



# LSI Instrument Air Compressor

## Soft Goods Kit Installations Instructions

### V2.0 Internals



<https://www.linkedin.com/company/lco-technologies/>



<https://www.youtube.com/@lcotechnologies8900>

© 2017 - 2024 LCO Technologies. All rights reserved.

**CONFIDENTIAL NOTICE.** The information contained in this document and all attached documents is strictly confidential and contains proprietary information. It may only be used by the named addressee(s) and is also subject to the terms of any other confidentiality or nondisclosure agreement between parties. All other use is strictly prohibited.

This publication is for informational purposes only. While every effort has been made to ensure accuracy, this publication shall not be read to include any warranty or guarantee, express or implied, including as regards the products or services described or their use or applicability. LCO Technologies (hereinafter "LCO Technologies" or "LCO") reserves the right to modify or improve the designs or specifications of its products at any time without notice. All sales are governed by LCO terms and conditions which are available upon request. LCO accepts no responsibility for proper selection, use or maintenance of any product, which remains solely with the purchaser and/or end-user. LCO Technologies, and the CROSSFIRE logo are trademarks and service marks of LCO Technologies. All other marks are the property of their respective owners.

#### LCO Technologies

115 – 1829 54 Street SE  
Calgary, AB T2B 1N5  
[info@lcotechnologies.com](mailto:info@lcotechnologies.com)

**Parts Breakdown:**

- 4x LSI White Delrin Bushings complete with Thrust Rod Seals & O-Rings
- 1x Shaft Seal
- 4x Outlet Bushing O-rings
- 4x Inlet Bushing O-rings
- 4x Piston U-Cup Seals (Tall Profile)
- 4x Paper Gaskets
- 4x 3/8" Teflon Balls for Inlet
- 4x Springs for Inlet
- 4x 1/2" Teflon Balls for Outlet
- 4x Guides for Outlet
- 4x Springs for Outlet
- 1x Replacement Filter

**Lubricant and Compound Provided:**

- Lubricant: Krytox GPL204
- Heat Compound: HY400 Thermal Grease

**Recommended Tools and Cleaning Products:**

- Isopropyl Alcohol and Paper Towel
- Allen Keys: 2.5mm
- Torque Wrench: Set to 120 in lbs
- Sockets: 7/16", 5/16", 10 mm
- Wrench: 11/16"
- Crescent wrench
- Straight Pick
- Q-Tip
- Pliers or vice grips

**Required:**

- ISO Weight 46 Hydraulic Oil (~7oz)
- Gasket Maker: Permatex Ultra Black Maximum Oil Resistance Gasket Maker
- Thread Sealant: LocTite 567 or SWAK



4x LSI White Delrin Sleeves



1x Shaft Seal



4x Outlet Bushing O-rings (thicker)



4x Inlet Bushing O-rings (thinner)



4x Piston U-Cup Seals (Tall Profile)



4x Paper Gaskets



4x 3/8" Teflon Balls for Inlet



4x Springs for Inlet



4x 1/2" Teflon Balls for Outlet



4x Guides for Outlet



4x Springs for Outlet



1x Replacement Filter

## Part Number: LCO-LSI-SoftGoodKit-2.0

**Suggested Time for Rebuild:** Around 3 to 4 hours, however, it takes around 24 hours for the gasket maker to fully set. After 1 hour it is dry and set enough to complete the build.



**Warning:** *It is critical when completing soft goods maintenance practice, to take precautions to keep all compressor components clean. The introduction of small particles, dirt, or even Teflon tape scraps from tubing may affect compressor performance. It is recommended that rebuilds are completed in a clean workshop, not directly on a well site.*

