HEV-LX-60750-BN
1	1	1-1/4	4	6	86028	HEV-S-61000-BN
	1	2	4-1/2	6	81938	HEV-R-61000-BN
	1	2-5/8	5	6	86029	HEV-M-61000-BN
new	1	3-1/4	6	6	87549	HEV-L-61000-BN

* .0005 max TIR

Speeds & Feeds on Page 152

6 FLUTE - CORNER RADIUS New Items!

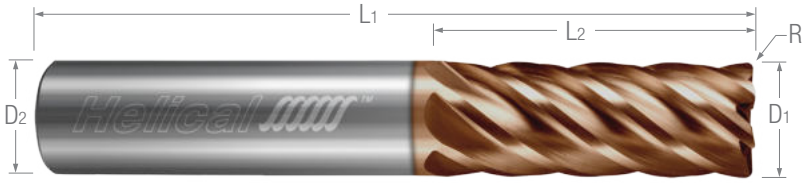
Variable Pitch

HEM

HEV-6

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 143 for A*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description	
1/4	1/4	.010	3/8	2	6	86007	HEV-S-60250-R.010	
	1/4	.010	1/2	2-1/2	6	86008	HEV-SR-60250-R.010	
	1/4	.010	3/4	2-1/2	6	86009	HEV-R-60250-R.010	
	1/4	.010	1	3	6	87580	HEV-M-60250-R.010	new
	1/4	.010	1-1/4	3	6	87581	HEV-L-60250-R.010	new
	1/4	.020	3/8	2	6	59912	HEV-S-60250-R.020	
	1/4	.020	1/2	2-1/2	6	59913	HEV-SR-60250-R.020	
	1/4	.020	3/4	2-1/2	6	59914	HEV-R-60250-R.020	
	1/4	.020	1	3	6	81900	HEV-M-60250-R.020	
	1/4	.020	1-1/4	3	6	83324	HEV-L-60250-R.020	
	1/4	.030	3/8	2	6	59915	HEV-S-60250-R.030	
	1/4	.030	1/2	2-1/2	6	59916	HEV-SR-60250-R.030	
	1/4	.030	3/4	2-1/2	6	59917	HEV-R-60250-R.030	
	1/4	.030	1	3	6	81901	HEV-M-60250-R.030	
	1/4	.030	1-1/4	3	6	83325	HEV-L-60250-R.030	
	1/4	.060	3/8	2	6	81902	HEV-S-60250-R.060	
	1/4	.060	1/2	2-1/2	6	81903	HEV-SR-60250-R.060	
	1/4	.060	3/4	2-1/2	6	81904	HEV-R-60250-R.060	
	1/4	.060	1	3	6	81905	HEV-M-60250-R.060	
	1/4	.060	1-1/4	3	6	83326	HEV-L-60250-R.060	
5/16	5/16	.020	7/16	2	6	82587	HEV-S-60312-R.020	
	5/16	.020	3/4	2-1/2	6	83327	HEV-R-60312-R.020	
	5/16	.020	1	3	6	86010	HEV-M-60312-R.020	
	5/16	.030	7/16	2	6	82588	HEV-S-60312-R.030	
	5/16	.030	3/4	2-1/2	6	83328	HEV-R-60312-R.030	
	5/16	.030	1	3	6	87582	HEV-M-60312-R.030	
	5/16	.060	7/16	2	6	83329	HEV-S-60312-R.060	new
	5/16	.060	3/4	2-1/2	6	83330	HEV-R-60312-R.060	
	5/16	.060	1	3	6	87583	HEV-M-60312-R.060	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 152

HEV-6

New Items! **6 FLUTE - CORNER RADIUS**

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
	3/8	3/8	.010	1/2	2	6	86011	HEV-S-60375-R.010
		3/8	.010	3/4	2-1/2	6	86012	HEV-SR-60375-R.010
		3/8	.010	1	3	6	86013	HEV-R-60375-R.010
		3/8	.010	1-1/4	3	6	86014	HEV-M-60375-R.010
new		3/8	.010	1-1/2	3-1/2	6	87584	HEV-L-60375-R.010
		3/8	.020	1/2	2	6	59918	HEV-S-60375-R.020
		3/8	.020	3/4	2-1/2	6	86015	HEV-SR-60375-R.020
		3/8	.020	1	3	6	59919	HEV-R-60375-R.020
		3/8	.020	1-1/4	3	6	59920	HEV-M-60375-R.020
		3/8	.020	1-1/2	3-1/2	6	83331	HEV-L-60375-R.020
		3/8	.030	1/2	2	6	59921	HEV-S-60375-R.030
		3/8	.030	3/4	2-1/2	6	86016	HEV-SR-60375-R.030
		3/8	.030	1	3	6	59922	HEV-R-60375-R.030
	3/8	3/8	.030	1-1/4	3	6	59923	HEV-M-60375-R.030
		3/8	.030	1-1/2	3-1/2	6	83332	HEV-L-60375-R.030
		3/8	.060	1/2	2	6	59924	HEV-S-60375-R.060
		3/8	.060	3/4	2-1/2	6	86017	HEV-SR-60375-R.060
		3/8	.060	1	3	6	59925	HEV-R-60375-R.060
		3/8	.060	1-1/4	3	6	59926	HEV-M-60375-R.060
		3/8	.060	1-1/2	3-1/2	6	83333	HEV-L-60375-R.060
		3/8	.060	2	4	6	86018	HEV-LX-60375-R.060
		3/8	.090	1/2	2	6	81906	HEV-S-60375-R.090
		3/8	.090	3/4	2-1/2	6	86019	HEV-SR-60375-R.090
		3/8	.090	1	3	6	81907	HEV-R-60375-R.090
		3/8	.090	1-1/4	3	6	83334	HEV-M-60375-R.090
		3/8	.090	1-1/2	3-1/2	6	83335	HEV-L-60375-R.090
	1/2	1/2	.010	1	3	6	83336	HEV-SR-60500-R.010
		1/2	.010	1-1/4	3	6	83337	HEV-R-60500-R.010
		1/2	.010	1-5/8	4	6	86020	HEV-M-60500-R.010
new		1/2	.010	2	4	6	87585	HEV-L-60500-R.010
new		1/2	.010	2-1/2	5	6	87586	HEV-LX-60500-R.010
		1/2	.015	1	3	6	83338	HEV-SR-60500-R.015
		1/2	.015	1-1/4	3	6	83339	HEV-R-60500-R.015
		1/2	.015	1-5/8	4	6	86021	HEV-M-60500-R.015
new		1/2	.015	2	4	6	87587	HEV-L-60500-R.015
new		1/2	.015	2-1/2	5	6	87588	HEV-LX-60500-R.015
	1/2	1/2	.020	1	3	6	83340	HEV-SR-60500-R.020
		1/2	.020	1-1/4	3	6	83341	HEV-R-60500-R.020
		1/2	.020	1-5/8	4	6	86022	HEV-M-60500-R.020
new		1/2	.020	2	4	6	87589	HEV-L-60500-R.020
new		1/2	.020	2-1/2	5	6	87590	HEV-LX-60500-R.020
		1/2	.030	5/8	2-1/2	6	59927	HEV-S-60500-R.030
		1/2	.030	1	3	6	59928	HEV-SR-60500-R.030
		1/2	.030	1-1/4	3	6	59929	HEV-R-60500-R.030
		1/2	.030	1-5/8	4	6	59930	HEV-M-60500-R.030
		1/2	.030	2	4	6	81908	HEV-L-60500-R.030
		1/2	.030	2-1/2	5	6	86023	HEV-LX-60500-R.030

* .0005 max TIR

continued on next page

6 FLUTE - CORNER RADIUS New Items!

Variable Pitch (cont.)

HEM **HEV-6**

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description	
1/2	1/2	.060	5/8	2-1/2	6	59931	HEV-S-60500-R.060	
	1/2	.060	1	3	6	59932	HEV-SR-60500-R.060	
	1/2	.060	1-1/4	3	6	59933	HEV-R-60500-R.060	
	1/2	.060	1-5/8	4	6	59934	HEV-M-60500-R.060	
	1/2	.060	2	4	6	81909	HEV-L-60500-R.060	
	1/2	.060	2-1/2	5	6	87591	HEV-LX-60500-R.060	new
	1/2	.090	5/8	2-1/2	6	83342	HEV-S-60500-R.090	
	1/2	.090	1	3	6	83343	HEV-SR-60500-R.090	
	1/2	.090	1-1/4	3	6	82589	HEV-R-60500-R.090	
	1/2	.090	1-5/8	4	6	82590	HEV-M-60500-R.090	
	1/2	.090	2	4	6	82591	HEV-L-60500-R.090	
	1/2	.125	5/8	2-1/2	6	59935	HEV-S-60500-R.125	
	1/2	.125	1	3	6	59936	HEV-SR-60500-R.125	
	1/2	.125	1-1/4	3	6	59937	HEV-R-60500-R.125	
	1/2	.125	1-5/8	4	6	59938	HEV-M-60500-R.125	
	1/2	.125	2	4	6	81910	HEV-L-60500-R.125	
	1/2	.125	2-1/2	5	6	87592	HEV-LX-60500-R.125	new
5/8	5/8	.030	1-1/4	3-1/2	6	83344	HEV-SR-60625-R.030	
	5/8	.030	1-5/8	3-1/2	6	83345	HEV-R-60625-R.030	
	5/8	.060	1-1/4	3-1/2	6	83346	HEV-SR-60625-R.060	
	5/8	.060	1-5/8	3-1/2	6	83347	HEV-R-60625-R.060	
	5/8	.090	1-1/4	3-1/2	6	83348	HEV-SR-60625-R.090	
	5/8	.090	1-5/8	3-1/2	6	83349	HEV-R-60625-R.090	
	5/8	.125	1-1/4	3-1/2	6	83350	HEV-SR-60625-R.125	
	5/8	.125	1-5/8	3-1/2	6	83351	HEV-R-60625-R.125	
3/4	3/4	.030	1	3	6	83352	HEV-S-60750-R.030	
	3/4	.030	1-5/8	4	6	81911	HEV-R-60750-R.030	
	3/4	.030	2-1/4	5	6	81912	HEV-M-60750-R.030	
	3/4	.030	2-3/4	5	6	81913	HEV-L-60750-R.030	
	3/4	.030	3-1/4	6	6	83353	HEV-LX-60750-R.030	
	3/4	.060	1-5/8	4	6	81914	HEV-R-60750-R.060	
	3/4	.060	2-1/4	5	6	81915	HEV-M-60750-R.060	
	3/4	.060	2-3/4	5	6	81916	HEV-L-60750-R.060	
	3/4	.090	1	3	6	81989	HEV-S-60750-R.090	
	3/4	.090	1-5/8	4	6	81917	HEV-R-60750-R.090	
	3/4	.090	2-1/4	5	6	81918	HEV-M-60750-R.090	
	3/4	.090	2-3/4	5	6	81919	HEV-L-60750-R.090	
	3/4	.120	1	3	6	87593	HEV-S-60750-R.120	new
	3/4	.120	1-5/8	4	6	87594	HEV-R-60750-R.120	new
	3/4	.120	2-1/4	5	6	87595	HEV-M-60750-R.120	new
	3/4	.125	1	3	6	83354	HEV-S-60750-R.125	
	3/4	.125	1-5/8	4	6	83355	HEV-R-60750-R.125	
	3/4	.125	2-1/4	5	6	83356	HEV-M-60750-R.125	
	3/4	.190	1	3	6	81990	HEV-S-60750-R.190	
	3/4	.250	1	3	6	83357	HEV-S-60750-R.250	
	3/4	.250	1-5/8	4	6	83358	HEV-R-60750-R.250	
	3/4	.250	2-1/4	5	6	83359	HEV-M-60750-R.250	
	3/4	.250	2-3/4	5	6	83360	HEV-L-60750-R.250	
1	1	.030	2	4-1/2	6	81920	HEV-R-61000-R.030	
	1	.030	2-5/8	5	6	81921	HEV-M-61000-R.030	
	1	.060	2	4-1/2	6	81922	HEV-R-61000-R.060	
	1	.060	2-5/8	5	6	81923	HEV-M-61000-R.060	

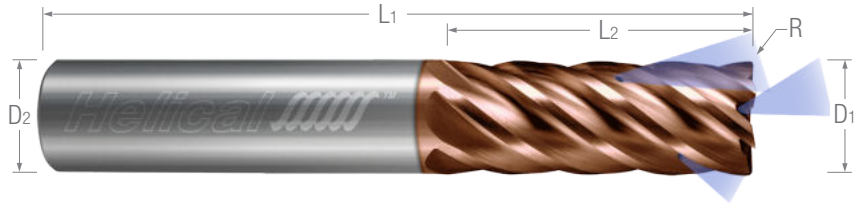
* .0005 max TIR

HEVC-6

6 FLUTE - CORNER RADIUS

Coolant Through - Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- 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
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
1/4	1/4	**.020**	3/8	2	6	**84314**	HEVC-015-60250-R.020
	1/4	**.020**	1/2	2-1/2	6	**84315**	HEVC-020-60250-R.020
3/8	3/8	**.020**	1/2	2	6	**84316**	HEVC-013-60375-R.020
	3/8	**.020**	1	3	6	**84317**	HEVC-026-60375-R.020
	3/8	**.030**	1/2	2	6	**84318**	HEVC-013-60375-R.030
	3/8	**.030**	1	3	6	**84319**	HEVC-026-60375-R.030
1/2	1/2	**.030**	1	3	6	**84320**	HEVC-020-60500-R.030
	1/2	**.030**	1-1/4	3	6	**84321**	HEVC-025-60500-R.030
	1/2	**.030**	1-5/8	4	6	**84322**	HEVC-032-60500-R.030
	1/2	**.060**	1	3	6	**84323**	HEVC-020-60500-R.060
	1/2	**.060**	1-1/4	3	6	**84324**	HEVC-025-60500-R.060
	1/2	**.060**	1-5/8	4	6	**84325**	HEVC-032-60500-R.060
3/4	3/4	**.060**	1-5/8	4	6	**84326**	HEVC-021-60750-R.060
	3/4	**.060**	2-1/4	5	6	**84327**	HEVC-030-60750-R.060

* .0005 max TIR

Speeds & Feeds on Page 152

6 FLUTE - SQUARE New!

Variable Pitch - Reduced Neck

HEM **HEV-RN-6**

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 149 for A*plus* coating

Cutter Diameter D_1 $^{+.000"}_{-.002"}$	Shank Diameter* D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description	
1/4	1/4	3/8	4	3/4	.237	6	86862	HEV-RN-S-60250	new
	1/4	3/8	4	1-1/8	.237	6	86863	HEV-RN-R-60250	new
	1/4	3/8	4-1/2	2-1/8	.237	6	86864	HEV-RN-M-60250	new
3/8	3/8	1/2	4	1-1/8	.356	6	86865	HEV-RN-S-60375	new
	3/8	1/2	4	2-1/8	.356	6	86866	HEV-RN-R-60375	new
	3/8	1/2	6	3-1/8	.356	6	86867	HEV-RN-M-60375	new
1/2	1/2	5/8	4	1-1/2	.475	6	86868	HEV-RN-S-60500	new
	1/2	5/8	4	2-1/4	.475	6	86869	HEV-RN-R-60500	new
	1/2	5/8	6	3-3/8	.475	6	86870	HEV-RN-M-60500	new
	1/2	5/8	6	4-1/8	.475	6	86871	HEV-RN-L-60500	new
3/4	3/4	1	4	2	.712	6	86872	HEV-RN-S-60750	new
	3/4	1	6	2-1/2	.712	6	86873	HEV-RN-R-60750	new
	3/4	1	6	3-3/8	.712	6	86874	HEV-RN-M-60750	new

* .0005 max TIR

8 Ways You're Killing Your End Mill

In The Loupe MACHINISTS BLOG

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.*

www.harveyperformance.com/in-the-loupe/8-ways-youre-killing-your-end-mill/

SCAN TO READ

Speeds & Feeds on Page 152

HEV-RN-6

HEM

New! **6 FLUTE - BALL**

Variable Pitch - Reduced Neck

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 150 for A*plus* coating

	Cutter Diameter D_1 $^{+.000"}_{-.002"}$	Shank Diameter* D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description
new	1/4	1/4	3/8	4	3/4	.237	6	86825	HEV-RN-S-60250-BN
new		1/4	3/8	4	1-1/8	.237	6	86826	HEV-RN-R-60250-BN
new		1/4	3/8	4	2-1/8	.237	6	86827	HEV-RN-M-60250-BN
new	3/8	3/8	1/2	4	1-1/8	.356	6	86828	HEV-RN-S-60375-BN
new		3/8	1/2	4	2-1/8	.356	6	86829	HEV-RN-R-60375-BN
new		3/8	1/2	6	3-1/8	.356	6	86830	HEV-RN-M-60375-BN
new	1/2	1/2	5/8	4	1-1/2	.475	6	86831	HEV-RN-S-60500-BN
new		1/2	5/8	4	2-1/4	.475	6	86832	HEV-RN-R-60500-BN
new		1/2	5/8	6	3-3/8	.475	6	86833	HEV-RN-M-60500-BN
new		1/2	5/8	6	4-1/8	.475	6	86834	HEV-RN-L-60500-BN
new	3/4	3/4	1	4	2	.712	6	86835	HEV-RN-S-60750-BN
new		3/4	1	6	2-1/2	.712	6	86836	HEV-RN-R-60750-BN
new		3/4	1	6	3-3/8	.712	6	86837	HEV-RN-M-60750-BN

* .0005 max TIR

Speeds & Feeds on Page 152

6 FLUTE - CORNER RADIUS New!

Variable Pitch - Reduced Neck

HEM

HEV-RN-6

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 151 for A*plus* coating

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Reach (LBS) L_3	Neck Diameter	Flutes	T*plus* Coated	Tool Description	
1/4	1/4	**.020**	3/8	4	3/4	.237	6	86838	HEV-RN-S-60250-R.020	new
	1/4	**.020**	3/8	4	1-1/8	.237	6	86839	HEV-RN-R-60250-R.020	new
	1/4	**.020**	3/8	4	2-1/8	.237	6	86840	HEV-RN-M-60250-R.020	new
3/8	3/8	**.020**	1/2	4	1-1/8	.356	6	86841	HEV-RN-S-60375-R.020	new
	3/8	**.020**	1/2	4	2-1/8	.356	6	86842	HEV-RN-R-60375-R.020	new
	3/8	**.020**	1/2	6	3-1/8	.356	6	86843	HEV-RN-M-60375-R.020	new
1/2	1/2	**.030**	5/8	4	1-1/2	.475	6	86844	HEV-RN-S-60500-R.030	new
	1/2	**.030**	5/8	4	2-1/4	.475	6	86845	HEV-RN-R-60500-R.030	new
	1/2	**.030**	5/8	6	3-3/8	.475	6	86846	HEV-RN-M-60500-R.030	new
	1/2	**.030**	5/8	6	4-1/8	.475	6	86847	HEV-RN-L-60500-R.030	new
	1/2	**.060**	5/8	4	1-1/2	.475	6	86848	HEV-RN-S-60500-R.060	new
	1/2	**.060**	5/8	4	2-1/4	.475	6	86849	HEV-RN-R-60500-R.060	new
	1/2	**.060**	5/8	6	3-3/8	.475	6	86850	HEV-RN-M-60500-R.060	new
	1/2	**.060**	5/8	6	4-1/8	.475	6	86851	HEV-RN-L-60500-R.060	new
	1/2	**.125**	5/8	4	1-1/2	.475	6	86852	HEV-RN-S-60500-R.125	new
	1/2	**.125**	5/8	4	2-1/4	.475	6	86853	HEV-RN-R-60500-R.125	new
	1/2	**.125**	5/8	6	3-3/8	.475	6	86854	HEV-RN-M-60500-R.125	new
	1/2	**.125**	5/8	6	4-1/8	.475	6	86855	HEV-RN-L-60500-R.125	new
3/4	3/4	**.030**	1	4	2	.712	6	86856	HEV-RN-S-60750-R.030	new
	3/4	**.030**	1	6	2-1/2	.712	6	86857	HEV-RN-R-60750-R.030	new
	3/4	**.030**	1	6	3-3/8	.712	6	86858	HEV-RN-M-60750-R.030	new
	3/4	**.060**	1	4	2	.712	6	86859	HEV-RN-S-60750-R.060	new
	3/4	**.060**	1	6	2-1/2	.712	6	86860	HEV-RN-R-60750-R.060	new
	3/4	**.060**	1	6	3-3/8	.712	6	86861	HEV-RN-M-60750-R.060	new

Speeds & Feeds on Page 152

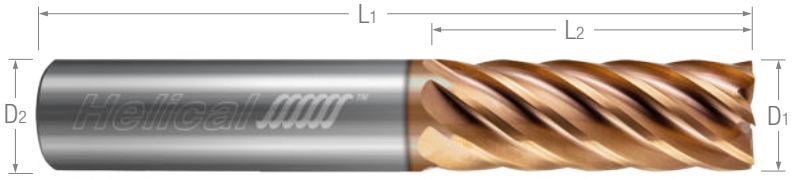
HEV-7

New Items!

7 FLUTE - SQUARE
Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 153 for A*plus* coating



	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Decription
	1/4	1/4	3/8	2	7	59939	HEV-S-70250
		1/4	1/2	2	7	59940	HEV-SR-70250
		1/4	3/4	2-1/2	7	59941	HEV-R-70250
		1/4	1	3	7	83375	HEV-M-70250
		1/4	1-1/4	3	7	86030	HEV-L-70250
	5/16	5/16	7/16	2	7	86031	HEV-S-70312
		5/16	3/4	2-1/2	7	86032	HEV-R-70312
		5/16	1	3	7	86033	HEV-M-70312
	3/8	3/8	1/2	2	7	59942	HEV-S-70375
		3/8	3/4	2-1/2	7	59943	HEV-SR-70375
		3/8	1	2-1/2	7	59944	HEV-R-70375
		3/8	1-1/4	3	7	86034	HEV-M-70375
		3/8	1-1/2	3-1/2	7	81939	HEV-L-70375
new		3/8	2	4	7	87102	HEV-LX-70375
	1/2	1/2	5/8	2-1/2	7	59945	HEV-S-70500
		1/2	1	3	7	59946	HEV-SR-70500
		1/2	1-1/4	3	7	59947	HEV-R-70500
		1/2	1-5/8	4	7	59948	HEV-M-70500
		1/2	2	4	7	81940	HEV-L-70500
		1/2	2-1/2	5	7	86035	HEV-LX-70500
		1/2	3-1/8	6	7	86036	HEV-X-70500
	5/8	5/8	3/4	3	7	81941	HEV-S-70625
		5/8	1-1/4	3-1/2	7	81942	HEV-SR-70625
		5/8	1-5/8	4	7	81943	HEV-R-70625
new		5/8	2-1/8	4	7	87103	HEV-M-70625
new	3/4	3/4	1-1/4	3-1/2	7	87104	HEV-SR-70750
		3/4	1-5/8	4	7	81944	HEV-R-70750
		3/4	2-1/4	5	7	81945	HEV-M-70750
		3/4	2-3/4	5	7	86037	HEV-L-70750
new		3/4	3-1/4	6	7	87105	HEV-LX-70750
	1	1	1-1/4	4	7	86038	HEV-S-71000
		1	2	5	7	81946	HEV-R-71000
		1	2-5/8	5	7	86039	HEV-M-71000

* .0005 max TIR

Speeds & Feeds on Page 163

7 FLUTE - CORNER RADIUS

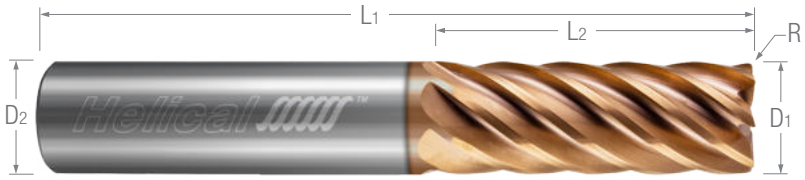
New Items!

HEV-7

Variable Pitch

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 156 for A*plus* coating



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description	
1/4	1/4	**.010**	3/8	2	7	87144	HEV-S-70250-R.010	new
	1/4	**.010**	1/2	2	7	87145	HEV-SR-70250-R.010	new
	1/4	**.010**	3/4	2-1/2	7	87146	HEV-R-70250-R.010	new
	1/4	**.010**	1	3	7	87147	HEV-M-70250-R.010	new
	1/4	**.010**	1-1/4	3	7	87148	HEV-L-70250-R.010	new
	1/4	**.020**	3/8	2	7	59949	HEV-S-70250-R.020	
	1/4	**.020**	1/2	2	7	59950	HEV-SR-70250-R.020	
	1/4	**.020**	3/4	2-1/2	7	59951	HEV-R-70250-R.020	
	1/4	**.020**	1	3	7	83389	HEV-M-70250-R.020	
	1/4	**.020**	1-1/4	3	7	86048	HEV-L-70250-R.020	
	1/4	**.030**	3/8	2	7	87149	HEV-S-70250-R.030	new
	1/4	**.030**	1/2	2	7	87150	HEV-SR-70250-R.030	new
	1/4	**.030**	3/4	2-1/2	7	87151	HEV-R-70250-R.030	new
	1/4	**.030**	1	3	7	87152	HEV-M-70250-R.030	new
	1/4	**.030**	1-1/4	3	7	87153	HEV-L-70250-R.030	new
3/8	3/8	**.010**	1/2	2	7	87154	HEV-S-70375-R.010	new
	3/8	**.010**	3/4	2-1/2	7	87155	HEV-SR-70375-R.010	new
	3/8	**.010**	1	2-1/2	7	87156	HEV-R-70375-R.010	new
	3/8	**.020**	1/2	2	7	59952	HEV-S-70375-R.020	
	3/8	**.020**	3/4	2-1/2	7	59953	HEV-SR-70375-R.020	
	3/8	**.020**	1	2-1/2	7	59954	HEV-R-70375-R.020	
	3/8	**.020**	1-1/4	3	7	86049	HEV-M-70375-R.020	
	3/8	**.020**	1-1/2	3-1/2	7	81947	HEV-L-70375-R.020	
	3/8	**.020**	2	4	7	86050	HEV-LX-70375-R.020	
	3/8	**.030**	1/2	2	7	87157	HEV-S-70375-R.030	new
	3/8	**.030**	3/4	2-1/2	7	87158	HEV-SR-70375-R.030	new
	3/8	**.030**	1	2-1/2	7	87159	HEV-R-70375-R.030	new
	3/8	**.060**	1/2	2	7	83390	HEV-S-70375-R.060	
	3/8	**.060**	3/4	2-1/2	7	83391	HEV-SR-70375-R.060	
	3/8	**.060**	1	2-1/2	7	83392	HEV-R-70375-R.060	
	3/8	**.125**	1/2	2	7	87160	HEV-S-70375-R.125	new
	3/8	**.125**	3/4	2-1/2	7	87161	HEV-SR-70375-R.125	new
	3/8	**.125**	1	2-1/2	7	87162	HEV-R-70375-R.125	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 163

HEV-7

New Items!

7 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
	1/2	1/2	.010	5/8	2-1/2	7	86051	HEV-S-70500-R.010
		1/2	.010	1	3	7	86052	HEV-SR-70500-R.010
		1/2	.010	1-1/4	3	7	86053	HEV-R-70500-R.010
		1/2	.010	1-5/8	4	7	86054	HEV-M-70500-R.010
new		1/2	.010	2	4	7	87163	HEV-L-70500-R.010
		1/2	.020	5/8	2-1/2	7	83393	HEV-S-70500-R.020
		1/2	.020	1	3	7	83394	HEV-SR-70500-R.020
		1/2	.020	1-1/4	3	7	83395	HEV-R-70500-R.020
		1/2	.020	1-5/8	4	7	83396	HEV-M-70500-R.020
		1/2	.020	2	4	7	86055	HEV-L-70500-R.020
		1/2	.030	5/8	2-1/2	7	59955	HEV-S-70500-R.030
		1/2	.030	1	3	7	59956	HEV-SR-70500-R.030
		1/2	.030	1-1/4	3	7	59957	HEV-R-70500-R.030
		1/2	.030	1-5/8	4	7	59958	HEV-M-70500-R.030
		1/2	.030	2	4	7	81948	HEV-L-70500-R.030
		1/2	.030	2-1/2	5	7	86056	HEV-LX-70500-R.030
		1/2	.060	5/8	2-1/2	7	83397	HEV-S-70500-R.060
		1/2	.060	1	3	7	83398	HEV-SR-70500-R.060
		1/2	.060	1-1/4	3	7	83399	HEV-R-70500-R.060
new		1/2	.060	1-5/8	4	7	87169	HEV-M-70500-R.060
new		1/2	.060	2	4	7	87170	HEV-L-70500-R.060
new		1/2	.125	5/8	2-1/2	7	87164	HEV-S-70500-R.125
new		1/2	.125	1	3	7	87165	HEV-SR-70500-R.125
new		1/2	.125	1-1/4	3	7	87166	HEV-R-70500-R.125
new		1/2	.125	1-5/8	4	7	87167	HEV-M-70500-R.125
new		1/2	.125	2	4	7	87168	HEV-L-70500-R.125
	5/8	5/8	.030	3/4	3	7	81949	HEV-S-70625-R.030
		5/8	.030	1-1/4	3-1/2	7	81950	HEV-SR-70625-R.030
		5/8	.030	1-5/8	4	7	81951	HEV-R-70625-R.030
		5/8	.030	2-1/8	4	7	86057	HEV-M-70625-R.030
		5/8	.060	1-1/4	3-1/2	7	83400	HEV-SR-70625-R.060
		5/8	.060	1-5/8	4	7	83401	HEV-R-70625-R.060
	3/4	3/4	.030	1	3	7	81952	HEV-S-70750-R.030
		3/4	.030	1-1/4	3-1/2	7	81953	HEV-SR-70750-R.030
		3/4	.030	1-5/8	4	7	81954	HEV-R-70750-R.030
		3/4	.030	2-1/4	5	7	81955	HEV-M-70750-R.030
new		3/4	.030	2-3/4	5	7	87171	HEV-L-70750-R.030
new		3/4	.030	3-1/4	6	7	87172	HEV-LX-70750-R.030
		3/4	.060	1	3	7	83402	HEV-S-70750-R.060
		3/4	.060	1-5/8	4	7	83403	HEV-R-70750-R.060
		3/4	.060	2-1/4	5	7	83404	HEV-M-70750-R.060
		3/4	.060	2-3/4	5	7	86058	HEV-L-70750-R.060
new		3/4	.060	3-1/4	6	7	87173	HEV-LX-70750-R.060
	1	1	.030	1-1/4	4	7	86059	HEV-S-71000-R.030
		1	.030	2	5	7	86060	HEV-R-71000-R.030
		1	.030	2-5/8	5	7	86061	HEV-M-71000-R.030

* .0005 max TIR

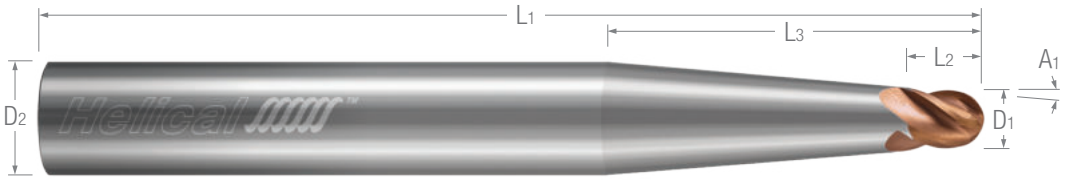
CONTOUR FINISHERS - 4 FLUTE - BALL

New!

