



Tool # 82920 pg 164

2021 Product Catalog

Featuring 1,300+ new high performance end mills, an all new Stainless Steels & High Temp Alloys section, and expanded Titanium options.



Let Us Impress You

Exceptional, Fully Stocked Tooling

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

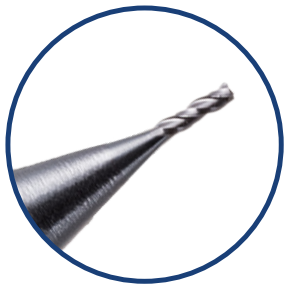
Unbeatable Custom Tool Experience

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

Outstanding Technical Expertise

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

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



Think Harvey Tool First

More than 24,000 miniature and specialty end mills.

Ship today, in your machine tomorrow.

www.harveytool.com



Let Helical Impress You

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

www.helicaltool.com



Make More with Micro 100

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

www.micro100.com



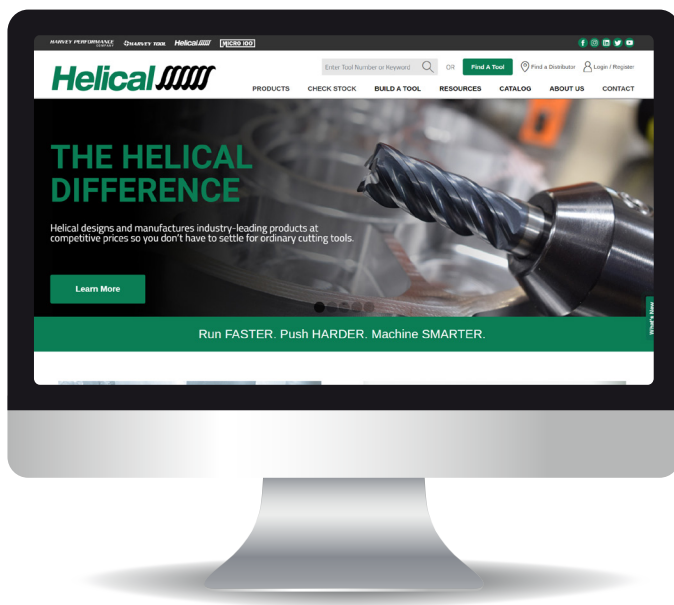
Trust in Titan USA

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

www.titancuttingtools.com

Order Tools 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. Learn more on **page 258**.



The Helical Difference

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

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

We offer **nearly 6,200 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 234**).

Our Tools Deliver

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

11 End Mills for Aluminum Alloys & Non-Ferrous Materials



67 End Mills for Steels, Tool Steels & Cast Iron



161 End Mills for Stainless Steels & High Temp Alloys



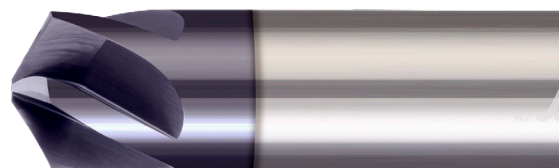
185 End Mills for Titanium & Titanium Alloys



215 High Feed End Mills



221 Specialty Profiles



END MILLS FOR ALUMINUM Aluminum Alloys & Non-Ferrous Materials

ROUGHERS

					PG
	H35ALV-C-3	3 Flute	Corner Radius	35° Helix - Chipbreaker Rougher - Variable Pitch	12
	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	18

2 FLUTE

					PG
	HMG-RN-2	2 Flute	Square	High Balance - Reduced Neck	20
	HMG-RN-2	2 Flute	Corner Radius	High Balance - Reduced Neck	21
	H45AL-2	2 Flute	Square	45° Helix New Items!	23
	H45AL-2	2 Flute	Ball	45° Helix New Items!	25
	H45AL-2	2 Flute	Corner Radius	45° Helix	26
	H45AL-RN-2	2 Flute	Square	45° Helix - Reduced Neck New Items!	27
	H45AL-RN-2	2 Flute	Ball	45° Helix - Reduced Neck New Items!	28

3 FLUTE

					PG
	HMGC-RN-3	3 Flute	Square	Coolant Through - High Balance - Reduced Neck	30
	HMGC-RN-3	3 Flute	Corner Radius	Coolant Through - High Balance - Reduced Neck	31
	H35AL-3	3 Flute	Square	35° Helix New Items!	33
	MH35AL-3	3 Flute	Square	35° Helix Metric	35
	H35AL-3	3 Flute	Corner Radius	35° Helix New Items!	36
	MH35AL-3	3 Flute	Corner Radius	35° Helix Metric	39
	H35AL-RN-3	3 Flute	Square	35° Helix - Reduced Neck New Items!	41
	H40ALV-3	3 Flute	Square	40° Helix - Variable Pitch New Items!	43
	H40ALV-3	3 Flute	Ball	40° Helix - Variable Pitch	45
	H40ALV-3	3 Flute	Corner Radius	40° Helix - Variable Pitch New Items!	47
	H40ALV-RN-3	3 Flute	Square	40° Helix - Variable Pitch - Reduced Neck New Items!	51
	H40ALV-RN-3	3 Flute	Ball	40° Helix - Variable Pitch - Reduced Neck New Items!	53
	H40ALV-RN-3	3 Flute	Corner Radius	40° Helix - Variable Pitch - Reduced Neck New Items!	55
	H45AL-3	3 Flute	Square	45° Helix New Items!	59
	H45AL-3	3 Flute	Corner Radius	45° Helix New Items!	61
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Steels, Tool Steels, & Cast Iron **END MILLS FOR STEELS**

ROUGHERS

PG

	HSVR-C-4	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	68
	HSVR-C-RN-4	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	New!	70
	HEV-C-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	72
	HEV-C-RN-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	New!	74
	HEV-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	76
	HEV-C-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	79
	HEV-C-RN-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	New!	81
	HXVR	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch	New Items!	83
	HXVR-RN	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch - Reduced Neck	New Items!	84

3 FLUTE

PG

	HSV-3	3 Flute	Square	Variable Pitch		87
	HSV-3	3 Flute	Corner Radius	Variable Pitch		88
	HST-3	3 Flute	Ball			90
	HST-3	3 Flute	Corner Radius			91
	HST-RN-3	3 Flute	Ball	Reduced Neck		92
	HST-RN-3	3 Flute	Corner Radius	Reduced Neck		93

4 FLUTE

PG

	HSV-4	4 Flute	Square	Variable Pitch	New Items!	95
	MHSV-4	4 Flute	Square	Variable Pitch	Metric	97
	HSV-4	4 Flute	Ball	Variable Pitch	New Items!	98
	HSV-4	4 Flute	Corner Radius	Variable Pitch	New Items!	100
	MHSV-4	4 Flute	Corner Radius	Variable Pitch	Metric	106
	HSV-RN-4	4 Flute	Square	Variable Pitch - Reduced Neck	New Items!	108
	HSV-RN-4	4 Flute	Ball	Variable Pitch - Reduced Neck	New Items!	110
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End Mills for Steels continues on next page

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

5 FLUTE

PG

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	MHEV-5	5 Flute	Square	Variable Pitch	Metric	118
	HEV-5	5 Flute	Corner Radius	Variable Pitch	New Items!	119
	MHEV-5	5 Flute	Corner Radius	Variable Pitch	Metric	125
	HEV-RN-5	5 Flute	Square	Variable Pitch - Reduced Neck	New Items!	127
	HEV-RN-5	5 Flute	Corner Radius	Variable Pitch - Reduced Neck	New Items!	129
	HEF-5	5 Flute	Square	Finisher		133

6 FLUTE

PG

	HEV-6	6 Flute	Square	Variable Pitch		136
	MHEV-6	6 Flute	Square	Variable Pitch	Metric	137
	HEV-6	6 Flute	Ball	Variable Pitch	New Items!	138
	HEV-6	6 Flute	Corner Radius	Variable Pitch	New Items!	139
	MHEV-6	6 Flute	Corner Radius	Variable Pitch	Metric	142
	HEV-RN-6	6 Flute	Square	Variable Pitch - Reduced Neck		144
	HEV-RN-6	6 Flute	Ball	Variable Pitch - Reduced Neck		145
	HEV-RN-6	6 Flute	Corner Radius	Variable Pitch - Reduced Neck		146

7 FLUTE

PG

	HEV-7	7 Flute	Square	Variable Pitch	New Items!	148
	MHEV-7	7 Flute	Square	Variable Pitch	Metric	149
	HEV-7	7 Flute	Corner Radius	Variable Pitch	New Items!	150
	MHEV-7	7 Flute	Corner Radius	Variable Pitch	Metric	152
	HEV-RN-7	7 Flute	Square	Variable Pitch - Reduced Neck	New!	154
	HEV-RN-7	7 Flute	Corner Radius	Variable Pitch - Reduced Neck	New!	155
	HSF-7	7 Flute	Square	Finisher		157

MULTI-FLUTE

PG

	HXF	Multi-Flute	Corner Radius	Finisher	New Items!	159
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END MILLS FOR STAINLESS STEELS & HIGH TEMP ALLOYS

ROUGHERS

PG

	HEV-C-5	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New!	162
	HEV-C-6	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New!	163
	HEV-C-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New!	164
	HXVR	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch	New!	165

4 FLUTE

PG

	HSV-4	4 Flute	Square	Variable Pitch	New Items!	166
	HSV-4	4 Flute	Ball	Variable Pitch	New!	168
	HSV-4	4 Flute	Corner Radius	Variable Pitch	New Items!	169

5 FLUTE

PG

	HEV-5	5 Flute	Square	Variable Pitch	New Items!	171
	HEV-5	5 Flute	Corner Radius	Variable Pitch	New Items!	173

6 FLUTE

PG

	HEV-6	6 Flute	Square	Variable Pitch	New Items!	177
	HEV-6	6 Flute	Ball	Variable Pitch	New Items!	178
	HEV-6	6 Flute	Corner Radius	Variable Pitch	New Items!	179

7 FLUTE

PG

	HEV-7	7 Flute	Square	Variable Pitch	New Items!	182
	HEV-7	7 Flute	Corner Radius	Variable Pitch	New Items!	183

MULTI-FLUTE

PG

	HXF	Multi-Flute	Corner Radius	Finisher	New Items!	184
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ROUGHERS

PG

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	HEV-C-7	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	New Items!	190

5 FLUTE

PG

	HEV-5	5 Flute	Corner Radius	Variable Pitch	New Items!	192
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6 FLUTE

PG

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	HEV-6	6 Flute	Corner Radius	Variable Pitch	New Items!	204
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7 FLUTE

PG

	HEV-7	7 Flute	Corner Radius	Variable Pitch	New Items!	209
	MHEV-7	7 Flute	Corner Radius	Variable Pitch	Metric	211

MULTI-FLUTE

PG

	HXF	Multi-Flute	Corner Radius	Finisher	New Items!	213
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MADE FOR HIGH EFFICIENCY MILLING (HEM)

HVTI-6 End Mill for Titanium pg 200

Experience higher Metal Removal Rates (MRR) and enjoy 20% more time in the cut with Helical's 6-flute variable pitch end mill for titanium, designed with a unique combination of rake, core, and edge geometries for exceptionally reliable and controlled wear.

Extensive testing in Ti 6-4 has proven its excellence in extending tool life and elevating part quality. This tool is a workhorse for HEM in Titanium.



HIGH FEED END MILLS

FOR STEELS UP TO 45 RC

				PG
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	MHFV	Steels Up to 45 Rc - Variable Pitch - Reduced Neck	Metric	217
	HFVC	Steels Up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck	New Items!	218
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SPECIALTY PROFILES

CHAMFER MILLS

				PG
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CAM Partners



Download Tool Libraries Now

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Look for additional industry-leading CAM partners in 2021.

OUR COATINGS

Standard Coatings

Materials:	Wrought Aluminum, Cast Aluminum, Graphite, and Other Non-Ferrous Materials	Low Alloy Steels, Medium Alloy Steels, Tool Steels, Cast Iron, and Titanium	Stainless Steels, High Temp Alloys, Hardened Steels
Coating:	Zplus <i>Zplus</i> 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. <i>Zplus</i> holds up well in abrasive materials and reduces the chance of built-upedge in softer, gummy alloys. 	Aplus <i>Aplus</i> 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. 	Tplus <i>Tplus</i> 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. 
Max. Usage Temp:	1,110° F	2,012° F	2,192° F
Microhardness (HV 0.05):	2243 (22 GPa)	4079 (40 GPa)	4487 (44 GPa)
Coefficient of Friction:	0.40	0.45	0.35
Coating Color:	light gold / champagne	black / grey	copper

Experience the Benefits of Tplus Coating in Stainless Steels & High Temp Alloys!!

Tplus is the superior coating choice for difficult material families such as stainless steel, high temp alloys, and hardened steels up to 65Rc.

Unique features include:

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

Tplus can also be an excellent option for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron.

Machinists with high quality, vibration-free, rigid machine setups will experience even greater tool performance with our *Tplus* coating offering.

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

END MILLS FOR ALUMINUM

Aluminum Alloys & Non-Ferrous Materials

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

ROUGHERS

PG

	3 Flute	Corner Radius	35° Helix - Variable Pitch - Chipbreaker Rougher	12
	3 Flute	Corner Radius	35° Helix - Variable Pitch - Chipbreaker Rougher - Reduced Neck	14
new	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher	16
	3 Flute	Corner Radius	45° Helix - Chipbreaker Rougher - Reduced Neck	18

2 FLUTE

PG

	2 Flute	Square	High Balance - Reduced Neck	20
	2 Flute	Corner Radius	High Balance - Reduced Neck	21
new	2 Flute	Square	45° Helix	23
new	2 Flute	Ball	45° Helix	25
	2 Flute	Corner Radius	45° Helix	26
new	2 Flute	Square	45° Helix - Reduced Neck	27
new	2 Flute	Ball	45° Helix - Reduced Neck	28

3 FLUTE

PG

	3 Flute	Square	Coolant Through - High Balance - Reduced Neck	30
	3 Flute	Corner Radius	Coolant Through - High Balance - Reduced Neck	31
new	3 Flute	Square	35° Helix	33
	3 Flute	Square	35° Helix - Metric	35
new	3 Flute	Corner Radius	35° Helix	36
	3 Flute	Corner Radius	35° Helix - Metric	39
new	3 Flute	Square	35° Helix - Reduced Neck	41
new	3 Flute	Square	40° Helix - Variable Pitch	43
	3 Flute	Ball	40° Helix - Variable Pitch	45
new	3 Flute	Corner Radius	40° Helix - Variable Pitch	47
new	3 Flute	Square	40° Helix - Variable Pitch - Reduced Neck	51
new	3 Flute	Ball	40° Helix - Variable Pitch - Reduced Neck	53
new	3 Flute	Corner Radius	40° Helix - Variable Pitch - Reduced Neck	55
new	3 Flute	Square	45° Helix	59
new	3 Flute	Corner Radius	45° Helix	61
new	3 Flute	Square	45° Helix - Reduced Neck	64

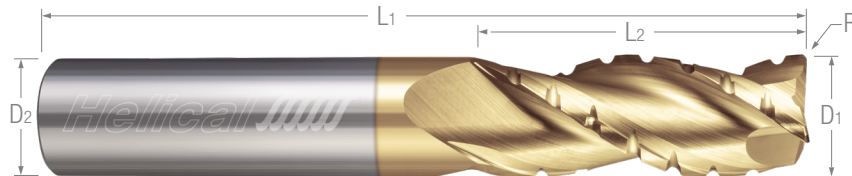


3 FLUTE - CORNER RADIUS


H35ALV-C-3

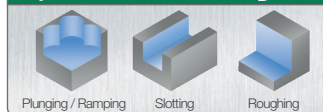
35° Helix - Variable Pitch - Chipbreaker Rougher

- Designed for outstanding performance and accelerated metal 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 ^{+0.002"} -0.002"	Length of Cut L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Flutes	Uncoated	<i>Zplus</i> 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
3/16	3/16	.010	5/16	2	3	82107	82108	H35ALV-C-016-30187-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
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
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	.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	.060	1/2	2	3	82009	82010	H35ALV-C-013-30375-R.060
	3/8	.060	1	3	3	82011	82012	H35ALV-C-026-30375-R.060
	3/8	.060	1-1/4	3-1/2	3	82013	82014	H35ALV-C-033-30375-R.060

continued on next page

Speeds & Feeds on Page 15


H35ALV-C-3**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
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	.060	5/8	2-1/2	3	82025	82026	H35ALV-C-012-30500-R.060
	1/2	.060	1	3	3	82027	82028	H35ALV-C-020-30500-R.060
	1/2	.060	1-1/4	3	3	82029	82030	H35ALV-C-025-30500-R.060
	1/2	.060	1-5/8	4	3	82031	82032	H35ALV-C-032-30500-R.060
	1/2	.060	2	4	3	82033	82034	H35ALV-C-040-30500-R.060
5/8	5/8	.030	3/4	3	3	82035	82036	H35ALV-C-012-30625-R.030
	5/8	.030	1-5/8	3-1/2	3	82037	82038	H35ALV-C-026-30625-R.030
	5/8	.060	3/4	3	3	82039	82040	H35ALV-C-012-30625-R.060
	5/8	.060	1-5/8	3-1/2	3	82041	82042	H35ALV-C-026-30625-R.060
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	.060	2	5	3	82057	82058	H35ALV-C-020-31000-R.060

*.0003 max TIR

3 FLUTE - CORNER RADIUS


H35ALV-C-RN-3

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

- Designed for outstanding performance and accelerated metal 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.* D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R $^{+.002"}_{-.002"}$	Length of Cut L2 $^{+.032"}_{-.000"}$	OAL L1 $^{+.062"}_{-.062"}$	Reach (LBS) L3	Neck Dia. Flutes	Uncoated	Zplus Coated	Tool Description
1/4	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
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
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

Speeds & Feeds on Page 15



H35ALV-C-3**SPEEDS & FEEDS**

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

Roughers

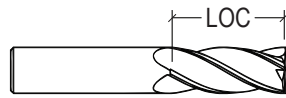
H35ALV-C-3 / H35ALV-C-RN-3

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

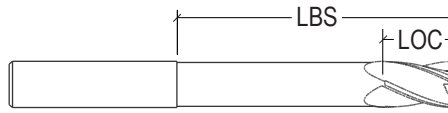
Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	75%-125% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-40% Diameter
	Reached	Up to Max LOC	30%-40% Diameter

NOTES:

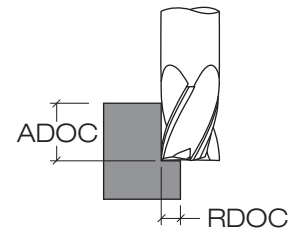
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style

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

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



3 FLUTE - CORNER RADIUS

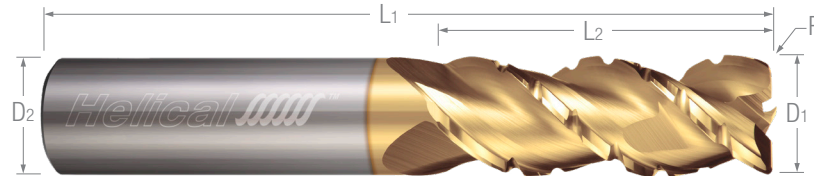
New Items!



H45AL-C-3

45° Helix - Chipbreaker Rougher

- Designed for outstanding performance and accelerated metal 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 ^{+0.02"} _{-0.02"}	Length of Cut L ₂ ^{+0.32"} _{-0.000"}	OAL L ₁ ^{+0.62"} _{-0.62"}	Flutes	Uncoated	Zplus Coated	Tool Description	
1/4	1/4	.010	1/2	2-1/2	3	82717	82718	H45AL-C-SR-30250-R.010	new
	1/4	.010	3/4	2-1/2	3	82719	82720	H45AL-C-R-30250-R.010	new
	1/4	.010	1	3	3	82721	82722	H45AL-C-M-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	new
	5/16	.020	1	3	3	29240	29242	H45AL-C-M-30312-R.020	
3/8	3/8	.020	1/2	2	3	29285	29287	H45AL-C-S-30375-R.020	
	3/8	.020	3/4	2-1/2	3	81305	81306	H45AL-C-SR-30375-R.020	
	3/8	.020	1	3	3	29300	29302	H45AL-C-R-30375-R.020	
	3/8	.020	1-1/4	3-1/2	3	29315	29317	H45AL-C-M-30375-R.020	
	3/8	.020	1-1/2	4	3	29330	29332	H45AL-C-L-30375-R.020	
	3/8	.020	2	4	3	29345	29347	H45AL-C-LX-30375-R.020	
	3/8	.060	1/2	2	3	82723	82724	H45AL-C-S-30375-R.060	new
	3/8	.060	1	3	3	82725	82726	H45AL-C-R-30375-R.060	new
	3/8	.060	1-1/4	3-1/2	3	82727	82728	H45AL-C-M-30375-R.060	new
1/2	1/2	.010	1	3	3	82729	82730	H45AL-C-SR-30500-R.010	new
	1/2	.010	1-1/4	3	3	82731	82732	H45AL-C-R-30500-R.010	new
	1/2	.010	1-5/8	4	3	82733	82734	H45AL-C-M-30500-R.010	new
	1/2	.010	2	4	3	82735	82736	H45AL-C-L-30500-R.010	new
	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	

* .0003 max TIR

continued on next page



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 ^{+0.002"} -0.002"	Length of Cut L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Flutes	Uncoated	Zplus Coated	Tool Description
new	1/2	1/2	.060	1	3	3	82737	82738	H45AL-C-SR-30500-R.060
new		1/2	.060	1-1/4	3	3	82739	82740	H45AL-C-R-30500-R.060
new		1/2	.060	1-5/8	4	3	82741	82742	H45AL-C-M-30500-R.060
new		1/2	.060	2	4	3	82743	82744	H45AL-C-L-30500-R.060
new	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	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

*.0003 max TIR

3 FLUTE - CORNER RADIUS

New Items!



H45AL-C-RN-3

45° Helix - Chipbreaker Rougher - Reduced Neck

- Designed for outstanding performance and accelerated metal 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	6	3-3/8	.475	3	28315	28317	H45AL-C-RN-L-30500-R.030
	1/2	.030	5/8	6	4-1/4	.475	3	28325	28327	H45AL-C-RN-X-30500-R.030
3/4	3/4	.030	1	4	2	.712	3	28405	28407	H45AL-C-RN-R-30750-R.030
	3/4	.030	1	6	2-1/2	.712	3	28420	28422	H45AL-C-RN-M-30750-R.030
	3/4	.030	1	6	3	.712	3	81303	81304	H45AL-C-RN-ML-30750-R.030
	3/4	.030	1	6	3-3/8	.712	3	28435	28437	H45AL-C-RN-L-30750-R.030
	3/4	.030	1	6	4-3/8	.712	3	28445	28447	H45AL-C-RN-X-30750-R.030
1	1	.030	1-1/4	5	2-5/8	.950	3	28465		H45AL-C-RN-R-31000-R.030
	1	.030	1-1/4	6	3-3/8	.950	3	28480		H45AL-C-RN-M-31000-R.030
	1	.030	1-1/4	7	4-3/8	.950	3	28495		H45AL-C-RN-L-31000-R.030

* .0003 max TIR

Speeds & Feeds on Page 19



Plunging / Ramping



Slotting



Roughing

H45AL-C-3**SPEEDS & FEEDS****3 Flute - 45° Helix - Chipbreaker Rougher****H45AL-C-3 / H45AL-C-RN-3**

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

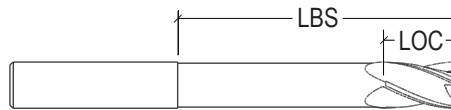
Milling Process	ADOC	RDOC	
Slot (Full Slotting)	Non-Reached	100%-150% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	100%-150% Diameter	35%-50% Diameter
	Reached	Up to Max LOC	30%-40% Diameter

NOTES:

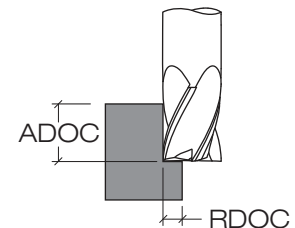
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

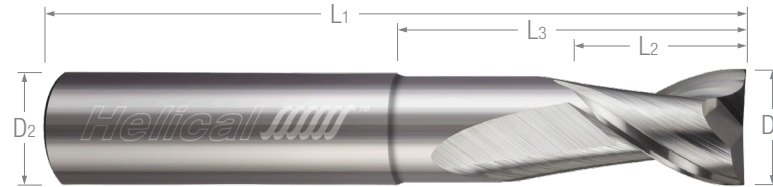
RDOC=Radial Depth of Cut

2 FLUTE - SQUARE


HMG-RN-2

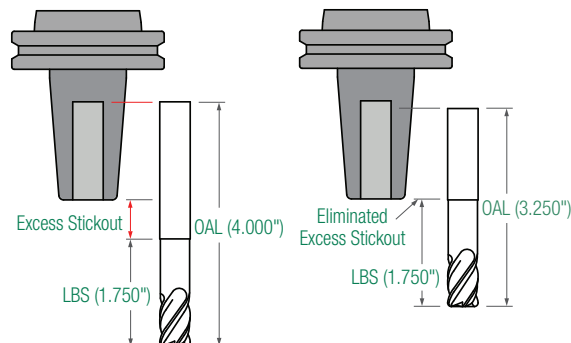
High Balance - Reduced Neck

- Designed for outstanding performance and accelerated metal 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



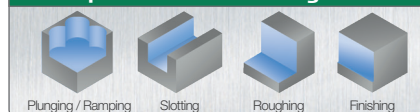
Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Tool Description
3/8	3/8	1/2	2-1/4	1-1/8	.356	2	59968	HMG-RN-030-20375
	3/8	1/2	2-3/4	1-1/2	.356	2	59971	HMG-RN-040-20375
	3/8	1/2	3-1/4	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 22



HMG-RN-2



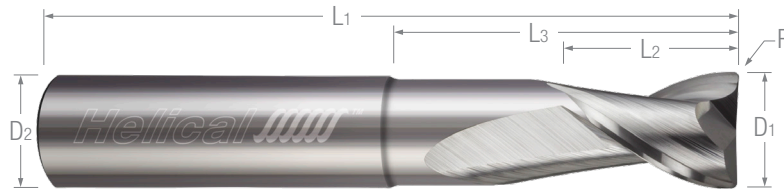
2 FLUTE - CORNER RADIUS

High Balance - Reduced Neck

- Designed for outstanding performance and accelerated metal 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 20
for shank length
benefits



2 Flute

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	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
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
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 22



2 FLUTE - CORNER RADIUS


HMG-RN-2

2 Flute - High Balance - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	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

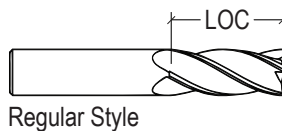
HMG-RN-2

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

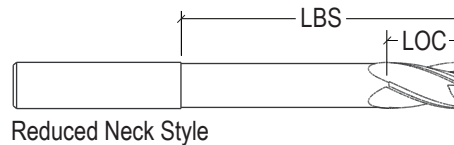
Milling Process	ADOC	RDOC
Slot (Full Slotting)	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Up to Max LOC	35%-50% Diameter
Fin (Finishing)	Up to Max LOC	4%-6% Diameter

NOTES:

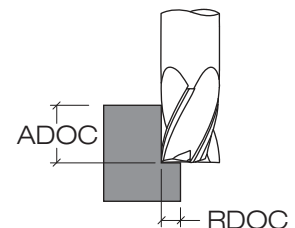
IPT values shown are for 4xD reach tools, and should be adjusted for longer or shorter reaches. For tools with reaches greater than 4xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut

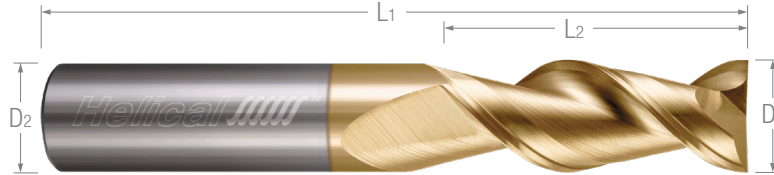
ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

H45AL-2**New Items!****2 FLUTE - SQUARE****45° Helix**

- Designed for outstanding performance and accelerated metal 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



2 Flute

new

new

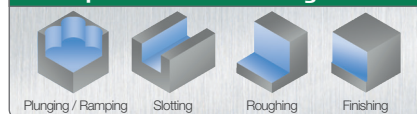
new

new

Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} _{-.000"}	Overall Length L ₁ ^{+0.062"} _{-.062"}	Flutes	Uncoated	<i>Zplus</i> 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

*.0003 max TIR

continued on next page

Speeds & Feeds on Page 29

2 FLUTE - SQUARE

New Items!

H45AL-2

45° Helix (cont.)

continued from previous page

Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Flutes	Uncoated	Zplus Coated	Tool Description	
1/2	1/2	5/8	2-1/2	2	00435	00437	H45AL-S-20500	
	1/2	1	3	2	00450	00452	H45AL-SR-20500	
	1/2	1-1/4	3	2	00465	00467	H45AL-R-20500	
	1/2	1-5/8	4	2	00480	00482	H45AL-M-20500	
	1/2	2	4	2	00495	00497	H45AL-L-20500	
	1/2	2-1/2	5	2	00510	00512	H45AL-LX-20500	
	1/2	3-1/8	6	2	00525	00527	H45AL-X-20500	
5/8	5/8	3/4	3	2	00555	00557	H45AL-S-20625	new
	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	new
	5/8	2-1/2	5	2	00600	00602	H45AL-L-20625	
	5/8	3-3/4	6	2	00615	00617	H45AL-X-20625	new
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	new
	1	2-5/8	6	2	00765	00767	H45AL-M-21000	new
	1	3-1/4	6	2	00780	00782	H45AL-L-21000	new
	1	4-1/8	7	2	00795	00797	H45AL-X-21000	new

*.0003 max TIR

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



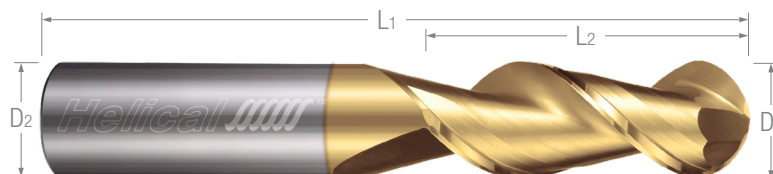
H45AL-2

New Items!

2 FLUTE - BALL

45° Helix

- Designed for outstanding performance and accelerated metal 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*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
	D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"				
new	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
new	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
new	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
new	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
new	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
new	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
new	5/8	5/8	3/4	3	2	17555	17557	H45AL-S-20625-BN
		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 29

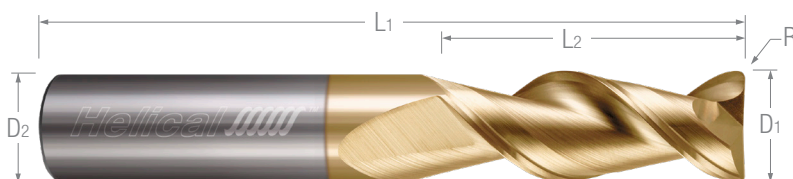


2 FLUTE - CORNER RADIUS

45° Helix

H45AL-2

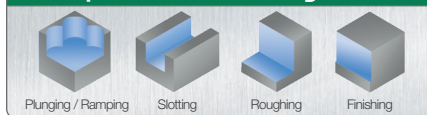
- Designed for outstanding performance and accelerated metal removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders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



Cutter Dia*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	R ^{+0.002"} _{-.002"}	L ₂ ^{+0.032"} _{-.000"}	L ₁ ^{+0.062"} _{-.062"}				
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 29



H45AL-RN-2**New Items!****2 FLUTE - SQUARE****45° Helix - Reduced Neck**

- Designed for outstanding performance and accelerated metal 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



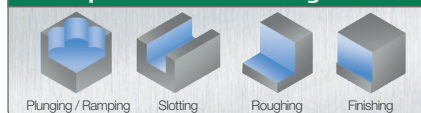
new
new
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new
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Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} _{-0.000"}	OAL L ₁ ^{+0.062"} _{-0.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	3	1/2	.118	2	02015	02017	H45AL-RN-R-20125
	1/8	5/32	3	3/4	.118	2	02030	02032	H45AL-RN-M-20125
	1/8	5/32	3	1	.118	2	81327	81328	H45AL-RN-L-20125
3/16	3/16	7/32	3	1/2	.178	2	02060	02062	H45AL-RN-R-20187
	3/16	7/32	3	3/4	.178	2	02075	02077	H45AL-RN-M-20187
	3/16	7/32	3	1	.178	2	81329	81330	H45AL-RN-ML-20187
1/4	1/4	3/8	4	3/4	.237	2	02105	02107	H45AL-RN-S-20250
	1/4	3/8	4	1-1/8	.237	2	02120	02122	H45AL-RN-R-20250
	1/4	3/8	4	1-5/8	.237	2	81331	81332	H45AL-RN-A-20250
	1/4	3/8	4	2-1/8	.237	2	02135	02137	H45AL-RN-M-20250
	1/4	3/8	4	2-1/2	.237	2	81333	81334	H45AL-RN-ML-20250
5/16	5/16	7/16	4	1-1/8	.296	2	02165	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	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	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	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	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	3/4	4	1-5/8	.593	2	02345	02347	H45AL-RN-R-20625
	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	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	1-1/4	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	1-1/4	7	4-3/8	.950	2	02495	02497	H45AL-RN-L-21000

*.0003 max TIR

Speeds & Feeds on Page 29

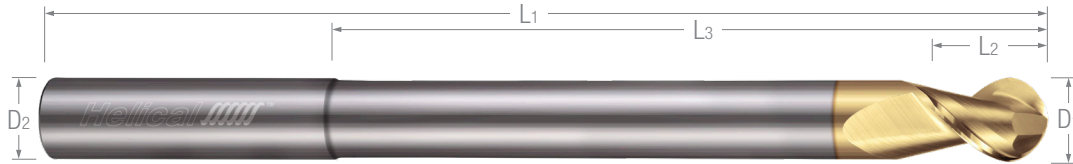
2 FLUTE - BALL

New Items!

H45AL-RN-2

45° Helix - Reduced Neck

- Designed for outstanding performance and accelerated metal 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 ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	3	1/2	.118	2	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

new
new

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Speeds & Feeds on Page 29



H45AL-RN-2**New Items!****2 FLUTE - BALL****45° Helix - Reduced Neck (cont.)**

continued from previous page

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
3/4	3/4	1	4	2	.712	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

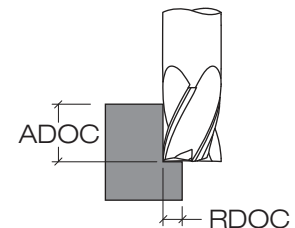
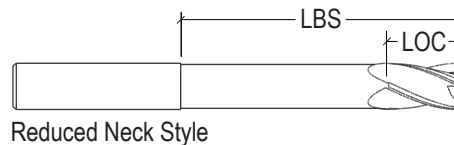
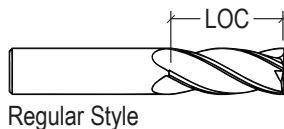
H45AL-2 / H45AL-RN-2

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.

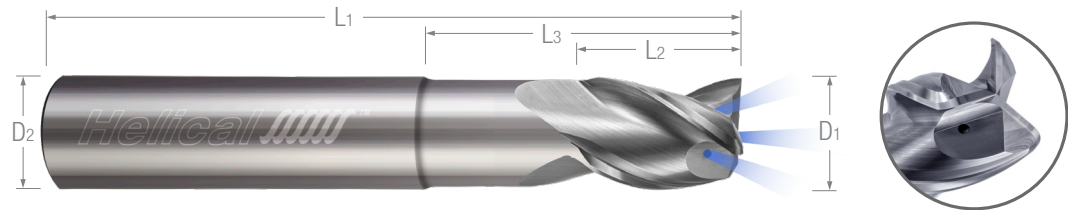
**Key: LOC=Length of Cut****ADOC=Axial Depth of Cut****RDOC=Radial Depth of Cut**

3 FLUTE - SQUARE


HMGC-RN-3

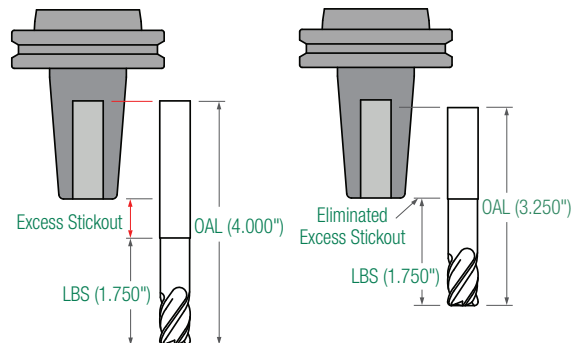
Coolant Through - High Balance - Reduced Neck

- Designed for outstanding performance and accelerated metal 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 ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	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 32



HMGC-RN-3

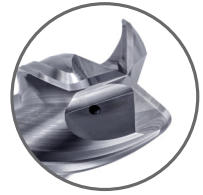
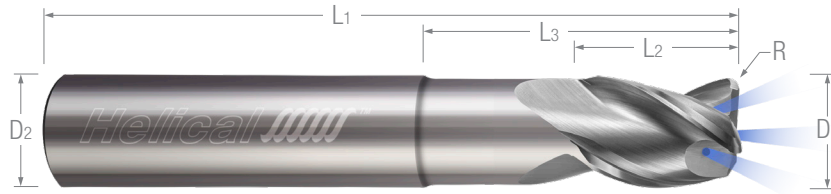


3 FLUTE - CORNER RADIUS

Coolant Through - High Balance - Reduced Neck

- Designed for outstanding performance and accelerated metal 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 30
for shank
length benefits



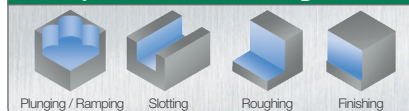
3 Flute

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	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

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 32



3 FLUTE - CORNER RADIUS


HMGC-RN-3

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

continued from previous page

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Tool Description
3/4	3/4	.030	1	4	2	.712	3	60056	HMGC-RN-026-30750-R.030
	3/4	.030	1	4-1/2	2-1/2	.712	3	60059	HMGC-RN-033-30750-R.030
	3/4	.030	1	5	3	.712	3	60062	HMGC-RN-040-30750-R.030
	3/4	.030	1	5	3-3/8	.712	3	60065	HMGC-RN-045-30750-R.030
	3/4	.060	1	4	2	.712	3	60057	HMGC-RN-026-30750-R.060
	3/4	.060	1	4-1/2	2-1/2	.712	3	60060	HMGC-RN-033-30750-R.060
	3/4	.060	1	5	3	.712	3	60063	HMGC-RN-040-30750-R.060
	3/4	.060	1	5	3-3/8	.712	3	60066	HMGC-RN-045-30750-R.060
1	1	.030	1-1/4	4-1/4	2-3/8	.950	3	60068	HMGC-RN-023-31000-R.030
	1	.030	1-1/4	4-1/4	2-5/8	.950	3	60071	HMGC-RN-026-31000-R.030
	1	.030	1-1/4	4-3/4	3	.950	3	60074	HMGC-RN-030-31000-R.030
	1	.060	1-1/4	4-1/4	2-3/8	.950	3	60069	HMGC-RN-023-31000-R.060
	1	.060	1-1/4	4-1/4	2-5/8	.950	3	60072	HMGC-RN-026-31000-R.060
	1	.060	1-1/4	4-3/4	3	.950	3	60075	HMGC-RN-030-31000-R.060

*.0003 max TIR

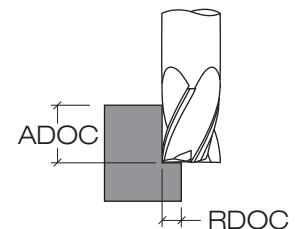
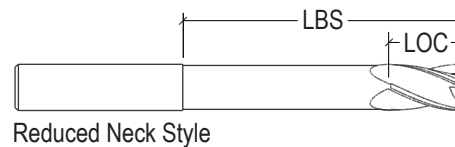
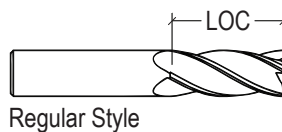
HMGC-RN-3

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.



Key: LOC=Length of Cut

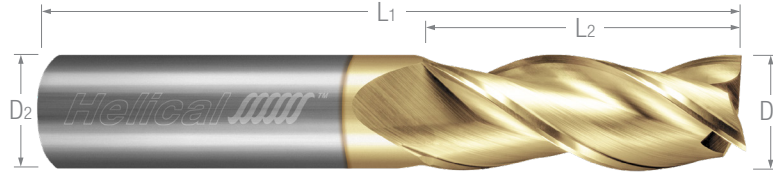
ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

H35AL-3**New Items!****3 FLUTE - SQUARE****35° Helix**

- Designed for outstanding performance and accelerated metal 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



new

new

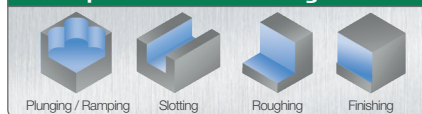
new

new

Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.32"} _{-0.000"}	Overall Length L ₁ ^{+0.62"} _{-0.62"}	Flutes	Uncoated	<i>Zplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	3	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

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3 FLUTE - SQUARE

New Items!



H35AL-3

35° Helix (cont.)

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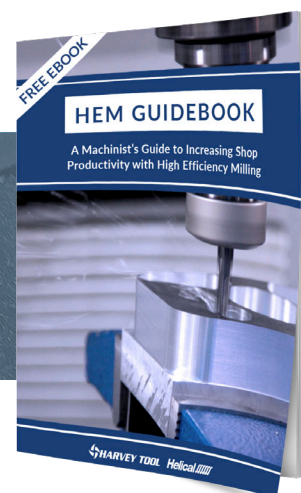
Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description	
1/2	1/2	5/8	2-1/2	3	01435	01437	H35AL-S-30500	
	1/2	1	3	3	01450	01452	H35AL-SR-30500	
	1/2	1-1/4	3	3	01465	01467	H35AL-R-30500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

*.0003 max TIR

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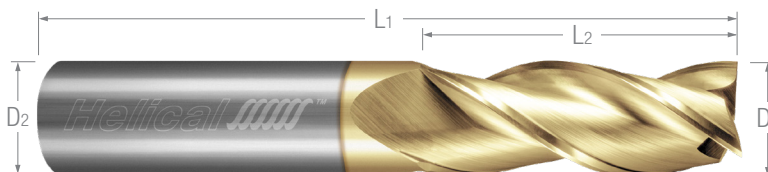
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MH35AL-3**METRIC****3 FLUTE - SQUARE - METRIC****35° Helix**

- Designed for outstanding performance and accelerated metal 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*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	<i>Zplus</i> Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.80 mm} -0.00 mm	L ₁ ^{+1.60 mm} -1.60 mm				
6 mm	6.00 mm	9.00 mm	63 mm	3	59690	59691	MH35AL-015-30600
	6.00 mm	12.00 mm	63 mm	3	59726	59727	MH35AL-020-30600
	6.00 mm	18.00 mm	63 mm	3	59794	59795	MH35AL-030-30600
8 mm	8.00 mm	12.00 mm	63 mm	3	59696	59697	MH35AL-015-30800
	8.00 mm	16.00 mm	63 mm	3	59732	59733	MH35AL-020-30800
	8.00 mm	24.00 mm	75 mm	3	59800	59801	MH35AL-030-30800
10 mm	10.00 mm	15.00 mm	63 mm	3	59702	59703	MH35AL-015-31000
	10.00 mm	20.00 mm	63 mm	3	59738	59739	MH35AL-020-31000
	10.00 mm	25.00 mm	75 mm	3	59766	59767	MH35AL-025-31000
12 mm	12.00 mm	18.00 mm	75 mm	3	59708	59709	MH35AL-015-31200
	12.00 mm	24.00 mm	75 mm	3	59744	59745	MH35AL-020-31200
	12.00 mm	30.00 mm	75 mm	3	59772	59773	MH35AL-025-31200
16 mm	16.00 mm	24.00 mm	89 mm	3	59714	59715	MH35AL-015-31600
	16.00 mm	32.00 mm	89 mm	3	59750	59751	MH35AL-020-31600
	16.00 mm	40.00 mm	89 mm	3	59778	59779	MH35AL-025-31600
20 mm	20.00 mm	30.00 mm	89 mm	3	59720	59721	MH35AL-015-32000
	20.00 mm	40.00 mm	100 mm	3	59756	59757	MH35AL-020-32000
	20.00 mm	50.00 mm	125 mm	3	59784	59785	MH35AL-025-32000
25 mm	25.00 mm	50.00 mm	125 mm	3	59762	59763	MH35AL-020-32500
	25.00 mm	64.00 mm	125 mm	3	59790	59791	MH35AL-025-32500

* .008 mm max TIR

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3 FLUTE - CORNER RADIUS

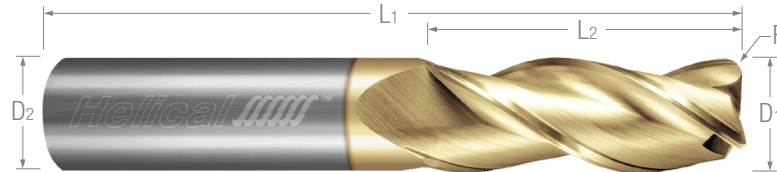
New Items!



H35AL-3

35° Helix

- Designed for outstanding performance and accelerated metal 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

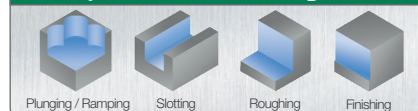


Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Corner Radius R $\begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	Length of Cut L ₂ $\begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length L ₁ $\begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	Uncoated	Zplus 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	new
	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	new
	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	new
	1/8	.030	1/4	1-1/2	3	59006	59007	H35AL-S-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	new
	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	new
	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	new
	3/16	.030	5/16	2	3	59022	59023	H35AL-S-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	new
	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	new
	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	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	new
	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	

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 42



H35AL-3



New Items!

3 FLUTE - CORNER RADIUS

35° Helix (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes			
	D ₁ (h6)	D ₂ (h6)	R ^{+0.002"} -0.002"	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"		Uncoated	Zplus Coated	Tool Description
new	1/4	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
		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
new	1/4	1/4	.060	1-1/4	3	3	82783	82784	H35AL-L-30250-R.060
		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
new	3/8	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	.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		
new	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

New Items!



