

SPINDLE REPAIR SIMPLIFIED

The repair or replacement of a machine tool's spindle is typically required after: 1) A cutting tool impacts a workpiece or fixture, oftentimes destroying the spindle's taper and/or damaging its bearings, or 2) Contaminants lurking in the machine's air, coolant or lubrication supply systems enter the spindle and maliciously find their way to the spindle bearings.

William Gibler, senior spindle technician for Toyoda, says impact accounts for 60 percent of the damaged spindles his business unit receives and remedies. The rest is largely due to contamination, often because a shop has either a subpar maintenance routine or no formal maintenance program whatsoever. In either instance, the result is lost production while the machine is down for what can be a costly, lengthy repair.

This spindle's modular design features a removable taper that makes repairs easy. The removable taper also allows users to switch between toolholder styles on a machine without replacing the entire spindle.

Mr. Gibler explains that Toyoda's modular spindle design allows repairs of those spindles to be performed quicker and easier than others. For instance, each Toyoda spindle is integrated into a spindle housing that bolts to the machine's headstock. (Kits are available to allow the machine to use its table and headstock motion to remove the hefty spindle housing.) The spindle cartridge with bearings remains enclosed inside the spindle housing. That way, repair technicians can not only disassemble and repair the spindle housing components at its repair facility, but can also use a test stand to dial-in the fresh spindle just as if it was mounted on the machine tool. After test-stand adjustments, the spindle housing is simply reattached to the headstock. This differs from other designs in which only the spindle cartridge is removed from the machine while the stator remains mounted in the headstock. After the spindle cartridge is repaired, spindle adjustments must be performed on the machine.

Similarly, Toyoda spindles have a modular drawbar assembly that can be removed from the front of the machine. This makes drawbar removal much easier than units that must be removed from the back of a machine where space is limited.

Mr. Gibler believes the most beneficial design element of Toyoda spindles is the removable taper. The taper is often destroyed after an impact. However, if that is the only spindle component to be damaged, the Toyoda machine can be up and running in 30 minutes by installing a new taper, he says.

The key is determining if the taper is the only damaged component. Mr. Gibler says shops can do this themselves by first removing the taper and performing indicator tests on the spindle tube. If the tests reveal that

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the bearings are functioning properly and the spindle is running true to centerline, users can install a new taper and indicate it to the centerline.

The precision tolerances of mating components allow shops to replace tapers on their own, Mr. Gibler says. The taper has two piloting diameters machined to a tolerance of ± 10 microns that guide it into the spindle tube (the tube is machined to the same tolerance). Users insert the taper, snug its cap screws and perform an indicator test inside the taper. Adjustments during this process are said to be minor and may be a matter of simply tightening the cap screws in a specific order.

The removable taper offers another advantage in that it allows shops to change to a different tool holder interface. For example, a shop can change from a CAT 40 or CAT 50 taper to an HSK 63a or HSK 100a. To do this, users also would have to change to a mating drawbar assembly, ATC pockets and ATC swing arm. However, a total spindle change is not required. Mr. Gibler says shops commonly change to the dual-contact Big Plus interface from Big Kaiser. That way, one taper can accommodate Big Plus toolholders when extreme rigidity is needed and also their CAT 40 or CAT 50 toolholders.

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CONTACT US

Standard Products Division
316 West University Drive
Arlington Heights, IL 60004
Tel: (847) 253-0340
Fax: (847) 253-0540
E-mail: info@toyoda.com

Automotive Products Division
51300 West Pontiac Trail
Wixom, MI 48393
Tel: (248) 624-5755
Fax: (248) 624-3814
E-mail: info@toyoda.com