HCF-TN-4

Tapered Neck

- Engineered for optimal performance in 3D contouring, profiling, and tapered wall applications
- Tapered length of cut and tapered neck for maximum rigidity and clearance in tight spaces
- Reach taper matches LOC taper and is relieved for clearance along entire reach length
- 4 flute variable pitch geometry designed for minimized harmonics and reduced tool pressure
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Angle Per Side A_1 $^{+0°30'}_{-0°30'}$	Cutter Dia D_1 $^{+.000"}_{-.002"}$	Shank Dia D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Flutes	T*plus* Coated	Tool Description	
2°	1/8	3/16	3/16	2-1/2	1.0329	4	86442	HCF020-TN-082-40125-BN	new
	1/8	1/4	3/16	4	1.9278	4	86443	HCF020-TN-154-40125-BN	new
	3/16	1/4	1/4	2-1/2	1.1007	4	86444	HCF020-TN-058-40187-BN	new
	3/16	5/16	1/4	4	1.9956	4	86445	HCF020-TN-106-40187-BN	new
	1/4	5/16	5/16	2-1/2	1.1685	4	86446	HCF020-TN-046-40250-BN	new
	1/4	3/8	5/16	4	2.0634	4	86447	HCF020-TN-082-40250-BN	new
	5/16	3/8	3/8	2-1/2	1.2362	4	86448	HCF020-TN-039-40312-BN	new
	5/16	7/16	3/8	4	2.1311	4	86449	HCF020-TN-068-40312-BN	new
	3/8	7/16	1/2	2-3/4	1.3065	4	86450	HCF020-TN-034-40375-BN	new
	3/8	1/2	1/2	4	2.2014	4	86451	HCF020-TN-058-40375-BN	new
3°	1/8	1/4	3/16	2-1/2	1.3062	4	86452	HCF030-TN-104-40125-BN	new
	1/8	3/8	3/16	4	2.4988	4	86453	HCF030-TN-199-40125-BN	new
	3/16	1/4	1/4	2	.7655	4	86454	HCF030-TN-040-40187-BN	new
	3/16	3/8	1/4	3-1/2	1.9581	4	86455	HCF030-TN-104-40187-BN	new
	1/4	3/8	5/16	3	1.4173	4	86456	HCF030-TN-056-40250-BN	new
	1/4	1/2	5/16	5	2.6099	4	86457	HCF030-TN-104-40250-BN	new
	5/16	3/8	3/8	2-1/2	.8766	4	86458	HCF030-TN-028-40312-BN	new
	5/16	1/2	3/8	4	2.0692	4	86459	HCF030-TN-066-40312-BN	new
	3/8	1/2	1/2	3	1.5310	4	86460	HCF030-TN-040-40375-BN	new
	3/8	5/8	1/2	5	2.7235	4	86461	HCF030-TN-072-40375-BN	new
5°	1/8	1/4	3/16	2	.8078	4	86462	HCF050-TN-064-40125-BN	new
	1/8	3/8	3/16	3-1/2	1.5222	4	86463	HCF050-TN-121-40125-BN	new
	3/16	5/16	1/4	2-1/2	.8533	4	86464	HCF050-TN-045-40187-BN	new
	3/16	1/2	1/4	4	1.9249	4	86465	HCF050-TN-102-40187-BN	new
	1/4	3/8	5/16	2-1/2	.8988	4	86466	HCF050-TN-035-40250-BN	new
	1/4	1/2	5/16	3-1/2	1.6132	4	86467	HCF050-TN-064-40250-BN	new
	5/16	1/2	3/8	3	1.3015	4	86468	HCF050-TN-041-40312-BN	new
	5/16	5/8	3/8	4	2.0158	4	86469	HCF050-TN-064-40312-BN	new
	3/8	1/2	1/2	2-1/2	.9922	4	86470	HCF050-TN-026-40375-BN	new
	3/8	5/8	1/2	3-1/2	1.7066	4	86471	HCF050-TN-045-40375-BN	new

Speeds & Feeds on Page 219

HCF-TN-4

SPEEDS & FEEDS

Contour Finishers - 4 Flute - Ball - Tapered Neck

HCF-TN-4									
Material Guide		Hardness	SFM	Inches per Tooth (IPT)					
				1/8	3/16	1/4	5/16	3/8	
				Fin	Fin	Fin	Fin	Fin	
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	800	.0014	.0017	.0019	.0020	.0022	
		75 - 98 HRB	750	.0013	.0014	.0016	.0018	.0019	
		21 - 36 HRC	700	.0010	.0012	.0013	.0014	.0015	
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	600	.0012	.0014	.0015	.0016	.0017	
		21 - 36 HRC	550	.0010	.0012	.0013	.0014	.0015	
		36 - 50 HRC	400	.0010	.0011	.0012	.0013	.0014	
		> 50 HRC	350	.0008	.0009	.0011	.0012	.0013	
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	550	.0012	.0014	.0015	.0016	.0017	
		21 - 36 HRC	500	.0011	.0012	.0014	.0014	.0015	
		36 - 50 HRC	450	.0009	.0011	.0012	.0013	.0014	
		> 50 HRC	400	.0008	.0009	.0011	.0012	.0013	
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	450	.0014	.0015	.0017	.0018	.0020	
		75 - 98 HRB	500	.0011	.0013	.0014	.0015	.0016	
		21 - 36 HRC	450	.0011	.0012	.0014	.0014	.0015	
		36 - 50 HRC	400	.0010	.0011	.0013	.0014	.0014	
		> 50 HRC	350	.0008	.0009	.0010	.0011	.0012	
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	500	.0012	.0014	.0015	.0016	.0017	
		21 - 36 HRC	450	.0011	.0013	.0014	.0015	.0016	
		36 - 50 HRC	400	.0010	.0011	.0013	.0014	.0014	
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	750	.0012	.0014	.0015	.0016	.0017	
		21 - 36 HRC	650	.0011	.0013	.0014	.0015	.0016	
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	450	.0010	.0011	.0013	.0014	.0014	
		36 - 50 HRC	400	.0010	.0011	.0013	.0013	.0014	
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	600	.0015	.0017	.0019	.0021	.0023	
		21 - 36 HRC	550	.0011	.0013	.0014	.0015	.0016	
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	550	.0012	.0014	.0015	.0016	.0017	
		21 - 36 HRC	450	.0011	.0013	.0014	.0015	.0016	
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	500	.0013	.0014	.0015	.0017	.0018	
		21 - 36 HRC	450	.0010	.0011	.0013	.0014	.0014	
		36 - 50 HRC	400	.0008	.0009	.0010	.0011	.0012	
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	600	.0014	.0015	.0018	.0019	.0021	
		75 - 98 HRB	550	.0013	.0014	.0016	.0018	.0019	
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	200	.0010	.0011	.0013	.0014	.0014	
		21 - 36 HRC	180	.0010	.0011	.0013	.0014	.0014	
		36 - 50 HRC	150	.0009	.0010	.0012	.0013	.0014	
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	350	.0016	.0018	.0021	.0023	.0024	
		75 - 98 HRB	400	.0015	.0017	.0019	.0020	.0022	
		21 - 36 HRC	325	.0013	.0014	.0016	.0018	.0019	
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	300	.0012	.0013	.0014	.0016	.0017	
		36 - 50 HRC	250	.0011	.0013	.0014	.0015	.0016	
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	225	.0011	.0012	.0014	.0014	.0015	
		21 - 36 HRC	150	.0010	.0012	.0014	.0014	.0015	
		36 - 50 HRC	90	.0008	.0010	.0011	.0012	.0013	

MILLING PROCESS	ADOC	RDOC
Fin (Finishing)	Up to Max LOC	4%-6% Diameter
	Up to Max LOC	4%-6% Diameter

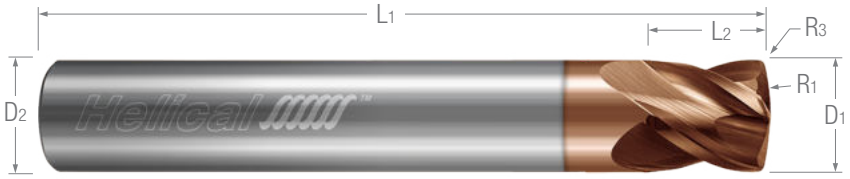
NOTES:
ADOC and RDOC are recommended starting values, and should be adjusted according to your finish requirements

MULTI-AXIS FINISHERS - 4 FLUTE

HMAF-FE-4

Lens Form

- Specially defined profile for massive reductions in cycle time and vastly improved surface finish
- Lens form with two tangential radii for finishing floors
- 4 flute geometry specifically designed for finishing in stainless steel, high temperature alloys, and other ferrous materials
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Major Radius R_1	Corner Radius R_3	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	T*plus* Coated	Tool Description
3/8	3/8	**3/4**	.020	3/8	2-1/2	4	2x	**86368**	HMAF-FE-40375-02-LNS
1/2	1/2	**1**	.030	1/2	3	4	2x	**86369**	HMAF-FE-40500-02-LNS
5/8	5/8	**1-1/4**	.035	5/8	3-1/2	4	2x	**86370**	HMAF-FE-40625-02-LNS
3/4	3/4	**1-1/2**	.045	3/4	4	4	2x	**86371**	HMAF-FE-40750-02-LNS

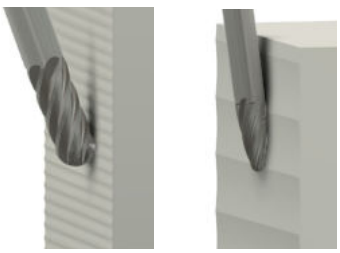
* .0005 max TIR

Speeds & Feeds on Page 223

Multi-Axis Finishers: Benefits & Stocked Profiles

Multi-Axis Finishers can significantly reduce cycle times and dramatically improve surface finish when used in place of a ball end mill, and are best used in wide open, flowing, and somewhat flat surfaces due to their large radii. Because of its larger radius, a far greater stepover can be used pass-to-pass while keeping the same cusp height as a ball end mill. This decreases the cycle time by a known value called the Benefit Multiple.

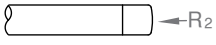
Pro Tip: Multi-Axis Finisher with a Benefit Multiple of 8 will reduce the cycle time to 1/8 of the cycle time for a ball end mill of the same shank diameter – an 87.5% time savings!



The images above show the comparison of a ball end mill to an oval shape Multi-Axis Finisher with a benefit multiple of 4.

3 Different Profiles of Multi-Axis Finishers

Lens

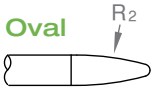


Geometry: 2 tangential radii on the end of the tool
Main Use: Primarily on the face of a part
Tip: Tilt angles of approximately 5 degrees are recommended for these tools to avoid working on-center

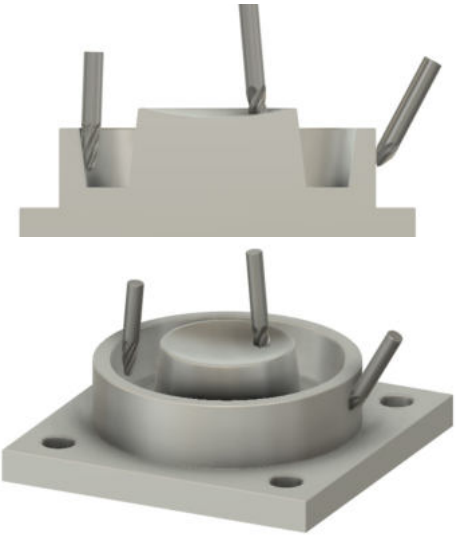
Taper

Geometry: 3 tangential radii and a taper angle
Main Use: When a specific approach angle is needed, and where maximum performance gain is desired
Tip: This form allows for the largest radius, and therefore the greatest potential improvement in finish and cycle time

Oval



Geometry: 2 tangential radii
Main Use: In smaller spaces where a slightly varied approach angle is required
Tip: This form offers the most versatility and is a common choice for machinists machining impellers or fan blades

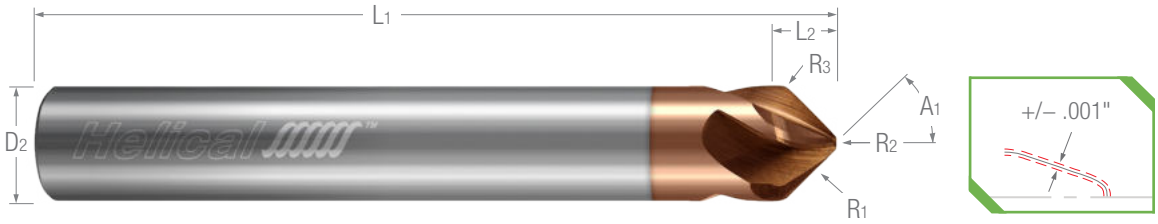


HMAF-FE-4

New! **MULTI-AXIS FINISHERS - 4 FLUTE**

Taper Form

- Specially defined profile for massive reductions in cycle time and vastly improved surface finish
- Taper form with three tangential radii and offered in a variety of angles for maximum performance and optimal clearance angle for any workpiece
- 4 flute geometry specifically designed for semi-finishing and finishing in stainless steel, high temperature alloys, and other ferrous materials
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



	Ang. Per Side A_1 $^{+0°30'}_{-0°30'}$	Shank Dia. D_2 (h6)	Major Radius R_1	Tip Radius R_2	Corner Radius R_3	Length of Cut L_2	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	T*plus* Coated	Tool Description
new	15°	3/8	**12**	3/64	.1875	.5901	2-1/2	4	8x	86476	HMAF-FE-40375-08-T15
new		3/8	**27**	3/64	.1875	.5902	2-1/2	4	12x	86479	HMAF-FE-40375-12-T15
new		1/2	**16**	1/16	.2500	.7868	3	4	8x	86482	HMAF-FE-40500-08-T15
new		1/2	**36**	1/16	.2500	.7869	3	4	12x	86485	HMAF-FE-40500-12-T15
new		5/8	**20**	5/64	.3125	.9834	3	4	8x	86488	HMAF-FE-40625-08-T15
new		5/8	**45**	5/64	.3125	.9836	3	4	12x	86491	HMAF-FE-40625-12-T15
new		3/4	**24**	3/32	.3750	1.1801	4	4	8x	86494	HMAF-FE-40750-08-T15
new		3/4	**54**	3/32	.3750	1.1803	4	4	12x	86497	HMAF-FE-40750-12-T15
new	30°	3/8	**12**	3/64	.1875	.3281	2-1/2	4	8x	86477	HMAF-FE-40375-08-T30
new		3/8	**27**	3/64	.1875	.3281	2-1/2	4	12x	86480	HMAF-FE-40375-12-T30
new		1/2	**16**	1/16	.2500	.4375	3	4	8x	86483	HMAF-FE-40500-08-T30
new		1/2	**36**	1/16	.2500	.4375	3	4	12x	86486	HMAF-FE-40500-12-T30
new		5/8	**20**	5/64	.3125	.5469	3	4	8x	86489	HMAF-FE-40625-08-T30
new		5/8	**45**	5/64	.3125	.5469	3	4	12x	86492	HMAF-FE-40625-12-T30
new		3/4	**24**	3/32	.3750	.6562	4	4	8x	86495	HMAF-FE-40750-08-T30
new		3/4	**54**	3/32	.3750	.6562	4	4	12x	86498	HMAF-FE-40750-12-T30
new	45°	3/8	**12**	3/64	.0468	.1875	2-1/2	4	8x	86478	HMAF-FE-40375-08-T45
new		3/8	**27**	3/64	.0468	.1875	2-1/2	4	12x	86481	HMAF-FE-40375-12-T45
new		1/2	**16**	1/16	.0625	.2500	3	4	8x	86484	HMAF-FE-40500-08-T45
new		1/2	**36**	1/16	.0625	.2500	3	4	12x	86487	HMAF-FE-40500-12-T45
new		5/8	**20**	5/64	.0781	.3125	3	4	8x	86490	HMAF-FE-40625-08-T45
new		5/8	**45**	5/64	.0781	.3125	3	4	12x	86493	HMAF-FE-40625-12-T45
new		3/4	**24**	3/32	.0937	.3750	4	4	8x	86496	HMAF-FE-40750-08-T45
new		3/4	**54**	3/32	.0937	.3750	4	4	12x	86499	HMAF-FE-40750-12-T45

* .0005 max TIR

Multi-Axis Finishers - Technical Information - pg 220

When switching from a traditional ball end mill, the unique geometries of Multi-Axis Finishers allow for dramatically improved surface finish, while significantly reducing cycle times. Learn more about the Benefit Multiple, profile options, and how these superior tools can pay dividends at the spindle.

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Speeds & Feeds on Page 223

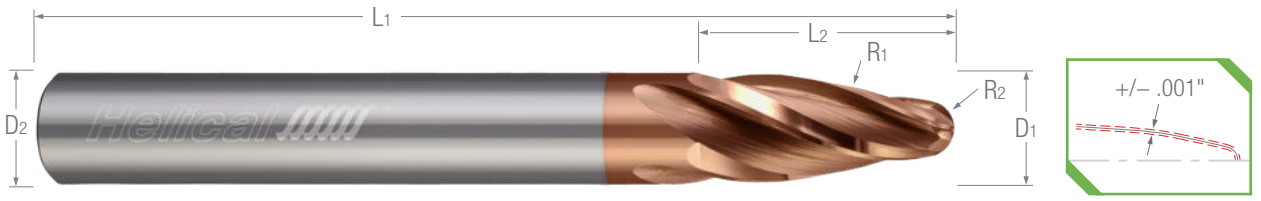
MULTI-AXIS FINISHERS - 4 FLUTE

New!

HMAF-FE-4

Oval Form

- Specially defined profile for massive reductions in cycle time and vastly improved surface finish
- Oval form with two tangential radii for versatility in angle of approach and clearance in tight spaces
- 4 flute geometry specifically designed for semi-finishing and finishing in stainless steel, high temperature alloys, and other ferrous materials
- Center cutting
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Major Radius R_1	Tip Radius R_2	Length of Cut L_2	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	T*plus* Coated	Tool Description	
3/8	3/8	**3**	3/32	.8260	2-1/2	4	4x	86472	HMAF-FE-40375-04-OVL	new
1/2	1/2	**4**	1/8	1.1013	3	4	4x	86473	HMAF-FE-40500-04-OVL	new
5/8	5/8	**5**	5/32	1.3766	3-1/2	4	4x	86474	HMAF-FE-40625-04-OVL	new
3/4	3/4	**6**	3/16	1.6519	4	4	4x	86475	HMAF-FE-40750-04-OVL	new

* .0005 max TIR

Multi-Axis Finishers - Technical Information - pg 220

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Speeds & Feeds on Page 223

HMAF-FE-4

SPEEDS & FEEDS

4 Flute - Multi-Axis Finishers

HMAF-FE-4

Material Guide		Hardness	SFM	Inches per Tooth (IPT) 1/8 Fin	3/16 Fin	1/4 Fin	3/8 Fin	1/2 Fin	5/8 Fin	3/4 Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	800	.0017	.0019	.0022	.0025	.0029	.0034	.0042
		75 - 98 HRB	750	.0014	.0016	.0018	.0021	.0025	.0029	.0036
		21 - 36 HRC	700	.0012	.0013	.0015	.0017	.0020	.0024	.0029
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	600	.0013	.0015	.0017	.0020	.0023	.0027	.0033
		21 - 36 HRC	550	.0011	.0013	.0015	.0017	.0020	.0023	.0028
		36 - 50 HRC	400	.0011	.0012	.0014	.0016	.0018	.0022	.0027
		> 50 HRC	350	.0010	.0011	.0012	.0014	.0016	.0019	.0024
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	550	.0013	.0015	.0017	.0020	.0023	.0027	.0033
		21 - 36 HRC	500	.0012	.0013	.0015	.0017	.0020	.0024	.0029
		36 - 50 HRC	450	.0011	.0012	.0014	.0015	.0018	.0022	.0026
		> 50 HRC	400	.0010	.0011	.0012	.0014	.0016	.0019	.0023
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	450	.0015	.0017	.0020	.0022	.0026	.0031	.0038
		75 - 98 HRB	500	.0013	.0014	.0016	.0019	.0022	.0026	.0031
		21 - 36 HRC	450	.0012	.0013	.0015	.0018	.0020	.0025	.0030
		36 - 50 HRC	400	.0011	.0013	.0014	.0017	.0019	.0023	.0028
		> 50 HRC	350	.0009	.0010	.0011	.0013	.0015	.0018	.0022
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	500	.0013	.0015	.0017	.0019	.0023	.0027	.0033
		21 - 36 HRC	450	.0013	.0014	.0016	.0018	.0021	.0026	.0031
		36 - 50 HRC	400	.0011	.0012	.0014	.0016	.0019	.0023	.0028
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	750	.0013	.0015	.0017	.0020	.0023	.0027	.0033
		21 - 36 HRC	650	.0013	.0014	.0016	.0018	.0021	.0025	.0031
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	450	.0011	.0013	.0015	.0017	.0020	.0023	.0028
		36 - 50 HRC	400	.0011	.0012	.0014	.0016	.0018	.0022	.0027
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	600	.0017	.0019	.0022	.0025	.0029	.0035	.0042
		21 - 36 HRC	550	.0013	.0014	.0016	.0018	.0021	.0025	.0031
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	550	.0014	.0015	.0017	.0020	.0023	.0028	.0034
		21 - 36 HRC	450	.0013	.0014	.0016	.0018	.0021	.0026	.0031
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	500	.0014	.0015	.0018	.0020	.0024	.0028	.0034
		21 - 36 HRC	450	.0011	.0013	.0014	.0017	.0019	.0023	.0028
		36 - 50 HRC	400	.0009	.0010	.0011	.0013	.0015	.0018	.0022
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	600	.0016	.0018	.0020	.0023	.0027	.0032	.0039
		75 - 98 HRB	550	.0014	.0016	.0018	.0021	.0025	.0029	.0036
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	200	.0011	.0013	.0014	.0016	.0019	.0023	.0028
		21 - 36 HRC	180	.0011	.0012	.0014	.0016	.0019	.0023	.0027
		36 - 50 HRC	150	.0010	.0011	.0013	.0015	.0017	.0021	.0025
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	350	.0019	.0021	.0024	.0027	.0032	.0038	.0046
		75 - 98 HRB	400	.0017	.0019	.0022	.0025	.0029	.0035	.0042
		21 - 36 HRC	325	.0015	.0017	.0019	.0022	.0025	.0030	.0036
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	300	.0013	.0015	.0017	.0019	.0022	.0027	.0032
		36 - 50 HRC	250	.0012	.0014	.0016	.0018	.0021	.0025	.0031
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	225	.0012	.0013	.0015	.0018	.0021	.0024	.0030
		21 - 36 HRC	150	.0012	.0013	.0015	.0017	.0020	.0024	.0029
		36 - 50 HRC	90	.0010	.0011	.0012	.0014	.0017	.0020	.0024

STYLE	TOOLPATH	ADOC (STOCK REMOVAL)	RDOC (STEPOVER PER PASS)
HMAF-FE-4	Finishing (Fin)	.005"-.010"	.025 x Dia x Benefit Multiple

NOTES:
ADOC and RDOC are recommended starting values, and should be adjusted according to your finish requirements
If converting from a ball end mill, the benefit multiple can be used to recalculate stepover pass-to-pass

MULTI-AXIS FINISHERS - 6 FLUTE

HMAF-FE-6

Taper Form

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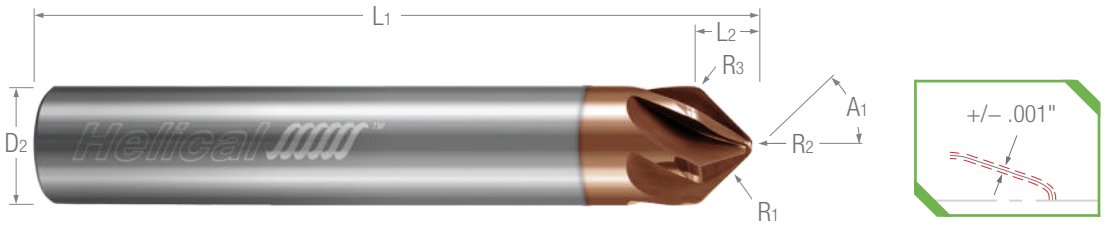
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Ang. Per Side A_1 $^{+0°30'}_{-0°30'}$	Shank Dia. D_2 (h6)	Major Radius R_1	Tip Radius R_2	Corner Radius R_3	Length of Cut L_2	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	T*plus* Coated	Tool Description
15°	3/8	**12**	3/64	3/16	.5901	2-1/2	6	8x	**86333**	HMAF-FE-60375-08-T15
	3/8	**27**	3/64	3/16	.5902	2-1/2	6	12x	**86338**	HMAF-FE-60375-12-T15
	1/2	**16**	1/16	1/4	.7868	3	6	8x	**86341**	HMAF-FE-60500-08-T15
	1/2	**36**	1/16	1/4	.7869	3	6	12x	**86346**	HMAF-FE-60500-12-T15
	5/8	**20**	5/64	5/16	.9834	3	6	8x	**86349**	HMAF-FE-60625-08-T15
	5/8	**45**	5/64	5/16	.9836	3	6	12x	**86354**	HMAF-FE-60625-12-T15
	3/4	**24**	3/32	3/8	1.1801	4	6	8x	**86357**	HMAF-FE-60750-08-T15
	3/4	**54**	3/32	3/8	1.1803	4	6	12x	**86362**	HMAF-FE-60750-12-T15
30°	3/8	**12**	3/64	3/16	.3281	2-1/2	6	8x	**86334**	HMAF-FE-60375-08-T30
	3/8	**27**	3/64	3/16	.3281	2-1/2	6	12x	**86339**	HMAF-FE-60375-12-T30
	1/2	**16**	1/16	1/4	.4375	3	6	8x	**86342**	HMAF-FE-60500-08-T30
	1/2	**36**	1/16	1/4	.4375	3	6	12x	**86347**	HMAF-FE-60500-12-T30
	5/8	**20**	5/64	5/16	.5469	3	6	8x	**86350**	HMAF-FE-60625-08-T30
	5/8	**45**	5/64	5/16	.5469	3	6	12x	**86355**	HMAF-FE-60625-12-T30
	3/4	**24**	3/32	3/8	.6562	4	6	8x	**86358**	HMAF-FE-60750-08-T30
	3/4	**54**	3/32	3/8	.6562	4	6	12x	**86363**	HMAF-FE-60750-12-T30
45°	3/8	**12**	3/64	3/64	.1875	2-1/2	6	8x	**86335**	HMAF-FE-60375-08-T45
	3/8	**27**	3/64	3/64	.1875	2-1/2	6	12x	**86340**	HMAF-FE-60375-12-T45
	1/2	**16**	1/16	1/16	.2500	3	6	8x	**86343**	HMAF-FE-60500-08-T45
	1/2	**36**	1/16	1/16	.2500	3	6	12x	**86348**	HMAF-FE-60500-12-T45
	5/8	**20**	5/64	5/64	.3125	3	6	8x	**86351**	HMAF-FE-60625-08-T45
	5/8	**45**	5/64	5/64	.3125	3	6	12x	**86356**	HMAF-FE-60625-12-T45
	3/4	**24**	3/32	3/32	.3750	4	6	8x	**86359**	HMAF-FE-60750-08-T45
	3/4	**54**	3/32	3/32	.3750	4	6	12x	**86364**	HMAF-FE-60750-12-T45

* .0005 max TIR

Multi-Axis Finishers - Technical Information - pg 220

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Speeds & Feeds on Page 226

HMAF-FE-6

MULTI-AXIS FINISHERS - 6 FLUTE

Oval Form

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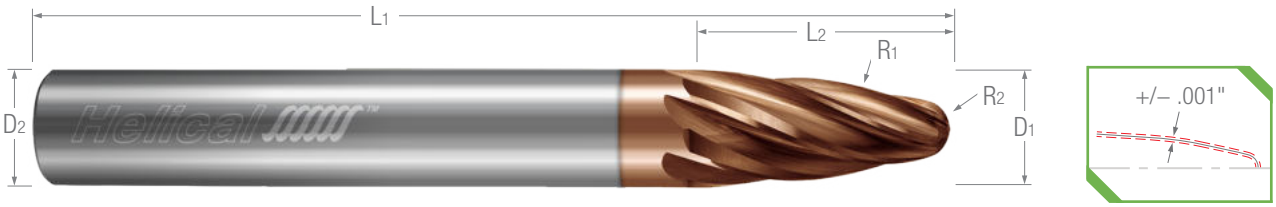

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Major Radius R_1	Tip Radius R_2	Length of Cut L_2	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Benefit Multiple	T*plus* Coated	Tool Description
3/8	3/8	**3**	3/32	.8260	2-1/2	6	4x	**86321**	HMAF-FE-60375-04-OVL
1/2	1/2	**4**	1/8	1.1013	3	6	4x	**86322**	HMAF-FE-60500-04-OVL
5/8	5/8	**5**	5/32	1.3766	3-1/2	6	4x	**86323**	HMAF-FE-60625-04-OVL
3/4	3/4	**6**	3/16	1.6519	4	6	4x	**86324**	HMAF-FE-60750-04-OVL

* .0005 max TIR

Multi-Axis Finishers - Technical Information - pg 220

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scan the QR code to read online

Speeds & Feeds on Page 226

SPEEDS & FEEDS

HMAF-FE-6

6 Flute - Multi-Axis Finishers

HMAF-FE-6

Material Guide		Hardness	SFM	Inches per Tooth (IPT)						
				1/8	3/16	1/4	3/8	1/2	5/8	3/4
				Fin	Fin	Fin	Fin	Fin	Fin	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	800	.0030	.0034	.0039	.0044	.0051	.0060	.0074
		75 - 98 HRB	750	.0025	.0028	.0032	.0037	.0044	.0051	.0064
		21 - 36 HRC	700	.0021	.0023	.0026	.0030	.0035	.0042	.0051
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	600	.0023	.0026	.0030	.0035	.0041	.0048	.0058
		21 - 36 HRC	550	.0019	.0023	.0026	.0030	.0035	.0041	.0049
		36 - 50 HRC	400	.0019	.0021	.0025	.0028	.0032	.0039	.0048
		> 50 HRC	350	.0018	.0019	.0021	.0025	.0028	.0034	.0042
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	550	.0023	.0026	.0030	.0035	.0041	.0048	.0058
		21 - 36 HRC	500	.0021	.0023	.0026	.0030	.0035	.0042	.0051
		36 - 50 HRC	450	.0019	.0021	.0025	.0026	.0032	.0039	.0046
		> 50 HRC	400	.0018	.0019	.0021	.0025	.0028	.0034	.0041
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	450	.0026	.0030	.0035	.0039	.0046	.0055	.0067
		75 - 98 HRB	500	.0023	.0025	.0028	.0034	.0039	.0046	.0055
		21 - 36 HRC	450	.0021	.0023	.0026	.0032	.0035	.0044	.0053
		36 - 50 HRC	400	.0019	.0023	.0025	.0030	.0034	.0041	.0049
		> 50 HRC	350	.0016	.0018	.0019	.0023	.0026	.0032	.0039
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	500	.0023	.0026	.0030	.0034	.0041	.0048	.0058
		21 - 36 HRC	450	.0023	.0025	.0028	.0032	.0037	.0046	.0055
		36 - 50 HRC	400	.0019	.0021	.0025	.0028	.0034	.0041	.0049
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	750	.0023	.0026	.0030	.0035	.0041	.0048	.0058
		21 - 36 HRC	650	.0023	.0025	.0028	.0032	.0037	.0044	.0055
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	450	.0019	.0023	.0026	.0030	.0035	.0041	.0049
		36 - 50 HRC	400	.0019	.0021	.0025	.0028	.0032	.0039	.0048
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	600	.0030	.0034	.0039	.0044	.0051	.0062	.0074
		21 - 36 HRC	550	.0023	.0025	.0028	.0032	.0037	.0044	.0055
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	550	.0025	.0026	.0030	.0035	.0041	.0049	.0060
		21 - 36 HRC	450	.0023	.0025	.0028	.0032	.0037	.0046	.0055
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	500	.0025	.0026	.0032	.0035	.0042	.0049	.0060
		21 - 36 HRC	450	.0019	.0023	.0025	.0030	.0034	.0041	.0049
		36 - 50 HRC	400	.0016	.0018	.0019	.0023	.0026	.0032	.0039
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	600	.0028	.0032	.0035	.0041	.0048	.0056	.0069
		75 - 98 HRB	550	.0025	.0028	.0032	.0037	.0044	.0051	.0064
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	200	.0019	.0023	.0025	.0028	.0034	.0041	.0049
		21 - 36 HRC	180	.0019	.0021	.0025	.0028	.0034	.0041	.0048
		36 - 50 HRC	150	.0018	.0019	.0023	.0026	.0030	.0037	.0044
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	350	.0034	.0037	.0042	.0048	.0056	.0067	.0081
		75 - 98 HRB	400	.0030	.0034	.0039	.0044	.0051	.0062	.0074
		21 - 36 HRC	325	.0026	.0030	.0034	.0039	.0044	.0053	.0064
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	300	.0023	.0026	.0030	.0034	.0039	.0048	.0056
		36 - 50 HRC	250	.0021	.0025	.0028	.0032	.0037	.0044	.0055
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	225	.0021	.0023	.0026	.0032	.0037	.0042	.0053
		21 - 36 HRC	150	.0021	.0023	.0026	.0030	.0035	.0042	.0051
		36 - 50 HRC	90	.0018	.0019	.0021	.0025	.0030	.0035	.0042

STYLE	TOOLPATH	ADOC (STOCK REMOVAL)	RDOC (STEPOVER PER PASS)
HMAF-FE-6	Finishing (Fin)	.005"-.010"	.025 x Dia x Benefit Multiple

NOTES:
ADOC and RDOC are recommended starting values, and should be adjusted according to your finish requirements

If converting from a ball end mill, the benefit multiple can be used to recalculate stepover pass-to-pass

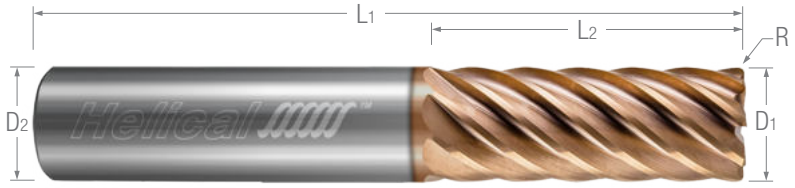
HXF

HEM

MULTI-FLUTE - CORNER RADIUS
Finisher

- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- 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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

For steel applications, see page 169 for A*plus* coating



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
1/4	1/4	**.020**	3/8	2	7	**59959**	HXF-S-070250-R.020
	1/4	**.020**	1/2	2	7	**83517**	HXF-SR-070250-R.020
	1/4	**.020**	3/4	2-1/2	7	**59960**	HXF-R-070250-R.020
3/8	3/8	**.020**	1/2	2	7	**59961**	HXF-S-070375-R.020
	3/8	**.020**	3/4	2-1/2	7	**83518**	HXF-SR-070375-R.020
	3/8	**.020**	1	3	7	**59962**	HXF-R-070375-R.020
	3/8	**.020**	1-1/4	3	7	**83519**	HXF-M-070375-R.020
1/2	1/2	**.030**	5/8	2-1/2	8	**59963**	HXF-S-080500-R.030
	1/2	**.030**	1	3	8	**59964**	HXF-SR-080500-R.030
	1/2	**.030**	1-1/4	3	8	**59965**	HXF-R-080500-R.030
	1/2	**.030**	1-5/8	3-1/2	8	**83520**	HXF-M-080500-R.030
3/4	3/4	**.060**	1	3	12	**59966**	HXF-S-120750-R.060
	3/4	**.060**	1-5/8	4	12	**59967**	HXF-R-120750-R.060

* .0005 max TIR

Finishers

Speeds & Feeds on Page 170

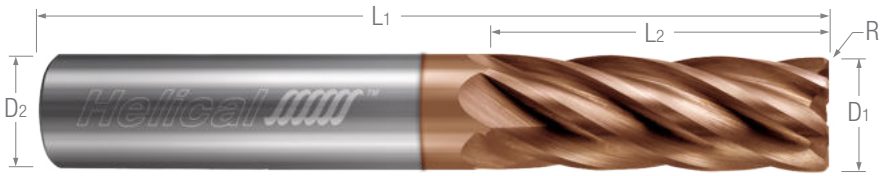
6 FLUTE - CORNER RADIUS New Items!

Variable Pitch

HEM

HVNI-6

- Specially engineered for optimal performance in Inconel 718 and other nickel-based superalloys in High Efficiency Milling (HEM) and traditional roughing toolpaths
- 6 flute variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description	
1/4	1/4	**.010**	3/8	2	6	87301	HVNI-015-60250-R.010	new
	1/4	**.010**	1/2	2-1/2	6	86178	HVNI-020-60250-R.010	
	1/4	**.010**	3/4	2-1/2	6	86179	HVNI-030-60250-R.010	
	1/4	**.010**	1	3	6	86180	HVNI-040-60250-R.010	
	1/4	**.030**	3/8	2	6	87302	HVNI-015-60250-R.030	new
	1/4	**.030**	1/2	2-1/2	6	86181	HVNI-020-60250-R.030	
	1/4	**.030**	3/4	2-1/2	6	86182	HVNI-030-60250-R.030	
	1/4	**.030**	1	3	6	86183	HVNI-040-60250-R.030	
3/8	3/8	**.010**	3/4	2-1/2	6	87303	HVNI-020-60375-R.010	new
	3/8	**.010**	1	3	6	86184	HVNI-026-60375-R.010	
	3/8	**.010**	1-1/4	3	6	86185	HVNI-033-60375-R.010	
	3/8	**.010**	1-1/2	3-1/2	6	86186	HVNI-040-60375-R.010	
	3/8	**.030**	3/4	2-1/2	6	87304	HVNI-020-60375-R.030	new
	3/8	**.030**	1	3	6	86187	HVNI-026-60375-R.030	
	3/8	**.030**	1-1/4	3	6	86188	HVNI-033-60375-R.030	
	3/8	**.030**	1-1/2	3-1/2	6	86189	HVNI-040-60375-R.030	
1/2	1/2	**.010**	1	3	6	87305	HVNI-020-60500-R.010	new
	1/2	**.010**	1-1/4	3	6	87306	HVNI-025-60500-R.010	new
	1/2	**.010**	1-5/8	4	6	87307	HVNI-032-60500-R.010	new
	1/2	**.010**	2	4	6	87308	HVNI-040-60500-R.010	new
	1/2	**.030**	1	3	6	86190	HVNI-020-60500-R.030	
	1/2	**.030**	1-1/4	3	6	86191	HVNI-025-60500-R.030	
	1/2	**.030**	1-5/8	4	6	86192	HVNI-032-60500-R.030	
	1/2	**.030**	2	4	6	86193	HVNI-040-60500-R.030	
	1/2	**.060**	1	3	6	86194	HVNI-020-60500-R.060	
	1/2	**.060**	1-1/4	3	6	86195	HVNI-025-60500-R.060	
	1/2	**.060**	1-5/8	4	6	86196	HVNI-032-60500-R.060	
	1/2	**.060**	2	4	6	86197	HVNI-040-60500-R.060	

continued on next page

Speeds & Feeds on Page 231

HVNI-6

New Items! 6 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
new	1/2	1/2	**.090**	1	3	6	87309	HVNI-020-60500-R.090
new		1/2	**.090**	1-1/4	3	6	87310	HVNI-025-60500-R.090
new		1/2	**.090**	1-5/8	4	6	87311	HVNI-032-60500-R.090
new		1/2	**.090**	2	4	6	87312	HVNI-040-60500-R.090
		1/2	**.120**	1	3	6	86198	HVNI-020-60500-R.120
		1/2	**.120**	1-1/4	3	6	86199	HVNI-025-60500-R.120
		1/2	**.120**	1-5/8	4	6	86200	HVNI-032-60500-R.120
		1/2	**.120**	2	4	6	86201	HVNI-040-60500-R.120
new	5/8	5/8	**.030**	1-5/8	3-1/2	6	87728	HVNI-026-60625-R.030
new		5/8	**.030**	2-1/8	4	6	87729	HVNI-034-60625-R.030
new		5/8	**.030**	2-1/2	5	6	87730	HVNI-040-60625-R.030
new		5/8	**.060**	1-5/8	3-1/2	6	87731	HVNI-026-60625-R.060
new		5/8	**.060**	2-1/8	4	6	87732	HVNI-034-60625-R.060
new		5/8	**.060**	2-1/2	5	6	87733	HVNI-040-60625-R.060
new		5/8	**.125**	1-5/8	3-1/2	6	87734	HVNI-026-60625-R.125
new		5/8	**.125**	2-1/8	4	6	87735	HVNI-034-60625-R.125
new		5/8	**.125**	2-1/2	5	6	87736	HVNI-040-60625-R.125
	3/4	3/4	**.030**	1-5/8	4	6	86202	HVNI-021-60750-R.030
		3/4	**.030**	2-1/4	5	6	86203	HVNI-030-60750-R.030
new		3/4	**.030**	2-3/4	5	6	87313	HVNI-036-60750-R.030
new		3/4	**.030**	3-1/4	6	6	87314	HVNI-043-60750-R.030
		3/4	**.060**	1-5/8	4	6	86204	HVNI-021-60750-R.060
		3/4	**.060**	2-1/4	5	6	86205	HVNI-030-60750-R.060
new		3/4	**.060**	2-3/4	5	6	87315	HVNI-036-60750-R.060
new		3/4	**.060**	3-1/4	6	6	87316	HVNI-043-60750-R.060
new		3/4	**.090**	1-5/8	4	6	87317	HVNI-021-60750-R.090
new		3/4	**.090**	2-1/4	5	6	87318	HVNI-030-60750-R.090
new		3/4	**.090**	2-3/4	5	6	87319	HVNI-036-60750-R.090
new		3/4	**.090**	3-1/4	6	6	87320	HVNI-043-60750-R.090
		3/4	**.120**	1-5/8	4	6	86206	HVNI-021-60750-R.120
		3/4	**.120**	2-1/4	5	6	86207	HVNI-030-60750-R.120
new		3/4	**.120**	2-3/4	5	6	87321	HVNI-036-60750-R.120
new		3/4	**.120**	3-1/4	6	6	87322	HVNI-043-60750-R.120

* .0005 max TIR

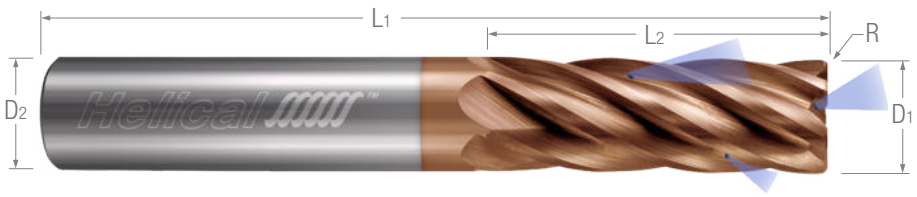
6 FLUTE - CORNER RADIUS New!

