

TECHNICAL DOCUMENT

PCNC 770 Power Drawbar Installation

Product Identification: PCNC 770 Power Drawbar (PN 32436)

Purpose: This document details the installation and use of the power drawbar on a PCNC 770® mill.

Qty.	PCNC 770 Power Drawbar	PN
2	1/4 inch Plastic Tube: 112 mm	31457
1	105A Wire Label	—
2	Air Fitting: Elbow	35924
2	Air Fitting: T-connector	35923
1	Control Assembly	—
1	Cylinder Assembly	—
1	Drawbar	31911
1	Drawbar Flange	31912
1	Eccentric Pivot Mount	32095
2	Hex Bolts	32455
2	Jam Nuts	32341
2	Latch Plate Adjustment Set Screw	32342
2	Latch Plates	32271
1	Left Sub Plate	31983
4	M8 Lock Washer	32339
1	M12 Flat Washer	32473
1	M12 Lock Washer	31379
5	M16 Flat Washer	31445
4	Mount Screws	31895
4	Mounting Screw	32338
1	Pendant	31471
1	Plastic Mount Tab	31460
1	Quick Release Pin	32353
1	Right Sub Plate	31984
1	Screw	32340
1	Sheet Metal Screw	31718
8	Spring Washer	31319
1	Thread Seal Tape	—
1	Wire Tie	31719



NOTE: If any of these items are missing, contact Tormach Customer Service for a replacement at (608) 849-8381.

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Required Tools

This procedure requires the following tools. Make sure you have them available before you start.

- 8 mm socket and drive with extension
- 9/32 inch drill bit
- 13/16 inch open-ended wrench
- #29 drill bit
- Drawbar wrench
- Electric drill
- Hack saw or similar
- Metric hex wrench set
- Phillips screwdriver
- Multi-purpose grease

Before You Begin

Air Requirements

Make sure your setup meets the following air requirements:

- **Air Supply.** The Power Drawbar requires an operating range between 90 psi and 120 psi. If supply exceeds 120 psi, a regulator must be used.
- **Dry Air.** We recommend you use a filter, desiccator, or compressed air dryer between the compressor and Power Drawbar to make sure the air is dry.
- **Lubricated Air.** Air should be lubricated with common air tool oil. Use the FRL Filter-Regulator-Lubricator (PN 32457) or similar for this purpose. Refer to documentation that ships with the FRL for more information on installation and use.

Electrical Requirements

When Power Drawbar is used in combination with the Automatic Tool Changer (ATC), power is provided internally. Otherwise, the unit's power requirements are 115-230 volts AC.

Power Drawbar Cylinder Assembly

1. Identify four air fittings included with this kit (see **Figure 1**).



Figure 1

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Figure 2

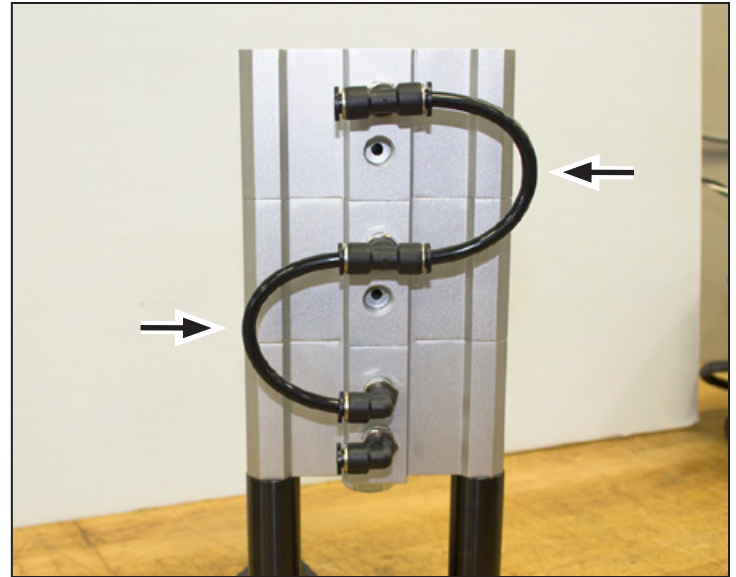


Figure 3

2. Using thread seal tape (included with this kit), completely wrap the threads of the four air fittings.
3. Put the power drawbar cylinder on a flat surface as shown in **Figure 2**.
4. Install air fittings in the power drawbar cylinder in the order specified, from top to bottom (see **Figure 2** and **Figure 3**):
 - a. T-connector
 - b. Empty
 - c. T-connector
 - d. Empty
 - e. Elbow connector
 - f. Elbow connector

When complete, make sure your power drawbar cylinder matches **Figure 3**.

5. Identify two 112 mm 1/4 inch Plastic Tubes included with this kit.
6. While facing the power drawbar cylinder, put one plastic tube between the left sides of both T-connector air fittings as shown in **Figure 3**.
7. Put the remaining plastic tube between the right sides of the T-connector air fitting and the elbow connector air fitting in as shown in **Figure 3**.

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Disassembly

For PCNC 770 Series 3 mills serial number 70200 and up:

- Complete Steps 1-2 in the section *Disassembly*. Then, go to the section [Mechanical Assembly](#).

For older PCNC 770 mills serial number 70200 and below:

- Complete all steps in the section *Disassembly*.
1. Power off the mill according to the *Power Off/On Procedure* detailed below.

 **WARNING! Electrical Shock Hazard:** Be sure to power off machine before making any electrical modifications. Failure to do so may result in serious injury or death.

Power Off/On Procedure

Power Off	1. Push in the red E-stop button
	2. Click <i>Exit</i> on the screen; when prompted click <i>OK</i> to power off
	3. Turn the Main Disconnect to the <i>Off</i> position (see image at right)
Power On	1. Turn the Main Disconnect to the <i>On</i> position (see image at right)
	2. After PathPilot® loads, twist the red E-stop button clockwise to release
	3. Press the green <i>Start</i> button
	4. From the PathPilot interface, click <i>Reset</i>



2. Open the spindle door and remove the following (see **Figure 4**):
 - The drawbar
 - The latch guard
 - The spindle belt
 - The spindle latch

NOTE: The following steps may be more easily accomplished by first removing the sheet metal spindle cover. The spindle cover is attached to the spindle head by five screws. If you remove the spindle cover, you must make sure that the lubrication manifold, lubrication lines, and spindle power cable are not damaged in the process.

