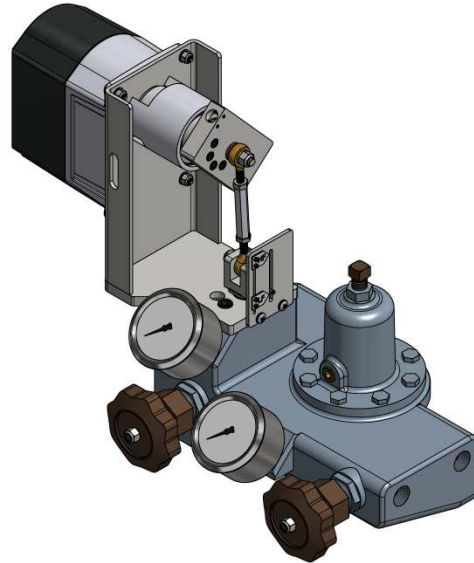


BR...CBOIL Fuel Oil Controller Retrofit Kits



Product Description

A BR...CBOIL retrofit kit reliably mounts an SQM33, SQM45, or SQM48 actuator to a Clever Brooks fuel oil controller.

Recommended Installation Tools

The following tools / supplies are recommended for bracket assembly installation:

1. 1/8" pin punch (with hammer)
2. Set of standard hex keys
3. #2 Phillips screwdriver
4. 3/16" flathead screwdriver
5. 7/16" open end wrench
6. 9mm open end wrench
7. 12" crescent wrench
8. Wooden or plastic V-block

Components Supplied

Figure 1 shows the components in a BR...CBOIL retrofit kit.

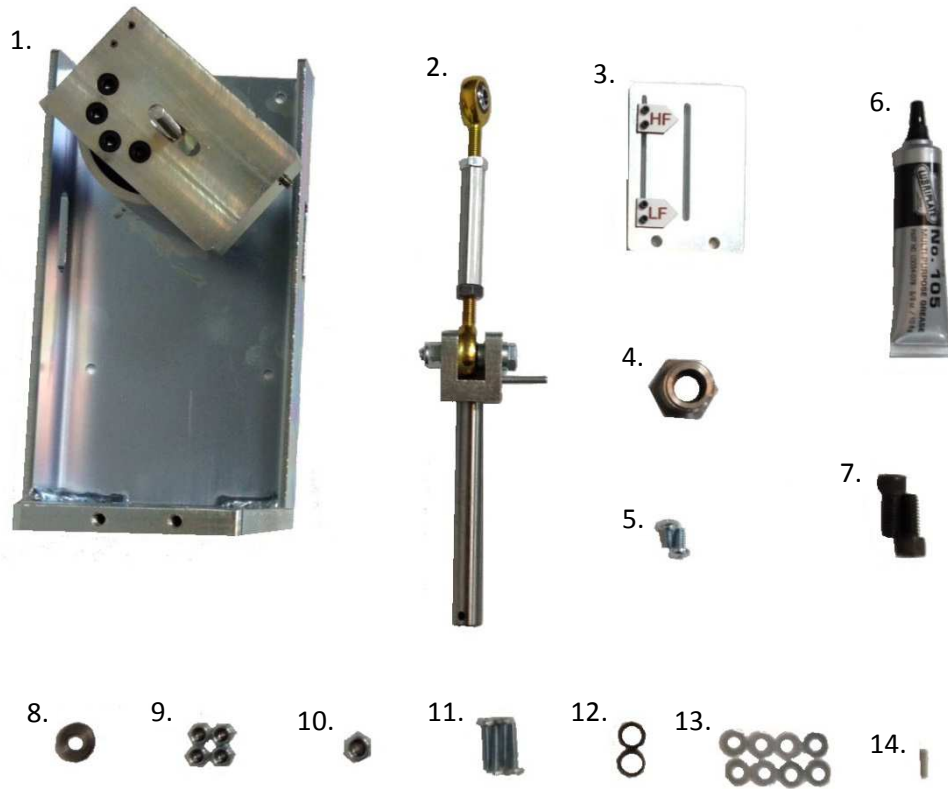


Figure 1: Components Included in a BR...CBOIL Fuel Oil Controller Retrofit Kit

- | | |
|---|--|
| 1. Bearing block bracket assembly | 8. 1/4" spacer |
| 2. Stem assembly | 9. #8-32 lock nuts (qty 4) |
| 3. Position indicator bracket | 10. 1/4"-20 lock nut |
| 4. Packing nut | 11. #8-32 x 3/4" pan head screws (qty 4) |
| 5. #10-24 x 3/8" pan head screws (qty 2) | 12. 5/16" lock washers (qty 2) |
| 6. Lubriplate grease | 13. #8 SAE washers (qty 8) |
| 7. 5/16"-18 x 3/4" socket head screws (qty 2) | 14. 1/8" x 7/16" roll pin |