Variable Pitch - Coolant Through

HEM

HVNIC-6

- Specially engineered for optimal performance in Inconel 718 and other nickel-based superalloys in High Efficiency Milling (HEM) and traditional roughing tool paths
- 6 flute variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description	
1/4	1/4	**.010**	1/2	2-1/2	6	87608	HVNIC-020-60250-R.010	new
	1/4	**.010**	3/4	2-1/2	6	87609	HVNIC-030-60250-R.010	new
	1/4	**.030**	1/2	2-1/2	6	87610	HVNIC-020-60250-R.030	new
	1/4	**.030**	3/4	2-1/2	6	87611	HVNIC-030-60250-R.030	new
3/8	3/8	**.010**	3/4	2-1/2	6	87612	HVNIC-020-60375-R.010	new
	3/8	**.010**	1	3	6	87613	HVNIC-027-60375-R.010	new
	3/8	**.030**	3/4	2-1/2	6	87614	HVNIC-020-60375-R.030	new
	3/8	**.030**	1	3	6	87615	HVNIC-027-60375-R.030	new
1/2	1/2	**.030**	1	3	6	87616	HVNIC-020-60500-R.030	new
	1/2	**.030**	1-1/4	3	6	87617	HVNIC-025-60500-R.030	new
	1/2	**.030**	1-5/8	4	6	87618	HVNIC-033-60500-R.030	new
	1/2	**.060**	1	3	6	87619	HVNIC-020-60500-R.060	new
	1/2	**.060**	1-1/4	3	6	87620	HVNIC-025-60500-R.060	new
	1/2	**.060**	1-5/8	4	6	87621	HVNIC-033-60500-R.060	new
3/4	3/4	**.030**	1-5/8	4	6	87622	HVNIC-022-60750-R.030	new
	3/4	**.030**	2-1/4	5	6	87623	HVNIC-030-60750-R.030	new
	3/4	**.060**	1-5/8	4	6	87624	HVNIC-022-60750-R.060	new
	3/4	**.060**	2-1/4	5	6	87625	HVNIC-030-60750-R.060	new

* .0005 max TIR

Speeds & Feeds on Page 231

HVNI-6

SPEEDS & FEEDS

6 Flute - Variable Pitch

HVNI-6 / HVNIC-6

Material Guide		Hardness	SFM	Inches per Tooth (IPT)														
				1/4			3/8			1/2			3/4			1		
				HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin	HEM	Rgh	Fin
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0060	.0028	.0018	.0088	.0041	.0021	.0116	.0054	.0025	.0165	.0077	.0029	.0212	.0099	.0036
		75 - 98 HRB	250	.0049	.0023	.0017	.0073	.0034	.0019	.0096	.0045	.0023	.0137	.0064	.0027	.0178	.0083	.0033
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0030	.0014	.0013	.0045	.0021	.0015	.0058	.0027	.0018	.0084	.0039	.0021	.0107	.0050	.0025
		21 - 36 HRC	75	.0030	.0014	.0013	.0043	.0020	.0015	.0056	.0026	.0017	.0081	.0038	.0020	.0105	.0049	.0025
		36 - 50 HRC	70	.0026	.0012	.0012	.0036	.0017	.0014	.0047	.0022	.0016	.0069	.0032	.0019	.0088	.0041	.0023
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0047	.0038	.0021	.0071	.0057	.0024	.0099	.0074	.0029	.0148	.0106	.0034	.0198	.0137	.0041
		75 - 98 HRB	275	.0040	.0032	.0019	.0059	.0048	.0023	.0082	.0062	.0026	.0123	.0089	.0031	.0165	.0115	.0038
		21 - 36 HRC	250	.0030	.0024	.0017	.0045	.0036	.0019	.0062	.0047	.0023	.0092	.0067	.0027	.0123	.0086	.0032
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0024	.0019	.0014	.0037	.0028	.0017	.0049	.0037	.0020	.0073	.0053	.0023	.0097	.0068	.0029
		36 - 50 HRC	160	.0022	.0017	.0014	.0032	.0026	.0016	.0044	.0034	.0019	.0067	.0048	.0023	.0089	.0062	.0027
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0034	.0016	.0014	.0051	.0024	.0016	.0066	.0031	.0019	.0096	.0045	.0022	.0122	.0057	.0027
		21 - 36 HRC	170	.0034	.0016	.0014	.0049	.0023	.0016	.0064	.0030	.0018	.0092	.0043	.0022	.0120	.0056	.0027
		36 - 50 HRC	65	.0021	.0010	.0011	.0034	.0016	.0013	.0043	.0020	.0015	.0062	.0029	.0018	.0081	.0038	.0022

MILLING PROCESS	ADOC	RDOC
HEM (High Efficiency Milling)	Up to Max LOC	Up to 10% Diameter
Rgh (Roughing)	Up to Max LOC	10%-20% Diameter
Fin (Finishing)	Up to Max LOC	4%-6% Diameter

Note: 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.

Understanding Nickel Alloys: Popularity, Chemical Composition, & Classification

In The Loupe MACHINISTS BLOG

Nickel-based alloys have been a cornerstone of manufacturing for decades, desirable for their broad range of varying resistances to heat, oxidation, and corrosion. Learn more about this unique and advantageous material, and dive into what makes it truly a staple in machine shops, by reading our “In the Loupe” post: *Understanding Nickel Alloys: Popularity, Chemical Composition, & Classification.*

www.harveyperformance.com/in-the-loupe/nickel-alloys/

SCAN TO READ

8 FLUTE - CORNER RADIUS New Items!

Variable Pitch - For High Efficiency Milling

HEM **HVNI-8**

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of Inconel 718 and other nickel-based superalloys
- 8 flute variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Not for use in traditional slotting and roughing toolpaths
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description	
3/8	3/8	**.010**	3/4	2-1/2	8	87323	HVNI-020-80375-R.010	new
	3/8	**.010**	1	3	8	86238	HVNI-026-80375-R.010	
	3/8	**.010**	1-1/4	3	8	86239	HVNI-033-80375-R.010	
	3/8	**.010**	1-1/2	3-1/2	8	86240	HVNI-040-80375-R.010	
	3/8	**.030**	3/4	2-1/2	8	87324	HVNI-020-80375-R.030	new
	3/8	**.030**	1	3	8	86241	HVNI-026-80375-R.030	
	3/8	**.030**	1-1/4	3	8	86242	HVNI-033-80375-R.030	
	3/8	**.030**	1-1/2	3-1/2	8	86243	HVNI-040-80375-R.030	
1/2	1/2	**.010**	1	3	8	87325	HVNI-020-80500-R.010	new
	1/2	**.010**	1-1/4	3	8	87326	HVNI-025-80500-R.010	new
	1/2	**.010**	1-5/8	4	8	87327	HVNI-032-80500-R.010	new
	1/2	**.010**	2	4	8	87328	HVNI-040-80500-R.010	new
	1/2	**.030**	1	3	8	86244	HVNI-020-80500-R.030	
	1/2	**.030**	1-1/4	3	8	86245	HVNI-025-80500-R.030	
	1/2	**.030**	1-5/8	4	8	86246	HVNI-032-80500-R.030	
	1/2	**.030**	2	4	8	86247	HVNI-040-80500-R.030	
	1/2	**.060**	1	3	8	86248	HVNI-020-80500-R.060	
	1/2	**.060**	1-1/4	3	8	86249	HVNI-025-80500-R.060	
	1/2	**.060**	1-5/8	4	8	86250	HVNI-032-80500-R.060	
	1/2	**.060**	2	4	8	86251	HVNI-040-80500-R.060	
	1/2	**.090**	1	3	8	87329	HVNI-020-80500-R.090	new
	1/2	**.090**	1-1/4	3	8	87330	HVNI-025-80500-R.090	new
	1/2	**.090**	1-5/8	4	8	87331	HVNI-032-80500-R.090	new
	1/2	**.090**	2	4	8	87332	HVNI-040-80500-R.090	new
	1/2	**.120**	1	3	8	86252	HVNI-020-80500-R.120	
	1/2	**.120**	1-1/4	3	8	86253	HVNI-025-80500-R.120	
	1/2	**.120**	1-5/8	4	8	86254	HVNI-032-80500-R.120	
	1/2	**.120**	2	4	8	86255	HVNI-040-80500-R.120	

continued on next page

Speeds & Feeds on Page 234

HVNI-8

New Items! **8 FLUTE - CORNER RADIUS**

Variable Pitch - For High Efficiency Milling (cont.)

continued from previous page

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	T*plus* Coated	Tool Description
new	5/8	5/8	.030	1-5/8	3-1/2	8	87737	HVNI-026-80625-R.030
new		5/8	.030	2-1/8	4	8	87738	HVNI-034-80625-R.030
new		5/8	.030	2-1/2	5	8	87739	HVNI-040-80625-R.030
new		5/8	.060	1-5/8	3-1/2	8	87740	HVNI-026-80625-R.060
new		5/8	.060	2-1/8	4	8	87741	HVNI-034-80625-R.060
new		5/8	.060	2-1/2	5	8	87742	HVNI-040-80625-R.060
new		5/8	.125	1-5/8	3-1/2	8	87743	HVNI-026-80625-R.125
new		5/8	.125	2-1/8	4	8	87744	HVNI-034-80625-R.125
new		5/8	.125	2-1/2	5	8	87745	HVNI-040-80625-R.125
	3/4	3/4	.030	1-5/8	4	8	86256	HVNI-021-80750-R.030
		3/4	.030	2-1/4	5	8	86257	HVNI-030-80750-R.030
new		3/4	.030	2-3/4	5	8	87333	HVNI-036-80750-R.030
new		3/4	.030	3-1/4	6	8	87334	HVNI-043-80750-R.030
		3/4	.060	1-5/8	4	8	86258	HVNI-021-80750-R.060
		3/4	.060	2-1/4	5	8	86259	HVNI-030-80750-R.060
new		3/4	.060	2-3/4	5	8	87335	HVNI-036-80750-R.060
new		3/4	.060	3-1/4	6	8	87336	HVNI-043-80750-R.060
new		3/4	.090	1-5/8	4	8	87337	HVNI-021-80750-R.090
new		3/4	.090	2-1/4	5	8	87338	HVNI-030-80750-R.090
new		3/4	.090	2-3/4	5	8	87339	HVNI-036-80750-R.090
new		3/4	.090	3-1/4	6	8	87340	HVNI-043-80750-R.090
		3/4	.120	1-5/8	4	8	86260	HVNI-021-80750-R.120
		3/4	.120	2-1/4	5	8	86261	HVNI-030-80750-R.120
new		3/4	.120	2-3/4	5	8	87341	HVNI-036-80750-R.120
new		3/4	.120	3-1/4	6	8	87342	HVNI-043-80750-R.120
	1	1	.060	2	4-1/2	8	86262	HVNI-020-81000-R.060
		1	.060	2-5/8	5	8	86263	HVNI-026-81000-R.060
new		1	.060	3-1/4	6	8	87746	HVNI-033-81000-R.060
new		1	.060	4-1/4	6	8	87747	HVNI-043-81000-R.060
new		1	.125	2	4-1/2	8	87748	HVNI-020-81000-R.125
new		1	.125	2-5/8	5	8	87749	HVNI-026-81000-R.125
new		1	.125	3-1/4	6	8	87750	HVNI-033-81000-R.125
new		1	.125	4-1/4	6	8	87751	HVNI-043-81000-R.125

SPEEDS & FEEDS

8 Flute - Variable Pitch - For High Efficiency Milling

HVNI-8

HVNI-8													
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	.0051	.0020	.0079	.0023	.0100	.0027	.0148	.0033	.0187	.0040
		75 - 98 HRB	250	.0043	.0019	.0066	.0022	.0084	.0025	.0125	.0030	.0157	.0036
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0026	.0015	.0041	.0017	.0051	.0020	.0075	.0023	.0095	.0028
		21 - 36 HRC	75	.0025	.0014	.0039	.0016	.0049	.0019	.0072	.0023	.0092	.0028
		36 - 50 HRC	70	.0021	.0013	.0033	.0015	.0041	.0018	.0062	.0021	.0079	.0026
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0042	.0021	.0063	.0024	.0088	.0029	.0131	.0034	.0176	.0041
		75 - 98 HRB	275	.0035	.0019	.0053	.0023	.0073	.0026	.0110	.0031	.0146	.0038
		21 - 36 HRC	250	.0026	.0017	.0040	.0019	.0055	.0023	.0082	.0027	.0110	.0032
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0022	.0014	.0033	.0017	.0043	.0020	.0065	.0023	.0086	.0029
		36 - 50 HRC	160	.0019	.0014	.0029	.0016	.0039	.0019	.0059	.0023	.0079	.0027
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0030	.0016	.0046	.0018	.0057	.0021	.0085	.0025	.0108	.0031
		21 - 36 HRC	170	.0030	.0015	.0044	.0017	.0056	.0021	.0082	.0025	.0105	.0030
		36 - 50 HRC	65	.0020	.0013	.0030	.0015	.0038	.0017	.0056	.0020	.0071	.0024

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

Note: 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.

Machining Nickel Alloys: Avoiding All-Too-Common Mishaps

In The Loupe MACHINISTS BLOG

Don't make an all-too-common mistake when machining nickel-based alloys. Let us help! From work hardening to tool adhesion, and even excessive heat generation, CNC machining nickel-based alloys without the proper knowledge for avoiding these often devastating mishaps can result in scrapped parts. Our "In the Loupe' blog post: Machining Nickel Alloys: *Avoiding All-Too-Common Mishaps* is a great place to start.

www.harveyperformance.com/in-the-loupe/machining-nickel-alloys/

SCAN TO READ

HEV-C-5

New Items!

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
	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
		1/8	**.010**	3/4	2-1/2	5	**83068**	HEV-C-M-50125-R.010
new		1/8	**.020**	1/4	1-1/2	5	**87343**	HEV-C-S-50125-R.020
new		1/8	**.020**	3/8	2	5	**87344**	HEV-C-SR-50125-R.020
new		1/8	**.020**	1/2	2-1/2	5	**87345**	HEV-C-R-50125-R.020
new		1/8	**.020**	5/8	2-1/2	5	**87346**	HEV-C-A-50125-R.020
new		1/8	**.020**	3/4	2-1/2	5	**87347**	HEV-C-M-50125-R.020
new		1/8	**.030**	1/4	1-1/2	5	**87348**	HEV-C-S-50125-R.030
new		1/8	**.030**	3/8	2	5	**87349**	HEV-C-SR-50125-R.030
new		1/8	**.030**	1/2	2-1/2	5	**87350**	HEV-C-R-50125-R.030
new		1/8	**.030**	5/8	2-1/2	5	**87351**	HEV-C-A-50125-R.030
new		1/8	**.030**	3/4	2-1/2	5	**87352**	HEV-C-M-50125-R.030
	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
		3/16	**.010**	1	2-1/2	5	**83069**	HEV-C-ML-50187-R.010
new		3/16	**.020**	5/16	2	5	**87353**	HEV-C-S-50187-R.020
new		3/16	**.020**	7/16	2	5	**87354**	HEV-C-SR-50187-R.020
new		3/16	**.020**	9/16	2-1/2	5	**87355**	HEV-C-R-50187-R.020
new		3/16	**.020**	3/4	2-1/2	5	**87356**	HEV-C-M-50187-R.020
new		3/16	**.020**	1	2-1/2	5	**87357**	HEV-C-ML-50187-R.020
		3/16	**.030**	5/16	2	5	**83070**	HEV-C-S-50187-R.030
		3/16	**.030**	7/16	2	5	**83071**	HEV-C-SR-50187-R.030
		3/16	**.030**	9/16	2-1/2	5	**83072**	HEV-C-R-50187-R.030
		3/16	**.030**	3/4	2-1/2	5	**83073**	HEV-C-M-50187-R.030
new		3/16	**.030**	1	2-1/2	5	**87358**	HEV-C-ML-50187-R.030

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 83

5 FLUTE - CORNER RADIUS New Items!

Chipbreaker Rougher - Variable Pitch (cont.)

HEM

HEV-C-5

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
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	
	1/4	.020	1-1/2	3	5	83074	HEV-C-LX-50250-R.020	
	1/4	.030	3/8	2	5	83075	HEV-C-S-50250-R.030	
	1/4	.030	1/2	2-1/2	5	83076	HEV-C-SR-50250-R.030	
	1/4	.030	3/4	2-1/2	5	83077	HEV-C-R-50250-R.030	
	1/4	.030	1	3	5	83078	HEV-C-M-50250-R.030	
	1/4	.060	3/8	2	5	87359	HEV-C-S-50250-R.060	new
	1/4	.060	1/2	2-1/2	5	87360	HEV-C-SR-50250-R.060	new
	1/4	.060	3/4	2-1/2	5	87361	HEV-C-R-50250-R.060	new
	1/4	.060	1	3	5	87362	HEV-C-M-50250-R.060	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	
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	
	3/8	.020	2	4	5	83079	HEV-C-LX-50375-R.020	
	3/8	.030	1/2	2	5	83080	HEV-C-S-50375-R.030	
	3/8	.030	3/4	2-1/2	5	83081	HEV-C-SR-50375-R.030	
	3/8	.030	1	3	5	83082	HEV-C-R-50375-R.030	
	3/8	.030	1-1/4	3	5	83083	HEV-C-M-50375-R.030	
	3/8	.060	1/2	2	5	87363	HEV-C-S-50375-R.060	new
	3/8	.060	3/4	2-1/2	5	87364	HEV-C-SR-50375-R.060	new
	3/8	.060	1	3	5	87365	HEV-C-R-50375-R.060	new
	3/8	.060	1-1/4	3	5	87366	HEV-C-M-50375-R.060	new
1/2	1/2	.010	5/8	2-1/2	5	83084	HEV-C-S-50500-R.010	
	1/2	.010	1	3	5	83085	HEV-C-SR-50500-R.010	
	1/2	.010	1-1/4	3	5	83086	HEV-C-R-50500-R.010	
	1/2	.010	1-5/8	4	5	83087	HEV-C-M-50500-R.010	
	1/2	.010	2	4	5	83088	HEV-C-L-50500-R.010	
	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	
	1/2	.030	3-5/8	6	5	82219	HEV-C-Y-50500-R.030	

* .0005 max TIR

continued on next page

HEV-C-5

New Items! 5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description
	1/2	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
		1/2	.060	3-1/8	6	5	83089	HEV-C-X-50500-R.060
new		1/2	.125	5/8	2-1/2	5	87367	HEV-C-S-50500-R.125
new		1/2	.125	1	3	5	87368	HEV-C-SR-50500-R.125
new		1/2	.125	1-1/4	3	5	87369	HEV-C-R-50500-R.125
new		1/2	.125	1-5/8	4	5	87370	HEV-C-M-50500-R.125
	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
		5/8	.030	3-1/4	6	5	82221	HEV-C-LX-50625-R.030
		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
		5/8	.060	2-1/8	4	5	81969	HEV-C-M-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
		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
		3/4	.060	3-1/4	6	5	81974	HEV-C-LX-50750-R.060
new		3/4	.125	1-5/8	4	5	87371	HEV-C-R-50750-R.125
new		3/4	.125	2-1/4	5	5	87372	HEV-C-M-50750-R.125
new		3/4	.125	2-3/4	5	5	87373	HEV-C-L-50750-R.125
new		3/4	.125	3-1/4	6	5	87374	HEV-C-LX-50750-R.125
	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

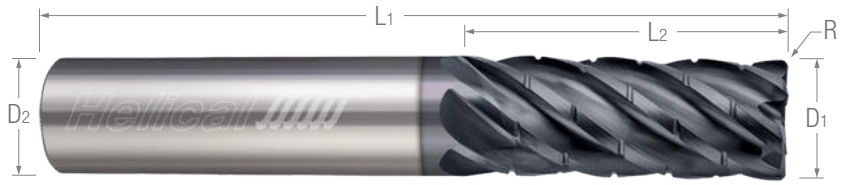
* .0005 max TIR

6 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch - For High Efficiency Milling

HVTI-C-6

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of Titanium 6Al4V and other titanium alloys
- 6 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- Not for use in traditional slotting and roughing toolpaths
- Center cutting
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description
1/4	1/4	.010	1/2	2-1/2	6	84520	HVTI-C-020-60250-R.010
	1/4	.010	3/4	2-1/2	6	84521	HVTI-C-030-60250-R.010
	1/4	.010	1	3	6	84522	HVTI-C-040-60250-R.010
	1/4	.030	1/2	2-1/2	6	84523	HVTI-C-020-60250-R.030
	1/4	.030	3/4	2-1/2	6	84524	HVTI-C-030-60250-R.030
	1/4	.030	1	3	6	84525	HVTI-C-040-60250-R.030
3/8	3/8	.010	1	3	6	84526	HVTI-C-026-60375-R.010
	3/8	.010	1-1/4	3	6	84527	HVTI-C-033-60375-R.010
	3/8	.010	1-1/2	3-1/2	6	84528	HVTI-C-040-60375-R.010
	3/8	.030	1	3	6	84529	HVTI-C-026-60375-R.030
	3/8	.030	1-1/4	3	6	84530	HVTI-C-033-60375-R.030
	3/8	.030	1-1/2	3-1/2	6	84531	HVTI-C-040-60375-R.030
1/2	1/2	.010	1	3	6	84532	HVTI-C-020-60500-R.010
	1/2	.010	1-1/4	3	6	84533	HVTI-C-025-60500-R.010
	1/2	.010	1-5/8	4	6	84534	HVTI-C-032-60500-R.010
	1/2	.010	2	4	6	84535	HVTI-C-040-60500-R.010
	1/2	.030	1	3	6	84536	HVTI-C-020-60500-R.030
	1/2	.030	1-1/4	3	6	84537	HVTI-C-025-60500-R.030
	1/2	.030	1-5/8	4	6	84538	HVTI-C-032-60500-R.030
	1/2	.030	2	4	6	84539	HVTI-C-040-60500-R.030
	1/2	.060	1	3	6	84540	HVTI-C-020-60500-R.060
	1/2	.060	1-1/4	3	6	84541	HVTI-C-025-60500-R.060
	1/2	.060	1-5/8	4	6	84542	HVTI-C-032-60500-R.060
	1/2	.060	2	4	6	84543	HVTI-C-040-60500-R.060
	1/2	.120	1	3	6	84544	HVTI-C-020-60500-R.120
	1/2	.120	1-1/4	3	6	84545	HVTI-C-025-60500-R.120
	1/2	.120	1-5/8	4	6	84546	HVTI-C-032-60500-R.120
	1/2	.120	2	4	6	84547	HVTI-C-040-60500-R.120
3/4	3/4	.030	1-5/8	4	6	84548	HVTI-C-021-60750-R.030
	3/4	.030	2-1/4	5	6	84549	HVTI-C-030-60750-R.030
	3/4	.060	1-5/8	4	6	84550	HVTI-C-021-60750-R.060
	3/4	.060	2-1/4	5	6	84551	HVTI-C-030-60750-R.060
	3/4	.120	1-5/8	4	6	84552	HVTI-C-021-60750-R.120
	3/4	.120	2-1/4	5	6	84553	HVTI-C-030-60750-R.120

* .0005 max TIR

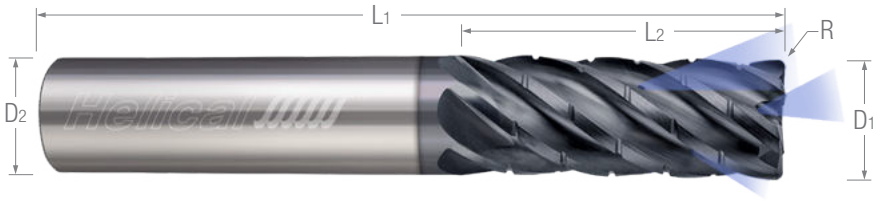
Speeds & Feeds on Page 240

HVTIC-C-6

6 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Coolant Through - Variable Pitch - For High Efficiency Milling

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of Titanium 6Al4V and other titanium alloys
- 6 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- Not for use in traditional slotting and roughing toolpaths
- Center cutting
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
1/4	1/4	**.030**	1/2	2-1/2	6	**84610**	HVTIC-C-020-60250-R.030
	1/4	**.030**	3/4	2-1/2	6	**84611**	HVTIC-C-030-60250-R.030
3/8	3/8	**.010**	1/2	2	6	**84612**	HVTIC-C-013-60375-R.010
	3/8	**.010**	1	3	6	**84613**	HVTIC-C-026-60375-R.010
	3/8	**.030**	1/2	2	6	**84614**	HVTIC-C-013-60375-R.030
	3/8	**.030**	1	3	6	**84615**	HVTIC-C-026-60375-R.030
1/2	1/2	**.030**	1	3	6	**84616**	HVTIC-C-020-60500-R.030
	1/2	**.030**	1-1/4	3	6	**84617**	HVTIC-C-025-60500-R.030
	1/2	**.030**	1-5/8	4	6	**84618**	HVTIC-C-032-60500-R.030
	1/2	**.060**	1	3	6	**84619**	HVTIC-C-020-60500-R.060
	1/2	**.060**	1-1/4	3	6	**84620**	HVTIC-C-025-60500-R.060
	1/2	**.060**	1-5/8	4	6	**84621**	HVTIC-C-032-60500-R.060
3/4	3/4	**.030**	1-5/8	4	6	**84622**	HVTIC-C-021-60750-R.030
	3/4	**.030**	2-1/4	5	6	**84623**	HVTIC-C-030-60750-R.030
	3/4	**.060**	1-5/8	4	6	**84624**	HVTIC-C-021-60750-R.060
	3/4	**.060**	2-1/4	5	6	**84625**	HVTIC-C-030-60750-R.060

* .0005 max TIR

Speeds & Feeds on Page 240

SPEEDS & FEEDS

6 Flute - Corner Radius - Chipbreaker Rougher - Variable Pitch - For High Efficiency Milling

HVTIC-C-6

HVTI-C-6 / HVTIC-C-6								
Material Guide		Hardness	SFM	Inches Per Tooth (IPT)				
				1/4	3/8	1/2	3/4	1
				HEM	HEM	HEM	HEM	HEM
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0038	.0058	.0079	.0118	.0159
		75 - 98 HRB	250	.0032	.0049	.0066	.0099	.0134
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0019	.0029	.0041	.0060	.0081
		21 - 36 HRC	75	.0019	.0028	.0039	.0058	.0077
		36 - 50 HRC	70	.0016	.0024	.0034	.0049	.0066
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0052	.0079	.0110	.0164	.0220
		75 - 98 HRB	275	.0044	.0066	.0091	.0137	.0183
		21 - 36 HRC	250	.0033	.0050	.0069	.0102	.0137
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0027	.0041	.0054	.0081	.0108
		36 - 50 HRC	160	.0024	.0036	.0049	.0074	.0099
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0022	.0034	.0046	.0069	.0092
		21 - 36 HRC	170	.0021	.0032	.0044	.0067	.0088
		36 - 50 HRC	65	.0014	.0023	.0030	.0046	.0060

MILLING PROCESS	ADOC	RDOC
HEM (High Efficiency Milling)	Up to Max LOC	Up to 10% 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.

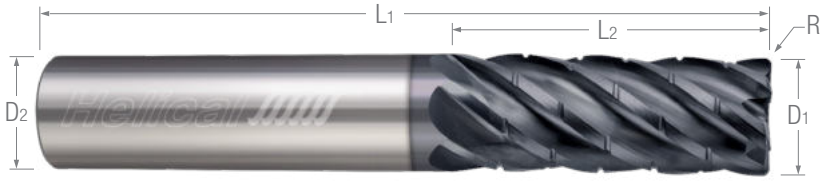
HEV-C-6

New Items!

6 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	A*plus* Coated	Tool Description
	1/8	1/8	**.010**	1/4	1-1/2	6	**84374**	HEV-C-S-60125-R.010
		1/8	**.010**	3/8	2	6	**84375**	HEV-C-SR-60125-R.010
		1/8	**.010**	1/2	2-1/2	6	**84376**	HEV-C-R-60125-R.010
		1/8	**.010**	5/8	2-1/2	6	**84377**	HEV-C-A-60125-R.010
	3/16	3/16	**.010**	5/16	2	6	**84378**	HEV-C-S-60187-R.010
		3/16	**.010**	7/16	2	6	**84379**	HEV-C-SR-60187-R.010
		3/16	**.010**	9/16	2-1/2	6	**84380**	HEV-C-R-60187-R.010
		3/16	**.010**	3/4	2-1/2	6	**84381**	HEV-C-M-60187-R.010
	1/4	1/4	**.010**	3/8	2	6	**83125**	HEV-C-S-60250-R.010
		1/4	**.010**	1/2	2-1/2	6	**83126**	HEV-C-SR-60250-R.010
		1/4	**.010**	3/4	2-1/2	6	**83127**	HEV-C-R-60250-R.010
		1/4	**.010**	1	3	6	**83128**	HEV-C-M-60250-R.010
		1/4	**.020**	3/8	2	6	**82223**	HEV-C-S-60250-R.020
		1/4	**.020**	1/2	2-1/2	6	**82224**	HEV-C-SR-60250-R.020
		1/4	**.020**	3/4	2-1/2	6	**82225**	HEV-C-R-60250-R.020
		1/4	**.020**	1	3	6	**82226**	HEV-C-M-60250-R.020
new		1/4	**.030**	3/8	2	6	**87403**	HEV-C-S-60250-R.030
new		1/4	**.030**	1/2	2-1/2	6	**87404**	HEV-C-SR-60250-R.030
new		1/4	**.030**	3/4	2-1/2	6	**87405**	HEV-C-R-60250-R.030
new		1/4	**.030**	1	3	6	**87406**	HEV-C-M-60250-R.030
new		1/4	**.060**	3/8	2	6	**87407**	HEV-C-S-60250-R.060
new		1/4	**.060**	1/2	2-1/2	6	**87408**	HEV-C-SR-60250-R.060
new		1/4	**.060**	3/4	2-1/2	6	**87409**	HEV-C-R-60250-R.060
new		1/4	**.060**	1	3	6	**87410**	HEV-C-M-60250-R.060
	3/8	3/8	**.010**	1/2	2	6	**83129**	HEV-C-S-60375-R.010
		3/8	**.010**	3/4	2-1/2	6	**83130**	HEV-C-SR-60375-R.010
		3/8	**.010**	1	3	6	**83131**	HEV-C-R-60375-R.010
		3/8	**.010**	1-1/4	3	6	**83132**	HEV-C-M-60375-R.010
new		3/8	**.020**	1/2	2	6	**87411**	HEV-C-S-60375-R.020
new		3/8	**.020**	3/4	2-1/2	6	**87412**	HEV-C-SR-60375-R.020
new		3/8	**.020**	1	3	6	**87413**	HEV-C-R-60375-R.020
new		3/8	**.020**	1-1/4	3	6	**87414**	HEV-C-M-60375-R.020

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 86

6 FLUTE - CORNER RADIUS New Items!

Chipbreaker Rougher - Variable Pitch (cont.)