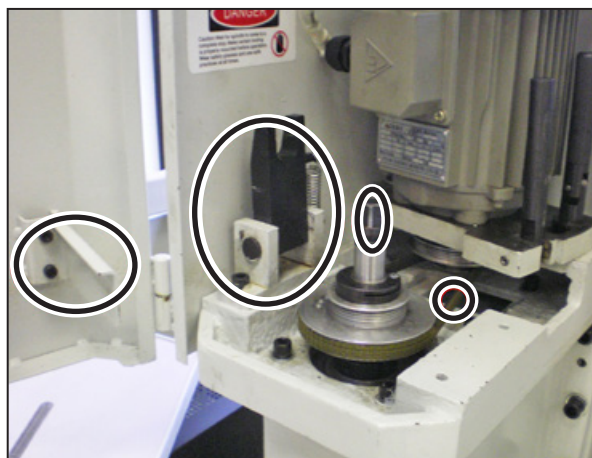


Figure 4

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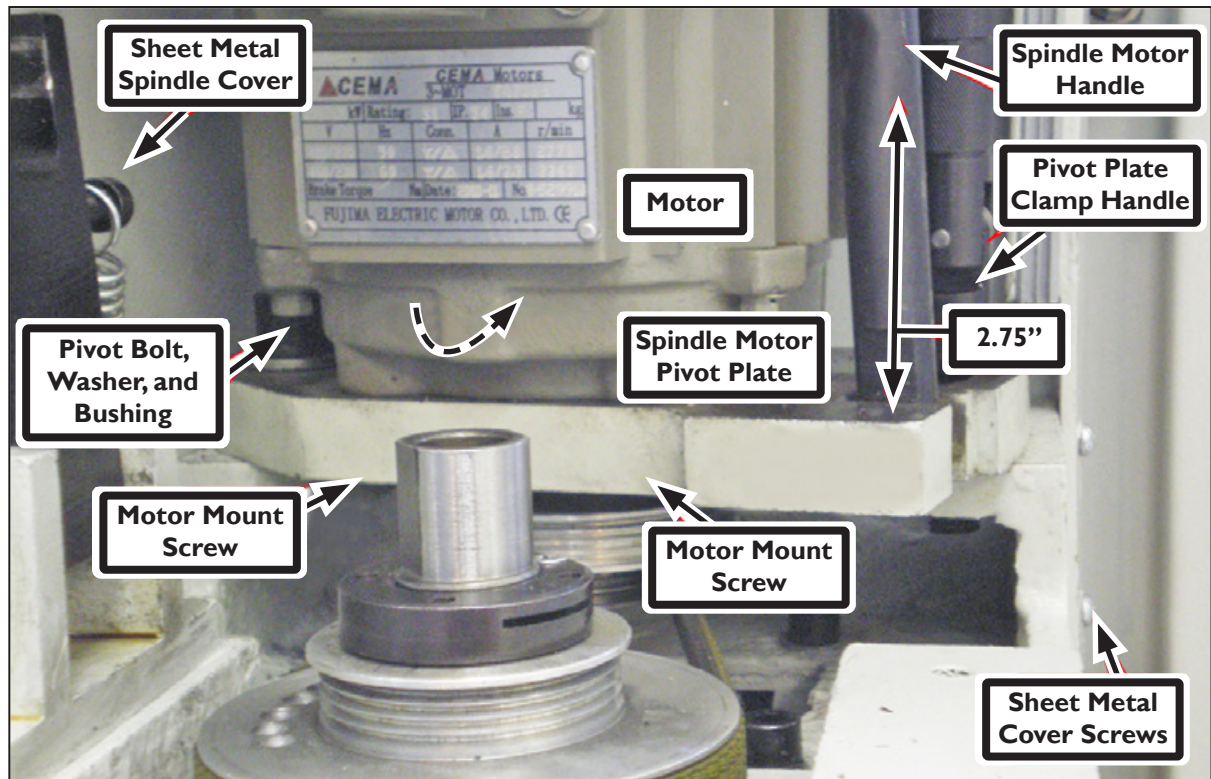


Figure 5

3. Remove the Pivot Plate Clamp Handle (see **Figure 5**) and discard.
4. Remove the wire connection cover on the spindle motor.
5. Make note of the position of the wires, and then disconnect the motor and remove the Pivot Bolt (see **Figure 5**); discard.

NOTE: Keep the Pivot Washer and the Pivot Bushing (see **Figure 5**).

6. Remove the Motor and the Spindle Motor Pivot Plate assembly (see **Figure 5**).
7. Using a hack saw or cut-off saw, shorten the Spindle Motor Handle to 2.75 inches (see **Figure 5**).
8. Remove the four Motor Mount Screws (see **Figure 5**); set aside.
9. Rotate the Motor 90° counterclockwise (relative to the Spindle Motor Pivot Plate) and reinstall the four Motor Mount Screws set aside earlier (see **Figure 5**).
10. Reinstall the Motor and the Spindle Motor Pivot Plate assembly using the following components:
 - Use one Hex Bolt to replace the discarded Pivot Bolt; reinstall the Pivot Bushing and Pivot Washer (see **Figure 5**).
 - Use one Hex Bolt and one Flat Washer in place of the Pivot Plate Clamp Handle (see **Figure 5**).
 - Re-wire the Motor using the original wire positions you made note of earlier in this section.

Mechanical Assembly

1. Make sure the Mounting Surfaces are free of burs and debris (see **Figure 6**). If necessary, clean the surfaces.

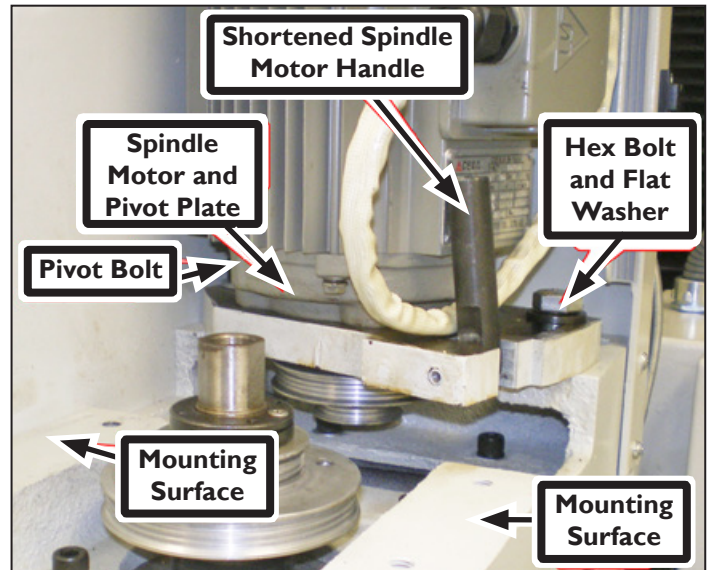


Figure 6

2. Using four Mount Screws, mount the Left Sub Plate and the Right Sub Plate) as shown in **Figure 7**.
3. Using four Mount Screws and four Lock Washers, mount two Latch Plates as shown in **Figure 7**.
4. Mount two Latch Plate Adjustment Set Screws and two Jam Nuts into the Latch Plates.
5. Screw the Latch Plate Adjustment Set Screws into the Latch Plate tab so that the flat tips are flush with the underside of the Latch Plate tab.

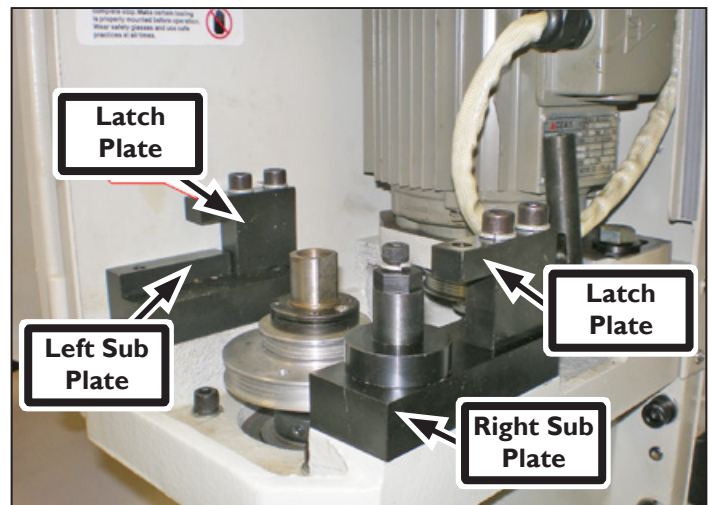


Figure 7

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6. Mount the Eccentric Pivot Mount with one Screw and Lock Washer. Put a dab of multi-purpose grease in the location indicated in **Figure 8**.