Installation Procedure

1. Measure the stroke of the existing oil valve from low fire to high fire. This can be done by setting the boiler at low fire and making a mark on the valve stem going into the fuel oil controller. Then using a tape measure, measure the vertical height that the stem raises when the boiler is modulated up to high fire. Write this number down for later.
2. Close all necessary valves to isolate the fuel oil controller. Detach the oil modulating cam assembly and any additional linkage currently hooked up to the fuel oil controller. Pull out the stem that moves in and out of the controller. The grooved pin connected to the end of the stem must be re-used in this assembly. Using the pin punch, V-block, and hammer, knock the roll pin out of the stem to detach the grooved pin as shown in Figure 2. Take care not to damage or mar the surface of the grooved pin. All other components of the cam assembly including the stem are not re-used.

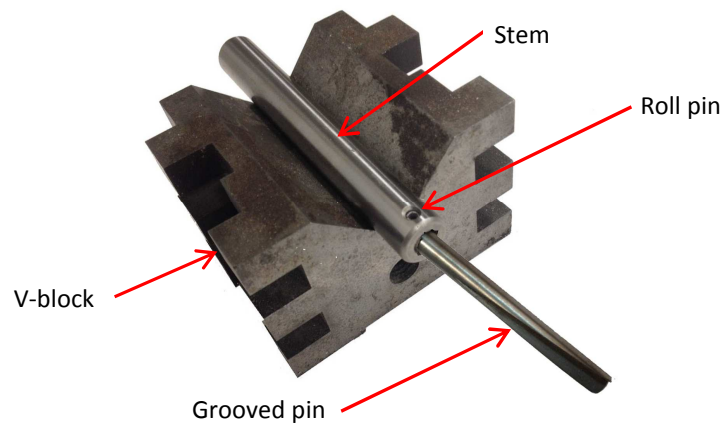


Figure 2: Disassembly of Oil Modulating Cam Assembly

3. Use some of the Lubriplate grease to lubricate the valve packing inside of the fuel oil controller. If the packing is being replaced, completely grease each individual piece of the packing before inserting into the controller. Proper packing order can be seen in Figure 3. If the packing is being reused, do not remove the packing from the controller because damage to the packing may result. Instead, apply grease to the inner diameter of each piece of the packing as best as possible. **NOTE: Use a significant amount of grease to form a thick layer on all surfaces of the packing which may rub against the valve stem.**



Figure 3: Order of Pieces in Packing Assembly

4. Using a hammer and the 1/8" pin punch, attach the grooved pin saved from step 1 to the stem assembly using the 1/8" x 7/16" roll pin. The roll pin must be recessed below the surface of the stem on both sides or the roll pin will damage the packing. **NOTE: During this step, take extreme care not to damage or mar the surface of the new valve stem. It is recommended to use a wooden or plastic V-block in order to perform this installation. Even a small nick or scratch in the stem may allow oil to leak out of the valve packing after installation.** Once step 4 is complete, the stem assembly should look like Figure 4 below.



Figure 4: Reassembled Stem and Pin

- Slide the packing nut over the valve stem. Place the $\frac{1}{4}$ " spacer over the threaded rod protruding from the bracket assembly. The bracket and stem assemblies should then look like Figure 5 below.