H35AL-3

35° Helix (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	R ^{+0.002"} -0.002"	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"				
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
5/8	1/2	.125	2	4	3	82797	82798	H35AL-L-30500-R.125
	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

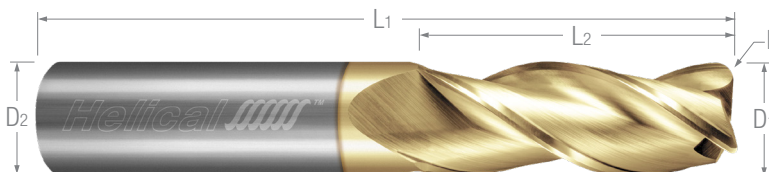
METRIC



3 FLUTE - CORNER RADIUS - METRIC

35° Helix

- Designed for outstanding performance and accelerated metal 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

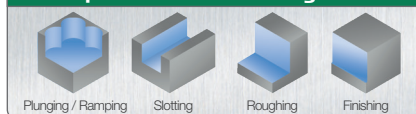


Cutter Diameter*	Shank Diameter	Corner Radius	LOC	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	R ^{+0.05 mm} _{-0.05 mm}	L ₂ ^{+0.80 mm} _{-0.00 mm}	L ₁ ^{+1.60 mm} _{-1.60 mm}				
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	3	59692	59693	MH35AL-015-30600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	3	59728	59729	MH35AL-020-30600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	3	59796	59797	MH35AL-030-30600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	3	59694	59695	MH35AL-015-30600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	3	59730	59731	MH35AL-020-30600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	3	59798	59799	MH35AL-030-30600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	3	59698	59699	MH35AL-015-30800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	3	59734	59735	MH35AL-020-30800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	3	59802	59803	MH35AL-030-30800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	3	59700	59701	MH35AL-015-30800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	3	59736	59737	MH35AL-020-30800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	3	59804	59805	MH35AL-030-30800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	3	59704	59705	MH35AL-015-31000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	3	59740	59741	MH35AL-020-31000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	3	59768	59769	MH35AL-025-31000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	3	59706	59707	MH35AL-015-31000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	3	59742	59743	MH35AL-020-31000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	3	59770	59771	MH35AL-025-31000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	3	59710	59711	MH35AL-015-31200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	3	59746	59747	MH35AL-020-31200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	3	59774	59775	MH35AL-025-31200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	3	59712	59713	MH35AL-015-31200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	3	59748	59749	MH35AL-020-31200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	3	59776	59777	MH35AL-025-31200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	3	59716	59717	MH35AL-015-31600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	3	59752	59753	MH35AL-020-31600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	3	59780	59781	MH35AL-025-31600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	3	59718	59719	MH35AL-015-31600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	3	59754	59755	MH35AL-020-31600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	3	59782	59783	MH35AL-025-31600-R1.00

* .008 mm max TIR

continued on next page

Speeds & Feeds on Page 42



3 FLUTE - CORNER RADIUS - METRIC

35° Helix (cont.)



MH35AL-3
METRIC

continued from previous page

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

* .008 mm max TIR

3 Flute



The Anatomy of an End Mill

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

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

H35AL-RN-3**New Items!****3 FLUTE - SQUARE****35° Helix - Reduced Neck**

- Designed for outstanding performance and accelerated metal 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



new

new

new

new

new

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} _{-.000"}	OAL L ₁ ^{+0.062"} _{-.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	5/32	3	1/2	.118	3	04015	04017	H35AL-RN-R-30125
	1/8	5/32	3	5/8	.118	3	81375	81376	H35AL-RN-A-30125
	1/8	5/32	3	3/4	.118	3	04030	04032	H35AL-RN-M-30125
	1/8	5/32	3	1	.118	3	81377	81378	H35AL-RN-L-30125
	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

* .0003 max TIR

continued on next page

Speeds & Feeds on Page 42

Plunging / Ramping



Slotting



Roughing



Finishing

SPEEDS & FEEDS

New Items!



H35AL-3

3 Flute - 35° Helix (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	Zplus Coated	Tool Description
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
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

new

* .0003 max TIR

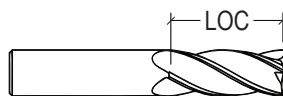
H35AL-3 / H35AL-RN-3

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

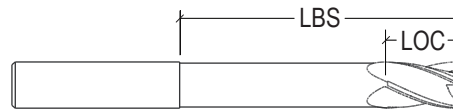
Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	75%-125% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-40% Diameter
	Reached	Up to Max LOC	30%-40% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

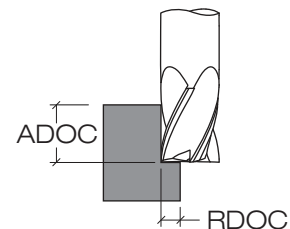
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



Key: LOC=Length of Cut

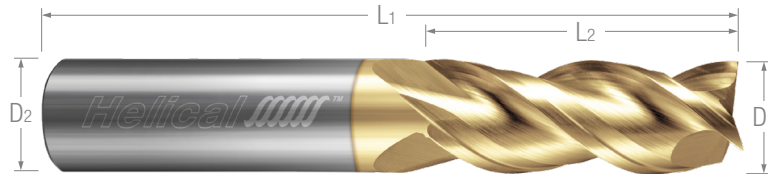
ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

H40ALV-3**New Items!****3 FLUTE - SQUARE****40° Helix - Variable Pitch**

- Designed for outstanding performance and accelerated metal 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



new

new

Cutter Diameter* D1 (h6)	Shank Diameter D2 (h6)	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	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
3/16	3/16	3/8	2	3	48030	48031	H40ALV-S-30187
	3/16	3/4	2-1/2	3	48045	48046	H40ALV-R-30187
	3/16	1	3	3	48060	48061	H40ALV-M-30187
	3/16	1-3/8	3	3	82391	82392	H40ALV-L-30187
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
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
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

* .0003 max TIR

continued on next page



3 FLUTE - SQUARE**New Items!****H40ALV-3**

40° Helix - Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Flutes	Uncoated	Zplus Coated	Tool Description
1/2	1/2	5/8	2-1/2	3	48335	48336	H40ALV-S-30500
	1/2	1	3	3	48365	48366	H40ALV-SR-30500
	1/2	1-1/4	3	3	48395	48396	H40ALV-R-30500
	1/2	1-5/8	4	3	48425	48426	H40ALV-M-30500
	1/2	2	4	3	48455	48456	H40ALV-L-30500
	1/2	2-1/2	5	3	81415	81416	H40ALV-LX-30500
	1/2	3-1/8	6	3	82397	82398	H40ALV-X-30500
5/8	5/8	3/4	3	3	48485	48486	H40ALV-S-30625
	5/8	1-1/4	3-1/2	3	48510	48511	H40ALV-SR-30625
	5/8	1-5/8	4	3	48535	48536	H40ALV-R-30625
	5/8	2	4	3	82399	82400	H40ALV-M-30625
3/4	3/4	1	3	3	48585	48586	H40ALV-S-30750
	3/4	1-5/8	4	3	48620	48621	H40ALV-R-30750
	3/4	2-1/4	5	3	48655	48656	H40ALV-M-30750
	3/4	2-3/4	5	3	81417	81418	H40ALV-ML-30750
	3/4	3-1/4	6	3	83525	83526	H40ALV-L-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

new

* .0003 max TIR

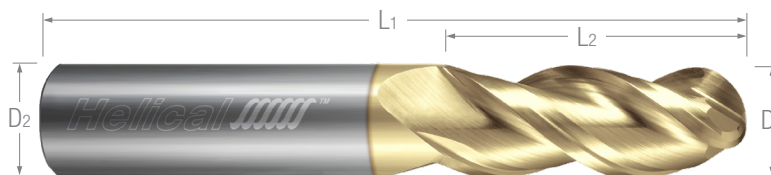
**Attacking Aluminum: A Machining Guide**

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

Read more on helical.blog/intheloupe

H40ALV-3**3 FLUTE - BALL****40° Helix - Variable Pitch**

- Designed for outstanding performance and accelerated metal 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

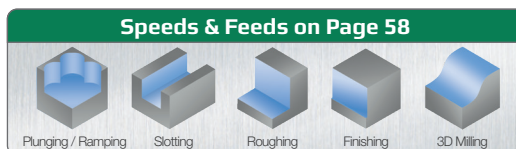


Cutter Diameter** D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} ^{-.000"}	Overall Length L ₁ ^{+0.062"} ^{-.062"}	Flutes	Uncoated	<i>Zplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	3	49030*	49031*	H40ALV-S-30125-BN
	1/8	3/8	2	3	49035*	49036*	H40ALV-SR-30125-BN
	1/8	1/2	2-1/2	3	49040*	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
3/16	3/16	3/8	2	3	49050*	49051*	H40ALV-S-30187-BN
	3/16	3/4	2-1/2	3	49060*	49061*	H40ALV-R-30187-BN
	3/16	1	3	3	49065*	49066*	H40ALV-M-30187-BN
	3/16	1-3/8	3	3	82455*	82456*	H40ALV-L-30187-BN
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
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
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
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

* 1/8 and 3/16 have 1 tooth to center

** .0003 max TIR

continued on next page



3 FLUTE - BALL**40° Helix - Variable Pitch (cont.)****H40ALV-3**

continued from previous page

Cutter Diameter** D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Flutes	Uncoated	Zplus Coated	Tool Description
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
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
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

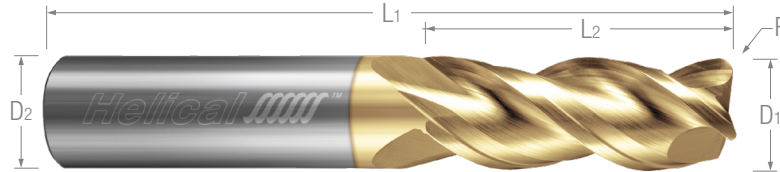
* 1/8 and 3/16 have 1 tooth to center

** .0003 max TIR

H40ALV-3**New Items!****3 FLUTE - CORNER RADIUS****40° Helix - Variable Pitch**

- Designed for outstanding performance and accelerated metal 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

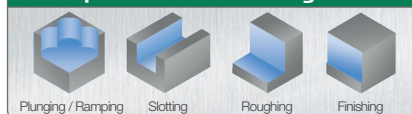


Cutter Dia.** D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} _{-.002"}	Length of Cut L ₂ ^{+0.032"} _{-.000"}	OAL L ₁ ^{+0.062"} _{-.062"}	Flutes	Uncoated	Zplus Coated	Tool Description
1/8	1/8	.010	1/4	1-1/2	3	82401	82402	H40ALV-S-30125-R.010
	1/8	.010	3/8	2	3	82403	82404	H40ALV-SR-30125-R.010
	1/8	.010	1/2	2-1/2	3	82405	82406	H40ALV-R-30125-R.010
	1/8	.015	1/4	1-1/2	3	48005	48006	H40ALV-S-30125-R.015
	1/8	.015	3/8	2	3	48015	48016	H40ALV-SR-30125-R.015
	1/8	.015	1/2	2-1/2	3	48025	48026	H40ALV-R-30125-R.015
	1/8	.015	5/8	2-1/2	3	82407	82408	H40ALV-M-30125-R.015
	1/8	.030	1/4	1-1/2	3	81419*	81420*	H40ALV-S-30125-R.030
	1/8	.030	3/8	2	3	81421*	81422*	H40ALV-SR-30125-R.030
	1/8	.030	1/2	2-1/2	3	81423*	81424*	H40ALV-R-30125-R.030
3/16	3/16	.015	3/8	2	3	48035	48036	H40ALV-S-30187-R.015
	3/16	.015	3/4	2-1/2	3	48050	48051	H40ALV-R-30187-R.015
	3/16	.015	1	3	3	48065	48066	H40ALV-M-30187-R.015
	3/16	.015	1-3/8	3	3	82411	82412	H40ALV-L-30187-R.015
	3/16	.030	3/8	2	3	48040	48041	H40ALV-S-30187-R.030
	3/16	.030	3/4	2-1/2	3	48055	48056	H40ALV-R-30187-R.030
	3/16	.030	1	3	3	48070	48071	H40ALV-M-30187-R.030
1/4	1/4	.010	3/8	2	3	82415	82416	H40ALV-S-30250-R.010
	1/4	.010	3/4	2-1/2	3	82417	82418	H40ALV-R-30250-R.010
	1/4	.010	1	3	3	82419	82420	H40ALV-M-30250-R.010
	1/4	.015	3/8	2	3	48080	48081	H40ALV-S-30250-R.015
	1/4	.015	1/2	2	3	81425	81426	H40ALV-SR-30250-R.015
	1/4	.015	3/4	2-1/2	3	48120	48121	H40ALV-R-30250-R.015
	1/4	.015	1	3	3	48140	48141	H40ALV-M-30250-R.015
	1/4	.015	1-1/4	3	3	82421	82422	H40ALV-L-30250-R.015
	1/4	.030	3/8	2	3	48085	48086	H40ALV-S-30250-R.030
	1/4	.030	1/2	2	3	81427	81428	H40ALV-SR-30250-R.030
	1/4	.030	3/4	2-1/2	3	48125	48126	H40ALV-R-30250-R.030
	1/4	.030	1	3	3	48145	48146	H40ALV-M-30250-R.030
	1/4	.030	1-1/4	3	3	82423	82424	H40ALV-L-30250-R.030

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

** .0003 max TIR

continued on next page

Speeds & Feeds on Page 58

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 $\begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	Length of Cut L ₂ $\begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	OAL L ₁ $\begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	Uncoated	Zplus Coated	Tool Description	
1/4	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	
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	new
	3/8	.010	1	2-1/2	3	81433	81434	H40ALV-R-30375-R.010	
	3/8	.010	1-1/2	3-1/2	3	81435	81436	H40ALV-L-30375-R.010	
	3/8	.015	1/2	2	3	48240	48241	H40ALV-S-30375-R.015	
	3/8	.015	3/4	2-1/2	3	81437	81438	H40ALV-SR-30375-R.015	
	3/8	.015	1	2-1/2	3	48265	48266	H40ALV-R-30375-R.015	
	3/8	.015	1-1/2	3-1/2	3	48315	48316	H40ALV-L-30375-R.015	
	3/8	.015	2	4	3	82427	82428	H40ALV-LX-30375-R.015	
	3/8	.030	1/2	2	3	48245	48246	H40ALV-S-30375-R.030	
	3/8	.030	3/4	2-1/2	3	81439	81440	H40ALV-SR-30375-R.030	
	3/8	.030	1	2-1/2	3	48270	48271	H40ALV-R-30375-R.030	
	3/8	.030	1-1/2	3-1/2	3	48320	48321	H40ALV-L-30375-R.030	
	3/8	.030	2	4	3	82429	82430	H40ALV-LX-30375-R.030	
	3/8	.060	1/2	2	3	48250	48251	H40ALV-S-30375-R.060	
	3/8	.060	3/4	2-1/2	3	81441	81442	H40ALV-SR-30375-R.060	
	3/8	.060	1	2-1/2	3	48275	48276	H40ALV-R-30375-R.060	
	3/8	.060	1-1/2	3-1/2	3	48325	48326	H40ALV-L-30375-R.060	
	3/8	.060	2	4	3	82431	82432	H40ALV-LX-30375-R.060	
	3/8	.090	1/2	2	3	48255*	48256*	H40ALV-S-30375-R.090	
	3/8	.090	3/4	2-1/2	3	81443*	81444*	H40ALV-SR-30375-R.090	
	3/8	.090	1	2-1/2	3	48280*	48281*	H40ALV-R-30375-R.090	
	3/8	.090	1-1/2	3-1/2	3	48330*	48331*	H40ALV-L-30375-R.090	
	3/8	.090	2	4	3	82433*	82434*	H40ALV-LX-30375-R.090	
	3/8	.125	1/2	2	3	83529*	83530*	H40ALV-S-30375-R.125	new
	3/8	.125	3/4	2-1/2	3	83531*	83532*	H40ALV-SR-30375-R.125	new
	3/8	.125	1	2-1/2	3	83533*	83534*	H40ALV-R-30375-R.125	new
	3/8	.125	1-1/2	3-1/2	3	83535*	83536*	H40ALV-L-30375-R.125	new
	3/8	.125	2	4	3	83537*	83538*	H40ALV-LX-30375-R.125	new
1/2	1/2	.010	5/8	2-1/2	3	81445	81446	H40ALV-S-30500-R.010	
	1/2	.010	1	3	3	81447	81448	H40ALV-SR-30500-R.010	
	1/2	.010	1-1/4	3	3	81449	81450	H40ALV-R-30500-R.010	
	1/2	.010	1-5/8	4	3	81451	81452	H40ALV-M-30500-R.010	
	1/2	.010	2	4	3	81453	81454	H40ALV-L-30500-R.010	
	1/2	.015	5/8	2-1/2	3	48340	48341	H40ALV-S-30500-R.015	
	1/2	.015	1	3	3	48370	48371	H40ALV-SR-30500-R.015	
	1/2	.015	1-1/4	3	3	48400	48401	H40ALV-R-30500-R.015	
	1/2	.015	1-5/8	4	3	48430	48431	H40ALV-M-30500-R.015	
	1/2	.015	2	4	3	48460	48461	H40ALV-L-30500-R.015	
	1/2	.015	2-1/2	5	3	82435	82436	H40ALV-LX-30500-R.015	

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

** .0003 max TIR

continued on next page

H40ALV-3**New Items!****3 FLUTE - CORNER RADIUS**

40° Helix - Variable Pitch (cont.)

continued from previous page

	Cutter Dia.** D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002" -0.002"}	Length of Cut L ₂ ^{+0.032" -0.000"}	OAL L ₁ ^{+0.062" -0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description
new new new new new	1/2	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		.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	
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	
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	
5/8		5/8	.030	3/4	3	3	48490	48491	H40ALV-S-30625-R.030
	5/8	.030	1-1/4	3-1/2	3	48515	48516	H40ALV-SR-30625-R.030	
	5/8	.030	1-5/8	4	3	48540	48541	H40ALV-R-30625-R.030	
	5/8	.030	2	4	3	82445	82446	H40ALV-M-30625-R.030	
	5/8	.060	3/4	3	3	48495	48496	H40ALV-S-30625-R.060	
	5/8	.060	1-1/4	3-1/2	3	48520	48521	H40ALV-SR-30625-R.060	
	5/8	.060	1-5/8	4	3	48545	48546	H40ALV-R-30625-R.060	
	5/8	.090	3/4	3	3	48500	48501	H40ALV-S-30625-R.090	
	5/8	.090	1-1/4	3-1/2	3	48525	48526	H40ALV-SR-30625-R.090	
	5/8	.090	1-5/8	4	3	48550	48551	H40ALV-R-30625-R.090	
	5/8	.125	3/4	3	3	48505	48506	H40ALV-S-30625-R.125	
	5/8	.125	1-1/4	3-1/2	3	48530	48531	H40ALV-SR-30625-R.125	
	5/8	.125	1-5/8	4	3	48555	48556	H40ALV-R-30625-R.125	
	5/8	.125	2	4	3	82447	82448	H40ALV-M-30625-R.125	

* 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 ^{+0.02"} _{-0.02"}	Length of Cut L ₂ ^{+0.032"} _{-0.000"}	OAL L ₁ ^{+0.062"} _{-0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description	
3/4	3/4	.015	1	3	3	83549	83550	H40ALV-S-30750-R.015	new
	3/4	.015	1-5/8	4	3	83551	83552	H40ALV-R-30750-R.015	new
	3/4	.015	2-1/4	5	3	83553	83554	H40ALV-M-30750-R.015	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	.090	1	3	3	48600	48601	H40ALV-S-30750-R.090	
	3/4	.090	1-5/8	4	3	48635	48636	H40ALV-R-30750-R.090	
	3/4	.090	2-1/4	5	3	48670	48671	H40ALV-M-30750-R.090	
	3/4	.125	1	3	3	48605	48606	H40ALV-S-30750-R.125	
	3/4	.125	1-5/8	4	3	48640	48641	H40ALV-R-30750-R.125	
	3/4	.125	2-1/4	5	3	48675	48676	H40ALV-M-30750-R.125	
	3/4	.125	2-3/4	5	3	82451	82452	H40ALV-ML-30750-R.125	
	3/4	.190	1	3	3	48610*	48611*	H40ALV-S-30750-R.190	
	3/4	.190	1-5/8	4	3	48645*	48646*	H40ALV-R-30750-R.190	
	3/4	.190	2-1/4	5	3	48680*	48681*	H40ALV-M-30750-R.190	
	3/4	.250	1	3	3	48615*	48616*	H40ALV-S-30750-R.250	
	3/4	.250	1-5/8	4	3	48650*	48651*	H40ALV-R-30750-R.250	
	3/4	.250	2-1/4	5	3	48685*	48686*	H40ALV-M-30750-R.250	
1	1	.030	1-1/4	4	3	48695	48696	H40ALV-S-31000-R.030	
	1	.030	2	5	3	48730	48731	H40ALV-R-31000-R.030	
	1	.030	3-1/4	6	3	48765	48766	H40ALV-M-31000-R.030	
	1	.060	1-1/4	4	3	48700	48701	H40ALV-S-31000-R.060	
	1	.060	2	5	3	48735	48736	H40ALV-R-31000-R.060	
	1	.060	3-1/4	6	3	48770	48771	H40ALV-M-31000-R.060	
	1	.125	1-1/4	4	3	48710	48711	H40ALV-S-31000-R.125	
	1	.125	2	5	3	48745	48746	H40ALV-R-31000-R.125	
	1	.125	3-1/4	6	3	48780	48781	H40ALV-M-31000-R.125	
	1	.250	1-1/4	4	3	48720*	48721*	H40ALV-S-31000-R.250	
	1	.250	2	5	3	48755*	48756*	H40ALV-R-31000-R.250	
	1	.250	3-1/4	6	3	48790*	48791*	H40ALV-M-31000-R.250	

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

** .0003 max TIR

H40ALV-RN-3**New Items!****3 FLUTE - SQUARE****40° Helix - Variable Pitch - Reduced Neck**

- Designed for outstanding performance and accelerated metal 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



new

new

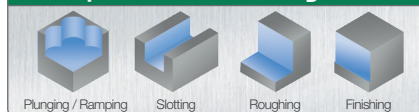
new

new

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	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
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 58

3 FLUTE - SQUARE

New Items!



H40ALV-RN-3

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

continued from previous page

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	LOC L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
1/2	1/2	5/8	3	1-3/8	.475	3	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
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
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

new

*.0003 max TIR

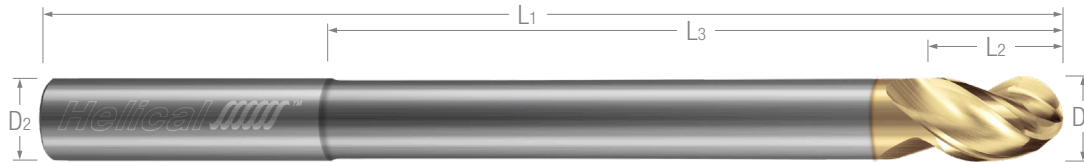
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H40ALV-RN-3**New Items!****3 FLUTE - BALL****40° Helix - Variable Pitch - Reduced Neck**

- Designed for outstanding performance and accelerated metal 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



new

new

new

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
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
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

* 1/8 & 3/16 have one tooth to center

** .0003 max TIR

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Speeds & Feeds on Page 58

3 FLUTE - BALL

New Items!



H40ALV-RN-3

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

continued from previous page

Cutter Dia.** D ₁ (h6)	Shank Dia. D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
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 new
	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 new
	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

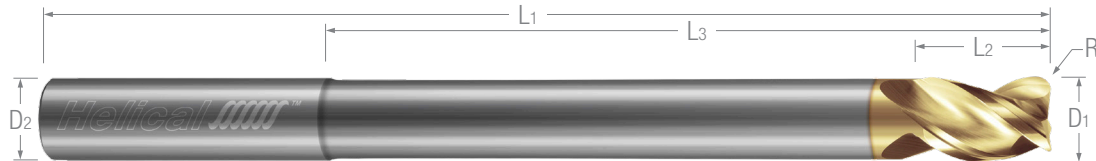
* 1/8 & 3/16 have one tooth to center

** .0003 max TIR

H40ALV-RN-3**New Items!****3 FLUTE - CORNER RADIUS****40° Helix - Variable Pitch - Reduced Neck**

- Designed for outstanding performance and accelerated metal 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*

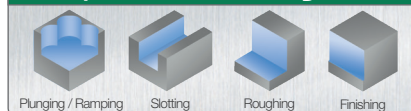
- Excellent performance in High Efficiency Milling (HEM)
- Center cutting
- h6 shank tolerance for high precision tool holders
- Uncoated tool offers an excellent option for aluminum finishing applications
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- Solid carbide
- CNC ground in the USA



Cutter Dia.**	Shank Dia.	Corner Radius	LOC	OAL	Reach (LBS)	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
D1 (h6)	D2 (h6)	R ^{+0.002"} _{-.002"}	L2 ^{+0.032"} _{-.000"}	L1 ^{+0.062"} _{-.062"}	L3					
new 1/8	1/8	.015	5/32	2-1/2	1/2	.118	3	46015	46016	H40ALV-RN-R-30125-R.015
	1/8	.015	5/32	3	3/4	.118	3	46025	46026	H40ALV-RN-M-30125-R.015
	1/8	.015	5/32	3	1	.118	3	82807	82808	H40ALV-RN-L-30125-R.015
new 3/16	3/16	.015	7/32	2-1/2	1/2	.178	3	46050	46051	H40ALV-RN-R-30187-R.015
	3/16	.015	7/32	3	3/4	.178	3	46065	46066	H40ALV-RN-M-30187-R.015
	3/16	.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
new 1/4	1/4	.015	3/8	2-1/2	3/4	.237	3	46080	46081	H40ALV-RN-S-30250-R.015
	1/4	.015	3/8	3	1-1/8	.237	3	46100	46101	H40ALV-RN-R-30250-R.015
	1/4	.015	3/8	3	1-3/8	.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	.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
	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

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

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Speeds & Feeds on Page 58

3 FLUTE - CORNER RADIUS

New Items!



H40ALV-RN-3

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

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Cutter Dia.** D1 (h6)	Shank Dia. D2 (h6)	Corner Radius R $^{+.002''}_{-.002''}$	LOC L2 $^{+.032''}_{-.000''}$	OAL L1 $^{+.062''}_{-.062''}$	Reach (LBS) L3	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description	
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	new
	3/8	.030	1/2	3	1-1/8	.356	3	46230	46231	H40ALV-RN-R-30375-R.030	
	3/8	.030	1/2	3	1-5/8	.356	3	81503	81504	H40ALV-RN-A-30375-R.030	
	3/8	.030	1/2	4	2-1/8	.356	3	46255	46256	H40ALV-RN-M-30375-R.030	
	3/8	.030	1/2	5	2-1/2	.356	3	81505	81506	H40ALV-RN-ML-30375-R.030	
	3/8	.060	1/2	3	1-1/8	.356	3	46235	46236	H40ALV-RN-R-30375-R.060	
	3/8	.060	1/2	3	1-5/8	.356	3	81507	81508	H40ALV-RN-A-30375-R.060	
	3/8	.060	1/2	4	2-1/8	.356	3	46260	46261	H40ALV-RN-M-30375-R.060	
	3/8	.060	1/2	5	2-1/2	.356	3	81509	81510	H40ALV-RN-ML-30375-R.060	
	3/8	.090	1/2	3	1-1/8	.356	3	46240*	46241*	H40ALV-RN-R-30375-R.090	
	3/8	.090	1/2	3	1-5/8	.356	3	82833*	82834*	H40ALV-RN-A-30375-R.090	new
	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	new
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-L-30500-R.030	new
	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	new
	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-L-30500-R.060	new
	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	new
	1/2	.090	5/8	3	1-3/8	.475	3	46320	46321	H40ALV-RN-R-30500-R.090	
	1/2	.090	5/8	4	2-1/4	.475	3	46350	46351	H40ALV-RN-M-30500-R.090	
	1/2	.090	5/8	5	3-3/8	.475	3	46380	46381	H40ALV-RN-L-30500-R.090	
	1/2	.090	5/8	6	4-1/4	.475	3	46410	46411	H40ALV-RN-X-30500-R.090	
	1/2	.125	5/8	3	1-3/8	.475	3	46325*	46326*	H40ALV-RN-R-30500-R.125	
	1/2	.125	5/8	3-1/2	1-3/4	.475	3	81519*	81520*	H40ALV-RN-A-30500-R.125	
	1/2	.125	5/8	4	2-1/4	.475	3	46355*	46356*	H40ALV-RN-M-30500-R.125	
	1/2	.125	5/8	4-1/2	2-3/4	.475	3	81521*	81522*	H40ALV-RN-ML-30500-R.125	
	1/2	.125	5/8	5	3-3/8	.475	3	46385*	46386*	H40ALV-RN-L-30500-R.125	
	1/2	.125	5/8	6	3-3/4	.475	3	82845*	82846*	H40ALV-RN-L-30500-R.125	new
	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	new

* 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 ^{+0.02"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
5/8	5/8	.030	3/4	4	2-3/8	.593	3	46475	46476	H40ALV-RN-M-30625-R.030
	5/8	.030	3/4	6	3-3/8	.593	3	46500	46501	H40ALV-RN-L-30625-R.030
	5/8	.060	3/4	4	2-3/8	.593	3	46480	46481	H40ALV-RN-M-30625-R.060
	5/8	.090	3/4	4	2-3/8	.593	3	46485	46486	H40ALV-RN-M-30625-R.090
	5/8	.125	3/4	4	2-3/8	.593	3	46490	46491	H40ALV-RN-M-30625-R.125
3/4	3/4	.030	1	4	2	.712	3	46560	46561	H40ALV-RN-R-30750-R.030
	3/4	.030	1	5	2-1/2	.712	3	81523	81524	H40ALV-RN-A-30750-R.030
	3/4	.030	1	6	3-3/8	.712	3	46595	46596	H40ALV-RN-M-30750-R.030
	3/4	.030	1	7	4-1/8	.712	3	81525	81526	H40ALV-RN-ML-30750-R.030
	3/4	.030	1	7	5	.712	3	46630	46631	H40ALV-RN-L-30750-R.030
	3/4	.060	1	4	2	.712	3	46565	46566	H40ALV-RN-R-30750-R.060
	3/4	.060	1	5	2-1/2	.712	3	81527	81528	H40ALV-RN-A-30750-R.060
	3/4	.060	1	6	3-3/8	.712	3	46600	46601	H40ALV-RN-M-30750-R.060
	3/4	.060	1	7	4-1/8	.712	3	81529	81530	H40ALV-RN-ML-30750-R.060
	3/4	.060	1	7	5	.712	3	46635	46636	H40ALV-RN-L-30750-R.060
	3/4	.090	1	4	2	.712	3	46570	46571	H40ALV-RN-R-30750-R.090
	3/4	.090	1	6	3-3/8	.712	3	46605	46606	H40ALV-RN-M-30750-R.090
	3/4	.125	1	4	2	.712	3	46575	46576	H40ALV-RN-R-30750-R.125
	3/4	.125	1	5	2-1/2	.712	3	81531	81532	H40ALV-RN-A-30750-R.125
	3/4	.125	1	6	3-3/8	.712	3	46610	46611	H40ALV-RN-M-30750-R.125
	3/4	.125	1	7	5	.712	3	46645	46646	H40ALV-RN-L-30750-R.125
	3/4	.190	1	4	2	.712	3	46580*	46581*	H40ALV-RN-R-30750-R.190
	3/4	.190	1	6	3-3/8	.712	3	46615*	46616*	H40ALV-RN-M-30750-R.190
	3/4	.250	1	4	2	.712	3	46585*	46586*	H40ALV-RN-R-30750-R.250
	3/4	.250	1	6	3-3/8	.712	3	46620*	46621*	H40ALV-RN-M-30750-R.250
	3/4	.250	1	7	5	.712	3	46655*	46656*	H40ALV-RN-L-30750-R.250
1	1	.030	1-1/4	5	2-5/8	.950	3	46700	46701	H40ALV-RN-R-31000-R.030
	1	.030	1-1/4	6	3-3/8	.950	3	46735	46736	H40ALV-RN-M-31000-R.030
	1	.030	1-1/4	7	4-3/8	.950	3	46770	46771	H40ALV-RN-L-31000-R.030
	1	.030	1-1/4	9	6	.950	3	46805	46806	H40ALV-RN-LX-31000-R.030
	1	.060	1-1/4	5	2-5/8	.950	3	46705	46706	H40ALV-RN-R-31000-R.060
	1	.060	1-1/4	7	4-3/8	.950	3	46775	46776	H40ALV-RN-L-31000-R.060
	1	.125	1-1/4	5	2-5/8	.950	3	46715	46716	H40ALV-RN-R-31000-R.125
	1	.125	1-1/4	6	3-3/8	.950	3	46750	46751	H40ALV-RN-M-31000-R.125
	1	.125	1-1/4	7	4-3/8	.950	3	46785	46786	H40ALV-RN-L-31000-R.125
	1	.125	1-1/4	9	6	.950	3	46820	46821	H40ALV-RN-LX-31000-R.125
	1	.250	1-1/4	5	2-5/8	.950	3	46725*	46726*	H40ALV-RN-R-31000-R.250
	1	.250	1-1/4	6	3-3/8	.950	3	46760*	46761*	H40ALV-RN-M-31000-R.250
	1	.250	1-1/4	7	4-3/8	.950	3	46795*	46796*	H40ALV-RN-L-31000-R.250
	1	.250	1-1/4	9	6	.950	3	46830*	46831*	H40ALV-RN-LX-31000-R.250

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

SPEEDS & FEEDS



H40ALV-RN-3

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

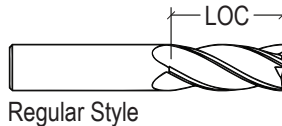
H40ALV-3 / H40ALV-RN-3

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

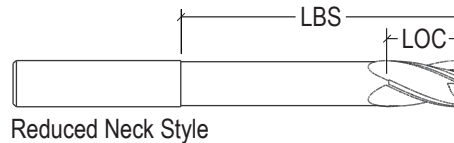
Milling Process	Style	ADOC	RDOC
Slot (Full Slotting)	Non-Reached	75%-125% Diameter	100% Diameter
	Reached	Up to Max LOC	100% Diameter
Rgh (Traditional Roughing)	Non-Reached	125%-200% Diameter	30%-40% Diameter
	Reached	Up to Max LOC	30%-40% Diameter
Fin (Finishing)	N/A	Up to Max LOC	4%-6% Diameter

NOTES:

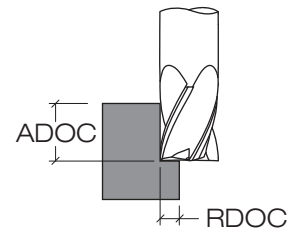
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.



Regular Style



Reduced Neck Style



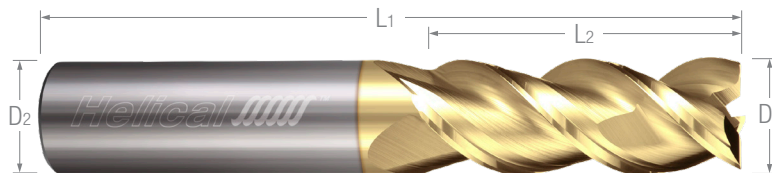
Key: LOC=Length of Cut

ADOC=Axial Depth of Cut

RDOC=Radial Depth of Cut

H45AL-3**New Items!****3 FLUTE - SQUARE****45° Helix**

- Designed for outstanding performance and accelerated metal 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



new

new

new

new

Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"				
1/8	1/8	1/4	1-1/2	3	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
3/16	3/16	5/16	2	3	03090	03092	H45AL-S-30187
	3/16	9/16	2-1/2	3	03105	03107	H45AL-R-30187
	3/16	3/4	2-1/2	3	03120	03122	H45AL-M-30187
	3/16	1	2-1/2	3	81553	81554	H45AL-ML-30187
	3/16	1-3/16	3	3	82851	82852	H45AL-L-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
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

* .0003 max TIR

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Speeds & Feeds on Page 65

3 FLUTE - SQUARE

New Items!



H45AL-3

45° Helix (cont.)

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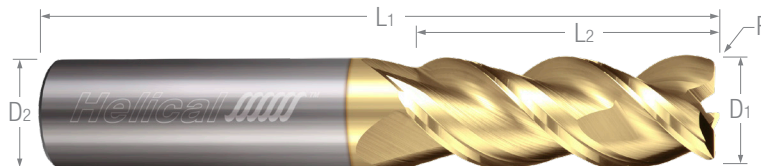
Cutter Diameter* D ₁ (h6)	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description
1/2	1/2	5/8	2-1/2	3	03435	03437	H45AL-S-30500
	1/2	1	3	3	03450	03452	H45AL-SR-30500
	1/2	1-1/4	3	3	03465	03467	H45AL-R-30500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

new

*.0003 max TIR

H45AL-3**New Items!****3 FLUTE - CORNER RADIUS****45° Helix**

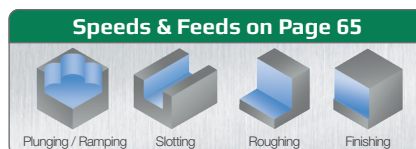
- Designed for outstanding performance and accelerated metal removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved part finish and shearing action
- Cylindrically ground to maintain edge strength
- Center cutting
- Excellent performance in High Efficiency Milling (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.*	Shank Dia.	Corner Radius	Length of Cut	OAL	Flutes	Uncoated	Zplus Coated	Tool Description
D1 (h6)	D2 (h6)	R $^{+.002''}_{-.002''}$	L2 $^{+.032''}_{-.000''}$	L1 $^{+.062''}_{-.062''}$				
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
	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
	1/8	.030	3/4	2-1/2	3	83591	83592	H45AL-M-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
	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
	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
	3/16	.030	1	3	3	83609	83610	H45AL-L-30187-R.030
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	.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	83625	83626	H45AL-L-30250-R.060

*.0003 max TIR

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3 FLUTE - CORNER RADIUS

New Items!



H45AL-3

45° Helix (cont.)

continued from previous page

Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} _{-0.002"}	Length of Cut L ₂ ^{+0.032"} _{-0.000"}	OAL L ₁ ^{+0.062"} _{-0.062"}	Flutes	Uncoated	Zplus Coated	Tool Description	
5/16	5/16	.010	7/16	2	3	83625	83626	H45AL-S-30312-R.010	new
	5/16	.010	13/16	2-1/2	3	83627	83628	H45AL-R-30312-R.010	new
	5/16	.010	1	3	3	83629	83630	H45AL-M-30312-R.010	new
	5/16	.030	7/16	2	3	83631	83632	H45AL-S-30312-R.030	new
	5/16	.030	13/16	2-1/2	3	83633	83634	H45AL-R-30312-R.030	new
	5/16	.030	1	3	3	83635	83636	H45AL-M-30312-R.030	new
	5/16	.060	7/16	2	3	83637	83638	H45AL-S-30312-R.060	new
	5/16	.060	13/16	2-1/2	3	83639	83640	H45AL-R-30312-R.060	new
3/8	5/16	.060	1	3	3	83641	83642	H45AL-M-30312-R.060	new
	3/8	.010	1/2	2	3	83643	83644	H45AL-S-30375-R.010	new
	3/8	.010	1	3	3	83645	83646	H45AL-R-30375-R.010	new
	3/8	.010	1-1/4	3-1/2	3	83647	83648	H45AL-M-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	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	
1/2	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	new
	1/2	.010	1	3	3	83653	83654	H45AL-SR-30500-R.010	new
	1/2	.010	1-1/4	3	3	83655	83656	H45AL-R-30500-R.010	new
	1/2	.010	1-5/8	4	3	83657	83658	H45AL-M-30500-R.010	new
	1/2	.010	2	4	3	83659	83660	H45AL-L-30500-R.010	new
	1/2	.020	1	3	3	83661	83662	H45AL-SR-30500-R.020	new
	1/2	.020	1-1/4	3	3	83663	83664	H45AL-R-30500-R.020	new
	1/2	.020	1-5/8	4	3	83665	83666	H45AL-M-30500-R.020	new
	1/2	.020	2	4	3	83667	83668	H45AL-L-30500-R.020	new
	1/2	.030	5/8	2-1/2	3	83669	83670	H45AL-S-30500-R.030	new
	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	new
	1/2	.060	5/8	2-1/2	3	83673	83674	H45AL-S-30500-R.060	new
	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	new
	1/2	.125	1	3	3	83677	83678	H45AL-SR-30500-R.125	new
	1/2	.125	1-1/4	3	3	83679	83680	H45AL-R-30500-R.125	new
	1/2	.125	1-5/8	4	3	83681	83682	H45AL-M-30500-R.125	new
	1/2	.125	2	4	3	83683	83684	H45AL-L-30500-R.125	new

*.0003 max TIR

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H45AL-3**New Items!****3 FLUTE - CORNER RADIUS**

45° Helix (cont.)

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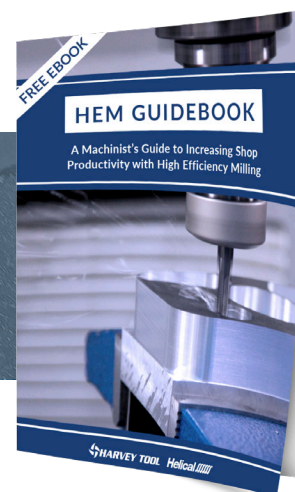
Cutter Dia.* D ₁ (h6)	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Flutes	Uncoated	Zplus Coated	Tool Description
new new new new new new new new new 5/8	5/8	.030	1-5/8	3-1/2	3	83685	83686	H45AL-R-30625-R.030
	5/8	.030	2-1/8	4	3	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
new new 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
	3/4	.125	2-1/4	5	3			

*.0003 max TIR

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3 FLUTE - SQUARE

New Items!



H45AL-RN-3

45° Helix - Reduced Neck

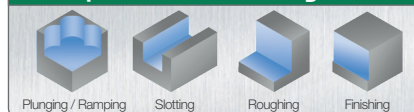
- Designed for outstanding performance and accelerated metal removal rates in aluminum and non-ferrous materials
- Designed with a high helix for improved part finish and shearing action
- High helix for increased part finish and shearing action
- Cylindrically ground to maintain edge strength
- Reduced 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 ^{+0.032"} _{-0.000"}	Overall Length L ₁ ^{+0.062"} _{-0.062"}	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description	
1/8	1/8	5/32	3	1/2	.118	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	new
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	new
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	new
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	new
	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	new
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	new
	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	new
	1/2	5/8	6	4-1/4	.475	3	19325	19327	H45AL-RN-X-30500	

continued on next page

Speeds & Feeds on Page 65



H45AL-3**New Items!****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 ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Uncoated	Zplus Coated	Tool Description
3/4	3/4	1	4	2	.712	3	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

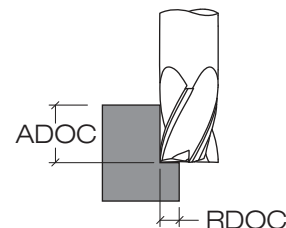
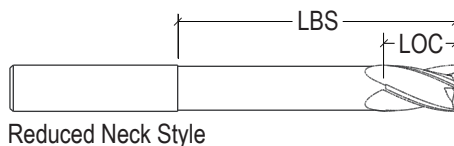
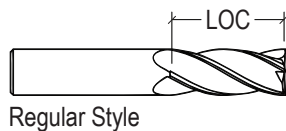
H45AL-3 / H45AL-RN-3

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

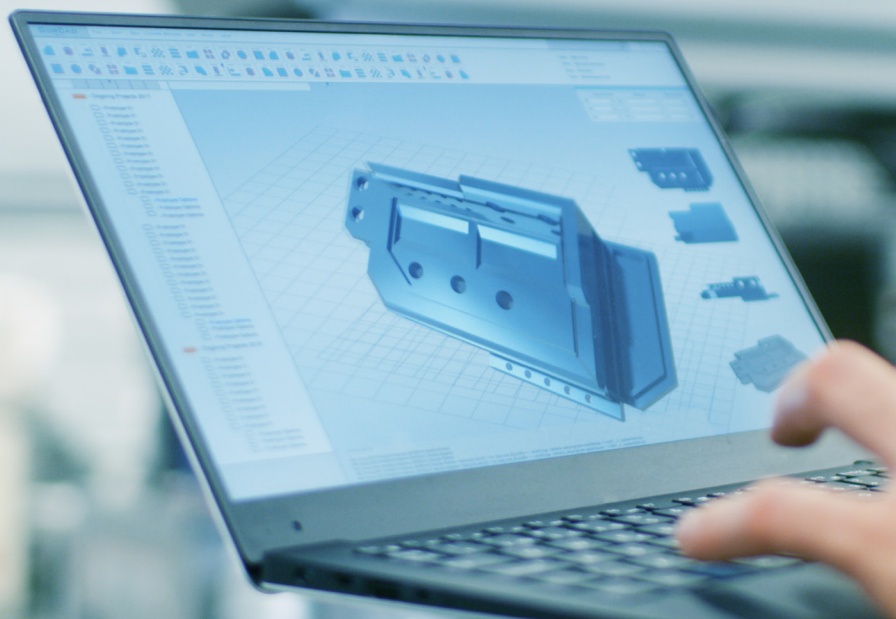
NOTES:

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.

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

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ROUGHERS

PG

new	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	68
new	4 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	70
new	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	72
new	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	74
new	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	76
new	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	79
new	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch - Reduced Neck	81
new	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch	83
new	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch - Reduced Neck	84

3 FLUTE

PG

3 Flute	Square	Variable Pitch	87
3 Flute	Corner Radius	Variable Pitch	88
3 Flute	Ball		90
3 Flute	Corner Radius		91
3 Flute	Ball	Reduced Neck	92
3 Flute	Corner Radius	Reduced Neck	93

4 FLUTE

PG

new	4 Flute	Square	Variable Pitch	95
	4 Flute	Square	Variable Pitch - Metric	97
new	4 Flute	Ball	Variable Pitch	98
new	4 Flute	Corner Radius	Variable Pitch	100
	4 Flute	Corner Radius	Variable Pitch - Metric	106
new	4 Flute	Square	Variable Pitch - Reduced Neck	108
new	4 Flute	Ball	Variable Pitch - Reduced Neck	110
new	4 Flute	Corner Radius	Variable Pitch - Reduced Neck	112

5 FLUTE

PG

new	5 Flute	Square	Variable Pitch	116
	5 Flute	Square	Variable Pitch - Metric	118
new	5 Flute	Corner Radius	Variable Pitch	119
	5 Flute	Corner Radius	Variable Pitch - Metric	125
new	5 Flute	Square	Variable Pitch - Reduced Neck	127
new	5 Flute	Corner Radius	Variable Pitch - Reduced Neck	129
	5 Flute	Square	Finisher	133

6 FLUTE

PG

	6 Flute	Square	Variable Pitch	136
	6 Flute	Square	Variable Pitch - Metric	137
new	6 Flute	Ball	Variable Pitch	138
new	6 Flute	Corner Radius	Variable Pitch	139
	6 Flute	Corner Radius	Variable Pitch - Metric	142
	6 Flute	Square	Variable Pitch - Reduced Neck	144
	6 Flute	Ball	Variable Pitch - Reduced Neck	145
	6 Flute	Corner Radius	Variable Pitch - Reduced Neck	146

7 FLUTE

PG

new	7 Flute	Square	Variable Pitch	148
	7 Flute	Square	Variable Pitch - Metric	149
new	7 Flute	Corner Radius	Variable Pitch	150
	7 Flute	Corner Radius	Variable Pitch - Metric	152
new	7 Flute	Square	Variable Pitch - Reduced Neck	154
new	7 Flute	Corner Radius	Variable Pitch - Reduced Neck	155
	7 Flute	Square	Finisher	157

MULTI-FLUTE

PG

new	Multi-Flute	Corner Radius	Finisher	159
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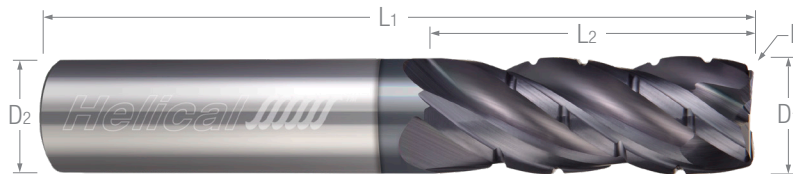
4 FLUTE - CORNER RADIUS

New Items!

