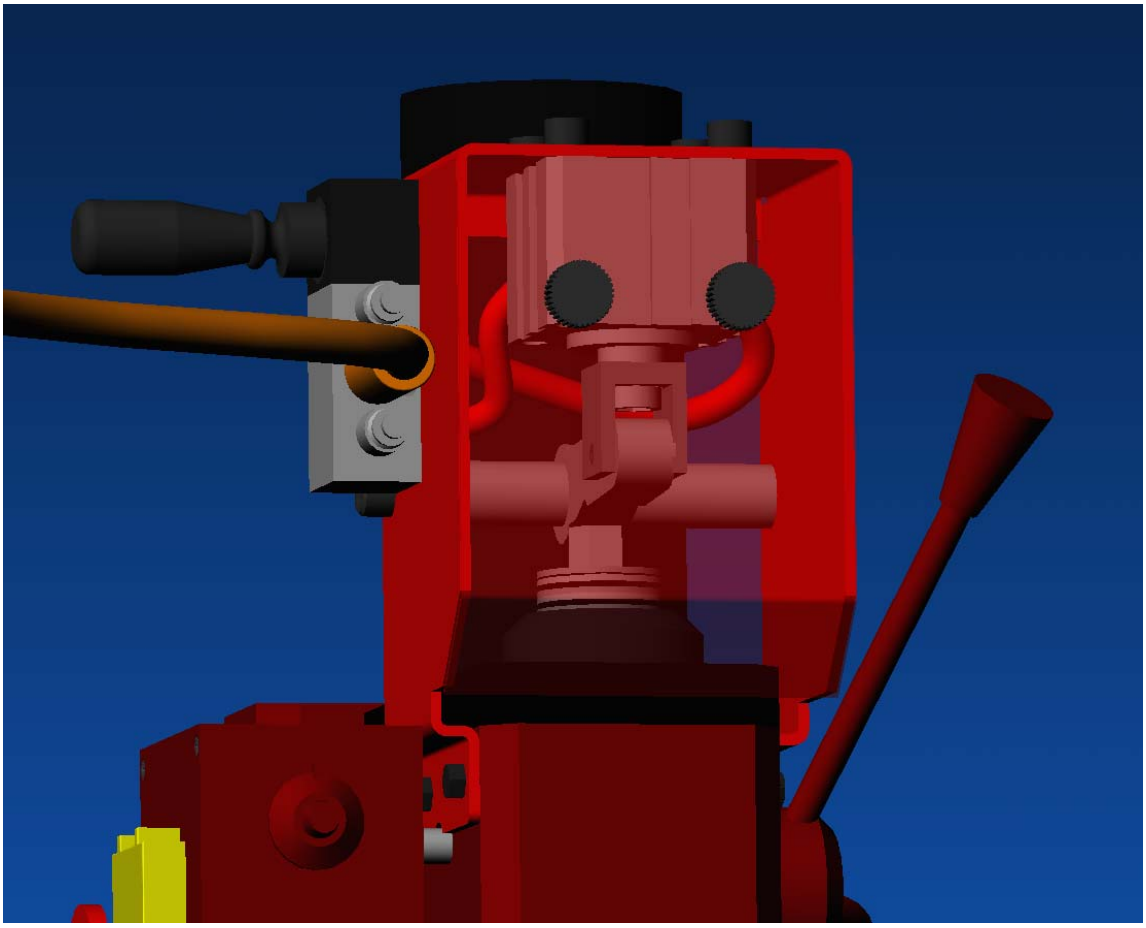
The Z-Bot Power Draw Bar



The Z-bot Power Draw Bar for mini mills is designed to work with the popular Tormach tooling system. This system employs an R8 or MT3 collet which remains in the spindle and accepts a ¾" straight shank undercut tool holder. It is designed for a high degree of repeatability and is particularly suited to CNC milling. However, it can also be used as a manual quick change tool system to great effect. The Tormach system is further enhanced by the use of a power draw bar which minimizes tool change time and effort. Driven by a shop compressor, and installed in less than an hour, the Z-bot Power Draw Bar brings a new level of convenience to milling and tool changing. Although a manual system, the Z-Bot Draw Bar can be easily upgraded to serve as a computer controlled component of the Z-Bot Automatic Tool Changing System for Tormach tooling by replacing the manual air valve with automatic solenoid controls.

For more information on the Tormach Tooling System, visit www.LittleMachineShop.com/Tormach

Z-bot Power Draw Bar incorporates a stack of Belleville spring washers that preload the drawbar into the tightened position. The force of the Belleville spring washers draws the collet into the spindle and retains the tool holder.

To release the tool holder, air from the compressor is directed through a four way valve to a double acting air cylinder. When the control handle is pushed downward, the air cylinder pushes the piston rod down, thereby moving the lever arm so that it bears on the top of the drawbar. The

lever action multiplies the force of the air cylinder to provide more than 1000 lbs of force to overcome the action of the Belleville spring washers. This action releases the Tormach tool holder.

Conversely, when the control handle is moved up, the piston rod is pulled up, which allows the lever arm to clear the top of the drawbar, and the Belleville spring washers pull the tool holder tightly against the spindle.

The height of the mechanism is adjusted so that the lever arm clears the top of the drawbar which allows free rotation of the spindle when milling.