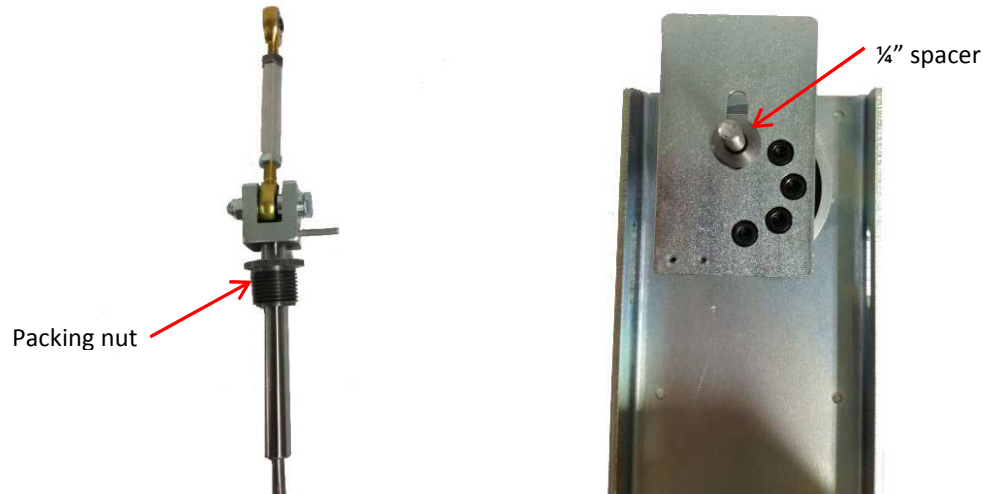


Figure 5: Placement of Packing Nut and $\frac{1}{4}$ " Spacer

Slide the valve stem through the threaded hole of the bracket assembly so that the roll pin sticking out of the stem assembly points in the direction shown in Figure 6 below. At the same time, slide the open rod end from the stem assembly over the threaded rod.

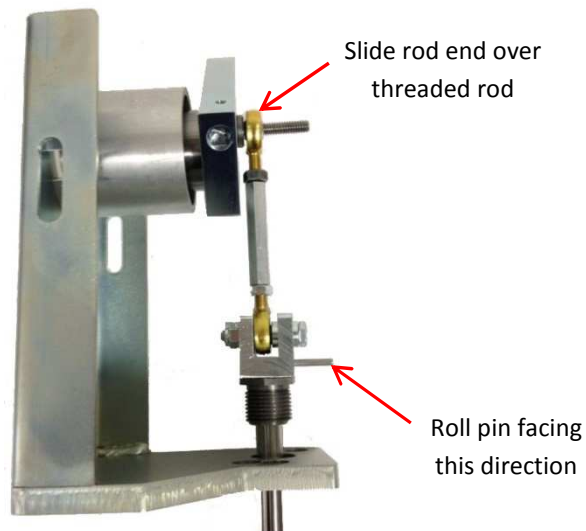


Figure 6: Correct Roll Pin Direction

Using the 1/4"-20 lock nut, tighten the rod end into place against the bracket assembly. Turn the packing nut by hand to begin threading it into the bracket. Only turn the packing nut so that one thread is engaged and then stop. The packing nut will be tightened more in a later step. Once step 4 is complete, the assembly should look like Figure 7.

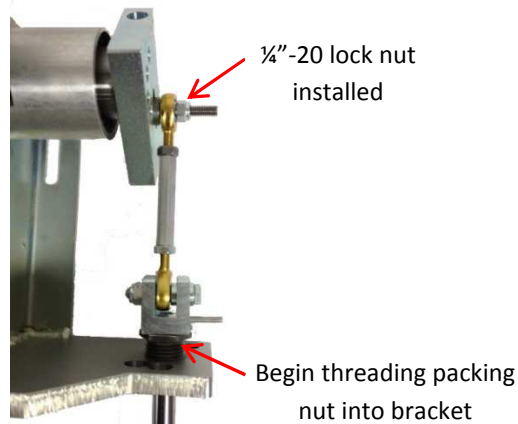


Figure 7: Completed Bracket and Stem Assembly

6. Attach indicator bracket to main bracket assembly by screwing the two #10-24 pan head screws into the threaded holes in the side of the bracket assembly. The roll pin from the stem assembly should slide into the wider slot in the indicator bracket. This bracket also doubles as an anti-rotation device so that the stem assembly does not rotate during boiler operation. The assembly should appear as shown in Figure 8.

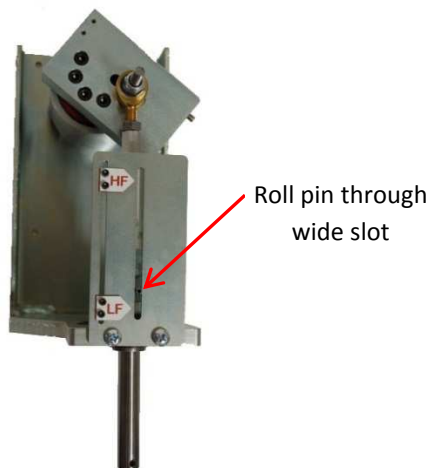


Figure 8: Position Indicator Assembly

7. Use some of the remaining Lubriplate grease to thoroughly lubricate the valve stem. Carefully lower the assembly shown in Figure 8 down onto the fuel oil controller, taking great care not to damage the packing with the grooved pin or the valve stem.
8. Attach the bracket assembly to the fuel oil controller using the two 5/16"-18 socket head cap screws with lockwashers through two of the four remaining holes in the bottom of the bracket. There are two possible ways to perform this mounting (see Figure 9).

