

R8 Spindle Kit Instructions

To install the LittleMachineShop.com R8 Spindle Kit you disassemble your mill and reassemble it with the new parts.

The R8 Spindle Kit includes the following parts:

- One R8 spindle
- Two spindle gears
- Two spacing rings
- Two keys
- One bearing
- One R8 Drawbar

Expect to spend between two and four hours on this project.

If you do not understand what a part is that is referenced in these instructions, see the manufacturer's parts diagram.

Tools

You will need the following tools:

- The hex (Allen) wrenches that came with your mill (3, 4, 5, and 6 mm)
- The open end wrenches that came with your mill (8 and 10 mm)
- The spindle locking pin that came with your mill
- The spanner wrench that came with your mill
- A #2 Phillips screw driver
- 16" of 1/2" - 13 NC threaded rod

You will also need the following shop-made tools or the LittleMachineShop.com Spindle Installation Kit (P/N 1665):

- 5" of 1-1/2" plastic or metal pipe. 1-1/2" plastic or metal pipe is approximately 1 7/8" OD. If you can't purchase a short piece of plastic pipe, get a 1-1/2" x 5" galvanized pipe nipple.

- One 1-1/2" pipe cap of the same material
- Two 1/2" flat washers
- One 3/4" flat washer
- Two 1/2" - 13 NC nuts
- One 3-1/2" hex electrical box
- 1/2" length of 1-1/2" diameter aluminum or brass

Tool Preparation

If you have the LittleMachineShop.com R8 Spindle Installation Kit you can skip this section. The kit includes all these tools.

You have to make several tools to press the spindle apart and back together.

1. Remove the knockout from the bottom of the 3-1/2" hex electrical box.
2. Make a bushing to protect the ends of the spindles as shown below. This bushing can be made from 1-1/2" diameter aluminum, steel, plastic or brass. There is a drawing of this bushing at the end of this document.



3. Drill a 1/2" (or slightly larger) hole through the center of the 1-1/2" pipe cap.
4. Bore the 3/4" washer to 1.19" ID.

Teardown

Follow this procedure to disassemble your mill.

Preliminary

See the Assembly Drawings in the *Instruction Manual* for item numbers.

1. Unplug the power cord.
2. Protect the table by placing a suitable cushion, such as corrugated cardboard, on top of it.
3. Remove the drawbar, drawbar bushing, and all tooling. The drawbar bushing is in the top of the spindle. If it doesn't come right out, tap it out using a long rod inserted up from the bottom of the spindle.
4. Loosen the M6x6 pointed tip set screw in the spindle nut.
5. Use the spindle locking pin and the spanner wrench supplied with the mini mill to loosen (but not remove) the spindle nut (item 119). It has a left-hand thread, so turn the nut clockwise to loosen it.
6. Remove the four M3x10 flat head Phillips sheet metal screws from the control box cover (item 111).
7. Remove the three M5x8 round head Phillips machine screws securing the control box (item 111) to the head. Leave the control box hanging from the connections.
8. If there is a cable tie holding the two flex conduits together, cut it or slide it to the top of the control box.

Spindle Head Removal

1. Remove the four M6x20 socket head cap screws from the motor mounting bracket (Item 130).
2. Lift the motor and mounting bracket off and set the motor on the table.
3. Remove the upper end washer and screw, (Items 102 & 103). These limit the upward travel of the spindle head.
4. Using the adjusting handle, raise the spindle head as high as it will go, until the pinion gear (item 50) disengages from the gear rack (item 46).
5. Set the limit block (item 65) to hold the spindle head in place.
6. If you have a torsion-spring (item 155) head support, remove the screw (item 160), and disengage the support shank (item 159) from the prop (item 158). You might need to loosen or remove the acorn nut (item 157). The torsion spring is not very strong and it will not spring out of control.
7. If you have an air spring (item 77) head support, remove the two M6x20 socket head cap screws holding the connecting block (item 76) in place. Rotate the connecting block out of the way.
8. Loosen the four gib adjusting screws and nuts (items 43 and 29) and the locking handle (item 30).

9. Lift the spindle box and spindle box seat (items 49 & 63) off the fuselage. Use care because it's heavy. Ensure the gib (item 45) doesn't fall out.

Spindle Head Disassembly

1. Remove the two Phillips head screws securing the cover (item 96) over the fine-adjustment rod.
2. Remove the two M5x25 socket head cap screws securing the bracket (item 89).
3. Remove the four M8x45 socket head cap screws securing the spindle box seat (item 63) to the spindle box (item 49).

