Technology

How to Master Your Surface Grinding Machining Operation

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What You Need to Know:

A bewildering variety of grits, abrasives, bonding mechanisms and shapes exist, so it's important to understand the variables in wheel grades and the grit wheel size (along with the material application, abrasive and the material removal needs).
Grinding works by tearing away small bits of metal, and the cutting fluid is responsible for providing lubricity as well as pulling heat away from the work zone.
Pay extra close attention to your workholding and firm grip since shrapnel will be flying (and use magnetic chucks and clamp it well).
Follow the best practices for routine maintenance for clean surfaces and lubrication, and watch the wear, make sure to ring test and inspect for damage.

From job shops to tool and die makers, surface grinding is an important machining technology, no matter what you make.

Whether it's used to square up a punch, sharpen a cutting tool or precisely shape tool steel for a fixture, every shop has at least one surface grinder. Perhaps you have a fully automated model with all the bells and whistles. Or maybe you are working with a hand-me-down grinder from the '70s … Either way, it would be impossible to perform many everyday shop tasks without these much-needed machines.

Despite their familiarity, however, are you sure that you're taking full grinding advantage of this machine shop companion? Here's a primer on how to get the most out of your surface grinding operation.

Understanding Grinding Wheel Applications

Let's start with the ***wheels***: A bewildering variety of grits, abrasives, bonding mechanisms and shapes exist, and some shops might settle for a general purpose wheel rather than investigate which of the many combinations will work best for a specific application. Here's what you need to understand to make surface grinding an efficient and effective process.

Wheel Grades

A relatively “soft” Grade H wheel is preferred for grinding harder workpiece materials, while a Grade J or K (which are harder) could be more suitable for soft materials. Taking a few minutes to switch from one to the other might make a huge difference in the number of parts sitting on the bench at the end of the day.

Grit Wheel Size

When removing large amounts of material, using a 120 or coarser grit will get the job done more quickly than, say, a 150 ***grit wheel***. And while vitrified bond aluminum oxide wheels are the go-to for general purpose work, shops grinding hardened tool steel and other difficult materials should consider investing in a resin bond ceramic or CBN wheel.

These examples are a gross simplification, as the performance of any grinding wheel depends on a variety of factors, including the type of abrasive, the material being cut and how much of it is being removed. The point is to research your available options and not settle for second best during the grinding wheel selection process.

Operational Success

Once you have the right wheel, cutting fluid and a rigid setup, here are a few more tips to have you grinding successfully:

- Always balance the wheel and arbor assembly before use, and if you remove it from the arbor, balance it again.
- Dress regularly to keep the wheel sharp.
- Once you’ve dressed it, leave the spindle running.
- The speed at which coolant exits the nozzle should be faster than the wheel rotation. Also, the stream should be laminar (i.e., flat).
- Don’t let grinding wheels bang together during storage.
- Keep them dry, handle them carefully and always use the oldest wheels first.
- Never exceed a wheel’s speed recommendation.

Keep Your Grinding Cool: Use Cutting Fluids, Oils and Mist Protection

It’s important to remember that surface grinding works by tearing away small bits of metal, and the cutting fluid is responsible for providing lubricity as well as pulling heat away from the work zone. Water-soluble or synthetic ***cutting fluids*** do a great job at cooling things down but provide less lubricity than straight oil. Still, water-based coolants are probably the first choice for general purpose use, and certainly for roughing operations (where heat is a major concern).

On CBN and diamond wheels (or in situations where super-fine finishes are needed), oil is often recommended. But oil can get everywhere and is not much fun to inhale, so mist protection must be provided. A fire suppression system is also a good idea, and might be a safety requirement in your area.

In either case, cutting fluids should be kept clean and filtered. Water-soluble fluids should be skimmed to remove tramp oil and prevent rancidity (which can be a big problem on machines that don’t see regular use).

FORUM

What's your take? Talk to your peers ***in the community forum*** *.*

The Importance of Keeping a Firm Grip

Holding parts securely during any machining process seems like an obvious best practice, but if you've ever seen a chunk of steel go zipping out the left end of a surface grinder, accompanied by flying chunks of grinding wheel shrapnel, you'll pay extra close attention to your workholding forever after.

Magnetic Chucks

Vacuum chucks and double-backed tape notwithstanding, the most common (and preferred) way to grip parts during grinding is with a ***magnetic chuck***. Two main types are available, electromagnetic and permanent magnet. Chances are your machine came with one or the other and you might now be stuck with it, but electromagnets offer greater clamping force and adjustability, and it's easy to demagnetize the chuck and workpiece after machining by reversing the current flow (but they're also more expensive).

Whichever one you use, be sure to properly support tall workpieces by clamping them to an angle plate or 1-2-3 block. Also, if you typically grind small workpieces, look for a fine pole chuck, or at least chock them in place using a thin piece of metal on the side of the part opposite the wheel rotation (or build a workholding fixture).

Surface Grinding Maintenance

Everyone's busy, and it's easy to overlook machine maintenance in favor of parts making, especially when the machine in question sits unused for days at a time. But when you need to hold a tenth for an inspection fixture, you'll want your surface grinder to be in as good a shape as the shop's other machine tools.

> **Grinding is a true craft with many variables and can take years to master. If you're not getting good results with your application, don't be afraid to ask experts for advice and guidance.**

Here are best practices for routine maintenance:

- Wipe down the grinding machine when you're done using it.
- Keep the way-lube reservoir filled.
- If your machine has a hydraulic feed, replace the oil per the manufacturer's recommendations.
- As mentioned earlier, cutting fluids should be filtered and skimmed, and keep an eye on pH and fluid concentration.
- Watch for and stay ahead of worn parts, and buildup of rust and crud.
- Check for chuck flatness with a dial indicator and regrind both it and the table if necessary.
- If something doesn't look right (and you have reason to suspect the wheel has been abused),

remove it from the arbor and “ring” test it.
- New wheels should always be ring-tested and inspected for damage. Doing so can prevent a catastrophe.

This was only a high-level overview of one of the most complex machining operations. Grinding is a true craft with many variables and can take years to master. If you’re not getting good results with your application, don’t be afraid to ask experts for advice and guidance.

What kind of surface grinding setup does your shop use? Share your story.