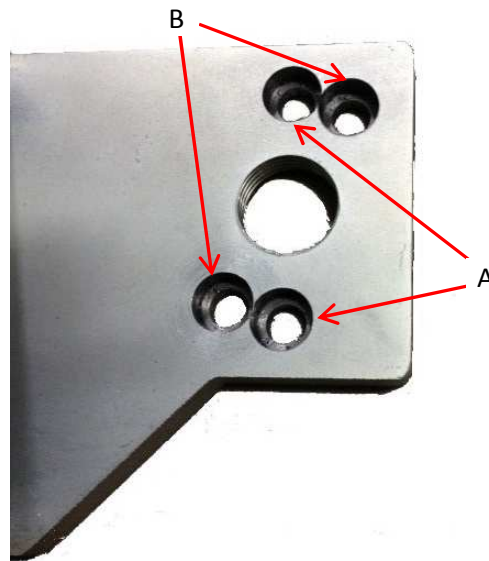


Figure 9: Possible Mounting Options

Use mounting holes labeled A if possible. If there are components attached to the boiler that prevent using these mounting holes, mounting holes B should be utilized to swing the entire assembly away from the boiler by 32°. If using mounting holes B, the supply pressure gauge on the controller may need to be moved. If this is the case, use a 1/4" pipe nipple to extend the pressure gauge away from the fuel oil controller. Once a mounting option has been chosen, tighten down the 5/16"-18 socket head screws with a 1/4" hex key. After step 8, the assembly should look like Figure 10.



Figure 10: Bracket Mounted to Fuel Oil Controller

9. Screw packing nut into bracket in order to tighten the valve packing. It is recommended to first tighten the packing nut by hand as much as possible. Then using a crescent wrench, tighten the packing by another half-turn. This should make the packing sufficiently tight around the stem, but still allow the stem to slide easily through the packing. Move the stem up and down by hand. If it feels too loose, tighten the nut slightly. **NOTE: Do NOT over tighten the packing nut! The packing nut can always be tightened later if necessary.** Figure 11 shows approximately where the packing nut should be after this step.

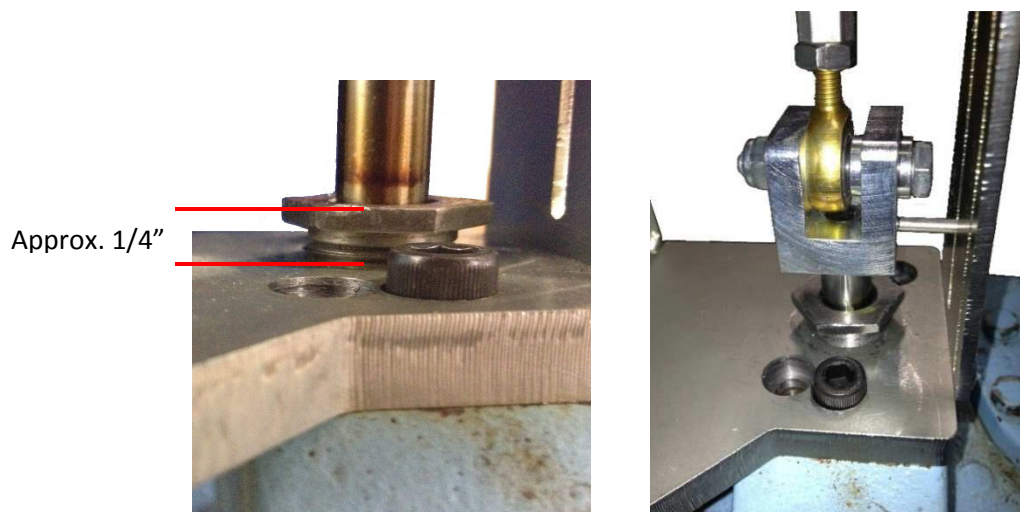


Figure 11: Packing Nut Tightened

10. Mount the SQM... actuator to the bracket assembly using the four #8-32 x 0.75" pan head screws, the eight #8 SAE washers, and the four #8-32 locknuts. Figure 12 shows the assembly after this step.