Idler Shaft and Gear Removal

1. Remove the top gear, screw, washers, and key (items 132 and 138, the key is not shown in the diagram).
2. In preparation for the next step, either elevate the bottom of the spindle box by putting blocks on each side of the idler shaft or lay the spindle box on its side.
3. Using a soft-faced hammer, tap the idler shaft (item 113) from the upper end (not the end with the snap ring) until it is free from the upper bearing (item 139). The shaft and lower bearing might come out of the spindle box together. This is preferred.
4. Slide the transmission gear (item 140) off the shaft as you remove the shaft and bearing from the housing. Remove the shift bar (item 141) from the linking board (item 142) during this process. Leave the key (item 114) in the shaft.

Spindle and Transmission Gear Removal

5. Remove the three M5x8 socket head cap screws securing each of the two bearing covers (item 122).
6. Remove the two bearing covers (item 122).
7. Remove the spindle nut (item 119). It has a left-hand thread, so turn the nut clockwise to remove it.
8. Remove the spacing ring (item 118).
9. Remove the key (item 120).
10. Put the threaded rod through the spindle. Put the protective spindle-pressing bushing, a 1/2" flat washer and a 1/2" nut on the top end.
 - If you have the R8 Spindle Installation Kit, put the 3" OD steel tubing and the crosspiece on the bottom end as shown below. Put a 1/2" flat washer on, followed by a 1/2" nut.



- If you don't have the R8 Spindle Installation Kit, put the 3-1/2" hex electrical box on the bottom end as shown below. Put a 1/2" flat washer or two on behind the electrical box, followed by a 1/2" nut. If your bearings are particularly tight in the spindle housing you might need to add a stiffener behind the electrical box to keep from crushing it. A piece of angle iron drilled for the threaded rod works fine.

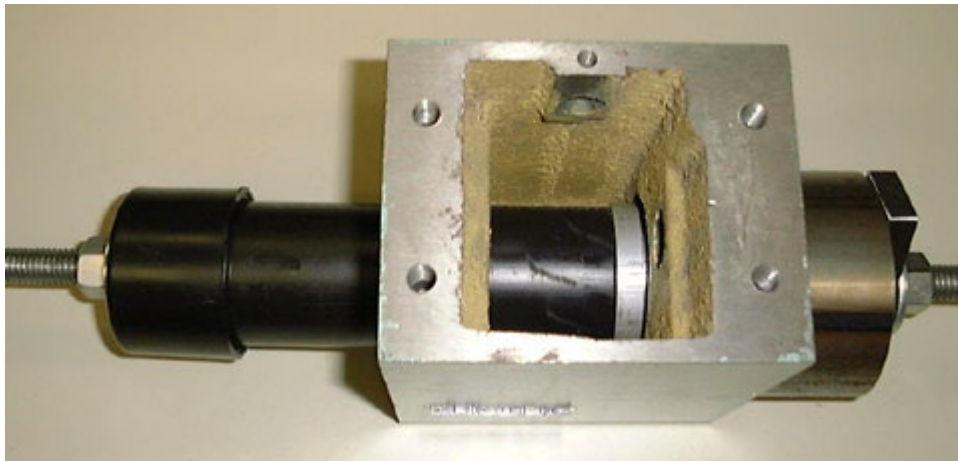


11. Tighten the nuts on the threaded rod to press the spindle (item 79) out of the spindle box (item 49) and top bearing. The spindle might come out together with the lower bearing. This is preferred.

12. Disassemble the tool.
13. Remove the transmission gear (item 80) and the top and bottom spacing rings (item 116) from the spindle box. Leave the top bearing (item 123) in the spindle box.

Upper Bearing Removal

1. Put the threaded rod through the 5" long section of 1-1/2" pipe and cap, followed a 1/2" flat washer and a 1/2" nut
 - If you have the R8 Spindle Installation Kit, place the smaller bearing-pressing bushing over the threaded rod.
 - If you don't have the R8 Spindle Installation Kit, place the bored 3/4" flat washer over the threaded rod.
2. Put the threaded rod through the spindle housing from the bottom, and through the top bearing.
 - If you have the R8 Spindle Installation Kit, put the 3" OD steel tubing and the crosspiece on the bottom end as shown below. Put a 1/2" flat washer on, followed by a 1/2" nut as shown below.



- If you don't have the R8 Spindle Installation Kit, put the 3-1/2" hex electrical box on the bottom end as shown below. Put a 1/2" flat washer on behind the electrical box, followed by a 1/2" nut.
3. Be sure everything is centered on the bearing, and tighten the nuts to press the bearing out of the housing.