### Step 1: Stop Compressor, Drain Oil, Remove Fan and Remove Tubing

- Stop the compressor and follow individual company lock out procedures for safety
- Drain the oil from the top works.
  - Open the ball valve and drain the oil into a container and dispose appropriately.
  - If you have a 90-degree elbow of tubing attached to the ball valve, rotate so it is pointing downwards. If you have a straight piece of tubing connected to the ball valve, ignore. Close the ball valve once complete.
- Remove the fan cowling.
- Disconnect the tubing upstream of the check valve (on the compressor side)
  - The volume bottle does not need to be drained prior, leaving it charged gives the opportunity to function test the check valve
  - If the check valve is leaking, it must be replaced
- Disconnect the top and bottom tubing from the inlet and outlet valves
- Remove the fan blades
  - Note: there are two different fan connections available depending on compressor age and version.
  - Option 1: If you have a hex nut, use a 10mm or 5/16" socket to remove that hex nut and pull the fan blades up and off the compressor.
  - Option 2: If you have a M6 bolt, loosen and remove the M6 bolt and pull the fan blades up and off the air compressor
- Remove the acrylic top plate and set aside
- Remove the clear tubing coming out of the bottom of the cylinders
  - Note: There are three different connection options for the clear tubing depending on compressor age and version.
  - Option 1: White plastic pieces with hose clamps (*Figure 1*)
    - Using a Phillips screwdriver, undo the 4 hose clamps holding the clear tubing coming out of the bottom of the cylinders. Use a flat blade screwdriver to gently pry the tubing off. Once removed, set aside and be careful not too lose the hose clamps.
  - Option 2: Metal male connector fitting (PMC) installed in black or green plastic piece (*Figure 2*)
    - Unscrew the hex nut of the fitting and pull the acrylic tubing down and out of the fitting
  - Option 3: Metal male connector fitting (PMC) installed directly into the metal cylinder (*Figure 3*)
    - Unscrew the hex nut of the fitting and pull the acrylic tubing down and out of the fitting



Figure 1: Clear tubing connection option 1



Figure 2: Clear tubing connection option 2



Figure 3: Clear tubing connection option 3



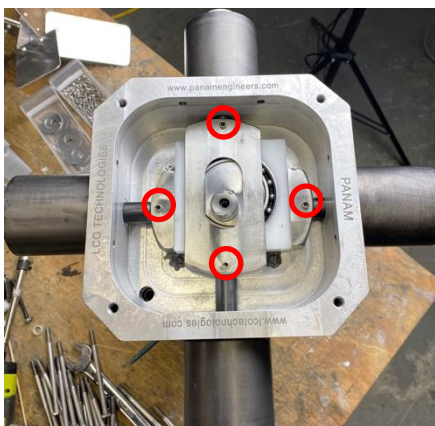
**Caution:** The plastic oil dam connectors are very delicate, especially with option 1, figure 1. Gently pry the plastic tubing off the connector. An upgrade to option 3 is available, please contact your supplier for more information.

## Step 2: Dis-Assemble Compressor

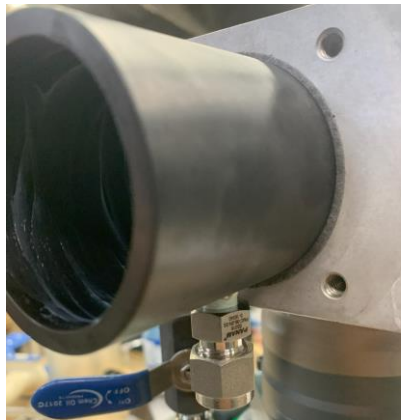
- Using a crescent wrench, loosen and crack open the top and bottom bushings
  - Leave them attached, but loosened until step 3
- Use the 7/16” socket to undo the four ¼” x 20 x 4 ¼” bolts holding the compressor heads on the top works platform
  - Carefully pull the compressor heads out and off the platform
  - Set aside until step 3
- Using an Allen key (2.5mm) remove the four screws in the trunnions holding the thrust rods in place. Set screws aside. *(Figure 4)*
- Slide the piston with the attached thrust rod out of the cylinders and off the top works platform. Then carefully remove the cylinder from the top works. *(Figure 5)*
  - TIP: Using a straight pick or a screwdriver, pry the thrust rods out of the trunnions forcing the pistons out of the cylinders. Use your second hand to grab the cylinder to avoid it falling off.
  - **CAUTION:** *Do not use the cylinder to pull out the piston. It will ruin the oil dam.*
- Pull the trunnions (including the middle white Delrin load block), up and out of the top works platform *(Figure 6)*
  - Note which trunnion is the top trunnion, and which is the bottom trunnion and set aside
- Undo the two bolts holding the metal bushing plate and white Delrin bushings on all four sides of the platform *(Figure 7)*
  - Set aside the bolts and bushing plate to reuse in re-assembly
  - Dispose of the Delrin bushings
- In the center of the Top Works there is a seal that needs to be removed.
  - Remove the gearbox key and set aside. *(Figure 8)*
  - Using an exacto blade, cut a line around the exterior of the shaft seal and use a pair of pliers or vice grips to remove it. *(Figure 9)*
  - Remove any old gasket maker from the empty shaft seal hole