HSVR-C-4

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
- *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

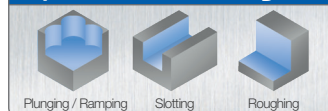


Cutter Diameter*	Shank Dia.	Corner Radius	LOC	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	Tool Description
$D_1^{+.000/-0.002}$	$D_2(h6)$	$R^{+.002/-0.002}$	$L_2^{+.032/-0.000}$	$L_1^{+.062/-0.062}$				
1/8	1/8	.010	1/4	1-1/2	4	33017		HSVR-C-S-40125-R.010
	1/8	.010	3/8	2	4	82499		HSVR-C-SR-40125-R.010
	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-R.010
	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
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 71



HSVR-C-4

New Items!

4 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter*	Shank Dia.	Corner Radius	LOC	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
	D ₁ ^{+0.000"} -0.002"	D ₂ (h6)	R ^{+0.002"} -0.002"	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"				
new	3/8	3/8	.010	1/2	2	4	83463		HSVR-C-S-40375-R.010
new		3/8	.010	7/8	3	4	83464		HSVR-C-SR-40375-R.010
new		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
new		3/8	.030	1/2	2	4	83466		HSVR-C-S-40375-R.030
new		3/8	.030	7/8	3	4	83467		HSVR-C-SR-40375-R.030
new		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
new	1/2	1/2	.010	5/8	2-1/2	4	83469		HSVR-C-S-40500-R.010
new		1/2	.010	1	3	4	83470		HSVR-C-SR-40500-R.010
new		1/2	.010	1-1/4	3	4	83471		HSVR-C-R-40500-R.010
new		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
new		1/2	.060	5/8	2-1/2	4	83473		HSVR-C-S-40500-R.060
new		1/2	.060	1	3	4	83474		HSVR-C-SR-40500-R.060
new		1/2	.060	1-1/4	3	4	83475		HSVR-C-R-40500-R.060
new		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
new		5/8	.060	1-1/4	3-1/2	4	83477		HSVR-C-SR-40625-R.060
new		5/8	.060	1-5/8	3-1/2	4	83478		HSVR-C-R-40625-R.060
new		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
new		3/4	.060	1-5/8	4	4	83480		HSVR-C-R-40750-R.060
new		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

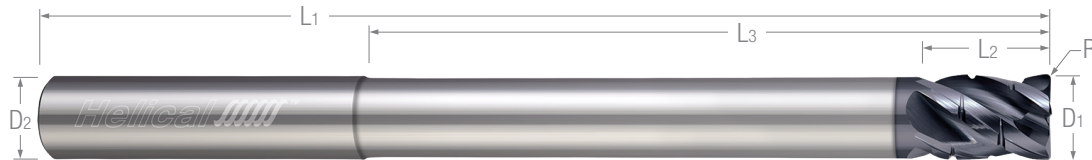
*.0005 max TIR

4 FLUTE - CORNER RADIUS

New!
HSVR-C-RN-4

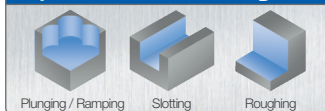
Chipbreaker Rougher - Variable Pitch - Reduced Neck

- 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
- *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.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	.020	3/8	4	3/4	.237	4	82876	HSVR-C-RN-S-40250-R.020	new
	1/4	.020	3/8	4	1-1/8	.237	4	82877	HSVR-C-RN-R-40250-R.020	new
	1/4	.020	3/8	4	2-1/8	.237	4	82878	HSVR-C-RN-M-40250-R.020	new
3/8	3/8	.020	1/2	4	1-1/8	.356	4	82879	HSVR-C-RN-S-40375-R.020	new
	3/8	.020	1/2	4	2-1/8	.356	4	82880	HSVR-C-RN-R-40375-R.020	new
	3/8	.020	1/2	6	3-1/8	.356	4	82881	HSVR-C-RN-M-40375-R.020	new
1/2	1/2	.030	5/8	4	1-1/2	.475	4	82882	HSVR-C-RN-S-40500-R.030	new
	1/2	.030	5/8	4	2-1/4	.475	4	82883	HSVR-C-RN-R-40500-R.030	new
	1/2	.030	5/8	6	3-3/8	.475	4	82884	HSVR-C-RN-M-40500-R.030	new
	1/2	.030	5/8	6	4-1/8	.475	4	82885	HSVR-C-RN-L-40500-R.030	new
3/4	3/4	.030	1	4	2	.712	4	82886	HSVR-C-RN-S-40750-R.030	new
	3/4	.030	1	6	2-1/2	.712	4	82887	HSVR-C-RN-R-40750-R.030	new
	3/4	.030	1	6	3-3/8	.712	4	82888	HSVR-C-RN-M-40750-R.030	new

* .0005 max TIR

Speeds & Feeds on Page 71


SPEEDS & FEEDS

HSVR-C-4

4 Flute - Chipbreaker Rougher - Variable Pitch

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
TOOL STEEL	A2, H13, L6, P20, S7	> 50 HRC	155	.0003	.0004	.0004	.0006	.0005	.0008	.0007	.0012	.0010	.0016	.0014	.0023	.0017	.0029
		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
SPECIALTY STEEL	A2, H13, L6, P20, S7	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
		< 75 HRB	290	.0006	.0011	.0010	.0015	.0013	.0021	.0019	.0031	.0025	.0040	.0035	.0058	.0045	.0073
AUSTENITIC STAINLESS STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	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
MARTENSITIC & FERRITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	> 50 HRC	55	.0002	.0004	.0003	.0005	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0019	.0015	.0025
		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
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	36 - 50 HRC	180	.0003	.0006	.0005	.0008	.0007	.0011	.0010	.0016	.0013	.0022	.0019	.0031	.0024	.0039
		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
GRAY CAST IRON	SAE J431, ASTM A48	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
		75 - 98 HRB	410	.0008	.0013	.0012	.0019	.0016	.0026	.0023	.0038	.0030	.0050	.0044	.0071	.0055	.0091
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	21 - 36 HRC	370	.0004	.0007	.0006	.0010	.0009	.0014	.0013	.0021	.0017	.0027	.0024	.0039	.0030	.0049
		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
		21 - 36 HRC	80	.0003	.0006	.0005	.0008	.0007	.0011	.0010	.0016	.0013	.0022	.0019	.0031	.0024	.0039
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	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
		< 75 HRB	300	.0009	.0015	.0014	.0022	.0018	.0030	.0027	.0044	.0036	.0058	.0051	.0083	.0065	.0106
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	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
		75 - 98 HRB	180	.0005	.0008	.0007	.0011	.0009	.0015	.0014	.0022	.0018	.0029	.0025	.0041	.0032	.0053
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	160	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0020	.0016	.0026	.0023	.0038	.0029	.0048
		36 - 50 HRC	160	.0004	.0007	.0006	.0010	.0008	.0014	.0012	.0020	.0016	.0026	.0023	.0038	.0029	.0048
		75 - 98 HRB	210	.0004	.0006	.0006	.0009	.0008	.0013	.0011	.0019	.0015	.0024	.0021	.0035	.0027	.0045
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	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
		< 75 HRB	210	.0004	.0006	.0006	.0009	.0008	.0013	.0011	.0019	.0015	.0024	.0021	.0035	.0027	.0045

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.

5 FLUTE - CORNER RADIUS

New Items!

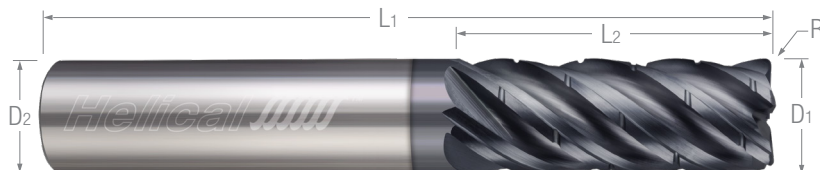


HEV-C-5

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
- 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

For increased wear resistance, see page 162 for Tplus coating



Cutter Diameter* D1 $^{+.000}_{-.002}$ "	Shank Diameter D2 (h6)	Corner Radius R $^{+.002}_{-.002}$ "	Length of Cut L2 $^{+.032}_{-.000}$ "	Overall Length L1 $^{+.062}_{-.062}$ "	Flutes	Aplus Coated	Tool Description
1/8	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
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
	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
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
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

*.0005 max TIR

Speeds & Feeds on Page 75

continued on next page



HEV-C-5



New Items!

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
	D1 $^{+.000"}_{-.002"}$	D2 (h6)	R $^{+.002"}_{-.002"}$	L2 $^{+.032"}_{-.000"}$	L1 $^{+.062"}_{-.062"}$			
new	3/8	3/8	.030	1/2	2	5	83080	HEV-C-S-50375-R.030
new		3/8	.030	3/4	2-1/2	5	83081	HEV-C-SR-50375-R.030
new		3/8	.030	1	3	5	83082	HEV-C-R-50375-R.030
new		3/8	.030	1-1/4	3	5	83083	HEV-C-M-50375-R.030
new	1/2	1/2	.010	5/8	2-1/2	5	83084	HEV-C-S-50500-R.010
new		1/2	.010	1	3	5	83085	HEV-C-SR-50500-R.010
new		1/2	.010	1-1/4	3	5	83086	HEV-C-R-50500-R.010
new		1/2	.010	1-5/8	4	5	83087	HEV-C-M-50500-R.010
new		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
		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
new		1/2	.060	3-1/8	6	5	83089	HEV-C-X-50500-R.060
	5/8	5/8	.030	3/4	3	5	59409	HEV-C-S-50625-R.030
		5/8	.030	1-1/4	3-1/2	5	59410	HEV-C-SR-50625-R.030
		5/8	.030	1-5/8	3-1/2	5	59411	HEV-C-R-50625-R.030
		5/8	.030	2-1/8	4	5	59412	HEV-C-M-50625-R.030
		5/8	.030	2-1/2	5	5	82220	HEV-C-L-50625-R.030
		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
	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
	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

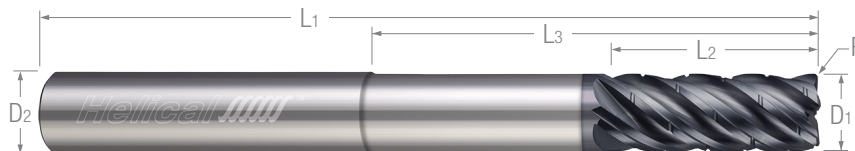
New!



HEV-C-RN-5

Chipbreaker Rougher - Variable Pitch- Reduced Neck

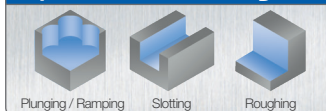
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in deep pocket High Efficiency Milling (HEM) applications
- 5 flute variable pitch and offset 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.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	.020	3/8	4	3/4	.237	5	82889	HEV-C-RN-S-50250-R.020	new
	1/4	.020	3/8	4	1-1/8	.237	5	82890	HEV-C-RN-R-50250-R.020	new
	1/4	.020	3/4	4	1-1/8	.237	5	82891	HEV-C-RNR-R-50250-R.020	new
	1/4	.020	3/8	4	2-1/8	.237	5	82892	HEV-C-RN-M-50250-R.020	new
	1/4	.020	3/4	4	2-1/8	.237	5	82893	HEV-C-RNR-M-50250-R.020	new
3/8	3/8	.020	1/2	4	1-1/8	.356	5	82894	HEV-C-RN-S-50375-R.020	new
	3/8	.020	1/2	4	2-1/8	.356	5	82895	HEV-C-RN-R-50375-R.020	new
	3/8	.020	1	4	2-1/8	.356	5	82896	HEV-C-RNR-R-50375-R.020	new
	3/8	.020	1/2	6	3-1/8	.356	5	82897	HEV-C-RN-M-50375-R.020	new
	3/8	.020	1	6	3-1/8	.356	5	82898	HEV-C-RNR-M-50375-R.020	new
1/2	1/2	.030	5/8	4	1-1/2	.475	5	82899	HEV-C-RN-S-50500-R.030	new
	1/2	.030	5/8	4	2-1/4	.475	5	82900	HEV-C-RN-R-50500-R.030	new
	1/2	.030	1-1/4	4	2-1/4	.475	5	82901	HEV-C-RNR-R-50500-R.030	new
	1/2	.030	5/8	6	3-3/8	.475	5	82902	HEV-C-RN-M-50500-R.030	new
	1/2	.030	1-1/4	6	3-3/8	.475	5	82903	HEV-C-RNR-M-50500-R.030	new
	1/2	.030	5/8	6	4-1/8	.475	5	82904	HEV-C-RN-L-50500-R.030	new
	1/2	.030	1-1/4	6	4-1/8	.475	5	82905	HEV-C-RNR-L-50500-R.030	new
3/4	3/4	.030	1	4	2	.712	5	82906	HEV-C-RN-S-50750-R.030	new
	3/4	.030	1	6	2-1/2	.712	5	82907	HEV-C-RN-R-50750-R.030	new
	3/4	.030	1-5/8	6	2-1/2	.712	5	82908	HEV-C-RNR-R-50750-R.030	new
	3/4	.030	1	6	3-3/8	.712	5	82909	HEV-C-RN-M-50750-R.030	new
	3/4	.030	1-5/8	6	3-3/8	.712	5	82910	HEV-C-RNR-M-50750-R.030	new

* .0005 max TIR

Speeds & Feeds on Page 75



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
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!

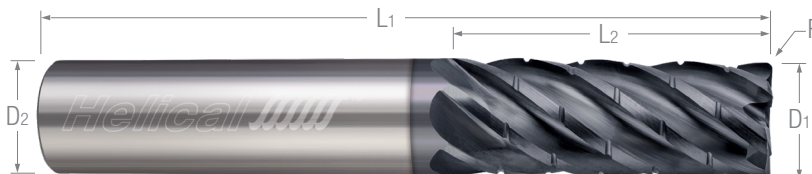


HEV-C-6

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)
- 6 flute variable pitch and offset chipbreaker geometry for optimal chip evacuation, reduced harmonics, and reduced tool pressure
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating 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 163 for *Tplus* coating

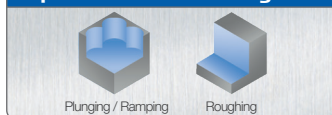


Cutter Diameter* D1 ^{+0.000"} / _{-.002"}	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} / _{-.002"}	Length of Cut L2 ^{+0.032"} / _{-.000"}	Overall Length L1 ^{+0.062"} / _{-.062"}	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	.010	3/8	2	6	83125	HEV-C-S-60250-R.010	new
	1/4	.010	1/2	2-1/2	6	83126	HEV-C-SR-60250-R.010	new
	1/4	.010	3/4	2-1/2	6	83127	HEV-C-R-60250-R.010	new
	1/4	.010	1	3	6	83128	HEV-C-M-60250-R.010	new
	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	
3/8	3/8	.010	1/2	2	6	83129	HEV-C-S-60375-R.010	new
	3/8	.010	3/4	2-1/2	6	83130	HEV-C-SR-60375-R.010	new
	3/8	.010	1	3	6	83131	HEV-C-R-60375-R.010	new
	3/8	.010	1-1/4	3	6	83132	HEV-C-M-60375-R.010	new
	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	
1/2	1/2	.010	5/8	2-1/2	6	83133	HEV-C-S-60500-R.010	new
	1/2	.010	1	3	6	83134	HEV-C-SR-60500-R.010	new
	1/2	.010	1-1/4	3	6	83135	HEV-C-R-60500-R.010	new
	1/2	.010	1-5/8	4	6	83136	HEV-C-M-60500-R.010	new
	1/2	.010	2	4	6	83137	HEV-C-L-60500-R.010	new
	1/2	.010	2-1/2	5	6	83138	HEV-C-LX-60500-R.010	new
	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	

* .0005 max TIR

Speeds & Feeds on Page 78

continued on next page



HEV-C-6



New Items!

6 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
new new 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
new new new 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

* .0005 max TIR

SPEEDS & FEEDS



HEV-C-6

6 Flute - Chipbreaker Rougher - Variable Pitch

HEV-C-6										
Material Guide		Hardness	SFM	1/8	3/16	1/4	3/8	1/2	3/4	1
				Rgh	Rgh	Rgh	Rgh	Rgh	Rgh	Rgh
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	455	.0014	.0020	.0028	.0041	.0054	.0077	.0099
		75 - 98 HRB	445	.0010	.0015	.0020	.0030	.0040	.0057	.0073
		21 - 36 HRC	400	.0007	.0010	.0013	.0020	.0026	.0037	.0047
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	390	.0009	.0013	.0018	.0026	.0034	.0049	.0063
		21 - 36 HRC	340	.0007	.0010	.0013	.0020	.0026	.0037	.0047
		36 - 50 HRC	260	.0006	.0008	.0011	.0017	.0022	.0032	.0041
		> 50 HRC	155	.0005	.0007	.0009	.0014	.0018	.0025	.0033
TOOL STEEL	A2, H13, L6, P20, S7	75 - 98 HRB	340	.0009	.0013	.0018	.0026	.0034	.0049	.0063
		21 - 36 HRC	250	.0007	.0010	.0014	.0021	.0027	.0039	.0050
		36 - 50 HRC	145	.0006	.0008	.0011	.0016	.0021	.0031	.0040
		> 50 HRC	85	.0005	.0007	.0009	.0013	.0017	.0025	.0032
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	< 75 HRB	290	.0012	.0017	.0023	.0034	.0045	.0064	.0082
		75 - 98 HRB	255	.0008	.0012	.0016	.0023	.0031	.0044	.0056
		21 - 36 HRC	175	.0007	.0010	.0014	.0021	.0027	.0039	.0051
		36 - 50 HRC	150	.0006	.0009	.0013	.0019	.0025	.0035	.0046
		> 50 HRC	55	.0004	.0006	.0008	.0012	.0015	.0022	.0028
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 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



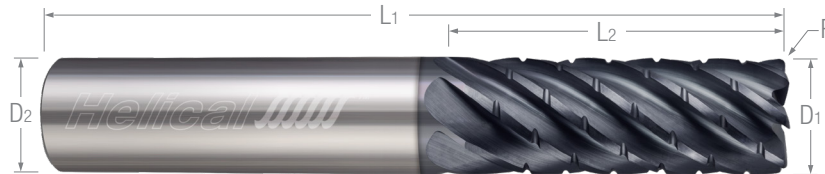
New Items!

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
- *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

For increased wear resistance, see page 164 for *Tplus* coating



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Cutter Diameter* D1 ^{+0.000"} -0.002"	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Flutes	<i>Aplus</i> Coated	Tool Description
1/4	1/4	.020	3/8	2	7	59420	HEV-C-S-70250-R.020
	1/4	.020	1/2	2	7	59421	HEV-C-SR-70250-R.020
	1/4	.020	3/4	2-1/2	7	59422	HEV-C-R-70250-R.020
	1/4	.020	1	3	7	82249	HEV-C-M-70250-R.020
	1/4	.020	1-1/4	3	7	83163	HEV-C-L-70250-R.020
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
	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
1/2	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
	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

continued on next page

Speeds & Feeds on Page 82



7 FLUTE - CORNER RADIUS

New Items!



HEV-C-7

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description	
$D_1^{+.000"}_{-.002"}$	$D_2 (h6)$	$R^{+.002"}_{-.002"}$	$L_2^{+.032"}_{-.000"}$	$L_1^{+.062"}_{-.062"}$				
5/8	5/8	.030	3/4	3	7	83173	HEV-C-S-70625-R.030	new
	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	new
	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	new
	3/4	.030	3-1/4	6	7	83175	HEV-C-LX-70750-R.030	
	3/4	.060	1-1/4	3-1/2	7	83176	HEV-C-SR-70750-R.060	new
	3/4	.060	1-5/8	4	7	81986	HEV-C-R-70750-R.060	
	3/4	.060	2-1/4	5	7	81987	HEV-C-M-70750-R.060	
	3/4	.060	2-3/4	5	7	81988	HEV-C-L-70750-R.060	

* .0005 max TIR

HEV-C-RN-7

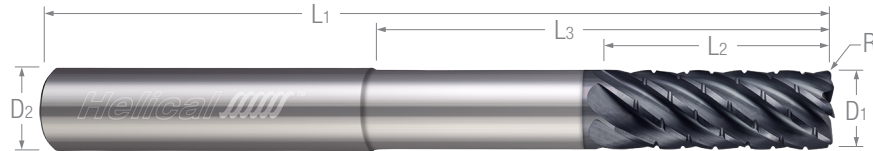


New!

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
- *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.* $D_1^{+.000/-0.002}$	Shank Dia. $D_2 (h6)$	Corner Radius $R^{+.002/-0.002}$	Length of Cut $L_2^{+.032/-0.000}$	OAL $L_1^{+.062/-0.062}$	Reach (LBS) L_3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
new	1/4	1/4	.020	3/4	4	1-1/8	.237	7	82927	HEV-C-RNR-R-70250-R.020
new		1/4	.020	3/4	4	2-1/8	.237	7	82928	HEV-C-RNR-M-70250-R.020
new	3/8	3/8	.020	1	4	2-1/8	.356	7	82929	HEV-C-RNR-R-70375-R.020
new		3/8	.020	1	6	3-1/8	.356	7	82930	HEV-C-RNR-M-70375-R.020
new	1/2	1/2	.030	1-1/4	4	2-1/4	.475	7	82931	HEV-C-RNR-R-70500-R.030
new		1/2	.030	1-1/4	6	3-3/8	.475	7	82932	HEV-C-RNR-M-70500-R.030
new		1/2	.030	1-1/4	6	4-1/8	.475	7	82933	HEV-C-RNR-L-70500-R.030
new		1/2	.060	1-1/4	4	2-1/4	.475	7	82934	HEV-C-RNR-R-70500-R.060
new		1/2	.060	1-1/4	6	3-3/8	.475	7	82935	HEV-C-RNR-M-70500-R.060
new		1/2	.060	1-1/4	6	4-1/8	.475	7	82936	HEV-C-RNR-L-70500-R.060
new	3/4	3/4	.030	1-5/8	6	2-1/2	.712	7	82937	HEV-C-RNR-R-70750-R.030
new		3/4	.030	1-5/8	6	3-3/8	.712	7	82938	HEV-C-RNR-M-70750-R.030
new		3/4	.060	1-5/8	6	2-1/2	.712	7	82939	HEV-C-RNR-R-70750-R.060
new		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 82



Roughing

SPEEDS & FEEDS



HEV-C-7

7 Flute - Chipbreaker Rougher - Variable Pitch

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

New Items!

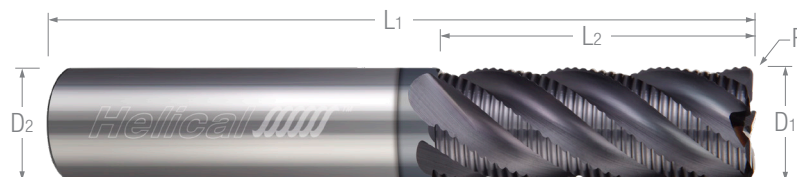
MULTI-FLUTE - CORNER RADIUS

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
- *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

For increased wear resistance, see page 165 for *Tplus* coating



	Cutter Diameter $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Corner Radius $R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
new	1/4	1/4	.030	3/8	2	4	54017	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	HXVR-R-40250-R.030
		1/4	.030	1	3	4	82860	HXVR-M-40250-R.030
new	3/8	3/8	.040	1/2	2	4	54092	HXVR-S-40375-R.040
		3/8	.040	1/2	2	5	55092	HXVR-S-50375-R.040
		3/8	.040	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	HXVR-R-40375-R.040
		3/8	.040	1	3	5	55107	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
new	1/2	1/2	.040	5/8	2-1/2	4	54152	HXVR-S-40500-R.040
		1/2	.040	5/8	2-1/2	5	55152	HXVR-S-50500-R.040
		1/2	.040	1	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	HXVR-R-40500-R.040
		1/2	.040	1-1/4	3	5	55182	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
new	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
new	3/4	3/4	.060	1	3	4	54302	HXVR-S-40750-R.060
		3/4	.060	1	3	5	55302	HXVR-S-50750-R.060
		3/4	.060	1-5/8	4	4	54317	HXVR-R-40750-R.060
		3/4	.060	1-5/8	4	5	55317	HXVR-R-50750-R.060
		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

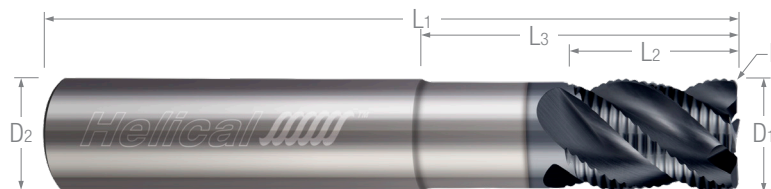
* .0005 max TIR

MULTI-FLUTE - CORNER RADIUS

New Items!
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
- *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.* D1 $^{+.0001}_{-.002}$	Shank Dia. D2 (h6)	Corner Radius R $^{+.002}_{-.002}$	Length of Cut L2 $^{+.032}_{-.000}$	Overall Length L1 $^{+.062}_{-.062}$	Reach (LBS) L3	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	new
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	new
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	new
	1/2	.040	5/8	4	2-1/4	.475	5	82874	HXVR-RN-M-50500-R.040	new
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	new
1	1	.060	1-1/4	5	2-5/8	.950	5	65377	HXVR-RN-R-51000-R.060	

* .0005 max TIR



Shank Tolerances, Collet Fits, & h6 Benefits

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

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

Speeds & Feeds on Pages 85-86



Plunging / Ramping



Slotting



Roughing

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
TOOL STEEL	A2, H13, L6, P20, S7	> 50 HRC	155	.0003	.0004	.0004	.0006	.0005	.0008	.0008	.0013	.0010	.0016	.0015	.0023	.0019	.0030
		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
SPECIALTY STEEL	A2, H13, L6, P20, S7	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
		< 75 HRB	290	.0003	.0005	.0005	.0008	.0008	.0012	.0011	.0018	.0015	.0023	.0021	.0034	.0027	.0043
AUSTENITIC STAINLESS STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	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
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	> 50 HRC	55	.0002	.0003	.0003	.0005	.0005	.0007	.0007	.0011	.0009	.0014	.0013	.0020	.0016	.0026
		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
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	36 - 50 HRC	180	.0003	.0005	.0005	.0007	.0007	.0010	.0010	.0016	.0013	.0020	.0019	.0029	.0024	.0037
		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
GRAY CAST IRON	SAE J431, ASTM A48	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
		75 - 98 HRB	410	.0008	.0012	.0011	.0018	.0017	.0026	.0025	.0039	.0033	.0052	.0047	.0074	.0060	.0094
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	21 - 36 HRC	370	.0004	.0007	.0006	.0010	.0009	.0014	.0014	.0021	.0018	.0028	.0026	.0040	.0033	.0051
		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
		21 - 36 HRC	250	.0004	.0006	.0006	.0009	.0008	.0013	.0012	.0019	.0016	.0025	.0023	.0036	.0029	.0046
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	75 - 98 HRB	180	.0004	.0007	.0007	.0010	.0010	.0015	.0015	.0023	.0019	.0030	.0027	.0043	.0035	.0054
		21 - 36 HRC	160	.0004	.0006	.0006	.0009	.0009	.0014	.0013	.0021	.0017	.0027	.0025	.0039	.0032	.0050
		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

HXVR-5

5 Flute - Knuckle Rougher - Variable Pitch

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	.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

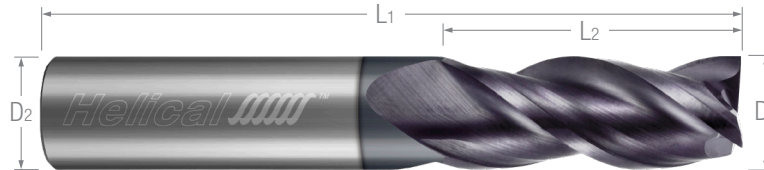
IPT values shown are for 2.5xD length of cut tools, and should be adjusted for longer or shorter lengths of cut. Values shown are for non-reached tools. For tools with reaches greater than 3xD, IPT should be reduced. For more accurate running parameters, please refer to Machining Advisor Pro.

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

* .0005 max TIR

Speeds & Feeds on Page 89

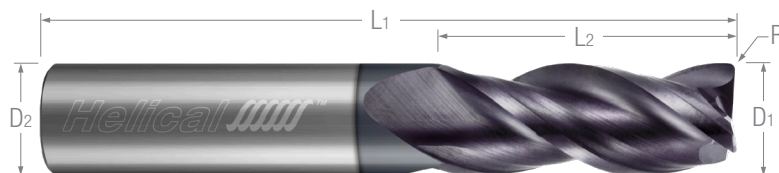


3 FLUTE - CORNER RADIUS

HSV-3

Variable Pitch

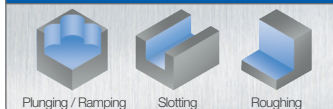
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Designed with variable pitch and 3 flutes for reduced harmonics, increased chip clearance, and higher quality parts in full slotting and heavy roughing applications
- Eccentric relief for maximum edge strength
- Center cutting
- h6 shank tolerance for high precision tool holders
- *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* D1 $^{+.000}_{-.002}$ "	Shank Diameter D2 (h6)	Corner Radius R $^{+.002}_{-.002}$ "	Length of Cut L2 $^{+.032}_{-.000}$ "	Overall Length L1 $^{+.062}_{-.062}$ "	Flutes	<i>Aplus</i> 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 89



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

3 Flute

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:

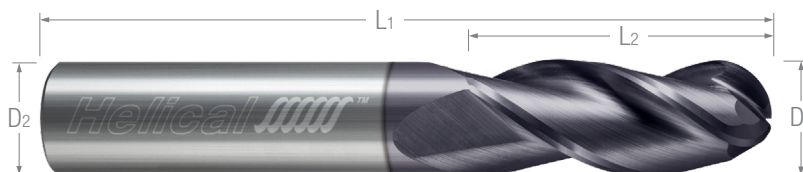
Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

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

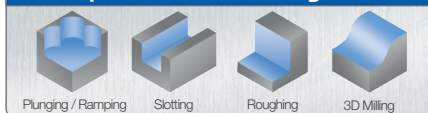
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *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* D1 $^{+.000}$ $_{-.002}$ "	Shank Diameter D2 (h6)	Length of Cut L2 $^{+.032}$ $_{-.000}$ "	Overall Length L1 $^{+.062}$ $_{-.062}$ "	Flutes	<i>Aplus</i> 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

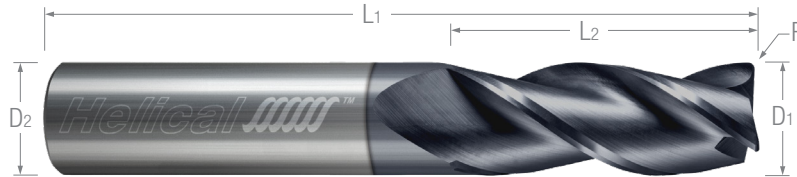
Speeds & Feeds on Page 94



HST-3

3 FLUTE - CORNER RADIUS

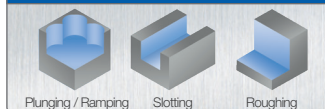
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- 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* D1 ^{+0.000"} -0.002"	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Flutes	Aplus 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 94

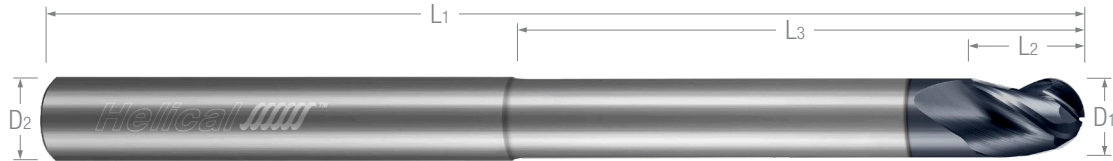


3 FLUTE - BALL

HST-RN-3

Reduced Neck

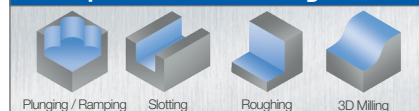
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *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*	Shank Diameter	Length of Cut	Overall Length	Reach (LBS)	Neck Diameter	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D_2 \text{ (h6)}$	$L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$	L_3				
1/8	1/8	5/32	3	3/8	.118	3	13017	HST-RN-S-30125-BN
	1/8	5/32	3	1/2	.118	3	13032	HST-RN-R-30125-BN
	1/8	5/32	3	5/8	.118	3	13047	HST-RN-M-30125-BN
3/16	3/16	7/32	3	1/2	.178	3	13077	HST-RN-R-30187-BN
	3/16	7/32	3	3/4	.178	3	13092	HST-RN-M-30187-BN
1/4	1/4	3/8	4	3/4	.237	3	13112	HST-RN-S-30250-BN
	1/4	3/8	4	1-1/8	.237	3	13122	HST-RN-R-30250-BN
	1/4	3/8	4	2-1/8	.237	3	13137	HST-RN-M-30250-BN
5/16	5/16	7/16	4	1-1/8	.296	3	13157	HST-RN-R-30312-BN
	5/16	7/16	4	2-1/8	.296	3	13167	HST-RN-M-30312-BN
3/8	3/8	1/2	4	1-1/8	.356	3	13197	HST-RN-R-30375-BN
	3/8	1/2	6	2-3/8	.356	3	13212	HST-RN-M-30375-BN
	3/8	1/2	6	3-3/8	.356	3	13227	HST-RN-L-30375-BN
	3/8	1/2	6	4	.356	3	13232	HST-RN-X-30375-BN
1/2	1/2	5/8	4	1-3/8	.475	3	13302	HST-RN-R-30500-BN
	1/2	5/8	6	2-3/8	.475	3	13317	HST-RN-M-30500-BN
	1/2	5/8	6	3-3/8	.475	3	13332	HST-RN-L-30500-BN
	1/2	5/8	6	4-1/8	.475	3	13347	HST-RN-X-30500-BN

* .0005 max TIR

Speeds & Feeds on Page 94

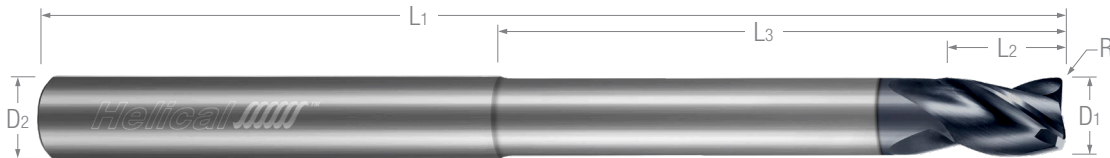


HST-RN-3

3 FLUTE - CORNER RADIUS

Reduced Neck

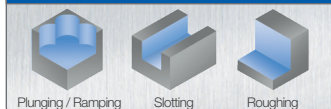
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Designed for excellent chip evacuation in slotting, pocketing, and roughing applications
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *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.* D1 ^{+0.001"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	.010	5/32	3	3/8	.118	3	10017	HST-RN-S-30125-R.010
	1/8	.010	5/32	3	5/8	.118	3	10047	HST-RN-M-30125-R.010
3/16	3/16	.010	7/32	3	3/4	.178	3	10092	HST-RN-M-30187-R.010
1/4	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 94



SPEEDS & FEEDS

HST-3

3 Flute

3 Flute

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
Tool Steel	A2, H13, L6, P20, S7	> 50 HRC	155	.0002	.0004	.0003	.0006	.0004	.0007	.0006	.0011	.0008	.0014	.0012	.0021	.0015	.0027
		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
Specialty Steel	A2, H13, L6, P20, S7	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
		< 75 HRB	290	.0006	.0010	.0008	.0015	.0011	.0019	.0016	.0029	.0021	.0037	.0030	.0053	.0038	.0068
Austenitic Stainless Steel	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	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
Martensitic & Ferritic Stainless Steel	403, 410, 416, 420, 440, 430, 446	> 50 HRC	55	.0002	.0003	.0003	.0005	.0004	.0007	.0005	.0010	.0007	.0012	.0010	.0018	.0013	.0023
		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
PH Stainless Steel	15-5, 17-4, Carpenter 450, Carpenter 465	36 - 50 HRC	180	.0003	.0005	.0004	.0008	.0006	.0010	.0009	.0015	.0011	.0020	.0016	.0029	.0020	.0037
		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
Gray Cast Iron	SAE J431, ASTM A48	36 - 50 HRC	145	.0003	.0005	.0004	.0007	.0005	.0009	.0008	.0014	.0010	.0018	.0014	.0026	.0018	.0033
		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
		36 - 50 HRC	260	.0003	.0005	.0004	.0008	.0006	.0010	.0009	.0015	.0011	.0020	.0016	.0029	.0020	.0037
Nodular (Ductile) Cast Iron	ASTM A536, ASTM 897	36 - 50 HRC	135	.0002	.0003	.0003	.0005	.0004	.0007	.0005	.0010	.0007	.0013	.0010	.0018	.0013	.0023
		75 - 98 HRB	285	.0006	.0010	.0008	.0015	.0011	.0020	.0017	.0030	.0022	.0038	.0031	.0056	.0040	.0072
		21 - 36 HRC	250	.0005	.0008	.0007	.0013	.0009	.0017	.0014	.0025	.0018	.0032	.0026	.0047	.0033	.0060
Pure Nickel	Nickel 200, Nickel 201	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
Nickel Alloy	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	300	.0008	.0014	.0012	.0021	.0015	.0027	.0023	.0041	.0030	.0053	.0043	.0077	.0055	.0099
		21 - 36 HRC	275	.0007	.0012	.0010	.0018	.0013	.0023	.0019	.0034	.0025	.0045	.0036	.0065	.0046	.0083
		36 - 50 HRC	250	.0005	.0009	.0007	.0013	.0010	.0017	.0014	.0026	.0019	.0033	.0027	.0049	.0034	.0062
Pure Titanium	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	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
		75 - 98 HRB	210	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0017	.0013	.0022	.0018	.0032	.0023	.0041
Titanium Alloy	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	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
		75 - 98 HRB	210	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0017	.0013	.0022	.0018	.0032	.0023	.0041
Cobalt Alloy	ASTM F562, ASTM F90, ASTM F75, ASTM F799	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
		75 - 98 HRB	210	.0003	.0006	.0005	.0009	.0007	.0012	.0010	.0017	.0013	.0022	.0018	.0032	.0023	.0041

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

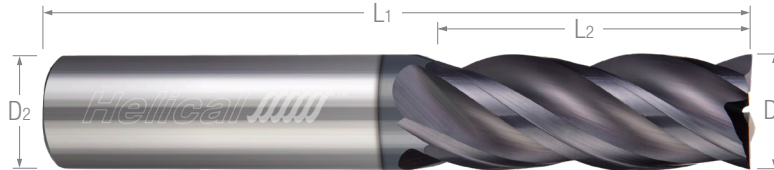
New Item!

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
- *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

For increased wear resistance, see page 166 for *Tplus* coating

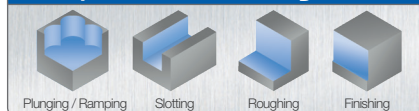


Cutter Diameter* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter D_2 (h6)	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + 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
5/32	3/16	3/16	2	4	30047		HSV-S-40156
	3/16	7/16	2-1/2	4	30062		HSV-R-40156
	3/16	9/16	2-1/2	4	81638		HSV-M-40156
	3/16	3/4	2-1/2	4	82254		HSV-ML-40156
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
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

* .0005 max TIR

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Speeds & Feeds on Page 115



4 FLUTE - SQUARE

New Item!

HSV-4

Variable Pitch (cont.)

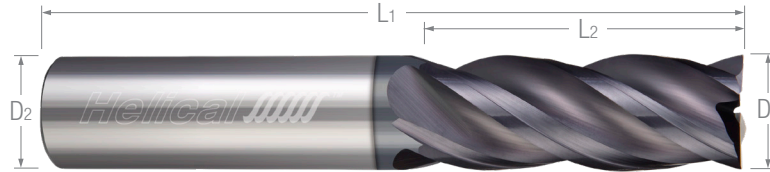
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Cutter Diameter* $D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Length of Cut $L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	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		HSV-M-40312
	5/16	1-9/16	4	4	82257		HSV-ML-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
13/32	7/16	1/2	2-3/4	4	30362		HSV-S-40406
7/16	7/16	5/8	2-3/4	4	30407		HSV-S-40437
	7/16	7/8	2-3/4	4	30422		HSV-R-40437
	7/16	1-1/8	3-1/2	4	30437		HSV-M-40437
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		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		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
3/4	3/4	7/8	3	4	30632		HSV-S-40750
	3/4	1-1/4	4	4	30647		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
1	1	1-1/2	4	4	30707		HSV-S-41000
	1	2	4-1/2	4	30722		HSV-R-41000
	1	2-5/8	5	4	30737		HSV-M-41000
	1	3	6	4	30742		HSV-ML-41000
	1	4-1/4	7	4	30752		HSV-L-41000

* .0005 max TIR

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
- *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* D1 $+0.00$ -0.05 mm	Shank Diameter D2 (h6)	Length of Cut L2 $+0.80$ -0.00 mm	Overall Length L1 $+1.60$ -1.60 mm	Flutes	<i>Aplus</i> 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 115

4 FLUTE - BALL

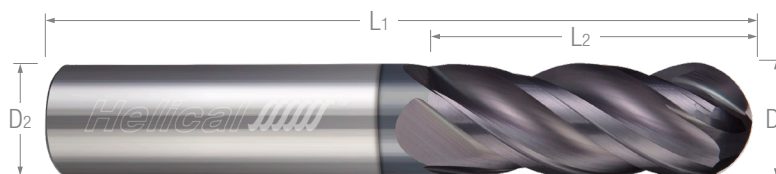
New Items!

HSV-4

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
- *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

For increased wear resistance, see page 168 for *Tplus* coating



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D1^{+.000}_{-.002}$	$D2 (h6)$	$L2^{+.032}_{-.000}$	$L1^{+.062}_{-.062}$			
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
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	3/16	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
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	5/16	1/2	2	4	56227	HSV-S-40312-BN
	5/16	3/4	2-1/2	4	56242	HSV-R-40312-BN
	5/16	1	2-1/2	4	81678	HSV-A-40312-BN
	5/16	1-1/4	3	4	56257	HSV-M-40312-BN
	5/16	1-9/16	4	4	82513	HSV-L-40312-BN
3/8	3/8	1/2	2	4	56317	HSV-S-40375-BN
	3/8	7/8	3	4	56332	HSV-SR-40375-BN
	3/8	1	3	4	56337	HSV-R-40375-BN
	3/8	1-1/4	3	4	56347	HSV-M-40375-BN
	3/8	1-1/2	3	4	82514	HSV-L-40375-BN

*.0005 max TIR

Speeds & Feeds on Page 115

continued on next page



HSV-4

New Items!

4 FLUTE - BALL

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* $D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Length of Cut $L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$	Flutes	Aplus Coated	Tool Description
7/16	7/16	5/8	2-3/4	4	56407	HSV-S-40437-BN
	7/16	7/8	2-3/4	4	56422	HSV-R-40437-BN
	7/16	1-1/8	3-1/2	4	56437	HSV-M-40437-BN
1/2	1/2	5/8	2-1/2	4	56497	HSV-S-40500-BN
	1/2	1	3	4	56512	HSV-SR-40500-BN
	1/2	1-1/4	3	4	56527	HSV-R-40500-BN
	1/2	1-5/8	4	4	56542	HSV-M-40500-BN
	1/2	2	4	4	81679	HSV-L-40500-BN
	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	3-1/4	6	4	56617	HSV-L-40625-BN
3/4	3/4	7/8	3	4	56632	HSV-S-40750-BN
	3/4	1-1/4	4	4	56647	HSV-SR-40750-BN
	3/4	1-5/8	4	4	56662	HSV-R-40750-BN
	3/4	2-1/4	5	4	56677	HSV-M-40750-BN
	3/4	3-1/4	6	4	56692	HSV-L-40750-BN
1	1	1-1/2	4	4	56707	HSV-S-41000-BN
	1	2	4- 1/2	4	56722	HSV-R-41000-BN
	1	2-5/8	5	4	56737	HSV-M-41000-BN
	1	3	6	4	56742	HSV-ML-41000-BN
	1	4-1/4	7	4	56752	HSV-L-41000-BN

* .0005 max TIR



Ball Nose Milling Strategy Guide

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

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

4 FLUTE - CORNER RADIUS

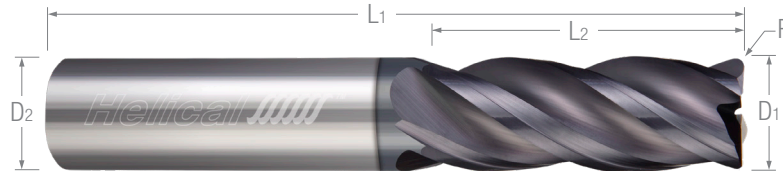
New Items!

HSV-4

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
- *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

For increased wear resistance, see page 169 for *Tplus* coating



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$				
1/8	1/8	.010	1/4	1-1/2	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
5/32	3/16	.010	3/16	2	4	31047		HSV-S-40156-R.010
	3/16	.010	7/16	2-1/2	4	31062		HSV-R-40156-R.010
	3/16	.010	9/16	2-1/2	4	81653		HSV-M-40156-R.010
	3/16	.030	3/16	2	4	82279		HSV-S-40156-R.030
	3/16	.030	7/16	2-1/2	4	82280		HSV-R-40156-R.030

* .0005 max TIR

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Speeds & Feeds on Page 115



HSV-4

New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
$D_1^{+.000''}_{-.002''}$	$D_2(h6)$	$R^{+.002''}_{-.002''}$	$L_2^{+.032''}_{-.000''}$	$L_1^{+.062''}_{-.062''}$				
new new new new new new new	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
	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
new	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		HSV-SR-40250-R.030
	1/4	.030	3/4	2-1/2	4	43152		HSV-R-40250-R.030
	1/4	.030	1	3	4	43167		HSV-M-40250-R.030
	1/4	.030	1-1/4	3	4	82291		HSV-L-40250-R.030
	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

*.0005 max TIR

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4 FLUTE - CORNER RADIUS

New Items!

HSV-4

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
$D_1^{+.000"}_{-.002"}\)$	$D_2(h6)$	$R^{+.002"}_{-.002"}\)$	$L_2^{+.032"}_{-.000"}\)$	$L_1^{+.062"}_{-.062"}\)$				
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	1-1/4	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		HSV-R-40312-R.020
	5/16	.020	1	2-1/2	4	81660		HSV-A-40312-R.020
	5/16	.020	1-1/4	3	4	31257		HSV-M-40312-R.020
	5/16	.020	1-9/16	4	4	82296		HSV-ML-40312-R.020
	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	1-1/4	3	4	43257		HSV-M-40312-R.030
	5/16	.060	1/2	2	4	43228		HSV-S-40312-R.060
	5/16	.060	3/4	2-1/2	4	43243		HSV-R-40312-R.060
	5/16	.060	1-1/4	3	4	43258		HSV-M-40312-R.060
3/8	3/8	.010	1/2	2	4	81661		HSV-S-40375-R.010
	3/8	.010	7/8	3	4	81662		HSV-SR-40375-R.010
	3/8	.010	1-1/4	3	4	81663		HSV-M-40375-R.010
	3/8	.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		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		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		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		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	15/16	2-3/4	4	31377		HSV-R-40406-R.020

*.0005 max TIR

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HSV-4

New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
D1 ^{+0.000"} -0.002"	D2 (h6)	R ^{+0.002"} -0.002"	L2 ^{+0.032"} -0.000"	L1 ^{+0.062"} -0.062"				
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
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	.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		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		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		HSV-S-40500-R.060
	1/2	.060	1	3	4	43512		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		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		HSV-M-40500-R.125	
1/2	.125	2	4	4	83237		HSV-L-40500-R.125	

* .0005 max TIR

continued on next page

4 FLUTE - CORNER RADIUS

New Items!

