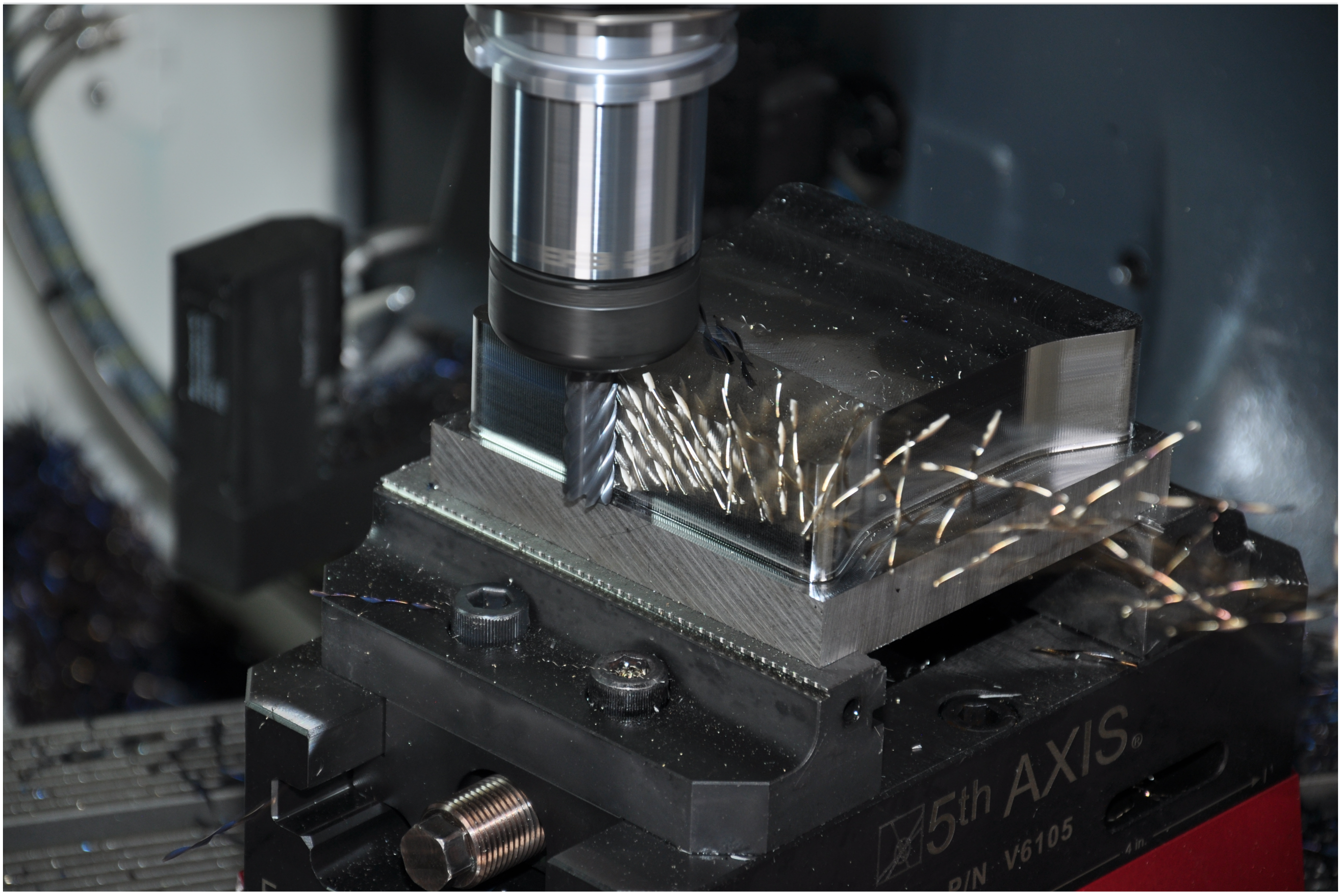
Technology

Six Tips for Effective Optimized Roughing

Jay Ball - Seco Product Manager, Solid Carbide End Mills | Jun 01, 2017

What You Need to Know

An optimized roughing strategy typically employs multi-flute tools.
Secure toolholders and fixturing High-precision holders are crucial in optimized roughing
Make sure your machine is capable of performing optimized roughing
It is nearly impossible to program an optimized roughing strategy manually
Select the right depth of cut
Follow recommended cutting parameters from tooling manufacturers