NOTE: Do not fully tighten the Eccentric Pivot Mount; it will be loosened later in this section.

7. Put a dab of multi-purpose grease on the Spring Washers.
8. Install the Power Drawbar with Spring Washers and the Drawbar Flange into the Tormach Tooling System (TTS)® collet.
9. Install an empty TTS tool holder in the collet and hand-tighten the drawbar.
10. Using a 13/16" wrench and a drawbar wrench, tighten the Power Drawbar approximately two full turns past hand-tightened (see **Figure 9**).

This is the starting pre-load.

IMPORTANT! After the initial installation, you must complete a final pre-load adjustment (refer to [Spring Washer Pre-Load Adjustment](#) section later in this document for more information). Failure to do so could result in tool pull-out.

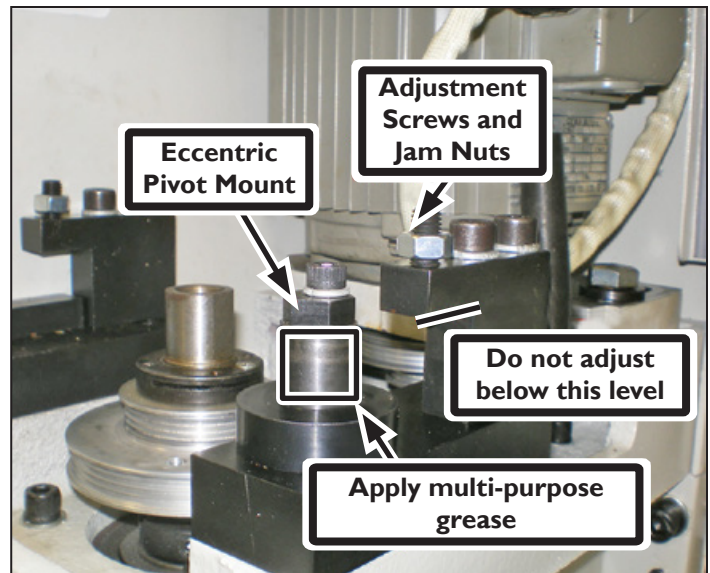


Figure 8



Figure 9

11. Mount the Cylinder Assembly over the Eccentric Pivot Mount and swing it into position. Use the Quick-release Pin to secure assembly. Note the 1/16 inch to 3/16 inch gap between the cylinder mounting plate and the Drawbar Flange as shown in **Figure 10**.

NOTE: Gap variations are a result of the mill's acceptable manufacturing tolerances. The gap between the cylindrical rod hex bolt and the top of the drawbar should be no larger than 1/8 inch when the cylinder is in the fully retracted position. To make sure the gap is less than 1/8 inch (see **Figure 10**), extra M16 Flat Washers (included) can be added to the hex bolt if needed.

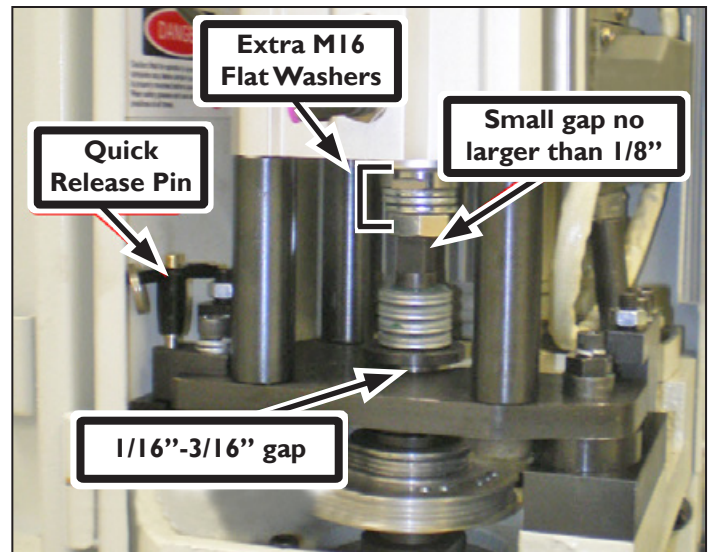


Figure 10

12. To prevent premature wear on the cylinder and maximize the holding capability of the system, you must align the cylinder concentrically with the drawbar. This is a two step process. Before starting, make sure that the screws indicated in **Figure 11** are snug, but not tight.

- a. Adjust the position in the -X- direction by using the back end of a drawbar wrench (or adjustable wrench) and turning the Eccentric Pivot Mount. There should be enough throw to visually align the cylinder and the drawbar. Tighten the -X- Hold Down Screw (see **Figure 11**).
- b. Adjust the position in the -Y- direction by pivoting the Cylinder Assembly and allowing it to slide under the adjustment block. After the cylinder is visually aligned with the drawbar, tighten the -Y- Hold Down Screw (see **Figure 11**).

