

Cutting Tools 101

AN INTRODUCTION TO CUTTING TOOLS
PRINCIPLES OF MACHINING



What are Cutting Tools?

Cutting tools are the sharpened and shaped tools that remove material from the workpiece. Some machinist will refer specifically to “tooling” which refers to the cutting tools used with a machine tool such as a mill, lathe, or drill press.

Cutting tools include:

- Drills, counterbores, countersinks
- Mill cutters
- Lathe bits
- Abrasive wheels
- Saw blades
- Reamers, taps, dies

While the details and use of these cuttings tools are most appropriate to learn when you are learning the use of that machine, it is beneficial to be able to identify the various types of cutting tools that you may encounter around the machine shop.

This handout will focus on drills, mill cutters, and lathe bits.

Cutting Tools – Flutes and Shanks

Drills and end mills share a few key characteristics.

These cutting tools have multiple flutes, which are the spirals around the tools. Flutes provide a cutting edge, and a means for chips to escape and cutting fluid to reach the cutting edges. Always handle the flutes with care – they may cut you.

The shank of the cutting tool is the non-cutting section that is held by the chuck, collet, handle, or socket. If too much pressure is put on a shank, it may break. This is more common with long or narrow shanks.



Cutting Tools – Flutes and Shanks



Cutting Tools - Drills



Drills normally have two flutes. In most cases, the cutting edges of the flutes are not sharp – the center, or tip of the drill is where the cutting occurs. Drills are plunging tools, not designed to cut from the edge.

Drills will have their diameter printed on the shank. It is good practice to measure unfamiliar drills, regardless of the printed diameter. If a drill was sharpened, it is possible that the diameter was changed and the drill is now undersized.

Drills can be used in a drill press, milling machine, or lathe.

Cutting Tools – Flat End Mills



End mills are cutting tools used in milling machines.

There are many different end mills. Most end mills have four flutes, but you may find some with only two or three flutes or up to twelve. All end mills can cut from the edges. Some can be used to make plunge cuts to machine a slot or recess. To determine if a end mill can make plunge cuts, look at the center. If there is a recess or gap between the cutting edges, you should not use it to make plunge cuts. If the cutting edges meet in the middle, it can.

When cutting slots or recesses, a flat end mill makes a square shoulder.

Cutting Tools – Ball Nose End Mills



Another common type of end mill is a ball nose end mill.

Like a flat end mill, a ball nose end mill can shape surfaces or cut slots or recesses. The difference is that this cutting tool makes a curved radius. When cutting slots or recesses, a ball nose end mill makes a rounded or contoured shoulder.

Cutting Tools – Face Mill



Face mills are large cutting tools used with milling machines. These will have multiple cutting edges. Many face mills have replaceable inserts for the cutting edges.

Face mills are used to surface a workpiece, to make a flat and even plane.

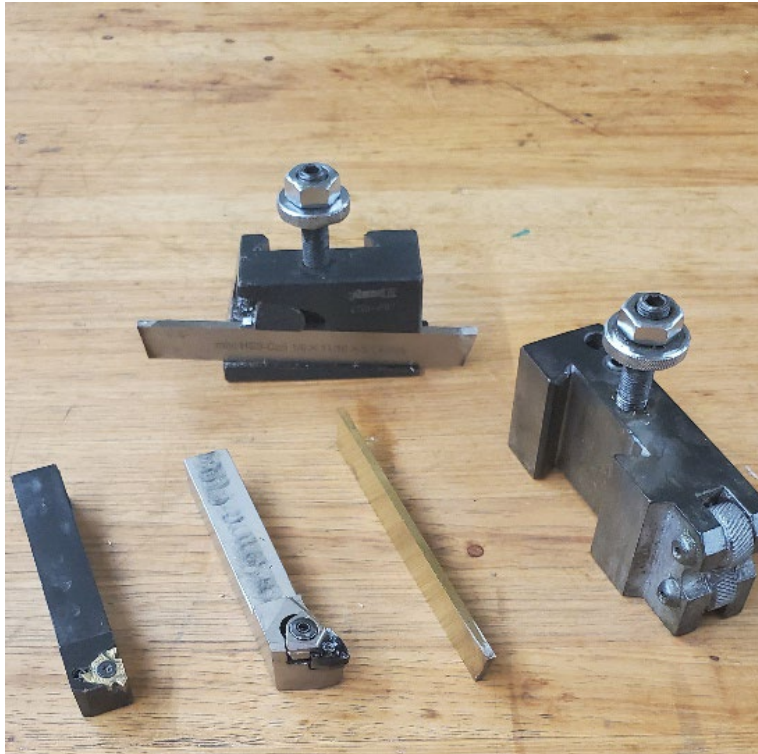
Cutting Tools – Fly Cutter



A fly cutter is another larger cutting tool used in milling machines to surface a workpiece. A fly cutter is a single-point cutting tool, there is only one cutting edge. A fly cutter consists of the mount and a high speed steel cutting tool, similar to ones used on a lathe.

A flat end mill, face cutter, and fly cutter can all be used in a milling machine to surface a workpiece. They are very different in terms of efficiency and finish quality.

Cutting Tools – Lathe Bits



Cutting tools used on a lathe are usually mounted in a tool holder that can be mounted on the lathe's tool post. The tool holders are designed to be easily swapped out, rather than swapping out the cutting tool in the tool holder.

Lathe cutting tools, or bits, will have a single cutting point.

Some lathe bits are single pieces of high speed steel, ground to an appropriate cutting shape. Others are a steel body with replaceable insert cutting points.

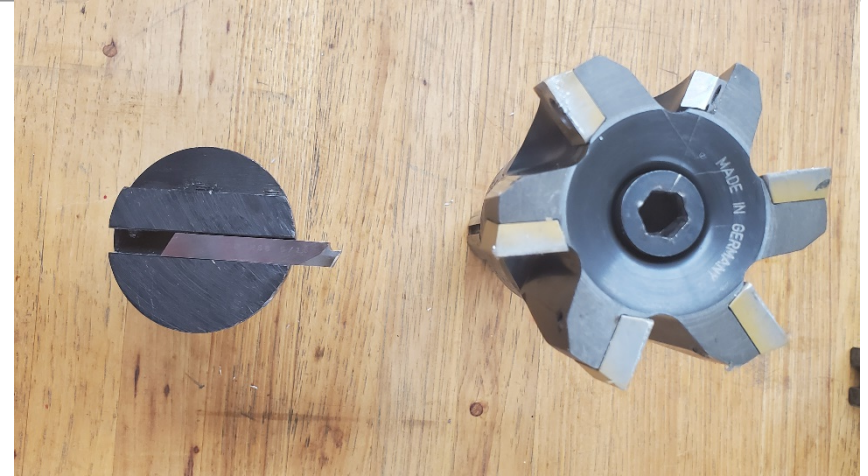
Cutting Tools

Being able to identify basic types of cutting tools in a machine shop, even if you are not knowledgeable on their use, has benefits.

If there are labeled storage areas for various tools, you are able to help keep the machine shop organized.

You are more likely to understand and participate in conversations regarding the various machine tools, and able to understand instructions better.

Cutting Tools





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