A silencer/flow control is installed on the "up" air valve exhaust port to assure the air cylinder does not return too violently. It is adjusted and thread locked at the factory. The "down" exhaust port has a simple air muffler as the Belleville washers slow its descent. Do not remove these air controls as it will result in shortened life of the air cylinder.

Z-Bot Power Draw Bar Components

The following components are included with the Z-Bot Power Draw Bar:

- Power draw bar actuator mechanism
- Sheet metal cover
- Two stand-offs
- Two ¼-20x.25 thumb screws
- Four ¼-20x.5 hex bolts
- Two M5 x25mm machine screws

You must also purchase either an MT3 or R8 Z-Bot spring bar set. This will include the following:

- Specially machined drawbar (either MT3 or R8)
- Six Belleville spring washers

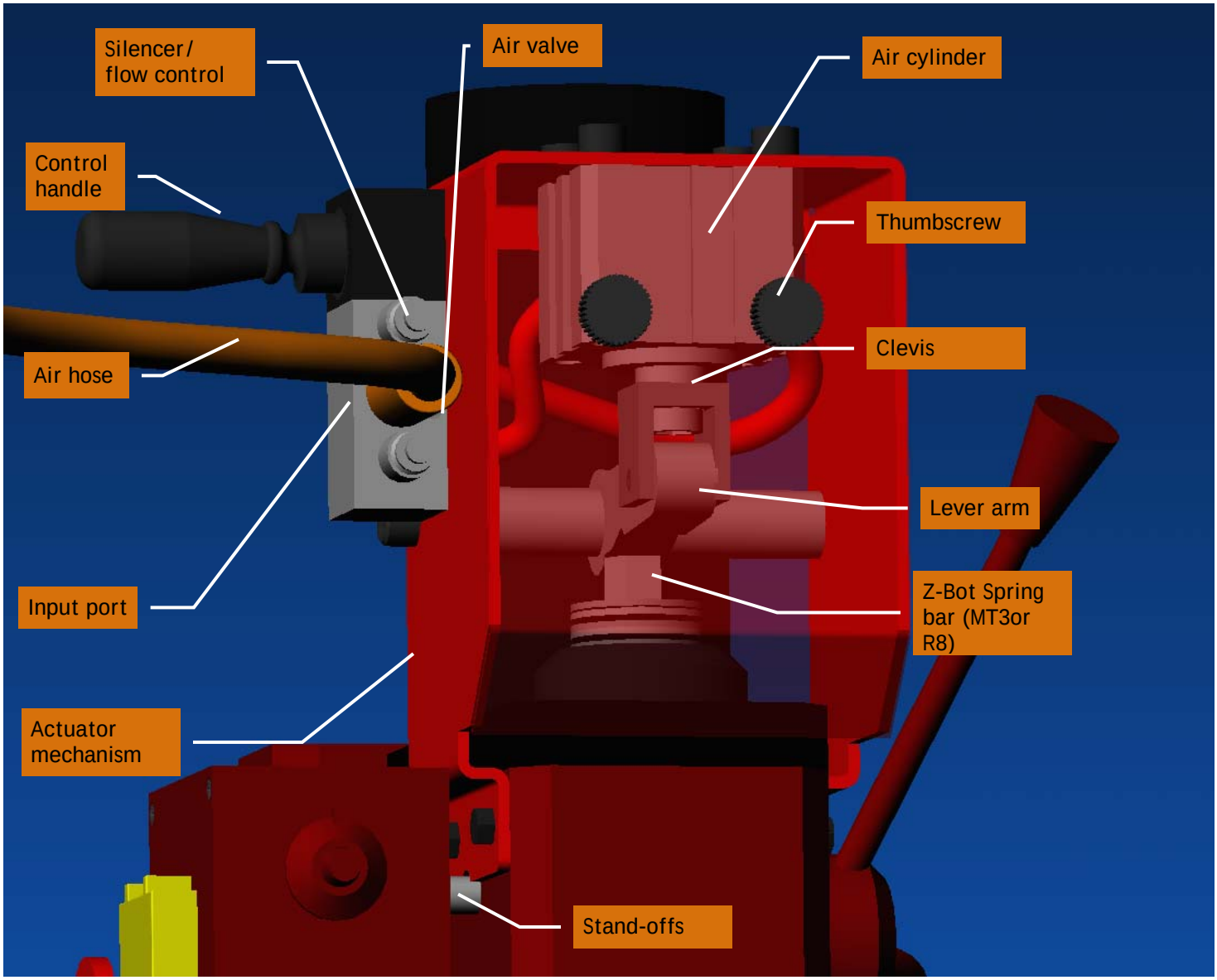
Tools Required

You must also furnish an air hose coupling or fitting for your compressed air hose with a ¼" NPT male thread.