HSV-4

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
D1 ^{+0.000"} -0.002"	D2 (h6)	R ^{+0.002"} -0.002"	L2 ^{+0.032"} -0.000"	L1 ^{+0.062"} -0.062"				
5/8	5/8	.030	3/4	3	4	31557		HSV-S-40625-R.030
	5/8	.030	1-1/4	3-1/2	4	31572	31572W	HSV-SR-40625-R.030
	5/8	.030	1-5/8	3-1/2	4	31587	31587W	HSV-R-40625-R.030
	5/8	.030	2	4	4	31602	31602W	HSV-M-40625-R.030
	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
	5/8	.060	3/4	3	4	43557		HSV-S-40625-R.060
	5/8	.060	1-1/4	3-1/2	4	43572		HSV-SR-40625-R.060
	5/8	.060	1-5/8	3-1/2	4	43587		HSV-R-40625-R.060
	5/8	.060	2	4	4	43602		HSV-M-40625-R.060
	5/8	.060	3-1/4	6	4	43617		HSV-L-40625-R.060
	5/8	.090	3/4	3	4	43558		HSV-S-40625-R.090
	5/8	.090	1-1/4	3-1/2	4	43573		HSV-SR-40625-R.090
	5/8	.090	1-5/8	3-1/2	4	43588		HSV-R-40625-R.090
	5/8	.090	2	4	4	43603		HSV-M-40625-R.090
	5/8	.090	3-1/4	6	4	43618		HSV-L-40625-R.090
	5/8	.125	3/4	3	4	43559		HSV-S-40625-R.125
	5/8	.125	1-1/4	3-1/2	4	43574		HSV-SR-40625-R.125
	5/8	.125	1-5/8	3-1/2	4	43589		HSV-R-40625-R.125
	5/8	.125	2	4	4	43604		HSV-M-40625-R.125
	5/8	.125	3-1/4	6	4	43619		HSV-L-40625-R.125
3/4	3/4	.015	1-1/4	4	4	81671		HSV-SR-40750-R.015
	3/4	.015	1-5/8	4	4	81672		HSV-R-40750-R.015
	3/4	.030	7/8	3	4	31632	31632W	HSV-S-40750-R.030
	3/4	.030	1-1/4	4	4	31647	31647W	HSV-SR-40750-R.030
	3/4	.030	1-5/8	4	4	31662	31662W	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	.060	7/8	3	4	43632		HSV-S-40750-R.060
	3/4	.060	1-1/4	4	4	43647		HSV-SR-40750-R.060
	3/4	.060	1-5/8	4	4	43662		HSV-R-40750-R.060
	3/4	.060	2-1/4	5	4	43677		HSV-M-40750-R.060
	3/4	.060	3-1/4	6	4	43692		HSV-L-40750-R.060
	3/4	.090	7/8	3	4	43633		HSV-S-40750-R.090
	3/4	.090	1-1/4	4	4	43648		HSV-SR-40750-R.090
	3/4	.090	1-5/8	4	4	43663		HSV-R-40750-R.090
	3/4	.090	2-1/4	5	4	43678		HSV-M-40750-R.090
	3/4	.090	3-1/4	6	4	43693		HSV-L-40750-R.090
	3/4	.125	7/8	3	4	43634		HSV-S-40750-R.125
	3/4	.125	1-1/4	4	4	43649		HSV-SR-40750-R.125
	3/4	.125	1-5/8	4	4	43664		HSV-R-40750-R.125
	3/4	.125	2-1/4	5	4	43679		HSV-M-40750-R.125
	3/4	.125	3-1/4	6	4	43694		HSV-L-40750-R.125

* .0005 max TIR

continued on next page

HSV-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	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
3/4	3/4	.190	7/8	3	4	43635		HSV-S-40750-R.190
	3/4	.190	1-1/4	4	4	43650		HSV-SR-40750-R.190
	3/4	.190	1-5/8	4	4	43665		HSV-R-40750-R.190
	3/4	.190	2-1/4	5	4	43680		HSV-M-40750-R.190
	3/4	.190	3-1/4	6	4	43695		HSV-L-40750-R.190
	3/4	.250	7/8	3	4	43636		HSV-S-40750-R.250
	3/4	.250	1-1/4	4	4	43651		HSV-SR-40750-R.250
	3/4	.250	1-5/8	4	4	43666		HSV-R-40750-R.250
	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		HSV-R-41000-R.030
	1	.030	2-5/8	5	4	31737		HSV-M-41000-R.030
	1	.030	3	6	4	31742		HSV-ML-41000-R.030
	1	.030	4-1/4	7	4	31752		HSV-L-41000-R.030
	1	.030	5-1/4	9	4	82302		HSV-LX-41000-R.030
	1	.060	1-1/2	4	4	43707		HSV-S-41000-R.060
	1	.060	2	4-1/2	4	43722		HSV-R-41000-R.060
	1	.060	2-5/8	5	4	43737		HSV-M-41000-R.060
	1	.060	3	6	4	43742		HSV-ML-41000-R.060
	1	.060	4-1/4	7	4	43752		HSV-L-41000-R.060
	1	.090	1-1/2	4	4	43708		HSV-S-41000-R.090
	1	.090	2	4-1/2	4	43723		HSV-R-41000-R.090
	1	.090	2-5/8	5	4	43738		HSV-M-41000-R.090
	1	.090	3	6	4	43743		HSV-ML-41000-R.090
	1	.090	4-1/4	7	4	43753		HSV-L-41000-R.090
	1	.125	1-1/2	4	4	43709		HSV-S-41000-R.125
	1	.125	2	4-1/2	4	43724		HSV-R-41000-R.125
	1	.125	2-5/8	5	4	43739		HSV-M-41000-R.125
	1	.125	3	6	4	43744		HSV-ML-41000-R.125
	1	.125	4-1/4	7	4	43754		HSV-L-41000-R.125
	1	.190	1-1/2	4	4	43710		HSV-S-41000-R.190
	1	.190	2	4-1/2	4	43725		HSV-R-41000-R.190
	1	.190	2-5/8	5	4	43740		HSV-M-41000-R.190
	1	.190	3	6	4	43745		HSV-ML-41000-R.190
	1	.190	4-1/4	7	4	43755		HSV-L-41000-R.190
	1	.250	1-1/2	4	4	43711		HSV-S-41000-R.250
	1	.250	2	4-1/2	4	43726		HSV-R-41000-R.250
	1	.250	2-5/8	5	4	43741		HSV-M-41000-R.250
	1	.250	3	6	4	43746		HSV-ML-41000-R.250
	1	.250	4-1/4	7	4	43756		HSV-L-41000-R.250

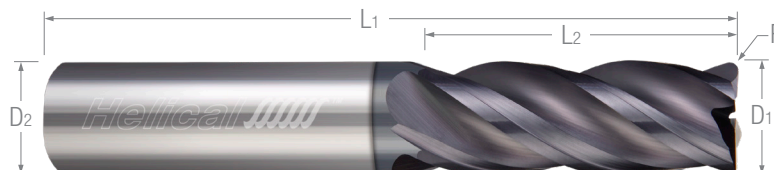
* .0005 max TIR

4 FLUTE - CORNER RADIUS - METRIC

MHSV-4
METRIC

Variable Pitch

- 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

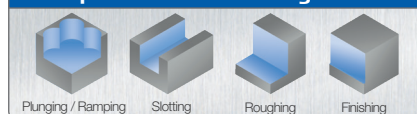


Cutter Dia.* D ₁ ^{+0.0 mm} _{-.05 mm}	Shank Diameter D ₂ (h6)	Corner Radius R ^{+0.05 mm} _{-.05 mm}	Length of Cut L ₂ ^{+0.80 mm} _{-.00 mm}	Overall Length L ₁ ^{+1.60 mm} _{-1.60 mm}	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	4	59459	MHSV-015-40600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	4	59477	MHSV-020-40600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	4	59511	MHSV-030-40600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	4	59460	MHSV-015-40600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	4	59478	MHSV-020-40600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	4	59512	MHSV-030-40600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	4	59462	MHSV-015-40800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	4	59480	MHSV-020-40800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	4	59514	MHSV-030-40800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	4	59463	MHSV-015-40800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	4	59481	MHSV-020-40800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	4	59515	MHSV-030-40800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	4	59465	MHSV-015-41000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	4	59483	MHSV-020-41000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	4	59497	MHSV-025-41000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	4	59466	MHSV-015-41000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	4	59484	MHSV-020-41000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	4	59498	MHSV-025-41000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	4	59468	MHSV-015-41200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	4	59486	MHSV-020-41200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	4	59500	MHSV-025-41200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	4	59469	MHSV-015-41200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	4	59487	MHSV-020-41200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	4	59501	MHSV-025-41200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	4	59471	MHSV-015-41600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	4	59489	MHSV-020-41600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	4	59503	MHSV-025-41600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	4	59472	MHSV-015-41600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	4	59490	MHSV-020-41600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	4	59504	MHSV-025-41600-R1.00

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 115



MHSV-4**METRIC****4 FLUTE - CORNER RADIUS - METRIC**

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.00 mm} -0.05 mm	Shank Diameter D ₂ (h6)	Corner Radius R ^{+0.05 mm} -0.05 mm	Length of Cut L ₂ ^{+0.80 mm} -0.00 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	4	59474	MHSV-015-42000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	4	59492	MHSV-020-42000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	4	59506	MHSV-025-42000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	4	59475	MHSV-015-42000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	4	59493	MHSV-020-42000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	4	59507	MHSV-025-42000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	4	59495	MHSV-020-42500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	4	59509	MHSV-025-42500-R1.00

*.013 mm max TIR

**8 Ways You're Killing Your End Mill**

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

Read more on helical.blog/intheloupe

4 FLUTE - SQUARE

New Items!

HSV-RN-4

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
- *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

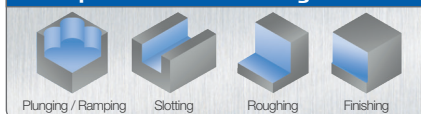


Cutter Dia.* D1 $^{+.000}_{-.002}$ "	Shank Diameter D2 (h6)	Length of Cut L2 $^{+.032}_{-.000}$ "	Overall Length L1 $^{+.062}_{-.062}$ "	Reach (LBS) L3	Neck Diameter	Flutes	Aplus Coated	Tool Description
1/8	1/8	5/32	3	3/8	.118	4	52017	HSV-RN-S-40125
	1/8	5/32	3	1/2	.118	4	52032	HSV-RN-R-40125
	1/8	5/32	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

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 115



HSV-RN-4

New Items!

4 FLUTE - SQUARE

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} _{-.002"}	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} _{-.000"}	Overall Length L ₁ ^{+0.062"} _{-.062"}	Reach (LBS) L ₃	Neck Diameter	Flutes	Aplus Coated	Tool Description
5/8	5/8	3/4	4	1-5/8	.593	4	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

4 FLUTE - BALL

New Items!

HSV-RN-4

Variable Pitch - Reduced Neck

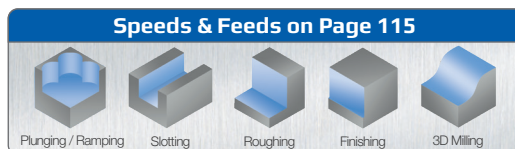
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results 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
- *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.* D1 $^{+.000"}_{-.002"}$	Shank Diameter D2 (h6)	Length of Cut L2 $^{+.032"}_{-.000"}$	Overall Length L1 $^{+.062"}_{-.062"}$	Reach (LBS) L3	Neck Diameter	Flutes	Aplus 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

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HSV-RN-4

New Items!

4 FLUTE - BALL

Variable Pitch - Reduced Neck (cont.)

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new

Cutter Dia.* D ₁ ^{+0.000"} -0.002"	Shank Diameter D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	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

4 FLUTE - CORNER RADIUS

New Items!

HSV-RN-4

Variable Pitch - Reduced Neck

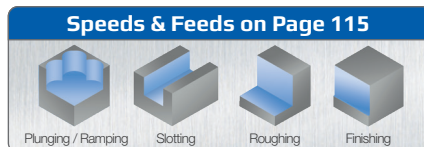
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered with eccentric relief for maximum edge strength in both roughing and finishing applications
- Variable pitch geometry results 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
- *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.* D1 $^{+.000}$ $_{-.002}$	Shank Dia. D2 (h6)	Corner Radius R $^{+.002}$ $_{-.002}$	LOC L2 $^{+.032}$ $_{-.000}$	OAL L1 $^{+.062}$ $_{-.062}$	Reach (LBS) L3	Neck Dia.	Flutes	Aplus 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
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
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
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

* .0005 max TIR

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HSV-RN-4

New Items!

4 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

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Cutter Dia.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	Aplus Coated	Tool Description
3/8	3/8	.030	1/2	4	1-1/8	.356	4	53152	HSV-RN-S-40375-R.030
	3/8	.030	1/2	4	2-1/8	.356	4	53167	HSV-RN-R-40375-R.030
	3/8	.030	1/2	6	3-1/8	.356	4	53182	HSV-RN-M-40375-R.030
	3/8	.030	1/2	6	4-1/8	.356	4	53197	HSV-RN-L-40375-R.030
	3/8	.060	1/2	4	1-1/8	.356	4	53153	HSV-RN-S-40375-R.060
	3/8	.060	1/2	4	2-1/8	.356	4	53168	HSV-RN-R-40375-R.060
	3/8	.060	1/2	6	3-1/8	.356	4	53183	HSV-RN-M-40375-R.060
	3/8	.060	1/2	6	4-1/8	.356	4	53198	HSV-RN-L-40375-R.060
	3/8	.090	1/2	4	1-1/8	.356	4	53154	HSV-RN-S-40375-R.090
	3/8	.090	1/2	4	2-1/8	.356	4	53169	HSV-RN-R-40375-R.090
	3/8	.090	1/2	6	3-1/8	.356	4	53184	HSV-RN-M-40375-R.090
	3/8	.090	1/2	6	4-1/8	.356	4	53199	HSV-RN-L-40375-R.090
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

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4 FLUTE - CORNER RADIUS

New Items!

HSV-RN-4

Variable Pitch - Reduced Neck (cont.)

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Cutter Dia.* D ₁ ^{+0.000"} _{-.002"}	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} _{-.002"}	LOC L ₂ ^{+0.032"} _{-.000"}	OAL L ₁ ^{+0.062"} _{-.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

HSV-4

SPEEDS & FEEDS

4 Flute - Variable Pitch

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	.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
TOOL STEEL	A2, H13, L6, P20, S7	> 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
		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
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	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
		< 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
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	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
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	> 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
		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
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	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
		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
GRAY CAST IRON	SAE J431, ASTM A48	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
		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
		75 - 98 HRB	310	.0003	.0004	.0007	.0005	.0008	.0013	.0007	.0012	.0015	.0009	.0016	.0017	.0013	.0023	.0019	.0017	.0031	.0023	.0025	.0044	.0027	.0032	.0056	.0033
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	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
		< 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
PURE NICKEL	Nickel 200, Nickel 201	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
		< 75 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
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	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
		< 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
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	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
		75 - 98 HRB	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
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	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
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

5 FLUTE - SQUARE

New Items!

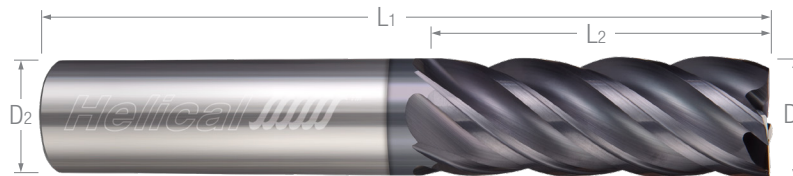


HEV-5

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
- *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

For increased wear resistance, see page 171 for *Tplus* coating

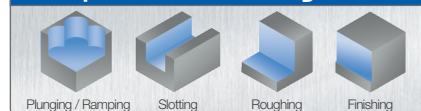


Cutter Diameter* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter $D_2 (h6)$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> 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
5/32	3/16	3/16	2	5	81703		HEV-S-50156
	3/16	7/16	2-1/2	5	81704		HEV-R-50156
	3/16	9/16	2-1/2	5	81705		HEV-M-50156
3/16	3/16	5/16	2	5	44062		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
7/32	1/4	5/16	2	5	81708		HEV-S-50218
	1/4	7/16	2-1/2	5	81709		HEV-R-50218
1/4	1/4	3/8	2	5	44107	44107W	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 132



HEV-5



New Items!

5 FLUTE - SQUARE

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
	D ₁ ^{+0.000"} -0.002"	D ₂ (h6)	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"				
new	5/16	5/16	7/16	2	5	44167	44167W	HEV-S-50312
		5/16	13/16	2-1/2	5	44182	44182W	HEV-R-50312
new		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
new	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
new		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
new	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
new		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
new		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
new	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
new		5/8	1-5/8	3-1/2	5	44332	44332W	HEV-R-50625
new		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
new	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
new		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
new	1	1	1-1/4	4	5	44407		HEV-S-51000
		1	2	4-1/2	5	44422		HEV-R-51000
		1	2-5/8	5	5	44437		HEV-M-51000
		1	3-1/4	6	5	44442		HEV-L-51000
		1	4-1/4	7	5	44447		HEV-X-51000

* .0005 max TIR

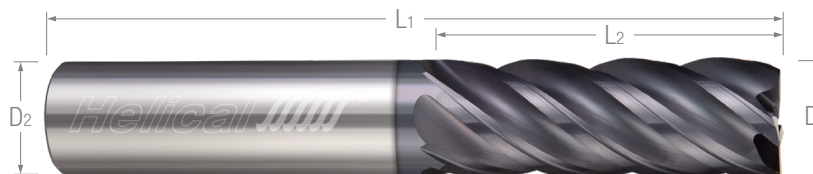
5 FLUTE - SQUARE - METRIC

Variable Pitch



MHEV-5
METRIC

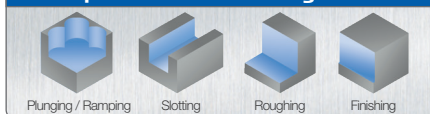
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *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* D1 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Diameter D2 (h6)	Length of Cut L2 $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length L1 $\begin{smallmatrix} +1.6 \text{ mm} \\ -1.6 \text{ mm} \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	9.00 mm	63 mm	5	59516	MHEV-015-50600
	6.00 mm	12.00 mm	63 mm	5	59534	MHEV-020-50600
	6.00 mm	18.00 mm	63 mm	5	59568	MHEV-030-50600
8 mm	8.00 mm	12.00 mm	63 mm	5	59519	MHEV-015-50800
	8.00 mm	16.00 mm	63 mm	5	59537	MHEV-020-50800
	8.00 mm	24.00 mm	75 mm	5	59571	MHEV-030-50800
10 mm	10.00 mm	15.00 mm	63 mm	5	59522	MHEV-015-51000
	10.00 mm	20.00 mm	63 mm	5	59540	MHEV-020-51000
	10.00 mm	25.00 mm	75 mm	5	59554	MHEV-025-51000
12 mm	12.00 mm	18.00 mm	75 mm	5	59525	MHEV-015-51200
	12.00 mm	24.00 mm	75 mm	5	59543	MHEV-020-51200
	12.00 mm	30.00 mm	75 mm	5	59557	MHEV-025-51200
16 mm	16.00 mm	24.00 mm	89 mm	5	59528	MHEV-015-51600
	16.00 mm	32.00 mm	89 mm	5	59546	MHEV-020-51600
	16.00 mm	40.00 mm	89 mm	5	59560	MHEV-025-51600
20 mm	20.00 mm	30.00 mm	89 mm	5	59531	MHEV-015-52000
	20.00 mm	40.00 mm	100 mm	5	59549	MHEV-020-52000
	20.00 mm	50.00 mm	125 mm	5	59563	MHEV-025-52000
25 mm	25.00 mm	50.00 mm	125 mm	5	59552	MHEV-020-52500
	25.00 mm	64.00 mm	125 mm	5	59566	MHEV-025-52500

* .013 mm max TIR

Speeds & Feeds on Page 132



HEV-5



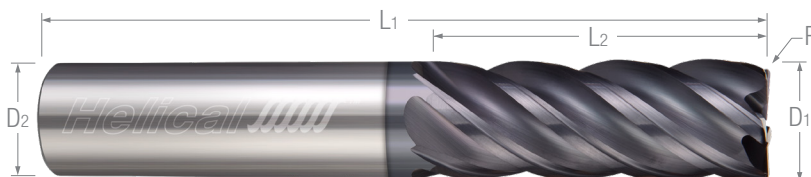
New Items!

5 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
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- 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

For increased wear resistance, see page 173 for *Tplus* coating

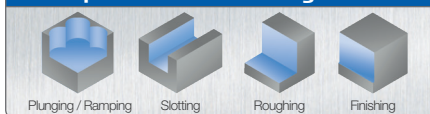


Cutter Dia.* D1 ^{+0.000"} / _{-.002"}	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} / _{-.002"}	LOC L2 ^{+0.032"} / _{-.000"}	OAL L1 ^{+0.062"} / _{-.062"}	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> Coated + Weldon Flat	Tool Description
1/8	1/8	.010	1/4	1-1/2	5	34017		HEV-S-50125-R.010
	1/8	.010	3/8	2	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	.015	1/4	1-1/2	5	81720		HEV-S-50125-R.015
	1/8	.015	3/8	2	5	82530		HEV-SR-50125-R.015
	1/8	.015	1/2	2-1/2	5	81721		HEV-R-50125-R.015
	1/8	.030	1/4	1-1/2	5	45017		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
5/32	3/16	.010	3/16	2	5	81722		HEV-S-50156-R.010
	3/16	.010	7/16	2-1/2	5	81723		HEV-R-50156-R.010
	3/16	.010	9/16	2-1/2	5	81724		HEV-M-50156-R.010
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	.015	5/16	2	5	81727		HEV-S-50187-R.015
	3/16	.015	7/16	2	5	82533		HEV-SR-50187-R.015
	3/16	.015	9/16	2-1/2	5	81728		HEV-R-50187-R.015
	3/16	.015	3/4	2-1/2	5	82534		HEV-M-50187-R.015
	3/16	.015	1	2-1/2	5	82535		HEV-ML-50187-R.015
	3/16	.030	5/16	2	5	45062		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
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

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 132



5 FLUTE - CORNER RADIUS

New Items!



HEV-5

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} -0.002"	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description	
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	new
	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	new
	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	new
	1/4	.030	1/2	2-1/2	5	45122	45122W	HEV-SR-50250-R.030	new
	1/4	.030	3/4	2-1/2	5	45137	45137W	HEV-R-50250-R.030	new
	1/4	.030	1	3	5	45152	45152W	HEV-M-50250-R.030	new
	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	new
	1/4	.060	1/2	2-1/2	5	45123	45123W	HEV-SR-50250-R.060	new
	1/4	.060	3/4	2-1/2	5	45138	45138W	HEV-R-50250-R.060	new
	1/4	.060	1	3	5	45153	45153W	HEV-M-50250-R.060	new
	1/4	.060	1-1/4	3	5	45158		HEV-L-50250-R.060	
	1/4	.060	1-1/2	3	5	82543		HEV-LX-50250-R.060	
9/32	5/16	.020	7/16	2	5	81738		HEV-S-50281-R.020	
	5/16	.020	3/4	2-1/2	5	81739		HEV-R-50281-R.020	
	5/16	.020	1	3	5	81740		HEV-M-50281-R.020	
5/16	5/16	.010	7/16	2	5	81741		HEV-S-50312-R.010	
	5/16	.010	13/16	2-1/2	5	81742		HEV-R-50312-R.010	
	5/16	.020	7/16	2	5	34167	34167W	HEV-S-50312-R.020	new
	5/16	.020	13/16	2-1/2	5	34182	34182W	HEV-R-50312-R.020	new
	5/16	.020	1	3	5	34197	34197W	HEV-M-50312-R.020	new
	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	new
	5/16	.030	13/16	2-1/2	5	45182	45182W	HEV-R-50312-R.030	new
	5/16	.030	1	3	5	45197	45197W	HEV-M-50312-R.030	new
	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	

*.0005 max TIR

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HEV-5



New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D1 $^{+.000}_{-.002}$ "	Shank Dia. D2 (h6)	Corner Radius R $^{+.002}_{-.002}$ "	LOC L2 $^{+.032}_{-.000}$ "	OAL L1 $^{+.062}_{-.062}$ "	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
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	.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	.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	.090	1/2	2	5	45214		HEV-S-50375-R.090
	3/8	.090	1	3	5	45229		HEV-R-50375-R.090
	3/8	.090	1-1/4	3	5	45244		HEV-M-50375-R.090
	3/8	.090	1-1/2	3-1/2	5	45249		HEV-L-50375-R.090
	3/8	.125	1/2	2	5	82549		HEV-S-50375-R.125
	3/8	.125	1	3	5	82550		HEV-R-50375-R.125
	3/8	.125	1-1/4	3	5	82551		HEV-M-50375-R.125

*.0005 max TIR

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5 FLUTE - CORNER RADIUS

New Items!



HEV-5

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} -0.002"	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description	
1/2	1/2	.010	5/8	2-1/2	5	81753	81753W	HEV-S-50500-R.010	new
	1/2	.010	1	3	5	81754	81754W	HEV-SR-50500-R.010	new
	1/2	.010	1-1/4	3	5	81755	81755W	HEV-R-50500-R.010	new
	1/2	.010	1-5/8	4	5	81756		HEV-M-50500-R.010	
	1/2	.010	2	4	5	81757		HEV-L-50500-R.010	
	1/2	.015	5/8	2-1/2	5	81758	81758W	HEV-S-50500-R.015	new
	1/2	.015	1	3	5	81759	81759W	HEV-SR-50500-R.015	new
	1/2	.015	1-1/4	3	5	81760	81760W	HEV-R-50500-R.015	new
	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	new
	1/2	.020	1	3	5	81762	81762W	HEV-SR-50500-R.020	new
	1/2	.020	1-1/4	3	5	81763	81763W	HEV-R-50500-R.020	new
	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	new
	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	new
	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	new
	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	new
	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	new
	1/2	.090	1	3	5	45273	45273W	HEV-SR-50500-R.090	new
	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	new
	1/2	.120	1	3	5	45274	45274W	HEV-SR-50500-R.120	new
	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	new
	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

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HEV-5



New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D1 $^{+.000''}_{-.002''}$	Shank Dia. D2 (h6)	Corner Radius R $^{+.002''}_{-.002''}$	LOC L2 $^{+.032''}_{-.000''}$	OAL L1 $^{+.062''}_{-.062''}$	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
5/8	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		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		HEV-L-50750-R.030
	3/4	.030	3-1/4	6	5	34402		HEV-LX-50750-R.030
	3/4	.030	4	6-1/2	5	82563		HEV-X-50750-R.030
	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
	3/4	.090	1	3	5	45363		HEV-S-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

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS

New Items!



HEV-5

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} -0.002"	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
3/4	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	1-5/8	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	1-5/8	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		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		HEV-S-51000-R.030
	1	.030	2	4-1/2	5	34422		HEV-R-51000-R.030
	1	.030	2-5/8	5	5	34437		HEV-M-51000-R.030
	1	.030	3-1/4	6	5	34442		HEV-L-51000-R.030
	1	.030	4-1/4	7	5	34447		HEV-X-51000-R.030
	1	.060	1-1/4	4	5	45407		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-L-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

new
new
new

*.0005 max TIR

MHEV-5

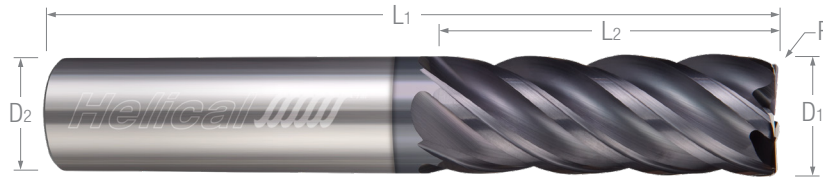
METRIC



5 FLUTE - CORNER RADIUS - METRIC

Variable Pitch

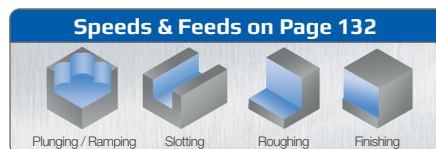
- Offers outstanding performance and high temperature resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 5 flute variable pitch design for reduced harmonics and increased feed rates
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating 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.* D1 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Dia. D2 (h6)	Corner Radius R $\begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Length of Cut L2 $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length L1 $\begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	5	59517	MHEV-015-50600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	5	59535	MHEV-020-50600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	5	59569	MHEV-030-50600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	5	59518	MHEV-015-50600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	5	59536	MHEV-020-50600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	5	59570	MHEV-030-50600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	5	59520	MHEV-015-50800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	5	59538	MHEV-020-50800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	5	59572	MHEV-030-50800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	5	59521	MHEV-015-50800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	5	59539	MHEV-020-50800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	5	59573	MHEV-030-50800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	5	59523	MHEV-015-51000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	5	59541	MHEV-020-51000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	5	59555	MHEV-025-51000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	5	59524	MHEV-015-51000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	5	59542	MHEV-020-51000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	5	59556	MHEV-025-51000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	5	59526	MHEV-015-51200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	5	59544	MHEV-020-51200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	5	59558	MHEV-025-51200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	5	59527	MHEV-015-51200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	5	59545	MHEV-020-51200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	5	59559	MHEV-025-51200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	5	59529	MHEV-015-51600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	5	59547	MHEV-020-51600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	5	59561	MHEV-025-51600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	5	59530	MHEV-015-51600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	5	59548	MHEV-020-51600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	5	59562	MHEV-025-51600-R1.00

* .013 mm max TIR

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5 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)



MHEV-5
METRIC

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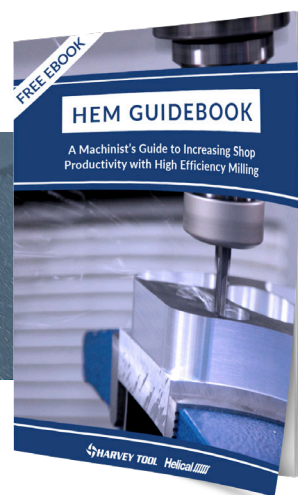
Cutter Dia.* $D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Dia. $D_2 \text{ (h6)}$	Corner Radius $R \begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Length of Cut $L_2 \begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +1.60 \text{ mm} \\ -.60 \text{ mm} \end{smallmatrix}$	Flutes	Aplus Coated	Tool Description
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	5	59532	MHEV-015-52000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	5	59550	MHEV-020-52000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	5	59564	MHEV-025-52000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	5	59533	MHEV-015-52000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	5	59551	MHEV-020-52000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	5	59565	MHEV-025-52000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	5	59553	MHEV-020-52500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	5	59567	MHEV-025-52500-R1.00

* .013 mm max TIR

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HEV-RN-5



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
- 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



new

new

new

new

new

new

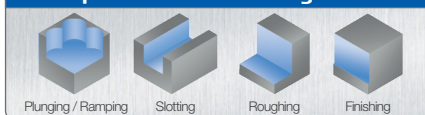
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Cutter Dia.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Diameter	Flutes	Aplus Coated	Tool Description
1/8	1/8	5/32	2	3/8	.118	5	50017	HEV-RN-S-50125
	1/8	5/32	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
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
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
	1/4	3/8	4-1/2	3	.237	5	83018	HEV-RN-L-50250
3/8	3/8	1/2	4	1-1/8	.356	5	50152	HEV-RN-S-50375
	3/8	1/2	4	1-5/8	.356	5	81784	HEV-RN-SR-50375
	3/8	1/2	4	2-1/8	.356	5	50167	HEV-RN-R-50375
	3/8	1	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	1/2	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	4-1/8	.356	5	50212	HEV-RN-L-50375

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 132



5 FLUTE - SQUARE

New Items!



HEV-RN-5

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} -0.002"	Shank Dia. D ₂ (h6)	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Diameter	Flutes	Aplus Coated	Tool Description
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	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
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	1	4	2	.712	5	50362	HEV-RN-S-50750
	3/4	1	6	2-1/2	.712	5	50377	HEV-RN-R-50750
	3/4	1-5/8	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
1	1	1-1/4	6	2-5/8	.950	5	50437	HEV-RN-R-51000
	1	1-1/4	6	3-3/8	.950	5	50452	HEV-RN-M-51000
	1	1-1/4	6	4-1/8	.950	5	50467	HEV-RN-L-51000

*.0005 max TIR

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HEV-RN-5

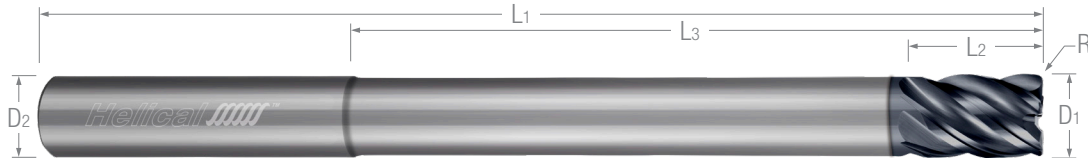


New Items!

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
- *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

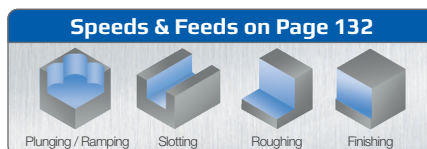


Cutter Dia.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	<i>Aplus</i> Coated	Tool Description
new 1/8	1/8	.010	5/32	2	3/8	.118	5	35017	HEV-RN-S-50125-R.010
	1/8	.010	5/32	2	1/2	.118	5	35032	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
new 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	.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
new 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	3/8	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	3/8	4	2-1/8	.237	5	51137	HEV-RN-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

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Speeds & Feeds on Page 132

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5 FLUTE - CORNER RADIUS

New Items!



HEV-RN-5

Variable Pitch - Reduced Neck (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} -0.002"	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Reach (LBS) L ₃	Neck Dia.	Flutes	Aplus Coated	Tool Description
3/8	3/8	.020	1/2	4	1-1/8	.356	5	35152	HEV-RN-S-50375-R.020
	3/8	.020	1/2	4	1-5/8	.356	5	81794	HEV-RN-SR-50375-R.020
	3/8	.020	1/2	4	2-1/8	.356	5	35167	HEV-RN-R-50375-R.020
	3/8	.020	1	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	.030	1/2	4	1-1/8	.356	5	51152	HEV-RN-S-50375-R.030
	3/8	.030	1/2	4	1-5/8	.356	5	81796	HEV-RN-SR-50375-R.030
	3/8	.030	1/2	4	2-1/8	.356	5	51167	HEV-RN-R-50375-R.030
	3/8	.030	1/2	6	2-1/2	.356	5	81797	HEV-RN-A-50375-R.030
	3/8	.030	1/2	6	3-1/8	.356	5	51197	HEV-RN-M-50375-R.030
	3/8	.030	1/2	6	4-1/8	.356	5	51212	HEV-RN-L-50375-R.030
	3/8	.060	1/2	4	1-1/8	.356	5	51153	HEV-RN-S-50375-R.060
	3/8	.060	1/2	4	2-1/8	.356	5	51168	HEV-RN-R-50375-R.060
	3/8	.060	1/2	6	3-1/8	.356	5	51198	HEV-RN-M-50375-R.060
	3/8	.090	1/2	4	1-1/8	.356	5	51154	HEV-RN-S-50375-R.090
	3/8	.090	1/2	4	2-1/8	.356	5	51169	HEV-RN-R-50375-R.090
	3/8	.090	1/2	6	3-1/8	.356	5	51199	HEV-RN-M-50375-R.090
1/2	1/2	.030	5/8	4	1-1/2	.475	5	35227	HEV-RN-S-50500-R.030
	1/2	.030	5/8	4	1-3/4	.475	5	81798	HEV-RN-SR-50500-R.030
	1/2	.030	5/8	4	2-1/4	.475	5	35242	HEV-RN-R-50500-R.030
	1/2	.030	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	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	2-1/4	.475	5	51242	HEV-RN-R-50500-R.060
	1/2	.060	5/8	6	3-3/8	.475	5	51272	HEV-RN-M-50500-R.060
	1/2	.060	5/8	6	4-1/8	.475	5	51287	HEV-RN-L-50500-R.060
	1/2	.090	5/8	4	1-1/2	.475	5	51228	HEV-RN-S-50500-R.090
	1/2	.090	5/8	4	2-1/4	.475	5	51243	HEV-RN-R-50500-R.090
	1/2	.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	2-1/4	.475	5	51244	HEV-RN-R-50500-R.120
	1/2	.120	5/8	6	3-3/8	.475	5	51274	HEV-RN-M-50500-R.120
	1/2	.120	5/8	6	4-1/8	.475	5	51289	HEV-RN-L-50500-R.120
5/8	5/8	.030	3/4	4	1-5/8	.593	5	35302	HEV-RN-S-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	4-1/8	.593	5	35347	HEV-RN-L-50625-R.030
	5/8	.120	3/4	4	1-5/8	.593	5	51304	HEV-RN-S-50625-R.120
	5/8	.120	3/4	6	2-3/8	.593	5	51319	HEV-RN-R-50625-R.120

*.0005 max TIR

continued on next page

HEV-RN-5



New Items!

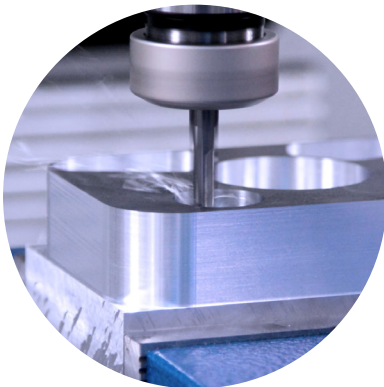
5 FLUTE - CORNER RADIUS

Variable Pitch - Reduced Neck (cont.)

continued from previous page

	Cutter Dia.* D1 $^{+.000''}_{-.002''}$	Shank Dia. D2 (h6)	Corner Radius R $^{+.002''}_{-.002''}$	LOC L2 $^{+.032''}_{-.000''}$	OAL L1 $^{+.062''}_{-.062''}$	Reach (LBS) L3	Neck Dia.	Flutes	Aplus Coated	Tool Description
new new	3/4	3/4	.030	1	4	2	.712	5	35362	HEV-RN-S-50750-R.030
		3/4	.030	1	6	2-1/2	.712	5	35377	HEV-RN-R-50750-R.030
		3/4	.030	1-5/8	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	.060	1	4	2	.712	5	51362	HEV-RN-S-50750-R.060
		3/4	.060	1	6	2-1/2	.712	5	51377	HEV-RN-R-50750-R.060
		3/4	.060	1	6	3-3/8	.712	5	51392	HEV-RN-M-50750-R.060
		3/4	.060	1	6	4-1/8	.712	5	51407	HEV-RN-L-50750-R.060
		3/4	.090	1	4	2	.712	5	51363	HEV-RN-S-50750-R.090
		3/4	.090	1	6	4-1/8	.712	5	51408	HEV-RN-L-50750-R.090
		3/4	.120	1	4	2	.712	5	51364	HEV-RN-S-50750-R.120
		3/4	.120	1	6	2-1/2	.712	5	51379	HEV-RN-R-50750-R.120
		3/4	.120	1	6	3-3/8	.712	5	51394	HEV-RN-M-50750-R.120
		3/4	.120	1	6	4-1/8	.712	5	51409	HEV-RN-L-50750-R.120
		3/4	.190	1	4	2	.712	5	51365	HEV-RN-S-50750-R.190
		3/4	.190	1	6	4-1/8	.712	5	51410	HEV-RN-L-50750-R.190
		3/4	.250	1	4	2	.712	5	51366	HEV-RN-S-50750-R.250
		3/4	.250	1	6	2-1/2	.712	5	51381	HEV-RN-R-50750-R.250
		3/4	.250	1	6	2-7/8	.712	5	81801	HEV-RN-A-50750-R.250
		3/4	.250	1	6	3-3/8	.712	5	51396	HEV-RN-M-50750-R.250
		3/4	.250	1	6	4-1/8	.712	5	51411	HEV-RN-L-50750-R.250
	1	1	.030	1-1/4	4	2-1/4	.950	5	35422	HEV-RN-S-51000-R.030
		1	.030	1-1/4	6	2-5/8	.950	5	35437	HEV-RN-R-51000-R.030
		1	.030	1-1/4	6	3-3/8	.950	5	35452	HEV-RN-M-51000-R.030
		1	.030	1-1/4	6	4-1/8	.950	5	35467	HEV-RN-L-51000-R.030

*.0005 max TIR



Avoiding 4 Major Types of Tool Wear

Excessive tool wear will show inconsistencies and have unwanted effects on your workpiece. Learn how to steer clear of tool wear in our "In the Loupe" blog post **How to Avoid 4 Major Types of Tool Wear**.

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

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	Slot
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	.0075
		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	
TOOL STEEL	A2, H13, L6, P20, S7	> 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	
		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	
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	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	
		< 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	
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	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	.0030	
		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	
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	> 50 HRC	55	.0002	.0002	.0005	.0003	.0004	.0009	.0004	.0006	.0010	.0005	.0008	.0012	.0008	.0012	.0014	.0010	.0016	.0016	.0022	.0019	.0018	.0029	.0023		
		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	
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	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	
		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	
GRAY CAST IRON	SAE J431, ASTM A48	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	
		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	
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	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	
		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	
		21 - 36 HRC	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	
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	75	.0002	.0003	.0006	.0004	.0006	.0012	.0006	.0009	.0013	.0008	.0013	.0015	.0012	.0019	.0017	.0015	.0024	.0020	.0022	.0034	.0023	.0028	.0043	.0028	
		21 - 36 HRC	70	.0002	.0003	.0006	.0004	.0006	.0012	.0006	.0009	.0013	.0008	.0013	.0015	.0012	.0019	.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	.0013	.0020	.0018	.0019	.0029	.0022	.0023	.0037	.0026	.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	
		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	
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	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	
		> 50 HRC	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	
		< 75 HRB	210	.0003	.0004	.0006	.0005	.0007	.0012	.0007	.0010	.0014	.															

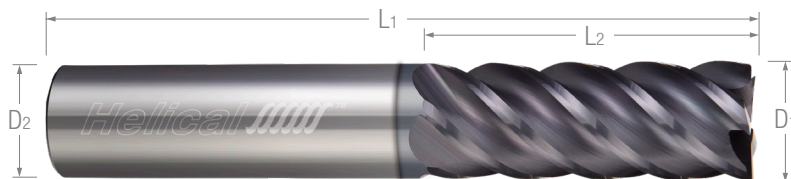
HEF-5



5 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
- Designed with 5 flutes for excellent performance in roughing, High Efficiency Milling (HEM), and finishing (including thin wall applications)
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating 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* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter $D_2 (h6)$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
1/8	1/8	1/4	1-1/2	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



5 FLUTE - SQUARE

Finisher (cont.)


HEF-5

continued from previous page

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

*.0005 max TIR

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



HEF-5



SPEEDS & FEEDS

5 Flute - Finisher

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
		> 50 HRC	155	.0005	.0011	.0007	.0012	.0010	.0014	.0015	.0016	.0020	.0019	.0028	.0022	.0036	.0027
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
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-TMO, 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
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
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
		36 - 50 HRC	180	.0007	.0013	.0010	.0014	.0014	.0016	.0021	.0019	.0027	.0022	.0039	.0026	.0050	.0032
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
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
		36 - 50 HRC	145	.0006	.0012	.0009	.0014	.0013	.0016	.0019	.0018	.0024	.0021	.0035	.0025	.0045	.0030
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
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
		36 - 50 HRC	335	.0007	.0013	.0010	.0014	.0014	.0016	.0021	.0019	.0027	.0022	.0039	.0026	.0050	.0032
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0010	.0015	.0015	.0017	.0020	.0019	.0030	.0022	.0039	.0026	.0055	.0031	.0071	.0038
		21 - 36 HRC	335	.0009	.0014	.0013	.0016	.0017	.0018	.0026	.0021	.0034	.0025	.0048	.0029	.0062	.0035
		36 - 50 HRC	335	.0009	.0014	.0013	.0016	.0017	.0018	.0026	.0021	.0034	.0025	.0048	.0029	.0062	.0035
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
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
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.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
		36 - 50 HRC	250	.0012	.0016	.0017	.0018	.0023	.0021	.0034	.0024	.0044	.0028	.0063	.0033	.0081	.0040
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
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
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.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	.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
		36 - 50 HRC	160	.0009	.0014	.0012	.0016	.0017	.0018	.0025	.0021	.0033	.0024	.0047	.0029	.0060	.0035
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	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
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025
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
		> 50 HRC	55	.0004	.0010	.0006	.0011	.0009	.0013	.0013	.0015	.0017	.0017	.0024	.0021	.0031	.0025

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.

6 FLUTE - SQUARE



HEV-6

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
- *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

For increased wear resistance, see page 177 for *Tplus* coating



Cutter Diameter* D1 $^{+.000}$ $_{-.002}$ "	Shank Diameter D2 (h6)	Length of Cut L2 $^{+.032}$ $_{-.000}$ "	Overall Length L1 $^{+.062}$ $_{-.062}$ "	Flutes	<i>Aplus</i> Coated	Tool Description
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
5/8	5/8	3/4	3	6	59267	HEV-S-60625
	5/8	1-1/4	3-1/2	6	59268	HEV-SR-60625
	5/8	1-5/8	3-1/2	6	59269	HEV-R-60625
	5/8	2	4	6	59270	HEV-M-60625
	5/8	2-1/2	5	6	59271	HEV-L-60625
3/4	3/4	1	3	6	59272	HEV-S-60750
	3/4	1-5/8	4	6	59273	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
1	1	2	4-1/2	6	59277	HEV-R-61000
	1	2-5/8	5	6	59278	HEV-M-61000
	1	3-1/4	6	6	59279	HEV-L-61000

* .0005 max TIR

Speeds & Feeds on Page 147



MHEV-6

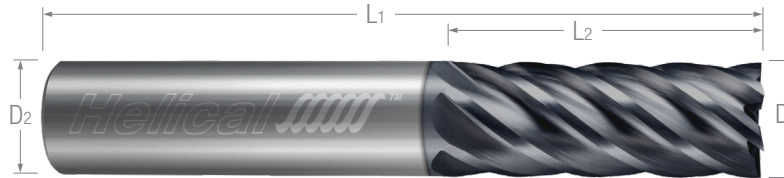
METRIC



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
- *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 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Diameter D ₂ (h6)	Length of Cut L ₂ $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length L ₁ $\begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	9.00 mm	63 mm	6	59574	MHEV-015-60600
	6.00 mm	12.00 mm	63 mm	6	59592	MHEV-020-60600
	6.00 mm	18.00 mm	63 mm	6	59626	MHEV-030-60600
8 mm	8.00 mm	12.00 mm	63 mm	6	59577	MHEV-015-60800
	8.00 mm	16.00 mm	63 mm	6	59595	MHEV-020-60800
	8.00 mm	24.00 mm	75 mm	6	59629	MHEV-030-60800
10 mm	10.00 mm	15.00 mm	63 mm	6	59580	MHEV-015-61000
	10.00 mm	20.00 mm	63 mm	6	59598	MHEV-020-61000
	10.00 mm	25.00 mm	75 mm	6	59612	MHEV-025-61000
12 mm	12.00 mm	18.00 mm	75 mm	6	59583	MHEV-015-61200
	12.00 mm	24.00 mm	75 mm	6	59601	MHEV-020-61200
	12.00 mm	30.00 mm	75 mm	6	59615	MHEV-025-61200
16 mm	16.00 mm	24.00 mm	89 mm	6	59586	MHEV-015-61600
	16.00 mm	32.00 mm	89 mm	6	59604	MHEV-020-61600
	16.00 mm	40.00 mm	89 mm	6	59618	MHEV-025-61600
20 mm	20.00 mm	30.00 mm	89 mm	6	59589	MHEV-015-62000
	20.00 mm	40.00 mm	100 mm	6	59607	MHEV-020-62000
	20.00 mm	50.00 mm	125 mm	6	59621	MHEV-025-62000
25 mm	25.00 mm	50.00 mm	125 mm	6	59610	MHEV-020-62500
	25.00 mm	64.00 mm	125 mm	6	59624	MHEV-025-62500

* .013 mm max TIR

Speeds & Feeds on Page 147



6 FLUTE - BALL

New Items!

