

Effective chuck maintenance clears the air of flying parts.

No-Fly Zone

► BY TECHNICAL EDITOR CHARLES M. BOYLES, CPE

Buck Forkardt

If you see a measurable increase in runout or a drop in part quality in your turning operations, you may need a chuck maintenance program in your shop. Other indicators of chuck problems include sticking jaws or parts flying out of the workholder. Even today, flying parts are all too common and a primary reason for maintaining your chucks.

Causes of Degradation

The need for maintenance is driven by three factors: dirt, absence or loss of lubrication, and a misunderstanding among operators as to how to set up the work.

If you consider a simple turning operation, the first two factors are a normal part of the operation. Dirt, grit or chips are an expected byproduct of

turning, and they will find their way into any chuck mechanism that is not completely sealed. These particles act as abrasives on the mating surfaces of the chuck.

Exacerbating the situation is that many turning operations call for coolants. While coolants enhance the actual cutting operation, they also tend to flush contaminants—dirt, grit and small chips—into the chuck. The contaminants can also combine with any lubricant in the chuck to make an abrasive paste.

Furthermore, if the coolant happens to contain a detergent, as some cutting oils do, then you can be assured the coolant will flush out any lubricant in the chuck you may have used, leaving a dirty, unlubricated workholding device. Also, should you notice any surface rust on the machine after the weekend, it's

likely that the internal parts are rusted.

The expected result of lubricant loss is an immediate loss of gripping force. According to Rainer Kempken, technical director at Buck Forkardt Inc. Portage, Mich., "If you have no grease in the chuck, you have perhaps 25 percent of the clamping force instead of 100 percent. For a 10" chuck that's designed to produce 25,000 lbs. of gripping force with grease, at 25 percent, that's only 6,250 lbs. of force. It means a part can fly out of the machine—all because the gripping force goes down."

The third cause of chuck degradation is often a response to the first two problems. The common remedy for loss of gripping force due to dirt and inadequate lubrication is overtightening the bolts and pinion as tight as possible to ensure the chucked part doesn't fly out

of the jaws during the machining operation. However, this method generally distorts the jaws and ways and leads to more inaccuracy and poorer part quality.

Approaches to Maintenance

The best approach to ensure that the previously mentioned problems do not affect your operation is regular verification that your chucks generate the

**Rebuilding a chuck
can save 40%
over price of new**

Returning a chuck to the manufacturer for rebuilding is a common and cost-effective practice. Rebuilding a chuck can save an owner as much as 40 percent of the price of a new chuck.

In a typical rebuild, a manufacturer disassembles the chuck and looks for worn and broken parts, then writes up a quote and sends it to the user to detail what will be done to the chuck.

The process is much like rebuilding an engine, but instead of boring the cylinders out and installing oversized pistons, the rebuild grinds the original body oversized until it is straight and replaces worn parts with oversized parts. Also, the ways—where the master jaws fit into the body—may require grinding. That can be done with a special horizontal grinder.

The OD, face and the spindle fit are also reground so everything runs true. At this point, the fit-up of the parts is critical. Tolerances of 0.0001" are common in a rebuild, while leaving sufficient clearance for lubricant to coat components and prevent galling. Additionally, on reassembly, torque wrenches are used to ensure proper bolt loading.

After reassembly, the chuck should be requalified for accuracy and repeatability. The chuck jaws can be ground in place. Additionally, when jaws are bored oversized, they slide in and out and find the natural center. Then, precision-ground master jaws with matching keys can drop into the ways to ensure repeatability within 0.0005". The jaws should slide in and out properly without any binding.

—C. Boyles

proper gripping force. This means testing the gripping force on your chuck based on usage. Maybe that means weekly or monthly verification—it's usage-dependent.

Both static and dynamic clamping-force test equipment is available. Buck Forkardt offers a digital readout test unit for static testing and Röhms Products of America, Lawrenceville, Ga., offers a dynamic tester.

Since a chuck's gripping force varies with the turning speed, you have to ensure your unit conforms to the manufacturer's specifications (Figure 1). These rpm and gripping-force specifications are usually stated in the operations and maintenance literature that comes with the chuck.

Additionally, you can verify runout based on the same test schedule. If the runout on the machine appears to be increasing, you have a confirmation that your chuck needs service. Your quality-control specifications may be of help in this instance. When a machinist sees runout increasing, it's a good indicator that internal components and jaws are out of tolerance.

With or without testing the gripping force of the chuck, regularly scheduled chuck cleaning and greasing are necessary. This means taking the chuck over to the bench, disassembling it, flushing it out with cleaner, blowing off any grit or dirt from the parts, and ensuring that the mating surfaces are flat and free of nicks and scratches.