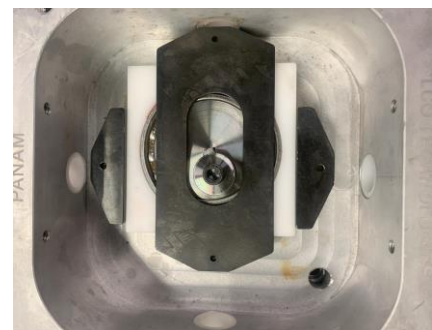
**Warning:** Gearbox key must be removed before the seal is removed. When reassembling later, please ensure that the seal is set and installed before sliding gearbox shaft through, there after re-attaching the key **last**.



*Figure 4: Remove trunnion screws*



*Figure 5: Remove cylinders*



*Figure 6: Remove trunnions and load block*



Figure 7: Remove the bushing plates & bushings



Figure 8: Remove gearbox key



Figure 9: Remove center shaft seal

### Step 3: Clean Components and Dispose of Used Soft Goods

- Load Block, Cam Wheel & Trunnions
  - o Clean the load block, cam wheel and trunnions off with isopropyl alcohol and ensure no leftover lubricant is present.
  - o Inspect parts for any damage. The trunnions should be flat and uniform on the interior with no scratches or scoring in the metal.
  - o Set parts aside for later re-assembly
  - o Using the isopropyl alcohol, be sure to wipe the excess oil and gasket maker from the center of the Top works
    - Note: If there is oil residue in the other areas of the Top works that's not an issue. It is only necessary to clean out where the center shaft seal goes.
    - Some units have gasket maker over the 4 bolt holes that attach the Gearbox to the Top works. If the gasket maker seal has been broken, remove any excess material and reapply the gasket maker for a good seal. If the gasket maker looks to be in good shape, leave it alone.



**Warning:** Gasket maker can take up to 24-hours to fully cure but usually dries after 1 hour

- Thrust rods with attached pistons
  - o Remove the old piston U-Cup seal out of the piston groove. Dispose the old U-cup.
  - o Clean the piston and attached thrust rod, taking extra care to clean the groove out (Figure 10)
  - o Inspect parts for any damage



Figure 10: Piston u-cup groove



Figure 11: Clean compressor head



Figure 12: Remove O-ring from outlet valve (top bushing)



Figure 13: Outlet valve



Figure 14: Bottom bushing (air inlet valve)



Figure 15: Paper gasket

- Compressor heads
  - o Clean heads off (Figure 11)
  - o Unscrew top bushing (from air outlet)
    - Remove top O-ring, and dispose (Figure 12)
    - Set the bushing aside for later re-use
  - o Remove the outlet valving and dispose the white ½" Teflon ball, spring and guide (Figure 13)
  - o Unscrew the bottom bushing (from air inlet), remove, dispose of O-ring, 3/8" Teflon ball and spring (Figure 14)
    - Clean inside seat.
    - Note: The spring may be stuck inside the compressor head, check, remove the spring, and dispose.
- Cylinders
  - o Clean inside of cylinder.
  - o **CAUTION:** If you have a cylinder version with a plastic oil dam, be very careful. The cylinder oil dam is very delicate – ensure this remains in place and is handled with care.
  - o Remove the paper gasket (Figure 15) and dispose.
  - o Pay extra attention and look for any scoring in the cylinder. The finish on the interior should be smooth, any scoring or indentations may affect future compressor performance.
- Filter
  - o Open the inlet filter and remove the internal paper filter – dispose
  - o Install new filter provided in the kit