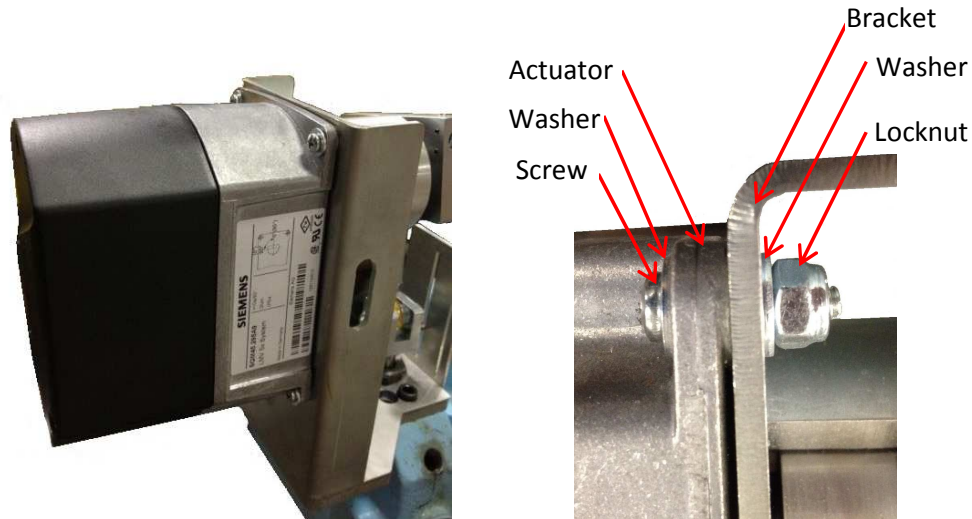


Figure 12: Actuator Mounted to Bracket

11. Tighten the three clamp collar set screws. These screws squeeze the bearing block shaft and clamp the actuator shaft. All three screws can be tightened with the actuator in the 0° position by using a 5/32" hex key through the slots in the bracket assembly. Figure 13 shows these set screws.

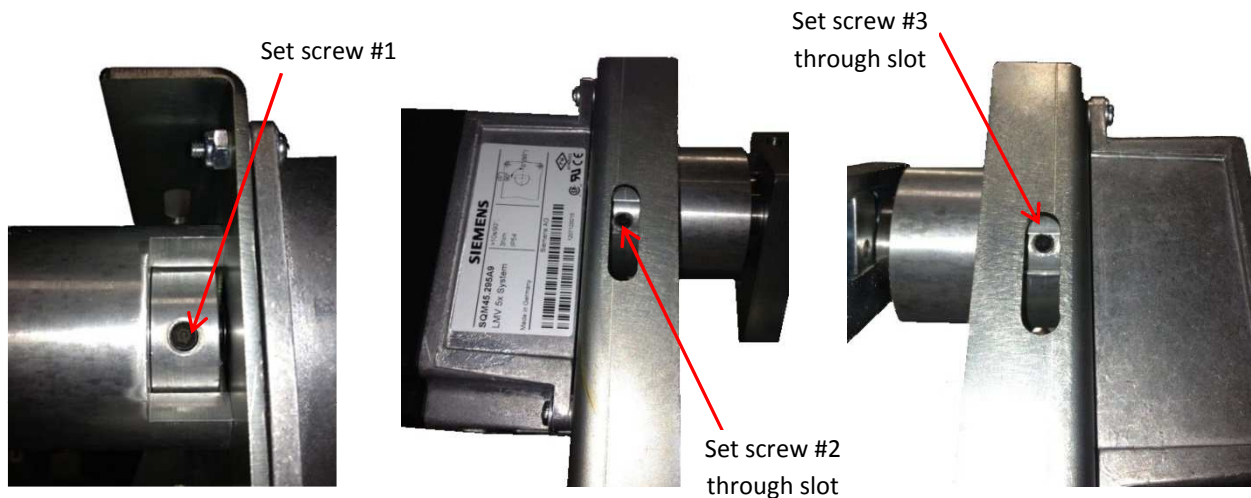


Figure 13: Clamp Collar Set Screws

12. The mechanical assembly is complete. An example of what the finished assembly looks like is shown in Figure 14.



Figure 14: Completed Mechanical Assembly

LMV Settings

1. If there is an existing fuel-air ratio curve for oil, make sure to erase all of the points on this curve:

LMV3: 201 (fuel 0) or 301 (fuel 1) = 0 (displayed as --)

LMV5: Params & Display > RatioControl > OilSettings > CurveParams > Curve Settings

2. The SQM... actuator must turn clockwise (with the shaft pointing away from you) to raise the valve stem assembly and increase the flow of oil to the burner. Likewise, a counterclockwise rotation will lower the valve stem and decrease the flow of oil to the burner.

