



Tools for High Technology Manufacturing

### 3 Flute END MILLS

*DCG, Radial Relief, Edge Prep, Body Clearance*

### 6 Flute END MILLS

*Radial Relief, Cylindrical Land, Body Clearance*

### 4 Flute END MILLS

*Variable Index, Radial Relief, Body Clearance*

### 7 Flute END MILLS

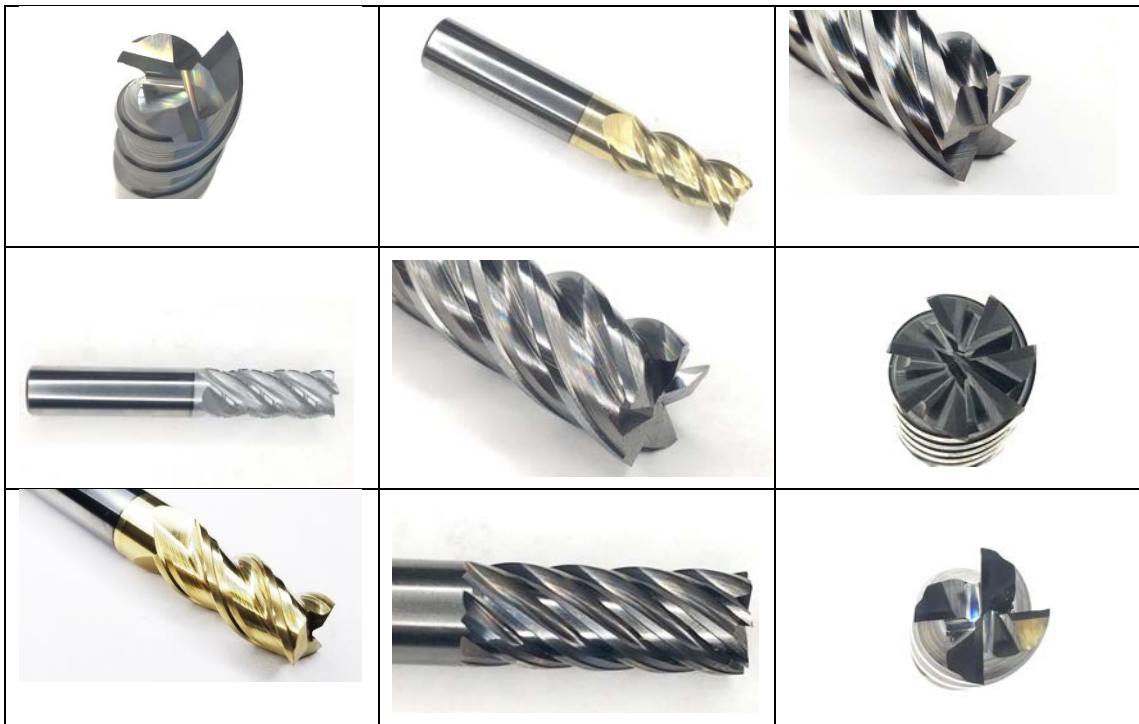
*Variable Index, Radial Relief, Body Clearance*

### 5 Flute END MILLS

*Variable Index, Radial Relief, Body Clearance*

### 8 or more Flutes

*Variable Index, Radial Relief, Body Clearance*



## Geometry

### Strength on Edge

There are many different variables that impact a cutting tool's performance. We design tools to be used in different conditions. We spent many years on perfecting the length of the primary and secondary grind in combination with the eccentric relief on our tools.

### Features on Our End Mills

- **Micrograin Tungsten Carbide Rods Available Content.**
  - 12% Cobalt Ultra Fine Grade Cemented Carbide for Rotary Tools.
  - 10% Cobalt Sub-micron Grade for general purpose on machining alloy metals.
  - 6% Cobalt Sub-micron Grade for printed circuit board industry
- **38 Degree Helix Angle (38HX), 45 Degree Helix Angle (45HX)** Our High -helix end mills have an extra heavy core at the center of the end mill. The increased core will maximize tool rigidity while decreasing tool deflection and chatter.
- **Variable Index Geometry (VIG)** Chatter has been a persistent problem in milling for many years. VIG features a custom geometry designed to reduce chatter. Our unique flute geometry creates a harmonics shift, resulting in an exceptional finish and minimal chatter.
- **Directional Chip Groove (DCG)** Our high finish directional chip groove flute face enables us to allow chip removal quicker than generic cutting tools.
- **Radial Relief (RR)** also known as Eccentric Outer Diameter (EOD) or eccentric relief, is a positive arched cutting edge. An eccentric relief increases the strength of an end mill's cutting edges.
- **Edge Prep High Finishing (EP)** Cutting tool edge prep or honing process on cutting tools improve surface finish of work pieces. Well edged cutting tools typically create less noise and vibration over those that have been dulled by repeated use and lack of care.