HEV-C-6

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
3/8	3/8	.030	1/2	2	6	82227	HEV-C-S-60375-R.030	
	3/8	.030	3/4	2-1/2	6	82228	HEV-C-SR-60375-R.030	
	3/8	.030	1	3	6	82229	HEV-C-R-60375-R.030	
	3/8	.030	1-1/4	3	6	82230	HEV-C-M-60375-R.030	
	3/8	.060	1/2	2	6	87415	HEV-C-S-60375-R.060	new
	3/8	.060	3/4	2-1/2	6	87416	HEV-C-SR-60375-R.060	new
	3/8	.060	1	3	6	87417	HEV-C-R-60375-R.060	new
	3/8	.060	1-1/4	3	6	87418	HEV-C-M-60375-R.060	new
1/2	1/2	.010	5/8	2-1/2	6	83133	HEV-C-S-60500-R.010	
	1/2	.010	1	3	6	83134	HEV-C-SR-60500-R.010	
	1/2	.010	1-1/4	3	6	83135	HEV-C-R-60500-R.010	
	1/2	.010	1-5/8	4	6	83136	HEV-C-M-60500-R.010	
	1/2	.010	2	4	6	83137	HEV-C-L-60500-R.010	
	1/2	.010	2-1/2	5	6	83138	HEV-C-LX-60500-R.010	
	1/2	.030	5/8	2-1/2	6	82231	HEV-C-S-60500-R.030	
	1/2	.030	1	3	6	82232	HEV-C-SR-60500-R.030	
	1/2	.030	1-1/4	3	6	82233	HEV-C-R-60500-R.030	
	1/2	.030	1-5/8	4	6	82234	HEV-C-M-60500-R.030	
	1/2	.030	2	4	6	82235	HEV-C-L-60500-R.030	
	1/2	.030	2-1/2	5	6	82236	HEV-C-LX-60500-R.030	
	1/2	.060	5/8	2-1/2	6	82237	HEV-C-S-60500-R.060	
	1/2	.060	1	3	6	82238	HEV-C-SR-60500-R.060	
	1/2	.060	1-1/4	3	6	82239	HEV-C-R-60500-R.060	
	1/2	.060	1-5/8	4	6	82240	HEV-C-M-60500-R.060	
	1/2	.060	2	4	6	82241	HEV-C-L-60500-R.060	
	1/2	.060	2-1/2	5	6	82242	HEV-C-LX-60500-R.060	
	1/2	.125	5/8	2-1/2	6	87419	HEV-C-S-60500-R.125	new
	1/2	.125	1	3	6	87420	HEV-C-SR-60500-R.125	new
	1/2	.125	1-1/4	3	6	87421	HEV-C-R-60500-R.125	new
	1/2	.125	1-5/8	4	6	87422	HEV-C-M-60500-R.125	new
5/8	5/8	.030	1-1/4	3-1/2	6	83139	HEV-C-SR-60625-R.030	
	5/8	.030	1-5/8	3-1/2	6	83140	HEV-C-R-60625-R.030	
	5/8	.030	2	4	6	83141	HEV-C-M-60625-R.030	
	5/8	.060	1-1/4	3-1/2	6	82243	HEV-C-SR-60625-R.060	
	5/8	.060	1-5/8	3-1/2	6	82244	HEV-C-R-60625-R.060	
	5/8	.060	2	4	6	82245	HEV-C-M-60625-R.060	
3/4	3/4	.030	1-5/8	4	6	83142	HEV-C-R-60750-R.030	
	3/4	.030	2-1/4	5	6	83143	HEV-C-M-60750-R.030	
	3/4	.030	2-3/4	5	6	83144	HEV-C-L-60750-R.030	
	3/4	.060	1-5/8	4	6	82246	HEV-C-R-60750-R.060	
	3/4	.060	2-1/4	5	6	82247	HEV-C-M-60750-R.060	
	3/4	.060	2-3/4	5	6	82248	HEV-C-L-60750-R.060	
	3/4	.125	1-5/8	4	6	87423	HEV-C-R-60750-R.125	new
	3/4	.125	2-1/4	5	6	87424	HEV-C-M-60750-R.125	new
	3/4	.125	2-3/4	5	6	87425	HEV-C-L-60750-R.125	new

* .0005 max TIR

HEV-C-7

New Items!

7 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* 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
		1/4	.020	1-1/4	3	7	83163	HEV-C-L-70250-R.020
new		1/4	.030	3/8	2	7	87174	HEV-C-S-70250-R.030
new		1/4	.030	1/2	2	7	87175	HEV-C-SR-70250-R.030
new		1/4	.030	3/4	2-1/2	7	87176	HEV-C-R-70250-R.030
	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		3/8	.030	1/2	2	7	87177	HEV-C-S-70375-R.030
new		3/8	.030	3/4	2-1/2	7	87178	HEV-C-SR-70375-R.030
new		3/8	.030	1	2-1/2	7	87179	HEV-C-R-70375-R.030
		3/8	.060	1/2	2	7	83164	HEV-C-S-70375-R.060
		3/8	.060	3/4	2-1/2	7	83165	HEV-C-SR-70375-R.060
		3/8	.060	1	2-1/2	7	83166	HEV-C-R-70375-R.060
new	1/2	1/2	.010	5/8	2-1/2	7	87180	HEV-C-S-70500-R.010
new		1/2	.010	1	3	7	87181	HEV-C-SR-70500-R.010
new		1/2	.010	1-1/4	3	7	87182	HEV-C-R-70500-R.010
new		1/2	.010	1-5/8	4	7	87183	HEV-C-M-70500-R.010
new		1/2	.010	2	4	7	87184	HEV-C-L-70500-R.010
		1/2	.020	5/8	2-1/2	7	83167	HEV-C-S-70500-R.020
		1/2	.020	1	3	7	83168	HEV-C-SR-70500-R.020
		1/2	.020	1-1/4	3	7	83169	HEV-C-R-70500-R.020
		1/2	.020	1-5/8	4	7	83170	HEV-C-M-70500-R.020
		1/2	.020	2	4	7	83171	HEV-C-L-70500-R.020
		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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 90

7 FLUTE - CORNER RADIUS

New Items!

HEV-C-7

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

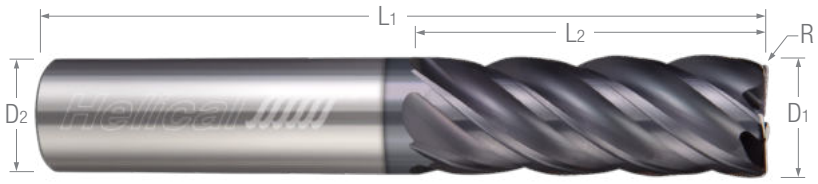
Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description	
1/2	1/2	**.030**	2-1/2	5	7	**82251**	HEV-C-LX-70500-R.030	
	1/2	**.030**	3-1/8	6	7	**82252**	HEV-C-X-70500-R.030	
	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	
	1/2	**.060**	2-1/2	5	7	**83172**	HEV-C-LX-70500-R.060	
5/8	5/8	**.030**	3/4	3	7	**83173**	HEV-C-S-70625-R.030	
	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**	1-1/4	3-1/2	7	**83174**	HEV-C-SR-70750-R.030	
	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	**.030**	3-1/4	6	7	**83175**	HEV-C-LX-70750-R.030	
	3/4	**.030**	4	6-1/2	7	**87185**	HEV-C-X-70750-R.030	new
	3/4	**.060**	1-1/4	3-1/2	7	**83176**	HEV-C-SR-70750-R.060	
	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	
	3/4	**.060**	3-1/4	6	7	**87186**	HEV-C-LX-70750-R.060	new
	3/4	**.060**	4	6-1/2	7	**87187**	HEV-C-X-70750-R.060	new
1	1	**.030**	2-5/8	5	7	**87188**	HEV-C-M-71000-R.030	new
	1	**.030**	3-1/4	6	7	**87189**	HEV-C-L-71000-R.030	new
	1	**.030**	4-1/8	7	7	**87190**	HEV-C-X-71000-R.030	new

* .0005 max TIR

HEV-5

5 FLUTE - CORNER RADIUS
Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
1/8	1/8	.010	1/4	1-1/2	5	34017		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		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	.010	7/8	2-1/2	5	84636		HEV-L-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	.015	5/8	2-1/2	5	84637		HEV-A-50125-R.015
	1/8	.020	1/4	1-1/2	5	84638		HEV-S-50125-R.020
	1/8	.020	3/8	2	5	84639		HEV-SR-50125-R.020
	1/8	.020	1/2	2-1/2	5	84640		HEV-R-50125-R.020
	1/8	.030	1/4	1-1/2	5	45017		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		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
	1/8	.030	7/8	2-1/2	5	84641		HEV-L-50125-R.030
5/32	3/16	.010	3/16	2	5	81722		HEV-S-50156-R.010
	3/16	.010	5/16	2	5	84642		HEV-SR-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
	3/16	.010	3/4	2-1/2	5	84643		HEV-ML-50156-R.010
3/16	3/16	.010	5/16	2	5	34062		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		HEV-R-50187-R.010
	3/16	.010	3/4	2-1/2	5	34092		HEV-M-50187-R.010
	3/16	.010	1	2-1/2	5	81726		HEV-ML-50187-R.010
	3/16	.010	1-3/16	3	5	84644		HEV-L-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	.020	5/16	2	5	84645		HEV-S-50187-R.020

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 138

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HEM

HEV-5

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
3/16	3/16	**.020**	7/16	2	5	**84646**		HEV-SR-50187-R.020
	3/16	**.020**	9/16	2-1/2	5	**84647**		HEV-R-50187-R.020
	3/16	**.030**	5/16	2	5	**45062**		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**		HEV-R-50187-R.030
	3/16	**.030**	3/4	2-1/2	5	**45092**		HEV-M-50187-R.030
	3/16	**.030**	1	2-1/2	5	**82536**		HEV-ML-50187-R.030
	3/16	**.030**	1-3/16	3	5	**84648**		HEV-L-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
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
	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**	HEV-S-50250-R.020
	1/4	**.020**	3/8	4	5	**82958**		HEV-S-50250-R.020
	1/4	**.020**	1/2	2-1/2	5	**34122**	**34122W**	HEV-SR-50250-R.020
	1/4	**.020**	3/4	2-1/2	5	**34137**	**34137W**	HEV-R-50250-R.020
	1/4	**.020**	3/4	4	5	**82959**		HEV-R-50250-R.020
	1/4	**.020**	1	3	5	**34152**	**34152W**	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**	**45107W**	HEV-S-50250-R.030
	1/4	**.030**	1/2	2-1/2	5	**45122**	**45122W**	HEV-SR-50250-R.030
	1/4	**.030**	3/4	2-1/2	5	**45137**	**45137W**	HEV-R-50250-R.030
	1/4	**.030**	1	3	5	**45152**	**45152W**	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**	**45108W**	HEV-S-50250-R.060
	1/4	**.060**	1/2	2-1/2	5	**45123**	**45123W**	HEV-SR-50250-R.060
	1/4	**.060**	3/4	2-1/2	5	**45138**	**45138W**	HEV-R-50250-R.060
	1/4	**.060**	1	3	5	**45153**	**45153W**	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	**.010**	1	3	5	**84649**		HEV-M-50312-R.010
	5/16	**.015**	7/16	2	5	**84650**		HEV-S-50312-R.015
	5/16	**.015**	13/16	2-1/2	5	**84651**		HEV-R-50312-R.015
	5/16	**.015**	1	3	5	**84652**		HEV-M-50312-R.015
	5/16	**.020**	7/16	2	5	**34167**	**34167W**	HEV-S-50312-R.020
	5/16	**.020**	5/8	2-1/2	5	**84653**		HEV-SR-50312-R.020

*.0005 max TIR

continued on next page

HEV-5

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/16	5/16	**.020**	13/16	2-1/2	5	**34182**	**34182W**	HEV-R-50312-R.020
	5/16	**.020**	1	3	5	**34197**	**34197W**	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**	**45167W**	HEV-S-50312-R.030
	5/16	**.030**	5/8	2-1/2	5	**84654**		HEV-SR-50312-R.030
	5/16	**.030**	13/16	2-1/2	5	**45182**	**45182W**	HEV-R-50312-R.030
	5/16	**.030**	1	3	5	**45197**	**45197W**	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**	HEV-S-50375-R.020
	3/8	**.020**	1/2	4	5	**82960**		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**	HEV-R-50375-R.020
	3/8	**.020**	1	6	5	**82961**		HEV-R-50375-R.020
	3/8	**.020**	1-1/4	3	5	**34242**	**34242W**	HEV-M-50375-R.020
	3/8	**.020**	1-1/2	3-1/2	5	**34247**		HEV-L-50375-R.020
	3/8	**.020**	2	4	5	**84655**		HEV-LX-50375-R.020
	3/8	**.030**	1/2	2	5	**45212**	**45212W**	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**	HEV-R-50375-R.030
	3/8	**.030**	1-1/4	3	5	**45242**	**45242W**	HEV-M-50375-R.030
	3/8	**.030**	1-1/2	3-1/2	5	**45247**	**45247W**	HEV-L-50375-R.030
	3/8	**.030**	2	4	5	**84656**		HEV-LX-50375-R.030
	3/8	**.060**	1/2	2	5	**45213**	**45213W**	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**	HEV-R-50375-R.060
	3/8	**.060**	1-1/4	3	5	**45243**	**45243W**	HEV-M-50375-R.060
	3/8	**.060**	1-1/2	3-1/2	5	**45248**		HEV-L-50375-R.060
	3/8	**.060**	2	4	5	**84657**		HEV-LX-50375-R.060
	3/8	**.090**	1/2	2	5	**45214**		HEV-S-50375-R.090
	3/8	**.090**	3/4	2-1/2	5	**84658**		HEV-SR-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**	3/4	2-1/2	5	**84659**		HEV-SR-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
	3/8	**.125**	1-1/2	3-1/2	5	**84660**		HEV-L-50375-R.125

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HEV-5

continued from previous page

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	LOC L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
1/2	1/2	**.010**	5/8	2-1/2	5	**81753**	**81753W**	HEV-S-50500-R.010
	1/2	**.010**	1	3	5	**81754**	**81754W**	HEV-SR-50500-R.010
	1/2	**.010**	1-1/4	3	5	**81755**	**81755W**	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	**.010**	2-1/2	5	5	**84661**		HEV-LX-50500-R.010
	1/2	**.015**	5/8	2-1/2	5	**81758**	**81758W**	HEV-S-50500-R.015
	1/2	**.015**	1	3	5	**81759**	**81759W**	HEV-SR-50500-R.015
	1/2	**.015**	1-1/4	3	5	**81760**	**81760W**	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**	**81761W**	HEV-S-50500-R.020
	1/2	**.020**	1	3	5	**81762**	**81762W**	HEV-SR-50500-R.020
	1/2	**.020**	1-1/4	3	5	**81763**	**81763W**	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**	HEV-S-50500-R.030
	1/2	**.030**	5/8	4	5	**82962**		HEV-S-50500-R.030
	1/2	**.030**	1	3	5	**34272**	**34272W**	HEV-SR-50500-R.030
	1/2	**.030**	1-1/4	3	5	**34287**	**34287W**	HEV-R-50500-R.030
	1/2	**.030**	1-1/4	6	5	**82963**		HEV-R-50500-R.030
	1/2	**.030**	1-5/8	4	5	**34302**	**34302W**	HEV-M-50500-R.030
	1/2	**.030**	2	4	5	**34307**	**34307W**	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**	HEV-S-50500-R.060
	1/2	**.060**	5/8	4	5	**82964**		HEV-S-50500-R.060
	1/2	**.060**	1	3	5	**45272**	**45272W**	HEV-SR-50500-R.060
	1/2	**.060**	1-1/4	3	5	**45287**	**45287W**	HEV-R-50500-R.060
	1/2	**.060**	1-1/4	6	5	**82965**		HEV-R-50500-R.060
	1/2	**.060**	1-5/8	4	5	**45302**	**45302W**	HEV-M-50500-R.060
	1/2	**.060**	2	4	5	**45307**	**45307W**	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**	**45258W**	HEV-S-50500-R.090
	1/2	**.090**	1	3	5	**45273**	**45273W**	HEV-SR-50500-R.090
	1/2	**.090**	1-1/4	3	5	**45288**	**45288W**	HEV-R-50500-R.090
	1/2	**.090**	1-5/8	4	5	**45303**		HEV-M-50500-R.090
	1/2	**.090**	2	4	5	**45308**		HEV-L-50500-R.090
	1/2	**.090**	2-1/2	5	5	**82558**		HEV-LX-50500-R.090
	1/2	**.120**	5/8	2-1/2	5	**45259**	**45259W**	HEV-S-50500-R.120
	1/2	**.120**	1	3	5	**45274**	**45274W**	HEV-SR-50500-R.120
	1/2	**.120**	1-1/4	3	5	**45289**	**45289W**	HEV-R-50500-R.120
	1/2	**.120**	1-5/8	4	5	**45304**	**45304W**	HEV-M-50500-R.120
	1/2	**.120**	2	4	5	**45309**	**45309W**	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

*.0005 max TIR

continued on next page

HEV-5

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
5/8	5/8	.015	1-1/4	3-1/2	5	84662		HEV-SR-50625-R.015
	5/8	.015	1-5/8	3-1/2	5	84663		HEV-R-50625-R.015
	5/8	.015	2-1/8	4	5	84664		HEV-M-50625-R.015
	5/8	.030	3/4	3	5	34317		HEV-S-50625-R.030
	5/8	.030	1-1/4	3-1/2	5	34322	34322W	HEV-SR-50625-R.030
	5/8	.030	1-5/8	3-1/2	5	34332	34332W	HEV-R-50625-R.030
	5/8	.030	2-1/8	4	5	34347	34347W	HEV-M-50625-R.030
	5/8	.030	2-1/2	5	5	34352		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		HEV-SR-50625-R.060
	5/8	.060	1-5/8	3-1/2	5	45332		HEV-R-50625-R.060
	5/8	.060	2-1/8	4	5	45347		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	HEV-S-50750-R.030
	3/4	.030	1	6	5	82966		HEV-S-50750-R.030
	3/4	.030	1-1/4	4	5	81778	81778W	HEV-SR-50750-R.030
	3/4	.030	1-5/8	4	5	34377	34377W	HEV-R-50750-R.030
	3/4	.030	1-5/8	6	5	82967		HEV-R-50750-R.030
	3/4	.030	2-1/4	5	5	34392	34392W	HEV-M-50750-R.030
	3/4	.030	2-3/4	5	5	34397	34397W	HEV-L-50750-R.030
	3/4	.030	3-1/4	6	5	34402	34402W	HEV-LX-50750-R.030
	3/4	.030	4	6-1/2	5	82563		HEV-X-50750-R.030
	3/4	.060	1	3	5	45362	45362W	HEV-S-50750-R.060
	3/4	.060	1	6	5	82968		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	HEV-R-50750-R.060
	3/4	.060	1-5/8	6	5	82969		HEV-R-50750-R.060
	3/4	.060	2-1/4	5	5	45392	45392W	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

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

HEV-5

continued from previous page

Cutter Dia.* D_1 +.000" −.002"	Shank Dia. D_2 (h6)	Corner Radius R +.002" −.002"	LOC L_2 +.032" −.000"	OAL L_1 +.062" −.062"	Flutes	*Aplus* Coated	*Aplus* Coated + Weldon Flat	Tool Description
3/4	3/4	.090	1	3	5	45363		HEV-S-50750-R.090
	3/4	.090	1-1/4	4	5	84665		HEV-SR-50750-R.090
	3/4	.090	1-5/8	4	5	45378	45378W	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		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	HEV-R-50750-R.120
	3/4	.120	2-1/4	5	5	45394	45394W	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	1-1/4	4	5	84666		HEV-SR-50750-R.190
	3/4	.190	1-5/8	4	5	45380	45380W	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	1-1/4	4	5	84667		HEV-SR-50750-R.250
	3/4	.250	1-5/8	4	5	45381	45381W	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	45401W	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	34407W	HEV-S-51000-R.030
	1	.030	2	4-1/2	5	34422	34422W	HEV-R-51000-R.030
	1	.030	2-5/8	5	5	34437	34437W	HEV-M-51000-R.030
	1	.030	3-1/4	6	5	34442	34442W	HEV-L-51000-R.030
	1	.030	4-1/4	7	5	34447	34447W	HEV-X-51000-R.030
	1	.030	5-1/4	9	5	84668		HEV-Y-51000-R.030
	1	.060	1-1/4	4	5	45407		HEV-S-51000-R.060
	1	.060	2	4-1/2	5	45422		HEV-R-51000-R.060
	1	.060	2-5/8	5	5	45437		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	.090	1-1/4	4	5	45408		HEV-S-51000-R.090
	1	.090	2	4-1/2	5	45423		HEV-R-51000-R.090
	1	.090	2-5/8	5	5	45438		HEV-M-51000-R.090
	1	.120	1-1/4	4	5	45409		HEV-S-51000-R.120
	1	.120	2	4-1/2	5	45424		HEV-R-51000-R.120
	1	.120	2-5/8	5	5	45439		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		HEV-S-51000-R.250
	1	.250	2	4-1/2	5	45426		HEV-R-51000-R.250
	1	.250	2-5/8	5	5	45441		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
1-1/4	1-1/4	.060	2	4-1/2	5	34467		HEV-R-51250-R.060
	1-1/4	.060	2-5/8	5-1/2	5	34482		HEV-M-51250-R.060
	1-1/4	.060	3-1/4	6	5	34497		HEV-L-51250-R.060
	1-1/4	.060	4-1/2	7	5	34512		HEV-LX-51250-R.060

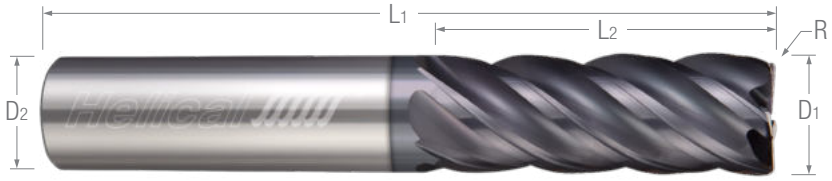
*.0005 max TIR

MHEV-5
METRIC

HEM

5 FLUTE - CORNER RADIUS - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 +.00 mm −.05 mm	Shank Dia. D_2 (h6)	Corner Radius R +.05 mm −.05 mm	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	A*plus* 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
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

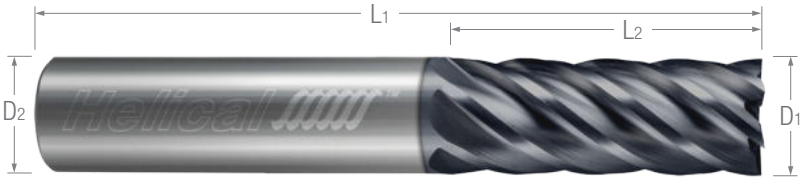
Speeds & Feeds on Page 138

6 FLUTE - SQUARE New Items!

Variable Pitch - For High Efficiency Milling

HVTI-6

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Extensive testing has proven HVTI-6's excellence in extending tool life for HEM operations in Titanium

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description	
1/8	1/4	1/4	2-1/2	6	87209	HVTI-020-60125	new
	1/4	3/8	2-1/2	6	87210	HVTI-030-60125	new
	1/4	1/2	2-1/2	6	87211	HVTI-040-60125	new
	1/4	5/8	2-1/2	6	87212	HVTI-050-60125	new
3/16	1/4	5/16	2-1/2	6	87213	HVTI-016-60187	new
	1/4	7/16	2-1/2	6	87214	HVTI-023-60187	new
	1/4	9/16	2-1/2	6	87215	HVTI-030-60187	new
	1/4	3/4	2-1/2	6	87216	HVTI-040-60187	new
1/4	1/4	3/8	2	6	87217	HVTI-015-60250	new
	1/4	1/2	2-1/2	6	84554	HVTI-020-60250	
	1/4	3/4	2-1/2	6	84555	HVTI-030-60250	
	1/4	1	3	6	84556	HVTI-040-60250	
	1/4	1-1/4	3	6	87218	HVTI-050-60250	new
5/16	5/16	7/16	2	6	87219	HVTI-014-60312	new
	5/16	3/4	2 -1/2	6	87220	HVTI-024-60312	new
	5/16	1	3	6	87221	HVTI-032-60312	new
3/8	3/8	1/2	2	6	87222	HVTI-013-60375	new
	3/8	3/4	2-1/2	6	87223	HVTI-020-60375	new
	3/8	1	3	6	84557	HVTI-026-60375	
	3/8	1-1/4	3	6	84558	HVTI-033-60375	
	3/8	1-1/2	3-1/2	6	84559	HVTI-040-60375	
1/2	1/2	5/8	2-1/2	6	87224	HVTI-012-60500	new
	1/2	1	3	6	84560	HVTI-020-60500	
	1/2	1-1/4	3	6	84561	HVTI-025-60500	
	1/2	1-5/8	4	6	84562	HVTI-032-60500	
	1/2	2	4	6	84563	HVTI-040-60500	
5/8	5/8	1-1/4	3-1/2	6	87225	HVTI-020-60625	new
	5/8	1-5/8	3-1/2	6	87226	HVTI-026-60625	new
3/4	3/4	1-1/4	4	6	87227	HVTI-016-60750	new
	3/4	1-5/8	4	6	84564	HVTI-021-60750	
	3/4	2-1/4	5	6	84565	HVTI-030-60750	

* .0005 max TIR

Speeds & Feeds on Page 258

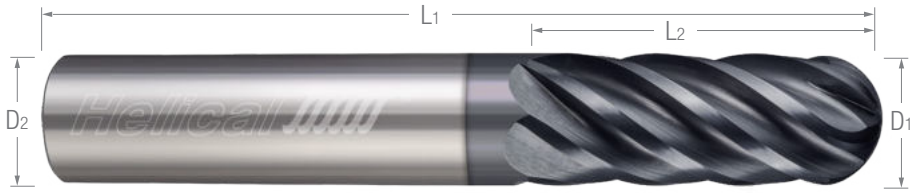
HVTI-6

New Items!

6 FLUTE - BALL

Variable Pitch - For High Efficiency Milling

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of 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 offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Extensive testing has proven HVTI-6's excellence in extending tool life for HEM operations in Titanium

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
new	1/8	1/4	1/4	2-1/2	6	87228	HVTI-020-60125-BN
new		1/4	3/8	2-1/2	6	87229	HVTI-030-60125-BN
new		1/4	1/2	2-1/2	6	87230	HVTI-040-60125-BN
new		1/4	5/8	2-1/2	6	87231	HVTI-050-60125-BN
new	3/16	1/4	5/16	2-1/2	6	87232	HVTI-016-60187-BN
new		1/4	7/16	2-1/2	6	87233	HVTI-023-60187-BN
new		1/4	9/16	2-1/2	6	87234	HVTI-030-60187-BN
new		1/4	3/4	2-1/2	6	87235	HVTI-040-60187-BN
new	1/4	1/4	3/8	2	6	87236	HVTI-015-60250-BN
		1/4	1/2	2-1/2	6	84566	HVTI-020-60250-BN
		1/4	3/4	2-1/2	6	84567	HVTI-030-60250-BN
		1/4	1	3	6	84568	HVTI-040-60250-BN
new		1/4	1-1/4	3	6	87237	HVTI-050-60250-BN
new	5/16	5/16	7/16	2	6	87238	HVTI-014-60312-BN
new		5/16	3/4	2-1/2	6	87239	HVTI-024-60312-BN
new		5/16	1	3	6	87240	HVTI-032-60312-BN
new	3/8	3/8	1/2	2	6	87241	HVTI-013-60375-BN
new		3/8	3/4	2-1/2	6	87242	HVTI-020-60375-BN
		3/8	1	3	6	84569	HVTI-026-60375-BN
		3/8	1-1/4	3	6	84570	HVTI-033-60375-BN
		3/8	1-1/2	3-1/2	6	84571	HVTI-040-60375-BN
new	1/2	1/2	5/8	2-1/2	6	87243	HVTI-012-60500-BN
		1/2	1	3	6	84572	HVTI-020-60500-BN
		1/2	1-1/4	3	6	84573	HVTI-025-60500-BN
		1/2	1-5/8	4	6	84574	HVTI-032-60500-BN
		1/2	2	4	6	84575	HVTI-040-60500-BN
new	5/8	5/8	1-1/4	3-1/2	6	87244	HVTI-020-60625-BN
new		5/8	1-5/8	3-1/2	6	87245	HVTI-026-60625-BN
new	3/4	3/4	1-1/4	4	6	87246	HVTI-016-60750-BN
		3/4	1-5/8	4	6	84576	HVTI-021-60750-BN
		3/4	2-1/4	5	6	84577	HVTI-030-60750-BN

* .0005 max TIR

Speeds & Feeds on Page 258

6 FLUTE - CORNER RADIUS

New Items!

HEM

HVTI-6

Variable Pitch - For High Efficiency Milling

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Extensive testing has proven HVTI-6's excellence in extending tool life for HEM operations in Titanium

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description	
1/8	1/4	.010	1/4	2-1/2	6	84358	HVTI-020-60125-R.010	
	1/4	.010	3/8	2-1/2	6	84359	HVTI-030-60125-R.010	
	1/4	.010	1/2	2-1/2	6	84360	HVTI-040-60125-R.010	
	1/4	.010	5/8	2-1/2	6	84361	HVTI-050-60125-R.010	
	1/4	.030	1/4	2-1/2	6	84362	HVTI-020-60125-R.030	
	1/4	.030	3/8	2-1/2	6	84363	HVTI-030-60125-R.030	
	1/4	.030	1/2	2-1/2	6	84364	HVTI-040-60125-R.030	
	1/4	.030	5/8	2-1/2	6	84365	HVTI-050-60125-R.030	
3/16	1/4	.010	5/16	2-1/2	6	84366	HVTI-016-60187-R.010	
	1/4	.010	7/16	2-1/2	6	84367	HVTI-023-60187-R.010	
	1/4	.010	9/16	2-1/2	6	84368	HVTI-030-60187-R.010	
	1/4	.010	3/4	2-1/2	6	84369	HVTI-040-60187-R.010	
	1/4	.010	1	2-1/2	6	87247	HVTI-053-60187-R.010	new
	1/4	.030	5/16	2-1/2	6	84370	HVTI-016-60187-R.030	
	1/4	.030	7/16	2-1/2	6	84371	HVTI-023-60187-R.030	
	1/4	.030	9/16	2-1/2	6	84372	HVTI-030-60187-R.030	
	1/4	.030	3/4	2-1/2	6	84373	HVTI-040-60187-R.030	
	1/4	.030	1	2-1/2	6	87248	HVTI-053-60187-R.030	new
1/4	1/4	.010	3/8	2	6	83887	HVTI-015-60250-R.010	
	1/4	.010	1/2	2-1/2	6	82059	HVTI-020-60250-R.010	
	1/4	.010	3/4	2-1/2	6	82060	HVTI-030-60250-R.010	
	1/4	.010	1	3	6	82061	HVTI-040-60250-R.010	
	1/4	.010	1-1/4	3	6	83888	HVTI-050-60250-R.010	
	1/4	.020	3/8	2	6	87249	HVTI-015-60250-R.020	new
	1/4	.020	1/2	2-1/2	6	83889	HVTI-020-60250-R.020	
	1/4	.020	3/4	2-1/2	6	83890	HVTI-030-60250-R.020	
	1/4	.020	1	3	6	83891	HVTI-040-60250-R.020	
	1/4	.030	3/8	2	6	83892	HVTI-015-60250-R.030	
	1/4	.030	1/2	2-1/2	6	82062	HVTI-020-60250-R.030	
	1/4	.030	3/4	2-1/2	6	82063	HVTI-030-60250-R.030	
	1/4	.030	1	3	6	82064	HVTI-040-60250-R.030	
	1/4	.030	1-1/4	3	6	83893	HVTI-050-60250-R.030	
	1/4	.060	3/8	2	6	87250	HVTI-015-60250-R.060	new
	1/4	.060	1/2	2-1/2	6	83894	HVTI-020-60250-R.060	
	1/4	.060	3/4	2-1/2	6	83895	HVTI-030-60250-R.060	
	1/4	.060	1	3	6	83896	HVTI-040-60250-R.060	

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 258

HVTI-6

HEM

New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch - For High Efficiency Milling (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description
new	5/16	5/16	.010	7/16	2	6	87251	HVTI-014-60312-R.010
new		5/16	.010	3/4	2-1/2	6	87252	HVTI-024-60312-R.010
new		5/16	.010	1	3	6	87253	HVTI-032-60312-R.010
new		5/16	.010	1-1/4	3	6	87254	HVTI-040-60312-R.010
		5/16	.030	7/16	2	6	83897	HVTI-014-60312-R.030
		5/16	.030	3/4	2-1/2	6	83898	HVTI-024-60312-R.030
		5/16	.030	1	3	6	83899	HVTI-032-60312-R.030
		5/16	.030	1-1/4	3	6	83900	HVTI-040-60312-R.030
		5/16	.060	7/16	2	6	83901	HVTI-014-60312-R.060
		5/16	.060	3/4	2-1/2	6	83902	HVTI-024-60312-R.060
		5/16	.060	1	3	6	83903	HVTI-032-60312-R.060
		5/16	.060	1-1/4	3	6	83904	HVTI-040-60312-R.060
	3/8	3/8	.010	1/2	2	6	83905	HVTI-013-60375-R.010
		3/8	.010	3/4	2-1/2	6	83906	HVTI-020-60375-R.010
		3/8	.010	1	3	6	82065	HVTI-026-60375-R.010
		3/8	.010	1-1/4	3	6	82066	HVTI-033-60375-R.010
		3/8	.010	1-1/2	3-1/2	6	82067	HVTI-040-60375-R.010
		3/8	.010	1-3/4	4	6	83907	HVTI-046-60375-R.010
		3/8	.020	1	3	6	83908	HVTI-026-60375-R.020
		3/8	.020	1-1/4	3	6	83909	HVTI-033-60375-R.020
		3/8	.020	1-1/2	3-1/2	6	83910	HVTI-040-60375-R.020
		3/8	.030	1/2	2	6	83911	HVTI-013-60375-R.030
		3/8	.030	3/4	2-1/2	6	83912	HVTI-020-60375-R.030
		3/8	.030	1	3	6	82068	HVTI-026-60375-R.030
		3/8	.030	1-1/4	3	6	82069	HVTI-033-60375-R.030
		3/8	.030	1-1/2	3-1/2	6	82070	HVTI-040-60375-R.030
		3/8	.030	1-3/4	4	6	83913	HVTI-046-60375-R.030
		3/8	.060	1	3	6	83914	HVTI-026-60375-R.060
		3/8	.060	1-1/4	3	6	83915	HVTI-033-60375-R.060
		3/8	.060	1-1/2	3-1/2	6	83916	HVTI-040-60375-R.060
	1/2	1/2	.010	5/8	2-1/2	6	84980	HVTI-012-60500-R.010
		1/2	.010	1	3	6	82071	HVTI-020-60500-R.010
		1/2	.010	1-1/4	3	6	82072	HVTI-025-60500-R.010
		1/2	.010	1-5/8	4	6	82073	HVTI-032-60500-R.010
		1/2	.010	2	4	6	82074	HVTI-040-60500-R.010
		1/2	.010	2-1/2	5	6	83917	HVTI-050-60500-R.010
new		1/2	.020	5/8	2-1/2	6	87255	HVTI-012-60500-R.020
		1/2	.020	1	3	6	83918	HVTI-020-60500-R.020
		1/2	.020	1-1/4	3	6	83919	HVTI-025-60500-R.020
		1/2	.020	1-5/8	4	6	83920	HVTI-032-60500-R.020
		1/2	.020	2	4	6	83921	HVTI-040-60500-R.020
		1/2	.030	5/8	2-1/2	6	83922	HVTI-012-60500-R.030
		1/2	.030	1	3	6	82075	HVTI-020-60500-R.030
		1/2	.030	1-1/4	3	6	82076	HVTI-025-60500-R.030
		1/2	.030	1-5/8	4	6	82077	HVTI-032-60500-R.030
		1/2	.030	2	4	6	82078	HVTI-040-60500-R.030
		1/2	.030	2-1/2	5	6	83923	HVTI-050-60500-R.030
		1/2	.030	3-1/8	6	6	83924	HVTI-062-60500-R.030
		1/2	.060	5/8	2-1/2	6	83925	HVTI-012-60500-R.060
		1/2	.060	1	3	6	82079	HVTI-020-60500-R.060
		1/2	.060	1-1/4	3	6	82080	HVTI-025-60500-R.060
		1/2	.060	1-5/8	4	6	82081	HVTI-032-60500-R.060
		1/2	.060	2	4	6	82082	HVTI-040-60500-R.060

* .0005 max TIR

continued on next page

6 FLUTE - CORNER RADIUS New Items!

Variable Pitch - For High Efficiency Milling (cont.)