Optimized roughing can be highly effective for machining part features such as pockets with challenging corners as well as any straight walls that require long axial depths of cuts. In fact, this strategy enables you to machine pockets three to four times faster than conventional methods while also dramatically extending the life of your tools. For example, under the right conditions, optimized roughing allows cutting tools to last up to 8 hours when machining titanium, as opposed to 30 minutes of tool life using conventional cutting methods. However, achieving the best possible results with today's optimized roughing strategy does require adhering to a few specific guidelines.

1. Adjust radial stepovers An optimized roughing strategy typically employs multi-flute tools with anywhere from five to nine flutes. As the number of flutes increases, the size of the stepover must

decrease to maintain surface finish at faster feed rates as well as accommodate for the decrease in chip spacing. If the stepover is too large, feed rates need to be lowered, which generates more heat due to the larger amount of metal removed in each pass. By decreasing the size of the stepover, you can use faster cutting speeds. More passes are necessary to remove the same amount of material, but the metal removal rates are still higher than at slower speeds due to the increased feed rates. This is the main reason optimized roughing makes tools last longer and heightens thermal stability.

2. Use strong, secure toolholders and fixturing High-precision holders are crucial in optimized roughing. The holder needs similar specifications to those for hard milling, including less than 0.0004" run out. A precise holder ensures the accuracy of the process, whereas a less secure holder will cause undesirable levels of vibration at optimized roughing's high feed rates. For the same reason, it's important to use strong workholding fixtures as well.

3. Make sure your machine is capable of performing optimized roughing. Machine tools used for optimized roughing not only need to be able to achieve extremely high feed rates, but they also need to be able process thousands of lines of code in a matter of seconds. This requires advanced look-ahead capabilities and processing systems found in newer machine tools. Rigidity throughout the machine tool from the spindle bearings all the way through to the ball screws ensures smooth cutting, consistent tool life and unsurpassed part quality.

4. Choose a suitable programming method It is nearly impossible to program an optimized roughing strategy manually. Many companies provide state-of-the-art programming software, but careful consideration must be made when choosing the right software or software add on. Not all software is created equal. For example, a programing software designed only for complex 3D high speed milling may not be able to perform the complex radial moves inside of tight corners to maintain a consistent angle of engagement, which is one of many keys to successful optimized roughing strategies.

5. Select the right depth of cut. We recommend a cutting depth of 2xD for optimized roughing and taking the full length of the cut in one pass. Smaller radial stepovers make such depths of the cut possible. A larger stepover would increase the amount of heat in the cut, which in-turn, will have a negative effect on tool life and performance, so rpm and feed rates must be reduced. However, a cut that is too deep, over 3xD for instance, creates cutting pressures greater than the tool can bear and causes deflection. Some manufactures add chip splitters in these cases to help reduce cutting pressure which, in-turn, reduces cutter deflection and also helps with chip control.

6. Follow recommended cutting parameters from tooling manufacturers. We frequently see customers encounter problems when they rely on the default cutting data recommendations from programming software suppliers instead of those provided by cutting tool suppliers. Tool manufacturers develop specific recommended cutting parameters after meticulous research and years of firsthand experience. They optimize cutting data for the tool's design, specifications and for specific material groups. Optimized roughing is an excellent strategy for achieving quality parts and extending tool life, but requires use of the right equipment and cutting parameters. If you are having problems implementing the approach or want to learn more about how to use the strategy to process a part, contact us.

Key Takeaways

If used correctly milling can be highly effective in machining pockets with challenging corners.

The recommended guidelines help to ensure you are using milling in the right situation.

Contact the manufacturer if there are issues implementing a milling or approach or if there is more information needed.