## MH345 Series 3 Flute High Performance Carbide End Mills



**3 Flute 45° Helix Finisher**

**3 Flute 45° Helix Rougher (Chip Breaker)**

For high-efficiency machining of plastic, aluminum and other non-ferrous materials.

Finsher Part#	Rougher Part#	Dia.of Cut	Shank Dia.	LOC	OAL	Radius	Coating (+ C1)	Coating (+ C5)
MH31213020	+ CB	3/16	3/16	13/16	2	SQ	AlTiN	ZrN
MH31606020	+ CB	1/4	1/4	3/8	2	SQ	AlTiN	ZrN
MH31608020	+ CB	1/4	1/4	1/2	2	SQ	AlTiN	ZrN
MH31612025	+ CB	1/4	1/4	3/4	2.5	SQ	AlTiN	ZrN
MH32013030	+ CB	5/16	5/16	13/16	3	SQ	AlTiN	ZrN
MH32410020	+ CB	3/8	3/8	5/8	2	SQ	AlTiN	ZrN
MH32416025	+ CB	3/8	3/8	1	2.5	SQ	AlTiN	ZrN
MH33204030	+ CB	1/2	1/2	1/4	3	SQ	AlTiN	ZrN
MH33212030	+ CB	1/2	1/2	3/4	3	SQ	AlTiN	ZrN
MH33216030	+ CB	1/2	1/2	1	3	SQ	AlTiN	ZrN
MH33220030	+ CB	1/2	1/2	1 1/4	3	SQ	AlTiN	ZrN
MH33212040	+ CB	1/2	1/2	3/4	4	SQ	AlTiN	ZrN
MH33216040	+ CB	1/2	1/2	1	4	SQ	AlTiN	ZrN
MH33220040	+ CB	1/2	1/2	1 1/4	4	SQ	AlTiN	ZrN
MH34020035	+ CB	5/8	5/8	1 1/4	3.5	SQ	AlTiN	ZrN
MH34026035	+ CB	5/8	5/8	1 5/8	3.5	SQ	AlTiN	ZrN
MH34816030	+ CB	3/4	3/4	1	3	SQ	AlTiN	ZrN
MH34824040	+ CB	3/4	3/4	1 1/2	4	SQ	AlTiN	ZrN
MH34832040	+ CB	3/4	3/4	2	4	SQ	AlTiN	ZrN
MH36416040	+ CB	1	1	1	4	SQ	AlTiN	ZrN
MH36428040	+ CB	1	1	1 3/4	4	SQ	AlTiN	ZrN

### Add a Customized Design

Your Choice of adding following features:

- **Corner Radius:** Add Corner Radius from 0.010" to full ball radius.
- **Length of Cut (LOC):** Different LOC is available upon request
- **Length Below Shank (LBS),** Neck Diameter is available upon request.
- **Shank Flats:** Weldon Flat, Whistle notch

<b>RH/LS</b>	Right-hand Cut, Left-hand Spiral	<b>LH/LS</b>	Left-hand Cut, Left-hand Spiral
<b>RH/RS</b>	Right-hand Cut, Right-hand Spiral	<b>LH/RS</b>	Left-hand Cut, Right-hand Spiral

## MH438 Series 4 Flute High Performance Carbide End Mills



4 Flute, 38 Degree Helix

4 Flute, 38 Degree Helix Rougher (Chip Breaker)

Finsher Part#	Rougher Part#	Dia.of Cut	Shank Dia.	LOC	OAL	Radius	Coating (+ C1)
MH41213020	+ CB	3/16	3/16	13/16	2	SQ	AlTiN
MH41606020	+ CB	1/4	1/4	3/8	2	SQ	AlTiN
MH41608020	+ CB	1/4	1/4	1/2	2	SQ	AlTiN
MH41612025	+ CB	1/4	1/4	3/4	2.5	SQ	AlTiN
MH42013030	+ CB	5/16	5/16	13/16	3	SQ	AlTiN
MH42410020	+ CB	3/8	3/8	5/8	2	SQ	AlTiN
MH42416025	+ CB	3/8	3/8	1	2.5	SQ	AlTiN
MH43204030	+ CB	1/2	1/2	1/4	3	SQ	AlTiN
MH43212030	+ CB	1/2	1/2	3/4	3	SQ	AlTiN
MH43216030	+ CB	1/2	1/2	1	3	SQ	AlTiN
MH43220030	+ CB	1/2	1/2	1 1/4	3	SQ	AlTiN
MH43212040	+ CB	1/2	1/2	3/4	4	SQ	AlTiN
MH43216040	+ CB	1/2	1/2	1	4	SQ	AlTiN
MH43220040	+ CB	1/2	1/2	1 1/4	4	SQ	AlTiN
MH44020035	+ CB	5/8	5/8	1 1/4	3.5	SQ	AlTiN
MH44026035	+ CB	5/8	5/8	1 5/8	3.5	SQ	AlTiN
MH44816030	+ CB	3/4	3/4	1	3	SQ	AlTiN
MH44824040	+ CB	3/4	3/4	1 1/2	4	SQ	AlTiN
MH44832040	+ CB	3/4	3/4	2	4	SQ	AlTiN
MH46416040	+ CB	1	1	1	4	SQ	AlTiN
MH46428040	+ CB	1	1	1 3/4	4	SQ	AlTiN