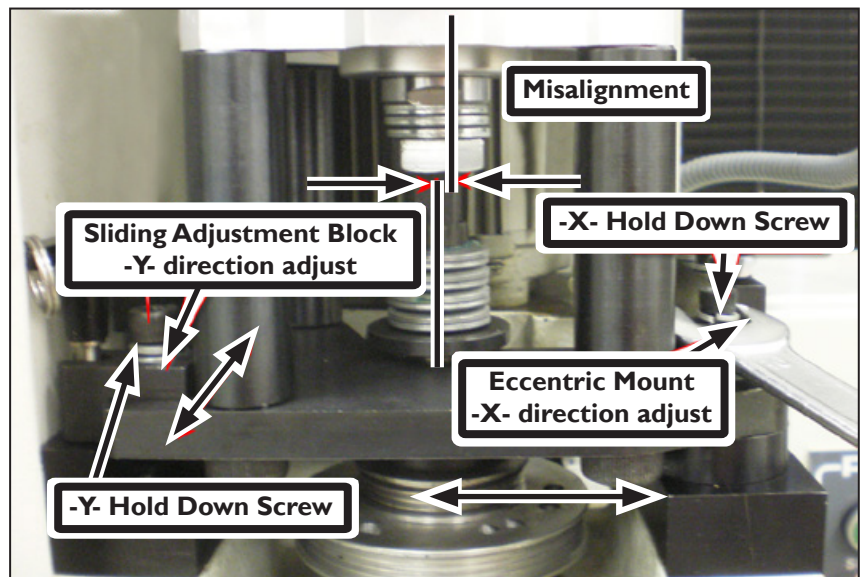


Figure 11

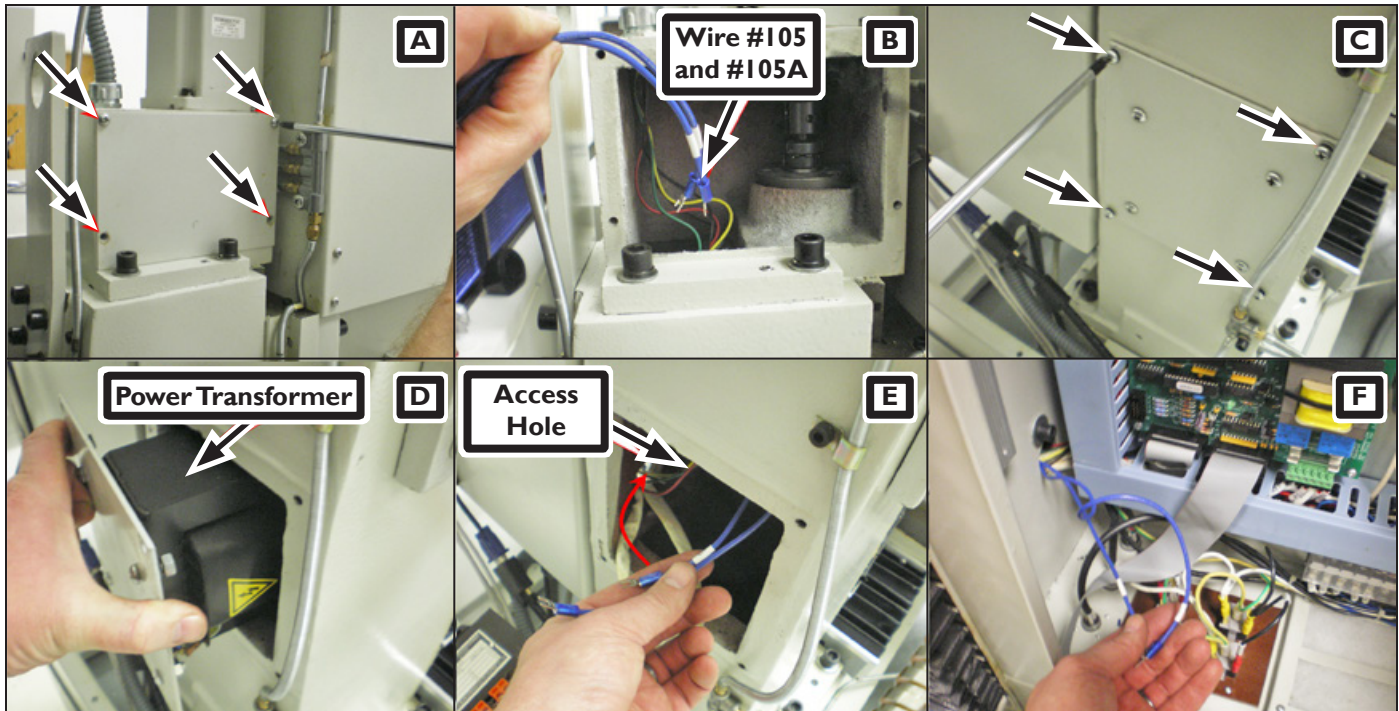


Figure 12

Control Assembly

NOTE: It may be easier to perform the following steps with the mill moved away from walls and other obstructions.

1. Remove four screws securing the Z-axis motor coupling cover plate (see **Figure 12A**); set aside.
2. Locate the blue interlock wires (wire #105 and #105A) on the Power Drawbar control box assembly and route them down the mill column casting (see **Figure 12B**).

NOTE: The following steps may also require removing the backslash, if installed, in order to facilitate electrical access.

3. Remove the four screws securing the cover plate on the back of the mill column (see **Figure 12C**) and the Power Transformer (see **Figure 12D**).

IMPORTANT! Do not rest the weight of the Power Transformer on its wires.

4. Locate the blue interlock wires and continue to route them into the Access Hole connecting the inside of the column with the electrical cabinet (see **Figure 12E**); pull them through into the electrical cabinet (see **Figure 12F**).
5. Remount the Power Transformer, cover plate, and, if necessary, backslash.

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Electrical Connections

1. Older machines are equipped with a Screw Terminal Strip, while newer machines have a Terminal Block. Identify the connection type in electrical cabinet specific to your machine as shown in **Figure 13**.

NOTE: For both the terminal block and strip, the wiring numbers and layout shown in **Figure 14** are the same.

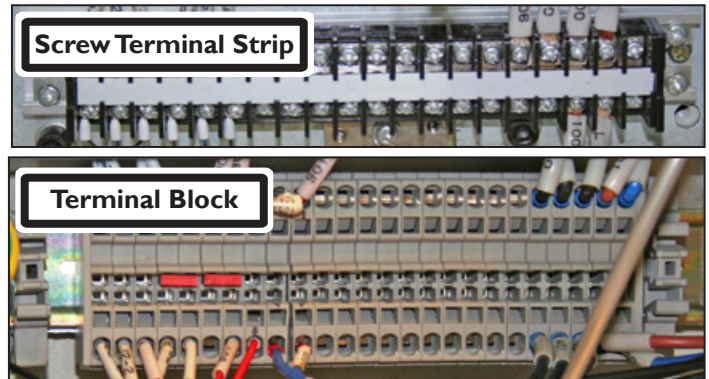


Figure 13

2. Follow the step-by-step instructions in **Figure 14** to put the new spindle door wires in series with the spindle door switch circuit. Some wiring configurations may appear different than shown, but wire numbers and layout are all the same.

NOTE: It may be useful to make a note of the wiring changes in the operator manual.

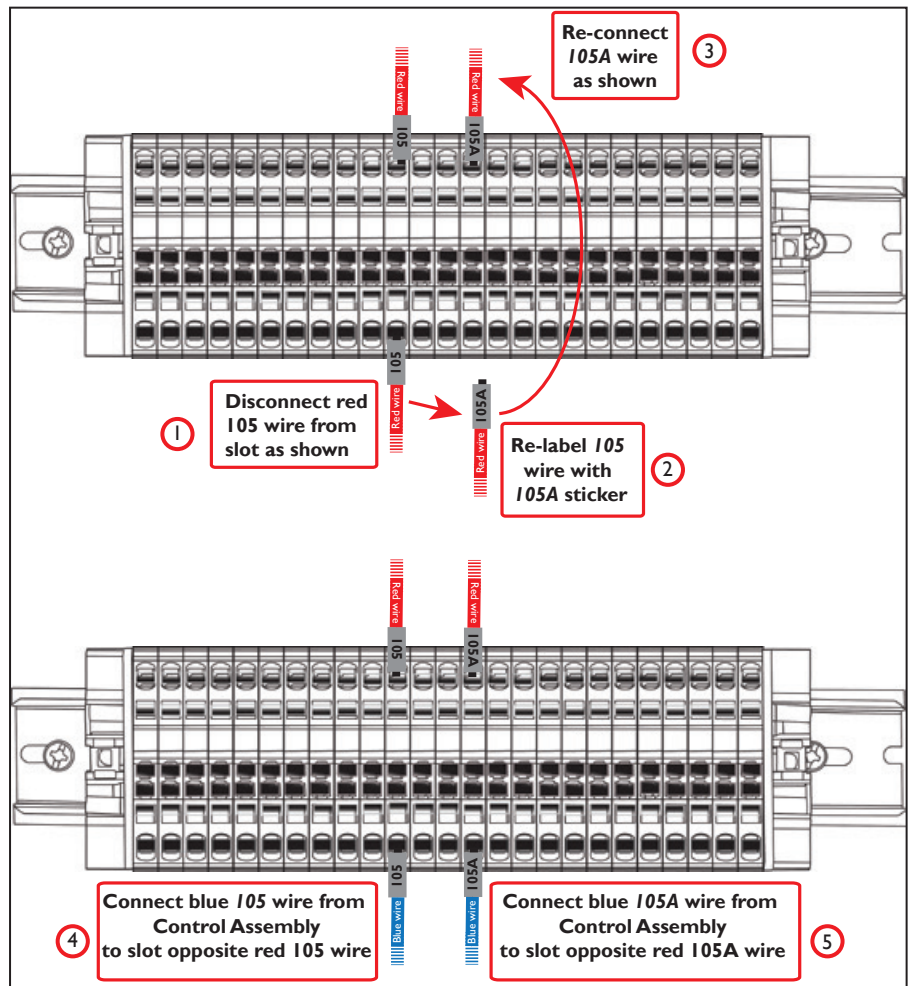


Figure 14

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3. If your machine has a terminal block, connect the wires as follows:
 - a. Slowly insert the end of a small, flat-head screwdriver into the slot above or below the selected wire connection site (see **Figure 15**).
 - b. Pry the terminal clip open carefully. Then, insert the wire into the terminal block.
 - c. Slowly remove the screwdriver.