When the parts are clean, they must be greased and reassembled. During reassembly, use a torque wrench, the cost of which is negligible. Each threaded element of the chuck has a specific maximum load setting. Exceeding the torque can only lead to damaged components.

If the components have degraded to a point where they are beyond your capabilities to service them properly, contact the manufacturer before you put the chuck in the scrap bin. Many chuck manufacturers restore and rebuild their products for a fraction of the cost of a

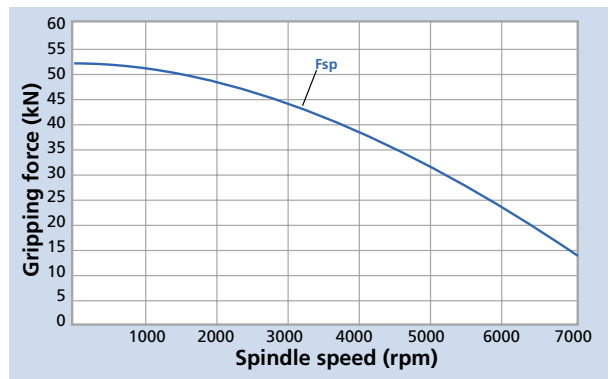


Figure 1: As the spindle speed increases, the gripping force decreases. The dynamic gripping force (F_{sp}) represents the minimum value of the available gripping force under normal operating conditions.

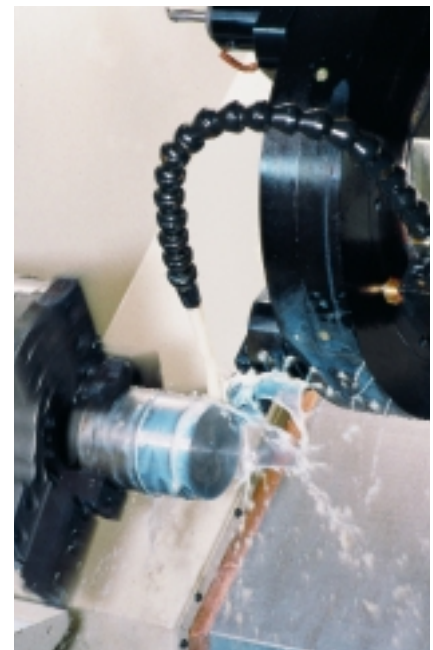
new chuck (see sidebar, this page).

During a rebuild, chucks are completely restored. Cushman Industries, Frankenmuth, Mich., is one company that offers a rebuilding service. Turn-around time is normally about 4 weeks.

Lubrication

Regular lubrication is the key to good chuck performance. It's so important that chuck manufacturers began by introducing grease fittings on their chucks in the '70s, then progressed to central lubrication systems for chucks. Now, some produce completely sealed units.

Regardless of the type of chuck you



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The companies that contributed to this article:

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(616) 327-8200
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Röhm Products of America
(800) 445-7646
www.rohm-products.com

**Tooling Systems Division
Cushman Industries**
(800) 873-3221
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have, it requires lubrication. Scrolls, pinions and gears need grease. Without grease, the gripping force can be reduced to as little as 25 percent of operating capacity. That occurs because friction limits the amount of force that can be transmitted to the jaws.

The chuck manufacturer's operation and maintenance literature should spec-

ify the type of grease to apply. Most maintenance literature calls for grease by product name, then specifies constituents and performance characteristics. The best recommendations for chucks, however, point to greases containing molybdenum disulfide.

Kempken said, "If someone has been using motor oil for lubrication in a chuck, they would have only 50 percent of the clamping force. Chucks require a heavy grease. The grease should be thick and contain molybdenum disulfide."

Cushman Industries' Bob Morse added, "Lubrication is critical. It reduces friction by 50 percent. First you have to have the right grease, because you can't control friction. Greases containing molybdenum disulfide help by reducing friction. A thin coat, burnished in, is very effective. The more you cycle these greases under load the better."

While effective maintenance extends the useful life of chucks, it's also important to follow proper operating practices. Use a torque wrench to tighten

jaws. A chuck distorts just like a head on an engine block. Also, there is a proper torque setting and a tightening sequence for the chuck. When someone uses a 3' cheater bar—a persuader—with a wrench to tighten some 3/4-10 bolts on precision-ground, tongue and groove parts, he probably won't increase the gripping force but will destroy the chuck.

Manufacturers are very straightforward about maintenance and shop safety. If a chuck is not maintained and properly lubricated, it won't have the maximum amount of gripping force. If someone overtorques the top jaws and distorts the master jaws, the master jaws will bind up in the jaw locks. Then, the chuck's repeatability and gripping force will be gone and parts will be thrown.

In the end, regular testing and maintenance, as well as proper lubricant selection and torque settings, are the critical elements that ensure you will get full-capacity performance from your chucks.