*Note: if any components outside of the standard soft goods appear damaged, contact your supplier for replacement parts. Re-use of damaged components may affect compressor performance.*

#### Step 4: Re-build Compressor

- Start with the Shaft seal. Using a Q-Tip apply a thin layer of the gasket maker around the inside of the shaft seal slot. Slide the shaft seal into the slot, with the “U” cut out facing up (flat side goes in first) (Figure 16). Spin the seal 45-degrees in a direction of your choosing to ensure that there is an even distribution of gasket maker holding the seal in place. Check that the seal is flat and fully inserted into the slot.
- Using your finger, apply an additional layer of gasket maker to the exterior ring of the shaft seal to ensure a good seal (Figure 17)

**CAUTION:** Do not get the gasket maker on the output shaft of the Gearbox, or on the ID of the seal.



**Warning:** Gasket maker takes 24-hours to fully cure. We prefer if you wait the full 24 hours, however the gasket maker will be set enough in approx. 1hr.

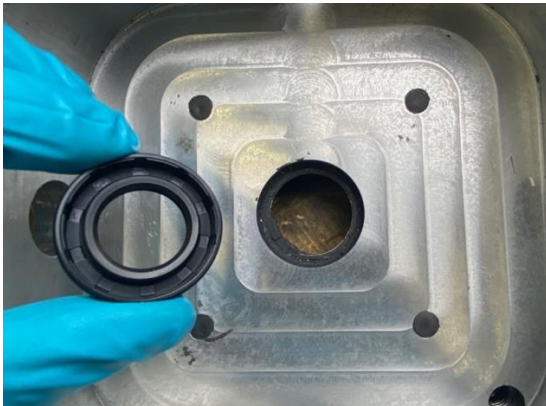


Figure 16: Shaft seal



Figure 17: Shaft seal installed in topworks

- White Delrin Bushings
  - o Locate the new sleeves with the installed thrust rod seals and O-rings. Apply a thin layer of thread sealant (i.e., LocTite 567 or SWAK) to the outside of the bushing where the O-ring is (Figure 18).
  - o Insert the bushings into the Top works, ensuring that they are flush with the edge (Figure 19).
  - o Locate the metal or black Delrin bushing covers and re-attach using the small bolts. Hand tighten the bolts until just snug, do not over tighten to ensure that the bushing cover is flat.
  - o Reference figure 20 for **incorrect** installation where the bushing cover is too tight and bending, and figure 21 for the **correct** installation.
  - o Check that the Delrin bushing ID aligns with the cover ID so there is no interference with the thrust rod.





Figure 18: Sleeve with thread sealant

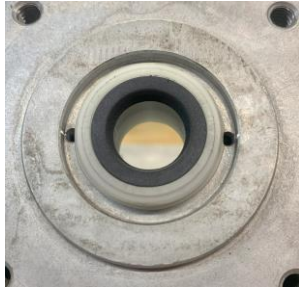


Figure 19: Sleeve installed in topworks



Figure 20: Incorrect – bushing plate too tight

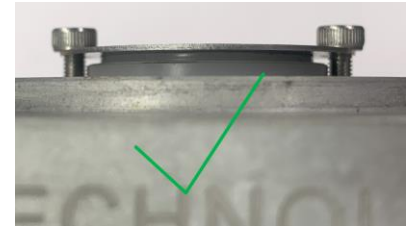


Figure 21: Correct – bushing plate installation

– Load Block and Trunnions

- Insert the Gearbox key. (Figure 22)
- Locate the original load block, cam wheel and trunnions set aside previously (Figure 23)
- Ensure you still have the top trunnion on top, and the bottom trunnion on the bottom. Additionally, the load block has a lip present that keeps the cam wheel from falling out of the block. Please ensure the lip side is down. **If you are unable to orient the parts, please contact LCO Technologies directly for assistance.**
- Place the assembled load block and trunnion assembly back into the top works - sliding the load block assembly over the Gearbox key (Figure 24)