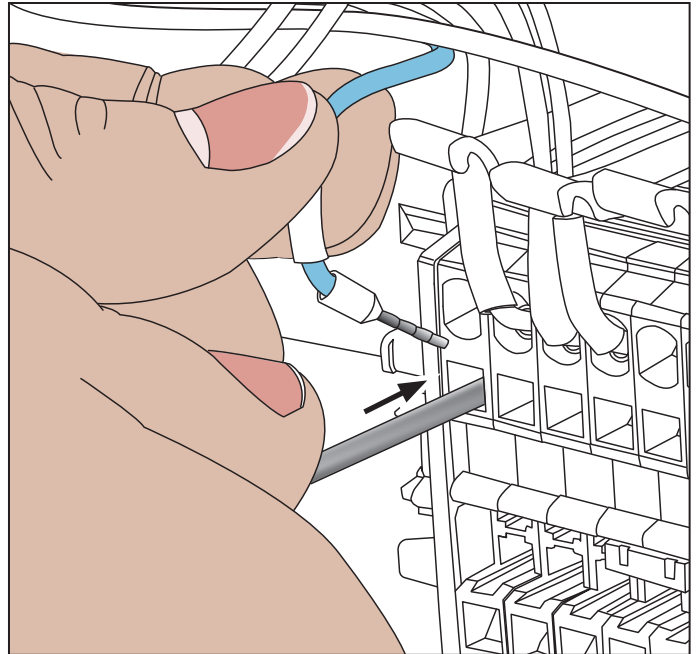


Figure 15

4. Connect the blue wires to the inside of the Power Drawbar control box (see **Figure 16**). This photo is for reference only; units are pre-wired.

NOTE: If installing an Automatic Tool Changer (ATC), the power input cord may be removed at this time.

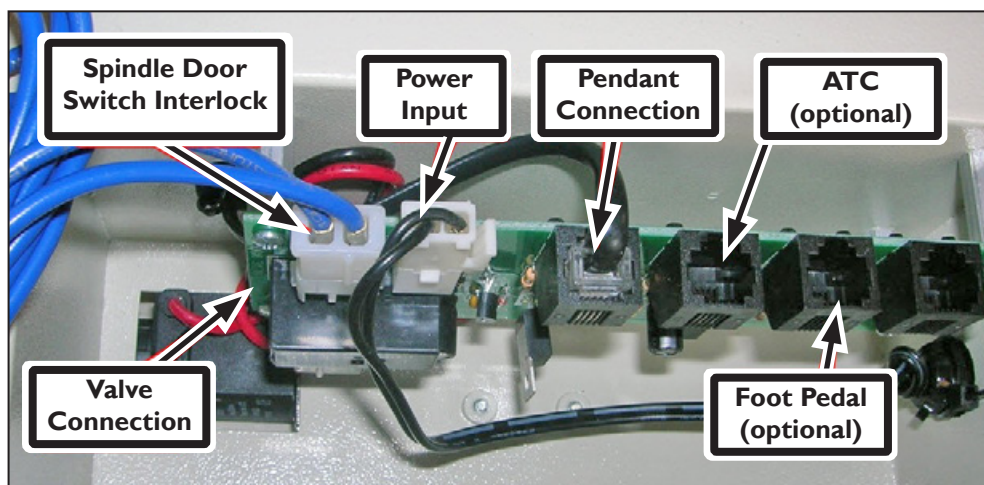


Figure 16

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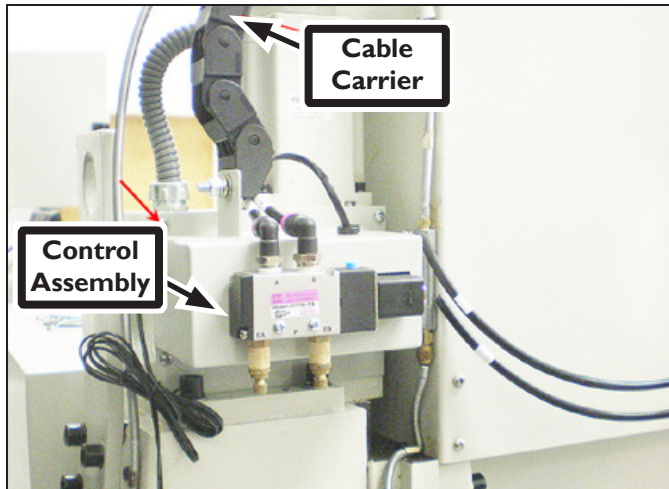


Figure 17

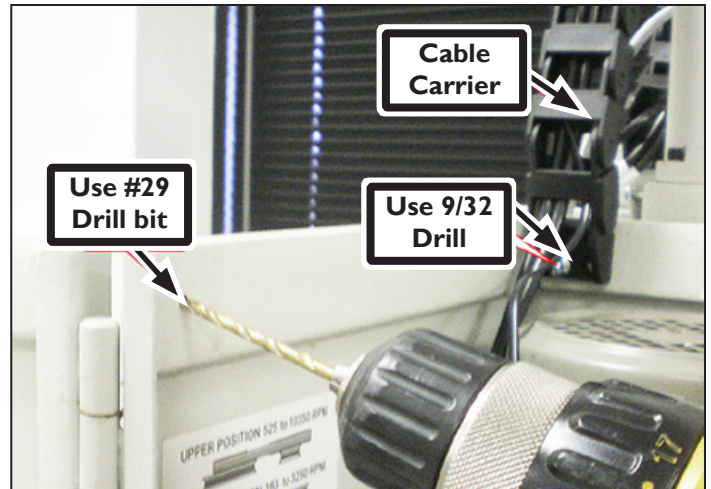


Figure 18

5. Using the screws removed earlier in this section, mount the Control Assembly as shown in **Figure 17**.
6. Position the Cable Carrier as shown in **Figure 18** and mark the location of one of the mounting holes. Using a 9/32 drill bit, make a hole through the two sheet metal layers of the spindle cover. Using the 1/4 inch screw, nut, and washer, mount the Cable Carrier to the spindle cover.
7. Using a #29 drill bit, make a hole though just one layer of the spindle cover in the position shown in **Figure 18**.
8. Using a Phillips screwdriver, mount the Plastic Mount Tab with one Sheet Metal Screw as shown in **Figure 19**. This will be used to bundle the Pendant wire and air tubes securely.