HVTI-6

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
1/2	1/2	.090	5/8	2-1/2	6	87256	HVTI-012-60500-R.090	new
	1/2	.090	1	3	6	84981	HVTI-020-60500-R.090	
	1/2	.090	1-1/4	3	6	84982	HVTI-025-60500-R.090	
	1/2	.090	1-5/8	4	6	84983	HVTI-032-60500-R.090	
	1/2	.090	2	4	6	87257	HVTI-040-60500-R.090	new
	1/2	.120	5/8	2-1/2	6	84984	HVTI-012-60500-R.120	
	1/2	.120	1	3	6	82083	HVTI-020-60500-R.120	
	1/2	.120	1-1/4	3	6	82084	HVTI-025-60500-R.120	
	1/2	.120	1-5/8	4	6	82085	HVTI-032-60500-R.120	
	1/2	.120	2	4	6	82086	HVTI-040-60500-R.120	
5/8	5/8	.030	1-1/4	3-1/2	6	83926	HVTI-020-60625-R.030	
	5/8	.030	1-5/8	3-1/2	6	83927	HVTI-026-60625-R.030	
	5/8	.030	2	4	6	83928	HVTI-032-60625-R.030	
	5/8	.030	2-1/2	5	6	83929	HVTI-040-60625-R.030	
	5/8	.060	1-1/4	3-1/2	6	83930	HVTI-020-60625-R.060	
	5/8	.060	1-5/8	3-1/2	6	83931	HVTI-026-60625-R.060	
	5/8	.060	2	4	6	83932	HVTI-032-60625-R.060	
	5/8	.060	2-1/2	5	6	83933	HVTI-040-60625-R.060	
	5/8	.120	1-1/4	3-1/2	6	83934	HVTI-020-60625-R.120	
	5/8	.120	1-5/8	3-1/2	6	83935	HVTI-026-60625-R.120	
	5/8	.120	2	4	6	83936	HVTI-032-60625-R.120	
	5/8	.120	2-1/2	5	6	83937	HVTI-040-60625-R.120	
3/4	3/4	.030	1-1/4	4	6	87258	HVTI-016-60750-R.030	new
	3/4	.030	1-5/8	4	6	82087	HVTI-021-60750-R.030	
	3/4	.030	2-1/4	5	6	82088	HVTI-030-60750-R.030	
	3/4	.030	2-3/4	5	6	83938	HVTI-036-60750-R.030	
	3/4	.030	3-1/4	6	6	84985	HVTI-043-60750-R.030	
	3/4	.030	4	6-1/2	6	87259	HVTI-053-60750-R.030	new
	3/4	.060	1-1/4	4	6	87260	HVTI-016-60750-R.060	new
	3/4	.060	1-5/8	4	6	82089	HVTI-021-60750-R.060	
	3/4	.060	2-1/4	5	6	82090	HVTI-030-60750-R.060	
	3/4	.060	2-3/4	5	6	83939	HVTI-036-60750-R.060	
	3/4	.060	3-1/4	6	6	87261	HVTI-043-60750-R.060	new
	3/4	.090	1-1/4	4	6	87262	HVTI-016-60750-R.090	new
	3/4	.090	1-5/8	4	6	82091	HVTI-021-60750-R.090	
	3/4	.090	2-1/4	5	6	82092	HVTI-030-60750-R.090	
	3/4	.090	2-3/4	5	6	87263	HVTI-036-60750-R.090	new
	3/4	.090	3-1/4	6	6	87264	HVTI-043-60750-R.090	new
	3/4	.120	1-1/4	4	6	87265	HVTI-016-60750-R.120	new
	3/4	.120	1-5/8	4	6	82093	HVTI-021-60750-R.120	
	3/4	.120	2-1/4	5	6	82094	HVTI-030-60750-R.120	
	3/4	.120	2-3/4	5	6	83940	HVTI-036-60750-R.120	
	3/4	.120	3-1/4	6	6	87266	HVTI-043-60750-R.120	new
1	1	.030	2	4-1/2	6	82095	HVTI-020-61000-R.030	
	1	.030	2-5/8	5	6	82096	HVTI-026-61000-R.030	
	1	.060	2	4-1/2	6	82097	HVTI-020-61000-R.060	
	1	.060	2-5/8	5	6	82098	HVTI-026-61000-R.060	
	1	.120	2	4-1/2	6	82099	HVTI-020-61000-R.120	
	1	.120	2-5/8	5	6	82100	HVTI-026-61000-R.120	

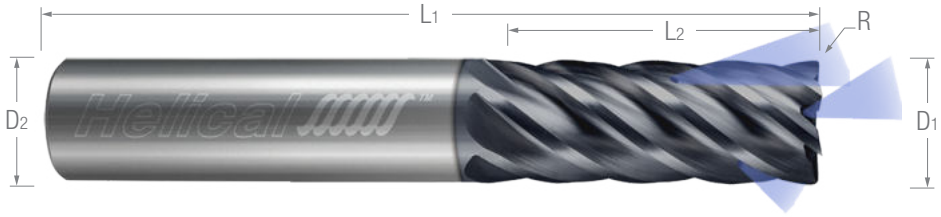
* .0005 max TIR

HVTIC-6

6 FLUTE - CORNER RADIUS

Coolant Through - Variable Pitch - For High Efficiency Milling

- Specially engineered for optimal performance in High Efficiency Milling (HEM) of 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
- Radial coolant holes for reduced heat, enhanced chip evacuation, and increased material removal rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Extensive testing has proven HVTI-6's excellence in extending tool life for HEM operations in Titanium

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
1/4	1/4	.030	1/2	2-1/2	6	**84504**	HVTIC-020-60250-R.030
	1/4	.030	3/4	2-1/2	6	**84505**	HVTIC-030-60250-R.030
3/8	3/8	.010	1/2	2	6	**84506**	HVTIC-013-60375-R.010
	3/8	.010	1	3	6	**84507**	HVTIC-026-60375-R.010
	3/8	.030	1/2	2	6	**84508**	HVTIC-013-60375-R.030
	3/8	.030	1	3	6	**84509**	HVTIC-026-60375-R.030
1/2	1/2	.030	1	3	6	**84510**	HVTIC-020-60500-R.030
	1/2	.030	1-1/4	3	6	**84511**	HVTIC-025-60500-R.030
	1/2	.030	1-5/8	4	6	**84512**	HVTIC-032-60500-R.030
	1/2	.060	1	3	6	**84513**	HVTIC-020-60500-R.060
	1/2	.060	1-1/4	3	6	**84514**	HVTIC-025-60500-R.060
	1/2	.060	1-5/8	4	6	**84515**	HVTIC-032-60500-R.060
3/4	3/4	.030	1-5/8	4	6	**84516**	HVTIC-021-60750-R.030
	3/4	.030	2-1/4	5	6	**84517**	HVTIC-030-60750-R.030
	3/4	.060	1-5/8	4	6	**84518**	HVTIC-021-60750-R.060
	3/4	.060	2-1/4	5	6	**84519**	HVTIC-030-60750-R.060

* .0005 max TIR

Speeds & Feeds on Page 258

SPEEDS & FEEDS

6 Flute - For High Efficiency Milling

HVTI-6

HVTI-6 / HVTIC-6																	
		Hardness		1/8		3/16		1/4		3/8		1/2		3/4		1	
				HEM	Fin	HEM	Fin	HEM	Fin	HEM	Fin	HEM	Fin	HEM	Fin	HEM	Fin
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0019	.0014	.0029	.0017	.0038	.0020	.0058	.0023	.0079	.0027	.0118	.0032	.0159	.0039
		75 - 98 HRB	250	.0016	.0012	.0024	.0015	.0032	.0018	.0049	.0021	.0066	.0025	.0099	.0029	.0134	.0036
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0010	.0010	.0014	.0012	.0019	.0014	.0029	.0016	.0041	.0019	.0060	.0023	.0081	.0028
		21 - 36 HRC	75	.0010	.0010	.0014	.0012	.0019	.0014	.0028	.0016	.0039	.0019	.0058	.0022	.0077	.0027
		36 - 50 HRC	70	.0008	.0009	.0012	.0011	.0016	.0013	.0024	.0015	.0034	.0017	.0049	.0021	.0066	.0025
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0026	.0015	.0039	.0019	.0052	.0023	.0079	.0027	.0110	.0032	.0164	.0038	.0220	.0046
		75 - 98 HRB	275	.0022	.0013	.0033	.0017	.0044	.0021	.0066	.0025	.0091	.0029	.0137	.0034	.0183	.0042
		21 - 36 HRC	250	.0017	.0015	.0025	.0017	.0033	.0019	.0050	.0021	.0069	.0025	.0102	.0030	.0137	.0036
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0014	.0010	.0020	.0013	.0027	.0016	.0041	.0019	.0054	.0022	.0081	.0026	.0108	.0032
		36 - 50 HRC	160	.0012	.0012	.0018	.0014	.0024	.0016	.0036	.0018	.0049	.0021	.0074	.0025	.0099	.0030
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0011	.0011	.0017	.0013	.0022	.0015	.0034	.0017	.0046	.0020	.0069	.0024	.0092	.0029
		21 - 36 HRC	170	.0011	.0011	.0016	.0013	.0021	.0015	.0032	.0017	.0044	.0020	.0067	.0024	.0088	.0029
		36 - 50 HRC	65	.0007	.0008	.0011	.0010	.0014	.0012	.0023	.0014	.0030	.0016	.0046	.0019	.0060	.0024

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 Efficiency Milling for Titanium Made Easy with Helical's HVTI Cutter

In The Loupe
MACHINISTS BLOG

Titanium is a notoriously difficult material to machine, especially in aggressive toolpaths, such as those associated with High Efficiency Milling (HEM). Helical's HVTI-6 tool, is optimized for Titanium 6Al4V and other titanium alloys, and is engineered to achieve exceptional performance in HEM operations. Learn more about this unique tool by reading our "In the Loupe" blog post *High Efficiency Milling for Titanium Made Easy With Helical's HVTI Cutter.*

www.harveyperformance.com/in-the-loupe/hem-titanium-helical-hvti/

SCAN TO READ

HEV-6

6 FLUTE - BALL
Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
1/8	1/8	1/4	1-1/2	6	**84406**	HEV-S-60125-BN
	1/8	3/8	2	6	**84407**	HEV-SR-60125-BN
	1/8	1/2	2-1/2	6	**84408**	HEV-R-60125-BN
	1/8	5/8	2-1/2	6	**84409**	HEV-A-60125-BN
3/16	3/16	5/16	2	6	**84410**	HEV-S-60187-BN
	3/16	7/16	2	6	**84411**	HEV-SR-60187-BN
	3/16	9/16	2-1/2	6	**84412**	HEV-R-60187-BN
	3/16	3/4	2-1/2	6	**84413**	HEV-M-60187-BN
1/4	1/4	3/8	2	6	**59434**	HEV-S-60250-BN
	1/4	1/2	2-1/2	6	**59435**	HEV-SR-60250-BN
	1/4	3/4	2-1/2	6	**59436**	HEV-R-60250-BN
	1/4	1	3	6	**59437**	HEV-M-60250-BN
	1/4	1-1/4	3	6	**59438**	HEV-L-60250-BN
	1/4	1-1/2	3	6	**83361**	HEV-LX-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
3/8	3/8	1/2	2	6	**59442**	HEV-S-60375-BN
	3/8	3/4	2-1/2	6	**82592**	HEV-SR-60375-BN
	3/8	1	3	6	**59443**	HEV-R-60375-BN
	3/8	1-1/4	3	6	**59444**	HEV-M-60375-BN
	3/8	1-1/2	3-1/2	6	**59445**	HEV-L-60375-BN
	3/8	2	4	6	**83362**	HEV-LX-60375-BN
1/2	1/2	5/8	2-1/2	6	**59446**	HEV-S-60500-BN
	1/2	1	3	6	**59447**	HEV-SR-60500-BN
	1/2	1-1/4	3	6	**59448**	HEV-R-60500-BN
	1/2	1-5/8	4	6	**59449**	HEV-M-60500-BN
	1/2	2	4	6	**59450**	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**	HEV-S-60750-BN
	3/4	1-5/8	4	6	**59455**	HEV-R-60750-BN
	3/4	2-1/4	5	6	**59456**	HEV-M-60750-BN
	3/4	2-3/4	5	6	**83363**	HEV-L-60750-BN
1	1	2	4-1/2	6	**59457**	HEV-R-61000-BN
	1	2-5/8	5	6	**82594**	HEV-M-61000-BN

* .0005 max TIR

Speeds & Feeds on Page 152

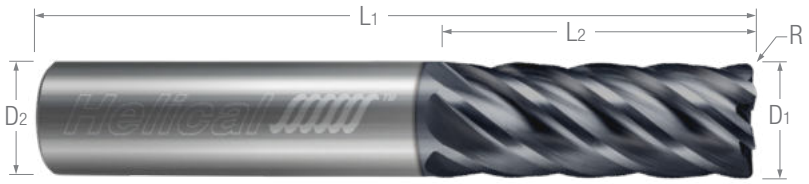
6 FLUTE - CORNER RADIUS New Items!

Variable Pitch

HEM

HEV-6

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	A*plus* Coated	Tool Description	
1/8	1/8	**.010**	1/4	1-1/2	6	**84390**	HEV-S-60125-R.010	
	1/8	**.010**	3/8	2	6	**84391**	HEV-SR-60125-R.010	
	1/8	**.010**	1/2	2-1/2	6	**84392**	HEV-R-60125-R.010	
	1/8	**.010**	5/8	2-1/2	6	**84393**	HEV-A-60125-R.010	
	1/8	**.030**	1/4	1-1/2	6	**84394**	HEV-S-60125-R.030	
	1/8	**.030**	3/8	2	6	**84395**	HEV-SR-60125-R.030	
	1/8	**.030**	1/2	2-1/2	6	**84396**	HEV-R-60125-R.030	
	1/8	**.030**	5/8	2-1/2	6	**84397**	HEV-A-60125-R.030	
3/16	3/16	**.010**	5/16	2	6	**84398**	HEV-S-60187-R.010	
	3/16	**.010**	7/16	2	6	**84399**	HEV-SR-60187-R.010	
	3/16	**.010**	9/16	2-1/2	6	**84400**	HEV-R-60187-R.010	
	3/16	**.010**	3/4	2-1/2	6	**84401**	HEV-M-60187-R.010	
	3/16	**.030**	5/16	2	6	**84402**	HEV-S-60187-R.030	
	3/16	**.030**	7/16	2	6	**84403**	HEV-SR-60187-R.030	
	3/16	**.030**	9/16	2-1/2	6	**84404**	HEV-R-60187-R.030	
	3/16	**.030**	3/4	2-1/2	6	**84405**	HEV-M-60187-R.030	
1/4	1/4	**.010**	3/8	2	6	**84995**	HEV-S-60250-R.010	
	1/4	**.010**	1/2	2-1/2	6	**84996**	HEV-SR-60250-R.010	
	1/4	**.010**	3/4	2-1/2	6	**84997**	HEV-R-60250-R.010	
	1/4	**.010**	1	3	6	**87550**	HEV-M-60250-R.010	new
	1/4	**.010**	1-1/4	3	6	**87551**	HEV-L-60250-R.010	new
	1/4	**.010**	1-1/2	3	6	**87552**	HEV-LX-60250-R.010	new
	1/4	**.020**	3/8	2	6	**59280**	HEV-S-60250-R.020	
	1/4	**.020**	1/2	2-1/2	6	**59283**	HEV-SR-60250-R.020	
	1/4	**.020**	3/4	2-1/2	6	**59286**	HEV-R-60250-R.020	
	1/4	**.020**	1	3	6	**59289**	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	
	1/4	**.030**	3/8	2	6	**59281**	HEV-S-60250-R.030	
	1/4	**.030**	1/2	2-1/2	6	**59284**	HEV-SR-60250-R.030	
	1/4	**.030**	3/4	2-1/2	6	**59287**	HEV-R-60250-R.030	
	1/4	**.030**	1	3	6	**59290**	HEV-M-60250-R.030	
	1/4	**.030**	1-1/4	3	6	**59293**	HEV-L-60250-R.030	
	1/4	**.030**	1-1/2	3	6	**87553**	HEV-LX-60250-R.030	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 152

HEV-6

New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
	1/4	1/4	**.060**	3/8	2	6	**59282**	HEV-S-60250-R.060
		1/4	**.060**	1/2	2-1/2	6	**59285**	HEV-SR-60250-R.060
		1/4	**.060**	3/4	2-1/2	6	**59288**	HEV-R-60250-R.060
		1/4	**.060**	1	3	6	**59291**	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	**.010**	7/16	2	6	**87554**	HEV-S-60312-R.010
new		5/16	**.010**	3/4	2-1/2	6	**87555**	HEV-R-60312-R.010
new		5/16	**.010**	1	3	6	**87556**	HEV-M-60312-R.010
		5/16	**.020**	7/16	2	6	**59295**	HEV-S-60312-R.020
		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**	HEV-S-60312-R.030
		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	**.010**	1/2	2	6	**84998**	HEV-S-60375-R.010
		3/8	**.010**	3/4	2-1/2	6	**84999**	HEV-SR-60375-R.010
		3/8	**.010**	1	3	6	**86000**	HEV-R-60375-R.010
		3/8	**.010**	1-1/4	3	6	**86001**	HEV-M-60375-R.010
new		3/8	**.010**	1-1/2	3-1/2	6	**87557**	HEV-L-60375-R.010
new		3/8	**.010**	2	4	6	**87558**	HEV-LX-60375-R.010
		3/8	**.020**	1/2	2	6	**59304**	HEV-S-60375-R.020
		3/8	**.020**	3/4	2-1/2	6	**82571**	HEV-SR-60375-R.020
		3/8	**.020**	1	3	6	**59308**	HEV-R-60375-R.020
		3/8	**.020**	1-1/4	3	6	**59312**	HEV-M-60375-R.020
		3/8	**.020**	1-1/2	3-1/2	6	**59316**	HEV-L-60375-R.020
		3/8	**.020**	2	4	6	**83318**	HEV-LX-60375-R.020
		3/8	**.030**	1/2	2	6	**59305**	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**	HEV-R-60375-R.030
		3/8	**.030**	1-1/4	3	6	**59313**	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**	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**	HEV-R-60375-R.060
		3/8	**.060**	1-1/4	3	6	**59314**	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**	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**	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

* .0005 max TIR

continued on next page

6 FLUTE - CORNER RADIUS New Items!

Variable Pitch (cont.)

HEM **HEV-6**

continued from previous page

Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
3/8	3/8	.125	1/2	2	6	87559	HEV-S-60375-R.125	new
	3/8	.125	3/4	2-1/2	6	87560	HEV-SR-60375-R.125	new
	3/8	.125	1	3	6	87561	HEV-R-60375-R.125	new
	3/8	.125	1-1/4	3	6	87562	HEV-M-60375-R.125	new
1/2	1/2	.010	5/8	2-1/2	6	83319	HEV-S-60500-R.010	
	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	.010	1-5/8	4	6	86002	HEV-M-60500-R.010	
	1/2	.010	2	4	6	87563	HEV-L-60500-R.010	new
	1/2	.010	2-1/2	5	6	87564	HEV-LX-60500-R.010	new
	1/2	.015	5/8	2-1/2	6	83320	HEV-S-60500-R.015	
	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	.015	1-5/8	4	6	86003	HEV-M-60500-R.015	
	1/2	.015	2	4	6	87565	HEV-L-60500-R.015	new
	1/2	.015	2-1/2	5	6	87566	HEV-LX-60500-R.015	new
	1/2	.020	5/8	2-1/2	6	87567	HEV-S-60500-R.020	new
	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	.020	2	4	6	87568	HEV-L-60500-R.020	new
	1/2	.020	2-1/2	5	6	87569	HEV-LX-60500-R.020	new
	1/2	.030	5/8	2-1/2	6	59320	HEV-S-60500-R.030	
	1/2	.030	1	3	6	59324	HEV-SR-60500-R.030	
	1/2	.030	1-1/4	3	6	59328	HEV-R-60500-R.030	
	1/2	.030	1-5/8	4	6	59332	HEV-M-60500-R.030	
	1/2	.030	2	4	6	59336	HEV-L-60500-R.030	
	1/2	.030	2-1/2	5	6	82584	HEV-LX-60500-R.030	
	1/2	.030	3-1/8	6	6	86004	HEV-X-60500-R.030	
	1/2	.060	5/8	2-1/2	6	59321	HEV-S-60500-R.060	
	1/2	.060	1	3	6	59325	HEV-SR-60500-R.060	
	1/2	.060	1-1/4	3	6	59329	HEV-R-60500-R.060	
	1/2	.060	1-5/8	4	6	59333	HEV-M-60500-R.060	
	1/2	.060	2	4	6	59337	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	HEV-R-60500-R.090	
	1/2	.090	1-5/8	4	6	59334	HEV-M-60500-R.090	
	1/2	.090	2	4	6	59338	HEV-L-60500-R.090	
	1/2	.090	2-1/2	5	6	82586	HEV-LX-60500-R.090	
	1/2	.120	5/8	2-1/2	6	87570	HEV-S-60500-R.120	new
	1/2	.120	1	3	6	87571	HEV-SR-60500-R.120	new
	1/2	.120	1-1/4	3	6	87572	HEV-R-60500-R.120	new
	1/2	.120	1-5/8	4	6	87573	HEV-M-60500-R.120	new
	1/2	.125	5/8	2-1/2	6	59323	HEV-S-60500-R.125	
	1/2	.125	1	3	6	59327	HEV-SR-60500-R.125	
	1/2	.125	1-1/4	3	6	59331	HEV-R-60500-R.125	
	1/2	.125	1-5/8	4	6	59335	HEV-M-60500-R.125	
	1/2	.125	2	4	6	59339	HEV-L-60500-R.125	
	1/2	.125	2-1/2	5	6	83321	HEV-LX-60500-R.125	

* .0005 max TIR

continued on next page

HEV-6

New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* 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
new		5/8	.060	3/4	3	6	87574	HEV-S-60625-R.060
		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
new		5/8	.060	2-1/2	5	6	87575	HEV-L-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
new		5/8	.125	3/4	3	6	87576	HEV-S-60625-R.125
		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
		5/8	.125	2-1/2	5	6	86005	HEV-L-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	HEV-R-60750-R.030
		3/4	.030	2-1/4	5	6	59366	HEV-M-60750-R.030
		3/4	.030	2-3/4	5	6	59372	HEV-L-60750-R.030
		3/4	.030	3-1/4	6	6	59378	HEV-LX-60750-R.030
		3/4	.030	4	6-1/2	6	86006	HEV-X-60750-R.030
		3/4	.060	1	3	6	59355	HEV-S-60750-R.060
		3/4	.060	1-5/8	4	6	59361	HEV-R-60750-R.060
		3/4	.060	2-1/4	5	6	59367	HEV-M-60750-R.060
		3/4	.060	2-3/4	5	6	59373	HEV-L-60750-R.060
		3/4	.060	3-1/4	6	6	83322	HEV-LX-60750-R.060
		3/4	.090	1	3	6	59356	HEV-S-60750-R.090
		3/4	.090	1-5/8	4	6	59362	HEV-R-60750-R.090
		3/4	.090	2-1/4	5	6	59368	HEV-M-60750-R.090
		3/4	.090	2-3/4	5	6	59374	HEV-L-60750-R.090
new		3/4	.120	1	3	6	87577	HEV-S-60750-R.120
new		3/4	.120	1-5/8	4	6	87578	HEV-R-60750-R.120
new		3/4	.120	2-1/4	5	6	87579	HEV-M-60750-R.120
		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	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
		3/4	.250	3-1/4	6	6	83323	HEV-LX-60750-R.250

* .0005 max TIR

continued on next page

6 FLUTE - CORNER RADIUS New Items!

Variable Pitch (cont.)

HEV-6

continued from previous page

Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description
1	1	**.030**	2	4-1/2	6	**59379**	HEV-R-61000-R.030
	1	**.030**	2-5/8	5	6	**59383**	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**	HEV-R-61000-R.060
	1	**.060**	2-5/8	5	6	**59384**	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

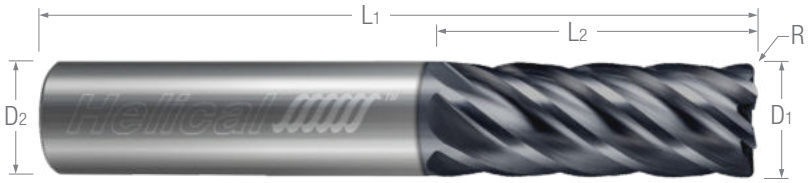
* .0005 max TIR

MHEV-6
METRIC

HEM

6 FLUTE - CORNER RADIUS - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.00 mm −.05 mm	Shank Diameter D_2 (h6)	Corner Radius R +.05 mm −.05 mm	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.6 mm −1.6 mm	Flutes	A*plus* Coated	Tool Description
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
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

Speeds & Feeds on Page 152

7 FLUTE - CORNER RADIUS

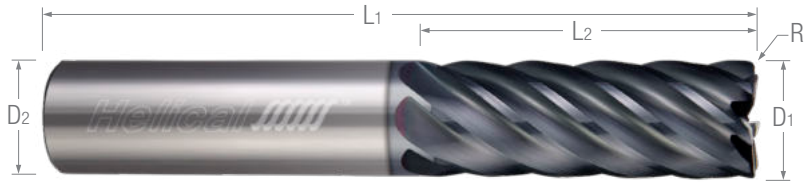
New Items!

Variable Pitch

HEM

HEV-7

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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 offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	*Aplus* Coated	Tool Description	
1/8	1/8	.010	1/4	1-1/2	7	84422	HEV-S-70125-R.010	
	1/8	.010	3/8	2	7	84423	HEV-SR-70125-R.010	
	1/8	.010	1/2	2-1/2	7	84424	HEV-R-70125-R.010	
	1/8	.010	5/8	2-1/2	7	84425	HEV-A-70125-R.010	
	1/8	.030	1/4	1-1/2	7	84426	HEV-S-70125-R.030	
	1/8	.030	3/8	2	7	84427	HEV-SR-70125-R.030	
	1/8	.030	1/2	2-1/2	7	84428	HEV-R-70125-R.030	
	1/8	.030	5/8	2-1/2	7	84429	HEV-A-70125-R.030	
3/16	3/16	.010	5/16	2	7	84430	HEV-S-70187-R.010	
	3/16	.010	7/16	2	7	84431	HEV-SR-70187-R.010	
	3/16	.010	9/16	2-1/2	7	84432	HEV-R-70187-R.010	
	3/16	.010	3/4	2-1/2	7	84433	HEV-M-70187-R.010	
	3/16	.030	5/16	2	7	84434	HEV-S-70187-R.030	
	3/16	.030	7/16	2	7	84435	HEV-SR-70187-R.030	
	3/16	.030	9/16	2-1/2	7	84436	HEV-R-70187-R.030	
	3/16	.030	3/4	2-1/2	7	84437	HEV-M-70187-R.030	
1/4	1/4	.010	3/8	2	7	83376	HEV-S-70250-R.010	
	1/4	.010	1/2	2	7	83377	HEV-SR-70250-R.010	
	1/4	.010	3/4	2-1/2	7	83378	HEV-R-70250-R.010	
	1/4	.010	1	3	7	83379	HEV-M-70250-R.010	
	1/4	.010	1-1/4	3	7	86040	HEV-L-70250-R.010	
	1/4	.020	3/8	2	7	27107	HEV-S-70250-R.020	
	1/4	.020	1/2	2	7	27122	HEV-SR-70250-R.020	
	1/4	.020	3/4	2-1/2	7	27137	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	.020	1-1/2	3	7	86041	HEV-LX-70250-R.020	
	1/4	.030	3/8	2	7	87106	HEV-S-70250-R.030	new
	1/4	.030	1/2	2	7	87107	HEV-SR-70250-R.030	new
	1/4	.030	3/4	2-1/2	7	87108	HEV-R-70250-R.030	new
	1/4	.030	1	3	7	87109	HEV-M-70250-R.030	new
	1/4	.030	1-1/4	3	7	87110	HEV-L-70250-R.030	new
	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	
	1/4	.060	1	3	7	81810	HEV-M-70250-R.060	
	1/4	.060	1-1/4	3	7	87111	HEV-L-70250-R.060	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 163

HEV-7

New Items!

7 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter* D_1 +.000" −.002"	Shank Diameter D_2 (h6)	Corner Radius R +.002" −.002"	Length of Cut L_2 +.032" −.000"	Overall Length L_1 +.062" −.062"	Flutes	Aplus Coated	Tool Description
	3/8	3/8	.010	1/2	2	7	83380	HEV-S-70375-R.010
		3/8	.010	3/4	2-1/2	7	83381	HEV-SR-70375-R.010
		3/8	.010	1	2-1/2	7	83382	HEV-R-70375-R.010
		3/8	.010	1-1/4	3	7	86042	HEV-M-70375-R.010
		3/8	.010	1-1/2	3-1/2	7	83383	HEV-L-70375-R.010
		3/8	.020	1/2	2	7	27212	HEV-S-70375-R.020
		3/8	.020	3/4	2-1/2	7	27227	HEV-SR-70375-R.020
		3/8	.020	1	2-1/2	7	27242	HEV-R-70375-R.020
new		3/8	.020	1-1/4	3	7	87112	HEV-M-70375-R.020
		3/8	.020	1-1/2	3-1/2	7	27247	HEV-L-70375-R.020
		3/8	.020	2	4	7	82656	HEV-LX-70375-R.020
new		3/8	.030	1/2	2	7	87113	HEV-S-70375-R.030
new		3/8	.030	3/4	2-1/2	7	87114	HEV-SR-70375-R.030
new	3/8	3/8	.030	1	2-1/2	7	87115	HEV-R-70375-R.030
new		3/8	.030	1-1/4	3	7	87116	HEV-M-70375-R.030
new		3/8	.030	1-1/2	3-1/2	7	87117	HEV-L-70375-R.030
		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		3/8	.060	1-1/4	3	7	87118	HEV-M-70375-R.060
new		3/8	.060	1-1/2	3-1/2	7	87119	HEV-L-70375-R.060
new		3/8	.125	1/2	2	7	87120	HEV-S-70375-R.125
new		3/8	.125	3/4	2-1/2	7	87121	HEV-SR-70375-R.125
new		3/8	.125	1	2-1/2	7	87122	HEV-R-70375-R.125
new		3/8	.125	1-1/4	3	7	87123	HEV-M-70375-R.125
new		3/8	.125	1-1/2	3-1/2	7	87124	HEV-L-70375-R.125
	1/2	1/2	.010	5/8	2-1/2	7	83384	HEV-S-70500-R.010
		1/2	.010	1	3	7	83385	HEV-SR-70500-R.010
		1/2	.010	1-1/4	3	7	83386	HEV-R-70500-R.010
		1/2	.010	1-5/8	4	7	83387	HEV-M-70500-R.010
		1/2	.010	2	4	7	83388	HEV-L-70500-R.010
new		1/2	.010	2-1/2	5	7	87125	HEV-LX-70500-R.010
		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
new		1/2	.020	2-1/2	5	7	87126	HEV-LX-70500-R.020
		1/2	.030	5/8	2-1/2	7	27257	HEV-S-70500-R.030
		1/2	.030	1	3	7	27272	HEV-SR-70500-R.030
		1/2	.030	1-1/4	3	7	27287	HEV-R-70500-R.030
		1/2	.030	1-5/8	4	7	27302	HEV-M-70500-R.030
		1/2	.030	2	4	7	27307	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

* .0005 max TIR

continued on next page

7 FLUTE - CORNER RADIUS

New Items!

HEV-7

Variable Pitch (cont.)

continued from previous page

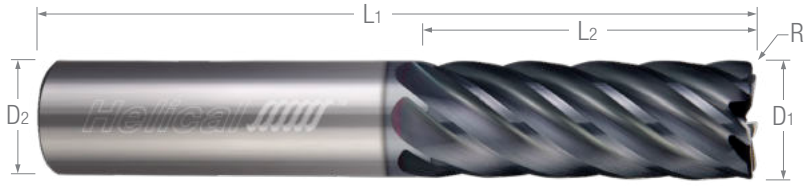
Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	*Aplus* Coated	Tool Description	
1/2	1/2	.060	5/8	2-1/2	7	81819	HEV-S-70500-R.060	
	1/2	.060	1	3	7	81820	HEV-SR-70500-R.060	
	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	
	1/2	.060	2-1/2	5	7	87127	HEV-LX-70500-R.060	new
	1/2	.125	5/8	2-1/2	7	87128	HEV-S-70500-R.125	new
	1/2	.125	1	3	7	87129	HEV-SR-70500-R.125	new
	1/2	.125	1-1/4	3	7	87130	HEV-R-70500-R.125	new
	1/2	.125	1-5/8	4	7	87131	HEV-M-70500-R.125	new
	1/2	.125	2	4	7	87132	HEV-L-70500-R.125	new
5/8	5/8	.010	3/4	3	7	87133	HEV-S-70625-R.010	new
	5/8	.010	1-1/4	3-1/2	7	87134	HEV-SR-70625-R.010	new
	5/8	.010	1-5/8	4	7	87135	HEV-R-70625-R.010	new
	5/8	.010	2-1/8	4	7	87136	HEV-M-70625-R.010	new
	5/8	.030	3/4	3	7	27317	HEV-S-70625-R.030	
	5/8	.030	1-1/4	3-1/2	7	27322	HEV-SR-70625-R.030	
	5/8	.030	1-5/8	4	7	27332	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	3/4	3	7	86043	HEV-S-70625-R.060	
	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	
	5/8	.060	2-1/8	4	7	86044	HEV-M-70625-R.060	
3/4	3/4	.030	1	3	7	27362	HEV-S-70750-R.030	
	3/4	.030	1-1/4	3-1/2	7	27367	HEV-SR-70750-R.030	
	3/4	.030	1-5/8	4	7	27377	HEV-R-70750-R.030	
	3/4	.030	2-1/4	5	7	27392	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	
	3/4	.060	2-1/4	5	7	81828	HEV-M-70750-R.060	
	3/4	.060	2-3/4	5	7	86045	HEV-L-70750-R.060	
	3/4	.060	3-1/4	6	7	87137	HEV-LX-70750-R.060	new
	3/4	.125	1	3	7	87138	HEV-S-70750-R.125	new
	3/4	.125	1-5/8	4	7	87139	HEV-R-70750-R.125	new
	3/4	.125	2-1/4	5	7	87140	HEV-M-70750-R.125	new
	3/4	.250	1	3	7	87141	HEV-S-70750-R.250	new
	3/4	.250	1-5/8	4	7	87142	HEV-R-70750-R.250	new
	3/4	.250	2-1/4	5	7	87143	HEV-M-70750-R.250	new
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	2-5/8	5	7	86046	HEV-M-71000-R.030	
	1	.030	3-1/4	6	7	27442	HEV-L-71000-R.030	
	1	.030	4-1/4	7	7	86047	HEV-X-71000-R.030	

* .0005 max TIR

MHEV-7
METRIC

7 FLUTE - CORNER RADIUS - METRIC
Variable Pitch

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 +.00 mm −.05 mm	Shank Diameter D_2 (h6)	Corner Radius R +.05 mm −.05 mm	Length of Cut L_2 +.80 mm −.00 mm	Overall Length L_1 +1.60 mm −1.60 mm	Flutes	*Aplus* 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
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

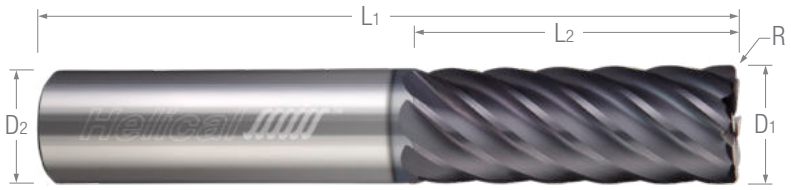
Speeds & Feeds on Page 163

MULTI-FLUTE - CORNER RADIUS

Finisher

HXF

- Offers outstanding performance and high temperature resistance in titanium and titanium alloys
- 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA



Cutter Diameter* D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
1/4	1/4	**.020**	3/8	2	7	**36016**	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**	HXF-R-070250-R.020
3/8	3/8	**.020**	1/2	2	7	**36046**	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**	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**	HXF-S-080500-R.030
	1/2	**.030**	1	3	8	**36091**	HXF-SR-080500-R.030
	1/2	**.030**	1-1/4	3	8	**36106**	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**	HXF-S-120750-R.060
	3/4	**.060**	1-5/8	4	12	**36166**	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
	1	**.060**	2	4-1/2	14	**36196**	HXF-R-141000-R.060

* .0005 max TIR

Speeds & Feeds on Page 170

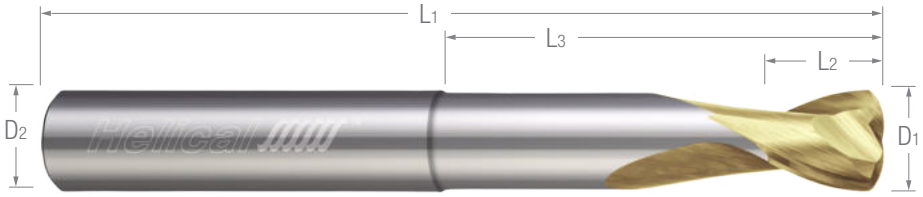
HFAL-2

New Items!