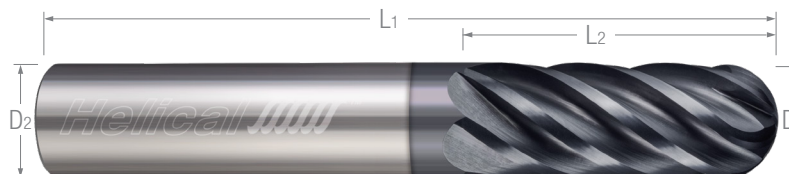


HEV-6

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
- *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

For increased wear resistance, see page 178 for *Tplus* coating



Cutter Diameter* $D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Length of Cut $L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
1/4	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 147



Plunging / Ramping



Roughing



Finishing



3D Milling

HEV-6



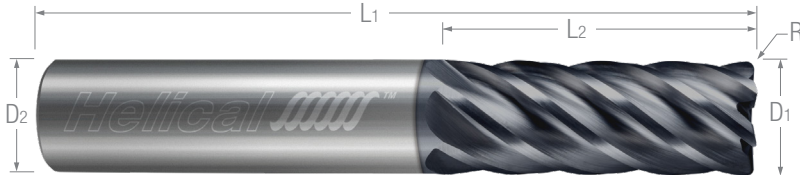
New Items!

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
- *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

For increased wear resistance, see page 179 for *Tplus* coating



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$			
1/4	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	.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	.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
3/8	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

new

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 147



Plunging / Ramping



Roughing



Finishing

6 FLUTE - CORNER RADIUS

New Items!



HEV-6

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D1 ^{+0.00"} -0.002"	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Flutes	Aplus Coated	Tool Description	
3/8	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	
1/2	1/2	.010	5/8	2-1/2	6	83319	HEV-S-60500-R.010	new
	1/2	.010	1	3	6	82578	HEV-SR-60500-R.010	
	1/2	.010	1-1/4	3	6	82579	HEV-R-60500-R.010	
	1/2	.015	5/8	2-1/2	6	83320	HEV-S-60500-R.015	new
	1/2	.015	1	3	6	82580	HEV-SR-60500-R.015	
	1/2	.015	1-1/4	3	6	82581	HEV-R-60500-R.015	
	1/2	.020	1	3	6	82582	HEV-SR-60500-R.020	
	1/2	.020	1-1/4	3	6	82583	HEV-R-60500-R.020	
	1/2	.030	5/8	2-1/2	6	59320	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	.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	.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	new

*.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 ^{+0.000"} -0.002"	Shank Diameter D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Flutes	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	1-1/4	3-1/2	6	59342	HEV-SR-60625-R.060
	5/8	.060	1-5/8	3-1/2	6	59346	HEV-R-60625-R.060
	5/8	.060	2	4	6	59350	HEV-M-60625-R.060
	5/8	.090	1-1/4	3-1/2	6	59343	HEV-SR-60625-R.090
	5/8	.090	1-5/8	3-1/2	6	59347	HEV-R-60625-R.090
	5/8	.090	2	4	6	59351	HEV-M-60625-R.090
	5/8	.125	1-1/4	3-1/2	6	59344	HEV-SR-60625-R.125
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	.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	.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
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

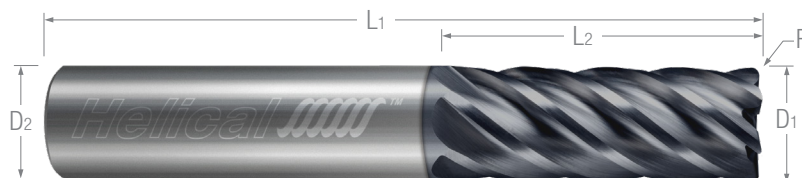
*.0005 max TIR

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
- *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*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
D1 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	D2 (h6)	R $\begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	L2 $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	L1 $\begin{smallmatrix} +1.6 \text{ mm} \\ -1.6 \text{ mm} \end{smallmatrix}$			
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	6	59575	MHEV-015-60600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	6	59593	MHEV-020-60600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	6	59627	MHEV-030-60600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	6	59576	MHEV-015-60600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	6	59594	MHEV-020-60600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	6	59628	MHEV-030-60600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	6	59578	MHEV-015-60800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	6	59596	MHEV-020-60800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	6	59630	MHEV-030-60800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	6	59579	MHEV-015-60800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	6	59597	MHEV-020-60800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	6	59631	MHEV-030-60800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	6	59581	MHEV-015-61000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	6	59599	MHEV-020-61000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	6	59613	MHEV-025-61000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	6	59582	MHEV-015-61000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	6	59600	MHEV-020-61000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	6	59614	MHEV-025-61000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	6	59584	MHEV-015-61200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	6	59602	MHEV-020-61200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	6	59616	MHEV-025-61200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	6	59585	MHEV-015-61200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	6	59603	MHEV-020-61200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	6	59617	MHEV-025-61200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	6	59587	MHEV-015-61600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	6	59605	MHEV-020-61600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	6	59619	MHEV-025-61600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	6	59588	MHEV-015-61600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	6	59606	MHEV-020-61600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	6	59620	MHEV-025-61600-R1.00

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 147


Plunging / Ramping



Roughing



Finishing

MHEV-6
METRIC

6 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)

continued from previous page

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

*.013 mm max TIR


5 Questions to Ask Before Selecting an End Mill

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

Read more on helical.blog/intheloupe

6 FLUTE - SQUARE


HEV-RN-6

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
- Designed with 6 flutes for excellent results in light profiling, High Efficiency Milling (HEM), and finishing applications
- Variable pitch geometry results in higher quality parts by decreasing chatter and harmonics
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating 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.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
1/4	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 147



Plunging / Ramping



Roughing



Finishing

HEV-RN-6



6 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 for excellent performance in light profiling, High Efficiency Milling (HEM), and finishing applications
- 6 flute variable pitch design for reduced harmonics and increased feed rates
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- Center cutting
- h6 shank tolerance for high precision tool holders
- *Aplus* coating 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.* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Dia. $D_2 \text{ (h6)}$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Reach (LBS) L_3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description
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 147



6 FLUTE - CORNER RADIUS


HEV-RN-6

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
- *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\"/> $

* .0005 max TIR

Speeds & Feeds on Page 147



Plunging / Ramping



Roughing



Finishing

HEV-6



SPEEDS & FEEDS

6 Flute - Variable Pitch

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
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.

7 FLUTE - SQUARE

New Items!

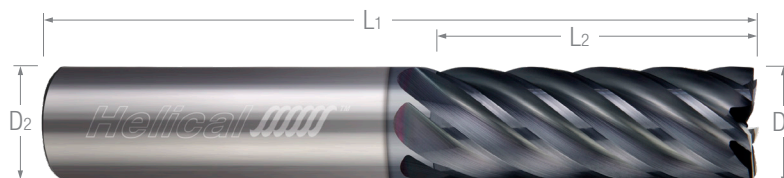


HEV-7

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
- *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

For increased wear resistance, see page 182 for *Tplus* coating



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

new

new

* .0005 max TIR

Speeds & Feeds on Page 156



MHEV-7

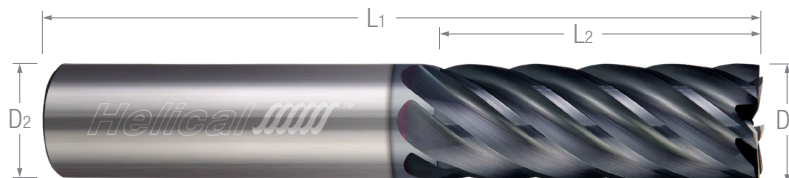
METRIC



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
- *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* D1 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	Shank Diameter D2 (h6)	Length of Cut L2 $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	Overall Length L1 $\begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$	Flutes	<i>Aplus</i> 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 156



7 FLUTE - CORNER RADIUS

New Items!

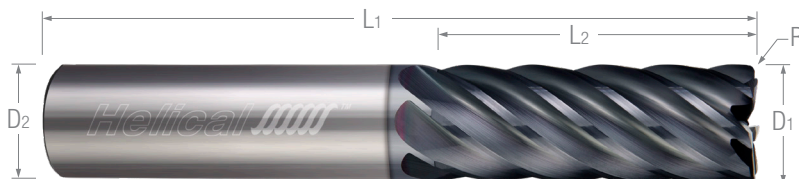


HEV-7

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
- 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

For increased wear resistance, see page 183 for Tplus coating



Cutter Diameter* D1 ^{+0.000"} _{-0.002"}	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} _{-0.002"}	Length of Cut L2 ^{+0.032"} _{-0.000"}	Overall Length L1 ^{+0.062"} _{-0.062"}	Flutes	Aplus Coated	Tool Description	
1/4	1/4	.010	3/8	2	7	83376	HEV-S-70250-R.010	new
	1/4	.010	1/2	2	7	83377	HEV-SR-70250-R.010	new
	1/4	.010	3/4	2-1/2	7	83378	HEV-R-70250-R.010	new
	1/4	.010	1	3	7	83379	HEV-M-70250-R.010	new
	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	.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	
3/8	3/8	.010	1/2	2	7	83380	HEV-S-70375-R.010	new
	3/8	.010	3/4	2-1/2	7	83381	HEV-SR-70375-R.010	new
	3/8	.010	1	2-1/2	7	83382	HEV-R-70375-R.010	new
	3/8	.010	1-1/2	3-1/2	7	83383	HEV-L-70375-R.010	new
	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	
	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	
	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	
1/2	1/2	.010	5/8	2-1/2	7	83384	HEV-S-70500-R.010	new
	1/2	.010	1	3	7	83385	HEV-SR-70500-R.010	new
	1/2	.010	1-1/4	3	7	83386	HEV-R-70500-R.010	new
	1/2	.010	1-5/8	4	7	83387	HEV-M-70500-R.010	new
	1/2	.010	2	4	7	83388	HEV-L-70500-R.010	new
	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	

* .0005 max TIR

Speeds & Feeds on Page 156

continued on next page



HEV-7



New Items!

7 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D_2 (h6)$	$R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
1/2	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
	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
5/8	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	1-1/4	3-1/2	7	81824	HEV-SR-70625-R.060
	5/8	.060	1-5/8	4	7	81825	HEV-R-70625-R.060
3/4	3/4	.030	1	3	7	27362	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
1	1	.030	1-1/4	4	7	27407	HEV-S-71000-R.030
	1	.030	2	5	7	27422	HEV-R-71000-R.030
	1	.030	3-1/4	6	7	27442	HEV-L-71000-R.030

* .0005 max TIR



Why Flute Count Matters

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

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

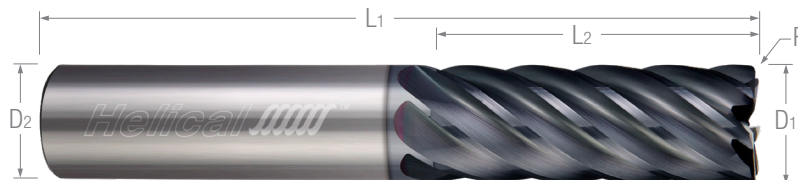
7 FLUTE - CORNER RADIUS - METRIC



MHEV-7
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
- *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*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	$L_1 \begin{smallmatrix} +1.60 \text{ mm} \\ -1.60 \text{ mm} \end{smallmatrix}$			
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	7	59633	MHEV-015-70600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	7	59651	MHEV-020-70600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	7	59685	MHEV-030-70600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	7	59634	MHEV-015-70600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	7	59652	MHEV-020-70600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	7	59686	MHEV-030-70600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	7	59636	MHEV-015-70800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	7	59654	MHEV-020-70800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	7	59688	MHEV-030-70800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	7	59637	MHEV-015-70800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	7	59655	MHEV-020-70800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	7	59689	MHEV-030-70800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	7	59639	MHEV-015-71000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	7	59657	MHEV-020-71000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	7	59671	MHEV-025-71000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	7	59640	MHEV-015-71000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	7	59658	MHEV-020-71000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	7	59672	MHEV-025-71000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	7	59642	MHEV-015-71200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	7	59660	MHEV-020-71200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	7	59674	MHEV-025-71200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	7	59643	MHEV-015-71200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	7	59661	MHEV-020-71200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	7	59675	MHEV-025-71200-R1.00

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 156



MHEV-7

METRIC



7 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
D1 $+0.00$ mm -0.05 mm	D2 (h6)	R $+0.05$ mm -0.05 mm	L2 $+0.80$ mm -0.00 mm	L1 $+1.60$ mm -1.60 mm			
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	7	59645	MHEV-015-71600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	7	59663	MHEV-020-71600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	7	59677	MHEV-025-71600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	7	59646	MHEV-015-71600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	7	59664	MHEV-020-71600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	7	59678	MHEV-025-71600-R1.00
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	7	59648	MHEV-015-72000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	7	59666	MHEV-020-72000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	7	59680	MHEV-025-72000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	7	59649	MHEV-015-72000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	7	59667	MHEV-020-72000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	7	59681	MHEV-025-72000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	7	59669	MHEV-020-72500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	7	59683	MHEV-025-72500-R1.00

* .013 mm max TIR

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



7 FLUTE - SQUARE

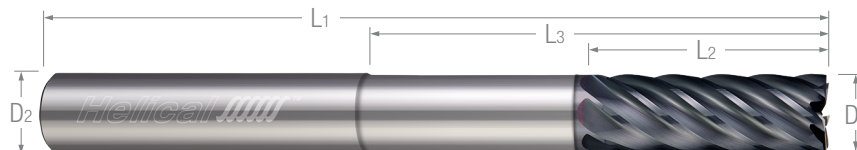
New!



HEV-RN-7

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
- *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.* D1 $^{+.000}$ $_{-.002}$	Shank Dia. D2 (h6)	Length of Cut L2 $^{+.032}$ $_{-.000}$	Overall Length L1 $^{+.062}$ $_{-.062}$	Reach (LBS) L3	Neck Diameter	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	3/4	4	1-1/8	.237	7	83045	HEV-RNR-R-70250	new
	1/4	3/4	4	2-1/8	.237	7	83046	HEV-RNR-M-70250	new
3/8	3/8	1	4	2-1/8	.356	7	83047	HEV-RNR-R-70375	new
	3/8	1	6	3-1/8	.356	7	83048	HEV-RNR-M-70375	new
1/2	1/2	1-1/4	4	2-1/4	.475	7	83049	HEV-RNR-R-70500	new
	1/2	1-1/4	6	3-3/8	.475	7	83050	HEV-RNR-M-70500	new
	1/2	1-1/4	6	4-1/8	.475	7	83051	HEV-RNR-L-70500	new
3/4	3/4	1-5/8	6	2-1/2	.712	7	83052	HEV-RNR-R-70750	new
	3/4	1-5/8	6	3-3/8	.712	7	83053	HEV-RNR-M-70750	new

*.0005 max TIR

Speeds & Feeds on Page 156



HEV-RN-7

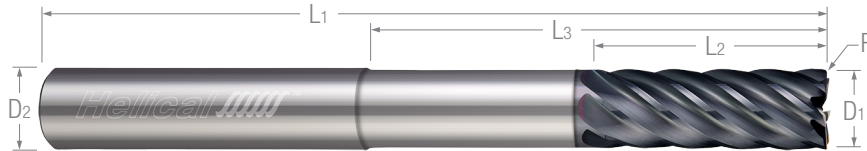


New!

7 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 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
- 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.* D1 $^{+.000}_{-.002}$ "	Shank Dia. D2 (h6)	Corner Radius R $^{+.002}_{-.002}$ "	LOC L2 $^{+.032}_{-.000}$ "	OAL L1 $^{+.062}_{-.062}$ "	Reach (LBS) L3	Neck Dia.	Flutes	Aplus Coated	Tool Description
new	1/4	1/4	.020	3/4	4	1-1/8	.237	7	83054	HEV-RNR-R-70250-R.020
new		1/4	.020	3/4	4	2-1/8	.237	7	83055	HEV-RNR-M-70250-R.020
new	3/8	3/8	.020	1	4	2-1/8	.356	7	83056	HEV-RNR-R-70375-R.020
new		3/8	.020	1	6	3-1/8	.356	7	83057	HEV-RNR-M-70375-R.020
new	1/2	1/2	.030	1-1/4	4	2-1/4	.475	7	83058	HEV-RNR-R-70500-R.030
new		1/2	.030	1-1/4	6	3-3/8	.475	7	83059	HEV-RNR-M-70500-R.030
new		1/2	.030	1-1/4	6	4-1/8	.475	7	83060	HEV-RNR-L-70500-R.030
new		1/2	.060	1-1/4	4	2-1/4	.475	7	83061	HEV-RNR-R-70500-R.060
new		1/2	.060	1-1/4	6	3-3/8	.475	7	83062	HEV-RNR-M-70500-R.060
new		1/2	.060	1-1/4	6	4-1/8	.475	7	83063	HEV-RNR-L-70500-R.060
new	3/4	3/4	.030	1-5/8	6	2-1/2	.712	7	83064	HEV-RNR-R-70750-R.030
new		3/4	.030	1-5/8	6	3-3/8	.712	7	83065	HEV-RNR-M-70750-R.030
new		3/4	.060	1-5/8	6	2-1/2	.712	7	83066	HEV-RNR-R-70750-R.060
new		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 156



SPEEDS & FEEDS

7 Flute - Variable Pitch



HEV-7

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.

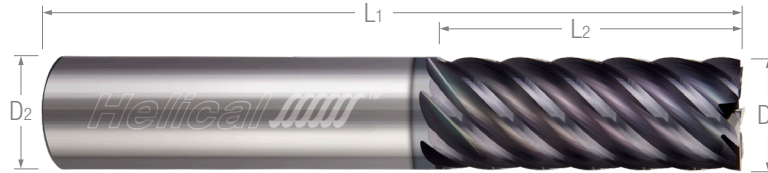
HSF-7



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* D1 ^{+0.000"} _{-0.002"}	Shank Diameter D2 (h6)	Length of Cut L2 ^{+0.032"} _{-0.000"}	Overall Length L1 ^{+0.062"} _{-0.062"}	Flutes	<i>Aplus</i> Coated	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 158



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
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	75 - 98 HRB	265	.0011	.0015	.0016	.0017	.0021	.0019	.0032	.0022	.0041	.0026	.0060	.0031	.0076	.0037
		21 - 36 HRC	225	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0024	.0054	.0029	.0069	.0035
		36 - 50 HRC	180	.0008	.0013	.0012	.0014	.0015	.0016	.0023	.0019	.0030	.0022	.0043	.0026	.0055	.0032
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	75 - 98 HRB	300	.0011	.0015	.0017	.0017	.0022	.0019	.0033	.0022	.0042	.0026	.0061	.0031	.0078	.0038
		21 - 36 HRC	280	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0024	.0053	.0029	.0068	.0035
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	21 - 36 HRC	200	.0008	.0013	.0012	.0014	.0016	.0017	.0024	.0019	.0031	.0022	.0045	.0026	.0057	.0032
		36 - 50 HRC	145	.0007	.0012	.0011	.0014	.0014	.0016	.0021	.0018	.0027	.0021	.0039	.0025	.0050	.0030
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB	410	.0018	.0019	.0027	.0022	.0035	.0024	.0053	.0028	.0068	.0033	.0099	.0039	.0127	.0048
		21 - 36 HRC	370	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0025	.0054	.0029	.0069	.0035
MALLEABLE CAST IRON	ASTM A47, ASTM A220, ASTM A602	75 - 98 HRB	345	.0011	.0015	.0017	.0017	.0022	.0020	.0034	.0023	.0043	.0026	.0063	.0031	.0080	.0038
		21 - 36 HRC	335	.0010	.0014	.0015	.0016	.0019	.0018	.0029	.0021	.0037	.0025	.0054	.0029	.0069	.0035
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB	310	.0012	.0016	.0018	.0017	.0023	.0020	.0035	.0023	.0045	.0027	.0065	.0032	.0083	.0039
		21 - 36 HRC	260	.0008	.0013	.0012	.0014	.0015	.0016	.0023	.0019	.0030	.0022	.0043	.0026	.0055	.0032
		36 - 50 HRC	135	.0005	.0010	.0008	.0011	.0010	.0013	.0015	.0015	.0019	.0017	.0028	.0021	.0035	.0025
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB	285	.0015	.0018	.0023	.0020	.0030	.0023	.0045	.0026	.0058	.0030	.0084	.0036	.0107	.0044
		75 - 98 HRB	250	.0013	.0016	.0019	.0018	.0025	.0021	.0038	.0024	.0048	.0028	.0071	.0033	.0090	.0040
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	75 - 98 HRB	80	.0008	.0013	.0012	.0014	.0015	.0016	.0023	.0019	.0029	.0022	.0043	.0026	.0055	.0031
		21 - 36 HRC	75	.0007	.0012	.0011	.0014	.0015	.0016	.0022	.0018	.0028	.0021	.0041	.0025	.0052	.0031
		36 - 50 HRC	70	.0006	.0011	.0009	.0013	.0013	.0015	.0019	.0017	.0024	.0020	.0035	.0023	.0045	.0028
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	< 75 HRB	300	.0021	.0021	.0032	.0024	.0041	.0027	.0062	.0031	.0080	.0036	.0116	.0043	.0148	.0052
		75 - 98 HRB	275	.0018	.0019	.0027	.0022	.0035	.0024	.0052	.0028	.0067	.0033	.0097	.0039	.0124	.0048
		21 - 36 HRC	250	.0013	.0017	.0020	.0019	.0026	.0021	.0039	.0024	.0050	.0028	.0073	.0034	.0093	.0041
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	21 - 36 HRC	180	.0010	.0015	.0016	.0017	.0020	.0019	.0031	.0022	.0040	.0025	.0058	.0030	.0073	.0037
		36 - 50 HRC	160	.0010	.0014	.0014	.0016	.0019	.0018	.0028	.0021	.0036	.0024	.0053	.0029	.0067	.0035
COBALT ALLOY	ASTM F562, ASTM F90, ASTM F75, ASTM F799	75 - 98 HRB	210	.0009	.0013	.0013	.0015	.0017	.0017	.0026	.0020	.0033	.0023	.0049	.0028	.0062	.0034
		21 - 36 HRC	170	.0009	.0013	.0013	.0015	.0017	.0017	.0025	.0019	.0033	.0023	.0047	.0027	.0060	.0033
		36 - 50 HRC	65	.0006	.0011	.0009	.0012	.0011	.0014	.0017	.0016	.0022	.0019	.0032	.0023	.0041	.0027

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

NOTES:

Hardness Scales: HRB = Rockwell B
HRC = Rockwell C

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

HXF



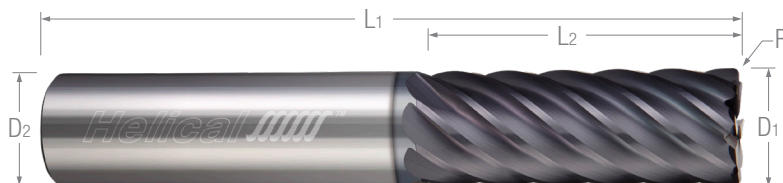
New Item!

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
- *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

For increased wear resistance, see page 184 for *Tplus* coating



Cutter Diameter* D1 $^{+.000}_{-.002}$ "	Shank Diameter D2 (h6)	Corner Radius R $^{+.002}_{-.002}$ "	Length of Cut L2 $^{+.032}_{-.000}$ "	Overall Length L1 $^{+.062}_{-.062}$ "	Flutes	<i>Aplus</i> 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

new

*.0005 max TIR

Speeds & Feeds on Page 160



SPEEDS & FEEDS

Multi-Flute - 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
		> 50 HRC	65	.0006	.0010	.0009	.0011	.0011	.0013	.0017	.0015	.0022	.0017	.0032	.0021	.0040	.0025
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.

END MILLS FOR STAINLESS STEELS & HIGH TEMP ALLOYS

Our End Mills for Stainless Steels and High Temp Alloys focuses on our extensive offering of *Tplus* coated end mills. *Tplus* offers excellent heat resistance and high hardness for reduced abrasion and extended tool life in these notorious alloys. Take on your next project knowing that you'll get the most out of your tooling with the tools in this section.

ROUGHERS

PG

new	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	162
new	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	163
new	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	164
new	Multi-Flute	Corner Radius	Knuckle Rougher - Variable Pitch	165

4 FLUTE

PG

new	4 Flute	Square	Variable Pitch	166
new	4 Flute	Ball	Variable Pitch	168
new	4 Flute	Corner Radius	Variable Pitch	169

5 FLUTE

PG

new	5 Flute	Square	Variable Pitch	171
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6 FLUTE

PG

new	6 Flute	Square	Variable Pitch	177
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7 FLUTE

PG

new	7 Flute	Square	Variable Pitch	182
new	7 Flute	Corner Radius	Variable Pitch	183

MULTI-FLUTE

PG

new	Multi-Flute	Corner Radius	Finisher	184
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5 FLUTE - CORNER RADIUS

New!

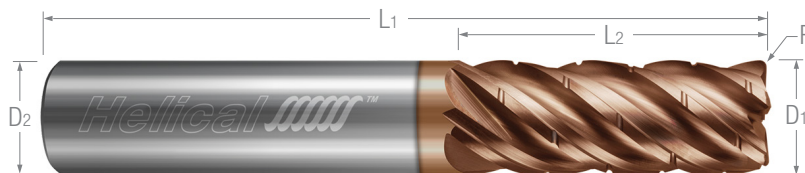


HEV-C-5

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

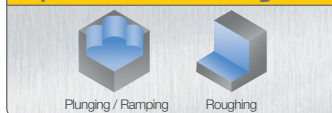
For steel applications, see page 72 for *Aplus* coating



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Tplus</i> Coated	Tool Description	
D1 $^{+.000''}_{-.002''}$	D2 (h6)	R $^{+.002''}_{-.002''}$	L2 $^{+.032''}_{-.000''}$	L1 $^{+.062''}_{-.062''}$				
1/8	1/8	.010	1/4	1-1/2	5	83090	HEV-C-S-50125-R.010	new
	1/8	.010	1/2	2-1/2	5	83091	HEV-C-R-50125-R.010	new
3/16	3/16	.010	5/16	2	5	83092	HEV-C-S-50187-R.010	new
	3/16	.010	7/16	2	5	83093	HEV-C-SR-50187-R.010	new
	3/16	.010	9/16	2-1/2	5	83094	HEV-C-R-50187-R.010	new
	3/16	.010	3/4	2-1/2	5	83095	HEV-C-M-50187-R.010	new
	3/16	.010	1	3	5	83096	HEV-C-S-50250-R.020	new
1/4	1/4	.020	3/8	2	5	83097	HEV-C-SR-50250-R.020	new
	1/4	.020	1/2	2-1/2	5	83098	HEV-C-R-50250-R.020	new
	1/4	.020	3/4	2-1/2	5	83099	HEV-C-M-50250-R.020	new
	1/4	.020	1	3	5	83100	HEV-C-S-50375-R.020	new
3/8	3/8	.020	1/2	2	5	83101	HEV-C-SR-50375-R.020	new
	3/8	.020	3/4	2-1/2	5	83102	HEV-C-R-50375-R.020	new
	3/8	.020	1	3	5	83103	HEV-C-M-50375-R.020	new
	3/8	.020	1-1/4	3	5	83104	HEV-C-S-50500-R.030	new
1/2	1/2	.030	5/8	2-1/2	5	83105	HEV-C-SR-50500-R.030	new
	1/2	.030	1	3	5	83106	HEV-C-R-50500-R.030	new
	1/2	.030	1-1/4	3	5	83107	HEV-C-M-50500-R.030	new
	1/2	.030	1-5/8	4	5	83108	HEV-C-L-50500-R.030	new
	1/2	.030	2	4	5	83109	HEV-C-LX-50500-R.030	new
	1/2	.030	2-1/2	5	5	83110	HEV-C-S-50500-R.060	new
	1/2	.060	5/8	2-1/2	5	83111	HEV-C-SR-50500-R.060	new
	1/2	.060	1	3	5	83112	HEV-C-R-50500-R.060	new
	1/2	.060	1-1/4	3	5	83113	HEV-C-M-50500-R.060	new
	1/2	.060	1-5/8	4	5	83114	HEV-C-L-50500-R.060	new
	1/2	.060	2	4	5	83115	HEV-C-LX-50500-R.060	new
	1/2	.060	2-1/2	5	5	83116	HEV-C-S-50625-R.030	new
5/8	5/8	.030	3/4	3	5	83117	HEV-C-SR-50625-R.030	new
	5/8	.030	1-1/4	3-1/2	5	83118	HEV-C-R-50625-R.030	new
	5/8	.030	1-5/8	3-1/2	5	83119	HEV-C-M-50625-R.030	new
	5/8	.030	2-1/8	4	5	83120	HEV-C-S-50750-R.030	new
3/4	3/4	.030	1	3	5	83121	HEV-C-R-50750-R.030	new
	3/4	.030	1-5/8	4	5	83122	HEV-C-M-50750-R.030	new
	3/4	.030	2-1/4	5	5	83123	HEV-C-L-50750-R.030	new
	3/4	.030	2-3/4	5	5	83124	HEV-C-LX-50750-R.030	new
	3/4	.030	3-1/4	6	5			

* .0005 max TIR

Speeds & Feeds on Page 75



HEV-C-6



New!

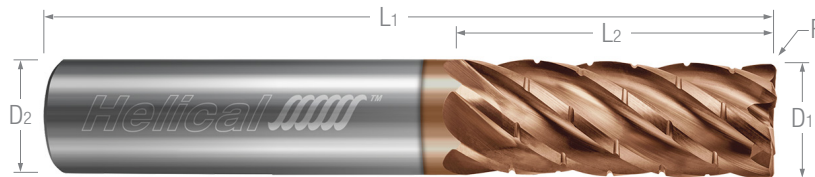
6 FLUTE - CORNER RADIUS

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
- *Tplus* 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 76 for *Aplus* coating

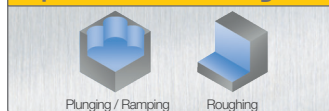


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Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Tplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D2 \text{ (h6)}$	$R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	$L2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
1/4	1/4	.020	3/8	2	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
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
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

*.0005 max TIR

Speeds & Feeds on Page 78



7 FLUTE - CORNER RADIUS

New!



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
- *Tplus* 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 *Aplus* coating



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Tplus Coated	Tool Description	
$D1^{+.000"}_{-.002"}\)$	$D2\ (h6)$	$R^{+.002"}_{-.002"}\)$	$L2^{+.032"}_{-.000"}\)$	$L1^{+.062"}_{-.062"}\)$				
1/4	1/4	.020	1/2	2	7	82911	HEV-C-SR-70250-R.020	new
	1/4	.020	3/4	2-1/2	7	82912	HEV-C-R-70250-R.020	new
3/8	3/8	.020	1/2	2	7	82913	HEV-C-S-70375-R.020	new
	3/8	.020	3/4	2-1/2	7	82914	HEV-C-SR-70375-R.020	new
	3/8	.020	1	2-1/2	7	82915	HEV-C-R-70375-R.020	new
1/2	1/2	.030	5/8	2-1/2	7	82916	HEV-C-S-70500-R.030	new
	1/2	.030	1	3	7	82917	HEV-C-SR-70500-R.030	new
	1/2	.030	1-1/4	3	7	82918	HEV-C-R-70500-R.030	new
	1/2	.030	1-5/8	4	7	82919	HEV-C-M-70500-R.030	new
	1/2	.030	2	4	7	82920	HEV-C-L-70500-R.030	new
	1/2	.060	5/8	2-1/2	7	83177	HEV-C-S-70500-R.060	new
	1/2	.060	1	3	7	83178	HEV-C-SR-70500-R.060	new
	1/2	.060	1-1/4	3	7	83179	HEV-C-R-70500-R.060	new
	1/2	.060	1-5/8	4	7	83180	HEV-C-M-70500-R.060	new
	1/2	.060	2	4	7	83181	HEV-C-L-70500-R.060	new
5/8	5/8	.030	1-1/4	3-1/2	7	82921	HEV-C-SR-70625-R.030	new
	5/8	.030	1-5/8	4	7	82922	HEV-C-R-70625-R.030	new
3/4	3/4	.030	1-5/8	4	7	82923	HEV-C-R-70750-R.030	new
	3/4	.030	2-1/4	5	7	82924	HEV-C-M-70750-R.030	new
	3/4	.060	1-5/8	4	7	82925	HEV-C-R-70750-R.060	new
	3/4	.060	2-1/4	5	7	82926	HEV-C-M-70750-R.060	new

* .0005 max TIR

Speeds & Feeds on Page 82



Roughing

HXVR

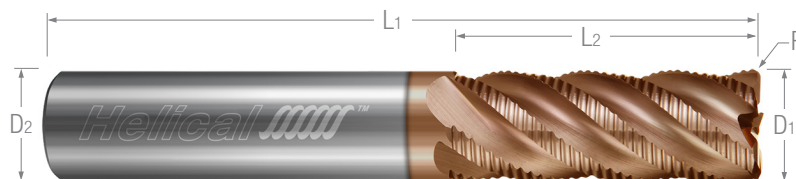
New!

MULTI-FLUTE - CORNER RADIUS

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 83 for Aplus coating



	Cutter Diameter $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Corner Radius $R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	T _{plus} Coated	Tool Description
new	1/4	1/4	.030	3/8	2	4	83482	HXVR-S-40250-R.030
new		1/4	.030	3/4	2-1/2	4	83483	HXVR-R-40250-R.030
new	3/8	3/8	.040	1/2	2	4	83484	HXVR-S-40375-R.040
new		3/8	.040	1/2	2	5	83485	HXVR-S-50375-R.040
new		3/8	.040	1	3	4	83486	HXVR-R-40375-R.040
new		3/8	.040	1	3	5	83487	HXVR-R-50375-R.040
new	1/2	1/2	.040	5/8	2-1/2	4	83488	HXVR-S-40500-R.040
new		1/2	.040	5/8	2-1/2	5	83489	HXVR-S-50500-R.040
new		1/2	.040	1-1/4	3	4	83490	HXVR-R-40500-R.040
new		1/2	.040	1-1/4	3	5	83491	HXVR-R-50500-R.040
new	3/4	3/4	.060	1	3	4	83492	HXVR-S-40750-R.060
new		3/4	.060	1	3	5	83493	HXVR-S-50750-R.060
new		3/4	.060	1-5/8	4	4	83494	HXVR-R-40750-R.060
new		3/4	.060	1-5/8	4	5	83495	HXVR-R-50750-R.060

* .0005 max TIR

Speeds & Feeds on Pages 85-86



4 FLUTE - SQUARE

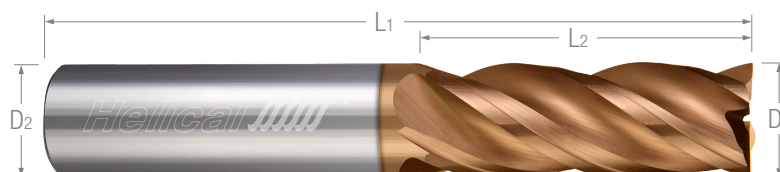
New Items!

HSV-4 / HSM-4

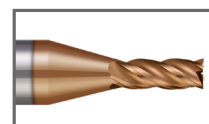
Variable Pitch

- 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
- *Tplus* 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 95 for *Aplus* coating



HSM series feature enlarged shanks for added strength



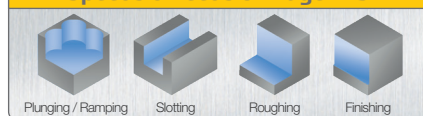
Cutter Diameter* $D_1 \begin{smallmatrix} +.0005'' \\ -.0005'' \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Length of Cut $L_2 \begin{smallmatrix} +.010'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Tplus</i> Coated	Tool Description	
1/32	1/4	3/32	2-1/2	4	84040	HSM-030-40031	new
	1/4	5/32	2-1/2	4	84041	HSM-050-40031	new
3/64	1/4	5/32	2-1/2	4	84042	HSM-033-40047	new
	1/4	1/4	2-1/2	4	84043	HSM-053-40047	new
1/16	1/4	3/16	2-1/2	4	84044	HSM-030-40062	new
	1/4	5/16	2-1/2	4	84045	HSM-050-40062	new
5/64	1/4	1/4	2-1/2	4	84046	HSM-032-40078	new
	1/4	3/8	2-1/2	4	84047	HSM-048-40078	new
3/32	1/4	9/32	2-1/2	4	84048	HSM-030-40093	new
	1/4	1/2	2-1/2	4	84049	HSM-053-40093	new

Cutter Diameter* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Tplus</i> Coated	Tool Description	
1/8	1/8	1/4	1-1/2	4	83183	HSV-S-40125	new
	1/4	1/4	2-1/2	4	84050	HSM-020-40125	new
	1/8	3/8	2	4	83184	HSV-SR-40125	new
	1/4	3/8	2-1/2	4	84051	HSM-030-40125	new
	1/8	1/2	2-1/2	4	83185	HSV-R-40125	new
	1/4	1/2	2-1/2	4	84052	HSM-040-40125	new
	1/8	5/8	2-1/2	4	83186	HSV-A-40125	new
	1/8	3/4	2-1/2	4	83187	HSV-M-40125	new
5/32	3/16	3/16	2	4	83188	HSV-S-40156	new
	3/16	7/16	2-1/2	4	83189	HSV-R-40156	new
	3/16	9/16	2-1/2	4	83190	HSV-M-40156	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 115



HSV-4 / HSM-4

New Items!

4 FLUTE - SQUARE

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Tplus Coated	Tool Description
	D1 ^{+0.000"} -0.002"	D2 (h6)	L2 ^{+0.032"} -0.000"	L1 ^{+0.062"} -0.062"			
new new new new new new new new	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
		3/16	5/8	2-1/2	4	83193	HSV-R-40187
		1/4	3/4	2-1/2	4	84056	HSM-040-40187
		3/16	1	2-1/2	4	83194	HSV-M-40187
new new new new new new	1/4	1/4	3/8	2	4	82262	HSV-S-40250
		1/4	1/2	2-1/2	4	82263	HSV-SR-40250
		1/4	3/4	2-1/2	4	82264	HSV-R-40250
		1/4	1	3	4	82265	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
new new new 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
new new new new new	3/8	3/8	1/2	2	4	82266	HSV-S-40375
		3/8	7/8	3	4	82267	HSV-SR-40375
		3/8	1	3	4	82268	HSV-R-40375
		3/8	1-1/4	3	4	82269	HSV-M-40375
		3/8	1-1/2	3	4	83201	HSV-L-40375
new new new new new new	1/2	1/2	5/8	2-1/2	4	82270	HSV-S-40500
		1/2	1	3	4	82271	HSV-SR-40500
		1/2	1-1/4	3	4	82272	HSV-R-40500
		1/2	1-5/8	4	4	82273	HSV-M-40500
		1/2	2	4	4	83202	HSV-L-40500
		1/2	2-1/2	5	4	83203	HSV-LX-40500
new new new new new new	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
new new new new new 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

*.0005 max TIR

4 FLUTE - BALL

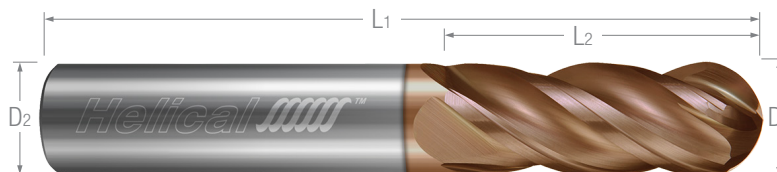
New!

HSV-4

Variable Pitch

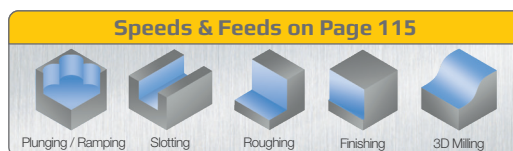
- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered with eccentric relief 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
- *Tplus* 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 98 for *Aplus* coating



Cutter Diameter* $D_1 \begin{smallmatrix} +.0001 \\ -.002 \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Length of Cut $L_2 \begin{smallmatrix} +.032 \\ -.000 \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062 \\ -.062 \end{smallmatrix}$	Flutes	<i>Tplus</i> Coated	Tool Description	
1/8	1/8	1/4	1-1/2	4	83275	HSV-S-40125-BN	new
	1/8	3/8	2	4	83276	HSV-SR-40125-BN	new
	1/8	1/2	2-1/2	4	83277	HSV-R-40125-BN	new
	1/8	5/8	2-1/2	4	83278	HSV-A-40125-BN	new
3/16	3/16	5/16	2	4	83279	HSV-S-40187-BN	new
	3/16	5/8	2-1/2	4	83280	HSV-R-40187-BN	new
	3/16	1	2-1/2	4	83281	HSV-M-40187-BN	new
1/4	1/4	3/8	2	4	83282	HSV-S-40250-BN	new
	1/4	1/2	2-1/2	4	83283	HSV-SR-40250-BN	new
	1/4	3/4	2-1/2	4	83284	HSV-R-40250-BN	new
	1/4	1	3	4	83285	HSV-M-40250-BN	new
	1/4	1-1/4	3	4	83286	HSV-L-40250-BN	new
5/16	5/16	1/2	2	4	83287	HSV-S-40312-BN	new
	5/16	3/4	2-1/2	4	83288	HSV-R-40312-BN	new
	5/16	1	2-1/2	4	83289	HSV-A-40312-BN	new
	5/16	1-1/4	3	4	83290	HSV-M-40312-BN	new
3/8	3/8	1/2	2	4	83291	HSV-S-40375-BN	new
	3/8	7/8	3	4	83292	HSV-SR-40375-BN	new
	3/8	1	3	4	83293	HSV-R-40375-BN	new
	3/8	1-1/4	3	4	83294	HSV-M-40375-BN	new
1/2	1/2	5/8	2-1/2	4	83295	HSV-S-40500-BN	new
	1/2	1	3	4	83296	HSV-SR-40500-BN	new
	1/2	1-1/4	3	4	83297	HSV-R-40500-BN	new
	1/2	1-5/8	4	4	83298	HSV-M-40500-BN	new
	1/2	2	4	4	83299	HSV-L-40500-BN	new
3/4	3/4	7/8	3	4	83300	HSV-S-40750-BN	new
	3/4	1-1/4	4	4	83301	HSV-SR-40750-BN	new
	3/4	1-5/8	4	4	83302	HSV-R-40750-BN	new

* .0005 max TIR



HSV-4 / HSM-4

New Items!

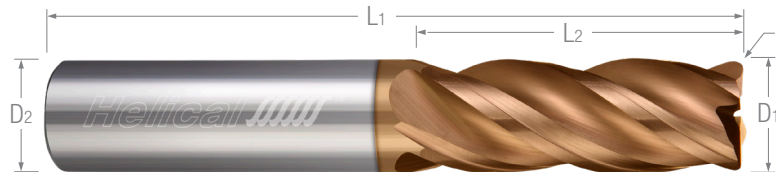
4 FLUTE - CORNER RADIUS

Variable Pitch

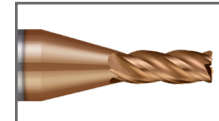
- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered with eccentric relief 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
- Tplus 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 100 for Aplus coating



HSM series feature enlarged shanks for added strength



4 Flute

	Cutter Diameter* D1 $^{+.0005''}_{-.0005''}$	Shank Diameter D2 (h6)	Corner Radius R $^{+.001''}_{-.001''}$	Length of Cut L2 $^{+.010''}_{-.000''}$	Overall Length L1 $^{+.062''}_{-.062''}$	Flutes	Tplus Coated	Tool Description
new	1/32	1/4	.005	3/32	2-1/2	4	84016	HSM-030-40031-R.005
new		1/4	.005	5/32	2-1/2	4	84017	HSM-050-40031-R.005
new	3/64	1/4	.010	5/32	2-1/2	4	84018	HSM-033-40047-R.010
new		1/4	.010	1/4	2-1/2	4	84019	HSM-053-40047-R.010
new	1/16	1/4	.010	3/16	2-1/2	4	84020	HSM-030-40062-R.010
new		1/4	.010	5/16	2-1/2	4	84021	HSM-050-40062-R.010
new	5/64	1/4	.010	1/4	2-1/2	4	84022	HSM-032-40078-R.010
new		1/4	.010	3/8	2-1/2	4	84023	HSM-048-40078-R.010
new	3/32	1/4	.010	9/32	2-1/2	4	84024	HSM-030-40093-R.010
new		1/4	.010	1/2	2-1/2	4	84025	HSM-053-40093-R.010

	D1 $^{+.000''}_{-.002''}$	D2 (h6)	R $^{+.002''}_{-.002''}$	L2 $^{+.032''}_{-.000''}$	L1 $^{+.062''}_{-.062''}$	Flutes	Tplus Coated	Tool Description
new	1/8	1/8	.010	1/4	1-1/2	4	83238	HSV-S-40125-R.010
new		1/4	.010	1/4	2-1/2	4	84026	HSM-020-40125-R.010
new		1/4	.010	3/8	2-1/2	4	84027	HSM-030-40125-R.010
new		1/8	.010	1/2	2-1/2	4	83239	HSV-R-40125-R.010
new		1/4	.010	1/2	2-1/2	4	84028	HSM-040-40125-R.010
new		1/8	.030	1/4	1-1/2	4	83240	HSV-S-40125-R.030
new		1/4	.030	1/4	2-1/2	4	84033	HSM-020-40125-R.030
new		1/4	.030	3/8	2-1/2	4	84034	HSM-030-40125-R.030
new		1/8	.030	1/2	2-1/2	4	83241	HSV-R-40125-R.030
new		1/4	.030	1/2	2-1/2	4	84035	HSM-040-40125-R.030
new	3/16	3/16	.010	5/16	2	4	83242	HSV-S-40187-R.010
new		1/4	.010	5/16	2-1/2	4	84029	HSM-016-40187-R.010
new		1/4	.010	7/16	2-1/2	4	84030	HSM-023-40187-R.010
new		1/4	.010	9/16	2-1/2	4	84031	HSM-029-40187-R.010
new		3/16	.010	5/8	2-1/2	4	83243	HSV-R-40187-R.010
new		1/4	.010	3/4	2-1/2	4	84032	HSM-040-40187-R.010
new		3/16	.030	5/16	2	4	83244	HSV-S-40187-R.030
new		1/4	.030	5/16	2-1/2	4	84036	HSM-016-40187-R.030
new		1/4	.030	7/16	2-1/2	4	84037	HSM-023-40187-R.030
new		1/4	.030	9/16	2-1/2	4	84038	HSM-029-40187-R.030
new		3/16	.030	5/8	2-1/2	4	83245	HSV-R-40187-R.030
new		1/4	.030	3/4	2-1/2	4	84039	HSM-040-40187-R.030

* .0005 max TIR

Speeds & Feeds on Page 115



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 ^{+0.000"} -0.002"	Shank Diameter D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L ₂ ^{+0.032"} -0.000"	Overall Length L ₁ ^{+0.062"} -0.062"	Flutes	Tplus Coated	Tool Description	
1/4	1/4	.010	3/8	2	4	83246	HSV-S-40250-R.010	new
	1/4	.010	1/2	2-1/2	4	83247	HSV-SR-40250-R.010	new
	1/4	.010	3/4	2-1/2	4	83248	HSV-R-40250-R.010	new
	1/4	.020	3/8	2	4	82303	HSV-S-40250-R.020	
	1/4	.020	1/2	2-1/2	4	82304	HSV-SR-40250-R.020	
	1/4	.020	3/4	2-1/2	4	82305	HSV-R-40250-R.020	
	1/4	.020	1	3	4	82306	HSV-M-40250-R.020	
	1/4	.030	3/8	2	4	83249	HSV-S-40250-R.030	new
	1/4	.030	1/2	2-1/2	4	83250	HSV-SR-40250-R.030	new
	1/4	.030	3/4	2-1/2	4	83251	HSV-R-40250-R.030	new
	1/4	.030	1	3	4	83252	HSV-M-40250-R.030	new
	1/4	.060	3/8	2	4	83253	HSV-S-40250-R.060	new
3/8	3/8	.020	1/2	2	4	82307	HSV-S-40375-R.020	
	3/8	.020	7/8	3	4	82308	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	new
	3/8	.060	7/8	3	4	83258	HSV-SR-40375-R.060	new
1/2	1/2	.015	5/8	2-1/2	4	83260	HSV-S-40500-R.015	new
	1/2	.015	1	3	4	83261	HSV-SR-40500-R.015	new
	1/2	.015	1-1/4	3	4	83262	HSV-R-40500-R.015	new
	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	HSV-S-40500-R.030	
	1/2	.030	1	3	4	82320	HSV-SR-40500-R.030	
	1/2	.030	1-1/4	3	4	82321	HSV-R-40500-R.030	
	1/2	.030	1-5/8	4	4	82322	HSV-M-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	.125	5/8	2-1/2	4	83263	HSV-S-40500-R.125	new
	1/2	.125	1	3	4	83264	HSV-SR-40500-R.125	new
	1/2	.125	1-1/4	3	4	83265	HSV-R-40500-R.125	new
5/8	5/8	.030	1-1/4	3-1/2	4	83267	HSV-SR-40625-R.030	new
	5/8	.030	1-5/8	3-1/2	4	83268	HSV-R-40625-R.030	new
	5/8	.030	2	4	4	83269	HSV-M-40625-R.030	new
3/4	3/4	.030	7/8	3	4	83270	HSV-S-40750-R.030	new
	3/4	.030	1-1/4	4	4	83271	HSV-SR-40750-R.030	new
	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	new

*.0005 max TIR

HEV-5 / HSM-5



New Items!