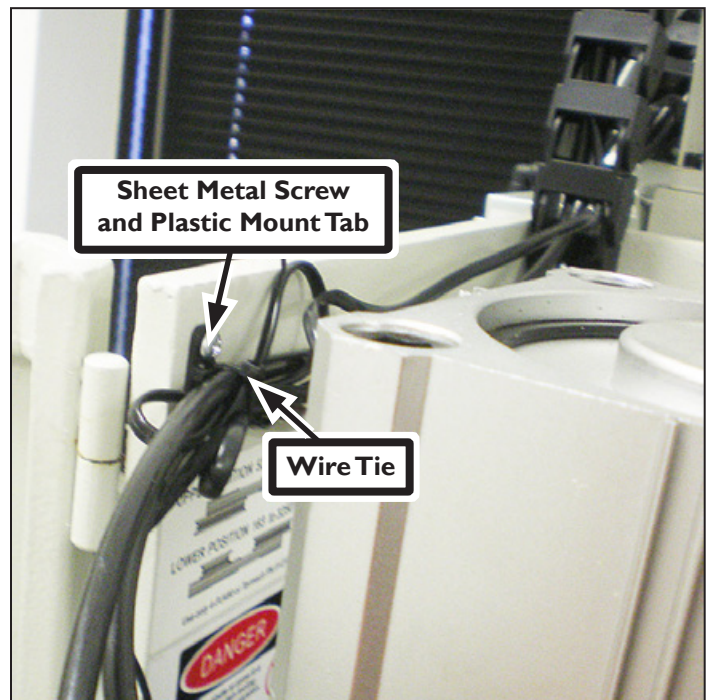


Figure 19

- Using pre-installed double-sided tape on back of the Pendant, mount the Pendant to the spindle head (see **Figure 20**).



Figure 20

- Connect the air lines as shown in **Figure 21**.

NOTE: Do not cut air lines shorter than provided. The cylinder needs to pivot out and away in order to gain access for belt changes, and the tube needs to be long enough to do this without disconnecting the lines.

- Bundle the air tubes and Pendant wire so that they are up and out of the way. Using a Wire Tie, mount them to the Plastic Mount Tab installed earlier in this section (see **Figure 19**).

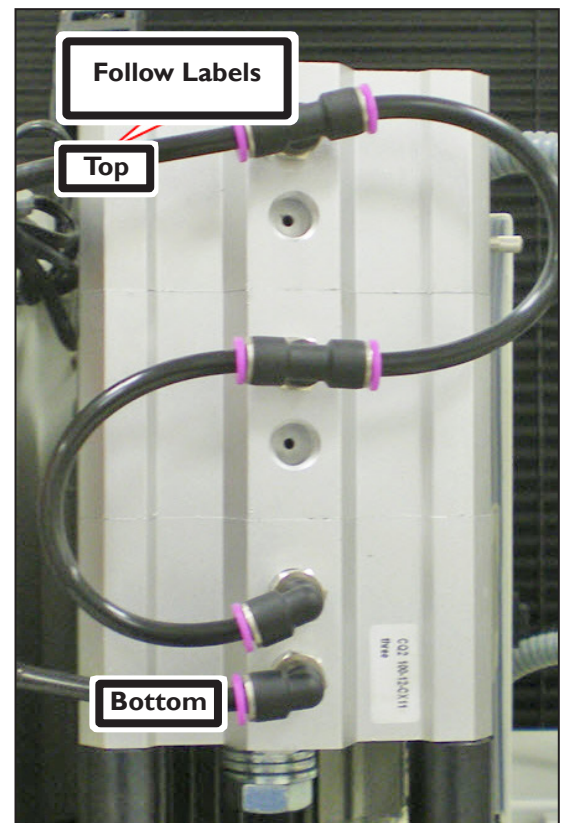


Figure 21

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12. Connect air supply to the air valve as shown; the port requires a 1/4" NPT fitting (see **Figure 22**).
13. Plug power cord into a 110-230 VAC outlet.

Operation

Air Pressure

The minimum system air pressure is 90 psi. Maximum allowable air pressure is 120 psi. Air should be dry and lubricated with air tool oil.

Pendant Control



WARNING! Ejection Hazard: Tooling could become a dangerous projectile. Do not press Pendant buttons before spindle has come to a complete stop; do not press Pendant buttons without one hand on the tool holder. Failure to do so could result in death, serious injury, and/or machine damage.

With one hand on the tool holder, press and hold *Release* to activate the power drawbar and release the tool holder in the spindle (see **Figure 23**); insert a new tool holder. Release the button to clamp the new tool holder in the spindle. The power drawbar automatically reverts to clamp mode when the button is released.

It is best to either:

- Leave the tool in the collet while the power drawbar is in the clamped position
- Leave the power drawbar in the unclamped position while there is no tool in the collet

Retracting the power drawbar to the clamped position with no tool in the collet will eventually fatigue the collet, and may shorten its service life.

The *Lock* button is used in the event that two hands are needed to insert a tool holder. The *Lock* button works much like a lock button on a hand drill – when activated, it holds the Power Drawbar in the release position without the need to hold the *Release* button. To activate the lock, push and hold *Release*, then push and release *Lock*. To deactivate the lock, push *Lock*.

NOTE: The power drawbar reverts to the clamped position in the event of an air pressure loss and in the event of a power loss.

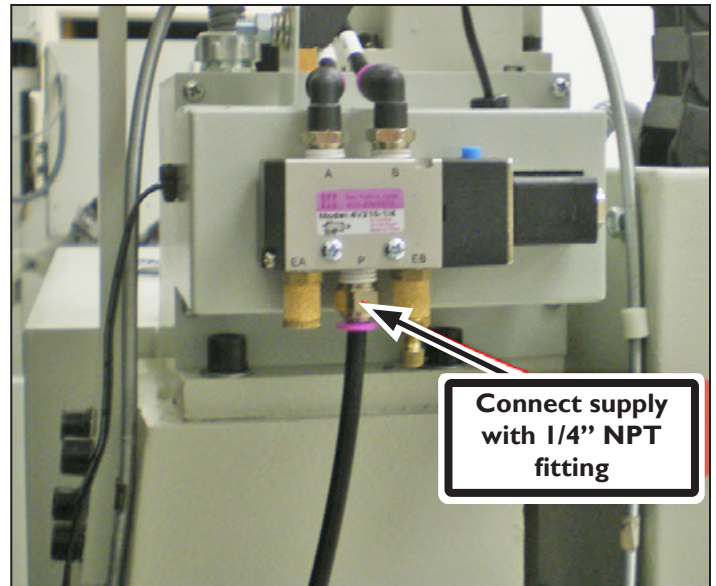


Figure 22



Figure 23

Changing the Spindle Belt

1. Pivot the support leg to the horizontal position.
2. Pivot the Cylinder Assembly out of the way.
3. Perform the belt change (for information, refer to the mill's *Operator Manual*).
4. Reposition the Cylinder Assembly.
5. Lower the support leg.

Changing to R8 Collet

Follow the instructions above to move the Cylinder Assembly out of position. Loosen the Power Drawbar from the spindle using two wrenches: one on the spindle, the other on the Power Drawbar. It may be useful to mark the rotational position of the Power Drawbar to avoid the need to re-adjust the Power Drawbar tension. If needed, the entire Cylinder Assembly can be easily removed from the mill by removing air pressure, disconnecting the air lines, and lifting the Cylinder Assembly off the Eccentric Mounting Post.