You will need the following tools to install the Z-Bot Power Draw Bar:

- Electric hand drill
- Screw drivers
- Hex (Allen) wrenches
- End wrenches
- 4" capacity C-clamp
- Teflon plumbers thread seal tape
- 0.25" transfer punch or center punch
- #7 drill bit
- ¼-20 plug tap and tap wrench
- Tapping fluid
- Tin snips

Nomenclature

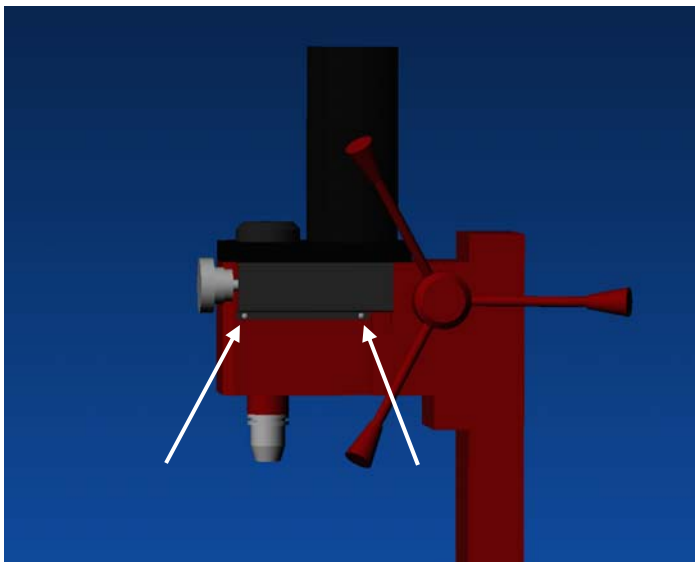


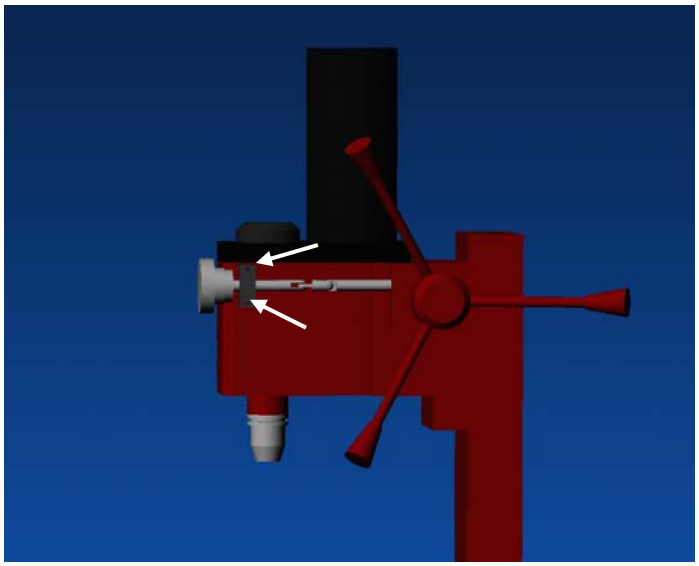
Installing the Z-Bot Power Draw Bar

Follow these steps to install the Z-Bot Power Draw Bar.

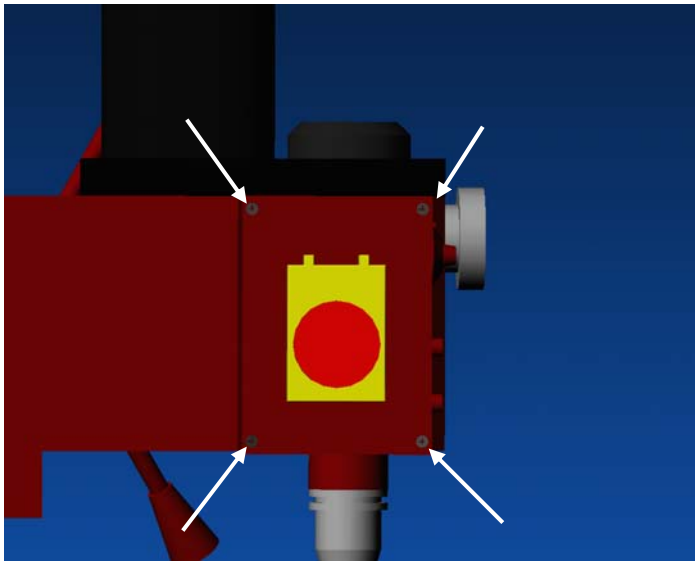
Preliminary

1. Unplug the mill's power cord.
2. Remove the two screws holding the sheet metal cover from the Z-axis fine feed linkage mechanism and set the sheet metal cover aside. Also remove the two socket head cap screws holding the front block to the mill head and let the linkage dangle down.