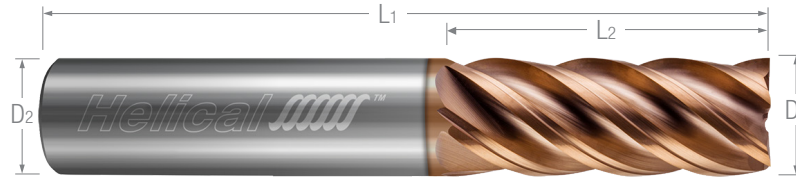
5 FLUTE - SQUARE

Variable Pitch

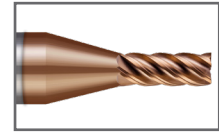
- Offers proven performance and extended tool life in stainless steels, high temp alloys, and hardened steels up to 65 Rc
- Well-suited for increased wear resistance in a wide range of ferrous materials, including low and medium alloy steels, tool steels, and cast iron
- Engineered for excellent performance in 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
- *Tplus* 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 *Aplus* coating



HSM series feature enlarged shanks for added strength



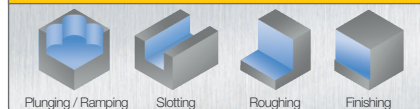
	Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Tplus</i> Coated	Tool Description
	$D_1^{+.0005}_{-.0005}$	D_2 (h6)	$L_2^{+.010}_{-.000}$	$L_1^{+.062}_{-.062}$			
new	1/32	1/4	3/32	2-1/2	5	84081	HSM-030-50031
new		1/4	5/32	2-1/2	5	84082	HSM-050-50031
new	3/64	1/4	5/32	2-1/2	5	84083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

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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 132



5 FLUTE - SQUARE

New Items!



HEV-5 / HSM-5

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter $D_2 (h6)$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	Tplus Coated	Tool Description	
7/32	1/4	5/16	2	5	82954	HEV-S-50218	new new
	1/4	7/16	2-1/2	5	82955	HEV-R-50218	
1/4	1/4	3/8	2	5	59836	HEV-S-50250	new
	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	
	1/4	1-1/2	3	5	82956	HEV-LX-50250	
5/16	5/16	7/16	2	5	59839	HEV-S-50312	new
	5/16	13/16	2-1/2	5	59840	HEV-R-50312	
	5/16	1	3	5	59841	HEV-M-50312	
3/8	3/8	1/2	2	5	59842	HEV-S-50375	
	3/8	3/4	2-1/2	5	82529	HEV-SR-50375	
	3/8	1	3	5	59843	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	
1/2	1/2	5/8	2-1/2	5	59845	HEV-S-50500	
	1/2	1	3	5	59846	HEV-SR-50500	
	1/2	1-1/4	3	5	59847	HEV-R-50500	
	1/2	1-5/8	4	5	59848	HEV-M-50500	
	1/2	2	4	5	81844	HEV-L-50500	
5/8	5/8	3/4	3	5	59849	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	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	HEV-R-50750	
	3/4	2-1/4	5	5	59854	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	new
	1	2-5/8	5	5	81849	HEV-M-51000	

* .0005 max TIR

HEV-5 / HSM-5



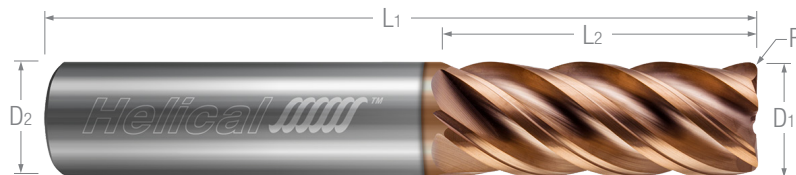
New Items!

5 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 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
- Tplus 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 Aplus coating



HSM series feature enlarged shanks for added strength



5 Flute

new
new
new
new
new
new
new
new
new

Cutter Dia.* D1 $^{+.0005}_{-.0005}$ "	Shank Dia. D2 (h6)	Corner Radius R $^{+.001}_{-.001}$ "	LOC L2 $^{+.010}_{-.000}$ "	OAL L1 $^{+.062}_{-.062}$ "	Flutes	Tplus Coated	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

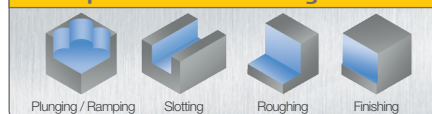
new
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D1 $^{+.000}_{-.002}$ "	D2 (h6)	R $^{+.002}_{-.002}$ "	L2 $^{+.032}_{-.000}$ "	L1 $^{+.062}_{-.062}$ "	Flutes	Tplus Coated	Tool Description
1/8	1/8	.010	1/4	1-1/2	5	59855	HEV-S-50125-R.010
	1/4	.010	1/4	2-1/2	5	84067	HSM-020-50125-R.010
	1/8	.010	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	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	1/2	2-1/2	5	82973	HEV-R-50125-R.015
	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
	1/4	.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	3/4	2-1/2	5	82974	HEV-M-50125-R.030

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 132



5 FLUTE - CORNER RADIUS

New Items!



HEV-5 / HSM-5

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Flutes	Tplus Coated	Tool Description	
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	new
	3/16	.010	7/16	2	5	82975	HEV-SR-50187-R.010	new
	1/4	.010	7/16	2-1/2	5	84071	HSM-023-50187-R.010	new
	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	new
	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	new
	3/16	.015	5/16	2	5	82976	HEV-S-50187-R.015	new
	3/16	.015	9/16	2-1/2	5	82977	HEV-R-50187-R.015	new
	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	new
	1/4	.030	7/16	2-1/2	5	84078	HSM-023-50187-R.030	new
	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	new
	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	new
1/4	1/4	.010	3/8	2	5	82978	HEV-S-50250-R.010	new
	1/4	.010	1/2	2-1/2	5	82979	HEV-SR-50250-R.010	new
	1/4	.010	3/4	2-1/2	5	82980	HEV-R-50250-R.010	new
	1/4	.015	3/8	2	5	82981	HEV-S-50250-R.015	new
	1/4	.015	1/2	2-1/2	5	82982	HEV-SR-50250-R.015	new
	1/4	.015	3/4	2-1/2	5	82983	HEV-R-50250-R.015	new
	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	new
	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	new
	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	new
5/16	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	new
	5/16	.030	13/16	2-1/2	5	82988	HEV-R-50312-R.030	new
	5/16	.030	1	3	5	82989	HEV-M-50312-R.030	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.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Flutes	Tplus Coated	Tool Description
new	3/8	3/8	.010	1/2	2	5	82990	HEV-S-50375-R.010
new		3/8	.010	1	3	5	82991	HEV-R-50375-R.010
new		3/8	.015	1	3	5	82992	HEV-R-50375-R.015
		3/8	.020	1/2	2	5	59866	HEV-S-50375-R.020
		3/8	.020	1	3	5	59867	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	HEV-S-50375-R.030
new		3/8	.030	3/4	2-1/2	5	82993	HEV-SR-50375-R.030
		3/8	.030	1	3	5	59870	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	HEV-L-50375-R.030
		3/8	.060	1/2	2	5	59872	HEV-S-50375-R.060
new		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
new		3/8	.090	1/2	2	5	82995	HEV-S-50375-R.090
new		3/8	.090	1	3	5	82996	HEV-R-50375-R.090
new	1/2	1/2	.010	5/8	2-1/2	5	82997	HEV-S-50500-R.010
new		1/2	.010	1	3	5	82998	HEV-SR-50500-R.010
new		1/2	.010	1-1/4	3	5	82999	HEV-R-50500-R.010
new		1/2	.015	5/8	2-1/2	5	83000	HEV-S-50500-R.015
new		1/2	.015	1	3	5	83001	HEV-SR-50500-R.015
new		1/2	.015	1-1/4	3	5	83002	HEV-R-50500-R.015
new		1/2	.020	5/8	2-1/2	5	83003	HEV-S-50500-R.020
new		1/2	.020	1	3	5	83004	HEV-SR-50500-R.020
new		1/2	.020	1-1/4	3	5	83005	HEV-R-50500-R.020
		1/2	.030	5/8	2-1/2	5	59875	HEV-S-50500-R.030
		1/2	.030	1	3	5	59876	HEV-SR-50500-R.030
		1/2	.030	1-1/4	3	5	59877	HEV-R-50500-R.030
		1/2	.030	1-5/8	4	5	59878	HEV-M-50500-R.030
		1/2	.030	2	4	5	81867	HEV-L-50500-R.030
new		1/2	.030	2-1/2	5	5	83006	HEV-LX-50500-R.030
		1/2	.060	5/8	2-1/2	5	59879	HEV-S-50500-R.060
		1/2	.060	1	3	5	59880	HEV-SR-50500-R.060
		1/2	.060	1-1/4	3	5	59881	HEV-R-50500-R.060
		1/2	.060	1-5/8	4	5	59882	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

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS

New Items!



HEV-5

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D1 ^{+0.001"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Flutes	Tplus Coated	Tool Description	
5/8	5/8	.030	3/4	3	5	59887	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	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	new
	5/8	.120	2-1/8	4	5	83008	HEV-M-50625-R.120	new
3/4	3/4	.030	1	3	5	59890	HEV-S-50750-R.030	
	3/4	.030	1-1/4	4	5	83009	HEV-SR-50750-R.030	new
	3/4	.030	1-5/8	4	5	59891	HEV-R-50750-R.030	
	3/4	.030	2-1/4	5	5	59892	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	new
	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	new
	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	new
	3/4	.060	3-1/4	6	5	83013	HEV-LX-50750-R.060	new
	3/4	.090	1-5/8	4	5	81881	HEV-R-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	.250	1-5/8	4	5	81883	HEV-R-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-6



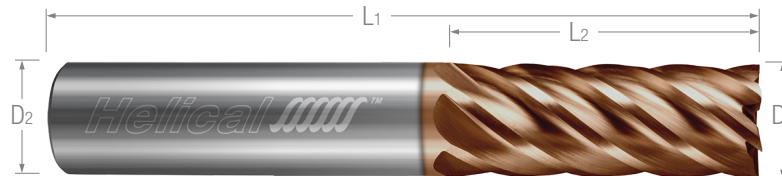
New Items!

6 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 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
- *Tplus* 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 136 for *Aplus* coating



	Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Tplus Coated	Tool Description
	D1 ^{+0.000"} _{-0.002"}	D2(h6)	L2 ^{+0.032"} _{-0.000"}	L1 ^{+0.062"} _{-0.062"}			
new new new new 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
new new new	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
new new	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
new new new new new new	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
new new new new new new	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
new	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

* .0005 max TIR

Speeds & Feeds on Page 147



6 FLUTE - BALL

New Items!

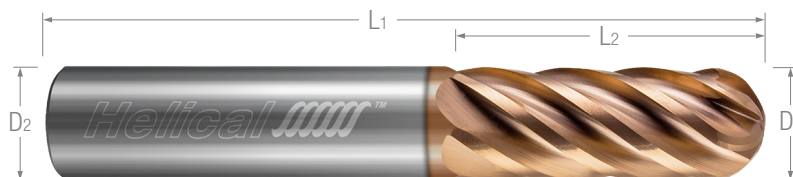


HEV-6

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
- *Tplus* 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 138 for *Aplus* coating



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Tplus</i> Coated	Tool Description
$D1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D2 \text{ (h6)}$	$L2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
1/4	1/4	3/8	2	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
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
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
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
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
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
1	1	2	4-1/2	6	81938	HEV-R-61000-BN

* .0005 max TIR

Speeds & Feeds on Page 147



Plunging / Ramping



Roughing



Finishing



3D Milling

HEV-6



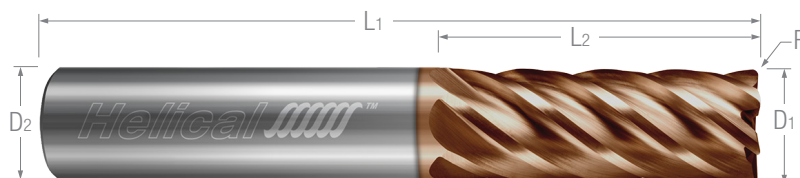
New Items!

6 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 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
- *Tplus* 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 *Aplus* coating



Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Tplus Coated	Tool Description
D ₁ ^{+0.000"} - .002"	D ₂ (h6)	R ^{+ .002"} - .002"	L ₂ ^{+ .032"} - .002"	L ₁ ^{+ .062"} - .062"			
1/4	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	.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	.060	7/16	2	6	83329	HEV-S-60312-R.060
	5/16	.060	3/4	2-1/2	6	83330	HEV-R-60312-R.060
3/8	3/8	.020	1/2	2	6	59918	HEV-S-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	1	3	6	59922	HEV-R-60375-R.030
	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	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

* .0005 max TIR

continued on next page



6 FLUTE - CORNER RADIUS

New Items!



HEV-6

Variable Pitch (cont.)

continued from previous page

Cutter Diameter* D1 ^{+0.000"} -0.002"	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Flutes	Tplus Coated	Tool Description	
3/8	3/8	.090	1/2	2	6	81906	HEV-S-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	new
	3/8	.090	1-1/2	3-1/2	6	83335	HEV-L-60375-R.090	new
1/2	1/2	.010	1	3	6	83336	HEV-SR-60500-R.010	new
	1/2	.010	1-1/4	3	6	83337	HEV-R-60500-R.010	new
	1/2	.015	1	3	6	83338	HEV-SR-60500-R.015	new
	1/2	.015	1-1/4	3	6	83339	HEV-R-60500-R.015	new
	1/2	.020	1	3	6	83340	HEV-SR-60500-R.020	new
	1/2	.020	1-1/4	3	6	83341	HEV-R-60500-R.020	new
	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	.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	.090	5/8	2-1/2	6	83342	HEV-S-60500-R.090	new
	1/2	.090	1	3	6	83343	HEV-SR-60500-R.090	new
	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	
5/8	5/8	.030	1-1/4	3-1/2	6	83344	HEV-SR-60625-R.030	new
	5/8	.030	1-5/8	3-1/2	6	83345	HEV-R-60625-R.030	new
	5/8	.060	1-1/4	3-1/2	6	83346	HEV-SR-60625-R.060	new
	5/8	.060	1-5/8	3-1/2	6	83347	HEV-R-60625-R.060	new
	5/8	.090	1-1/4	3-1/2	6	83348	HEV-SR-60625-R.090	new
	5/8	.090	1-5/8	3-1/2	6	83349	HEV-R-60625-R.090	new
	5/8	.125	1-1/4	3-1/2	6	83350	HEV-SR-60625-R.125	new
	5/8	.125	1-5/8	3-1/2	6	83351	HEV-R-60625-R.125	new

* .0005 max TIR

continued on next page

HEV-6



New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Tplus Coated	Tool Description
	$D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D_2 (h6)$	$R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
new	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
new		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
new		3/4	.125	1	3	6	83354	HEV-S-60750-R.125
new		3/4	.125	1-5/8	4	6	83355	HEV-R-60750-R.125
new		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
new	1	3/4	.250	1	3	6	83357	HEV-S-60750-R.250
new		3/4	.250	1-5/8	4	6	83358	HEV-R-60750-R.250
new		3/4	.250	2-1/4	5	6	83359	HEV-M-60750-R.250
new		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

7 FLUTE - SQUARE

New Item!

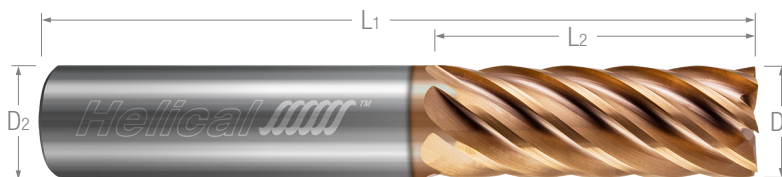


HEV-7

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 148 for Aplus coating



Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	T _{plus} Coated	Tool Description
D1 $\begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	D2 (h6)	L2 $\begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	L1 $\begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
1/4	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
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	1-1/2	3-1/2	7	81939	HEV-L-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
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
	3/4	1-5/8	4	7	81944	HEV-R-70750
	3/4	2-1/4	5	7	81945	HEV-M-70750
	1	2	5	7	81946	HEV-R-71000

new

* .0005 max TIR

Speeds & Feeds on Page 156



HEV-7



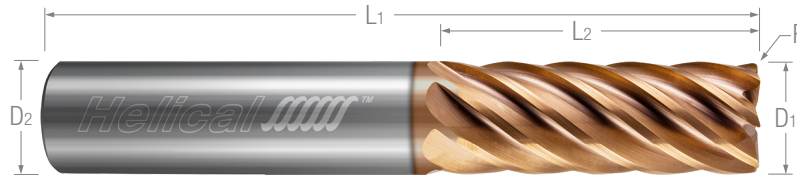
New Items!

7 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 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 150 for Aplus coating



new

new

new

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new

new

7 Flute

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	T _{plus} Coated	Tool Description
D ₁ ^{+0.000"} -0.002"	D ₂ (h6)	R ^{+0.002"} -0.002"	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"			
1/4	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
3/8	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	1-1/2	3-1/2	7	81947	HEV-L-70375-R.020
	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
1/2	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	.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	.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
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	.060	1-1/4	3-1/2	7	83400	HEV-SR-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
	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	2-1/4	5	7	83404	HEV-M-70750-R.060

* .0005 max TIR

Speeds & Feeds on Page 156



MULTI-FLUTE - CORNER RADIUS

New Items!

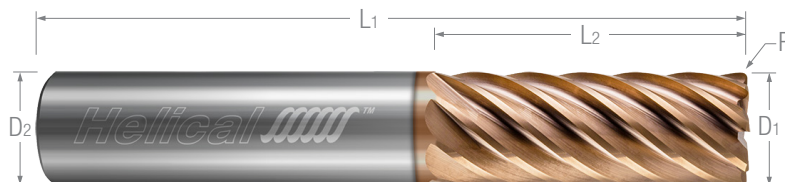


HXF

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
- *Tplus* 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 159 for *Aplus* coating



Cutter Diameter* $D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Corner Radius $R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	Length of Cut $L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$	Flutes	<i>Tplus</i> 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	new
	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	new
	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	new
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	new
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

Speeds & Feeds on Page 160



END MILLS FOR TITANIUM

Titanium & Titanium Alloys

ROUGHERS

				PG
new	5 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	186
new	6 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	188
new	7 Flute	Corner Radius	Chipbreaker Rougher - Variable Pitch	190

5 FLUTE

				PG
new	5 Flute	Corner Radius	Variable Pitch	192
	5 Flute	Corner Radius	Variable Pitch - Metric	198

6 FLUTE

				PG
new	6 Flute	Corner Radius	Variable Pitch - For High Efficiency Milling	200
new	6 Flute	Ball	Variable Pitch	203
new	6 Flute	Corner Radius	Variable Pitch	204
	6 Flute	Corner Radius	Variable Pitch - Metric	207

7 FLUTE

				PG
new	7 Flute	Corner Radius	Variable Pitch	209
	7 Flute	Corner Radius	Variable Pitch - Metric	211

MULTI-FLUTE

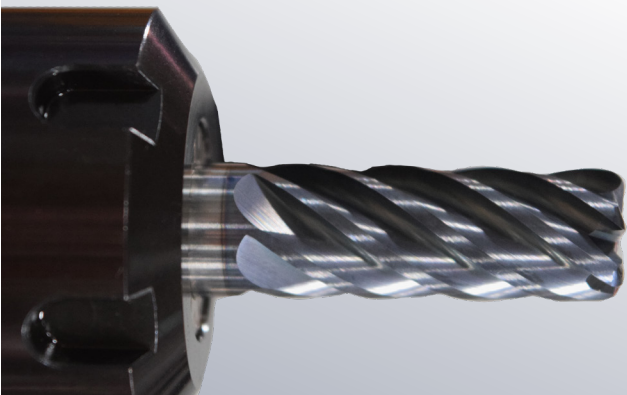
				PG
new	Multi-Flute	Corner Radius	Finisher	213

MADE FOR HIGH EFFICIENCY MILLING (HEM)

HVTI-6 End Mill for Titanium pg 200

Experience higher Metal Removal Rates (MRR) and enjoy 20% more time in the cut with Helical's 6-flute variable pitch end mill for titanium, designed with a unique combination of rake, core, and edge geometries for exceptionally reliable and controlled wear.

Extensive testing in Ti 6-4 has proven its excellence in extending tool life and elevating part quality. This tool is a workhorse for HEM in Titanium.



5 FLUTE - CORNER RADIUS

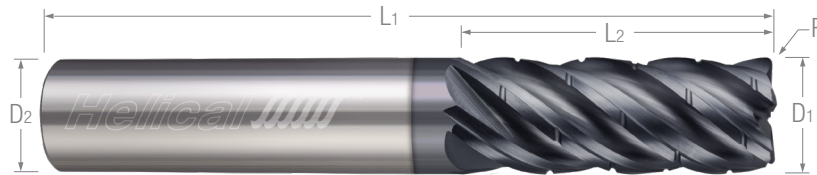
New Items!



HEV-C-5

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
- *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

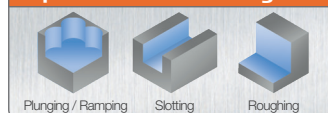


Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description	
D1 ^{+0.000"} -0.002"	D2 (h6)	R ^{+0.002"} -0.002"	L2 ^{+0.032"} -0.000"	L1 ^{+0.062"} -0.062"				
1/8	1/8	.010	1/4	1-1/2	5	59391	HEV-C-S-50125-R.010	
	1/8	.010	3/8	2	5	82213	HEV-C-SR-50125-R.010	
	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
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	.030	5/16	2	5	83070	HEV-C-S-50187-R.030	new
	3/16	.030	7/16	2	5	83071	HEV-C-SR-50187-R.030	new
	3/16	.030	9/16	2-1/2	5	83072	HEV-C-R-50187-R.030	new
1/4	1/4	.020	3/8	2	5	59395	HEV-C-S-50250-R.020	
	1/4	.020	1/2	2-1/2	5	59396	HEV-C-SR-50250-R.020	
	1/4	.020	3/4	2-1/2	5	59397	HEV-C-R-50250-R.020	
	1/4	.020	1	3	5	59398	HEV-C-M-50250-R.020	
	1/4	.020	1-1/4	3	5	82215	HEV-C-L-50250-R.020	
	1/4	.020	1-1/2	3	5	83074	HEV-C-LX-50250-R.020	new
	1/4	.030	3/8	2	5	83075	HEV-C-S-50250-R.030	new
	1/4	.030	1/2	2-1/2	5	83076	HEV-C-SR-50250-R.030	new
	1/4	.030	3/4	2-1/2	5	83077	HEV-C-R-50250-R.030	new
	1/4	.030	1	3	5	83078	HEV-C-M-50250-R.030	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	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 75



HEV-C-5



New Items!

5 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

Roughers

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
	D1 ^{+0.000"} -0.002"	D2 (h6)	R ^{+0.002"} -0.002"	L2 ^{+0.032"} -0.000"	L1 ^{+0.062"} -0.062"			
new	3/8	3/8	.030	1/2	2	5	83080	HEV-C-S-50375-R.030
new		3/8	.030	3/4	2-1/2	5	83081	HEV-C-SR-50375-R.030
new		3/8	.030	1	3	5	83082	HEV-C-R-50375-R.030
new		3/8	.030	1-1/4	3	5	83083	HEV-C-M-50375-R.030
new	1/2	1/2	.010	5/8	2-1/2	5	83084	HEV-C-S-50500-R.010
new		1/2	.010	1	3	5	83085	HEV-C-SR-50500-R.010
new		1/2	.010	1-1/4	3	5	83086	HEV-C-R-50500-R.010
new		1/2	.010	1-5/8	4	5	83087	HEV-C-M-50500-R.010
new		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
		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
new		1/2	.060	3-1/8	6	5	83089	HEV-C-X-50500-R.060
	5/8	5/8	.030	3/4	3	5	59409	HEV-C-S-50625-R.030
		5/8	.030	1-1/4	3-1/2	5	59410	HEV-C-SR-50625-R.030
		5/8	.030	1-5/8	3-1/2	5	59411	HEV-C-R-50625-R.030
		5/8	.030	2-1/8	4	5	59412	HEV-C-M-50625-R.030
		5/8	.030	2-1/2	5	5	82220	HEV-C-L-50625-R.030
		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
	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
	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

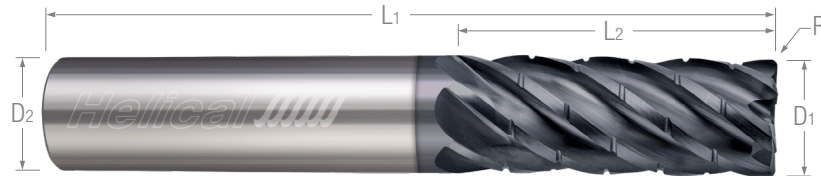
New Items!



HEV-C-6

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
- *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

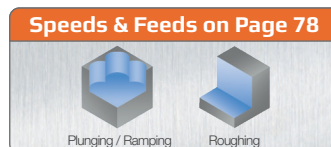


Cutter Diameter* D1 ^{+0.000"} -0.002"	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Flutes	Aplus Coated	Tool Description	
1/4	1/4	.010	3/8	2	6	83125	HEV-C-S-60250-R.010	new
	1/4	.010	1/2	2-1/2	6	83126	HEV-C-SR-60250-R.010	new
	1/4	.010	3/4	2-1/2	6	83127	HEV-C-R-60250-R.010	new
	1/4	.010	1	3	6	83128	HEV-C-M-60250-R.010	new
	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	
3/8	3/8	.010	1/2	2	6	83129	HEV-C-S-60375-R.010	new
	3/8	.010	3/4	2-1/2	6	83130	HEV-C-SR-60375-R.010	new
	3/8	.010	1	3	6	83131	HEV-C-R-60375-R.010	new
	3/8	.010	1-1/4	3	6	83132	HEV-C-M-60375-R.010	new
	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	
1/2	1/2	.010	5/8	2-1/2	6	83133	HEV-C-S-60500-R.010	new
	1/2	.010	1	3	6	83134	HEV-C-SR-60500-R.010	new
	1/2	.010	1-1/4	3	6	83135	HEV-C-R-60500-R.010	new
	1/2	.010	1-5/8	4	6	83136	HEV-C-M-60500-R.010	new
	1/2	.010	2	4	6	83137	HEV-C-L-60500-R.010	new
	1/2	.010	2-1/2	5	6	83138	HEV-C-LX-60500-R.010	new
	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	

* .0005 max TIR

Speeds & Feeds on Page 78

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HEV-C-6



New Items!

6 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
new new 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
new new new 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

* .0005 max TIR

7 FLUTE - CORNER RADIUS

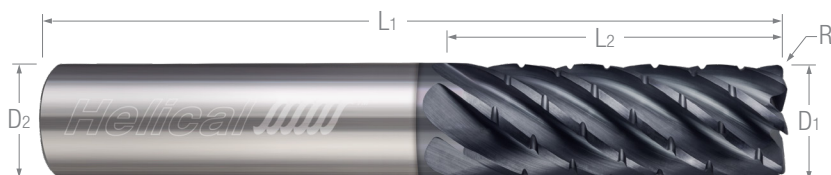
New Items!



HEV-C-7

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
- *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* D1 ^{+0.000"} _{-.002"}	Shank Diameter D2 (h6)	Corner Radius R ^{+0.002"} _{-.002"}	Length of Cut L2 ^{+0.032"} _{-.000"}	Overall Length L1 ^{+0.062"} _{-.062"}	Flutes	<i>Aplus</i> Coated	Tool Description	
1/4	1/4	.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
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	
	3/8	.060	1/2	2	7	83164	HEV-C-S-70375-R.060	new
	3/8	.060	3/4	2-1/2	7	83165	HEV-C-SR-70375-R.060	new
	3/8	.060	1	2-1/2	7	83166	HEV-C-R-70375-R.060	new
1/2	1/2	.020	5/8	2-1/2	7	83167	HEV-C-S-70500-R.020	new
	1/2	.020	1	3	7	83168	HEV-C-SR-70500-R.020	new
	1/2	.020	1-1/4	3	7	83169	HEV-C-R-70500-R.020	new
	1/2	.020	1-5/8	4	7	83170	HEV-C-M-70500-R.020	new
	1/2	.020	2	4	7	83171	HEV-C-L-70500-R.020	new
	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	
	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	new

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Speeds & Feeds on Page 82



Roughing

HEV-C-7



New Items!

7 FLUTE - CORNER RADIUS

Chipbreaker Rougher - Variable Pitch (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
	$D_1 \begin{smallmatrix} +.000'' \\ -.002'' \end{smallmatrix}$	$D_2 (h6)$	$R \begin{smallmatrix} +.002'' \\ -.002'' \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032'' \\ -.000'' \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062'' \\ -.062'' \end{smallmatrix}$			
new	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
new	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	.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
new	3/4	3/4	.060	2-1/4	5	7	81987	HEV-C-M-70750-R.060
		3/4	.060	2-3/4	5	7	81988	HEV-C-L-70750-R.060

* .0005 max TIR

5 FLUTE - CORNER RADIUS

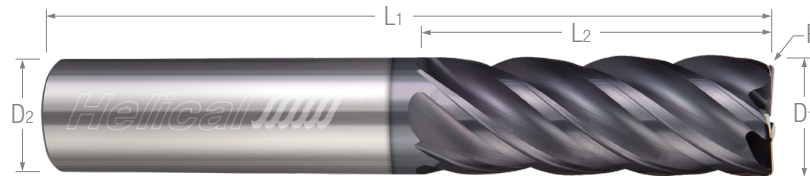
New Items!



HEV-5

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
- *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.* D1 $^{+.000''}_{-.002''}$	Shank Dia. D2 (h6)	Corner Radius R $^{+.002''}_{-.002''}$	LOC L2 $^{+.032''}_{-.000''}$	OAL L1 $^{+.062''}_{-.062''}$	Flutes	<i>Aplus</i> Coated	<i>Aplus</i> 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	.015	1/4	1-1/2	5	81720		HEV-S-50125-R.015
	1/8	.015	3/8	2	5	82530		HEV-SR-50125-R.015
	1/8	.015	1/2	2-1/2	5	81721		HEV-R-50125-R.015
	1/8	.030	1/4	1-1/2	5	45017		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
5/32	3/16	.010	3/16	2	5	81722		HEV-S-50156-R.010
	3/16	.010	7/16	2-1/2	5	81723		HEV-R-50156-R.010
	3/16	.010	9/16	2-1/2	5	81724		HEV-M-50156-R.010
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	.015	5/16	2	5	81727		HEV-S-50187-R.015
	3/16	.015	7/16	2	5	82533		HEV-SR-50187-R.015
	3/16	.015	9/16	2-1/2	5	81728		HEV-R-50187-R.015
	3/16	.015	3/4	2-1/2	5	82534		HEV-M-50187-R.015
	3/16	.015	1	2-1/2	5	82535		HEV-ML-50187-R.015
	3/16	.030	5/16	2	5	45062		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

*.0005 max TIR

continued on next page

Speeds & Feeds on Page 132



HEV-5



New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} -0.002"	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L ₂ ^{+0.032"} -0.000"	OAL L ₁ ^{+0.062"} -0.062"	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
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	.020	7/16	2	5	34167	34167W	HEV-S-50312-R.020
	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	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

*.0005 max TIR

continued on next page

5 FLUTE - CORNER RADIUS

New Items!



HEV-5

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.000"} _{-.002"}	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.002"} _{-.002"}	LOC L ₂ ^{+0.032"} _{-.000"}	OAL L ₁ ^{+0.062"} _{-.062"}	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
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	.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	.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	.090	1/2	2	5	45214		HEV-S-50375-R.090
	3/8	.090	1	3	5	45229		HEV-R-50375-R.090
	3/8	.090	1-1/4	3	5	45244		HEV-M-50375-R.090
	3/8	.090	1-1/2	3-1/2	5	45249		HEV-L-50375-R.090
	3/8	.125	1/2	2	5	82549		HEV-S-50375-R.125
	3/8	.125	1	3	5	82550		HEV-R-50375-R.125
	3/8	.125	1-1/4	3	5	82551		HEV-M-50375-R.125

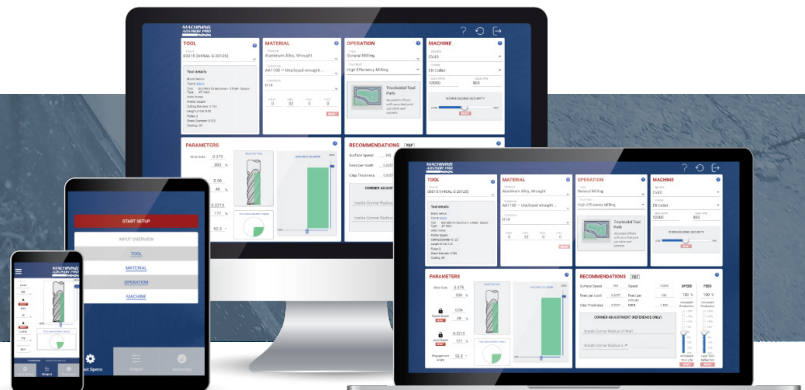
new

new

*.0005 max TIR

continued on next page

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HEV-5



New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

	Cutter Dia.* $D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	Shank Dia. $D_2 (h6)$	Corner Radius $R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	LOC $L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	OAL $L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
new	1/2	1/2	.010	5/8	2-1/2	5	81753	81753W	HEV-S-50500-R.010
new		1/2	.010	1	3	5	81754	81754W	HEV-SR-50500-R.010
new		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
new		1/2	.015	5/8	2-1/2	5	81758	81758W	HEV-S-50500-R.015
new		1/2	.015	1	3	5	81759	81759W	HEV-SR-50500-R.015
new		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
new		1/2	.020	5/8	2-1/2	5	81761	81761W	HEV-S-50500-R.020
new		1/2	.020	1	3	5	81762	81762W	HEV-SR-50500-R.020
new		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
new		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
new		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
new		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
new		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
new		1/2	.090	5/8	2-1/2	5	45258	45258W	HEV-S-50500-R.090
new		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
new		1/2	.120	5/8	2-1/2	5	45259	45259W	HEV-S-50500-R.120
new		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
new		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

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5 FLUTE - CORNER RADIUS

New Items!



HEV-5

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Corner Radius R ^{+0.002"} -0.002"	LOC L2 ^{+0.032"} -0.000"	OAL L1 ^{+0.062"} -0.062"	Flutes	Aplus Coated	Aplus Coated + Weldon Flat	Tool Description
5/8	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		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		HEV-L-50750-R.030
	3/4	.030	3-1/4	6	5	34402		HEV-LX-50750-R.030
	3/4	.030	4	6-1/2	5	82563		HEV-X-50750-R.030
	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

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HEV-5



New Items!

5 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* $D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	Shank Dia. $D_2 (h6)$	Corner Radius $R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	LOC $L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	OAL $L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$	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	1-5/8	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	1-5/8	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	1-5/8	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		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		HEV-S-51000-R.030
	1	.030	2	4-1/2	5	34422		HEV-R-51000-R.030
	1	.030	2-5/8	5	5	34437		HEV-M-51000-R.030
	1	.030	3-1/4	6	5	34442		HEV-L-51000-R.030
	1	.030	4-1/4	7	5	34447		HEV-X-51000-R.030
	1	.060	1-1/4	4	5	45407		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

*.0005 max TIR

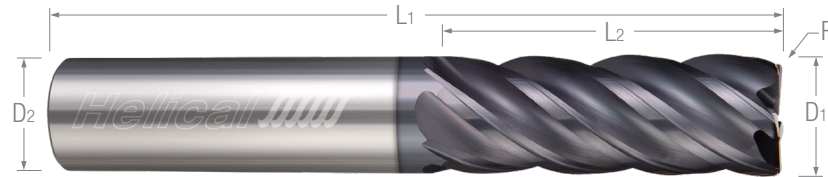
5 FLUTE - CORNER RADIUS - METRIC



MHEV-5
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
- *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

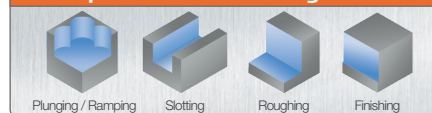


Cutter Dia.* D1 $+0.00$ -0.05 mm	Shank Dia. D2 (h6)	Corner Radius R $+0.05$ -0.05 mm	Length of Cut L2 $+0.80$ -0.00 mm	Overall Length L1 $+1.60$ -1.60 mm	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	5	59517	MHEV-015-50600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	5	59535	MHEV-020-50600-R0.50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

* .013 mm max TIR

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Speeds & Feeds on Page 132



MHEV-5

METRIC



5 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)

continued from previous page

Cutter Dia.* D ₁ ^{+0.00 mm} -0.05 mm	Shank Dia. D ₂ (h6)	Corner Radius R ^{+0.05 mm} -0.05 mm	Length of Cut L ₂ ^{+0.80 mm} -0.00 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	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

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



6 FLUTE - CORNER RADIUS

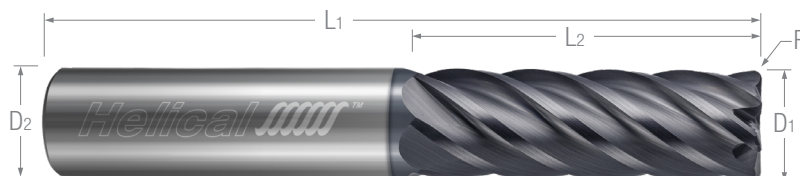
New Items!



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
- *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* D1 $^{+.0001}_{-.002}$	Shank Diameter D2 (h6)	Corner Radius R $^{+.002}_{-.002}$	Length of Cut L2 $^{+.032}_{-.000}$	Overall Length L1 $^{+.062}_{-.062}$	Flutes	Aplus Coated	Tool Description	
1/4	1/4	.010	3/8	2	6	83887	HVTI-015-60250-R.010	new
	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	new
	1/4	.020	1/2	2-1/2	6	83889	HVTI-020-60250-R.020	new
	1/4	.020	3/4	2-1/2	6	83890	HVTI-030-60250-R.020	new
	1/4	.020	1	3	6	83891	HVTI-040-60250-R.020	new
	1/4	.030	3/8	2	6	83892	HVTI-015-60250-R.030	new
	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	new
	1/4	.060	1/2	2-1/2	6	83894	HVTI-020-60250-R.060	new
	1/4	.060	3/4	2-1/2	6	83895	HVTI-030-60250-R.060	new
	1/4	.060	1	3	6	83896	HVTI-040-60250-R.060	new
5/16	5/16	.030	7/16	2	6	83897	HVTI-014-60312-R.030	new
	5/16	.030	3/4	2-1/2	6	83898	HVTI-024-60312-R.030	new
	5/16	.030	1	3	6	83899	HVTI-032-60312-R.030	new
	5/16	.030	1-1/4	3	6	83900	HVTI-040-60312-R.030	new
	5/16	.060	7/16	2	6	83901	HVTI-014-60312-R.060	new
	5/16	.060	3/4	2-1/2	6	83902	HVTI-024-60312-R.060	new
	5/16	.060	1	3	6	83903	HVTI-032-60312-R.060	new
	5/16	.060	1-1/4	3	6	83904	HVTI-040-60312-R.060	new
3/8	3/8	.010	1/2	2	6	83905	HVTI-013-60375-R.010	new
	3/8	.010	3/4	2-1/2	6	83906	HVTI-020-60375-R.010	new
	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	new
	3/8	.020	1	3	6	83908	HVTI-026-60375-R.020	new
	3/8	.020	1-1/4	3	6	83909	HVTI-033-60375-R.020	new
	3/8	.020	1-1/2	3-1/2	6	83910	HVTI-040-60375-R.020	new

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 202



HVTI-6



New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch - For High Efficiency Milling (cont.)

continued from previous page

	Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
	D ₁ ^{+0.000"} -0.002"	D ₂ (h6)	R ^{+0.002"} -0.002"	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"			
new	3/8	3/8	.030	1/2	2	6	83911	HVTI-013-60375-R.030
new		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
new		3/8	.030	1-3/4	4	6	83913	HVTI-046-60375-R.030
new		3/8	.060	1	3	6	83914	HVTI-026-60375-R.060
new		3/8	.060	1-1/4	3	6	83915	HVTI-033-60375-R.060
new		3/8	.060	1-1/2	3-1/2	6	83916	HVTI-040-60375-R.060
	1/2	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
new		1/2	.010	2-1/2	5	6	83917	HVTI-050-60500-R.010
new		1/2	.020	1	3	6	83918	HVTI-020-60500-R.020
new		1/2	.020	1-1/4	3	6	83919	HVTI-025-60500-R.020
new		1/2	.020	1-5/8	4	6	83920	HVTI-032-60500-R.020
new		1/2	.020	2	4	6	83921	HVTI-040-60500-R.020
new		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
new		1/2	.030	2-1/2	5	6	83923	HVTI-050-60500-R.030
new		1/2	.030	3-1/8	6	6	83924	HVTI-062-60500-R.030
new		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
		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
new	5/8	5/8	.030	1-1/4	3-1/2	6	83926	HVTI-020-60625-R.030
new		5/8	.030	1-5/8	3-1/2	6	83927	HVTI-026-60625-R.030
new		5/8	.030	2	4	6	83928	HVTI-032-60625-R.030
new		5/8	.030	2-1/2	5	6	83929	HVTI-040-60625-R.030
new		5/8	.060	1-1/4	3-1/2	6	83930	HVTI-020-60625-R.060
new		5/8	.060	1-5/8	3-1/2	6	83931	HVTI-026-60625-R.060
new		5/8	.060	2	4	6	83932	HVTI-032-60625-R.060
new		5/8	.060	2-1/2	5	6	83933	HVTI-040-60625-R.060
new		5/8	.120	1-1/4	3-1/2	6	83934	HVTI-020-60625-R.120
new		5/8	.120	1-5/8	3-1/2	6	83935	HVTI-026-60625-R.120
new		5/8	.120	2	4	6	83936	HVTI-032-60625-R.120
new		5/8	.120	2-1/2	5	6	83937	HVTI-040-60625-R.120

*.0005 max TIR

continued on next page

6 FLUTE - CORNER RADIUS

New Items!



HVTI-6

Variable Pitch - For High Efficiency Milling (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description	
$D_1^{+.000"}_{-.002"}$	$D_2(h6)$	$R^{+.002"}_{-.002"}$	$L_2^{+.032"}_{-.000"}$	$L_1^{+.062"}_{-.062"}$				
3/4	3/4	.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	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	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	.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	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

HVTI-6

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

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

NOTES:

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

HEV-6

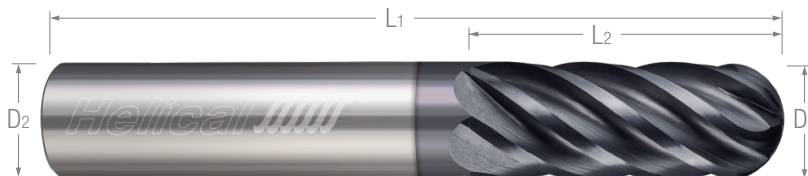


New Items!

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
- *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



new

new

new

Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
D1 $^{+.000}_{-.002}$ "	D2 (h6)	L2 $^{+.032}_{-.000}$ "	L1 $^{+.062}_{-.062}$ "			
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 147



Plunging / Ramping



Roughing



Finishing



3D Milling

6 FLUTE - CORNER RADIUS

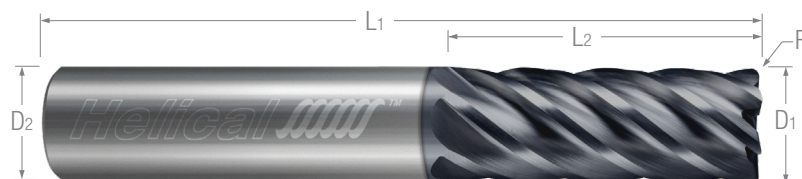
New Items!



HEV-6

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
- *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*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1^{+.000}_{-.002}$	D_2 (h6)	$R^{+.002}_{-.002}$	$L_2^{+.032}_{-.000}$	$L_1^{+.062}_{-.062}$			
1/4	1/4	.020	3/8	2	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	.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	.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	.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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 147



HEV-6



New Items!