LMV3: 602.00 (fuel 0) or 609.00 (fuel 1) = **0**

LMV5: Params & Display > Actuators > DirectionRot > OilActuator = **standard**

3. For an LMV3 only, the SQM33 actuator must be allowed to reference. With this retrofit kit, the actuator needs to reference on the open side.

LMV3: 601.00 (fuel 0) or 608.00 (fuel 1) = **1**

4. For an LMV5 only, the actuator must be addressed as the oil actuator by using the following menu path:

LMV5: Params & Display > Actuators > Addressing > OilActuator

5. For an LMV5 only, make sure that the oil actuator is activated:

LMV5: Params & Display > RatioControl > OilSettings > OilActuator = **activated**

6. Set the home position of the oil actuator to 5 degrees:

LMV3: 501.00 (fuel 0) or 504.00 (fuel 1) = **5.0°**

LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions > HomePos > HomePosOil = **5.0°**

7. Ignition position of the oil actuator should initially be set to 5 degrees as well:

LMV3: In curve settings (P0), OF = **5.0°**

LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions > IgnitionPos > IgnitionPosOil = **5.0°**

LMV Settings (continued)

8. Set the program stop to phase 52 so that the ignition position can be changed during the initial startup of the boiler:

LMV3: Done automatically during the commissioning process

LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions > ProgramStop
= **52 Interv 2**

Adjustment Process

Once the LMV settings are programmed properly, the adjustment process can begin. There are two ways to make adjustments to this assembly, and both will need to be utilized to get proper operation of the boiler. A general description of both adjustments is presented below.

a. **Alter the length of the turnbuckle assembly** – The turnbuckle assembly will get longer or shorter as the center hex piece is rotated since one rod end has right-hand threads and the other rod end has left-hand threads. In order to do this, the jam nuts on either end of the middle hex piece must first be loosened. Once that is done, the hex piece can be turned by hand in order to lengthen or shorten the turnbuckle assembly. When the desired length is achieved, the jam nuts need to be tightened so that the hex piece cannot rotate.

The turnbuckle assembly is shipped at its maximum length of 4.47". Making the turnbuckle assembly longer than 4.47" will result in insufficient thread engagement of the rod ends. The minimum turnbuckle length is 3.52". Figure 15 below shows the turnbuckle assembly and its maximum and minimum lengths.

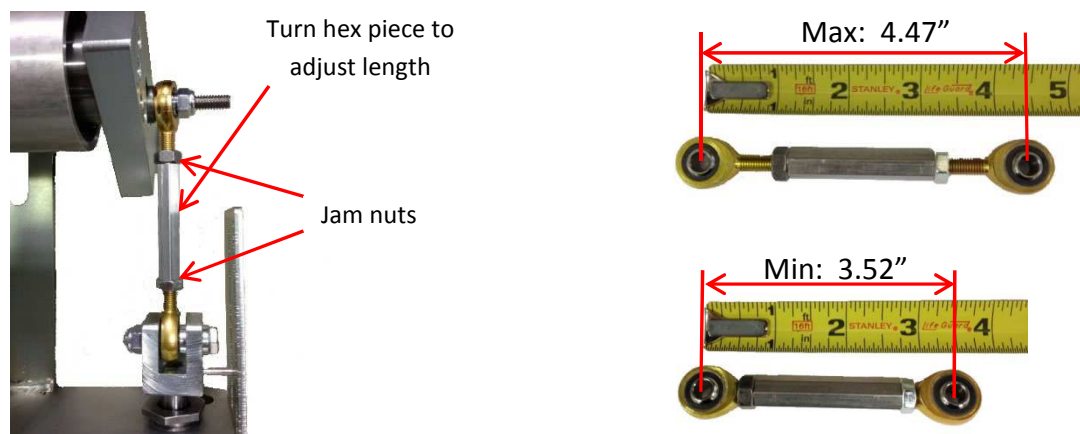


Figure 15: Turnbuckle Assembly

Adjustment Process (continued)

b. **Adjust the stroke length of the valve stem** – As the actuator shaft rotates, the valve stem will move in and out of the controller to control oil flow into the burner. For a 90° rotation of the actuator shaft, the stroke length of the valve stem can be adjusted between ½" and 1½". The assembly ships at a default stroke length of ¾". See Figure 16 below that shows where to position the threaded rod in order to achieve the desired stroke length.