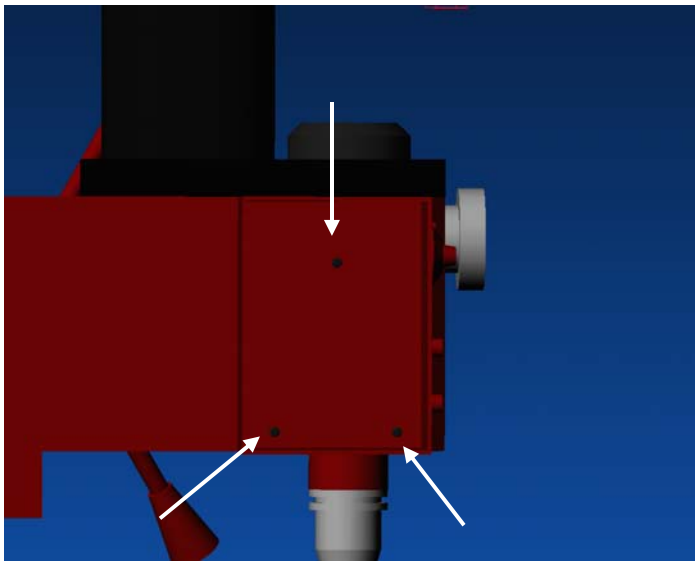




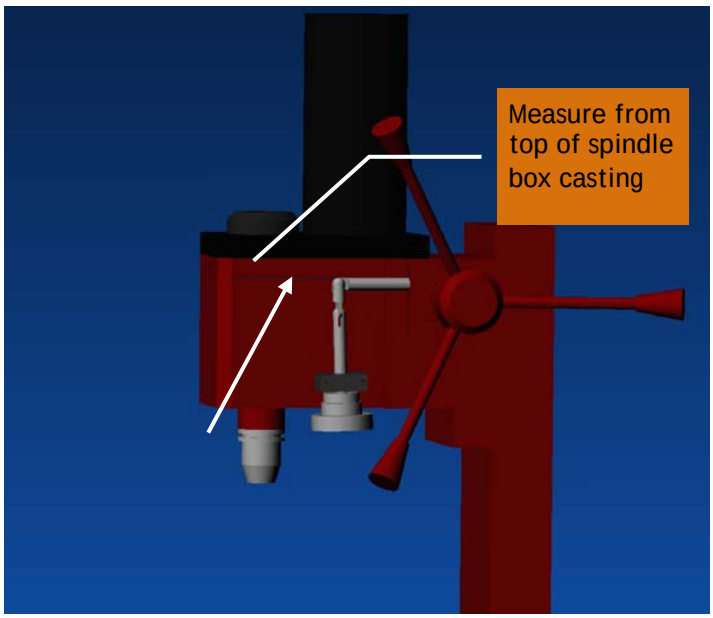
3. Remove the four screws holding the cover on the plastic control box.



4. Remove the three screws holding the control box to the mill head and push the control box aside. Let it hang on its cables. The control box will be reinstalled on two standoffs in the bottom holes after the draw bar is installed.

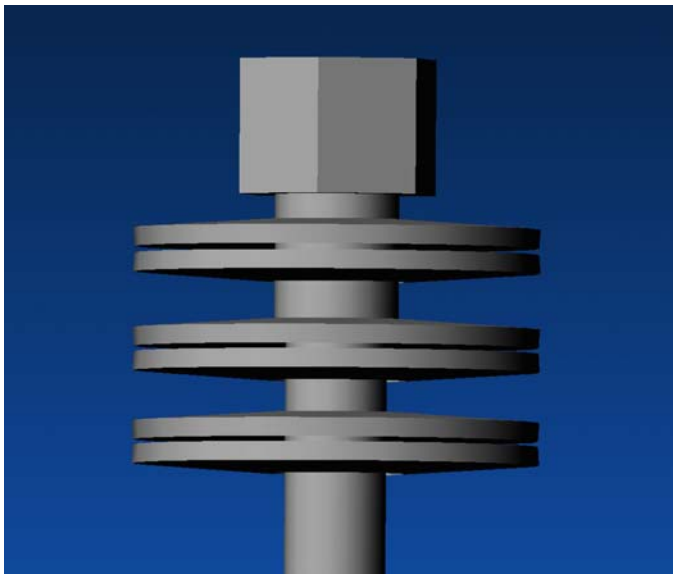


5. On each side of the mill head scribe a line 0.6” below the top of the mill head casting. These lines will be used to locate the holes for the drawbar actuator assembly mounting bolts.

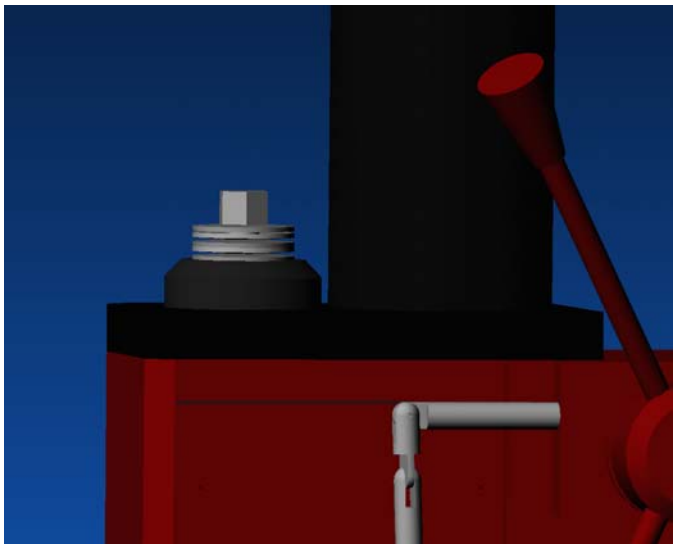


Install the drawbar

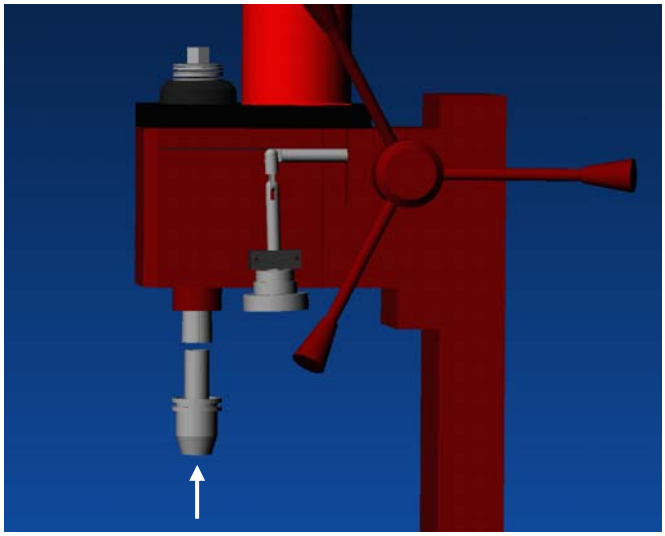
1. Remove the appropriate Z-Bot Spring Bar Assembly (R8 or MT3) from its packing tube and remove the blue retainer tape.