Figure 22: Insert gearbox key



Figure 23: Assembled trunnion set

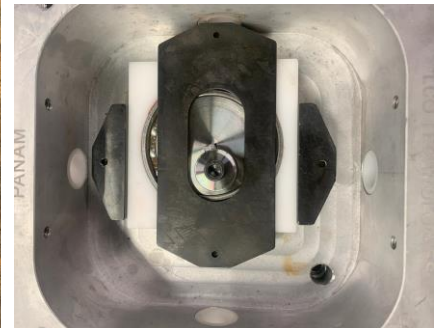


Figure 24: Trunnion set inserted into topworks

– Cylinders, Thrust Rods, and Attached Pistons

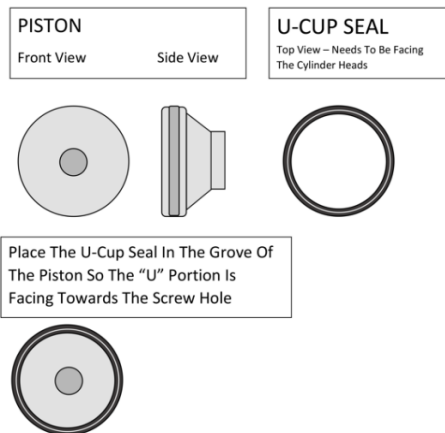
- Locate the four new tall profile U-cup seals
- Place the U-cup seal into the piston groove
  - Make sure that the “U” portion of the seal is facing away from the attached thrust rod and towards the piston bolt (Figure 25)
  - Repeat on the remaining three pistons. Make sure the U-cup seal is not twisted in the groove. (Figure 26)
- Locate the clean cylinders and apply a rice sized amount of provided Krytox lubricant inside the cylinder. Spread lubricant around so there is a thin, even layer present.
- Place the paper gasket on the side of the top works around the locating ring, making sure that the gasket is flat (Figure 27).

- Carefully place the cylinder onto the top works by centering the cylinder around the thrust rod hole and locating ring. Ensure the side with the attached fitting or oil dam is closest to the top works and facing down (*Figure 28*).
- Slide the thrust rod with attached piston into the cylinder (thrust rod enters first) and slide the thrust rod through the white Delrin bushing on the side of the top works (*Figure 29*)
  - The piston will help hold the cylinder in place.
  - Insert the thrust rods into the trunnions, using a straight pick to line up the hole in the thrust rod and the trunnion (*Figure 30*). Insert the original screws back into place and tighten.
  - **Recommendation:** Attach the thrust rods into the bottom trunnions first, then attach the two for the top trunnion.
  - **TIP:** The trunnion bolt should be easy to thread. If it is not, slowly rotate the bolt counterclockwise until there is a “click”, then you can thread the bolt easily.



**WARNING:** The trunnion bolts can break if the thrust rod hole and trunnion hole are not properly aligned. If you feel any resistance while screwing the bolt in, re-align with a straight pick and try again.

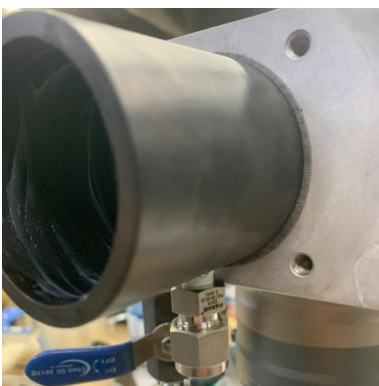
- Repeat the above steps on the remaining 3 sides
- The center top works is now rebuilt, and cylinders and pistons are properly attached