HIGH FEED END MILLS

Aluminum - Reduced Neck

- Designed for outstanding performance and maximum feed rates in aluminum and non-ferrous materials
- Specifically engineered end profile for optimal tool engagement and reduced cutting forces
- 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
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



	Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Theoretical Radius**	*Zplus* Coated	Tool Description
	1/8	1/4	1/8	2-1/2	1/2	.118	2	.0213	84439	HFAL-RN-040-20125
		1/4	1/8	2-1/2	3/4	.118	2	.0213	84441	HFAL-RN-060-20125
		1/4	1/8	2-1/2	1	.118	2	.0213	84443	HFAL-RN-080-20125
new		1/4	1/8	2-1/2	1-1/4	.118	2	.0213	87287	HFAL-RN-100-20125
	3/16	1/4	3/16	2-1/2	3/4	.178	2	.0319	84445	HFAL-RN-040-20187
		1/4	3/16	2-1/2	1-1/8	.178	2	.0319	84447	HFAL-RN-060-20187
		1/4	3/16	3	1-1/2	.178	2	.0319	84449	HFAL-RN-080-20187
new		1/4	3/16	3	1-7/8	.178	2	.0319	87288	HFAL-RN-100-20187
	1/4	1/4	1/4	3	1	.237	2	.0425	84451	HFAL-RN-040-20250
		1/4	1/4	3	1-1/2	.237	2	.0425	84453	HFAL-RN-060-20250
		1/4	1/4	4	2	.237	2	.0425	84455	HFAL-RN-080-20250
new		1/4	1/4	4	2-1/2	.237	2	.0425	87289	HFAL-RN-100-20250
new	5/16	5/16	5/16	4	1-1/4	.296	2	.0531	87290	HFAL-RN-040-20312
new		5/16	5/16	4	1-7/8	.296	2	.0531	87291	HFAL-RN-060-20312
new		5/16	5/16	4	2-1/2	.296	2	.0531	87292	HFAL-RN-080-20312
	3/8	3/8	3/8	4	1-1/2	.356	2	.0638	84457	HFAL-RN-040-20375
		3/8	3/8	4	2-1/4	.356	2	.0638	84459	HFAL-RN-060-20375
		3/8	3/8	6	3	.356	2	.0638	84461	HFAL-RN-080-20375
new		3/8	3/8	6	3-3/4	.356	2	.0638	87293	HFAL-RN-100-20375
	1/2	1/2	1/2	5	2	.475	2	.0850	84463	HFAL-RN-040-20500
		1/2	1/2	5	3	.475	2	.0850	84465	HFAL-RN-060-20500
		1/2	1/2	7	4	.475	2	.0850	84467	HFAL-RN-080-20500
new		1/2	1/2	7	5	.475	2	.0850	87294	HFAL-RN-100-20500
new	5/8	5/8	5/8	4	2-1/2	.593	2	.1063	87295	HFAL-RN-040-20625
new		5/8	5/8	6	3-3/4	.593	2	.1063	87296	HFAL-RN-060-20625
new		5/8	5/8	7	5	.593	2	.1063	87297	HFAL-RN-080-20625
new	3/4	3/4	3/4	6	3	.712	2	.1275	87298	HFAL-RN-040-20750
new		3/4	3/4	7	4-1/2	.712	2	.1275	87299	HFAL-RN-060-20750
new		3/4	3/4	8	6	.712	2	.1275	87300	HFAL-RN-080-20750

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

See page 272 for diagram of theoretical radius

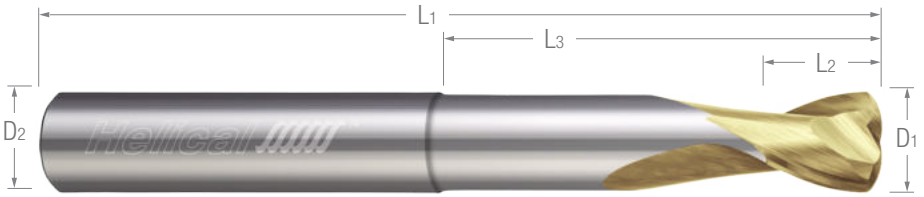
Speeds & Feeds on Page 273

HIGH FEED END MILLS - METRIC

Aluminum - Reduced Neck

MHFAL-2
METRIC

- Designed for outstanding performance and maximum feed rates in aluminum and non-ferrous materials
- Specifically engineered end profile for optimal tool engagement and reduced cutting forces
- 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
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA

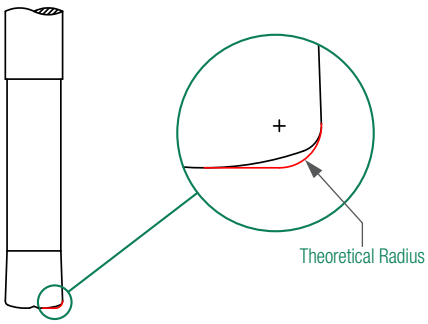


Cutter Dia.* D_1 +.00 mm −.05 mm	Shank Dia. D_2 (h6)	Length of Cut L_2 +.80 mm −.00 mm	OAL L_1 +1.60 mm −1.60 mm	Reach (LBS) L_3	Neck Dia.	Flutes	Theoretical Radius**	*Zplus* Coated	Tool Description
3 mm	6.00 mm	3.00 mm	63 mm	12.00 mm	2.85 mm	2	0.51 mm	**84942**	MHFAL-RN-040-20300
	6.00 mm	3.00 mm	63 mm	18.00 mm	2.85 mm	2	0.51 mm	**84943**	MHFAL-RN-060-20300
	6.00 mm	3.00 mm	63 mm	24.00 mm	2.85 mm	2	0.51 mm	**84944**	MHFAL-RN-080-20300
4 mm	6.00 mm	4.00 mm	63 mm	16.00 mm	3.80 mm	2	0.68 mm	**84945**	MHFAL-RN-040-20400
	6.00 mm	4.00 mm	63 mm	24.00 mm	3.80 mm	2	0.68 mm	**84946**	MHFAL-RN-060-20400
	6.00 mm	4.00 mm	63 mm	32.00 mm	3.80 mm	2	0.68 mm	**84947**	MHFAL-RN-080-20400
6 mm	6.00 mm	6.00 mm	75 mm	24.00 mm	5.70 mm	2	1.02 mm	**84948**	MHFAL-RN-040-20600
	6.00 mm	6.00 mm	75 mm	36.00 mm	5.70 mm	2	1.02 mm	**84949**	MHFAL-RN-060-20600
	6.00 mm	6.00 mm	75 mm	48.00 mm	5.70 mm	2	1.02 mm	**84950**	MHFAL-RN-080-20600
8 mm	8.00 mm	8.00 mm	100 mm	32.00 mm	7.60 mm	2	1.36 mm	**84951**	MHFAL-RN-040-20800
	8.00 mm	8.00 mm	100 mm	48.00 mm	7.60 mm	2	1.36 mm	**84952**	MHFAL-RN-060-20800
	8.00 mm	8.00 mm	100 mm	64.00 mm	7.60 mm	2	1.36 mm	**84953**	MHFAL-RN-080-20800
10 mm	10.00 mm	10.00 mm	125 mm	40.00 mm	9.50 mm	2	1.70 mm	**84954**	MHFAL-RN-040-21000
	10.00 mm	10.00 mm	125 mm	60.00 mm	9.50 mm	2	1.70 mm	**84955**	MHFAL-RN-060-21000
	10.00 mm	10.00 mm	125 mm	80.00 mm	9.50 mm	2	1.70 mm	**84956**	MHFAL-RN-080-21000
12 mm	12.00 mm	12.00 mm	125 mm	48.00 mm	11.40 mm	2	2.04 mm	**84957**	MHFAL-RN-040-21200
	12.00 mm	12.00 mm	125 mm	72.00 mm	11.40 mm	2	2.04 mm	**84958**	MHFAL-RN-060-21200
	12.00 mm	12.00 mm	150 mm	96.00 mm	11.40 mm	2	2.04 mm	**84959**	MHFAL-RN-080-21200

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

Visit www.helicaltool.com to download precise Simulation Files for all Feed Mills.

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 273

HFAL-2

SPEEDS & FEEDS

High Feed End Mills - Aluminum

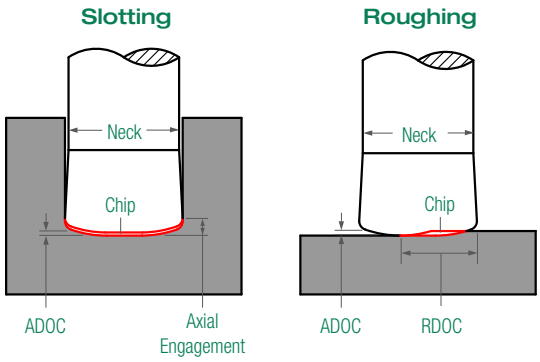
HFAL-2/MHFAL-2

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	.0023	.0032	.0036	.0046	.0050	.0055	.0082	.0091	.0100	.0114	.0160	.0182	.0205	.0228
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	1400	.0041	.0046	.0068	.0082	.0082	.0100	.0128	.0160	.0160	.0205	.0251	.0319	.0319	.0410
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	770	.0027	.0036	.0041	.0055	.0055	.0068	.0091	.0100	.0114	.0137	.0182	.0205	.0228	.0274

MILLING PROCESS	ADOC	RDOC
Slot (Full Slotting)	3.00%-5.00% Diameter	100% Diameter
Rgh (Traditional Roughing)	3.00%-5.00% Diameter	Up to 65% Diameter

NOTES:
IPT values shown are for 4xD reach tools, for tools with reaches greater than 4xD, IPT should be reduced.

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



The Secret Mechanics of High Feed End Mills

In The Loupe
MACHINISTS BLOG

A High Feed End Mill is a type of High Efficiency Milling (HEM) tool with a specialized end profile that allows the tool to utilize chip thinning to have dramatically increased feed rates. These tools are meant to operate with an extremely low axial depth of cut so that the cutting action takes place along the curved edge of the bottom profile. Read more from our "In the Loupe" blog post *The Secret Mechanics of High Feed End Mills*.

www.harveyperformance.com/in-the-loupe/the-secret-mechanics-of-high-feed-end-mills/

SCAN TO READ

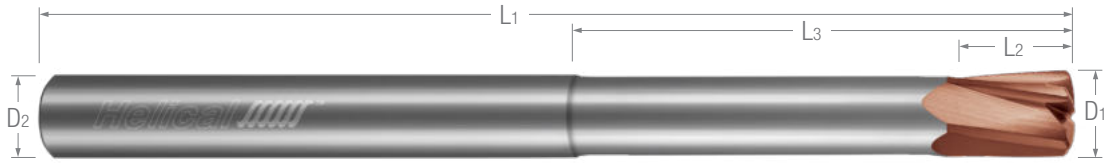
HIGH FEED END MILLS

New Items!

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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description	
1/8	1/8	1/8	2	1/4	.110	4	.0157	82663	HFV-RN-020-40125	
	1/8	1/8	2	1/2	.110	4	.0157	82664	HFV-RN-040-40125	
	1/4	1/8	2-1/2	1/2	.110	4	.0157	83725	HFV-RN-040-40125	
	1/8	1/8	2	3/4	.110	4	.0157	82665	HFV-RN-060-40125	
	1/4	1/8	2-1/2	3/4	.110	4	.0157	83726	HFV-RN-060-40125	
	1/4	1/8	2-1/2	1	.110	4	.0157	83727	HFV-RN-080-40125	
	1/4	1/8	2-1/2	1-1/4	.110	4	.0157	83728	HFV-RN-100-40125	
3/16	3/16	3/16	2-1/2	3/8	.165	4	.0235	82666	HFV-RN-020-40187	
	3/16	3/16	2-1/2	3/4	.165	4	.0235	82667	HFV-RN-040-40187	
	1/4	3/16	2-1/2	3/4	.165	4	.0235	83729	HFV-RN-040-40187	
	3/16	3/16	2-1/2	1-1/8	.165	4	.0235	82668	HFV-RN-060-40187	
	1/4	3/16	2-1/2	1-1/8	.165	4	.0235	83730	HFV-RN-060-40187	
	1/4	3/16	3	1-1/2	.165	4	.0235	83731	HFV-RN-080-40187	
	1/4	3/16	3	1-7/8	.165	4	.0235	83732	HFV-RN-100-40187	
1/4	1/4	1/4	3	1/2	.220	5	.0314	82669	HFV-RN-020-50250	
	1/4	1/4	3	1	.220	5	.0314	82670	HFV-RN-040-50250	
	1/4	1/4	3	1-1/2	.220	5	.0314	82671	HFV-RN-060-50250	
	1/4	1/4	4	2	.220	5	.0314	83719	HFV-RN-080-50250	
	1/4	1/4	4	2-1/2	.220	5	.0314	83720	HFV-RN-100-50250	
5/16	5/16	5/16	3	5/8	.275	5	.0393	87267	HFV-RN-020-50312	new
	5/16	5/16	4	1-1/4	.275	5	.0393	87268	HFV-RN-040-50312	new
	5/16	5/16	4	1-7/8	.275	5	.0393	87269	HFV-RN-060-50312	new
	5/16	5/16	4	2-1/2	.275	5	.0393	87270	HFV-RN-080-50312	new
3/8	3/8	3/8	4	3/4	.330	5	.0471	82672	HFV-RN-020-50375	
	3/8	3/8	4	1-1/2	.330	5	.0471	82673	HFV-RN-040-50375	
	3/8	3/8	4	2-1/4	.330	5	.0471	82674	HFV-RN-060-50375	
	3/8	3/8	6	3	.330	5	.0471	83721	HFV-RN-080-50375	
	3/8	3/8	6	3-3/4	.330	5	.0471	83722	HFV-RN-100-50375	
1/2	1/2	1/2	5	1	.440	5	.0628	82675	HFV-RN-020-50500	
	1/2	1/2	5	2	.440	5	.0628	82676	HFV-RN-040-50500	
	1/2	1/2	5	3	.440	5	.0628	82677	HFV-RN-060-50500	
	1/2	1/2	7	4	.440	5	.0628	83723	HFV-RN-080-50500	
	1/2	1/2	7	5	.440	5	.0628	83724	HFV-RN-100-50500	

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

continued on next page

Speeds & Feeds on Page 279

HFV

New Items! **HIGH FEED END MILLS**

Steels Up to 45 Rc - Variable Pitch - Reduced Neck

continued from previous page

	Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description
new	5/8	5/8	5/8	4	1-1/4	.550	5	.0785	87271	HFV-RN-020-50625
new		5/8	5/8	4	2-1/2	.550	5	.0785	87272	HFV-RN-040-50625
new		5/8	5/8	6	3-3/4	.550	5	.0785	87273	HFV-RN-060-50625
new		5/8	5/8	7	5	.550	5	.0785	87274	HFV-RN-080-50625
new	3/4	3/4	3/4	4	1-1/2	.660	5	.0942	87275	HFV-RN-020-50750
new		3/4	3/4	6	3	.660	5	.0942	87276	HFV-RN-040-50750
new		3/4	3/4	7	4-1/2	.660	5	.0942	87277	HFV-RN-060-50750
new		3/4	3/4	8	6	.660	5	.0942	87278	HFV-RN-080-50750

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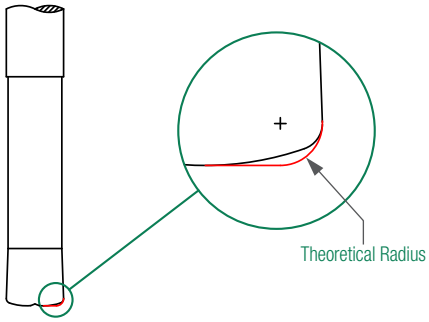


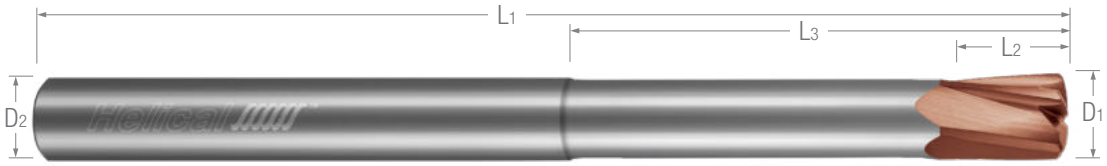
HIGH FEED END MILLS - METRIC

New Items!

MHFV
METRIC

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
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 +.00 mm −.05 mm	Shank Dia. D_2 (h6)	Length of Cut L_2 +.80 mm −.00 mm	OAL L_1 +1.60 mm −1.60 mm	Reach (LBS) L_3	Neck Dia.	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description	
3 mm	3.00 mm	3.00 mm	50 mm	6.00 mm	2.64 mm	4	.377 mm	82678	MHFV-RN-020-40300	
	3.00 mm	3.00 mm	50 mm	12.00 mm	2.64 mm	4	.377 mm	82679	MHFV-RN-040-40300	
	3.00 mm	3.00 mm	50 mm	18.00 mm	2.64 mm	4	.377 mm	82680	MHFV-RN-060-40300	
	3.00 mm	3.00 mm	63 mm	24.00 mm	2.64 mm	4	.377 mm	87279	MHFV-RN-080-40300	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	
	4.00 mm	4.00 mm	63 mm	16.00 mm	3.52 mm	4	.502 mm	82682	MHFV-RN-040-40400	
	4.00 mm	4.00 mm	63 mm	24.00 mm	3.52 mm	4	.502 mm	82683	MHFV-RN-060-40400	
	4.00 mm	4.00 mm	63 mm	32.00 mm	3.52 mm	4	.502 mm	87280	MHFV-RN-080-40400	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	
	6.00 mm	6.00 mm	75 mm	24.00 mm	5.28 mm	5	.754 mm	82685	MHFV-RN-040-50600	
	6.00 mm	6.00 mm	75 mm	36.00 mm	5.28 mm	5	.754 mm	82686	MHFV-RN-060-50600	
	6.00 mm	6.00 mm	75 mm	48.00 mm	5.28 mm	5	.754 mm	87281	MHFV-RN-080-50600	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	
	8.00 mm	8.00 mm	100 mm	32.00 mm	7.04 mm	5	1.005 mm	82688	MHFV-RN-040-50800	
	8.00 mm	8.00 mm	100 mm	48.00 mm	7.04 mm	5	1.005 mm	82689	MHFV-RN-060-50800	
	8.00 mm	8.00 mm	100 mm	64.00 mm	7.04 mm	5	1.005 mm	87282	MHFV-RN-080-50800	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	
	10.00 mm	10.00 mm	125 mm	40.00 mm	8.80 mm	5	1.257 mm	82691	MHFV-RN-040-51000	
	10.00 mm	10.00 mm	125 mm	60.00 mm	8.80 mm	5	1.257 mm	82692	MHFV-RN-060-51000	
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	
	12.00 mm	12.00 mm	125 mm	48.00 mm	10.55 mm	5	1.508 mm	82694	MHFV-RN-040-51200	
	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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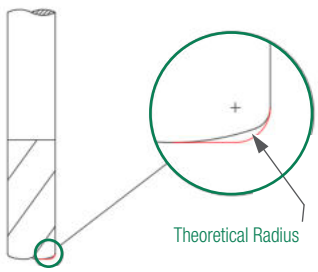

Speeds & Feeds on Page 279

HFVC

HIGH FEED END MILLS

Steels up to 45 Rc - Variable Pitch - Coolant Through - 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
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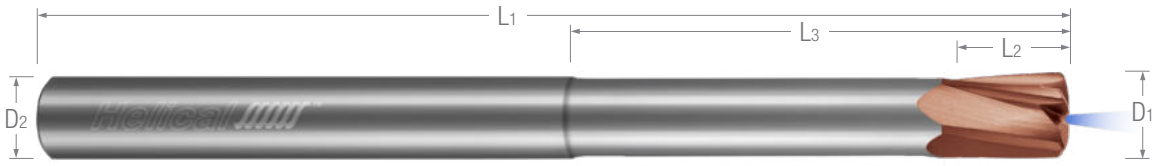
- Solid carbide
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	OAL L_1 $^{+.062"}_{-.062"}$	Reach (LBS) L_3	Neck Dia.	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description
1/4	1/4	1/4	3	1/2	.220	5	.0314	**82696**	HFVC-RN-020-50250
	1/4	1/4	3	1	.220	5	.0314	**82697**	HFVC-RN-040-50250
	1/4	1/4	3	1-1/2	.220	5	.0314	**82698**	HFVC-RN-060-50250
	1/4	1/4	4	2	.220	5	.0314	**83733**	HFVC-RN-080-50250
	1/4	1/4	4	2-1/2	.220	5	.0314	**83734**	HFVC-RN-100-50250
3/8	3/8	3/8	4	3/4	.330	5	.0471	**82699**	HFVC-RN-020-50375
	3/8	3/8	4	1-1/2	.330	5	.0471	**82700**	HFVC-RN-040-50375
	3/8	3/8	4	2-1/4	.330	5	.0471	**82701**	HFVC-RN-060-50375
	3/8	3/8	6	3	.330	5	.0471	**83735**	HFVC-RN-080-50375
	3/8	3/8	6	3-3/4	.330	5	.0471	**83736**	HFVC-RN-100-50375
1/2	1/2	1/2	5	1	.440	5	.0628	**82702**	HFVC-RN-020-50500
	1/2	1/2	5	2	.440	5	.0628	**82703**	HFVC-RN-040-50500
	1/2	1/2	5	3	.440	5	.0628	**82704**	HFVC-RN-060-50500
	1/2	1/2	7	4	.440	5	.0628	**83737**	HFVC-RN-080-50500
	1/2	1/2	7	5	.440	5	.0628	**83738**	HFVC-RN-100-50500

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

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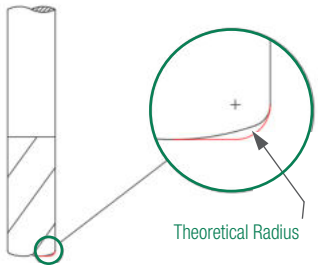

Speeds & Feeds on Page 279

HIGH FEED END MILLS - METRIC

MHFVC
METRIC

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

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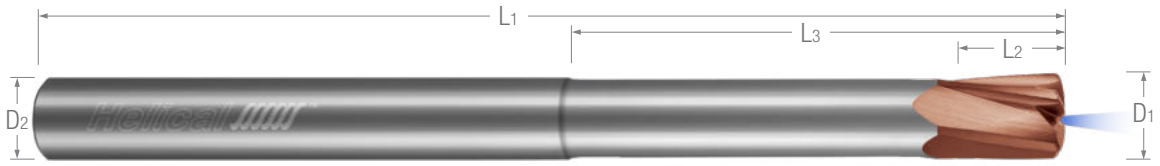
- CNC ground in the USA



Cutter Dia.* D_1 $^{+.00\ mm}_{-.05\ mm}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.80\ mm}_{-.00\ mm}$	OAL L_1 $^{+1.60\ mm}_{-1.60\ mm}$	Reach (LBS) L_3	Neck Diameter	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description
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
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
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
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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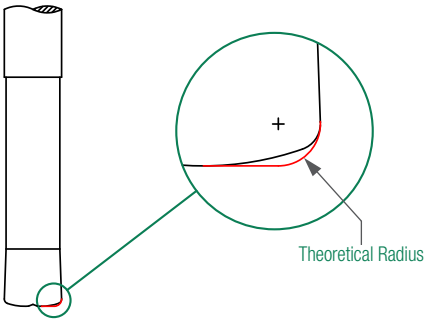


Speeds & Feeds on Page 279

HFV

SPEEDS & FEEDS
High Feed End Mills

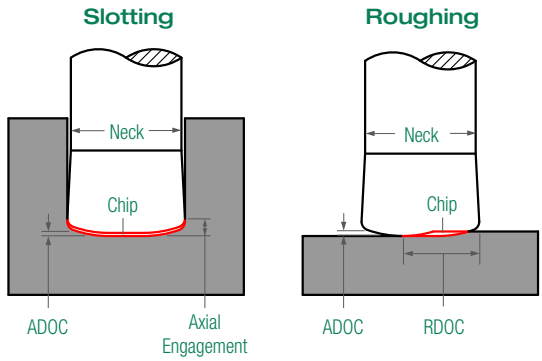
HFV / HFVC

Material Guide		Hardness	SFM	Inches Per Tooth (IPT)									
				1/8		3/16		1/4		3/8		1/2	
				Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh	Slot	Rgh
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
		> 50 HRC	350	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
TOOL STEEL	A2, H13, L6, P20, S7	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
		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
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	450	.0027	.0067	.0040	.0100	.0053	.0133	.0080	.0140	.0107	.0187
		75 - 98 HRB	500	.0027	.0060	.0040	.0090	.0053	.0120	.0080	.0140	.0107	.0187
		21 - 36 HRC	450	.0027	.0047	.0040	.0070	.0053	.0093	.0080	.0140	.0107	.0187
		36 - 50 HRC	400	.0020	.0033	.0030	.0050	.0040	.0067	.0060	.0100	.0080	.0133
		> 50 HRC	350	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	500	.0027	.0053	.0040	.0080	.0053	.0107	.0080	.0140	.0107	.0187
		21 - 36 HRC	450	.0027	.0047	.0040	.0070	.0053	.0093	.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
		36 - 50 HRC	400	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	600	.0027	.0047	.0040	.0070	.0053	.0094	.0080	.0140	.0107	.0187
		75 - 98 HRB	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.



COMBINATION FEED & HEM - 4 FLUTE

Chipbreaker Rougher - Variable Pitch

HEM **HEVF-C-4**

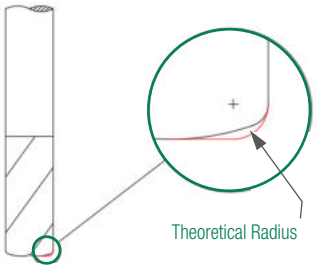
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, cast iron, titanium, and titanium alloys
- Combination of specialized end profile and OD geometry for both high feed and HEM applications
- 4 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description
1/8	1/8	1/4	1-1/2	4	.0157	**84468**	HEVF-C-020-40125
	1/8	3/8	2	4	.0157	**84469**	HEVF-C-030-40125
	1/8	1/2	2-1/2	4	.0157	**84470**	HEVF-C-040-40125
3/16	3/16	5/16	2	4	.0235	**84471**	HEVF-C-016-40187
	3/16	7/16	2	4	.0235	**84472**	HEVF-C-023-40187
	3/16	9/16	2-1/2	4	.0235	**84473**	HEVF-C-030-40187
1/4	1/4	3/8	2	4	.0314	**84474**	HEVF-C-015-40250
	1/4	1/2	2-1/2	4	.0314	**84475**	HEVF-C-020-40250
	1/4	3/4	2-1/2	4	.0314	**84476**	HEVF-C-030-40250
3/8	3/8	1/2	2	4	.0471	**84477**	HEVF-C-013-40375
	3/8	1	3	4	.0471	**84478**	HEVF-C-026-40375
	3/8	1-1/4	3	4	.0471	**84479**	HEVF-C-033-40375
1/2	1/2	1	3	4	.0628	**84480**	HEVF-C-020-40500
	1/2	1-1/4	3	4	.0628	**84481**	HEVF-C-025-40500
	1/2	1-5/8	4	4	.0628	**84482**	HEVF-C-032-40500
5/8	5/8	1-1/4	3-1/2	4	.0785	**84483**	HEVF-C-020-40625
	5/8	1-5/8	3-1/2	4	.0785	**84484**	HEVF-C-026-40625
	5/8	2-1/8	4	4	.0785	**84485**	HEVF-C-034-40625
3/4	3/4	1	3	4	.0942	**84486**	HEVF-C-013-40750
	3/4	1-5/8	4	4	.0942	**84487**	HEVF-C-021-40750
	3/4	2-1/4	5	4	.0942	**84488**	HEVF-C-030-40750

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

Visit www.helicaltool.com to download precise Simulation Files for all Feed Mills.

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.



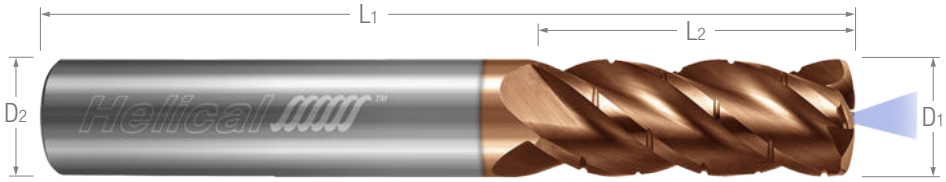
Speeds & Feeds on Page 282

HEVFC-C-4

New! **COMBINATION FEED & HEM - 4 FLUTE**

Chipbreaker Rougher - Variable Pitch - Coolant Through

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, cast iron, titanium, and titanium alloys
- Combination of specialized end profile and OD geometry for both high feed and High Efficiency Milling (HEM) applications
- 4 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- Center coolant hole for reduced heat, enhanced chip evacuation, and increased material removal rates
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA



	Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description
new	1/4	1/4	3/8	2	4	.0314	86412	HEVFC-C-015-40250
new		1/4	1/2	2-1/2	4	.0314	86413	HEVFC-C-020-40250
new		1/4	3/4	2-1/2	4	.0314	86414	HEVFC-C-030-40250
new	3/8	3/8	1/2	2	4	.0471	86415	HEVFC-C-013-40375
new		3/8	1	3	4	.0471	86416	HEVFC-C-026-40375
new		3/8	1-1/4	3	4	.0471	86417	HEVFC-C-033-40375
new	1/2	1/2	1	3	4	.0628	86418	HEVFC-C-020-40500
new		1/2	1-1/4	3	4	.0628	86419	HEVFC-C-025-40500
new		1/2	1-5/8	4	4	.0628	86420	HEVFC-C-032-40500
new	5/8	5/8	1-1/4	3-1/2	4	.0785	86421	HEVFC-C-020-40625
new		5/8	1-5/8	3-1/2	4	.0785	86422	HEVFC-C-026-40625
new		5/8	2-1/8	4	4	.0785	86423	HEVFC-C-034-40625
new	3/4	3/4	1	3	4	.0942	86424	HEVFC-C-013-40750
new		3/4	1-5/8	4	4	.0942	86425	HEVFC-C-021-40750
new		3/4	2-1/4	5	4	.0942	86426	HEVFC-C-030-40750

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

See page 280 for diagram of theoretical radius

4 Key Benefits of Combination Feed & HEM End Mills

In The Loupe
MACHINISTS BLOG

Machinists have lauded this tool's amazing benefits, including its ability to cut down on part cycle times, address machine limitations, and limit complexity of use, among others. For a full breakdown of this Helical fan-favorite, check out our "In the Loupe" blog post: *4 Key Benefits of Combination Feed & HEM End Mills*

www.harveyperformance.com/in-the-loupe/4-key-benefits-of-combination-feed-hem/

SCAN TO READ

Speeds & Feeds on Page 282

SPEEDS & FEEDS

Combination Feed & HEM - 4 Flute

HEVF-C-4

HEVF-C-4 / HEVFC-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	455	.0027	.0012	.0040	.0018	.0053	.0024	.0080	.0036	.0107	.0047	.0160	.0067	.0214	.0086
		75 - 98 HRB	445	.0020	.0009	.0030	.0013	.0040	.0018	.0060	.0026	.0080	.0034	.0120	.0049	.0160	.0063
		21 - 36 HRC	400	.0013	.0006	.0020	.0009	.0027	.0011	.0040	.0017	.0053	.0022	.0080	.0032	.0106	.0041
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0027	.0008	.0040	.0011	.0053	.0015	.0080	.0023	.0107	.0030	.0160	.0043	.0214	.0054
		21 - 36 HRC	340	.0027	.0006	.0040	.0009	.0053	.0012	.0080	.0017	.0107	.0022	.0160	.0032	.0214	.0040
		36 - 50 HRC	260	.0020	.0005	.0030	.0007	.0040	.0010	.0060	.0015	.0080	.0019	.0120	.0028	.0160	.0035
		> 50 HRC	155	.0013	.0004	.0020	.0006	.0027	.0008	.0040	.0012	.0053	.0015	.0080	.0022	.0106	.0028
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0027	.0008	.0040	.0011	.0053	.0015	.0080	.0023	.0107	.0030	.0160	.0043	.0214	.0054
		21 - 36 HRC	250	.0027	.0006	.0040	.0009	.0053	.0012	.0080	.0018	.0107	.0024	.0160	.0034	.0214	.0043
		36 - 50 HRC	145	.0020	.0005	.0030	.0007	.0040	.0010	.0060	.0014	.0080	.0019	.0120	.0027	.0160	.0034
		> 50 HRC	85	.0013	.0004	.0020	.0006	.0027	.0008	.0040	.0012	.0053	.0015	.0080	.0022	.0106	.0028
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0027	.0010	.0040	.0015	.0053	.0020	.0080	.0030	.0107	.0039	.0160	.0056	.0214	.0071
		75 - 98 HRB	255	.0027	.0007	.0040	.0010	.0053	.0014	.0080	.0021	.0107	.0027	.0160	.0038	.0214	.0049
		21 - 36 HRC	175	.0027	.0006	.0040	.0009	.0053	.0012	.0080	.0018	.0107	.0024	.0160	.0034	.0214	.0044
		36 - 50 HRC	150	.0020	.0006	.0030	.0008	.0040	.0011	.0060	.0016	.0080	.0021	.0120	.0031	.0160	.0039
		> 50 HRC	55	.0013	.0004	.0020	.0005	.0027	.0007	.0040	.0010	.0053	.0013	.0080	.0019	.0106	.0024
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0027	.0008	.0040	.0011	.0053	.0015	.0080	.0022	.0107	.0029	.0160	.0042	.0214	.0053
		21 - 36 HRC	225	.0027	.0007	.0040	.0010	.0053	.0014	.0080	.0020	.0107	.0026	.0160	.0038	.0214	.0048
		36 - 50 HRC	180	.0022	.0006	.0033	.0008	.0043	.0011	.0065	.0016	.0087	.0021	.0130	.0030	.0174	.0038
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0025	.0008	.0038	.0011	.0050	.0016	.0075	.0023	.0100	.0030	.0150	.0043	.0200	.0055
		21 - 36 HRC	280	.0027	.0007	.0040	.0010	.0053	.0013	.0080	.0020	.0107	.0026	.0160	.0037	.0214	.0047
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0025	.0006	.0038	.0008	.0050	.0011	.0075	.0017	.0100	.0022	.0150	.0031	.0200	.0040
		36 - 50 HRC	145	.0020	.0005	.0030	.0007	.0040	.0010	.0060	.0014	.0080	.0019	.0120	.0027	.0160	.0035
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0027	.0013	.0040	.0019	.0053	.0025	.0080	.0037	.0107	.0048	.0160	.0069	.0214	.0088
		21 - 36 HRC	370	.0027	.0007	.0040	.0010	.0053	.0013	.0080	.0020	.0107	.0026	.0160	.0038	.0214	.0048
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0023	.0107	.0031	.0160	.0044	.0214	.0056
		21 - 36 HRC	335	.0027	.0007	.0040	.0010	.0053	.0014	.0080	.0020	.0107	.0026	.0160	.0038	.0214	.0048
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0024	.0107	.0032	.0160	.0046	.0214	.0058
		21 - 36 HRC	260	.0027	.0006	.0040	.0008	.0053	.0011	.0080	.0016	.0107	.0021	.0160	.0030	.0214	.0039
		36 - 50 HRC	135	.0013	.0004	.0020	.0005	.0027	.0007	.0040	.0010	.0053	.0013	.0080	.0019	.0106	.0024
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0027	.0011	.0040	.0016	.0053	.0021	.0080	.0031	.0107	.0041	.0160	.0059	.0214	.0075
		75 - 98 HRB	250	.0027	.0009	.0040	.0013	.0053	.0018	.0080	.0026	.0107	.0034	.0160	.0049	.0214	.0063
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0027	.0005	.0040	.0008	.0053	.0011	.0080	.0016	.0107	.0021	.0160	.0030	.0214	.0038
		21 - 36 HRC	75	.0027	.0005	.0040	.0008	.0053	.0010	.0080	.0015	.0107	.0020	.0160	.0029	.0214	.0036
		36 - 50 HRC	70	.0022	.0005	.0033	.0007	.0043	.0009	.0065	.0013	.0087	.0017	.0130	.0025	.0174	.0031
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0027	.0015	.0040	.0022	.0053	.0029	.0080	.0043	.0107	.0057	.0160	.0081	.0214	.0103
		75 - 98 HRB	275	.0027	.0012	.0040	.0018	.0053	.0024	.0080	.0036	.0107	.0047	.0160	.0068	.0214	.0087
		21 - 36 HRC	250	.0027	.0009	.0040	.0014	.0053	.0018	.0080	.0027	.0107	.0036	.0160	.0051	.0214	.0065
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0027	.0007	.0040	.0011	.0053	.0014	.0080	.0021	.0107	.0028	.0160	.0040	.0214	.0051
		36 - 50 HRC	160	.0025	.0007	.0038	.0010	.0050	.0013	.0075	.0020	.0100	.0026	.0150	.0037	.0200	.0047
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0020	.0006	.0030	.0009	.0040	.0012	.0060	.0018	.0080	.0024	.0120	.0034	.0160	.0043
		21 - 36 HRC	170	.0027	.0006	.0040	.0009	.0053	.0012	.0080	.0017	.0107	.0023	.0160	.0033	.0214	.0042
		36 - 50 HRC	65	.0020	.0004	.0030	.0006	.0040	.0008	.0060	.0012	.0080	.0016	.0120	.0022	.0160	.0028

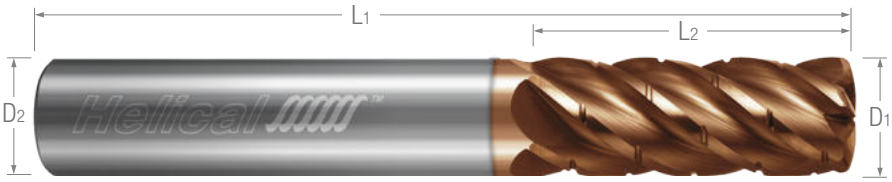
MILLING PROCESS	HARDNESS	ADOC	RDOC
Slot (Full Slotting)	< 35 HRC	3.00%-5.00% Diameter	100% Diameter
	≥ 35 HRC	2.50%-4.00% Diameter	100% Diameter
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	25%-35% Diameter

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.