Initial Setup

The purpose of this adjustment is to set the highest possible pre-load, while still allowing the power drawbar cylinder to release the tool.

Spring Washer Pre-load Adjustment

IMPORTANT! After initial installation, you must check spring washer pre-load regularly; failure to do so could result in tool pull-out.

1. Insert TTS® collet and thread in the Power Drawbar.
2. Install an empty TTS tool holder in the collet.
3. Using a standard drawbar wrench and a 13/16 inch wrench, tighten the Power Drawbar to approximately the same torque normally used to tighten a manual drawbar system.
4. Actuate the Power Drawbar by pushing the *Release* button. If the tool releases, go to Step 5; if the tool does not release, go to Step 6.
5. If the tool holder releases, tighten the Power Drawbar using a standard drawbar wrench and a 13/16 inch wrench in quarter-turn increments, pushing the *Release* button after each increment until the tool holder does not release.
6. Loosen the Power Drawbar a quarter-turn using two large adjustable wrenches; push *Release*. The tool holder releases.

NOTE: If the tool holder does not release, repeat Steps 5-6.

7. Using a paint pen or similar, put witness marks on the Power Drawbar head and the spindle body to maintain a visual reference of proper adjustment.

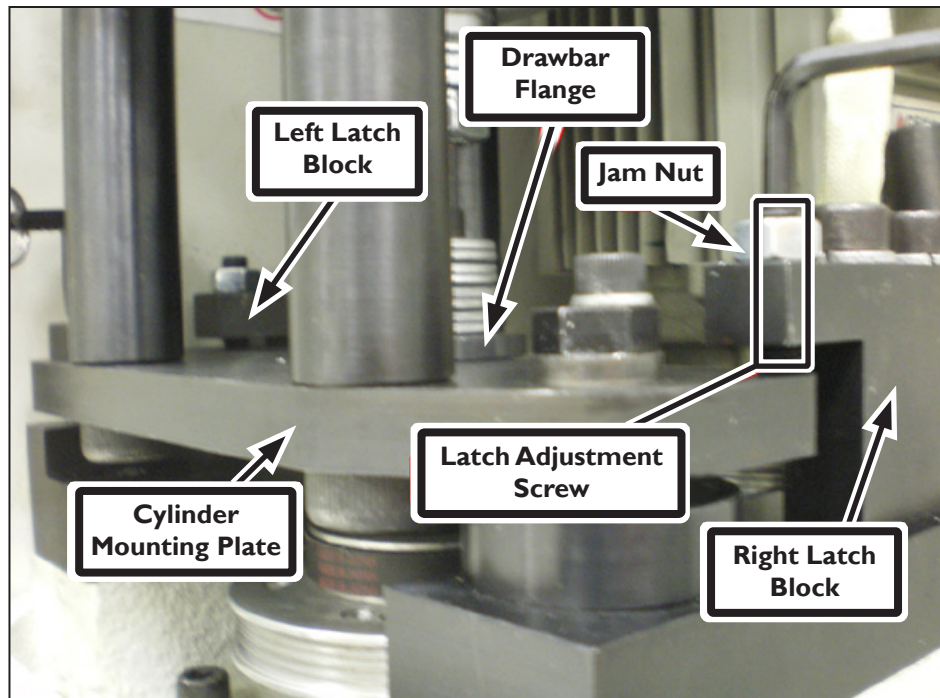


Figure 24

Latch Height Adjustment

On some installations it is possible that when the spring washers are compressed by the cylinder, the TTS® collet remains embedded in the spindle even though the clamping tension in the Power Drawbar has been released. This happens from friction between the TTS collet and the side walls of the spindle bore. The air cylinder can only remove tension on the Power Drawbar, and, save for its own weight pushing down on the drawbar, does not exert any additional downward force. This can also be seen on a manual drawbar set-up where the top of the drawbar may require tapping to get the tool to drop out. The purpose of the Latch Plates is to utilize a small portion of cylinder force to act as a tapping action.

1. Make sure that the Latch Adjustment Screws are fully retracted into the left and right Latch Plate (see **Figure 24**).
2. Using the Pendant, push the *RELEASE* and the *LOCK* buttons to activate and hold the Power Drawbar.
3. Place a block of wood or similar under the spindle and collet. Then, slowly lower the Z-axis to the block.
4. When the collet contacts the block, it will push up on the drawbar and Cylinder Assembly. Continue to slowly bring down the Z-axis until the collet bottoms out in the spindle.

IMPORTANT! This condition represents what might happen if a collet gets stuck while actuating the Power Drawbar. To avoid damage to the collet and the mill, do not over travel during this step.

5. Using a hex wrench, tighten the Latch Adjustment Screws until they just touch the Cylinder Mounting Plate (see **Figure 24**).
6. Push the **LOCK** button to release the Power Drawbar and raise the Z-axis up off the wooden block.

NOTE: Access will likely be easier to swing the cylinder out of the way. Tighten the Latch Adjustment Screws one additional turn and then, without turning these screws, further tighten the Jam Nut (see **Figure 19**).

7. Re-engage the cylinder and test it.

NOTE: If the Cylinder Mounting Plate engages the set screws before it engages the Drawbar Flange, then the adjustment screws have been tightened too much. Repeat this adjustment procedure, loosening the adjustment screws 1/4 turn.

Performance Expectations

The Power Drawbar is designed to provide more than sufficient tool holding force in normal situations. Machining practices outside of these situations may result in tool holder pullout.

Avoid these conditions:

- High chatter machining
- High cutter engagement (chip load) combined with high helix angle cutter geometries

Exhaust Valve Adjustment

The air valve in this system has two adjustable choked exhaust ports. Adjusting these ports changes the rate at which air will exit the system. Tightening the screw slows air flow (and motion); loosening increases the flow (and motion). Retract can be adjusted for fast motion, but Extend should be a bit slower (see **Figure 25**).

If this is adjusted too tight, no flow occurs and the cylinder will likely not move. If these are adjusted too loose, the cylinder moves too fast and impacts the drawbar with more speed than is needed, increasing wear on the system. Proper adjustment results in smooth and solid motion with no banging and no sluggishness.

NOTE: Make sure that the jam nuts are tightened when the adjustment is complete.