### Add a Customized Design

Your Choice of adding following features:

- **Corner Radius:** Add Corner Radius from 0.010" to full ball radius.
- **Length of Cut (LOC):** Different LOC is available upon request
- **Length Below Shank (LBS),** Neck Diameter is available upon request.
- **Shank Flats:** Weldon Flat, Whistle notch

<b>RH/LS</b>	Right-hand Cut, Left-hand Spiral	<b>LH/LS</b>	Left-hand Cut, Left-hand Spiral
<b>RH/RS</b>	Right-hand Cut, Right-hand Spiral	<b>LH/RS</b>	Left-hand Cut, Right-hand Spiral

## MH538 Series 5 Flute High Performance Carbide End Mills

5 Flute, 38 Degree Helix

5 Flute, 38 Degree Helix Rougher (Chip Breaker)



Finsher Part#	Rougher Part#	Dia.of Cut	Shank Dia.	LOC	OAL	Radius	Coating (+ C1)
MH51213020	+ CB	3/16	3/16	13/16	2	SQ	AlTiN
MH51606020	+ CB	1/4	1/4	3/8	2	SQ	AlTiN
MH51608020	+ CB	1/4	1/4	1/2	2	SQ	AlTiN
MH51612025	+ CB	1/4	1/4	3/4	2.5	SQ	AlTiN
MH52013030	+ CB	5/16	5/16	13/16	3	SQ	AlTiN
MH52410020	+ CB	3/8	3/8	5/8	2	SQ	AlTiN
MH52416025	+ CB	3/8	3/8	1	2.5	SQ	AlTiN
MH53204030	+ CB	1/2	1/2	1/4	3	SQ	AlTiN
MH53212030	+ CB	1/2	1/2	3/4	3	SQ	AlTiN
MH53216030	+ CB	1/2	1/2	1	3	SQ	AlTiN
MH53220030	+ CB	1/2	1/2	1 1/4	3	SQ	AlTiN
MH53212040	+ CB	1/2	1/2	3/4	4	SQ	AlTiN
MH53216040	+ CB	1/2	1/2	1	4	SQ	AlTiN
MH53220040	+ CB	1/2	1/2	1 1/4	4	SQ	AlTiN
MH54020035	+ CB	5/8	5/8	1 1/4	3.5	SQ	AlTiN
MH54026035	+ CB	5/8	5/8	1 5/8	3.5	SQ	AlTiN
MH54816030	+ CB	3/4	3/4	1	3	SQ	AlTiN
MH54824040	+ CB	3/4	3/4	1 1/2	4	SQ	AlTiN
MH54832040	+ CB	3/4	3/4	2	4	SQ	AlTiN
MH56416040	+ CB	1	1	1	4	SQ	AlTiN
MH56428040	+ CB	1	1	1 3/4	4	SQ	AlTiN

### Add a Customized Design

Your Choice of adding following features:

- **Corner Radius:** Add Corner Radius from 0.010" to full ball radius.
- **Length of Cut (LOC):** Different LOC is available upon request
- **Length Below Shank (LBS), Neck Diameter** is available upon request.
- **Shank Flats:** Weldon Flat, Whistle notch

<b>RH/LS</b>	Right-hand Cut, Left-hand Spiral	<b>LH/LS</b>	Left-hand Cut, Left-hand Spiral
<b>RH/RS</b>	Right-hand Cut, Right-hand Spiral	<b>LH/RS</b>	Left-hand Cut, Right-hand Spiral