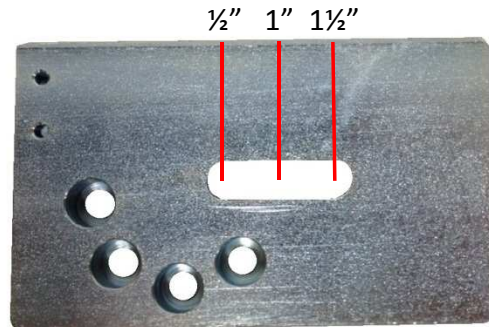


Figure 16: Stroke Length for a 90° Rotation

The stroke length should initially be set to approximately 1/8" longer than the stroke determined in step 1 of these instructions. In order to adjust the stroke length, the #10 set screw and ¼"-20 lock nut shown in Figure 17 must first be loosened. Then using a flathead screwdriver, turn the head of the jackscrew to adjust the stroke length. Once the desired stroke length has been achieved, tighten down both the #10 set screw and the ¼"-20 lock nut.

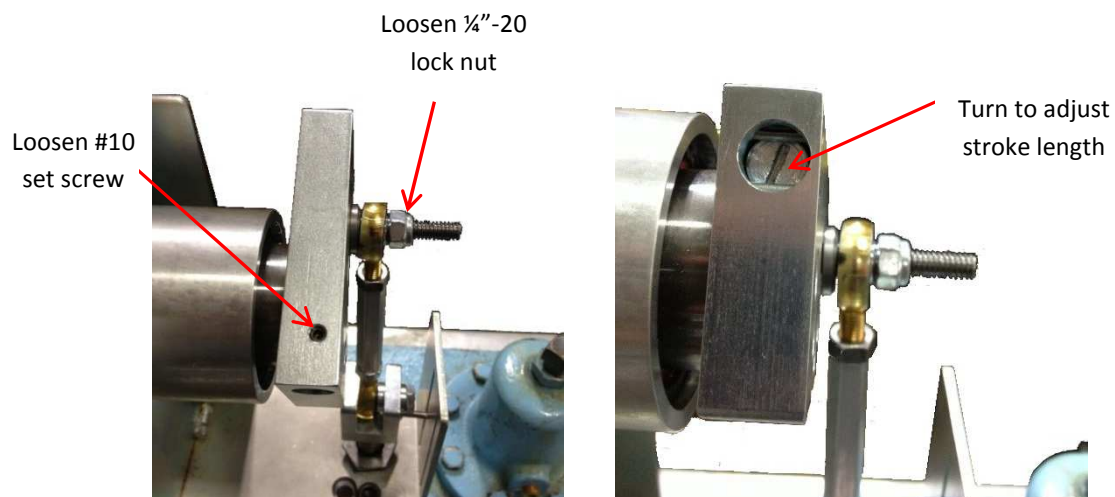


Figure 17: Stroke Length Adjustment Process

Adjustment Process (continued)

1. Verify that the SQM... actuator is wired correctly.
2. Verify that the LMV settings are set as outlined in the previous section called “LMV Settings”.
3. If safe to do, power on the LMV and verify that the LMV is in phase 12 (standby) and that the SQM... actuator mounted to the oil controller is at home position (5.0°).
4. Ensure that the turnbuckle assembly is at maximum length (see Figure 15 on page 12). This can be verified by measuring the distance that the anti-rotation roll pin is from the bottom of the slot in the indicator bracket. This should be roughly 7/16” as seen in Figure 18 below.

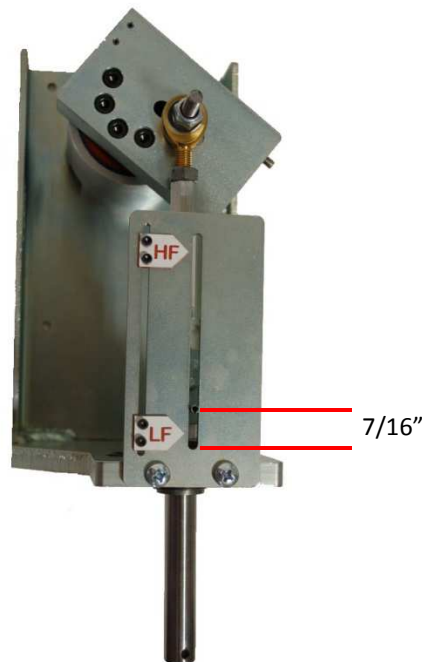


Figure 18: Distance from Roll Pin to Bottom of Slot

5. Ensure the correct manual valves in the oil supply line are open or closed.
6. Verify correct ignition positions in the LMV for all actuators (and VSD). If correct, attempt to light off on oil.
7. Verify correct supply oil pressure to the fuel oil controller (approximately 40 psi).