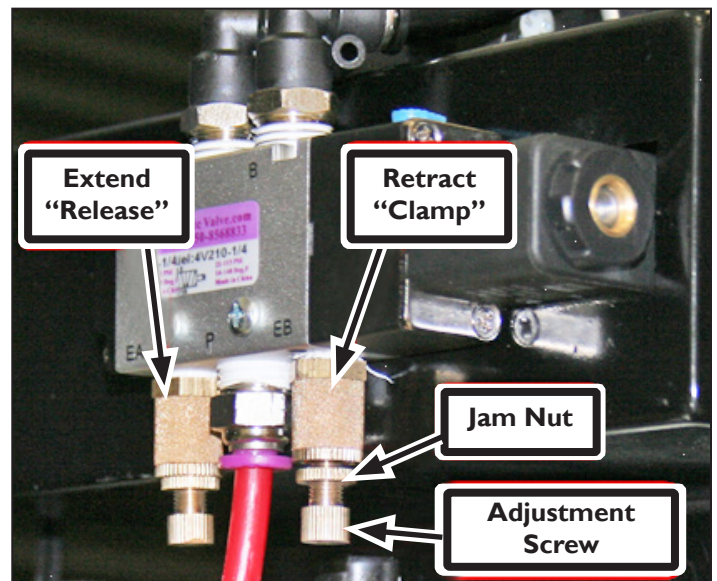


Figure 25

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General Maintenance

- To provide smooth motion during actuation and prevent premature component failure, use pressurized air that has been lubricated with common air tool oil.
- There are two places on the system that require greasing once every 5000 cycles or six months, whichever comes first:
 1. Top of the Power Drawbar (under the drawbar flange and the spring washers)
 2. Eccentric pivot mount
- Spring washers are wear items; inspect all spring washers once a month for cracks. Replacements available for purchase at www.tormach.com include:

Description	PN
Power Drawbar Spring Washer	31319

- Follow the *Exhaust Valve Adjustment* procedure earlier in this document to increase the life of spring washers.
- The TTS® collet and drawbar are wear items; using the power drawbar may cause these items to wear faster than with a manual drawbar. Replacements available for purchase at www.tormach.com include:

Description	PN
R8 Drawbar for PCNC 770	31911
TTS R8 Adaptor Collet	35356

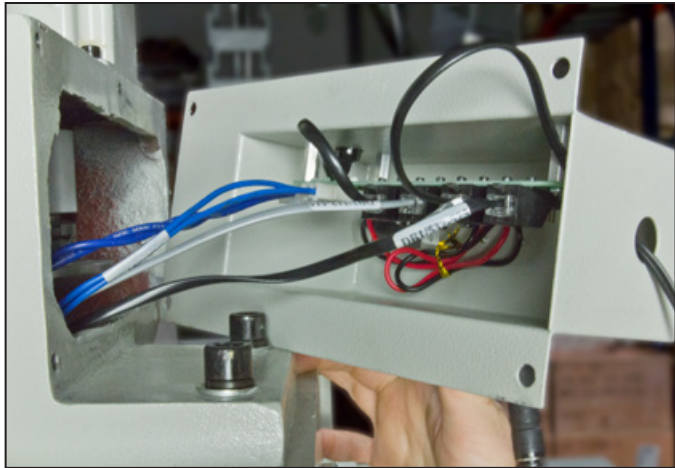


Figure 26



Figure 27

Optional Accessories

Power Drawbar Foot Pedal Kit

The Power Drawbar Foot Pedal Kit (PN 31728) provides foot activation of the Power Drawbar for hands-free operation.

1. Remove the Power Drawbar electrical housing (see **Figure 26**).
2. Plug the foot pedal cable into the foot pedal connector port on the Power Drawbar control board (see **Figure 28**).
3. Place the foot pedal in a position that allows for easy access during mill operation (see **Figure 27**).

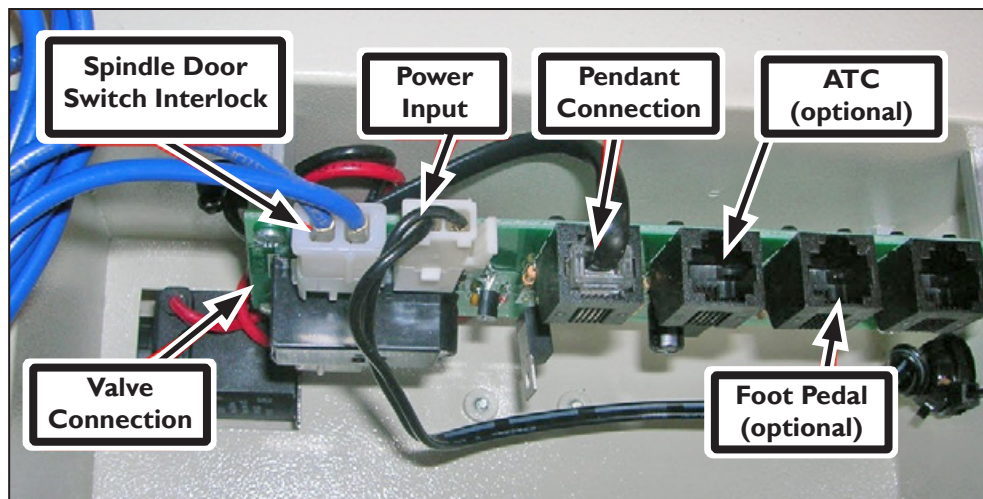


Figure 28

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Troubleshooting

Problem: Power Drawbar Will Not Release

Possible Cause	Probability	Action to Identify Cause of Problem	Discussion
Drawbar pre-load not properly adjusted	High	Refer to Spring Washer Pre-load Adjustment section earlier in this document.	If the pre-load is too tight, the cylinder will not have enough force available to overcome the pre-load and release the tool.
Cylinder position not adjusted	High	Visually inspect that cylinder hex bolt is aligned concentrically with the drawbar. Refer to Mechanical Assembly section earlier in this document for more information.	It is ideal to pass 100 percent of the available cylinder force directly down into the spring washers. Any misalignment will result in some side loading and a reduction of downward force. Component damage can also occur in cases of extreme misalignment.
Components are worn or not lubricated, causing binding	Medium	Inspect all sliding components: cylinder, eccentric post, spring washers, and drawbar.	Follow lubrication directions in Mechanical Assembly section earlier in this document to avoid premature wear and failure. Other sliding components only need to be greased from time to time to prevent premature wear, galling, and binding.
Improper air pressure (too high or low)	Medium	Use a pressure gauge at the power drawbar valve input; double check compressor or Filter-Regulator-Lubricator (FRL) gauge.	Excessively high pressure can result in valve or cylinder damage. Excessively low pressure and there may not be enough downward force available to release the tool.
Malfunctioning Filter-Regulator-Lubricator (FRL)	Low	Check that filter is not clogged and that oiler is introducing an oil mist into the air stream.	Particulate debris and/or lack of lubricated air can damage the valve and the cylinder.
Cylinder is stroking out (running out of travel) before compressing the spring washers fully	Low	There should be no more than a 1/8" gap between the cylinder hex bolt and the top of the drawbar. If gap is too large, cylinder will stroke out (run out of travel).	This will primarily be an issue found only during installation. Should this occur, add a flat washer under the cylinder rod hex bolt to reduce gap. For more information, refer to Mechanical Assembly section earlier in this document.
Check valve is installed backward, or is malfunctioning (ATC owners only)	Low	Inspect the check valve	If the check valve is installed backward, or is malfunctioning, then air flow will not reach the cylinder or may be depleted from the cylinder during tool changes.

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Problem: Tool Pullout

Possible Cause	Probability	Action to Identify Cause of Problem	Discussion
Drawbar pre-load not adjusted properly	High	Refer to Spring Washer Pre-load Adjustment section earlier in this document.	If the pre-load is too loose, the spring washers will not hold the tool holder tight enough. Pre-load should be checked occasionally as use can cause the system to fall out of adjustment.
Spring washers are worn or cracked	Medium	Inspect spring washers	Spring washers are a wear item; replace as needed.
System is not aligned properly or is worn and binding	Medium	Refer to table Power Drawbar Will Not Release earlier in this section.	Refer to Spring Washer Pre-load Adjustment section earlier in this document and follow directions listed. It is possible that optimum pre-load cannot be achieved (refer to table Power Drawbar Will Not Release earlier in this section). Inspect, adjust, and replace components as needed.