2. Insert the drawbar, with the Belleville washers installed, into the top of the spindle as shown.

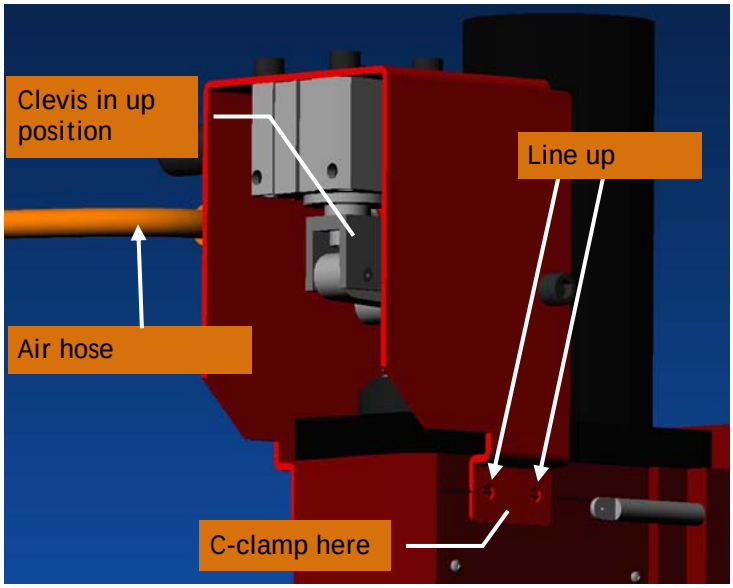


3. Install a Tormach collet into the spindle and engage the drawbar.
4. Insert a Tormach tool holder into the Tormach collet and tighten the drawbar until it is finger tight
5. Using a wrench, tighten the drawbar against the spring washers another full turn. This is sufficient to hold the tool. You may need to adjust this again later when the draw bar is fitted.

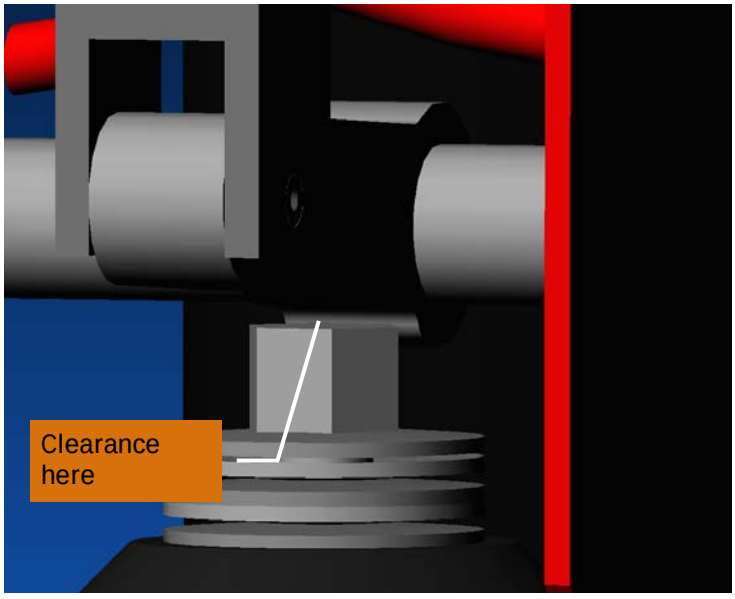


Install the drawbar actuator assembly

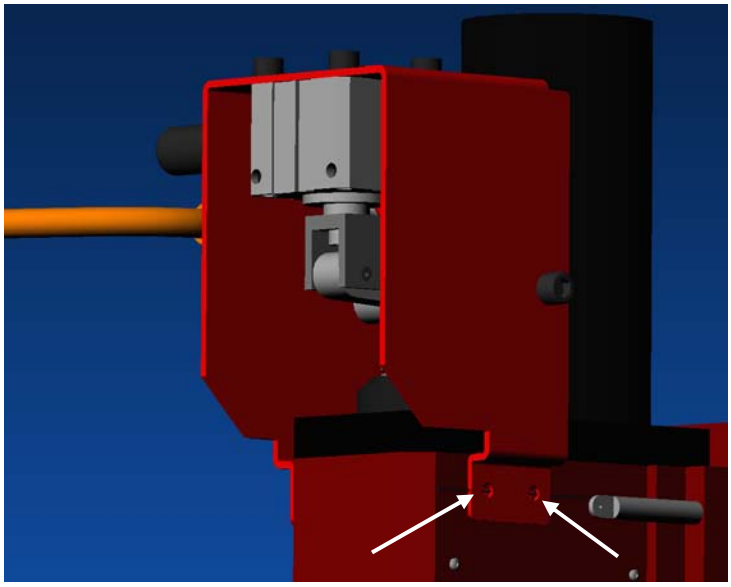
1. Install an appropriate air hose connector or fitting for your air hose into the ¼ NPT air input port on the left side of the draw bar actuator assembly. Seal threads with Teflon plumbers tape.
2. Connect an air hose to the connector or fitting and charge the hose with at least 95 PSI air.
3. Ensure that your fingers are out of the mechanism of the drawbar actuator assembly. Push the black rubber draw bar control handle up to raise the internal lever and clevis to the up position.
4. Place the drawbar actuator assembly (with the control handle raised) so the center of the mounting holes line up with the center of the score line.
5. Temporarily C-clamp the sides of the draw bar housing to the mill head so the mechanism is straight up and down.



