

Technical Resources

HELICAL RAMP TO CREATE AN ENTRY HOLE

Using a helical ramp move to generate an entry hole is a preferred method to enter the middle of a part. The creation of the entry hole can be either a one-step or a two-step process depending on the number of flutes on the end mill. Tools with seven or fewer flutes only require one step; tools with more than seven flutes require two steps.

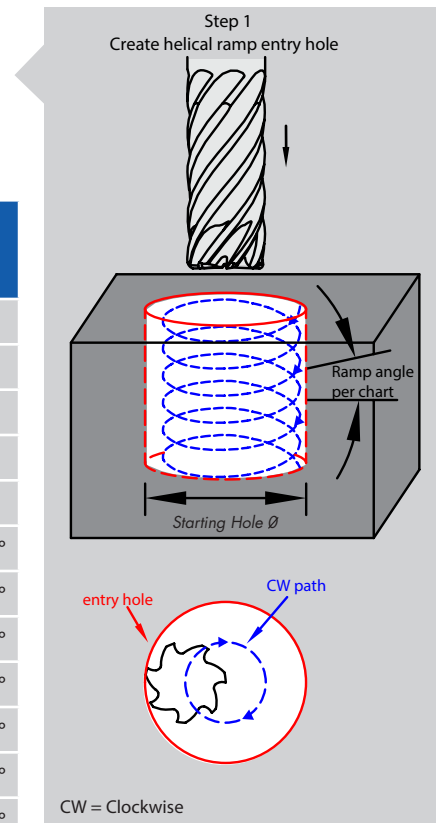
Step 1: Create helical ramp entry hole

The diameter of the starting hole will be: $(\text{tool diameter} \times 2) - (\text{corner radius} \times 2)$

Use the following guide for speed, feed and ramp angle parameters.

Note that the terms "Same as chart," "Slotting speed in chart," "Slotting feed in chart," and IPT and MMPT reference the data that is shown in the speed and feed charts located in each tool series section.

Tool	Speed	Feed Adjustment – with high-pressure coolant	Feed Adjustment – with standard flood coolant	Ramp Angle
IPT/C 7	Same as chart	IPT or MMPT x 1.6	IPT or MMPT x 1.25	0.5°
IPT/C 9	Same as chart	IPT or MMPT x 1.6	IPT or MMPT x 1.25	0.5°
IPT/C 11	Same as chart	IPT or MMPT x 1.6	IPT or MMPT x 1.25	0.5°
IPT/C 13	Same as chart	IPT or MMPT x 1.6	IPT or MMPT x 1.25	0.5°
APT/C 5	Same as chart	IPT or MMPT x 1.6	IPT or MMPT x 1.25	3°
M525	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M527	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M503	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M726	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M706	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M806	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M924	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M904	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M905	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M223	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	3° - 5°
M233	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	3° - 5°
M203	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	3° - 5°
M202	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	3° - 5°
E14	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
E13	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
E12	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°
M104	Slotting speed in chart	Slotting feed in chart	Slotting feed in chart	1° - 2.5°



IPT = Inch per tooth from the speed and feed charts

MMPT = Millimeter per tooth from the speed and feed charts

Speed = Surface feet per minute (SFM) or meters per min (M/Min)

Step 2: There are two common methods to open up the starter hole.

METHOD A – Expand the entry hole from inside out.

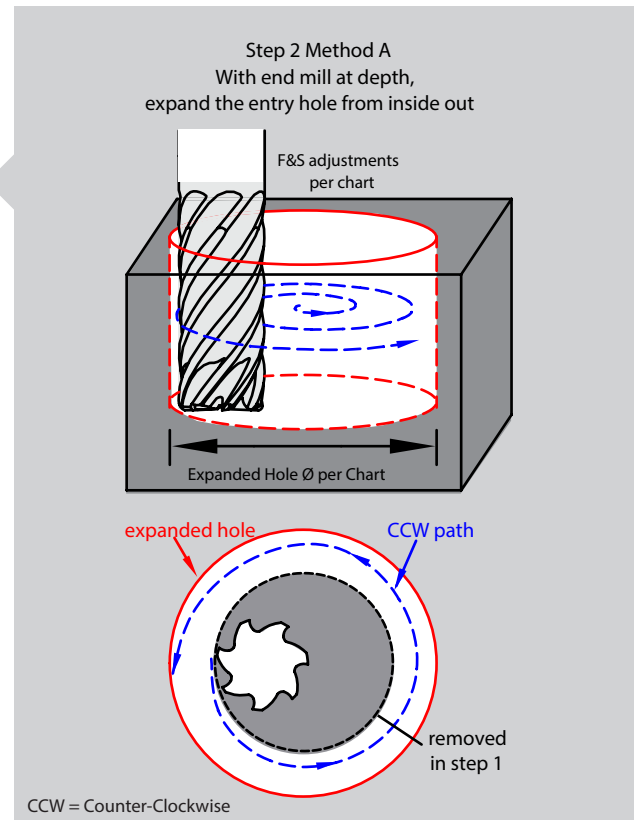
7-, 9-, 11- and 13-flute tools

After reaching the desired entry hole depth in Step 1, and with the end mill still at depth, expand the hole outwards using the feed rate adjustment found in the chart below. Continue until the entry hole is enlarged to the expanded diameter shown below.

Tool	Expanded Hole Ø	Feed Rate Adjustment	Step-Over Adjustment
IPT/C 7,9	3 x D	IPT or MMPT x .75	RDOC x .5
IPT/C 11	3.75 x D	IPT or MMPT x .75	RDOC x .5
IPT/C 13	3.75 x D	IPT or MMPT x .75	RDOC x .5

D = Tool Diameter

Once the expanded entry hole diameter is achieved, climb cut machining can begin at 100% of the Peripheral-HEM values in the feed and speed chart for the tool series you're using.



METHOD B – Expand the entry hole with a second helical ramp move.

Method B will expand the entry hole by doing a second helical ramp entry hole of a larger diameter than in Step 1. After completing Step 1, retract the end from the hole, and machine the second helical ramp entry hole using the same speed, feed and location as the first hole.

Tool	Expanded Hole Ø	Feed Rate Adjustment	Ramp Angle
IPT/C 9	3 x D	IPT or MMPT x 1.6	0.5°
IPT/C 11	3.75 x D	IPT or MMPT x 1.6	0.5°
IPT/C 13	3.75 x D	IPT or MMPT x 1.6	0.5°

D = Tool Diameter

Once the expanded entry hole diameter is achieved, climb cut machining can begin at 100% of the Peripheral-HEM values in the feed and speed chart for the tool series you're using.