Reassembly

Follow this procedure to reassemble your mill.

See the Spindle and Gear Box Assembly Drawing in the *R8 Spindle Kit* for item numbers.

Preliminary

1. Gather the parts that you will need to install the new spindle. The parts that ride on the spindle are shown below.

	<p>From top to bottom, these parts are:</p> <ul style="list-style-type: none">▪ Spindle nut (item 119)▪ Spacing ring (item 118)▪ Upper bearing (item 123)▪ Black plastic spacing ring (item 116)▪ Small spindle gear 2 (item 166)*▪ Metal spacing ring (item 167)*▪ Large spindle gear 1 (item 168)*▪ White spacing ring (item 169)*▪ Lower bearing (item 170)* <p>* Included in R8 Spindle Kit.</p> <p>Besides the parts shown here you need the new R8 spindle included in the R8 Spindle Kit</p>
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2. Mark the location of the keyway on the outside of all the parts with keyways. This will make it easier to align them when they are inside the spindle box.

R8 Spindle Inspection

Check the locating pin inside the R8 spindle. On some spindles this pin is too long. The locating groove in R8 taper collets is specified at 0.062" deep. If the pin is too long, use a Dremel or other grinder to shorten it.

R8 Spindle and Bearing Assembly

1. Place the lower bearing over the top of the R8 spindle. Be careful to start the bearing on straight.

- Put the threaded rod through the spindle. Put the protective spindle-pressing bushing, a 1/2" flat washer, and a 1/2" nut on the bottom end.
 - If you have the R8 Spindle Installation Kit, put the larger bearing-pressing bushing over the top of the spindle. Place the 5" long section of 1-1/2" pipe over the top of the spindle. Put the cap on the pipe, followed by a 1/2" flat washers and a 1/2" nut, as shown below.



- If you don't have the R8 Spindle Installation Kit, place the 5" long section of 1-1/2" pipe over the top of the spindle. Put the cap on the pipe, followed by a 1/2" flat washers and a 1/2" nut, as shown below.



- Tighten the nuts to press the bearing into place. Be sure it is seated against the step on the spindle.
- Disassemble the tool, leaving the cap on the end.

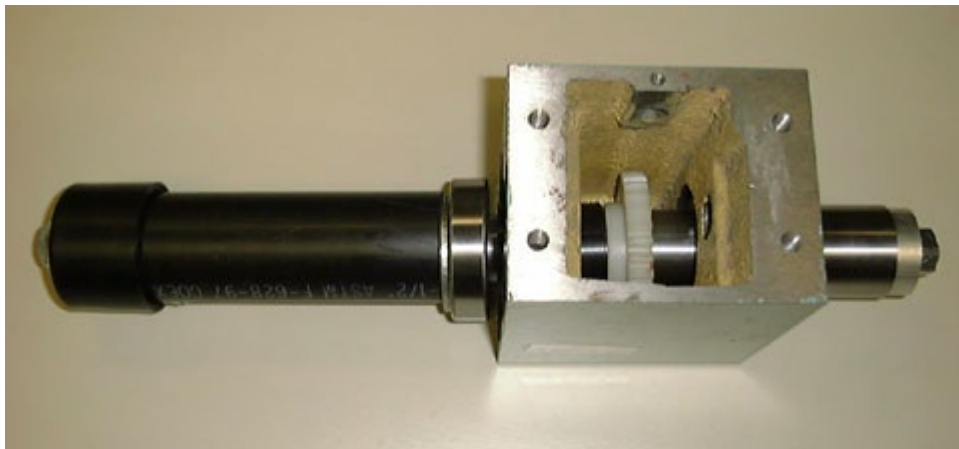
Spindle and Transmission Gear Replacement

- Stack the following items inside the spindle box. They are listed from top to bottom. Note that the flanges on the gears point toward each other.
 - Black plastic spacing ring (item 116)
 - Small spindle gear 2 (item 166)*
 - Metal Spacing ring (item 167)*
 - Large spindle gear 1 (item 168)*
- Put an M5x16 key and an M5x20 in the two lower slots in the spindle.
- Put the white plastic spacing ring (item 169)* on the spindle.
- Insert the spindle and bearing assembly in through the bottom hole of the spindle box, then through the parts listed in Step 1. Align the keys in the spindle with the key slots in the gears and spacing rings during this process.
- Put the threaded rod through the spindle. Put the protective spindle-pressing bushing, a 1/2" flat washer, and a 1/2" nut on the bottom end.