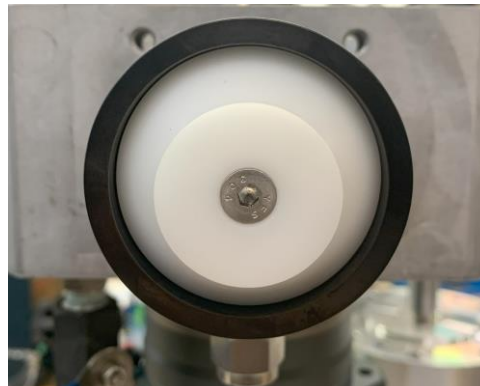
*Figure 25: U-Cup seal orientation*

*Figure 26: U-cup installed on piston*

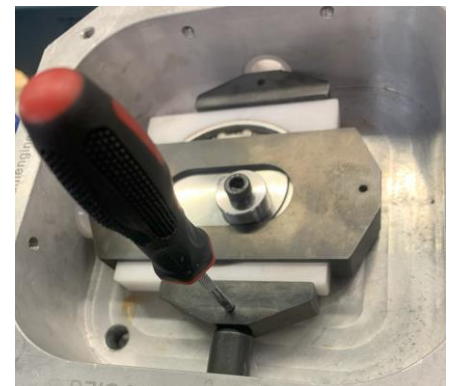
*Figure 27: Installed paper gasket*



*Figure 28: Install cylinder on topworks*



*Figure 29: Install piston into cylinder*



*Figure 30: Line up thrust rod and trunnion holes*

- Compressor Heads
  - o Using a Q-tip, apply a thin layer of the supplied heat compound to the outer, flat lip of the cylinder slot. Be sure to avoid getting any on the conical area of the head.
    - **Note:** Heat compound is a necessary component to ensure heat transfers from the cylinders to the compressor head and through the heat sinks. Please use the included heat compound and do not skip this step. (Figure 31 and 32)
  - o Slide the four 1/4" x 20 x 4 1/4" bolts back through the compressor head
  - o Grab the entire head assembly and hold it up to the cylinder on the Top Works. Ensure the top bushing (outlet) is facing up.
  - o Line up the four bolts with the four holes on the top works and tighten the bolts in a cross hatched pattern until they are very loosely tightened. (Figure 33)
  - o Repeat on the remaining three compressor heads
  - o Using the torque wrench set at **120in lbs. and a 7/16" socket**, tighten the bolts down slowly in a cross hatched pattern. When the **torque wrench clicks once, stop tightening**. The bolt is now tightened perfectly. Repeat on the remaining compressor head bolts.

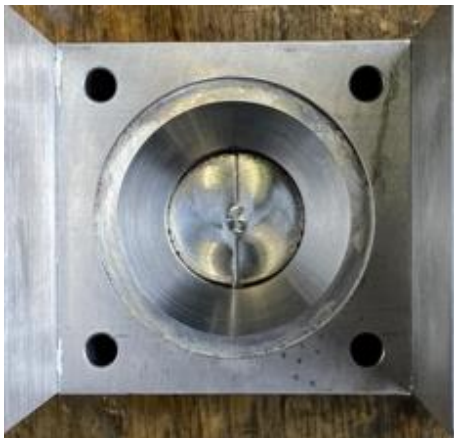


Figure 31: Compressor head

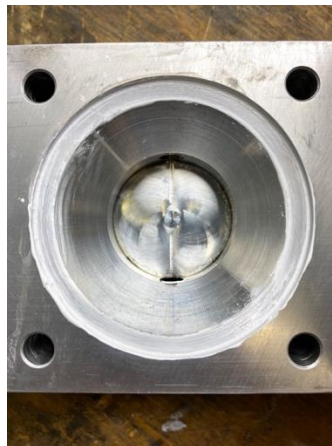


Figure 32: Compressor head with heat compound

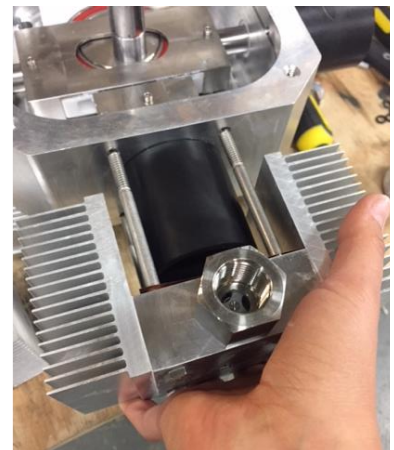


Figure 33: Install compressor head on topworks



**WARNING:** The compressor bolts must be tightened equally on all four sides to the exact torque spec to ensure an airtight seal. Carefully tighten bolts in a cross hatched pattern working to keep the bolts as square and evenly tightened as possible during this process.