## MH638 Series 6 Flute High Performance Carbide End Mills

6 Flute, 38 Degree Helix

6 Flute, 38 Degree Helix Rougher (Chip Breaker)



Finsher Part#	Rougher Part#	Dia.of Cut	Shank Dia.	LOC	OAL	Radius	Coating (+ C1)
MH61213020	+ CB	3/16	3/16	13/16	2	SQ	AlTiN
MH61606020	+ CB	1/4	1/4	3/8	2	SQ	AlTiN
MH61608020	+ CB	1/4	1/4	1/2	2	SQ	AlTiN
MH61612025	+ CB	1/4	1/4	3/4	2.5	SQ	AlTiN
MH62013030	+ CB	5/16	5/16	13/16	3	SQ	AlTiN
MH62410020	+ CB	3/8	3/8	5/8	2	SQ	AlTiN
MH62416025	+ CB	3/8	3/8	1	2.5	SQ	AlTiN
MH63204030	+ CB	1/2	1/2	1/4	3	SQ	AlTiN
MH63212030	+ CB	1/2	1/2	3/4	3	SQ	AlTiN
MH63216030	+ CB	1/2	1/2	1	3	SQ	AlTiN
MH63220030	+ CB	1/2	1/2	1 1/4	3	SQ	AlTiN
MH63212040	+ CB	1/2	1/2	3/4	4	SQ	AlTiN
MH63216040	+ CB	1/2	1/2	1	4	SQ	AlTiN
MH63220040	+ CB	1/2	1/2	1 1/4	4	SQ	AlTiN
MH64020035	+ CB	5/8	5/8	1 1/4	3.5	SQ	AlTiN
MH64026035	+ CB	5/8	5/8	1 5/8	3.5	SQ	AlTiN
MH64816030	+ CB	3/4	3/4	1	3	SQ	AlTiN
MH64824040	+ CB	3/4	3/4	1 1/2	4	SQ	AlTiN
MH64832040	+ CB	3/4	3/4	2	4	SQ	AlTiN
MH66416040	+ CB	1	1	1	4	SQ	AlTiN
MH66428040	+ CB	1	1	1 3/4	4	SQ	AlTiN

### Add a Customized Design

Your Choice of adding following features:

- **Corner Radius:** Add Corner Radius from 0.010" to full ball radius.
- **Length of Cut (LOC):** Different LOC is available upon request
- **Length Below Shank (LBS), Neck Diameter** is available upon request.
- **Shank Flats:** Weldon Flat, Whistle notch

<b>RH/LS</b>	Right-hand Cut, Left-hand Spiral	<b>LH/LS</b>	Left-hand Cut, Left-hand Spiral
<b>RH/RS</b>	Right-hand Cut, Right-hand Spiral	<b>LH/RS</b>	Left-hand Cut, Right-hand Spiral

## MH738 Series 7 Flute High Performance Carbide End Mills

7 Flute, 38 Degree Helix



Finsher Part#	Rougher Part#	Dia.of Cut	Shank Dia.	LOC	OAL	Radius	Coating (+ C1)
MH71213020	+ CB	3/16	3/16	13/16	2	SQ	AlTiN
MH71606020	+ CB	1/4	1/4	3/8	2	SQ	AlTiN
MH71608020	+ CB	1/4	1/4	1/2	2	SQ	AlTiN
MH71612025	+ CB	1/4	1/4	3/4	2.5	SQ	AlTiN
MH72013030	+ CB	5/16	5/16	13/16	3	SQ	AlTiN
MH72410020	+ CB	3/8	3/8	5/8	2	SQ	AlTiN
MH72416025	+ CB	3/8	3/8	1	2.5	SQ	AlTiN
MH73204030	+ CB	1/2	1/2	1/4	3	SQ	AlTiN
MH73212030	+ CB	1/2	1/2	3/4	3	SQ	AlTiN
MH73216030	+ CB	1/2	1/2	1	3	SQ	AlTiN
MH73220030	+ CB	1/2	1/2	1 1/4	3	SQ	AlTiN
MH73212040	+ CB	1/2	1/2	3/4	4	SQ	AlTiN
MH73216040	+ CB	1/2	1/2	1	4	SQ	AlTiN
MH73220040	+ CB	1/2	1/2	1 1/4	4	SQ	AlTiN
MH74020035	+ CB	5/8	5/8	1 1/4	3.5	SQ	AlTiN
MH74026035	+ CB	5/8	5/8	1 5/8	3.5	SQ	AlTiN
MH74816030	+ CB	3/4	3/4	1	3	SQ	AlTiN
MH74824040	+ CB	3/4	3/4	1 1/2	4	SQ	AlTiN
MH74832040	+ CB	3/4	3/4	2	4	SQ	AlTiN
MH76416040	+ CB	1	1	1	4	SQ	AlTiN
MH76428040	+ CB	1	1	1 3/4	4	SQ	AlTiN

Your Choice of adding following features:

- **Corner Radius:** Add Corner Radius from 0.010" to full ball radius.
- **Length of Cut (LOC):** Different LOC is available upon request
- **Length Below Shank (LBS),** Neck Diameter is available upon request.
- **Shank Flats:** Weldon Flat, Whistle notch

<b>RH/LS</b>	Right-hand Cut, Left-hand Spiral	<b>LH/LS</b>	Left-hand Cut, Left-hand Spiral
<b>RH/RS</b>	Right-hand Cut, Right-hand Spiral	<b>LH/RS</b>	Left-hand Cut, Right-hand Spiral