HEVF-C-5 New Items! COMBINATION FEED & HEM - 5 FLUTE

Chipbreaker Rougher - Variable Pitch

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, cast iron, titanium, and titanium alloys.
- Combination of specialized end profile and OD geometry for both high feed and HEM applications
- 5 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

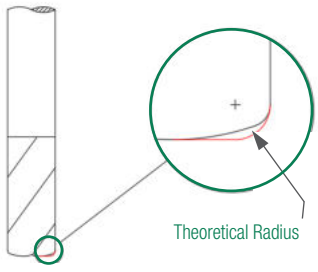


	Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description
	1/4	1/4	3/8	2	5	.0314	84489	HEVF-C-015-50250
		1/4	1/2	2-1/2	5	.0314	84490	HEVF-C-020-50250
		1/4	3/4	2-1/2	5	.0314	84491	HEVF-C-030-50250
new		1/4	1	3	5	.0314	87283	HEVF-C-040-50250
	3/8	3/8	1/2	2	5	.0471	84492	HEVF-C-013-50375
		3/8	1	3	5	.0471	84493	HEVF-C-026-50375
		3/8	1-1/4	3	5	.0471	84494	HEVF-C-033-50375
new		3/8	1-1/2	3-1/2	5	.0471	87284	HEVF-C-040-50375
new	1/2	1/2	5/8	2-1/2	5	.0628	87285	HEVF-C-012-50500
		1/2	1	3	5	.0628	84495	HEVF-C-020-50500
		1/2	1-1/4	3	5	.0628	84496	HEVF-C-025-50500
		1/2	1-5/8	4	5	.0628	84497	HEVF-C-032-50500
new		1/2	2	4	5	.0628	87286	HEVF-C-040-50500
	5/8	5/8	1-1/4	3-1/2	5	.0785	84498	HEVF-C-020-50625
		5/8	1-5/8	3-1/2	5	.0785	84499	HEVF-C-026-50625
		5/8	2-1/8	4	5	.0785	84500	HEVF-C-034-50625
	3/4	3/4	1	3	5	.0942	84501	HEVF-C-013-50750
		3/4	1-5/8	4	5	.0942	84502	HEVF-C-021-50750
		3/4	2-1/4	5	5	.0942	84503	HEVF-C-030-50750

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

Visit www.helicaltool.com to download precise Simulation Files for all Feed Mills.

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.



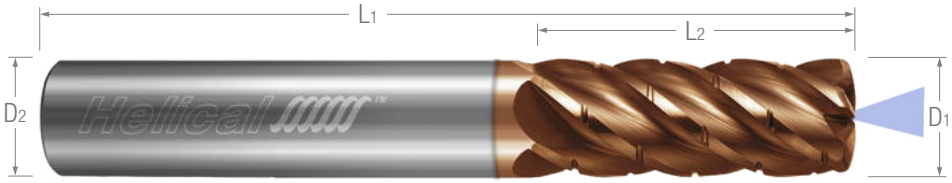
Speeds & Feeds on Page 285

COMBINATION FEED & HEM - 5 FLUTE New!

Chipbreaker Rougher - Variable Pitch - Coolant Through

HEM **HEVFC-C-5**

- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, cast iron, titanium, and titanium alloys
- Combination of specialized end profile and OD geometry for both high feed and High Efficiency Milling (HEM) applications
- 5 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, minimized harmonics, and reduced tool pressure
- Center coolant hole for reduced heat, enhanced chip evacuation, and increased material removal rates
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

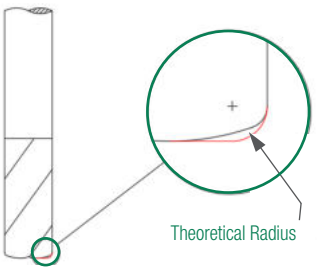


Cutter Dia.* D_1 $^{+.000"}_{-.002"}$	Shank Dia. D_2 (h6)	Length of Cut L_2 $^{+.032"}_{-.000"}$	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	Theoretical Radius**	T*plus* Coated	Tool Description	
1/4	1/4	3/8	2	5	.0314	86427	HEVFC-C-015-50250	new
	1/4	1/2	2-1/2	5	.0314	86428	HEVFC-C-020-50250	new
	1/4	3/4	2-1/2	5	.0314	86429	HEVFC-C-030-50250	new
3/8	3/8	1/2	2	5	.0471	86430	HEVFC-C-013-50375	new
	3/8	1	3	5	.0471	86431	HEVFC-C-026-50375	new
	3/8	1-1/4	3	5	.0471	86432	HEVFC-C-033-50375	new
1/2	1/2	1	3	5	.0628	86433	HEVFC-C-020-50500	new
	1/2	1-1/4	3	5	.0628	86434	HEVFC-C-025-50500	new
	1/2	1-5/8	4	5	.0628	86435	HEVFC-C-032-50500	new
5/8	5/8	1-1/4	3-1/2	5	.0785	86436	HEVFC-C-020-50625	new
	5/8	1-5/8	3-1/2	5	.0785	86437	HEVFC-C-026-50625	new
	5/8	2-1/8	4	5	.0785	86438	HEVFC-C-034-50625	new
3/4	3/4	1	3	5	.0942	86439	HEVFC-C-013-50750	new
	3/4	1-5/8	4	5	.0942	86440	HEVFC-C-021-50750	new
	3/4	2-1/4	5	5	.0942	86441	HEVFC-C-030-50750	new

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

Visit www.helicaltool.com to download precise Simulation Files for all Feed Mills.

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 285

HEVF-C-5

SPEEDS & FEEDS

Combination Feed & End Mill - 5 Flute

HEVF-C-5 / HEVFC-C-5

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	455	.0027	.0015	.0040	.0021	.0053	.0029	.0080	.0043	.0107	.0056	.0160	.0080	.0214	.0102
		75 - 98 HRB	445	.0020	.0011	.0030	.0015	.0040	.0021	.0060	.0031	.0080	.0041	.0120	.0059	.0160	.0075
		21 - 36 HRC	400	.0013	.0007	.0020	.0010	.0027	.0014	.0040	.0020	.0053	.0026	.0080	.0038	.0106	.0048
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0027	.0009	.0040	.0013	.0053	.0018	.0080	.0027	.0107	.0035	.0160	.0051	.0214	.0065
		21 - 36 HRC	340	.0027	.0007	.0040	.0010	.0053	.0013	.0080	.0020	.0107	.0026	.0160	.0038	.0214	.0048
		36 - 50 HRC	260	.0020	.0006	.0030	.0009	.0040	.0012	.0060	.0017	.0080	.0023	.0120	.0033	.0160	.0042
		> 50 HRC	155	.0013	.0005	.0020	.0007	.0027	.0009	.0040	.0014	.0053	.0018	.0080	.0026	.0106	.0033
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0027	.0009	.0040	.0013	.0053	.0018	.0080	.0027	.0107	.0035	.0160	.0051	.0214	.0065
		21 - 36 HRC	250	.0027	.0007	.0040	.0011	.0053	.0015	.0080	.0022	.0107	.0028	.0160	.0040	.0214	.0051
		36 - 50 HRC	145	.0020	.0006	.0030	.0008	.0040	.0011	.0060	.0017	.0080	.0022	.0120	.0031	.0160	.0040
		> 50 HRC	85	.0013	.0005	.0020	.0007	.0027	.0009	.0040	.0014	.0053	.0018	.0080	.0026	.0106	.0033
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0027	.0012	.0040	.0018	.0053	.0024	.0080	.0035	.0107	.0046	.0160	.0066	.0214	.0085
		75 - 98 HRB	255	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0024	.0107	.0032	.0160	.0045	.0214	.0058
		21 - 36 HRC	175	.0027	.0008	.0040	.0011	.0053	.0015	.0080	.0022	.0107	.0029	.0160	.0041	.0214	.0052
		36 - 50 HRC	150	.0020	.0007	.0030	.0010	.0040	.0013	.0060	.0019	.0080	.0026	.0120	.0037	.0160	.0046
		> 50 HRC	55	.0013	.0004	.0020	.0006	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0022	.0106	.0029
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0027	.0009	.0040	.0013	.0053	.0018	.0080	.0026	.0107	.0034	.0160	.0049	.0214	.0063
		21 - 36 HRC	225	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0024	.0107	.0031	.0160	.0044	.0214	.0057
		36 - 50 HRC	180	.0022	.0007	.0033	.0009	.0043	.0013	.0065	.0019	.0087	.0025	.0130	.0036	.0174	.0045
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0025	.0009	.0038	.0013	.0050	.0018	.0075	.0027	.0100	.0035	.0150	.0051	.0200	.0065
		21 - 36 HRC	280	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0024	.0107	.0031	.0160	.0044	.0214	.0056
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0025	.0007	.0038	.0010	.0050	.0013	.0075	.0020	.0100	.0026	.0150	.0037	.0200	.0048
		36 - 50 HRC	145	.0020	.0006	.0030	.0009	.0040	.0012	.0060	.0017	.0080	.0023	.0120	.0032	.0160	.0041
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0027	.0015	.0040	.0022	.0053	.0029	.0080	.0044	.0107	.0057	.0160	.0082	.0214	.0104
		21 - 36 HRC	370	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0024	.0107	.0031	.0160	.0045	.0214	.0057
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0027	.0010	.0040	.0014	.0053	.0019	.0080	.0028	.0107	.0036	.0160	.0052	.0214	.0066
		21 - 36 HRC	335	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0024	.0107	.0031	.0160	.0045	.0214	.0057
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0027	.0010	.0040	.0014	.0053	.0020	.0080	.0029	.0107	.0038	.0160	.0054	.0214	.0069
		21 - 36 HRC	260	.0027	.0007	.0040	.0010	.0053	.0013	.0080	.0019	.0107	.0025	.0160	.0036	.0214	.0046
		36 - 50 HRC	135	.0013	.0004	.0020	.0006	.0027	.0008	.0040	.0012	.0053	.0016	.0080	.0023	.0106	.0029
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0027	.0013	.0040	.0018	.0053	.0025	.0080	.0037	.0107	.0049	.0160	.0070	.0214	.0089
		75 - 98 HRB	250	.0027	.0011	.0040	.0015	.0053	.0021	.0080	.0031	.0107	.0041	.0160	.0058	.0214	.0074
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0027	.0006	.0040	.0009	.0053	.0013	.0080	.0019	.0107	.0025	.0160	.0035	.0214	.0045
		21 - 36 HRC	75	.0027	.0006	.0040	.0009	.0053	.0012	.0080	.0018	.0107	.0024	.0160	.0034	.0214	.0043
		36 - 50 HRC	70	.0022	.0005	.0033	.0008	.0043	.0010	.0065	.0015	.0087	.0020	.0130	.0029	.0174	.0037
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0027	.0017	.0040	.0025	.0053	.0035	.0080	.0051	.0107	.0067	.0160	.0096	.0214	.0122
		75 - 98 HRB	275	.0027	.0015	.0040	.0021	.0053	.0029	.0080	.0043	.0107	.0056	.0160	.0081	.0214	.0103
		21 - 36 HRC	250	.0027	.0011	.0040	.0016	.0053	.0022	.0080	.0032	.0107	.0042	.0160	.0060	.0214	.0077
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0027	.0009	.0040	.0013	.0053	.0017	.0080	.0025	.0107	.0033	.0160	.0048	.0214	.0061
		36 - 50 HRC	160	.0025	.0008	.0038	.0012	.0050	.0016	.0075	.0023	.0100	.0030	.0150	.0043	.0200	.0055
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0020	.0007	.0030	.0011	.0040	.0015	.0060	.0021	.0080	.0028	.0120	.0040	.0160	.0051
		21 - 36 HRC	170	.0027	.0007	.0040	.0010	.0053	.0014	.0080	.0021	.0107	.0027	.0160	.0039	.0214	.0050
		36 - 50 HRC	65	.0020	.0005	.0030	.0007	.0040	.0010	.0060	.0014	.0080	.0018	.0120	.0026	.0160	.0034

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	Up to Max LOC	15%-30% Diameter
	≥ 35 HRC	Up to Max LOC	10%-20% Diameter

Note: 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.

TAPERED END MILLS - 4 FLUTE

Ball - Variable Pitch

HTPR-4

- Tapered profile designed for use in mold and die pockets and other tapered wall applications
- Engineered for excellent performance in light profiling and finishing applications
- 4 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Angle Per Side A_1 $^{+0°30'}_{-0°30'}$	Cutter Diameter D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
0.5°	1/8	3/16	3/8	2	4	**84870**	HTPR005-030-40125-BN
	1/8	3/16	5/8	2	4	**84888**	HTPR005-050-40125-BN
	3/16	1/4	5/8	2-1/2	4	**84876**	HTPR005-033-40187-BN
	3/16	1/4	1	2-1/2	4	**84894**	HTPR005-053-40187-BN
	1/4	5/16	3/4	2-1/2	4	**84882**	HTPR005-030-40250-BN
	1/4	5/16	1-1/4	3	4	**84900**	HTPR005-050-40250-BN
1°	1/8	3/16	3/8	2	4	**84871**	HTPR010-030-40125-BN
	1/8	3/16	5/8	2	4	**84889**	HTPR010-050-40125-BN
	3/16	1/4	5/8	2-1/2	4	**84877**	HTPR010-033-40187-BN
	3/16	1/4	1	2-1/2	4	**84895**	HTPR010-053-40187-BN
	1/4	5/16	3/4	2-1/2	4	**84883**	HTPR010-030-40250-BN
	1/4	5/16	1-1/4	3	4	**84901**	HTPR010-050-40250-BN
1.5°	1/8	3/16	3/8	2	4	**84872**	HTPR015-030-40125-BN
	1/8	3/16	5/8	2	4	**84890**	HTPR015-050-40125-BN
	3/16	1/4	5/8	2-1/2	4	**84878**	HTPR015-033-40187-BN
	3/16	1/4	1	2-1/2	4	**84896**	HTPR015-053-40187-BN
	1/4	5/16	3/4	2-1/2	4	**84884**	HTPR015-030-40250-BN
	1/4	3/8	1-1/4	3	4	**84902**	HTPR015-050-40250-BN
2°	1/8	3/16	3/8	2	4	**84873**	HTPR020-030-40125-BN
	1/8	3/16	5/8	2	4	**84891**	HTPR020-050-40125-BN
	3/16	1/4	5/8	2-1/2	4	**84879**	HTPR020-033-40187-BN
	3/16	5/16	1	2-1/2	4	**84897**	HTPR020-053-40187-BN
	1/4	5/16	3/4	2-1/2	4	**84885**	HTPR020-030-40250-BN
	1/4	3/8	1-1/4	3	4	**84903**	HTPR020-050-40250-BN
3°	1/8	3/16	3/8	2	4	**84874**	HTPR030-030-40125-BN
	1/8	1/4	5/8	2	4	**84892**	HTPR030-050-40125-BN
	3/16	5/16	5/8	2-1/2	4	**84880**	HTPR030-033-40187-BN
	3/16	5/16	1	2-1/2	4	**84898**	HTPR030-053-40187-BN
	1/4	3/8	3/4	2-1/2	4	**84886**	HTPR030-030-40250-BN
	1/4	1/2	1-1/4	3	4	**84904**	HTPR030-050-40250-BN
5°	1/8	1/4	3/8	2	4	**84875**	HTPR050-030-40125-BN
	1/8	1/4	5/8	2	4	**84893**	HTPR050-050-40125-BN
	3/16	5/16	5/8	2-1/2	4	**84881**	HTPR050-033-40187-BN
	3/16	3/8	1	2-1/2	4	**84899**	HTPR050-053-40187-BN
	1/4	1/2	3/4	2-1/2	4	**84887**	HTPR050-030-40250-BN
	1/4	1/2	1-1/4	3	4	**84905**	HTPR050-050-40250-BN

Speeds & Feeds on Page 287

HTPR-4

SPEEDS & FEEDS

Tapered End Mill - 4 Flute - Ball - Variable Pitch

HTPR-4

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	455	.0012	.0016	.0018	.0019	.0024	.0021	.0036	.0024	.0047	.0028
		75 - 98 HRB	445	.0009	.0014	.0013	.0016	.0018	.0018	.0026	.0021	.0034	.0024
		21 - 36 HRC	400	.0006	.0011	.0009	.0013	.0011	.0014	.0017	.0017	.0022	.0019
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0008	.0013	.0011	.0015	.0015	.0017	.0023	.0019	.0030	.0023
		21 - 36 HRC	340	.0006	.0011	.0009	.0013	.0012	.0014	.0017	.0017	.0022	.0019
		36 - 50 HRC	260	.0005	.0011	.0007	.0012	.0010	.0013	.0015	.0016	.0019	.0018
		> 50 HRC	155	.0004	.0009	.0006	.0010	.0008	.0012	.0012	.0014	.0015	.0016
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0008	.0013	.0011	.0015	.0015	.0017	.0023	.0019	.0030	.0023
		21 - 36 HRC	250	.0006	.0012	.0009	.0013	.0012	.0015	.0018	.0017	.0024	.0020
		36 - 50 HRC	145	.0005	.0010	.0007	.0012	.0010	.0013	.0014	.0015	.0019	.0018
		> 50 HRC	85	.0004	.0009	.0006	.0010	.0008	.0012	.0012	.0014	.0015	.0016
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0010	.0015	.0015	.0017	.0020	.0019	.0030	.0022	.0039	.0026
		75 - 98 HRB	255	.0007	.0012	.0010	.0014	.0014	.0016	.0021	.0018	.0027	.0021
		21 - 36 HRC	175	.0006	.0012	.0009	.0013	.0012	.0015	.0018	.0017	.0024	.0020
		36 - 50 HRC	150	.0006	.0011	.0008	.0012	.0011	.0014	.0016	.0016	.0021	.0019
		> 50 HRC	55	.0004	.0009	.0005	.0010	.0007	.0011	.0010	.0013	.0013	.0015
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0008	.0013	.0011	.0015	.0015	.0017	.0022	.0019	.0029	.0022
		21 - 36 HRC	225	.0007	.0012	.0010	.0014	.0014	.0016	.0020	.0018	.0026	.0021
		36 - 50 HRC	180	.0006	.0011	.0008	.0012	.0011	.0014	.0016	.0016	.0021	.0019
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0008	.0013	.0011	.0015	.0016	.0017	.0023	.0019	.0030	.0023
		21 - 36 HRC	280	.0007	.0012	.0010	.0014	.0013	.0016	.0020	.0018	.0026	.0021
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0006	.0011	.0008	.0012	.0011	.0014	.0017	.0016	.0022	.0019
		36 - 50 HRC	145	.0005	.0011	.0007	.0012	.0010	.0014	.0014	.0015	.0019	.0018
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0013	.0017	.0019	.0019	.0025	.0021	.0037	.0025	.0048	.0029
		21 - 36 HRC	370	.0007	.0012	.0010	.0014	.0013	.0016	.0020	.0018	.0026	.0021
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0008	.0013	.0012	.0015	.0016	.0017	.0023	.0019	.0031	.0023
		21 - 36 HRC	335	.0007	.0012	.0010	.0014	.0014	.0016	.0020	.0018	.0026	.0021
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0008	.0014	.0012	.0015	.0016	.0017	.0024	.0020	.0032	.0023
		21 - 36 HRC	260	.0006	.0011	.0008	.0012	.0011	.0014	.0016	.0016	.0021	.0019
		36 - 50 HRC	135	.0004	.0009	.0005	.0010	.0007	.0011	.0010	.0013	.0013	.0015
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0011	.0015	.0016	.0017	.0021	.0020	.0031	.0023	.0041	.0026
		75 - 98 HRB	250	.0009	.0014	.0013	.0016	.0018	.0018	.0026	.0021	.0034	.0024
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0005	.0011	.0008	.0012	.0011	.0014	.0016	.0016	.0021	.0019
		21 - 36 HRC	75	.0005	.0011	.0008	.0012	.0010	.0014	.0015	.0016	.0020	.0018
		36 - 50 HRC	70	.0005	.0010	.0007	.0011	.0009	.0013	.0013	.0015	.0017	.0017
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0015	.0018	.0022	.0020	.0029	.0023	.0043	.0027	.0057	.0031
		75 - 98 HRB	275	.0012	.0017	.0018	.0019	.0024	.0021	.0036	.0024	.0047	.0028
		21 - 36 HRC	250	.0009	.0014	.0014	.0016	.0018	.0018	.0027	.0021	.0036	.0025
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0007	.0013	.0011	.0014	.0014	.0016	.0021	.0019	.0028	.0022
		36 - 50 HRC	160	.0007	.0012	.0010	.0014	.0013	.0016	.0020	.0018	.0026	.0021
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0006	.0012	.0009	.0013	.0012	.0015	.0018	.0017	.0024	.0020
		21 - 36 HRC	170	.0006	.0011	.0009	.0013	.0012	.0015	.0017	.0017	.0023	.0020
		36 - 50 HRC	65	.0004	.0009	.0006	.0011	.0008	.0012	.0012	.0014	.0016	.0016

MILLING PROCESS	HARDNESS	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	25%-35% Diameter
Fin (Finishing)	< 35 HRC	Up to Max LOC	4%-6% Diameter
	≥ 35 HRC	Up to Max LOC	4%-6% Diameter

Note: Speed (SFM) and feed (IPT) numbers shown in table above are considered to be average values. Use a tolerance of +/-25% as needed.

Effective cutter diameter should be used to select the proper chipload per tooth.

TAPERED END MILLS - 5 FLUTE

Square - Variable Pitch

HTPR-5

- Tapered profile designed for use in mold and die pockets and other tapered wall applications
- Engineered for excellent performance in light profiling 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Angle Per Side A_1 $^{+0°30'}_{-0°30'}$	Cutter Dia. D_1 $^{+.000"}_{-.002"}$	Shank Diameter D_2 (h6)	Length of Cut L_2	Overall Length L_1 $^{+.062"}_{-.062"}$	Flutes	A*plus* Coated	Tool Description
0.5°	1/8	3/16	3/8	2	5	**84906**	HTPR005-030-50125
	1/8	3/16	5/8	2	5	**84924**	HTPR005-050-50125
	3/16	1/4	5/8	2-1/2	5	**84912**	HTPR005-033-50187
	3/16	1/4	1	2-1/2	5	**84930**	HTPR005-053-50187
	1/4	5/16	3/4	2-1/2	5	**84918**	HTPR005-030-50250
	1/4	5/16	1-1/4	3	5	**84936**	HTPR005-050-50250
1°	1/8	3/16	3/8	2	5	**84907**	HTPR010-030-50125
	1/8	3/16	5/8	2	5	**84925**	HTPR010-050-50125
	3/16	1/4	5/8	2-1/2	5	**84913**	HTPR010-033-50187
	3/16	1/4	1	2-1/2	5	**84931**	HTPR010-053-50187
	1/4	5/16	3/4	2-1/2	5	**84919**	HTPR010-030-50250
	1/4	5/16	1-1/4	3	5	**84937**	HTPR010-050-50250
1.5°	1/8	3/16	3/8	2	5	**84908**	HTPR015-030-50125
	1/8	3/16	5/8	2	5	**84926**	HTPR015-050-50125
	3/16	1/4	5/8	2-1/2	5	**84914**	HTPR015-033-50187
	3/16	1/4	1	2-1/2	5	**84932**	HTPR015-053-50187
	1/4	5/16	3/4	2-1/2	5	**84920**	HTPR015-030-50250
	1/4	3/8	1-1/4	3	5	**84938**	HTPR015-050-50250
2°	1/8	3/16	3/8	2	5	**84909**	HTPR020-030-50125
	1/8	3/16	5/8	2	5	**84927**	HTPR020-050-50125
	3/16	1/4	5/8	2-1/2	5	**84915**	HTPR020-033-50187
	3/16	5/16	1	2-1/2	5	**84933**	HTPR020-053-50187
	1/4	5/16	3/4	2-1/2	5	**84921**	HTPR020-030-50250
	1/4	3/8	1-1/4	3	5	**84939**	HTPR020-050-50250
3°	1/8	3/16	3/8	2	5	**84910**	HTPR030-030-50125
	1/8	1/4	5/8	2	5	**84928**	HTPR030-050-50125
	3/16	5/16	5/8	2-1/2	5	**84916**	HTPR030-033-50187
	3/16	5/16	1	2-1/2	5	**84934**	HTPR030-053-50187
	1/4	3/8	3/4	2-1/2	5	**84922**	HTPR030-030-50250
	1/4	1/2	1-1/4	3	5	**84940**	HTPR030-050-50250
5°	1/8	1/4	3/8	2	5	**84911**	HTPR050-030-50125
	1/8	1/4	5/8	2	5	**84929**	HTPR050-050-50125
	3/16	5/16	5/8	2-1/2	5	**84917**	HTPR050-033-50187
	3/16	3/8	1	2-1/2	5	**84935**	HTPR050-053-50187
	1/4	1/2	3/4	2-1/2	5	**84923**	HTPR050-030-50250
	1/4	1/2	1-1/4	3	5	**84941**	HTPR050-050-50250

Speeds & Feeds on Page 289

HTPR-5

SPEEDS & FEEDS

Tapered End Mill - 5 Flute - Square - Variable Pitch

HTPR-5

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

MILLING PROCESS	HARDNESS	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	25%-35% Diameter
Fin (Finishing)	< 35 HRC	Up to Max LOC	4%-6% Diameter
	≥ 35 HRC	Up to Max LOC	4%-6% Diameter

Note: Speed (SFM) and feed (IPT) numbers shown in table above are considered to be average values. Use a tolerance of +/-25% as needed.

Effective cutter diameter should be used to select the proper chipload per tooth.

CHAMFER MILLS - STRAIGHT FLUTE

HCM

2 & 4 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
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life
- Solid carbide
- CNC ground in the USA

Included Angle A +0°30' −0°30'	Shank Diameter* D2 (h6)	Web Thickness (MAX)	Length of Cut L2	Overall Length L1 +.062" −.062"	Flutes	Uncoated	A*plus* 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
	5/16	.028	.270	2-1/2	2	**84772**	**84773**	HCM60-20312
	5/16	.028	.270	2-1/2	4	**84774**	**84775**	HCM60-40312
	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
	5/8	.043	.541	3	2	**84780**	**84781**	HCM60-20625
	5/8	.043	.541	3	4	**84782**	**84783**	HCM60-40625
	3/4	.045	.649	3	2	**84788**	**84789**	HCM60-20750
	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
	5/16	.028	.156	2-1/2	2	**84776**	**84777**	HCM90-20312
	5/16	.028	.156	2-1/2	4	**84778**	**84779**	HCM90-40312
	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
	5/8	.043	.312	3	2	**84784**	**84785**	HCM90-20625
	5/8	.043	.312	3	4	**84786**	**84787**	HCM90-40625
	3/4	.045	.375	3	2	**84790**	**84791**	HCM90-20750
	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

Speeds & Feeds on Page 291

HCM

SPEEDS & FEEDS

Chamfer Mills - Straight Flute

HCM

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	2200	.0009	.0018	.0028	.0035	.0045	.0055	.0070	.0090	.0110
		≥ 120 HBS	2200	.0006	.0012	.0018	.0022	.0028	.0035	.0045	.0055	.0070
CAST ALUMINUM ALLOY	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	< 120 HBS	1800	.0012	.0025	.0040	.0050	.0060	.0080	.0100	.0130	.0150
		≥ 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

2 & 4 Flute - High Performance - Pointed

HPCM

- Helically ground with positive axial rake and clearance for high performance chamfering
- Helical flute geometry results in superior part finish
- Pointed tip for precise applications and detailed workpieces
- h6 shank tolerance for high precision tool holders
- *Z*plus coating offers higher hardness and added lubricity for maximum performance
- A*plus* 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

Incl. Angle A +0°30' −0°30'	Shank Dia.* D2 (h6)	LOC L2	Overall Length L1 +.062" −.062"	Web Thickness (MAX)	Flutes	*Z*plus Coated	A*plus* Coated	Tool Description
60°	1/8	.100	1-1/2	.010	2	**83836**	**83780**	HPCM60-20125
	3/16	.154	2	.010	2	**83838**	**83782**	HPCM60-20187
	3/16	.154	2	.010	4		**83784**	HPCM60-40187
	1/4	.208	2-1/2	.010	2	**83840**	**83786**	HPCM60-20250
	1/4	.208	2-1/2	.010	4		**83788**	HPCM60-40250
	3/8	.316	2-1/2	.010	2	**83842**	**83790**	HPCM60-20375
	3/8	.316	2-1/2	.010	4		**83792**	HPCM60-40375
	1/2	.424	3	.010	2	**83844**	**83794**	HPCM60-20500
	1/2	.424	3	.010	4		**83796**	HPCM60-40500
90°	1/8	.058	1-1/2	.010	2	**83846**	**83798**	HPCM90-20125
	1/8	.058	1-1/2	.010	4		**83800**	HPCM90-40125
	3/16	.089	2	.010	2	**83848**	**83802**	HPCM90-20187
	3/16	.089	2	.010	4		**83804**	HPCM90-40187
	1/4	.120	2-1/2	.010	2	**83850**	**83806**	HPCM90-20250
	1/4	.120	2-1/2	.010	4		**83808**	HPCM90-40250
	3/8	.183	2-1/2	.010	2	**83852**	**83810**	HPCM90-20375
	3/8	.183	2-1/2	.010	4		**83812**	HPCM90-40375
	1/2	.245	3	.010	2	**83854**	**83814**	HPCM90-20500
	1/2	.245	3	.010	4		**83816**	HPCM90-40500
120°	1/8	.033	1-1/2	.010	2	**83856**	**83818**	HPCM120-20125
	3/16	.051	2	.010	2	**83858**	**83820**	HPCM120-20187
	3/16	.051	2	.010	4		**83822**	HPCM120-40187
	1/4	.069	2-1/2	.010	2	**83860**	**83824**	HPCM120-20250
	1/4	.069	2-1/2	.010	4		**83826**	HPCM120-40250
	3/8	.105	2-1/2	.010	2	**83862**	**83828**	HPCM120-20375
	3/8	.105	2-1/2	.010	4		**83830**	HPCM120-40375
	1/2	.141	3	.010	2	**83864**	**83832**	HPCM120-20500
	1/2	.141	3	.010	4		**83834**	HPCM120-40500

* .0005 max TIR

Speeds & Feeds on Page 295

HPCM

CHAMFER MILLS - HELICAL FLUTE

3 & 5 Flute - High Performance - Tipped-Off

- 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
- *Z*plus coating offers higher hardness and added lubricity for maximum performance in non-ferrous materials
- A*plus* coating offers added lubricity and high temperature resistance for faster speeds and feeds and improved tool life in ferrous materials
- Solid carbide
- CNC ground in the USA

Incl. Angle A +0°30' −0°30'	Shank Dia.* D2 (h6)	LOC L2	Overall Length L1 +.062" −.062"	Theoretical Tip Length L3	Tip Diameter D3 +.002" −.002"	Flutes	*Z*plus Coated	A*plus* Coated	Tool Description
60°	1/8	.074	1-1/2	.035	.040	3	83880	83866	HPCM60-30125
	1/8	.074	1-1/2	.035	.040	5		84582	HPCM60-50125
	3/16	.119	2	.043	.050	3	83882	83868	HPCM60-30187
	3/16	.119	2	.043	.050	5		83870	HPCM60-50187
	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
82°	1/8	.049	1-1/2	.023	.040	3	84595	84583	HPCM82-30125
	1/8	.049	1-1/2	.023	.040	5		84584	HPCM82-50125
	3/16	.079	2	.029	.050	3	84596	84585	HPCM82-30187
	3/16	.079	2	.029	.050	5		84586	HPCM82-50187
	1/4	.109	2-1/2	.035	.060	3	84607	84601	HPCM82-30250
	1/4	.109	2-1/2	.035	.060	5		84602	HPCM82-50250
	3/8	.175	2-1/2	.040	.070	3	84608	84603	HPCM82-30375
	3/8	.175	2-1/2	.040	.070	5		84604	HPCM82-50375
	1/2	.242	3	.046	.080	3	84609	84605	HPCM82-30500
	1/2	.242	3	.046	.080	5		84606	HPCM82-50500
90°	1/8	.043	1-1/2	.020	.040	3	83884	83872	HPCM90-30125
	1/8	.043	1-1/2	.020	.040	5		83874	HPCM90-50125
	3/16	.069	2	.025	.050	3	83886	83876	HPCM90-30187
	3/16	.069	2	.025	.050	5		83878	HPCM90-50187
	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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 295

CHAMFER MILLS - HELICAL FLUTE

3 & 5 Flute - High Performance - Tipped-Off (cont.)