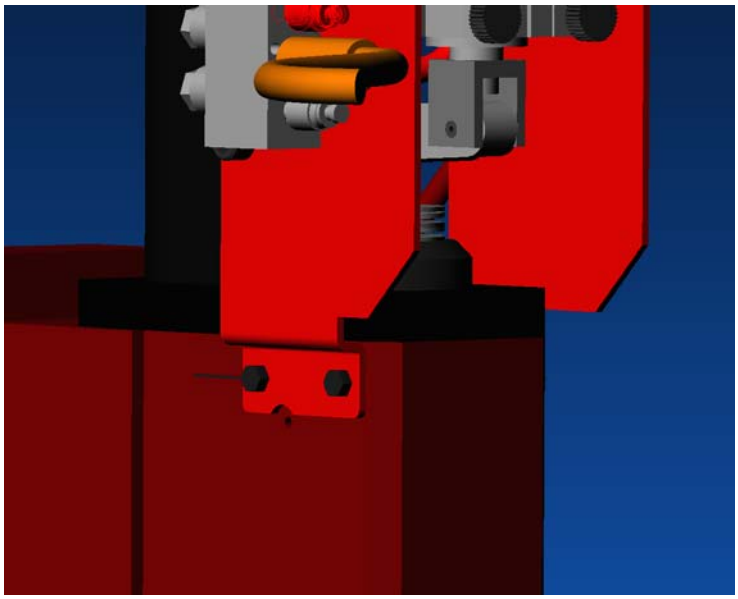
6. Check the orientation of the lever arm and ensure it is in the position shown in the illustration above. Double check that the holes are centered on the score line. Check that there is clearance between the drawbar and lever arm. The spindle should spin without interference. Tighten the draw bar slightly, if necessary to allow the spindle to turn freely.

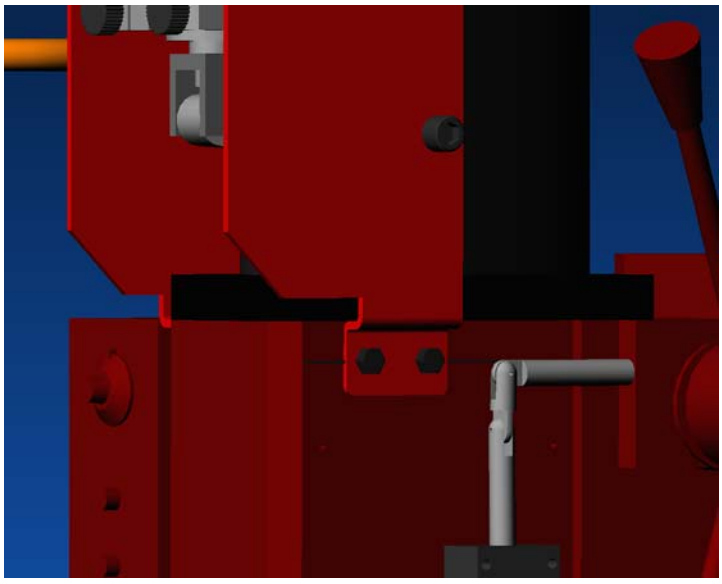


7. Using a transfer punch or center punch, mark the locations of the holes for the four mounting bolts. Mark the spot that is at the intersection of the line that you scribed and the center of the hole for each of the four mounting bolt holes.
8. Use a #7 (0.201”) drill bit to drill the four mounting holes 0.5” deep.
9. Use a ¼-20 plug tap and tapping fluid to tap the four mounting holes to a depth of at least 0.4”. Clear the chips from the holes.

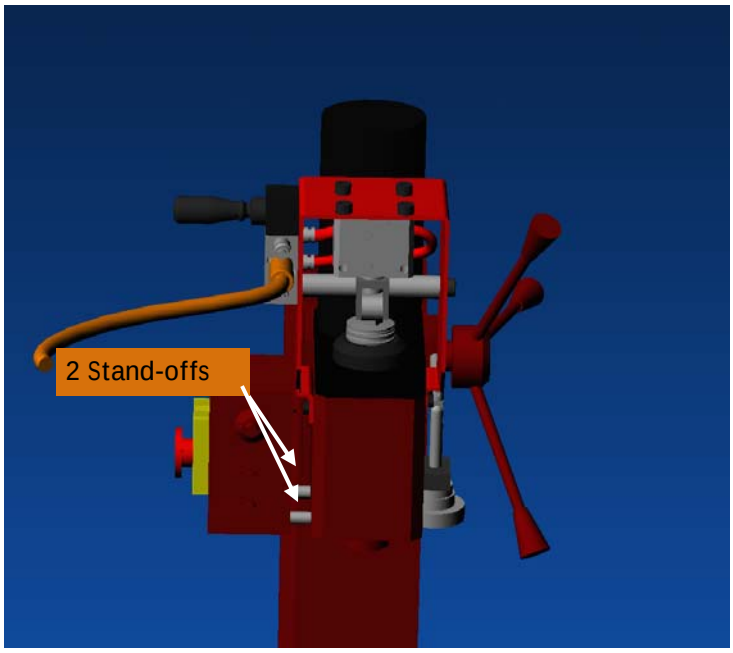


10. Thread 1/4-20 x .5” hex screws through draw bar housing into the tapped holes. Tighten the screws to clamp the draw bar housing firmly to the mill head.

