David Wynn
Director of Technical Services

Chip Breakers

Maximize Up Time by Controlling Chips

In the world of machining, the selection and utilization of appropriate chip breakers play a pivotal role in optimizing cutting processes. Chip breakers are features integrated into cutting tools to control chip formation, breakage, and evacuation during material removal. Effective chip management is crucial for enhancing cutting efficiency, improving surface finish and extending tool life.

The formation and management of chips are critical to having a stable process. Improper chip control can lead to several issues but the most important issue is machine downtime. Chip breakers are designed to move the chip from the work area and create manageable chunks that can be evacuated from the machine. Proper management of chips is crucial to maximizing uptime.

There are several ways to break a chip. Many times, changes to machining parameters can break chips. Adjusting the feed and speed, creating peck cycles or utilizing the new features on some machines to create automated peck cycles while turning. (Think Citizen LFV, Tsugami Oscillation Cutting or Star HFT technology.) Some materials, no matter what techniques we utilize, still need help from tool geometry to break the chip. Chip breakers will even vary by material because different properties require different geometry to break the chip. Copper alloys will need different geometry than high nickel alloys.

Types of Chip Breakers

Chip breakers come in various designs, each tailored to specific machining requirements. Most manufacturers have proprietary chip breakers, but I feel most fall into these categories. Here are the primary types:

2 Dimensional (2D)

Examples include top grooves ground into a tool, grinding grooves along the drill margin to break chips, creation of raised back walls or reduced back walls on tools. All of these give room for the chip to flow away from the work and create a stress point to break the chip. Most of your 2D chip breakers are simple types that we have learned how to grind into our tooling. Chip breakers of this type were discovered through trial and error while cutting metal.

Simple 3 Dimensional (3D)

These types of chip breakers are much more complex than traditional 2D styles. It takes precise manufacturing techniques to produce the more complex shape. Tools with Simple 3D chip breakers have been CNC ground or had the shapes pressed into them during manufacturing. Variable grooves, flowing rank angles, stepped geometries and more are precisely designed for specific purposes and materials.

Complex 3 Dimensional (3D)

Complex chip breakers are formed by pressing raw inserts to create complex shapes such as dimples, finger grooves, wavy formations, chip channels along the insert cutting edge and more. New styles are being developed every day. The complex shapes have allowed insert manufacturers to tackle very specific machining problems. Advances in manufacturing have allowed insert manufacturers the ability to make higher mixes of shapes providing greater variety in choice of chip breakers.

In conclusion, the selection and utilization of appropriate chip breakers is integral to achieving efficient and effective machining processes. By understanding the importance of chip control and becoming familiar with different chip breaker types, machinists can optimize cutting tool performance, increase uptime to improve tool life and enhance overall productivity.

David Wynn, MBA is the PMPA Director of Technical Services with over 20 years of experience in the areas of manufacturing, quality, ownership, IT and economics. Email: **dwynn@pmpa.org** — Website: **pmpa.org**.