- Attach Top and Bottom Bushings for Inlet and Outlet Valves
  - o Locate the four bottom bushings, new inlet springs, new 3/8" Teflon balls, and four new inlet bushing O-rings
  - o Note: The O-rings used on the inlet bushing are thinner and shown on the right hand side in [Figure 36](#)
    - Stretch the four inlet bushing O-rings over the outside threading and into the groove on the base of the bushing ([Figure 34](#))
    - Apply a rice grain sized amount of Krytox lubricant to the 3/8" Teflon ball and inside seat of the bottom bushing and place the Teflon ball in the bushing.
    - Carefully balance a spring on the Teflon ball and carefully take the bushing assembly and screw it into the bottom of the compressor head valve. Be very cautious to ensure the spring is centered and standing up right. ([Figure 35](#))
    - Tighten the bushing to ensure no air will leak.
    - Repeat on the remaining compressor heads.
  - o Locate the four top bushings, new 1/2" Teflon balls, new guides and new outlet springs
    - Note: The O-rings for the top outlet bushings are much thicker than the ones used for the bottom inlet bushings. ([Figure 36](#))
    - Stretch the new bushing O-ring over the outside threading and into the groove on the base of outlet bushing. Ensure the O-ring is not twisted. ([Figure 37](#))
    - Install the spring onto the delrin guide, onto the center raised circle ([Figure 38](#))
    - **TIP:** Bend the end of the spring slightly so it holds onto the delrin
    - Install the delrin guide and spring into the bushing, spring up ([Figure 39](#))
    - Apply a small amount of Krytox to the conical hole in the top of the compressor head
    - Drop the 1/2" Teflon ball in, and roll it around to coat the ball in Krytox ([Figure 40](#))
    - Screw the top outlet bushing back in – ensuring that the spring remains straight between the ball and the guide, and tighten ([Figure 41](#))
    - Repeat on the remaining compressor heads.