6 FLUTE - CORNER RADIUS

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	$D_2 (h6)$	$R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	$L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	$L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$			
3/8	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
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	.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	.020	1	3	6	82582	HEV-SR-60500-R.020
	1/2	.020	1-1/4	3	6	82583	HEV-R-60500-R.020
	1/2	.030	5/8	2-1/2	6	59320	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	.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	.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

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6 FLUTE - CORNER RADIUS

New Items!



HEV-6

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
D1 ^{+0.000"} -0.002"	D2 (h6)	R ^{+0.002"} -0.002"	L2 ^{+0.032"} -0.000"	L1 ^{+0.062"} -0.062"			
5/8	5/8	.030	3/4	3	6	59340	HEV-S-60625-R.030
	5/8	.030	1-1/4	3-1/2	6	59341	HEV-SR-60625-R.030
	5/8	.030	1-5/8	3-1/2	6	59345	HEV-R-60625-R.030
	5/8	.030	2	4	6	59349	HEV-M-60625-R.030
	5/8	.030	2-1/2	5	6	59353	HEV-L-60625-R.030
	5/8	.060	1-1/4	3-1/2	6	59342	HEV-SR-60625-R.060
	5/8	.060	1-5/8	3-1/2	6	59346	HEV-R-60625-R.060
	5/8	.060	2	4	6	59350	HEV-M-60625-R.060
	5/8	.090	1-1/4	3-1/2	6	59343	HEV-SR-60625-R.090
	5/8	.090	1-5/8	3-1/2	6	59347	HEV-R-60625-R.090
	5/8	.090	2	4	6	59351	HEV-M-60625-R.090
	5/8	.125	1-1/4	3-1/2	6	59344	HEV-SR-60625-R.125
	5/8	.125	1-5/8	3-1/2	6	59348	HEV-R-60625-R.125
	5/8	.125	2	4	6	59352	HEV-M-60625-R.125
3/4	3/4	.030	1	3	6	59354	HEV-S-60750-R.030
	3/4	.030	1-5/8	4	6	59360	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	.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	.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
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

new

new

MHEV-6

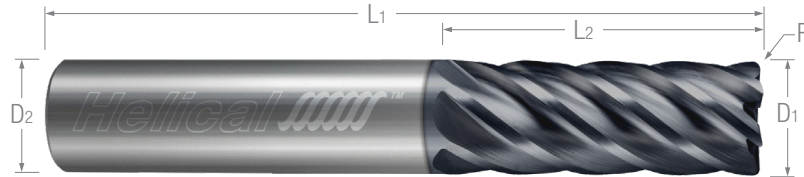
METRIC



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
- *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*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
D1 $+0.00$ -0.05 mm	D2 (h6)	R $+0.05$ -0.05 mm	L2 $+0.80$ -0.00 mm	L1 $+1.6$ -1.6 mm			
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	6	59575	MHEV-015-60600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	6	59593	MHEV-020-60600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	6	59627	MHEV-030-60600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	6	59576	MHEV-015-60600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	6	59594	MHEV-020-60600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	6	59628	MHEV-030-60600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	6	59578	MHEV-015-60800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	6	59596	MHEV-020-60800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	6	59630	MHEV-030-60800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	6	59579	MHEV-015-60800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	6	59597	MHEV-020-60800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	6	59631	MHEV-030-60800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	6	59581	MHEV-015-61000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	6	59599	MHEV-020-61000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	6	59613	MHEV-025-61000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	6	59582	MHEV-015-61000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	6	59600	MHEV-020-61000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	6	59614	MHEV-025-61000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	6	59584	MHEV-015-61200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	6	59602	MHEV-020-61200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	6	59616	MHEV-025-61200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	6	59585	MHEV-015-61200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	6	59603	MHEV-020-61200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	6	59617	MHEV-025-61200-R1.00
16 mm	16.00 mm	.50 mm	24.00 mm	89 mm	6	59587	MHEV-015-61600-R0.50
	16.00 mm	.50 mm	32.00 mm	89 mm	6	59605	MHEV-020-61600-R0.50
	16.00 mm	.50 mm	40.00 mm	89 mm	6	59619	MHEV-025-61600-R0.50
	16.00 mm	1.00 mm	24.00 mm	89 mm	6	59588	MHEV-015-61600-R1.00
	16.00 mm	1.00 mm	32.00 mm	89 mm	6	59606	MHEV-020-61600-R1.00
	16.00 mm	1.00 mm	40.00 mm	89 mm	6	59620	MHEV-025-61600-R1.00

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 147



Plunging / Ramping



Roughing



Finishing

6 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)



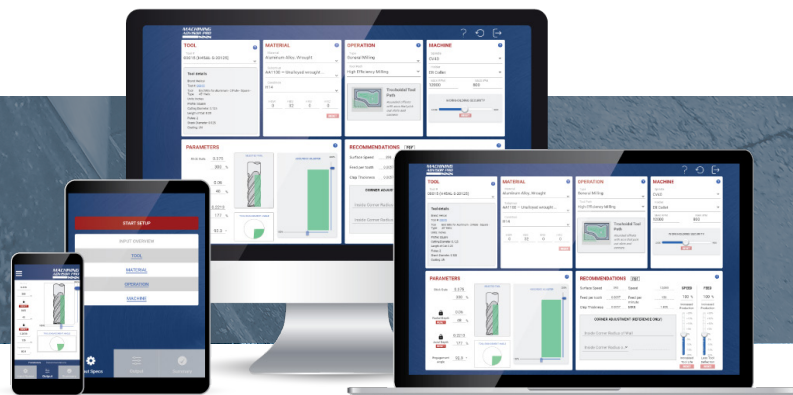
MHEV-6
METRIC

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Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
D1 $\begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	D2 (h6)	R $\begin{smallmatrix} +.05 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	L2 $\begin{smallmatrix} +.80 \text{ mm} \\ -.00 \text{ mm} \end{smallmatrix}$	L1 $\begin{smallmatrix} +1.6 \text{ mm} \\ -.1.6 \text{ mm} \end{smallmatrix}$			
20 mm	20.00 mm	.50 mm	30.00 mm	89 mm	6	59590	MHEV-015-62000-R0.50
	20.00 mm	.50 mm	40.00 mm	100 mm	6	59608	MHEV-020-62000-R0.50
	20.00 mm	.50 mm	50.00 mm	125 mm	6	59622	MHEV-025-62000-R0.50
	20.00 mm	1.00 mm	30.00 mm	89 mm	6	59591	MHEV-015-62000-R1.00
	20.00 mm	1.00 mm	40.00 mm	100 mm	6	59609	MHEV-020-62000-R1.00
	20.00 mm	1.00 mm	50.00 mm	125 mm	6	59623	MHEV-025-62000-R1.00
25 mm	25.00 mm	1.00 mm	50.00 mm	125 mm	6	59611	MHEV-020-62500-R1.00
	25.00 mm	1.00 mm	64.00 mm	125 mm	6	59625	MHEV-025-62500-R1.00

* .013 mm max TIR

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HEV-7

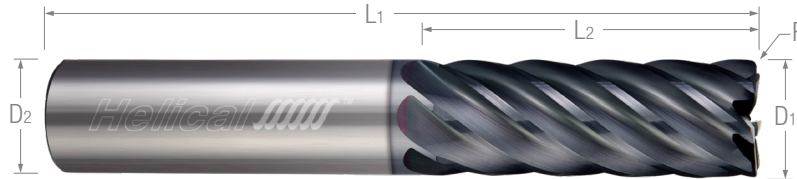


New Items!

7 FLUTE - CORNER RADIUS

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
- *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*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	<i>Aplus</i> Coated	Tool Description
	D1 ^{+0.000"} -0.002"	D2 (h6)	R ^{+0.002"} -0.002"	L2 ^{+0.032"} -0.000"	L1 ^{+0.062"} -0.062"			
new new new new	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	.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	.060	3/8	2	7	81807	HEV-S-70250-R.060
		1/4	.060	1/2	2	7	81808	HEV-SR-70250-R.060
		1/4	.060	3/4	2-1/2	7	81809	HEV-R-70250-R.060
new new new new	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	1-1/2	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
		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
		3/8	.060	1/2	2	7	81811	HEV-S-70375-R.060
		3/8	.060	3/4	2-1/2	7	81812	HEV-SR-70375-R.060
		3/8	.060	1	2-1/2	7	81813	HEV-R-70375-R.060
new new new new new	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
		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

* .0005 max TIR

continued on next page

Speeds & Feeds on Page 156



7 FLUTE - CORNER RADIUS

New Items!



HEV-7

Variable Pitch (cont.)

continued from previous page

Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
D ₁ ^{+0.000"} -0.002"	D ₂ (h6)	R ^{+0.002"} -0.002"	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"			
1/2	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
	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
5/8	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	1-1/4	3-1/2	7	81824	HEV-SR-70625-R.060
	5/8	.060	1-5/8	4	7	81825	HEV-R-70625-R.060
3/4	3/4	.030	1	3	7	27362	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
1	1	.030	1-1/4	4	7	27407	HEV-S-71000-R.030
	1	.030	2	5	7	27422	HEV-R-71000-R.030
	1	.030	3-1/4	6	7	27442	HEV-L-71000-R.030

* .0005 max TIR

MHEV-7

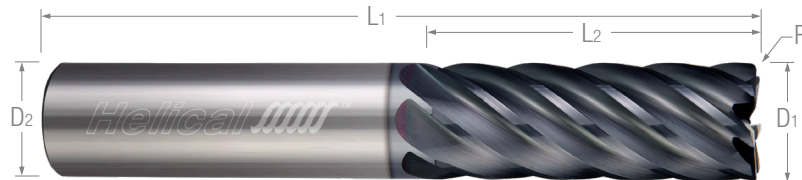
METRIC



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
- *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* D1 $+0.00$ mm -0.05 mm	Shank Diameter D2 (h6)	Corner Radius R $+0.05$ mm -0.05 mm	Length of Cut L2 $+0.80$ mm -0.00 mm	Overall Length L1 $+1.60$ mm -1.60 mm	Flutes	<i>Aplus</i> Coated	Tool Description
6 mm	6.00 mm	.50 mm	9.00 mm	63 mm	7	59633	MHEV-015-70600-R0.50
	6.00 mm	.50 mm	12.00 mm	63 mm	7	59651	MHEV-020-70600-R0.50
	6.00 mm	.50 mm	18.00 mm	63 mm	7	59685	MHEV-030-70600-R0.50
	6.00 mm	1.00 mm	9.00 mm	63 mm	7	59634	MHEV-015-70600-R1.00
	6.00 mm	1.00 mm	12.00 mm	63 mm	7	59652	MHEV-020-70600-R1.00
	6.00 mm	1.00 mm	18.00 mm	63 mm	7	59686	MHEV-030-70600-R1.00
8 mm	8.00 mm	.50 mm	12.00 mm	63 mm	7	59636	MHEV-015-70800-R0.50
	8.00 mm	.50 mm	16.00 mm	63 mm	7	59654	MHEV-020-70800-R0.50
	8.00 mm	.50 mm	24.00 mm	75 mm	7	59688	MHEV-030-70800-R0.50
	8.00 mm	1.00 mm	12.00 mm	63 mm	7	59637	MHEV-015-70800-R1.00
	8.00 mm	1.00 mm	16.00 mm	63 mm	7	59655	MHEV-020-70800-R1.00
	8.00 mm	1.00 mm	24.00 mm	75 mm	7	59689	MHEV-030-70800-R1.00
10 mm	10.00 mm	.50 mm	15.00 mm	63 mm	7	59639	MHEV-015-71000-R0.50
	10.00 mm	.50 mm	20.00 mm	63 mm	7	59657	MHEV-020-71000-R0.50
	10.00 mm	.50 mm	25.00 mm	75 mm	7	59671	MHEV-025-71000-R0.50
	10.00 mm	1.00 mm	15.00 mm	63 mm	7	59640	MHEV-015-71000-R1.00
	10.00 mm	1.00 mm	20.00 mm	63 mm	7	59658	MHEV-020-71000-R1.00
	10.00 mm	1.00 mm	25.00 mm	75 mm	7	59672	MHEV-025-71000-R1.00
12 mm	12.00 mm	.50 mm	18.00 mm	75 mm	7	59642	MHEV-015-71200-R0.50
	12.00 mm	.50 mm	24.00 mm	75 mm	7	59660	MHEV-020-71200-R0.50
	12.00 mm	.50 mm	30.00 mm	75 mm	7	59674	MHEV-025-71200-R0.50
	12.00 mm	1.00 mm	18.00 mm	75 mm	7	59643	MHEV-015-71200-R1.00
	12.00 mm	1.00 mm	24.00 mm	75 mm	7	59661	MHEV-020-71200-R1.00
	12.00 mm	1.00 mm	30.00 mm	75 mm	7	59675	MHEV-025-71200-R1.00

* .013 mm max TIR

continued on next page

Speeds & Feeds on Page 156



7 FLUTE - CORNER RADIUS - METRIC

Variable Pitch (cont.)


MHEV-7
METRIC

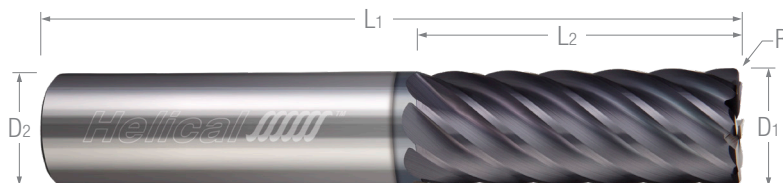
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Cutter Diameter*	Shank Diameter	Corner Radius	Length of Cut	Overall Length	Flutes	Aplus Coated	Tool Description
$D_1 \begin{smallmatrix} +.00 \text{ mm} \\ -.05 \text{ mm} \end{smallmatrix}$	$D_2 \text{ (h6)}$	$R \begin{smallmatrix} +.05 \text{ mm}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

*.013 mm max TIR

HXF**New Item!****MULTI-FLUTE - CORNER RADIUS****Finisher**

- 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
- *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* $D_1 \begin{smallmatrix} +.000" \\ -.002" \end{smallmatrix}$	Shank Diameter $D_2 \text{ (h6)}$	Corner Radius $R \begin{smallmatrix} +.002" \\ -.002" \end{smallmatrix}$	Length of Cut $L_2 \begin{smallmatrix} +.032" \\ -.000" \end{smallmatrix}$	Overall Length $L_1 \begin{smallmatrix} +.062" \\ -.062" \end{smallmatrix}$	Flutes	<i>Aplus</i> Coated	Tool Description
1/4	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

new

*.0005 max TIR

Multi-Flute

Speeds & Feeds on Page 160

FREE HEM GUIDEBOOK

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

HEM Defined

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

Best Practices

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

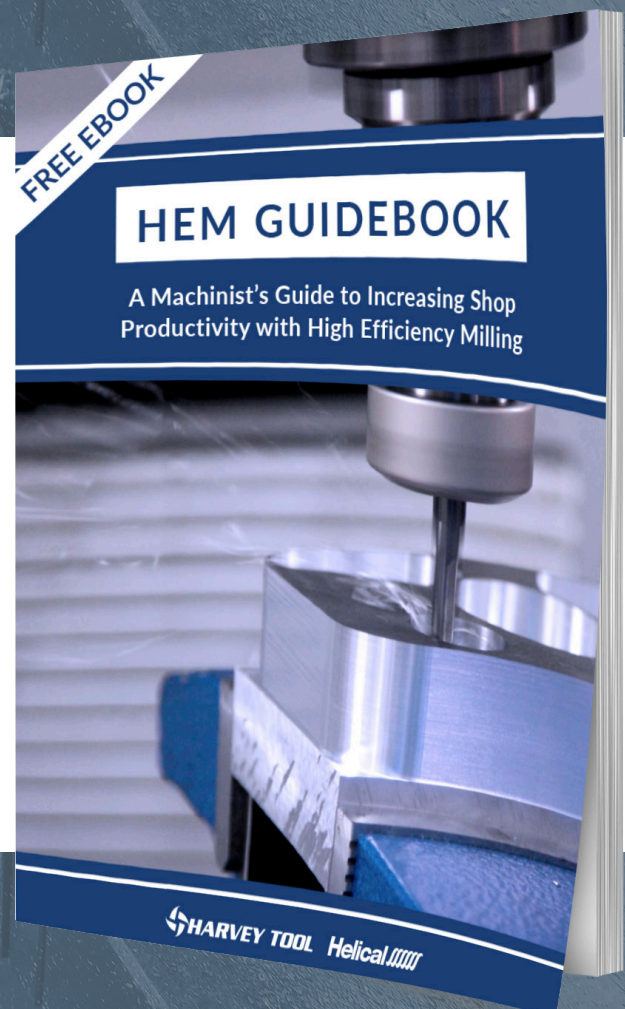
Pro Tips

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

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

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

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



www.helicaltool.com/hem

HIGH FEED END MILLS

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

	HIGH FEED END MILLS	PG
new	Steels Up to 45 Rc - Variable Pitch - Reduced Neck	216
	Steels Up to 45 Rc - Metric - Variable Pitch - Reduced Neck	217
new	Steels Up to 45 Rc - Variable Pitch - Coolant Through - Reduced Neck	218
	Steels Up to 45 Rc - Metric - Variable Pitch - Coolant Through - Reduced Neck	219

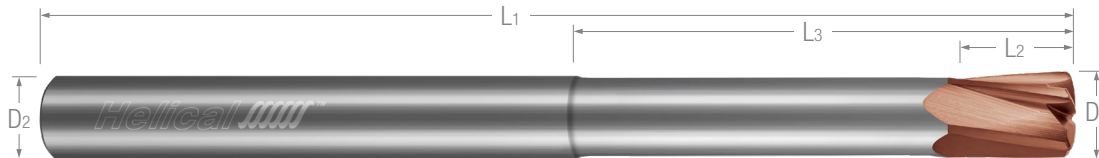


HIGH FEED END MILLS

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
- Tplus* 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.* D1 ^{+0.000"} -0.002"	Shank Dia. D2 (h6)	Length of Cut L2 ^{+0.032"} -0.000"	Overall Length L1 ^{+0.062"} -0.062"	Reach (LBS) L3	Neck Dia.	Flutes	Theoretical Radius**	<i>Tplus</i> 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 new
	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 new
	1/4	1/8	2-1/2	1	.110	4	.0157	83727	HFV-RN-080-40125 new
	1/4	1/8	2-1/2	1-1/4	.110	4	.0157	83728	HFV-RN-100-40125 new
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 new
	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 new
	1/4	3/16	3	1-1/2	.165	4	.0235	83731	HFV-RN-080-40187 new
	1/4	3/16	3	1-7/8	.165	4	.0235	83732	HFV-RN-100-40187 new
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 new
	1/4	1/4	4	2-1/2	.220	5	.0314	83720	HFV-RN-100-50250 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 new
	3/8	3/8	6	3-3/4	.330	5	.0471	83722	HFV-RN-100-50375 new
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 new
	1/2	1/2	7	5	.440	5	.0628	83724	HFV-RN-100-50500 new

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

See page 217 for diagram of theoretical radius



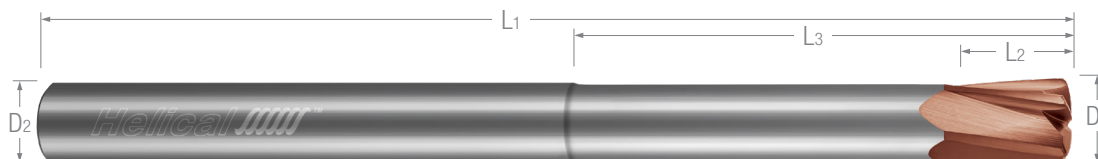
MHFV

METRIC

HIGH FEED END MILLS

Steels Up to 45 Rc - Metric - Variable Pitch - Reduced Neck

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

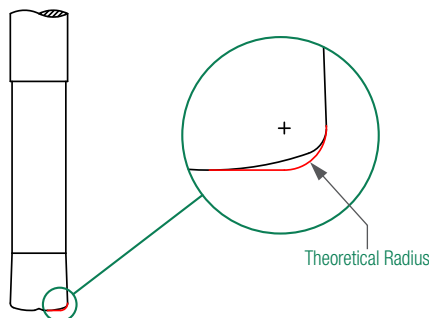


Cutter Dia.*	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Dia.	Flutes	Theoretical Radius**	<i>Tplus</i> Coated	Tool Description
$D_1^{+.00 \text{ mm}}_{-.05 \text{ mm}}$	$D_2 (h6)$	$L_2^{+.80 \text{ mm}}_{-.00 \text{ mm}}$	$L_1^{+.160 \text{ mm}}_{-1.60 \text{ mm}}$	L_3					
3 mm	3.00 mm	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
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
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
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
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

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.

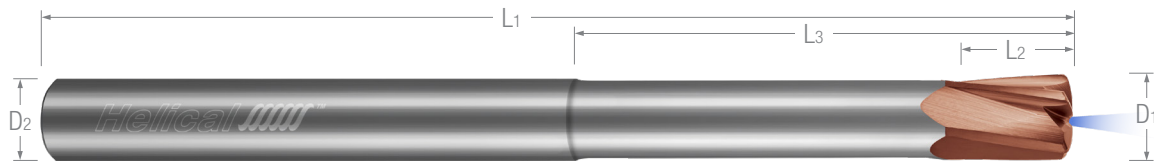


Speeds & Feeds on Page 220



HIGH FEED END MILLS **New Items!****HFVC****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
- Straight-through coolant hole for superior chip evacuation and heat management at the cutting edge
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Tplus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

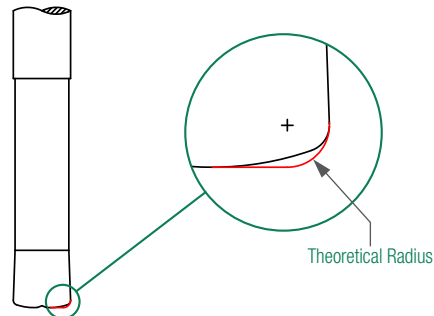


Cutter Dia.* $D_1^{+.000}_{-.002}$	Shank Dia. D_2 (h6)	Length of Cut $L_2^{+.032}_{-.000}$	Overall Length $L_1^{+.062}_{-.062}$	Reach (LBS) L_3	Neck Dia.	Flutes	Theoretical Radius**	<i>Tplus</i> Coated	Tool Description
1/4	1/4	1/4	3	1/2	.220	5	.0314	82696	HFVC-RN-020-50250
	1/4	1/4	3	1	.220	5	.0314	82697	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 new
	1/4	1/4	4	2-1/2	.220	5	.0314	83734	HFVC-RN-100-50250 new
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 new
	3/8	3/8	6	3-3/4	.330	5	.0471	83736	HFVC-RN-100-50375 new
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 new
	1/2	1/2	7	5	.440	5	.0628	83738	HFVC-RN-100-50500 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.

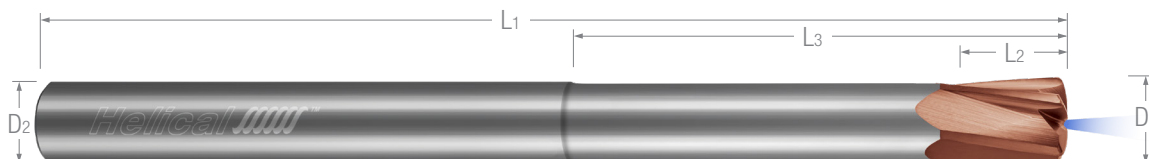
**Speeds & Feeds on Page 220**

MHFVC METRIC

HIGH FEED END MILLS

Steels Up to 45 Rc - Metric - 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
- Straight-through coolant hole for superior chip evacuation and heat management at the cutting edge
- Reduced neck provides maximum strength in long reach and deep pocketing applications
- End cutting geometry (non-center cutting)
- h6 shank tolerance for high precision tool holders
- *Tplus* coating offers high hardness for improved tool life and increased edge strength in difficult-to-machine materials
- Solid carbide
- CNC ground in the USA

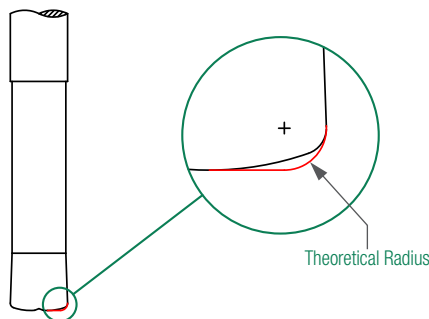


Cutter Dia.*	Shank Dia.	Length of Cut	Overall Length	Reach (LBS)	Neck Diameter	Flutes	Theoretical Radius**	Tplus Coated	Tool Description
D ₁ ^{+0.00 mm} -0.05 mm	D ₂ (h6)	L ₂ ^{+0.80 mm} -0.00 mm	L ₁ ^{+1.60 mm} -1.60 mm	L ₃					
6 mm	6.00 mm	6.00 mm	75 mm	12.00 mm	5.28 mm	5	.734 mm	82705	MHFVC-RN-020-50600
	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

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

HFV

High Feed End Mills

HFV / HFVC

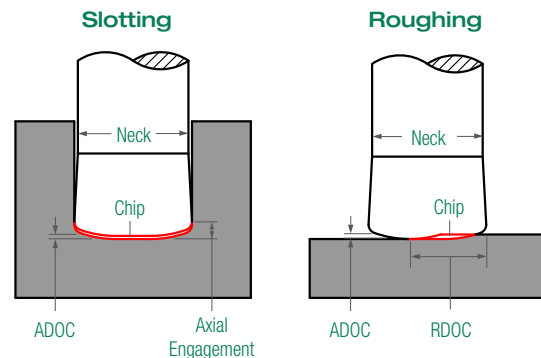
Material Guide		Hardness	SFM	Inches Per Tooth (IPT)									
				1/8		3/16		1/4		3/8		1/2	
				Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin	Rgh	Fin
CARBON STEEL	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	< 75 HRB	800	.0027	.0057	.0040	.0085	.0053	.0113	.0080	.0140	.0107	.0187
		75 - 98 HRB	750	.0020	.0037	.0030	.0055	.0040	.0073	.0060	.0110	.0080	.0147
		21 - 36 HRC	700	.0013	.0025	.0020	.0038	.0027	.0050	.0040	.0075	.0053	.0100
LOW ALLOY STEEL	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	75 - 98 HRB	600	.0027	.0057	.0040	.0085	.0053	.0113	.0080	.0140	.0107	.0187
		21 - 36 HRC	550	.0027	.0047	.0040	.0070	.0053	.0093	.0080	.0140	.0107	.0187
		36 - 50 HRC	400	.0020	.0033	.0030	.0050	.0040	.0067	.0060	.0100	.0080	.0133
TOOL STEEL	A2, H13, L6, P20, S7	> 50 HRC	350	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
		75 - 98 HRB	550	.0027	.0057	.0040	.0085	.0053	.0113	.0080	.0140	.0107	.0187
		21 - 36 HRC	500	.0027	.0047	.0040	.0070	.0053	.0093	.0080	.0140	.0107	.0187
SPECIALTY STEEL	A2, H13, L6, P20, S7	36 - 50 HRC	450	.0020	.0033	.0030	.0050	.0040	.0067	.0060	.0100	.0080	.0133
		> 50 HRC	400	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
		< 75 HRB	450	.0027	.0067	.0040	.0100	.0053	.0133	.0080	.0140	.0107	.0187
AUSTENITIC STAINLESS STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	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
MARTENSITIC & FERRITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	> 50 HRC	350	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
		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
PH STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	36 - 50 HRC	400	.0022	.0040	.0033	.0060	.0043	.0080	.0065	.0120	.0087	.0160
		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
GRAY CAST IRON	15-5, 17-4, Carpenter 450, Carpenter 465	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
		36 - 50 HRC	400	.0020	.0033	.0030	.0050	.0040	.0067	.0060	.0100	.0080	.0133
MALLEABLE CAST IRON	SAE J431, ASTM A48	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
		36 - 50 HRC	400	.0013	.0020	.0020	.0030	.0027	.0040	.0040	.0060	.0053	.0080
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
		36 - 50 HRC	150	.0022	.0028	.0033	.0042	.0043	.0056	.0065	.0084	.0087	.0112
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	75 - 98 HRB	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
		21 - 36 HRC	225	.0020	.0023	.0030	.0035	.0040	.0047	.0060	.0070	.0080	.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.

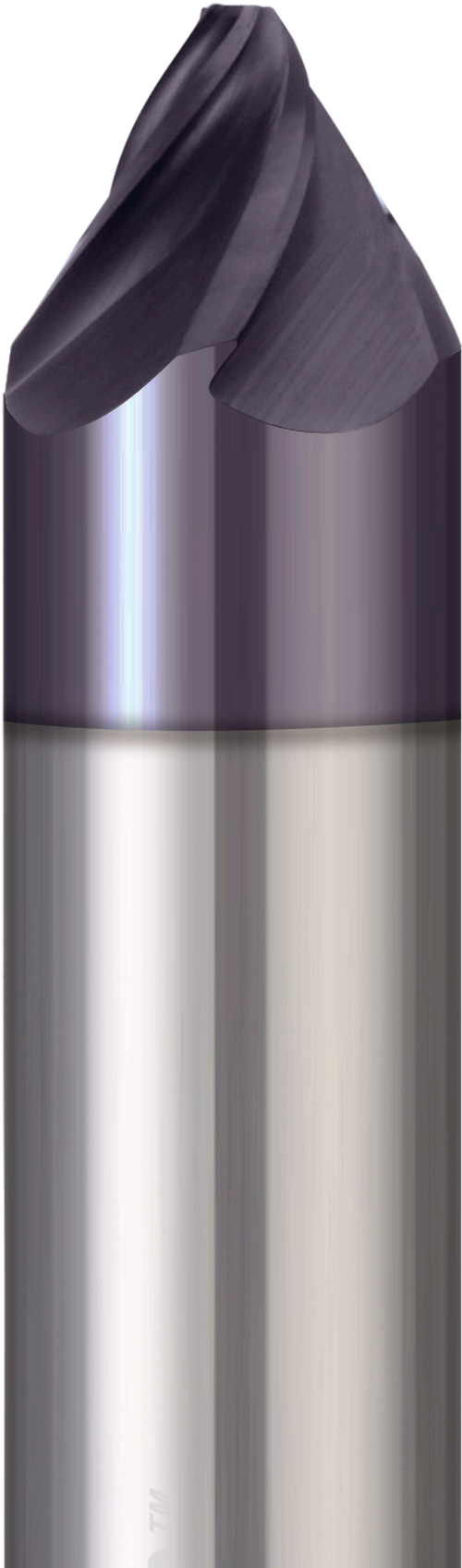


SPECIALTY PROFILES

Chamfer Cutters & Combination Chamfer / End Mills

Helical's offering of Chamfer Mills include two unique flute styles: straight flute, and helical flute. Our Straight Flute Chamfer Cutters are fully stocked in 2 and 4 flute options, and are perfect for generating high quality results in standard operations. Our Helical Flute Chamfer Cutters, engineered for versatility and excellent performance in chamfering and side milling applications, are offered with a tipped-off end profile in 3 or 5 flutes, or in a pointed end profile in 2 and 4 flutes.

Finally, Helical's new Combination Chamfer / End Mills are a great choice for profile milling and chamfering applications where tool space in your machine is limited. With a variable helix and helically fluted tip design, these combination tools provide versatility without sacrificing performance.



CHAMFER MILLS			PG
2 & 4 Flute	Chamfer Mills	Straight Flute	222
2 & 4 Flute	Chamfer Mills	Helical Flute - High Performance	224
3 & 5 Flute	Chamfer mills	Helical Flute - High Performance	225
COMBINATION CHAMFER / END MILLS			PG
4 Flute	Combination Mills	4 Flute - High Performance	228

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
- 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



Included Angle A $+0^{\circ}30'$ $-0^{\circ}30'$	Shank Diameter* D2 (h6)	Web Thickness (MAX)	Length of Cut L2	Overall Length L1 $+0.062''$ $-0.062''$	Flutes	Uncoated	<i>Aplus</i> Coated	Tool Description
60°	1/8	.015	.108	2	2	06225	06228	HCM60-20125
	3/16	.018	.162	2	2	06240	06243	HCM60-20187
	3/16	.018	.162	2	4	06330	06333	HCM60-40187
	1/4	.020	.216	2-1/2	2	06255	06258	HCM60-20250
	1/4	.020	.216	2-1/2	4	06345	06348	HCM60-40250
	3/8	.035	.324	2-1/2	2	06270	06273	HCM60-20375
	3/8	.035	.324	2-1/2	4	06360	06363	HCM60-40375
	1/2	.040	.433	3	2	06285	06288	HCM60-20500
	1/2	.040	.433	3	4	06375	06378	HCM60-40500
	3/4	.045	.649	3	4	06390	06393	HCM60-40750
90°	1/8	.015	.062	2	2	06015	06018	HCM90-20125
	3/16	.018	.093	2	2	06030	06033	HCM90-20187
	3/16	.018	.093	2	4	06120	06123	HCM90-40187
	1/4	.020	.125	2-1/2	2	06045	06048	HCM90-20250
	1/4	.020	.125	2-1/2	4	06135	06138	HCM90-40250
	3/8	.035	.187	2-1/2	2	06060	06063	HCM90-20375
	3/8	.035	.187	2-1/2	4	06150	06153	HCM90-40375
	1/2	.040	.250	3	2	06075	06078	HCM90-20500
	1/2	.040	.250	3	4	06165	06168	HCM90-40500
	3/4	.045	.375	3	4	06180	06183	HCM90-40750
120°	1/8	.015	.037	2	2	06405	06408	HCM120-20125
	3/16	.018	.056	2	2	06420	06423	HCM120-20187
	3/16	.018	.056	2	4	06480	06483	HCM120-40187
	1/4	.020	.075	2-1/2	2	06435	06438	HCM120-20250
	1/4	.020	.075	2-1/2	4	06495	06498	HCM120-40250
	3/8	.035	.112	2-1/2	2	06450	06453	HCM120-20375
	3/8	.035	.112	2-1/2	4	06510	06513	HCM120-40375
	1/2	.040	.150	3	2	06465	06468	HCM120-20500
	1/2	.040	.150	3	4	06525	06528	HCM120-40500
	3/4	.045	.225	3	4	06540	06543	HCM120-40750

* .0005 max TIR

HCM

SPEEDS & FEEDS

Chamfer Mills - Straight Flute

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 21 - 36 HRC	325 300	.0004 .0005	.0008 .0011	.0012 .0018	.0018 .0022	.0020 .0028	.0025 .0035	.0035 .0045	.0040 .0055	.0050 .0070
PH STAINLESS STEEL	15-5, 17-4 Carpenter 450 Carpenter 465	21 - 36 HRC 36 - 50 HRC	225 120	.0004 .0003	.0009 .0007	.0012 .0010	.0018 .0012	.0022 .0018	.0028 .0020	.0035 .0028	.0045 .0035	.0055 .0040
GRAY CAST IRON	SAE J431, ASTM A48	75 - 98 HRB 21 - 36 HRC	450 400	.0011 .0008	.0022 .0015	.0035 .0022	.0045 .0030	.0055 .0040	.0070 .0045	.0090 .0060	.0110 .0080	.0130 .0090
MALLEABLE CAST IRON	ASTM A47, ASTM A220 ASTM A602	75 - 98 HRB 21 - 36 HRC	350 300	.0007 .0005	.0012 .0009	.0020 .0015	.0028 .0020	.0035 .0022	.0040 .0028	.0055 .0040	.0070 .0045	.0080 .0055
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	325 275 160	.0007 .0005 .0002	.0012 .0010 .0005	.0020 .0015 .0007	.0028 .0020 .0010	.0035 .0025 .0012	.0040 .0030 .0015	.0055 .0040 .0020	.0070 .0050 .0025	.0080 .0060 .0030
PURE NICKEL	Nickel 200, Nickel 201	< 75 HRB 75 - 98 HRB	450 450	.0008 .0007	.0015 .0015	.0022 .0020	.0030 .0028	.0040 .0035	.0045 .0040	.0060 .0055	.0080 .0070	.0090 .0080
NICKEL ALLOY	Hastelloy C-22 Inconel 625, Waspaloy René 41, Inconel 718 Incoloy 20	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	175 150 80	.0004 .0004 .0004	.0009 .0008 .0007	.0012 .0012 .0011	.0018 .0015 .0015	.0022 .0020 .0018	.0028 .0025 .0020	.0035 .0030 .0028	.0045 .0040 .0035	.0055 .0050 .0040
PURE TITANIUM	Ti Grade 1, Ti Grade 2 Ti Grade 3, Ti Grade 4 Ti Grade 7, Ti Grade 12	< 75 HRB 75 - 98 HRB 21 - 36 HRC	350 400 350	.0009 .0005 .0005	.0018 .0010 .0011	.0028 .0015 .0015	.0035 .0020 .0022	.0045 .0025 .0028	.0055 .0030 .0030	.0070 .0040 .0045	.0090 .0050 .0055	.0110 .0060 .0060
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	21 - 36 HRC 36 - 50 HRC	200 140	.0004 .0004	.0009 .0007	.0012 .0010	.0018 .0015	.0022 .0018	.0028 .0022	.0035 .0030	.0045 .0035	.0055 .0045
COBALT ALLOY	ASTM F562, ASTM F90 ASTM F75, ASTM F799	75 - 98 HRB 21 - 36 HRC 36 - 50 HRC	225 150 80	.0003 .0004 .0003	.0006 .0008 .0006	.0008 .0012 .0010	.0010 .0018 .0012	.0015 .0020 .0015	.0018 .0025 .0020	.0022 .0035 .0025	.0028 .0040 .0030	.0035 .0050 .0040

NOTES:

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

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

HRB = Rockwell B

HRC = Rockwell C

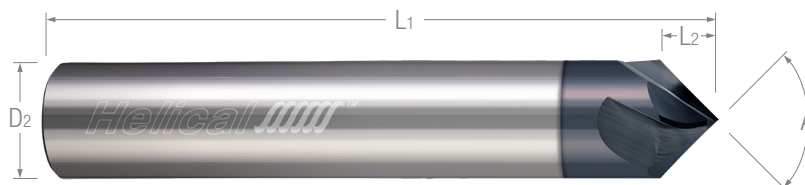
CHAMFER MILLS - HELICAL FLUTE

New!

HPCM

2 & 4 Flute - High Performance - Pointed

- 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
- *Zplus* coating offers higher hardness and added lubricity for maximum performance
- *Aplus* coating for added lubricity and higher speeds and feeds in a wide variety of ferrous metals and titanium alloys
- Solid carbide
- CNC ground in the USA



Incl. Angle A $+0^{\circ}30'$ $-0^{\circ}30'$	Shank Dia.* D ₂ (h6)	LOC L ₂	Web Thickness (MAX)	Overall Length L ₁ $+0.062''$ $-0.062''$	Flutes	Zplus Coated	Aplus Coated	Tool Description	
60°	1/8	.010	.100	1-1/2	2	83836	83780	HPCM60-20125	new
	3/16	.010	.154	2	2	83838	83782	HPCM60-20187	new
	3/16	.010	.154	2	4		83784	HPCM60-40187	new
	1/4	.010	.208	2-1/2	2	83840	83786	HPCM60-20250	new
	1/4	.010	.208	2-1/2	4		83788	HPCM60-40250	new
	3/8	.010	.316	2-1/2	2	83842	83790	HPCM60-20375	new
	3/8	.010	.316	2-1/2	4		83792	HPCM60-40375	new
	1/2	.010	.424	3	2	83844	83794	HPCM60-20500	new
	1/2	.010	.424	3	4		83796	HPCM60-40500	new
90°	1/8	.010	.058	1-1/2	2	83846	83798	HPCM90-20125	new
	1/8	.010	.058	1-1/2	4		83800	HPCM90-40125	new
	3/16	.010	.089	2	2	83848	83802	HPCM90-20187	new
	3/16	.010	.089	2	4		83804	HPCM90-40187	new
	1/4	.010	.120	2-1/2	2	83850	83806	HPCM90-20250	new
	1/4	.010	.120	2-1/2	4		83808	HPCM90-40250	new
	3/8	.010	.183	2-1/2	2	83852	83810	HPCM90-20375	new
	3/8	.010	.183	2-1/2	4		83812	HPCM90-40375	new
	1/2	.010	.245	3	2	83854	83814	HPCM90-20500	new
	1/2	.010	.245	3	4		83816	HPCM90-40500	new
120°	1/8	.010	.033	1-1/2	2	83856	83818	HPCM120-20125	new
	3/16	.010	.051	2	2	83858	83820	HPCM120-20187	new
	3/16	.010	.051	2	4		83822	HPCM120-40187	new
	1/4	.010	.069	2-1/2	2	83860	83824	HPCM120-20250	new
	1/4	.010	.069	2-1/2	4		83826	HPCM120-40250	new
	3/8	.010	.105	2-1/2	2	83862	83828	HPCM120-20375	new
	3/8	.010	.105	2-1/2	4		83830	HPCM120-40375	new
	1/2	.010	.141	3	2	83864	83832	HPCM120-20500	new
	1/2	.010	.141	3	4		83834	HPCM120-40500	new

* .0005 max TIR

HPCM

New Items!

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
- Zplus coating offers higher hardness and added lubricity for maximum performance
- 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



Incl. Angle	Shank Dia.*	LOC	Overall Length	Theoretical Tip Length	Tip Diameter	Flutes	Zplus Coated	Aplus Coated	Tool Description
A $+0^{\circ}30'$ $-0^{\circ}30'$	D2 (h6)	L2	L1 $+0.062''$ $-0.062''$	L3	D3 $+0.002''$ $-0.002''$				
60°	1/8	.074	1-1/2	.035	.040	3	83880	83866	HPCM60-30125
	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
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
	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

*.0005 max TIR

continued on next page

CHAMFER MILLS - HELICAL FLUTE

New Items!

HPCM

3 & 5 Flute - High Performance (cont.)

continued from previous page

Incl. Angle A $+0^{\circ}30'$ $-0^{\circ}30'$	Shank Dia.* D ₂ (h6)	LOC L ₂	Overall Length L ₁ $+0.062''$ $-0.062''$	Theoretical Tip Length L ₃	Tip Diameter D ₃ $+0.002''$ $-0.002''$	Flutes	Zplus Coated	Aplus Coated	Tool Description
100°	1/4	.080	2-1/2	.025	.060	3	59825	59809	HPCM100-30250
	1/4	.080	2-1/2	.025	.060	5		59812	HPCM100-50250
	3/8	.128	2-1/2	.029	.070	3	59826	59810	HPCM100-30375
	3/8	.128	2-1/2	.029	.070	5		59813	HPCM100-50375
	1/2	.176	3	.034	.080	3	59827	59811	HPCM100-30500
	1/2	.176	3	.034	.080	5		59814	HPCM100-50500
120°	1/4	.057	2-1/2	.017	.060	3	59828	07015	HPCM120-30250
	1/4	.057	2-1/2	.017	.060	5		59808	HPCM120-50250
	3/8	.091	2-1/2	.020	.070	3	59829	07016	HPCM120-30375
	3/8	.091	2-1/2	.020	.070	5		07034	HPCM120-50375
	1/2	.126	3	.023	.080	3	59830	07017	HPCM120-30500
	1/2	.126	3	.023	.080	5		07035	HPCM120-50500
	5/8	.157	3	.026	.090	3	59831	07018	HPCM120-30625
	5/8	.157	3	.026	.090	5		07036	HPCM120-50625
	3/4	.195	3	.029	.100	3	59832	07019	HPCM120-30750
	3/4	.195	3	.029	.100	5		07037	HPCM120-50750

*.0005 max TIR

HPCM

SPEEDS & FEEDS

Chamfer Mills - Helical Flute

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
LOW ALLOY STEEL	13XX, 41XX, 43XX 51XX, 86XX, 93XX	21 - 36 HRC	400	.0005	.0010	.0015	.0020	.0025	.0030	.0040	.0050	.0060
		36 - 50 HRC	350	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040
TOOL STEEL	A2, H13, L6, P20, S7	> 50 HRC	200	.0003	.0005	.0008	.0010	.0012	.0015	.0020	.0025	.0030
			90	.0003	.0005	.0008	.0010	.0012	.0015	.0020	.0025	.0030
SPECIALTY STEEL	300M, Invar 36, Kovar Maraging 200 Maraging 250 Maraging 300 Maraging 350	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
AUSTENITIC STAINLESS STEEL	Nitronic 50 Nitronic 60, 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347	36 - 50 HRC	150	.0003	.0007	.0010	.0012	.0018	.0020	.0028	.0035	.0040
			50	.0002	.0005	.0007	.0010	.0012	.0015	.0020	.0025	.0030
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420 440, 430, 446	75 - 98 HRB	325	.0006	.0010	.0018	.0022	.0028	.0035	.0045	.0055	.0070
		21 - 36 HRC	300	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0050
PH STAINLESS STEEL	15-5, 17-4 Carpenter 450 Carpenter 465	75 - 98 HRB	325	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0050
		21 - 36 HRC	300	.0004	.0009	.0012	.0018	.0022	.0028	.0035	.0045	.0050
GRAY CAST IRON	SAE J431, ASTM A48	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
MALLEABLE CAST IRON	ASTM A47, ASTM A220 ASTM A602	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
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	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
PURE NICKEL	Nickel 200, Nickel 201	36 - 50 HRC	160	.0003	.0005	.0008	.0010	.0012	.0015	.0020	.0025	.0030
NICKEL ALLOY	Hastelloy C-22 Inconel 625, Waspaloy René 41, Inconel 718 Incoloy 20	< 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
PURE TITANIUM	Ti Grade 1, Ti Grade 2 Ti Grade 3, Ti Grade 4 Ti Grade 7, Ti Grade 12	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
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	36 - 50 HRC	80	.0004	.0007	.0011	.0015	.0018	.0022	.0030	.0035	.0045
COBALT ALLOY	ASTM F562, ASTM F90 ASTM F75, ASTM F799	< 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
COBALT ALLOY	ASTM F562, ASTM F90 ASTM F75, ASTM F799	21 - 36 HRC	350	.0006	.0010	.0018	.0022	.0028	.0035	.0045	.0055	.0070
		36 - 50 HRC	200	.0005	.0008	.0012	.0015	.0020	.0022	.0028	.0030	.0045
COBALT ALLOY	ASTM F562, ASTM F90 ASTM F75, ASTM F799	21 - 36 HRC	225	.0003	.0006	.0009	.0012	.0015	.0018	.0022	.0030	.0035
		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 $\pm 25\%$ as needed.

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

HRB = Rockwell B

HRC = Rockwell C

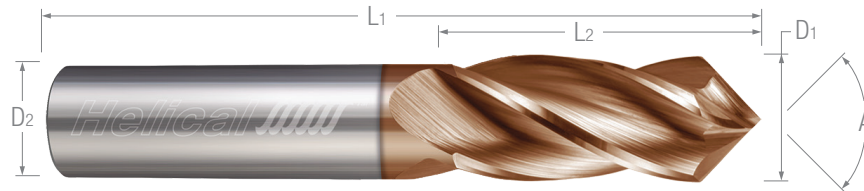
COMBINATION CHAMFER / END MILLS

New!