Adjustment Process (continued)

8. If the burner does not light off due to lack of oil, shorten the turnbuckle slightly (one full revolution of the center hex piece) and attempt to light off again.

NOTE: The above step must not be repeated more than 6 times without checking for oil accumulation in the boiler!

9. Once the burner lights off successfully on oil, tighten the turnbuckle jam nuts and snug the lock nut.
10. Adjust the ignition positions of the air and oil actuators in the LMV to achieve satisfactory combustion at the ignition / low fire point.
11. Mark the low fire point on the indicator bracket as shown in Figure 19 below.

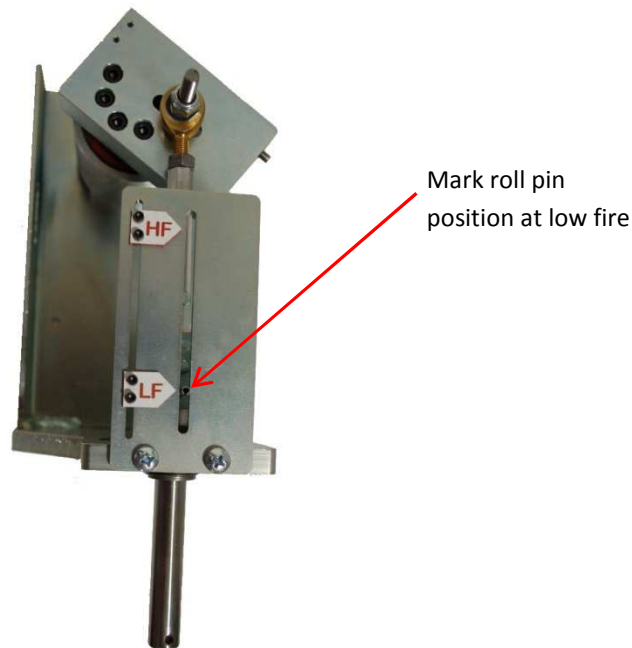


Figure 19: Mark the Low Fire Position

12. After verifying that no fuel/air ratio control points have been previously entered for oil, de-activate the program stop in the LMV5.

LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions >
ProgramStop = **deactivated**

Adjustment Process (continued)

13. Tune the fuel-air ratio control curve. This step is outlined in detail in the LMV literature.
14. The SQM... actuator stroke should be at least 30 degrees from ignition / low fire to high fire. If this is not at least 30 degrees, the following corrective actions are recommended:
 - a. Return to low fire. Shorten the stroke of the linkage and adjust the turnbuckle as necessary to maintain the low fire point (as marked on bracket). **NOTE: Do not extend turnbuckle past its maximum length!**
 - b. Re-tune the fuel-air ratio curves. The stroke should exceed 30 degrees from low fire to high fire.
15. Mark the high fire position on the indicator bracket as shown in Figure 20 below.

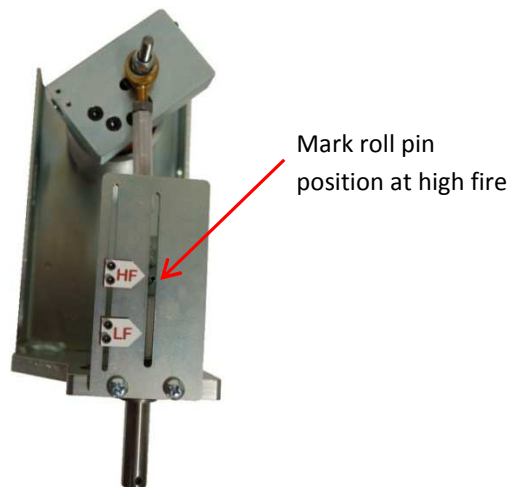


Figure 20: Mark the High Fire Position

Maintenance

It is common for oil to eventually begin to slowly leak out of the top of the packing after some time. If this happens, give the packing nut a half-turn. **NOTE: Do not over tighten the packing nut! A half-turn is sufficient to prevent further leakage out of the top of the packing.**

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