Broken Springs?

Mis-adjusted gripper stroke?

Inadequate lubrication?

Incorrect retention knob?

- Quickly diagnose drawbar problems
- Avoid unexpected emergency repairs
- Detect clamping system problems early
- Prevent machine damage and accidents

Is your power drawbar working correctly?

Find out in seconds.

Improve tool life and part finish

Correct tool holding force ensures that the spindle-tool holder interface is as rigid as possible. A rigid interface will improve tool life by reducing chatter and excess wear, and in turn improve workpiece finish.

Protect your spindles and ensure machining accuracy

Insufficient tool holding force can quickly wear or damage the critical spindle taper resulting in loss of machine accuracy and an expensive repair bill.

For the HSK taper, wear and damage on the spindle taper are even more detrimental. The HSK taper relies on an interference fit between the spindle and tool holder tapers, meaning drawbar force must be sufficient for the tool holder to properly seat. Because the HSK interface seats both on the tool holder taper and flange, dimensional tolerances are extremely tight. For HSK forms E and F, correct clamping force is crucial because there are not drive keys or dogs to transmit torque – the system relies entirely on the power drawbar's holding force.

Predict problems with the spindle's Belleville / disk spring stack

Machining centers with automatic tool clamping systems typically use Belleville/disk spring stack to hold a tool in the spindle, with a hydraulic cylinder used to overcome the spring force to unclamp the tool.

High RPM is often an important design criterion for a spindle, meaning the use of small diameter bearings makes sense from an engineering standpoint. Small bearings necessitate the use of small diameter springs to fit into the spindle arbor. Small-diameter springs lead to highly stressed springs for tool clamping, and even more so during tool unclamp.

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A typical drawbar spring stack is designed to last approximately 1 million cycles. This may sound like a big number, but tool changes add up quickly. An example: a process with 3 to 4 tool changes per minute (many do much more), with 2,000 operating hours per year (one shift), means between 360,000 and 480,000 cycles are made per year. In this scenario, the springs have reached the end of the design life cycle and should be replaced after two years. We have found some processes that reach 1 million cycles after 6 months – with the complaint that the “springs break all the time.”

Springs will not break all at once. Initially only one spring might break without significant impact on tool holding force. However, soon others will break since they have to do the work of the broken spring (or springs) as well. Soon the rest of the springs will be overloaded and break or take a permanent set.

This failure process can be detected with a clamping force measuring device and action can be taken before the clamping system fails completely.

Check for the role that friction plays in the clamping system and for proper lubrication

Some drawbar designs use a mechanical force intensification mechanism to increase tool holding force. When force intensification is used, friction is a factor to be watched. It is difficult to quantify friction without measurement. Machine builders typically provide a tool holding force specification for a properly lubricated and adjusted clamping system.

Most power drawbar systems with HSK tapers use force intensification in the gripper design. The mechanical intensification of the force is typically between 3 and 9 times, making friction is a major factor in the proper operation of the system.

For systems with manual HSK grippers such as those supplied by Mapal and Guehring, periodic verification of correct tool holding force is also of critical importance. Per manufacturer recommendation, tools should be clamped using a torque wrench to ensure correct force. However, if the gripper is not properly lubricated, tool holding force will be much lower at the specified torque.

Operator Safety

Eventually, the tool holding system of a machine will fail catastrophically if left unchecked. There will be lots of mysterious little problems such as poor part finish and lots of broken tools, and eventually leading to the tool flying out of the spindle and damaging the workpiece, machine, or worse – injuring the operator.

Standards compliance

The ISO and DIN HSK standards have recommended minimum clamping forces. The ForceCheck gauge can verify that these are met.

The “CAT” steep taper standard ASME B5.50 specifically recommends using a drawbar force gauge.

ISO 9000 compliance requires that critical machine parameters be periodically checked.

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