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
- Tplus* 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 $+0^{\circ}30'$ $-0^{\circ}30'$	Cutter Diameter* D1 $+0.000''$ $-0.002''$	Shank Diameter D2 (h6)	Web Thickness (MAX)	LOC L2 $+0.032''$ $-0.000''$	Overall Length L1 $+0.062''$ $-0.062''$	Flutes	<i>Tplus</i> Coated	Tool Description	
60°	1/8	1/8	.009	1/2	1-1/2	4	83740	HCCM60-40125	new
	3/16	3/16	.010	5/8	2	4	83742	HCCM60-40187	new
	1/4	1/4	.010	3/4	2-1/2	4	83744	HCCM60-40250	new
	3/8	3/8	.013	7/8	2-1/2	4	83746	HCCM60-40375	new
	1/2	1/2	.013	1	3	4	83748	HCCM60-40500	new
90°	1/8	1/8	.009	1/2	1-1/2	4	83750	HCCM90-40125	new
	3/16	3/16	.010	5/8	2	4	83752	HCCM90-40187	new
	1/4	1/4	.010	3/4	2-1/2	4	83754	HCCM90-40250	new
	3/8	3/8	.013	7/8	2-1/2	4	83756	HCCM90-40375	new
	1/2	1/2	.013	1	3	4	83758	HCCM90-40500	new
100°	1/8	1/8	.009	1/2	1-1/2	4	83760	HCCM100-40125	new
	1/4	1/4	.010	3/4	2-1/2	4	83764	HCCM100-40250	new
	3/8	3/8	.013	7/8	2-1/2	4	83766	HCCM100-40375	new
	1/2	1/2	.013	1	3	4	83768	HCCM100-40500	new
120°	1/8	1/8	.009	1/2	1-1/2	4	83770	HCCM120-40125	new
	3/16	3/16	.010	5/8	2	4	83772	HCCM120-40187	new
	1/4	1/4	.010	3/4	2-1/2	4	83774	HCCM120-40250	new
	3/8	3/8	.013	7/8	2-1/2	4	83776	HCCM120-40375	new
	1/2	1/2	.013	1	3	4	83778	HCCM120-40500	new

* .0005 max TIR

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
TOOL STEEL	A2, H13, L6, P20, S7	> 50 HRC	155	.0004	.0003	.0006	.0005	.0008	.0008	.0012	.0012	.0015	.0015
		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
SPECIALTY STEEL	300M, Invar 36, Kovar, Maraging 200, Maraging 250, Maraging 300, Maraging 350	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
		75 - 98 HRB	290	.0010	.0006	.0015	.0012	.0020	.0020	.0030	.0030	.0039	.0040
AUSTENITIC STAINLESS STEEL	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	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
MARTENSITIC & FERRITIC STAINLESS STEEL	403, 410, 416, 420, 440, 430, 446	> 50 HRC	55	.0004	.0003	.0005	.0005	.0007	.0008	.0010	.0012	.0013	.0015
		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
PH STAINLESS STEEL	15-5, 17-4, Carpenter 450, Carpenter 465	36 - 50 HRC	180	.0006	.0004	.0008	.0007	.0011	.0011	.0016	.0018	.0021	.0020
		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
GRAY CAST IRON	SAE J431, ASTM A48	36 - 50 HRC	145	.0005	.0003	.0007	.0007	.0010	.0010	.0014	.0018	.0019	.0020
		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
		75 - 98 HRB	310	.0008	.0007	.0012	.0015	.0016	.0020	.0024	.0035	.0032	.0040
NODULAR (DUCTILE) CAST IRON	ASTM A536, ASTM 897	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
		75 - 98 HRB	285	.0011	.0008	.0016	.0015	.0021	.0022	.0031	.0040	.0041	.0045
PURE NICKEL	Nickel 200, Nickel 201	75 - 98 HRB	250	.0009	.0007	.0013	.0015	.0018	.0022	.0026	.0035	.0034	.0045
		< 75 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
NICKEL ALLOY	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	36 - 50 HRC	70	.0005	.0004	.0007	.0007	.0009	.0011	.0013	.0018	.0017	.0022
		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
PURE TITANIUM	Ti Grade 1, Ti Grade 2, Ti Grade 3, Ti Grade 4, Ti Grade 7, Ti Grade 12	75 - 98 HRB	300	.0015	.0009	.0022	.0020	.0029	.0028	.0043	.0045	.0057	.0055
		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
TITANIUM ALLOY	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	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
		> 50 HRC	65	.0004	.0003	.0006	.0007	.0008	.0010	.0012	.0018	.0016	.0020
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
		> 50 HRC	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.



IN THE LOUPE

Your Source for Machining Solutions

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



**How to Avoid Common
Part Finish Problems**



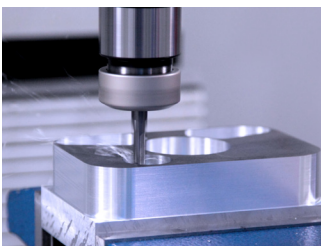
**Optimize Roughing with
Chipbreaker Tooling**



**Why Flute
Count Matters**



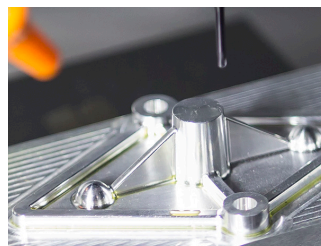
**Titanium
Machining Guide**



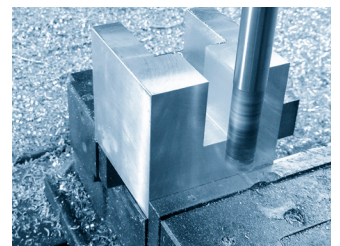
**How to Avoid 4 Major
Types of Tool Wear**



**Ball Nose
Milling Strategy**



**Corner Engagement:
How to Machine Corners**



**Introduction to High
Efficiency Milling**

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TECHNICAL INFORMATION

Programs, Resources, & More

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

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OUR PART NUMBERS

EDP Number

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

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

Cutter Diameter*	Shank Diameter	Length of Cut	Overall Length	Flutes	Uncoated	Zplus Coated	Tool Description
D ₁ (h6)	D ₂ (h6)	L ₂ ^{+0.032"} -0.000"	L ₁ ^{+0.062"} -0.062"				
1/8	1/8	1/4	1-1/2	3	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

new

new

Tool Description

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

Not applicable to square corner tools.

M	H	35	AL	C	RN	S or O40	3	O500	R.010
Metric	Helical	Helix Angle	Material Type Part Family	Chipbreaker	Reduced Neck	Length of Cut or LBS (Reach)	Number of Flutes	Cutter Diameter (0.000" or 00.00 mm)	Corner Radius / Profile
			AL - Aluminum ALV - Aluminum Variable Pitch CCM - Combination Chamfer / End Mill CM - Chamfer Mill EF - Exotic Finisher EV - Exotic Variable Pitch FV - Feed Mill Variable Pitch FVC - Feed Mill Variable Pitch Coolant-Through MG - High Balance MGC - High Balance Coolant-Through PCM - High Performance Chamfer Mill SF - Steel Finisher SV - Steel Variable Pitch SVR - Steel Variable Rougher VTI - Variable Pitch Titanium XF - Multi-Flute Finisher XVR - Multi-Flute Variable Pitch Rougher			S - Stub SR - Stub Regular R - Regular A - Regular/Medium M - Medium ML - Medium Long L - Long LX - Long/Extra Long X - Xtra Long Multiple 015 = 1.5x 040 = 4x 120 = 12x			R.010 - .010 Corner Radius R.015 - .015 Corner Radius R.030 - .030 Corner Radius R.060 - .060 Corner Radius R.090 - .090 Corner Radius R.120 - .120 Corner Radius R.190 - .190 Corner Radius R.250 - .250 Corner Radius R0.50 - 0.50 mm Corner Radius R1.00 - 1.00 mm Corner Radius BN - Ball Nose

SQUARE

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

EDP# 48396

H40ALV-R-30500

BALL

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

EDP# 49286

H40ALV-R-30500-BN

CORNER RADIUS

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

EDP# 48406

H40ALV-R-30500-R.030

CHOOSING THE RIGHT HELIX ANGLE

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

35° Helix

(Noted throughout our catalog as H35AL & H35ALV)

Slower helix design ensures:

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



40° Helix

(Noted throughout our catalog as H40ALV)

Medium helix design ensures:

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

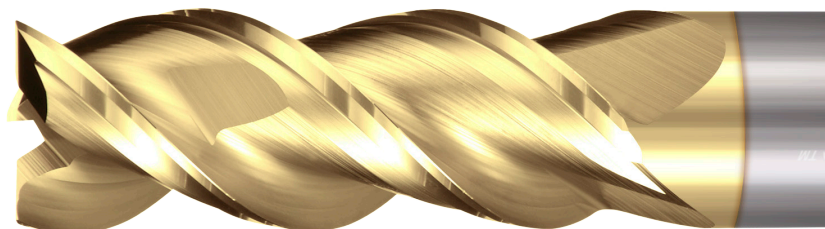


45° Helix

(Noted throughout our catalog as H45AL)

Higher helix design ensures:

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



CUSTOM TOOLS

How We Are Different

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

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

Our Capabilities

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

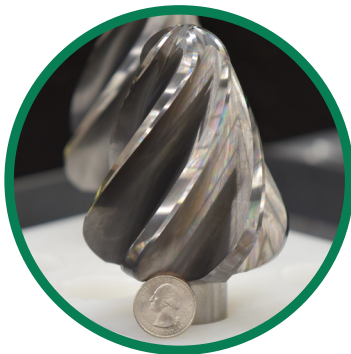
While we specialize in end mills, our team of professional engineers regularly design and manufacture form tools, drills, coolant-fed tooling, step drills, Christmas tree cutters, end mills, and more.

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

We Provide

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

Our Custom Tool Process



Detailed Understanding of Your Requirements

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



Designs Optimized for Your Specific Application

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



Outstanding Quality & Reliable Lead Times

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

1-866-543-5422

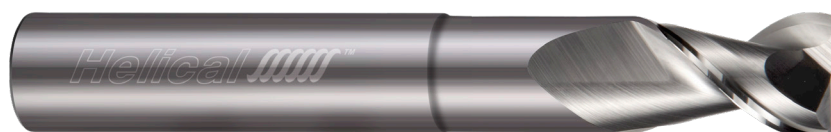
helicaltech@harveyperformance.com

TOOL MODIFICATIONS

What We Offer

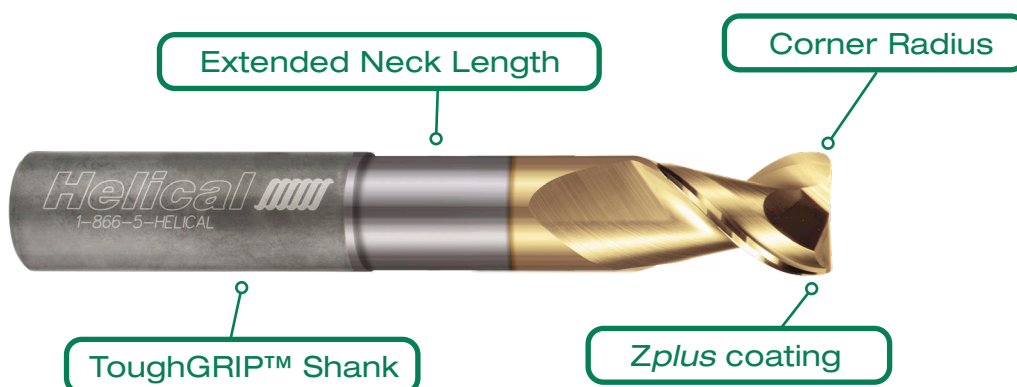
Custom tool needs can often be accommodated by modifying one of our standard tools. Upon receiving a custom tool RFQ, we will evaluate each modification request to confirm optimal performance. Should we feel a full custom tool design is warranted, we'll quote accordingly.

BEFORE



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

AFTER



Possible Modifications Include

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

Please see pages 236-237 for our Shank Modifications

SHANK MODIFICATIONS

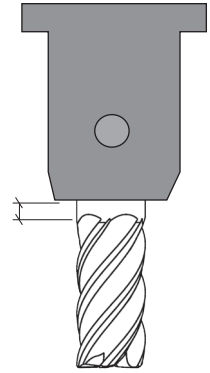
Types of Modifications

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

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

Factory-ground flats have several key advantages:

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



Our “flat location procedure” ensures:

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

Weldon Flat Specifications

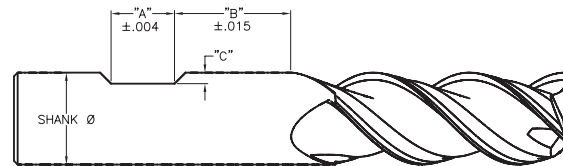
Weldon Flat specifications are typically based on NAS 986, a high speed steel tool standard, and are measured from the shank end. Currently, there is no standardized specification for high performance Solid carbide end mills. All flats will be ground using the dimensional chart (Figure 1.1) unless specified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

[Figure 1.1]

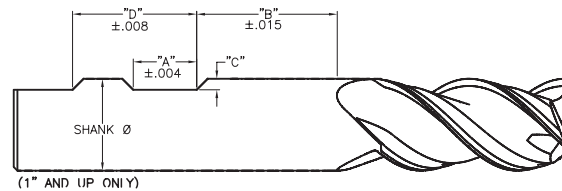
Shank Dia.	“A”	“B”	“C”	“D”
.1250	.155	.500	.012 +.005/-.000	-
.1875	.155	.500	.015 +.005/-.000	-
.250	.155	.500	.017 +.005/-.000	-
.3125	.295	.750	.020 +.005/-.000	-
.375	.295	.750	.050 +.015/-.000	-
.4375	.345	.835	.060 +.015/-.000	-
.500	.345	.835	.060 +.015/-.000	-
.625	.415	.900	.065 +.015/-.000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

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

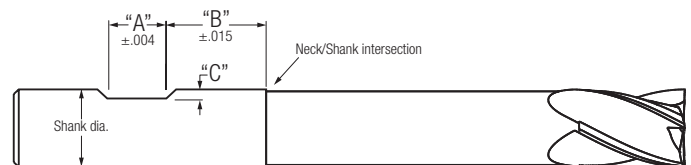
Hand-ground flats are not recommended, as they may cause higher tool runout, a susceptible area of breakage, and inconsistent alignment. Factory warranty is voided with hand-ground flats.



Single Weldon



Double Weldon



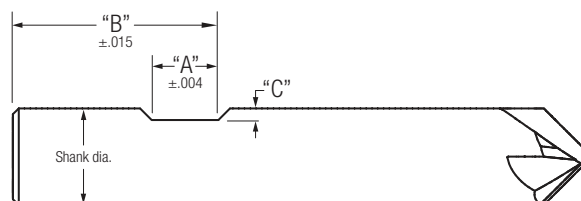
Single Weldon Reduced Neck

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

SHANK MODIFICATIONS

Chamfer Mill with Weldon Flat Specifications

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



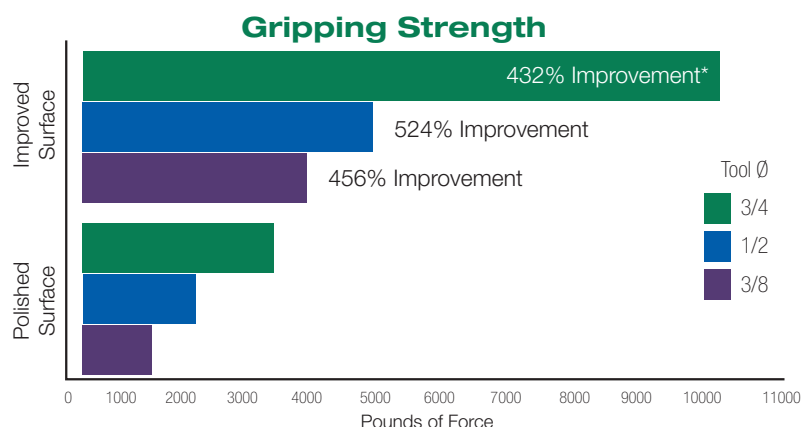
ToughGRIP™ Shank

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



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

ToughGRIP™ shanks provide increased friction for superior gripping strength.



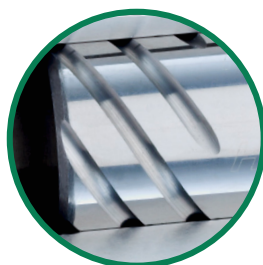
Based on independent laboratory testing. All tests were completed utilizing Command Tooling Systems' line of HYDRO-GRIP™ HD Hydraulic tool holders by ETP Transmission.

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

Haimer Safe-Lock™ System

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

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



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



TOOL RENEWAL

The Program

What It Is

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

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

How It Works

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

Renewal Benefits

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

How To Get Started

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

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



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

TOOL RENEWAL

The Process



TYPES OF TOOL ENTRY



Pre-Drilled Hole

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

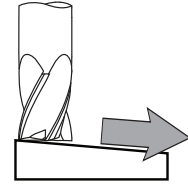
This method ensures the least amount of end work abuse and premature tool wear.



Helical Interpolation

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

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



Ramping-In

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

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

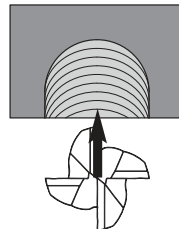
Download Machining Advisor Pro at www.machiningadvisorpro.com to get real-time Helical Interpolation information for your specific application.



Straight Plunge

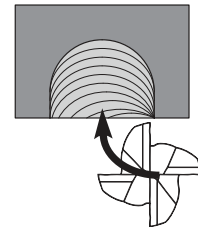
The least preferred method and one that can easily break a tool. The tool must be center cutting. End milling incorporates a flat entry point making chip evacuation tough, tool pressure very high and success random at best.

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



Straight Entry

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



Roll-In Entry

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

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

ANGLE OF ENGAGEMENT & CHIP THINNING

Tool Engagement Angle

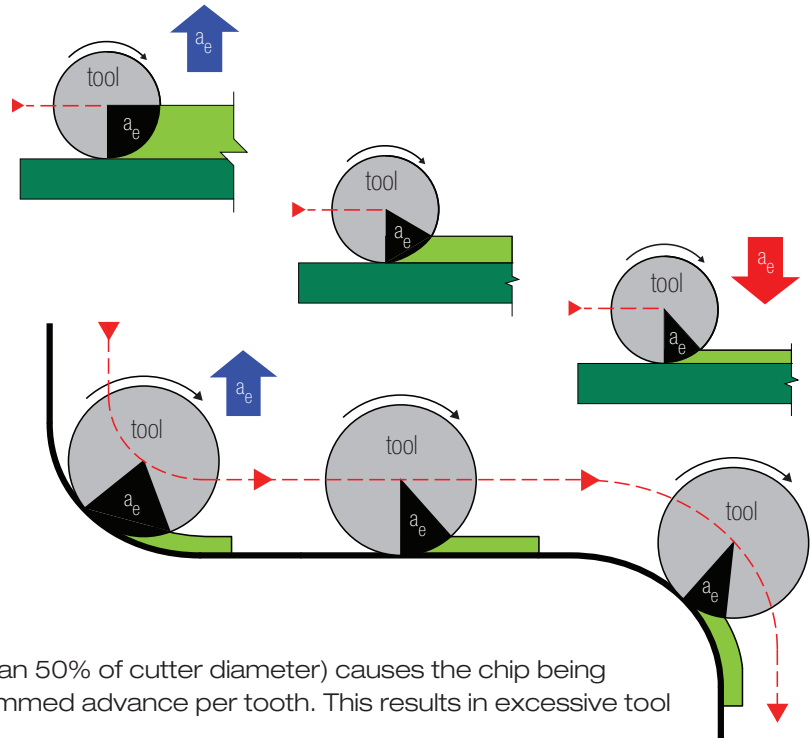
Tool Engagement Angle (a_e) is an angular measurement about the periphery of the cutter that is in contact with the material being removed and directly related to the radial chip thickness.

An **Increasing** a_e can result in:

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

A **decreasing** a_e can result in:

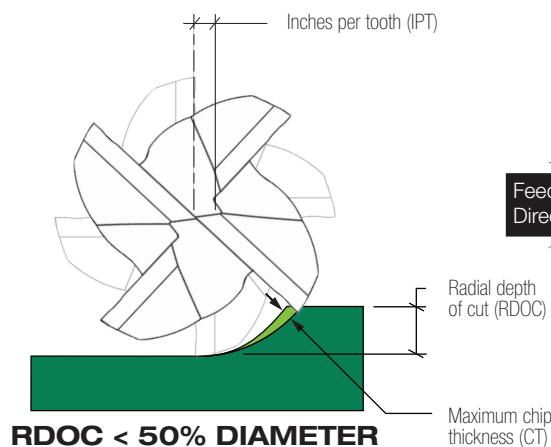
- Lower horsepower requirement
- Decreased tool deflection
- Lower spindle load (wear/tear)
- Increased Feed Rates



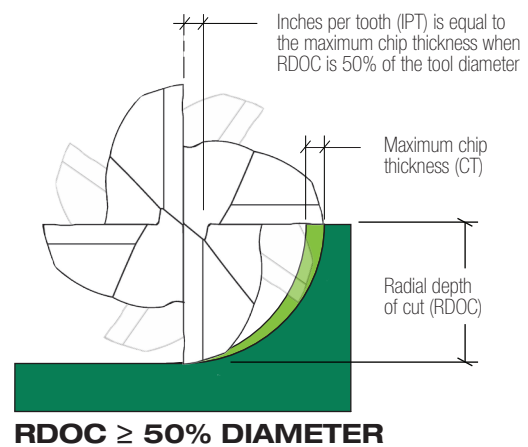
Chip Thinning

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

[Figure 1]



[Figure 2]



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

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

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

[Figure 3]

INDEX

EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG
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00017	23	00497	24	01257	33	01737	34	02467	27	03452	60	04182	41
00030	23	00510	24	01270	33	01750	34	02480	27	03465	60	04190	41
00032	23	00512	24	01272	33	01752	34	02482	27	03467	60	04192	41
00045	23	00525	24	01285	33	01765	34	02495	27	03480	60	04200	41
00047	23	00527	24	01287	33	01767	34	02497	27	03482	60	04202	41
00060	23	00555	24	01300	33	01780	34	03015	59	03495	60	04210	41
00062	23	00557	24	01302	33	01782	34	03017	59	03497	60	04212	41
00090	23	00570	24	01330	33	01795	34	03030	59	03510	60	04225	41
00092	23	00572	24	01332	33	01797	34	03032	59	03512	60	04227	41
00105	23	00585	24	01345	33	02015	27	03045	59	03525	60	04235	41
00107	23	00587	24	01347	33	02017	27	03047	59	03527	60	04237	41
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00122	23	00602	24	01362	33	02032	27	03062	59	03557	60	04247	41
00150	23	00615	24	01375	33	02060	27	03090	59	03570	60	04285	42
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00180	23	00675	24	01435	34	02120	27	03150	59	03610	60	04325	42
00182	23	00677	24	01437	34	02122	27	03152	59	03612	60	04327	42
00195	23	00690	24	01450	34	02135	27	03155	59	03645	60	04345	42
00197	23	00692	24	01452	34	02137	27	03157	59	03647	60	04347	42
00210	23	00705	24	01465	34	02165	27	03165	59	03660	60	04360	42
00212	23	00707	24	01467	34	02167	27	03167	59	03662	60	04362	42
00240	23	00750	24	01480	34	02180	27	03180	59	03675	60	04375	42
00242	23	00752	24	01482	34	02182	27	03182	59	03677	60	04377	42
00255	23	00765	24	01495	34	02190	27	03195	59	03690	60	04405	42
00257	23	00767	24	01497	34	02192	27	03197	59	03692	60	04407	42
00270	23	00780	24	01510	34	02210	27	03210	59	03705	60	04420	42
00272	23	00782	24	01512	34	02212	27	03212	59	03707	60	04422	42
00285	23	00795	24	01525	34	02225	27	03240	59	03750	60	04435	42
00287	23	00797	24	01527	34	02227	27	03242	59	03752	60	04437	42
00300	23	01015	33	01555	34	02235	27	03255	59	03765	60	04445	42
00302	23	01017	33	01557	34	02237	27	03257	59	03767	60	04447	42
00330	23	01030	33	01570	34	02245	27	03270	59	03780	60	04465	42
00332	23	01032	33	01572	34	02247	27	03272	59	03782	60	04480	42
00345	23	01045	33	01585	34	02285	27	03285	59	03795	60	04495	42
00347	23	01047	33	01587	34	02287	27	03287	59	03797	60	05007	133
00360	23	01090	33	01600	34	02300	27	03300	59	04015	41	05022	133
00362	23	01092	33	01602	34	02302	27	03302	59	04017	41	05037	133
00375	23	01105	33	01610	34	02315	27	03330	59	04030	41	05067	133
00377	23	01107	33	01612	34	02317	27	03332	59	04032	41	05082	133
00390	23	01150	33	01615	34	02325	27	03345	59	04060	41	05097	133
00392	23	01152	33	01617	34	02327	27	03347	59	04062	41	05127	133
00405	23	01155	33	01645	34	02345	27	03360	59	04075	41	05132	133
00407	23	01157	33	01647	34	02347	27	03362	59	04077	41	05142	133
00435	24	01165	33	01660	34	02405	27	03375	59	04105	41	05157	133
00437	24	01167	33	01662	34	02407	27	03377	59	04107	41	05172	133
00450	24	01180	33	01675	34	02420	27	03390	59	04120	41	05182	133
00452	24	01182	33	01677	34	02422	27	03392	59	04122	41	05202	133
00465	24	01195	33	01690	34	02435	27	03405	59	04135	41	05217	133
00467	24	01197	33	01692	34	02437	27	03407	59	04137	41	05232	133
00480	24	01240	33	01705	34	02445	27	03435	60	04165	41	05247	133
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05307	133	06255	222	07029	225	12167	90	17465	25	18480	29	23050	87
05322	133	06258	222	07030	225	12182	90	17467	25	18482	29	23051	88
05337	133	06270	222	07031	225	12212	90	17555	25	18495	29	23070	87
05352	133	06273	222	07034	226	12227	90	17557	25	18497	29	23072	88
05367	133	06285	222	07035	226	12317	90	17645	25	19015	64	23080	87
05397	133	06288	222	07036	226	12332	90	17647	25	19017	64	23082	88
05412	133	06330	222	07037	226	12347	90	17660	25	19030	64	23090	87
05427	133	06333	222	08017	91	12407	90	17662	25	19032	64	23092	88
05457	134	06345	222	08032	91	12467	90	17750	25	19060	64	23100	87
05472	134	06348	222	08062	91	12482	90	17752	25	19062	64	23102	88
05487	134	06360	222	08077	91	12527	90	18015	28	19075	64	23120	87
05502	134	06363	222	08107	91	12542	90	18017	28	19077	64	23122	88
05517	134	06375	222	08112	91	13017	92	18030	28	19105	64	23130	87
05532	134	06378	222	08122	91	13032	92	18032	28	19107	64	23132	88
05547	134	06390	222	08137	91	13047	92	18060	28	19120	64	23140	87
05607	134	06393	222	08167	91	13077	92	18062	28	19122	64	23142	88
05622	134	06405	222	08182	91	13092	92	18075	28	19135	64	23150	87
05637	134	06408	222	08192	91	13112	92	18077	28	19137	64	23152	88
05652	134	06420	222	08212	91	13122	92	18105	28	19165	64	23160	87
05662	134	06423	222	08227	91	13137	92	18107	28	19167	64	23162	88
05667	134	06435	222	08242	91	13157	92	18120	28	19180	64	23170	87
05697	134	06438	222	08317	91	13167	92	18122	28	19182	64	23172	88
05712	134	06450	222	08332	91	13197	92	18135	28	19190	64	23190	87
05727	134	06453	222	08347	91	13212	92	18137	28	19192	64	23193	88
05742	134	06465	222	08362	91	13227	92	18165	28	19210	64	23200	87
05757	134	06468	222	08392	91	13232	92	18167	28	19212	64	23203	88
05772	134	06480	222	08407	91	13302	92	18180	28	19225	64	23210	87
05862	134	06483	222	08422	91	13317	92	18182	28	19227	64	23213	88
05877	134	06495	222	08437	91	13332	92	18190	28	19235	64	23220	87
05892	134	06498	222	08467	91	13347	92	18192	28	19237	64	23223	88
05907	134	06510	222	08482	91	17015	25	18210	28	19245	64	23240	87
05922	134	06513	222	08497	91	17017	25	18212	28	19247	64	23243	88
06015	222	06525	222	08527	91	17030	25	18225	28	19285	64	23250	87
06018	222	06528	222	08542	91	17032	25	18227	28	19287	64	23253	88
06030	222	06540	222	08557	91	17045	25	18235	28	19300	64	23260	87
06033	222	06543	222	10017	93	17047	25	18237	28	19302	64	23263	88
06045	222	07001	225	10047	93	17090	25	18245	28	19315	64	23270	87
06048	222	07002	225	10092	93	17092	25	18247	28	19317	64	23273	88
06060	222	07003	225	10112	93	17105	25	18285	28	19325	64	23290	87
06063	222	07004	225	10122	93	17107	25	18287	28	19327	64	23293	88
06075	222	07005	225	10137	93	17150	25	18300	28	19405	65	23300	87
06078	222	07008	225	10157	93	17152	25	18302	28	19407	65	23303	88
06120	222	07009	225	10167	93	17155	25	18315	28	19420	65	23310	87
06123	222	07010	225	10197	93	17157	25	18317	28	19422	65	23313	88
06135	222	07011	225	10212	93	17165	25	18325	28	19435	65	23330	87
06138	222	07012	225	10302	93	17167	25	18327	28	19437	65	23333	88
06150	222	07015	226	10317	93	17240	25	18405	29	19445	65	23340	87
06153	222	07016	226	10332	93	17242	25	18407	29	19447	65	23343	88
06165	222	07017	226	10347	93	17255	25	18420	29	19495	65	23350	87
06168	222	07018	226	12017	90	17257	25	18422	29	19497	65	23353	88
06180	222	07019	226	12032	90	17330	25	18435	29	23010	87	24017	157
06183	222	07022	225	12062	90	17332	25	18437	29	23011	88	24022	157
06225	222	07023	225	12077	90	17345	25	18445	29	23020	87	24032	157
06228	222	07024	225	12107	90	17347	25	18447	29	23021	88	24047	157
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24122	157	27152	150, 209	29135	16	29660	17	30587W	96	31512	103	32422	114
24137	157	27212	150, 209	29137	16	29662	17	30602	96	31512W	103	32437	114
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24257	157	27302	151, 210	29225	16	30017	95	30677W	96	31572W	104	33142	68
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24482	157	27407	151, 210	29330	16	30142	95	31047	100	31662	104	33332	69
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24557	157	28107	18	29375	16	30167	95	31107	101	31692	104	33347	69
24572	157	28120	18	29377	16	30167W	95	31122	101	31692W	104	33347W	69
24587	157	28122	18	29390	16	30182	95	31137	101	31707	105	33407	69
24617	157	28135	18	29392	16	30197	95	31137W	101	31722	105	33422	69
24632	157	28137	18	29405	16	30212	95	31142	101	31737	105	33497	69
24647	157	28165	18	29407	16	30227	96	31142W	101	31742	105	33497W	69
24662	157	28167	18	29420	16	30227W	96	31152	101	31752	105	33512	69
26107	148	28180	18	29422	16	30242	96	31152W	101	32017	112	33512W	69
26122	148	28182	18	29435	16	30242W	96	31167	101	32032	112	33527	69
26137	148	28210	18	29437	16	30257	96	31167W	101	32047	112	33527W	69
26152	148	28212	18	29450	16	30317	96	31182	101	32062	112	33542	69
26212	148	28225	18	29452	16	30317W	96	31197	101	32077	112	33542W	69
26227	148	28227	18	29465	16	30332	96	31212	101	32092	112	33557	69
26242	148	28285	18	29467	16	30332W	96	31227	102	32107	112	33557W	69
26247	148	28287	18	29480	17	30337	96	31227W	102	32122	112	33572	69
26257	148	28300	18	29482	17	30337W	96	31242	102	32137	112	33572W	69
26272	148	28302	18	29495	17	30347	96	31257	102	32152	112	33587	69
26287	148	28315	18	29497	17	30347W	96	31317	102	32167	112	33587W	69
26302	148	28317	18	29510	17	30362	96	31317W	102	32182	112	33602	69
26307	148	28325	18	29512	17	30407	96	31332	102	32197	112	33602W	69
26317	148	28327	18	29525	17	30422	96	31332W	102	32212	113	33617	69
26322	148	28405	18	29527	17	30437	96	31337	102	32227	113	33632	69
26332	148	28407	18	29570	17	30497	96	31337W	102	32242	113	33632W	69
26347	148	28420	18	29572	17	30497W	96	31347	102	32257	113	33647	69
26362	148	28422	18	29585	17	30512	96	31347W	102	32272	113	33647W	69
26367	148	28435	18	29587	17	30512W	96	31377	102	32287	113	33662	69
26377	148	28437	18	29600	17	30527	96	31407	103	32302	113	33662W	69
26392	148	28445	18	29602	17	30527W	96	31422	103	32317	113	33677	69
26407	148	28447	18	29615	17	30542	96	31437	103	32332	114	33677W	69
26422	148	28465	18	29617	17	30542W	96	31452	103	32347	114	33692	69
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45377W	123, 196	46046	51	46321	56	46561	57	46771	57	47451	54	48146	47
45378	123, 196	46050	55	46325*	56	46565	57	46775	57	47465	54	48150*	48
45378W	123, 196	46051	55	46326*	56	46566	57	46776	57	47466	54	48151*	48
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45379W	124, 197	46056	55	46331	52	46571	57	46786	57	47481	54	48236	43
45380	124, 197	46060	51	46335	56	46575	57	46795*	57	48000	43	48240	48
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45381	124, 197	46065	55	46340	56	46580*	57	46800	52	48005	47	48245	48
45381W	124, 197	46066	55	46341	56	46581*	57	46801	52	48006	47	48246	48
45392	123, 196	46070	55	46345	56	46585*	57	46805	57	48010	43	48250	48
45392W	123, 196	46071	55	46346	56	46586*	57	46806	57	48011	43	48251	48
45393	123, 196	46075	51	46350	56	46590	52	46820	57	48015	47	48255*	48
45394	124, 197	46076	51	46351	56	46591	52	46821	57	48016	47	48256*	48
45394W	124, 197	46080	55	46355*	56	46595	57	46830*	57	48020	43	48260	43
45395	124, 197	46081	55	46356*	56	46596	57	46831*	57	48021	43	48261	43
45396	124, 197	46085	55	46360	52	46600	57	47040*	53	48025	47	48265	48
45397	123, 196	46086	55	46361	52	46601	57	47041*	53	48026	47	48266	48
45398	124, 197	46090*	55	46365	56	46605	57	47045*	53	48030	43	48270	48
45399	124, 197	46091*	55	46366	56	46606	57	47046*	53	48031	43	48271	48
45400	124, 197	46095	51	46370	56	46610	57	47060*	53	48035	47	48275	48
45401	124, 197	46096	51	46371	56	46611	57	47061*	53	48036	47	48276	48
45402	123, 196	46100	55	46375	56	46615*	57	47065*	53	48040	47	48280*	48
45403	124, 197	46101	55	46376	56	46616*	57	47066*	53	48041	47	48281*	48
45404	124, 197	46105	55	46380	56	46620*	57	47075	53	48045	43	48310	43
45405	124, 197	46106	55	46381	56	46621*	57	47076	53	48046	43	48311	43
45406	124, 197	46110*	55	46385*	56	46625	52	47090	53	48050	47	48315	48
45407	124, 197	46111*	55	46386*	56	46626	52	47091	53	48051	47	48316	48
45408	124, 197	46220	51	46390	52	46630	57	47180	53	48055	47	48320	48
45409	124, 197	46221	51	46391	52	46631	57	47181	53	48056	47	48321	48
45411	124, 197	46225	56	46395	56	46635	57	47195	53	48060	43	48325	48
45422	124, 197	46226	56	46396	56	46636	57	47196	53	48061	43	48326	48
45423	124, 197	46230	56	46400	56	46645	57	47225	53	48065	47	48330*	48
45424	124, 197	46231	56	46401	56	46646	57	47226	53	48066	47	48331*	48
45425	124, 197	46235	56	46405	56	46655*	57	47240	53	48070	47	48335	44
45426	124, 197	46236	56	46406	56	46656*	57	47241	53	48071	47	48336	44
45437	124, 197	46240*	56	46410	56	46695	52	47255	53	48075	43	48340	48
45438	124, 197	46241*	56	46411	56	46696	52	47256	53	48076	43	48341	48
45439	124, 197	46245	51	46415*	56	46700	57	47270	53	48080	47	48345	49
45441	124, 197	46246	51	46416*	56	46701	57	47271	53	48081	47	48346	49
45442	124, 197	46250	56	46470	52	46705	57	47300	54	48085	47	48350	49
45444	124, 197	46251	56	46471	52	46706	57	47301	54	48086	47	48351	49
45445	124, 197	46255	56	46475	57	46715	57	47315	54	48090*	48	48355	49
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48370	48	48510	44	48675	50	49210	45	50407	128	52032	108	53226	113
48371	48	48511	44	48676	50	49211	45	50437	128	52047	108	53227	113
48375	49	48515	49	48680*	50	49240	45	50452	128	52062	108	53228	113
48376	49	48516	49	48681*	50	49241	45	50467	128	52077	108	53229	113
48380	49	48520	49	48685*	50	49255	45	51017	129	52092	108	53241	113
48381	49	48521	49	48686*	50	49256	45	51032	129	52107	108	53242	113
48385	49	48525	49	48690	44	49270	45	51047	129	52122	108	53243	113
48386	49	48526	49	48691	44	49271	45	51062	129	52137	108	53244	113
48390*	49	48530	49	48695	50	49285	45	51077	129	52152	108	53256	113
48391*	49	48531	49	48696	50	49286	45	51092	129	52167	108	53257	113
48395	44	48535	44	48700	50	49300	45	51107	129	52182	108	53258	113
48396	44	48536	44	48701	50	49301	45	51108	129	52197	108	53259	113
48400	48	48540	49	48710	50	49315	45	51122	129	52212	108	53272	113
48401	48	48541	49	48711	50	49316	45	51123	129	52227	108	53273	113
48405	49	48545	49	48720*	50	49330	46	51137	129	52242	108	53274	113
48406	49	48546	49	48721*	50	49331	46	51138	129	52257	108	53287	113
48410	49	48550	49	48725	44	49345	46	51152	130	52272	109	53288	113
48411	49	48551	49	48726	44	49346	46	51153	130	52287	109	53289	113
48415	49	48555	49	48730	50	49360	46	51154	130	52302	109	53302	113
48416	49	48556	49	48731	50	49361	46	51167	130	52317	109	53303	113
48420*	49	48585	44	48735	50	49390	46	51168	130	52332	109	53304	113
48421*	49	48586	44	48736	50	49391	46	51169	130	52347	109	53317	113
48425	44	48590	50	48745	50	49405	46	51197	130	52362	109	53318	113
48426	44	48591	50	48746	50	49406	46	51198	130	52377	109	53319	113
48430	48	48595	50	48755*	50	49420	46	51199	130	52392	109	53332	114
48431	48	48596	50	48756*	50	49421	46	51212	130	52407	109	53333	114
48435	49	48600	50	48760	44	49435	46	51227	130	52422	109	53334	114
48436	49	48601	50	48761	44	49436	46	51228	130	52437	109	53335	114
48440	49	48605	50	48765	50	49450	46	51229	130	53017	112	53336	114
48441	49	48606	50	48766	50	49451	46	51242	130	53032	112	53347	114
48445	49	48610*	50	48770	50	49465	46	51243	130	53047	112	53348	114
48446	49	48611*	50	48771	50	49466	46	51244	130	53062	112	53349	114
48450*	49	48615*	50	48780	50	50017	127	51272	130	53077	112	53350	114
48451*	49	48616*	50	48781	50	50032	127	51273	130	53092	112	53351	114
48455	44	48620	44	48790*	50	50047	127	51274	130	53107	112	53362	114
48456	44	48621	44	48791*	50	50062	127	51287	130	53108	112	53363	114
48460	48	48625	50	49030*	45	50077	127	51289	130	53122	112	53364	114
48461	48	48626	50	49031*	45	50092	127	51304	130	53123	112	53365	114
48465	49	48630	50	49035*	45	50107	127	51319	130	53137	112	53366	114
48466	49	48631	50	49036*	45	50122	127	51362	131	53138	112	53377	114
48470	49	48635	50	49040*	45	50137	127	51363	131	53152	113	53378	114
48471	49	48636	50	49041*	45	50152	127	51364	131	53153	113	53379	114
48475	49	48640	50	49050*	45	50167	127	51365	131	53154	113	53380	114
48476	49	48641	50	49051*	45	50197	127	51366	131	53167	113	53381	114
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48481*	49	48646*	50	49061*	45	50227	128	51379	131	53169	113	53393	114
48485	44	48650*	50	49065*	45	50242	128	51381	131	53182	113	53394	114
48486	44	48651*	50	49066*	45	50272	128	51392	131	53183	113	53395	114
48490	49	48655	44	49075	45	50287	128	51394	131	53184	113	53396	114
48491	49	48656	44	49076	45	50302	128	51396	131	53197	113	53407	114
48495	49	48660	50	49105	45	50317	128	51407	131	53198	113	53408	114
48496	49	48661	50	49106	45	50332	128	51408	131	53199	113	53409	114
48500	49	48665	50	49120	45	50347	128	51409	131	53211	113	53410	114
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53424	114	56617	99	59016	36	59072	37	59128	37	59184	38	59240	38
53425	114	56632	99	59017	36	59073	37	59129	37	59185	38	59241	38
53426	114	56647	99	59018	36	59074	37	59130	37	59186	38	59242	38
53437	114	56662	99	59019	36	59075	37	59131	37	59187	38	59243	38
53438	114	56677	99	59020	36	59076	37	59132	37	59188	38	59244	38
53439	114	56692	99	59021	36	59077	37	59133	37	59189	38	59245	38
53440	114	56707	99	59022	36	59078	37	59134	38	59190	38	59246	38
53441	114	56722	99	59023	36	59079	37	59135	38	59191	38	59247	38
54017	83	56737	99	59024	36	59080	37	59136	38	59192	38	59248	38
54047	83	56742	99	59025	36	59081	37	59137	38	59193	38	59249	38
54092	83	56752	99	59026	36	59082	37	59138	37	59194	38	59250	136
54107	83	57017	110	59027	36	59083	37	59139	37	59195	38	59251	136
54152	83	57032	110	59028	36	59084	37	59140	37	59196	38	59252	136
54182	83	57047	110	59029	36	59085	37	59141	37	59197	38	59253	136
54227	83	57062	110	59030	36	59086	37	59142	37	59198	38	59254	136
54257	83	57077	110	59031	36	59087	37	59143	37	59199	38	59255	136
54302	83	57092	110	59032	36	59088	37	59144	37	59200	38	59256	136
54317	83	57107	110	59033	36	59089	37	59145	37	59201	38	59257	136
54377	83	57122	110	59034	36	59090	37	59146	37	59202	38	59258	136
54392	83	57137	110	59035	36	59091	37	59147	37	59203	38	59259	136
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55107	83	57167	110	59037	36	59093	37	59149	38	59205	38	59261	136
55152	83	57182	110	59038	36	59094	37	59150	38	59206	38	59262	136
55182	83	57197	110	59039	36	59095	37	59151	38	59207	38	59263	136
55227	83	57212	110	59040	37	59096	37	59152	37	59208	38	59264	136
55257	83	57227	110	59041	37	59097	37	59153	37	59209	38	59265	136
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55377	83	57272	111	59044	36	59100	37	59156	37	59212	38	59268	136
55392	83	57287	111	59045	36	59101	37	59157	37	59213	38	59269	136
56017	98	57302	111	59046	36	59102	37	59158	37	59214	38	59270	136
56032	98	57317	111	59047	36	59103	37	59159	37	59215	38	59271	136
56077	98	57332	111	59048	36	59104	37	59160	37	59216	38	59272	136
56092	98	57347	111	59049	36	59105	37	59161	37	59217	38	59273	136
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56142	98	57377	111	59051	37	59107	37	59163	38	59219	38	59275	136
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56242	98	57437	111	59055	36	59111	37	59167	38	59223	38	59279	136
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56407	99	59005	36	59061	37	59117	37	59173	38	59229	38	59285	139, 204
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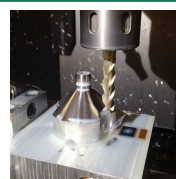
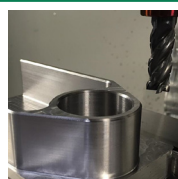
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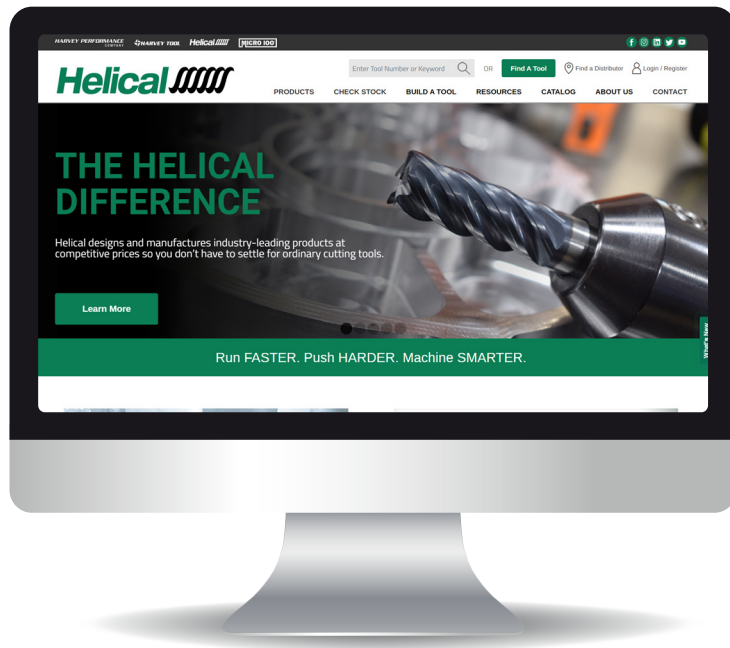
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EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG	EDP	PG
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83683	62	83729	216										

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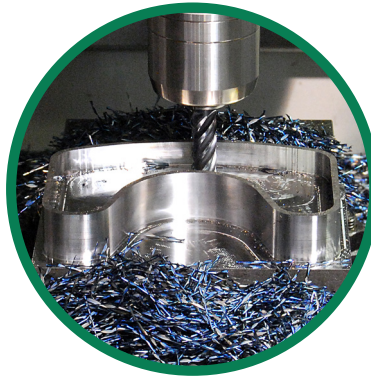
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Helical end mills are meticulously designed for maximum rigidity to support aggressive speeds and feeds. Use Machining Advisor Pro (page 54) to optimize your running parameters.



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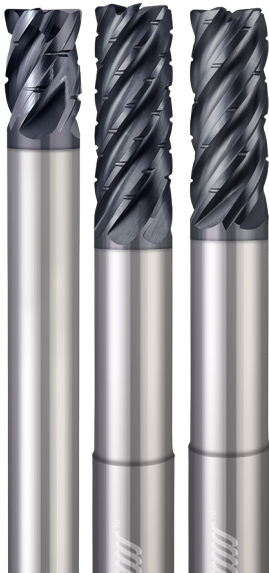
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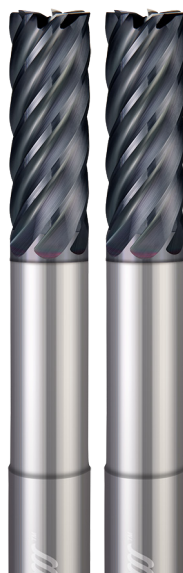
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& Cast Iron

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