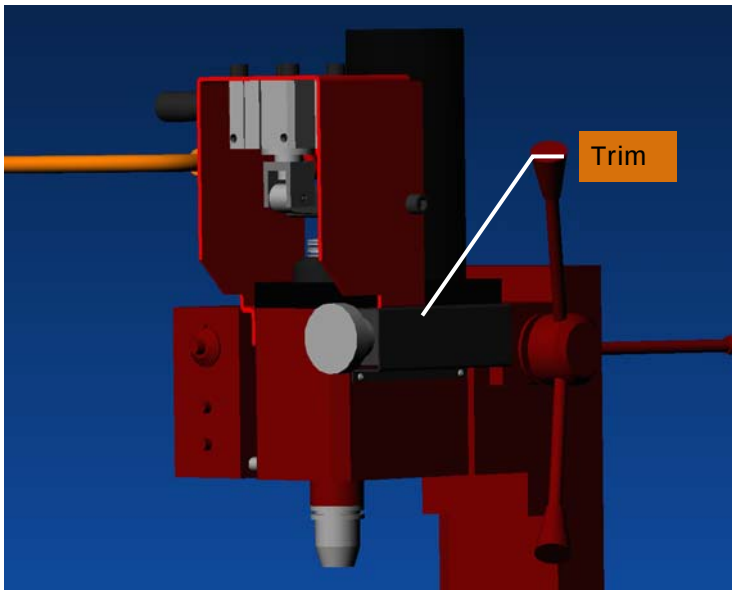




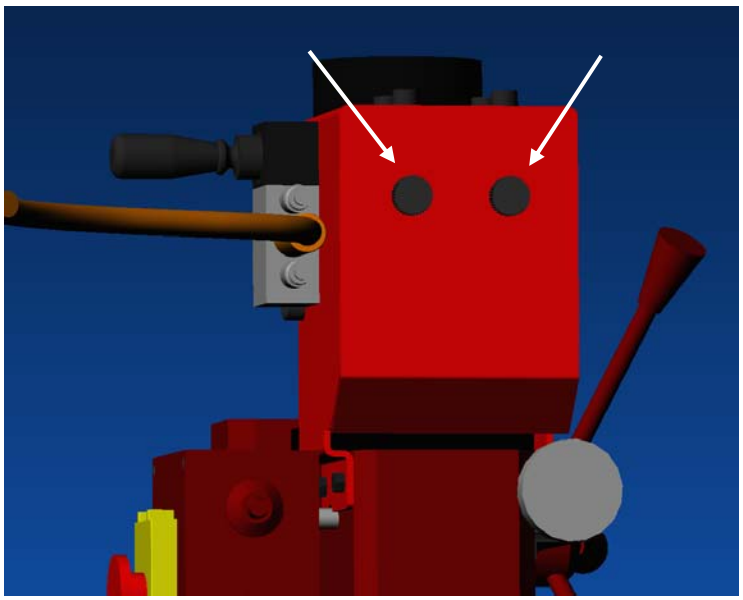
11. Replace the control box using the 2 25mm M5 screws provided and 16mm plastic standoffs between the mill head and the box.
12. Replace the control box cover using the four original screws.



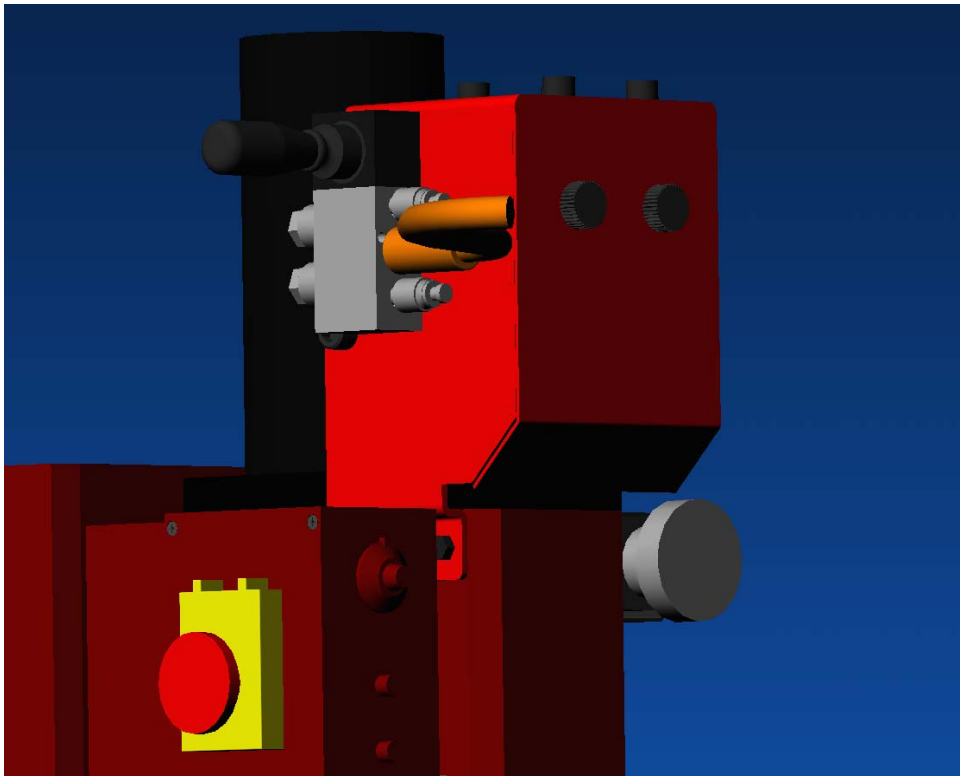
13. Reinstall the Z-axis micro feed mechanism block. Optionally, use tin snips to trim the sheet metal from the Z-axis fine feed mechanism cover where it overlaps the draw bar housing. Alternately, this cover may be left off the mill. Removal and re-installation of the draw bar mechanism is easier without the cover.