6. Put the upper spindle bearing on the end of the spindle.
 - If you have the R8 Spindle Installation Kit, place the larger bearing-pressing bushing over the top of the spindle. Put the 5" long section of 1-1/2" pipe and cap over the top of the spindle, followed a 1/2" flat washer and a 1/2" nut, as shown below.



- If you don't have the R8 Spindle Installation Kit, place the bored 3/4" washer over the top of the spindle. Put the 5" long section of 1-1/2" pipe and cap over the top of the spindle, followed by one or two 1/2" flat washers and a 1/2" nut, as shown below. Don't forget the 3/4" washer. You will crush the bearing shield without it.



7. Tighten the nuts to press the spindle into the spindle box. Tighten until the bottom bearing is seated in the housing.
8. Disassemble the tool.
9. Insert an M5x16 key into the keyway at the top of the spindle.
10. Insert the spacing ring (item 118) over the top of the spindle shaft.
11. Thread the spindle nut onto the top of the spindle. It has a left-hand thread, so turn the nut counter-clockwise to tighten it. Snug, but don't tighten the spindle nut.

Idler Gear and Shaft Replacement

1. Insert the gear (item 140) and the shift bar (item 141) into the spindle box. Ensure the gear is correctly oriented (large gear at top), and that the shift bar is engaged around the gear and into the linking board (item 142). Note that this gear is assembled backwards from the way it was originally.
2. Insert the idler shaft and bearing into the bottom of the spindle and through the gear, inserting and engaging the long key into the slot in the gear.
3. Using a soft hammer, tap the idler shaft and bearing assembly back into the upper bearing until the lower bearing is fully seated. It may be necessary to support the upper bearing while doing this. An appropriate size wrench socket can be used.
4. Reinstall the top gear, key, M5 washer, and M5x8 Phillips head screw (items 132 and 138).
5. Verify that everything moves freely.
6. Lubricate the internals of the spindle box with white lithium grease.

Spindle Head Reassembly

1. Install the two bearing covers (item 122) and secure each one with three M5x8 socket head cap screws.
2. Securing the spindle box seat (item 63) to the spindle box (item 49) with four M8x45 socket head cap screws.
3. Replace the two M5x25 socket head cap screws securing the fine-adjustment bracket (item 89).
4. Replace the two M4x6 Phillips head screws securing the cover (item 96) over the fine-adjustment rod.

Spindle Head Replacement

1. Place the spindle assembly on the fuselage, allowing it to rest on the limit block (item 65).
2. Insert the gib into place and adjust loosely.
3. If you have a torsion-spring (item 155) head support, install the screw (item 160), and engage the support shank (item 159) from the prop (item 158). You might need to tighten or install the acorn nut (item 157). The torsion spring is not very strong and it will not spring out of control.
4. If you have an air spring (item 77) head support, install the two M6x20 socket head cap screws holding the connecting block (item 76) in place.
5. Loosen the limit block (item 65) so the spindle head can move down.
6. Install the upper end washer and M6x16 socket head cap screw, (Items 102 & 103). These limit the upward travel of the spindle head.

7. Place the motor and mounting bracket on the top of the mill.
8. Replace the four M6x20 socket head cap screws in the motor mounting bracket (Item 130).
9. Replace the three M5x8 round head Phillips machine screws securing the control box (item 111) to the head.
10. Replace the four M3x10 flat head Phillips sheet metal screws securing the control box cover (item 111).
11. Use the spindle locking pin and the spanner wrench supplied with the mini mill to tighten the spindle nut (item 119). It has a left-hand thread, so turn the nut counter-clockwise to tighten it, then clockwise to slightly loosen it. There should be a small amount of preload on the bearings. Ensure that the spindle turns freely.
12. Tighten the M6x6 pointed tip set screw in the spindle nut.
13. Adjust the Z-axis gib.
14. Slightly loosen the four M6x20 socket head cap screws holding the motor mounting bracket (item 130). Turn the mill on at low speed and adjust the position of the motor plate for the least noise, then tighten the screws.

Final

1. Replace or relocate the cable tie holding the two flex conduits together.
2. Install the new High/Low label to the left side of the spindle box.

Notice that the shifter works backwards from the way it was originally. The transmission is in low speed when the handle is forward, and high speed when the handle is back.

Leftovers

You should have the following items left on your bench.

- One 3MT spindle
- One ball bearing
- One double gear
- One spacer
- One key