How it Works

1. Drawbar
2. Toolholder

[A] The drawbar and the spindle taper keep the toolholder in the spindle. These components operate together with the toolholder and the pull stud to keep the tool inside the spindle while the machine is in operation.

The drawbar supplies the clamp force on the toolholder pull stud [4]. The clamp force comes from many Belleville springs [5] installed in a specific pattern along the length of the drawbar. Inside the cylindrical pocket on the tool end of the drawbar are retention balls [3]. The retention balls [3] hold and release the toolholder pull stud, depending on the tool clamp status of the machine.

Note: Some drawbars have 4, 5, or 6 retention balls.

[B] When the tool is clamped in the spindle, the retention balls [3] pull against the pull stud [4]. The Belleville springs [5] pull the assembly up into the spindle bore. The "Drawbar Force Reference Table" gives the drawbar clamp force for each machine model.

The spindle taper accurately fits the taper on the toolholder, which aligns the tool and further helps to clamp the tool.

When the tool release piston (TRP) pushes down on the drawbar, the Belleville springs [5] compress. This aligns the retention balls [3] with the tapered pocket at the top of the spindle taper. The top of the drawbar pocket pushes on the pull stud [4] to push the tool out of the spindle taper. As the retention balls [3] move down in the taper, they release the pull stud, and unclamp the tool.

For drawbar force measurements, refer to Drawbar Force Reference Table on diy.haascnc.com.
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Section 1

**Symptom:** The toolholder is fretting in the taper. The part has a poor finish. The tool drops before the tool changer can grab it.

**Possible Cause:** The tool pulls out of the taper. The tool length is too long. The clamp force on the toolholder is too low, or the TRP pre-charge is not set correctly.

**Corrective Action:**

Verify that the tool length, axis feed, and spindle RPM are correct according to the tooling manufacturer's recommendations.

Check the clamp force with a clamp force measuring tool. Go to [Drawbar Force Reference Table](diy.haascnc.com) for the. If the pull force is low, the drawbar is faulty.

If the Belleville springs on your drawbar are damaged, you must replace the drawbar. The drawbar in inline spindles cannot be removed. If the drawbar in an inline spindle is damaged, you must replace the entire spindle assembly.

Refer to the tool release piston pre-charge adjustment procedure [diy.haascnc.com](diy.haascnc.com) that is appropriate for your machine.
Section 2

**Symptom:** (TSC Only) Excessive coolant comes out of the coolant tube behind the spindle.

**Possible Cause:** The carbide insert on the drawbar is damaged.

**Corrective Action:**

Remove the TRP to verify the condition of the carbide insert. Check for damage to the carbide insert or the TRP. Measure the surface [1] of the drawbar insert with a 0.0005 indicator [2]. Rotate the spindle with your hand to rotate the drawbar. The measurement must be less than 0.0005 TIR. If it is more than 0.0005 TIR, the drawbar is faulty.

Section 3

**Symptom:** The drawbar does not release the toolholder smoothly.

**Possible Cause:** The pull stud is pitted or damaged.

**Corrective Action:**

Remove the toolholder from the spindle. Check for damage to the pull stud. The pull stud must have a 45° angle [1].

Ball marks on the edge of the pull stud indicate that the drawbar does not open completely.

Refer to the TRP clamp/unclamp sensor adjustment procedure on diy.haascnc.com that is appropriate for your machine.
Section 4

Symptom: The drawbar does not release the toolholder smoothly.

Possible Cause: The alignment of the tool release piston sensor(s) is not correct.

Corrective Action:

There are different models of TRPs on different machines.

Refer to the TRP clamp/unclamp sensor adjustment procedure on diy.haascnc.com that is appropriate for your machine.

Section 5

Symptom: The drawbar will not release the toolholder smoothly.

Possible Cause: The air pressure/volume is too low.

Corrective Action:

Verify that the air pressure to the TRP solenoid [1] is 90-psi (6.21 bar).

If the volume is correct, there should be only a 10-psi (0.69 bar) of an air drop during a tool change. Use an inline air gauge to measure the change in air pressure.

Check for kinks or splits in the air hose that goes to the TRP assembly [2].

Make sure the volume of air supplied to the machine is sufficient.

Refer to New Machine Setup/Pre-Installation on diy.haascnc.com.
Section 6

Symptom: The drawbar will not release the toolholder smoothly.

Possible Cause: The drawbar retaining balls are dry.

Corrective Action:

To grease the retaining balls, put a ball of RED-i grease on top of a pull stud (the size of a nickel).

Put the toolholder into the spindle. Clamp and unclamp (4) or (5) times to load the grease onto the retaining balls.

Remove the toolholder. Wipe excess grease from the toolholder and spindle taper.

Section 7

Symptom: The toolholder makes a popping sound when it is released.

Possible Cause: The toolholder and spindle taper are dirty.

This effect can also occur while the machine is in operation if a cold toolholder is placed into a warm spindle taper. This creates thermal expansion [1] on the sides of the toolholder and makes it stick in the spindle taper before it is released.

A common example is if you change from a hot cutter to the cool spindle probe to check your part at the end of a cycle. If the cool probe is left in the hot spindle overnight, it will make a "popping" noise when it is released.

Corrective Action:

Clean the toolholders and spindle taper. Check for damaged toolholders before you put them back in the machine. A damaged toolholder can cause damage to the spindle taper and create tool runout or problems with finish.