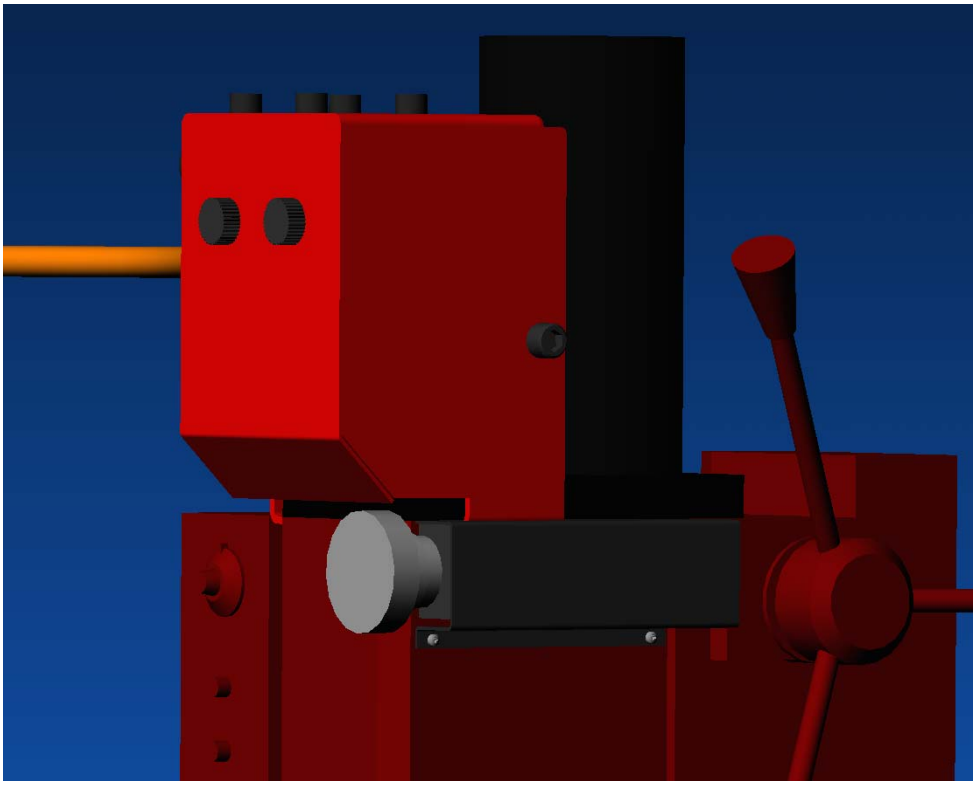


14. Install the sheet metal cover on the draw bar housing by threading the ¼-20 thumb screws into the air cylinder holes.



Congratualtions! The Z-Bot Power Draw Bar is ready to use. It should look like this:





Operating the Z-Bot Power Draw Bar

WARNING: Never operate the Z-Bot Power Draw Bar when the mill spindle is turning!

Connect an air hose to the input port of the air valve on the actuator mechanism. Set the air pressure to a minimum of 95 psi and a maximum of 150 psi. The power draw bar will not release the tool holder without sufficient air pressure.

To change a Tormach tool holder:

1. Turn the spindle off and wait until it stops rotating.
2. With your right hand, grasp the tool holder so it does not fall out of the collet.
3. With your left hand, push the draw bar control handle down to release the tool holder from the Tormach collet.
4. Remove the tool holder from the collet.
5. Insert the new tool into the Tormach collet and push the draw bar handle up.

To remove the draw bar actuator to use a non-Tormach tool:

1. Turn the spindle off and wait until it stops rotating.
2. Remove the four hex screws holding the draw bar actuator to the spindle head.
3. Slide the draw bar actuator mechanism up and off the mill head and set it aside. There is no need to disconnect the air hose.
4. Lock the spindle using the pin supplied with the mill and unscrew the drawbar from the Tormach collet.
5. Insert another tool holder in the spindle and tighten the draw bar against the spring washers.

To replace the draw bar actuator to use Tormach tooling:

1. Turn the spindle off and wait until it stops rotating.
2. Lock the spindle using the pin supplied with the mill and unscrew the drawbar from the tool holder.
3. Install a Tormach collet into the spindle and engage the drawbar.
4. Insert a Tormach tool holder into the Tormach collet and tighten the drawbar until it is finger tight
5. Using a wrench, tighten the drawbar against the spring washers another full turn. This is sufficient to hold the tool.
6. Slide the draw bar housing onto the mounting screws on the mill head and insert and tighten the hex screws.

The draw bar is ready to be used again.