HPCM

continued from previous page

Incl. Angle A $^{+0°30'}_{-0°30'}$	Shank Dia.* D2 (h6)	LOC L2	Overall Length L1 $^{+.062"}_{-.062"}$	Theoretical Tip Length L3	Tip Diameter D3 $^{+.002"}_{-.002"}$	Flutes	*Zplus* Coated	*Aplus* Coated	Tool Description
90°	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
100°	1/8	.036	1-1/2	.017	.040	3	**84597**	**84587**	HPCM100-30125
	1/8	.036	1-1/2	.017	.040	5		**84588**	HPCM100-50125
	3/16	.058	2	.021	.050	3	**84598**	**84589**	HPCM100-30187
	3/16	.058	2	.021	.050	5		**84590**	HPCM100-50187
	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°	1/8	.025	1-1/2	.012	.040	3	**84599**	**84591**	HPCM120-30125
	1/8	.025	1-1/2	.012	.040	5		**84592**	HPCM120-50125
	3/16	.040	2	.014	.050	3	**84600**	**84593**	HPCM120-30187
	3/16	.040	2	.014	.050	5		**84594**	HPCM120-50187
	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

The Multiple Uses of a Chamfer Mill

In The Loupe
MACHINISTS BLOG

Did you know that a Chamfer Cutter, or Chamfer Mill, is one of the most versatile tools you can have in your carousel? Learn how this single tool can preform several different machining operations in our "In the Loupe" blog post *The Multiple Uses of a Chamfer Mill.*

www.harveyperformance.com/in-the-loupe/multiple-uses-chamfer-mill/

SCAN TO READ

HPCM

SPEEDS & FEEDS
Chamfer Mills - Helical Flute

HPCM

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	2200	.0009	.0018	.0028	.0035	.0045	.0055	.0070	.0090	.0110
		≥ 120 HBS	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	1800	.0012	.0028	.0040	.0055	.0070	.0080	.0110	.0130	.0160
		≥ 120 HBS	1600	.0011	.0022	.0030	.0045	.0055	.0060	.0090	.0110	.0130
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	< 75 HRB	600	.0008	.0015	.0022	.0030	.0040	.0045	.0060	.0080	.0090
		75 - 98 HRB	450	.0007	.0015	.0022	.0030	.0035	.0045	.0060	.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	.0022	.0028	.0035	.0045	.0055	.0070	.0090
		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	.0020	.0025	.0030	.0040	.0050	.0060	.0080
		21 - 36 HRC	350	.0005	.0010	.0015	.0020	.0025	.0028	.0040	.0050	.0055
		36 - 50 HRC	200	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040
		> 50 HRC	90	.0003	.0005	.0008	.0010	.0012	.0015	.0020	.0025	.0030
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	325	.0006	.0010	.0018	.0022	.0028	.0035	.0045	.0055	.0070
		21 - 36 HRC	250	.0005	.0010	.0015	.0020	.0025	.0028	.0040	.0050	.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	.0018	.0022	.0028	.0035	.0045	.0055	.0070
		21 - 36 HRC	225	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
		36 - 50 HRC	140	.0004	.0008	.0012	.0015	.0020	.0025	.0030	.0040	.0050
		> 50 HRC	45	.0003	.0005	.0008	.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	.0005	.0009	.0015	.0018	.0022	.0028	.0035	.0045	.0055
		21 - 36 HRC	225	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
		36 - 50 HRC	175	.0004	.0007	.0011	.0015	.0018	.0020	.0028	.0035	.0040
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	325	.0004	.0009	.0012	.0018	.0022	.0025	.0035	.0045	.0050
		21 - 36 HRC	300	.0006	.0012	.0018	.0022	.0028	.0035	.0045	.0055	.0070
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	225	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
		36 - 50 HRC	120	.0003	.0007	.0010	.0015	.0018	.0020	.0028	.0035	.0040
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	450	.0012	.0022	.0035	.0045	.0055	.0070	.0090	.0110	.0140
		21 - 36 HRC	400	.0008	.0015	.0025	.0030	.0040	.0050	.0060	.0080	.0100
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	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	325	.0007	.0015	.0020	.0028	.0035	.0040	.0055	.0070	.0080
		21 - 36 HRC	275	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060
		36 - 50 HRC	160	.0003	.0005	.0008	.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	.0022	.0030	.0035	.0045	.0060	.0070	.0090
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	175	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
		21 - 36 HRC	150	.0004	.0008	.0012	.0018	.0020	.0025	.0035	.0040	.0050
		36 - 50 HRC	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	350	.0009	.0020	.0028	.0040	.0045	.0055	.0080	.0090	.0110
		75 - 98 HRB	400	.0005	.0011	.0015	.0020	.0028	.0030	.0040	.0055	.0060
		21 - 36 HRC	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	200	.0005	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
		36 - 50 HRC	140	.0004	.0008	.0012	.0015	.0020	.0022	.0030	.0040	.0045
COBALT ALLOY	ASTM F562 , ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	225	.0003	.0006	.0009	.0012	.0015	.0018	.0022	.0030	.0035
		21 - 36 HRC	150	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0055
		36 - 50 HRC	80	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040

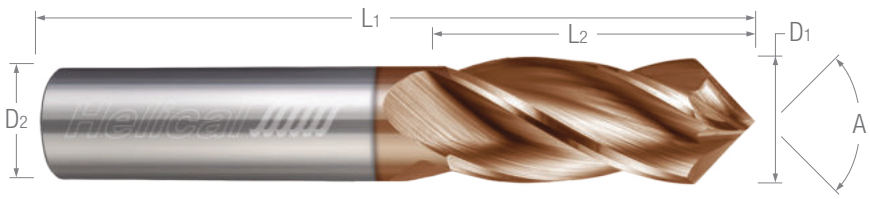
NOTES:
Speed (SFM) and feed (IPT) numbers shown in the table above are considered to be average values. Use a tolerance of ± 25% as needed.
Hardness Scales: HBS = Brinell (500-kgf steel ball)
HRB = Rockwell B
HRC = Rockwell C

COMBINATION CHAMFER / END MILLS

HCCM

4 Flute - High Performance

- Engineered for versatility and excellent performance in chamfering and side milling applications
- Specialized helically fluted tip design for superior performance, surface finish, and chip evacuation
- Variable geometry reduces chatter and harmonics and increases material removal rates
- T*plus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- h6 shank tolerance for high precision tool holders
- Solid carbide
- CNC ground in the USA



Incl. Angle A +0°30' −0°30'	Cutter Diameter* D1 +.000" −.002"	Shank Diameter D2 (h6)	Web Thickness (MAX)	LOC L2 +.032" −.000"	Overall Length L1 +.062" −.062"	Flutes	T*plus* Coated	Tool Description
60°	1/8	1/8	.009	1/2	1-1/2	4	**83740**	HCCM60-40125
	3/16	3/16	.010	5/8	2	4	**83742**	HCCM60-40187
	1/4	1/4	.010	3/4	2-1/2	4	**83744**	HCCM60-40250
	3/8	3/8	.013	7/8	2-1/2	4	**83746**	HCCM60-40375
	1/2	1/2	.013	1	3	4	**83748**	HCCM60-40500
90°	1/8	1/8	.009	1/2	1-1/2	4	**83750**	HCCM90-40125
	3/16	3/16	.010	5/8	2	4	**83752**	HCCM90-40187
	1/4	1/4	.010	3/4	2-1/2	4	**83754**	HCCM90-40250
	3/8	3/8	.013	7/8	2-1/2	4	**83756**	HCCM90-40375
	1/2	1/2	.013	1	3	4	**83758**	HCCM90-40500
100°	1/8	1/8	.009	1/2	1-1/2	4	**83760**	HCCM100-40125
	1/4	1/4	.010	3/4	2-1/2	4	**83764**	HCCM100-40250
	3/8	3/8	.013	7/8	2-1/2	4	**83766**	HCCM100-40375
	1/2	1/2	.013	1	3	4	**83768**	HCCM100-40500
120°	1/8	1/8	.009	1/2	1-1/2	4	**83770**	HCCM120-40125
	3/16	3/16	.010	5/8	2	4	**83772**	HCCM120-40187
	1/4	1/4	.010	3/4	2-1/2	4	**83774**	HCCM120-40250
	3/8	3/8	.013	7/8	2-1/2	4	**83776**	HCCM120-40375
	1/2	1/2	.013	1	3	4	**83778**	HCCM120-40500

* .0005 max TIR

Speeds & Feeds on Page 297

HCCM

SPEEDS AND FEEDS

Combination Chamfer / End Mills - 4 Flute - High Performance

HCCM

Material Guide		Hardness	SFM	Inches Per Tooth (IPT)									
				1/8		3/16		1/4		3/8		1/2	
				Rgh	Chf	Rgh	Chf	Rgh	Chf	Rgh	Chf	Rgh	Chf
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0012	.0010	.0018	.0020	.0024	.0030	.0036	.0050	.0047	.0060
		75 - 98 HRB	445	.0009	.0007	.0013	.0015	.0018	.0022	.0026	.0035	.0034	.0045
		21 - 36 HRC	400	.0006	.0005	.0009	.0010	.0011	.0015	.0017	.0025	.0022	.0030
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0008	.0006	.0011	.0012	.0015	.0020	.0023	.0030	.0030	.0040
		21 - 36 HRC	340	.0006	.0005	.0009	.0010	.0012	.0015	.0017	.0025	.0022	.0028
		36 - 50 HRC	260	.0005	.0003	.0007	.0007	.0010	.0010	.0015	.0018	.0019	.0020
		> 50 HRC	155	.0004	.0003	.0006	.0005	.0008	.0008	.0012	.0012	.0015	.0015
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0008	.0005	.0011	.0010	.0015	.0018	.0023	.0028	.0030	.0035
		21 - 36 HRC	250	.0006	.0005	.0009	.0010	.0012	.0015	.0018	.0025	.0024	.0028
		36 - 50 HRC	145	.0005	.0003	.0007	.0007	.0010	.0010	.0014	.0018	.0019	.0020
		> 50 HRC	85	.0004	.0002	.0006	.0005	.0008	.0007	.0012	.0012	.0015	.0015
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0010	.0006	.0015	.0012	.0020	.0020	.0030	.0030	.0039	.0040
		75 - 98 HRB	255	.0007	.0005	.0010	.0014	.0014	.0018	.0021	.0028	.0027	.0035
		21 - 36 HRC	175	.0006	.0004	.0009	.0009	.0012	.0012	.0018	.0022	.0024	.0028
		36 - 50 HRC	150	.0006	.0004	.0008	.0008	.0011	.0012	.0016	.0020	.0021	.0025
		> 50 HRC	55	.0004	.0003	.0005	.0005	.0007	.0008	.0010	.0012	.0013	.0015
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0008	.0005	.0011	.0009	.0015	.0015	.0022	.0022	.0029	.0028
		21 - 36 HRC	225	.0007	.0005	.0010	.0009	.0014	.0012	.0020	.0022	.0026	.0028
		36 - 50 HRC	180	.0006	.0004	.0008	.0007	.0011	.0011	.0016	.0018	.0021	.0020
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0008	.0004	.0011	.0009	.0016	.0012	.0023	.0022	.0030	.0025
		21 - 36 HRC	280	.0007	.0006	.0010	.0012	.0013	.0018	.0020	.0028	.0026	.0035
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0006	.0005	.0008	.0009	.0011	.0012	.0017	.0022	.0022	.0028
		36 - 50 HRC	145	.0005	.0003	.0007	.0007	.0010	.0010	.0014	.0018	.0019	.0020
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0013	.0012	.0019	.0022	.0025	.0035	.0037	.0055	.0048	.0070
		21 - 36 HRC	370	.0007	.0008	.0010	.0015	.0013	.0025	.0020	.0040	.0026	.0050
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0008	.0007	.0012	.0012	.0016	.0020	.0023	.0035	.0031	.0040
		21 - 36 HRC	335	.0007	.0005	.0010	.0010	.0014	.0015	.0020	.0025	.0026	.0030
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0008	.0007	.0012	.0015	.0016	.0020	.0024	.0035	.0032	.0040
		21 - 36 HRC	260	.0006	.0005	.0008	.0010	.0011	.0015	.0016	.0025	.0021	.0030
		36 - 50 HRC	135	.0004	.0003	.0005	.0005	.0007	.0008	.0010	.0012	.0013	.0015
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0011	.0008	.0016	.0015	.0021	.0022	.0031	.0040	.0041	.0045
		75 - 98 HRB	250	.0009	.0007	.0013	.0015	.0018	.0022	.0026	.0035	.0034	.0045
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0005	.0005	.0008	.0009	.0011	.0012	.0016	.0022	.0021	.0028
		21 - 36 HRC	75	.0005	.0004	.0008	.0008	.0010	.0012	.0015	.0020	.0020	.0025
		36 - 50 HRC	70	.0005	.0004	.0007	.0007	.0009	.0011	.0013	.0018	.0017	.0022
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0015	.0009	.0022	.0020	.0029	.0028	.0043	.0045	.0057	.0055
		75 - 98 HRB	275	.0012	.0005	.0018	.0011	.0024	.0015	.0036	.0028	.0047	.0030
		21 - 36 HRC	250	.0009	.0006	.0014	.0010	.0018	.0018	.0027	.0028	.0036	.0035
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0007	.0005	.0011	.0009	.0014	.0012	.0021	.0022	.0028	.0028
		36 - 50 HRC	160	.0007	.0004	.0010	.0008	.0013	.0012	.0020	.0020	.0026	.0022
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0006	.0003	.0009	.0006	.0012	.0009	.0018	.0015	.0024	.0018
		21 - 36 HRC	170	.0006	.0004	.0009	.0009	.0012	.0012	.0017	.0028	.0023	.0028
			65	.0004	.0003	.0006	.0007	.0008	.0010	.0012	.0018	.0016	.0020

MILLING PROCESS	HARDNESS	ADOC	RDOC
Rgh (Traditional Roughing)	< 35 HRC	Up to Max LOC	30%-40% Diameter
	≥ 35 HRC	Up to Max LOC	25%-35% Diameter
Chf (Chamfering)	N/A	3 Passes	

NOTES:
Speed (SFM) and feed (IPT) numbers shown in table above are considered to be average values. Use a tolerance of +/-25% as needed.

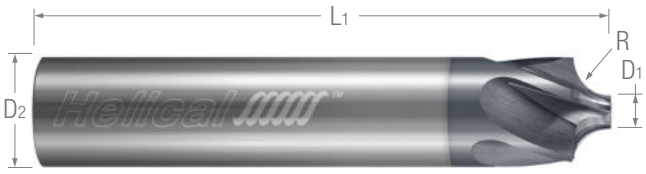
Effective cutter diameter should be used to select the proper chipload per tooth for chamfering operations.

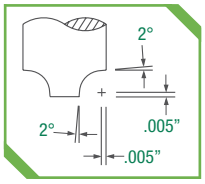
CORNER ROUNDING END MILLS New!

HPCR

Helical Flute - 3 & 5 Flute - High Performance

- Helically ground with positive rake for high performance and superior part finish
- Large pilot diameters for maximum tool strength and consistent performance
- 2° flares for smooth transitions
- Radius center is offset .005" from OD and end of tool
- h6 shank tolerance for high precision tool holders
- *Zplus* coating offers higher hardness and added lubricity for maximum performance in aluminum and non-ferrous alloys
- A*plus* 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





Radius R +.002" −.002"	Pilot Diameter D1 +.000" −.002"	Shank Diameter D2 (h6)	Overall Length L1 +.062" −.062"	Flutes	*Zplus* Coated	A*plus* Coated	Tool Description	
.010	.095	1/8	1-1/2	3	87626	87645	HPCR-30125-R.010	new
.010	.095	1/8	1-1/2	5		87664	HPCR-50125-R.010	new
.015	.085	1/8	1-1/2	3	87627	87646	HPCR-30125-R.015	new
.015	.085	1/8	1-1/2	5		87665	HPCR-50125-R.015	new
.020	.075	1/8	1-1/2	3	87628	87647	HPCR-30125-R.020	new
.020	.075	1/8	1-1/2	5		87666	HPCR-50125-R.020	new
.025	.065	1/8	1-1/2	3	87629	87648	HPCR-30125-R.025	new
.025	.065	1/8	1-1/2	5		87667	HPCR-50125-R.025	new
.030	.055	1/8	1-1/2	3	87630	87649	HPCR-30125-R.030	new
.030	.055	1/8	1-1/2	5		87668	HPCR-50125-R.030	new
.031	.053	1/8	1-1/2	3	87631	87650	HPCR-30125-R.031	new
.031	.053	1/8	1-1/2	5		87669	HPCR-50125-R.031	new
.039	.099	3/16	2	3	87632	87651	HPCR-30187-R.039	new
.039	.099	3/16	2	5		87670	HPCR-50187-R.039	new
.040	.097	3/16	2	3	87633	87652	HPCR-30187-R.040	new
.040	.097	3/16	2	5		87671	HPCR-50187-R.040	new
.047	.083	3/16	2	3	87634	87653	HPCR-30187-R.047	new
.047	.083	3/16	2	5		87672	HPCR-50187-R.047	new
.050	.077	3/16	2	3	87635	87654	HPCR-30187-R.050	new
.050	.077	3/16	2	5		87673	HPCR-50187-R.050	new
.060	.120	1/4	2	3	87636	87655	HPCR-30250-R.060	new
.060	.120	1/4	2	5		87674	HPCR-50250-R.060	new
.062	.116	1/4	2	3	87637	87656	HPCR-30250-R.062	new
.062	.116	1/4	2	5		87675	HPCR-50250-R.062	new
.078	.156	5/16	2	3	87638	87657	HPCR-30312-R.078	new
.078	.156	5/16	2	5		87676	HPCR-50312-R.078	new

continued on next page

Speeds & Feeds on Page 300

HPCR

New! CORNER ROUNDING END MILLS

Helical Flute - 3 & 5 Flute - High Performance (cont.)

continued from previous page

	Radius R +.002" −.002"	Pilot Diameter D1 +.000" −.002"	Shank Diameter D2 (h6)	Overall Length L1 +.062" −.062"	Flutes	Zplus Coated	Aplus Coated	Tool Description
new	.093	.166	5/16	2	3	87639	87658	HPCR-30312-R.093
new	.093	.166	5/16	2	5		87677	HPCR-50312-R.093
new	.100	.165	3/8	2	3	87640	87659	HPCR-30375-R.100
new	.100	.165	3/8	2	5		87678	HPCR-50375-R.100
new	.125	.177	7/16	2-3/4	3	87641	87660	HPCR-30437-R.125
new	.125	.177	7/16	2-3/4	5		87679	HPCR-50437-R.125
new	.156	.177	1/2	2-1/2	3	87642	87661	HPCR-30500-R.156
new	.156	.177	1/2	2-1/2	5		87680	HPCR-50500-R.156
new	.187	.240	5/8	3	3	87643	87662	HPCR-30625-R.187
new	.187	.240	5/8	3	5		87681	HPCR-50625-R.187
new	.250	.239	3/4	3	3	87644	87663	HPCR-30750-R.250
new	.250	.239	3/4	3	5		87682	HPCR-50750-R.250

SPEEDS AND FEEDS

Corner Rounding Mills - 3 & 5 Flute

HPCR

HPCR

Material Guide		Hardness	SFM	Inches Per Tooth (IPT) Effective Cutting Diameter (Deff) 1/8	3/16	1/4	3/8	1/2	3/4	1
WROUGHT ALIMINUM ALLOY	2014, 5052, 6061, 7050, 7075, 7475	< 120 HBS	2200	.0009	.0018	.0028	.0045	.0055	.0090	.0110
		≥ 120 HBS	2200	.0006	.0012	.0018	.0030	.0035	.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	1800	.0012	.0028	.0040	.0070	.0080	.0130	.0180
		≥ 120 HBS	1600	.0011	.0022	.0030	.0055	.0060	.0110	.0130
COPPER ALLOY	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	< 75 HRB	600	.0008	.0015	.0022	.0040	.0045	.0080	.0090
		75 - 98 HRB	450	.0007	.0015	.0022	.0035	.0045	.0070	.0090
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0012	.0018	.0025	.0036	.0048	.0068	.0087
		75 - 98 HRB	445	.0009	.0013	.0018	.0026	.0034	.0049	.0063
		21 - 36 HRC	400	.0006	.0009	.0011	.0018	.0022	.0032	.0041
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0008	.0011	.0016	.0023	.0030	.0043	.0055
		21 - 36 HRC	340	.0006	.0009	.0011	.0017	.0022	.0032	.0041
		36 - 50 HRC	260	.0005	.0007	.0010	.0015	.0019	.0028	.0036
		> 50 HRC	155	.0004	.0006	.0008	.0011	.0015	.0022	.0028
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0008	.0011	.0016	.0023	.0030	.0043	.0055
		21 - 36 HRC	250	.0006	.0009	.0012	.0018	.0024	.0034	.0044
		36 - 50 HRC	145	.0005	.0007	.0010	.0014	.0018	.0026	.0034
		> 50 HRC	85	.0004	.0006	.0008	.0011	.0015	.0022	.0028
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0011	.0015	.0020	.0030	.0040	.0056	.0072
		75 - 98 HRB	255	.0007	.0011	.0014	.0020	.0027	.0039	.0049
		21 - 36 HRC	175	.0006	.0009	.0012	.0018	.0024	.0034	.0045
		36 - 50 HRC	150	.0005	.0008	.0011	.0017	.0022	.0031	.0040
		> 50 HRC	55	.0004	.0005	.0007	.0011	.0013	.0019	.0025
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0008	.0011	.0015	.0022	.0029	.0042	.0054
		21 - 36 HRC	225	.0007	.0010	.0013	.0020	.0026	.0038	.0048
		36 - 50 HRC	180	.0005	.0008	.0011	.0016	.0021	.0030	.0039
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0008	.0011	.0016	.0023	.0030	.0043	.0055
		21 - 36 HRC	280	.0007	.0010	.0013	.0020	.0026	.0038	.0048
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0006	.0009	.0011	.0017	.0022	.0032	.0041
		36 - 50 HRC	145	.0005	.0007	.0010	.0015	.0019	.0027	.0035
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0012	.0018	.0026	.0037	.0048	.0070	.0090
		21 - 36 HRC	370	.0007	.0010	.0013	.0020	.0026	.0038	.0048
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0008	.0011	.0016	.0024	.0031	.0044	.0057
		21 - 36 HRC	335	.0007	.0010	.0014	.0020	.0026	.0038	.0049
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0008	.0012	.0017	.0025	.0032	.0046	.0059
		21 - 36 HRC	260	.0005	.0008	.0011	.0017	.0021	.0031	.0039
		36 - 50 HRC	135	.0004	.0005	.0007	.0011	.0013	.0019	.0025
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0011	.0016	.0021	.0032	.0041	.0059	.0076
		75 - 98 HRB	250	.0009	.0013	.0018	.0026	.0034	.0049	.0063
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0005	.0008	.0011	.0016	.0021	.0030	.0039
		21 - 36 HRC	75	.0005	.0008	.0011	.0015	.0020	.0029	.0037
		36 - 50 HRC	70	.0004	.0006	.0009	.0013	.0018	.0025	.0032
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0015	.0021	.0029	.0043	.0057	.0082	.0105
		75 - 98 HRB	275	.0012	.0018	.0025	.0036	.0048	.0069	.0088
		21 - 36 HRC	250	.0010	.0013	.0018	.0027	.0036	.0051	.0066
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0008	.0011	.0015	.0021	.0028	.0041	.0052
		36 - 50 HRC	160	.0007	.0010	.0013	.0019	.0026	.0037	.0048
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0006	.0009	.0012	.0018	.0024	.0034	.0044
		21 - 36 HRC	170	.0006	.0009	.0012	.0018	.0023	.0033	.0042
		36 - 50 HRC	65	.0004	.0006	.0008	.0012	.0016	.0022	.0029

MILLING PROCESS	HARDNESS	ADOC	RDOC
Non-Ferrous Corner Rounding	n/a	100%	1 Pass at Full Depth
Ferrous Corner Rounding	< 35 HRC	100%	1 Pass at Full Depth
	≥ 35 HRC	100%	2 Passes to Full Depth

NOTES:
Speed (SFM) numbers shown in table above are considered to be average values. Use a tolerance of +/-25% as needed

Feed (IPT) numbers shown in table above are considered to be starting values and may be increased given optimal sonditions

Effective cutter diameter should be used to calculate RPM and to select the proper chipload per tooth

Effective Cutter Diameter = Pilot Diameter + Radius

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
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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.

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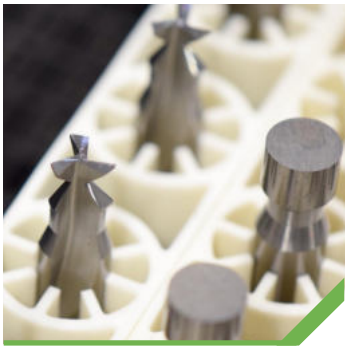
Our objective is to return a quote **within 48 hours** that includes tool design, dimensions, and expected lead time. We will also provide a copy of your quote to your preferred distributor at a **very competitive price**.



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**.

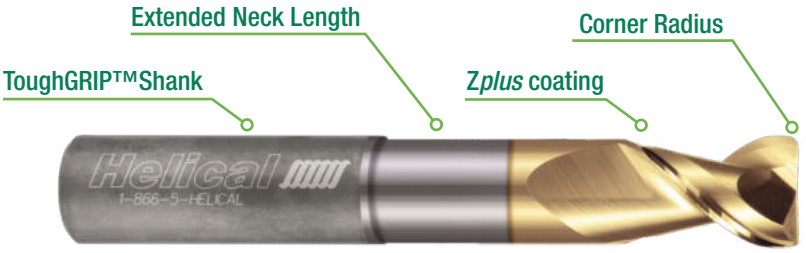
Call 1-866-543-5422 or email helicaltech@harveyperformance.com

TOOL MODIFICATIONS

What We Offer

Custom tool needs can often be accommodated by modifying one of our standard tools. We're able to modify our standard tools in a variety of ways, including by adding corner radii, coatings, neck lengthening (or additions), overall length adjustments, or even chipbreakers.

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. Call your preferred distributor today to get started!

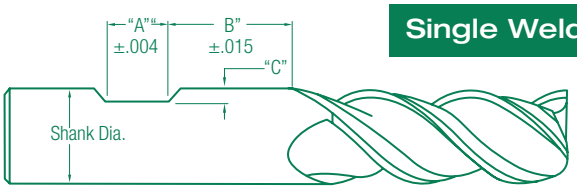


SHANK MODIFICATIONS

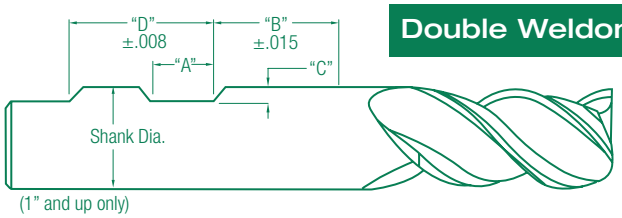
Weldon Flat Specifications

Factory-ground flats have several key advantages, including that they are ground parallel with the centerline of the tool, are consistently level for the entire length of the flat, and are accurately ground with no excess runout. Helical Solutions employs a "flat location procedure" to ensure that flutes will not end up inside of the tool holder, avoiding chip compaction, and that tool "stick out" is minimal in order to achieve optimum tool strength.

Single Weldon

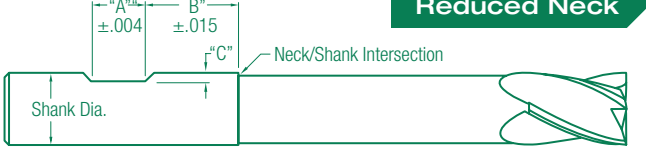


Double Weldon



(1" and up only)

Single Weldon Reduced Neck



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

Weldon Flat Specifications

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.

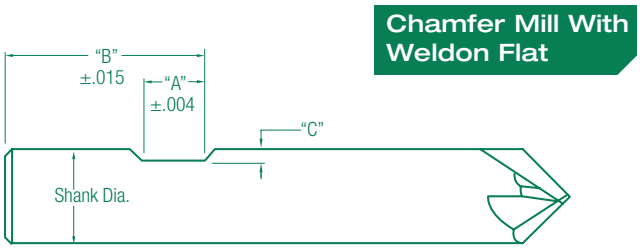
Weldon Flat specifications are typically based on NAS 986, a high speed steel tool standard, and are measured from the shank end. Currently, there is no standardized specification for high performance solid carbide end mills. All flats will be ground using the dimension chart above unless specified otherwise 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.

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

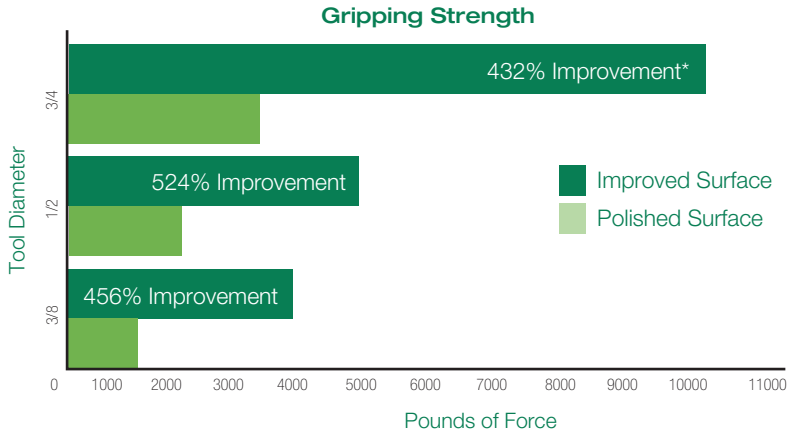
Weldon Flat specifications are typically based on NAS 986, a high speed steel tool standard, and are measured from the shank end. Currently, there is no standardized specification for high performance solid carbide end mills. All flats will be ground using the dimension chart above unless specified otherwise 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.



ToughGRIP™ Shank

Are you familiar with ToughGRIP™ Shanks? They provide increased friction for superior gripping strength, as the mirror finish provided on most shanks does not always provide the necessary amount of tool holding security. Helical's ToughGRIP™ Shank maintains shank concentricity and h6 shrink-fit tolerance, and features 30 +/- 3 Ra surface roughness, consistent with 2 Ra.

ToughGRIP™ Shank provides 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

Looking for even more tool holding security? Helical Solutions was the first Haimer Safe-Lock licensee, and have been manufacturing this shank configuration – added groove on the cutting shank that work opposite the cutting direction of the flutes – since 2008.

+ Minimizes runout
+ Up to 5x the tool life
+ No pull-out or spinning

For more information on any Helical Solutions Shank Modifications, including Weldon Flats, ToughGRIP Shanks, or the Haimer Safe-Lock™ System, visit our website at **helicaltool.com/resources**

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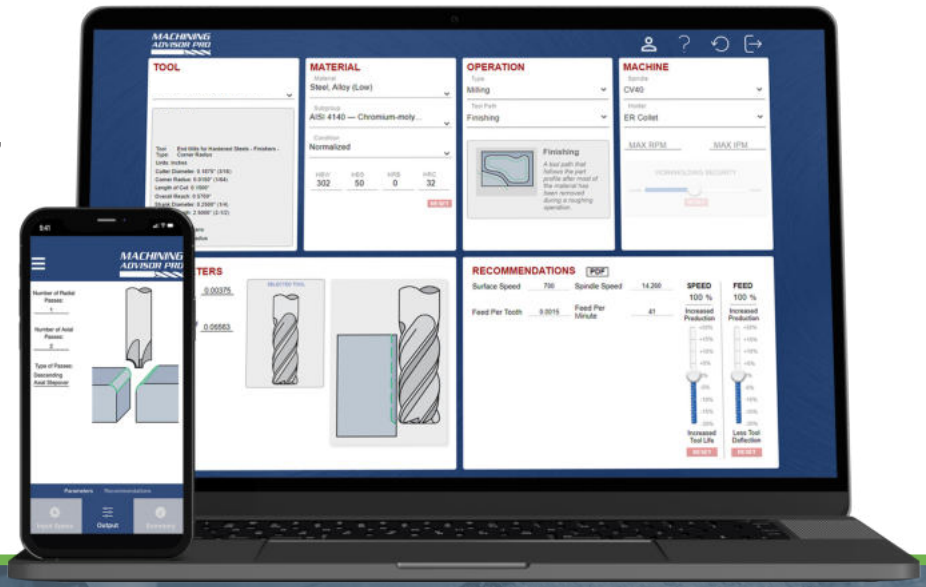

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Run FASTER.

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

Push HARDER.

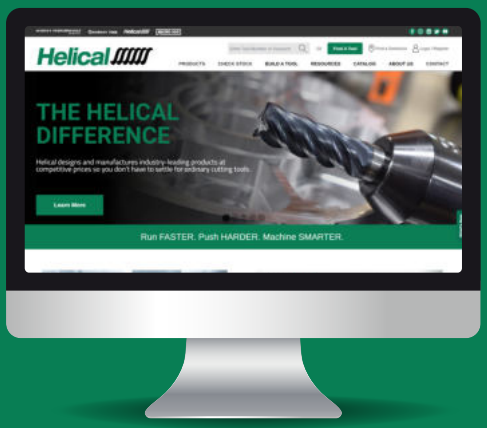
Engineered for optimal performance in non-ferrous and ferrous materials, our unique geometries ensure extended tool life and significantly higher material removal rates.

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.

Place an order with your distributor on Helicaltool.com

Did you know that you can place a Helical Solutions order directly to your distributor from our website? After creating your Helicaltool.com account, you're able to build and send "shopping carts" directly to your participating distributor to order.



Shopping Cart

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.

Direct MAP Connection

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.

Build a Tool

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

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.

Product Table Filtering

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

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.

New Tools for 2023

High Feed End Mills

4 and 5 Flute Combo Feed & HEM - Chipbreaker - Variable Pitch - Coolant Through

Specialty Profiles

Corner Rounding End Mills - Helical Flute - 3 & 5 Flute - High Performance

End Mills for Stainless & High Temp Alloys

Contour Finishers - 4 Flute Ball - Tapered Neck

End Mills for Nickel Alloys

6 flute - Corner Radius - Variable Pitch - Coolant Through

End Mills for Stainless & High Temp Alloys

4 Flute - Taper & Oval - Multi-Axis Finishers

End Mills for Stainless & High Temp Alloys

4, 5 and 6 Flute - Variable Pitch - Reduced Neck

End Mills for Aluminum Alloys & Non-Ferrous Materials

3 Flute - Corner Radius - 35° Helix - Reduced Neck

Looking for the Index?

The Helical index has moved! Visit www.helicaltool.com and search by the 5-digit EDP number. Each tool detail page will show the page number of the catalog where you can find that tool.

Additionally, to see a PDF of the index with all EDP numbers from the 2023 catalog, scan the QR code below or visit www.helicaltool.com/catalog-request and download the index document.

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