Photo S

Figure 34: Installed Inlet O-ring



Photo T

Figure 35: Balance ball and spring

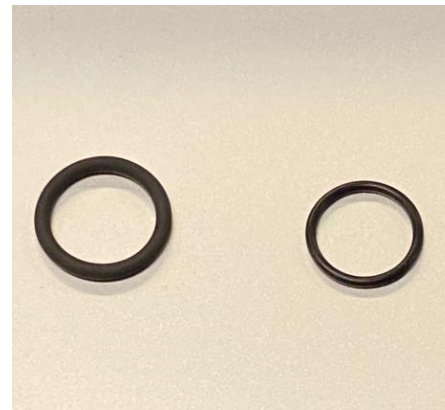


Photo U

Figure 36: Comparing inlet (right) and outlet (left) O-rings



Figure 37: Installed Outlet O-ring

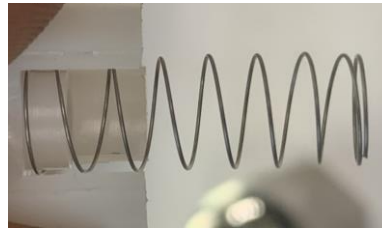


Figure 38: Install spring onto delrin guide



Figure 39: Install delrin guide and spring into outlet bushing

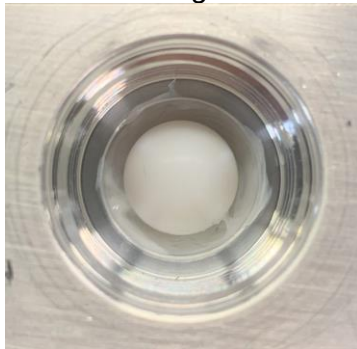


Figure 40: Ball installed in conical outlet valve



Figure 41: Installing top outlet bushing, ensuring spring is STRAIGHT

### Step 5: Attach Fan, Attach Tubing, and Test Compressor

- Add a few drops of oil from the squeeze bottle onto the load block. Start the compressor and feel the outlet valves to check air flow. There should be consistent pulses of air out of the four outlets, making four puffs per rotation.
  - o If air flow does not appear consistent, call LCO Technologies for assistance.
- Stop compressor
- Re-attach the acrylic cover
- Re-attach fan blades. Note: Depending on the age of your compressor, the fan may be connected in two different ways. Follow option 1 or 2 based on your device.
  - o Option 1: Single ready rod and tubing riser
    - Screw the M5 or M6 ready rod into the output shaft of the gearbox
    - Slide the flat washer over the ready rod in the center
    - Place the tubing over the ready rod
    - Slide the remaining lock washer and flat washer over the ready rod so it sits against the top of the tubing
    - Place the fan blades on top – it should rest on the ready rod/tubing stand
    - Install the nut on top of the fan assembly – tighten sufficiently
  - o Option 2: Custom Aluminum riser with ready rod
    - Place fan back on fan riser - align pin
    - Install nut back onto riser ready rod – tighten sufficiently

**Note:** Depending on purchase date of compressor, the ready rod will either be M5 or M6, affecting the nut size for the rod. It is recommended to carry both a 5/16" and 10 mm socket for both options.

- Re-attach the Polyurethane tubing
- Re-attach top and bottom metal tubing.
- Fill unit with oil
  - o Locate oil squeeze bottle with 7 fluid oz of **ISO weight 46 hydraulic oil**
  - o Squeeze oil into the hole in the top works if present (*Figure 42*)
    - Replace the blue plastic dust plug once filled with oil (*Figure 43*)
  - o If not present:
    - Locate the 90-degree elbow connected to the ball valve and rotate until it's pointing up. Open the ball valve. (*Figure 44*)
    - Squeeze the new oil into the 90-degree elbow to fill the top works back up with oil. When finished close the ball valve



**WARNING:** ISO weight 46 hydraulic oil **must be used** in the air compressor. Use of alternative hydraulic oils (such as Univis™) is NOT allowed and will cause extreme wear and tear of your compressor. Other hydraulic fluids contain additives that attract water and debris, which will damage the compressor components over time. Please contact LCO technologies if you need assistance purchasing the correct oil.

- Place the fan cowling back over the unit
- Complete!



*Figure 42: Hole in topworks to insert oil*



*Figure 43: Replace plastic dust plug once completed*



*Figure 44: Elbow pointing up*



<https://www.linkedin.com/company/lco-technologies/>



<https://www.youtube.com/@lco-technologies8900>

© 2017 - 2024 LCO Technologies. All rights reserved.

**CONFIDENTIAL NOTICE.** The information contained in this document and all attached documents is strictly confidential and contains proprietary information. It may only be used by the named addressee(s) and is also subject to the terms of any other confidentiality or nondisclosure agreement between parties. All other use is strictly prohibited.

This publication is for informational purposes only. While every effort has been made to ensure accuracy, this publication shall not be read to include any warranty or guarantee, express or implied, including as regards the products or services described or their use or applicability. LCO Technologies (hereinafter "LCO Technologies" or "LCO") reserves the right to modify or improve the designs or specifications of its products at any time without notice. All sales are governed by LCO terms and conditions which are available upon request. LCO accepts no responsibility for proper selection, use or maintenance of any product, which remains solely with the purchaser and/or end-user. LCO Technologies, and the CROSSFIRE logo are trademarks and service marks of LCO Technologies. All other marks are the property of their respective owners.

**LCO Technologies**

115 – 1829 54 Street SE  
Calgary, AB T2B 1N5  
info@lco-technologies.com