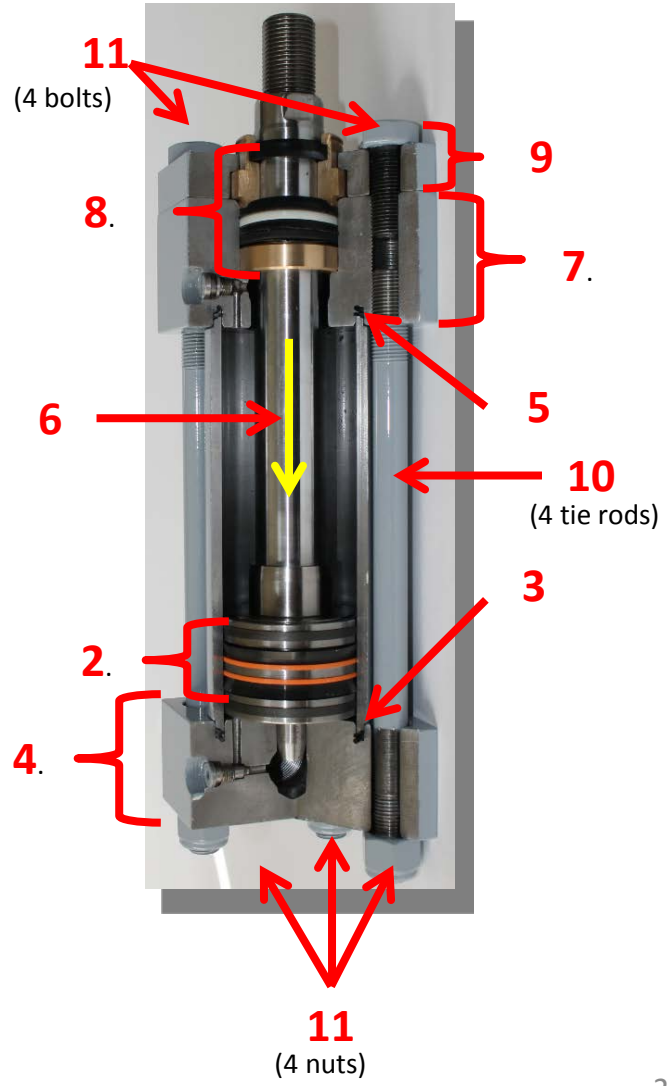
Milwaukee Cylinder:
Re-assembly Procedure for Series H
High Pressure Hydraulic Cylinder

16 Dec 2013

Procedure Steps

1. Starting Point
2. Putting Seals on Piston
3. Installing Blind End Tube Seals
4. Installing Tube into Blind End-End Cap
5. Installing Rod End Tube Seals
6. Piston Installation
7. Final End Cap Assembly
8. Installing Rod Bushing & Seal
9. Installing Retainer Plate
10. Installing Tie Rods
11. Final Torque

Related Part of Cylinder for Procedure Steps

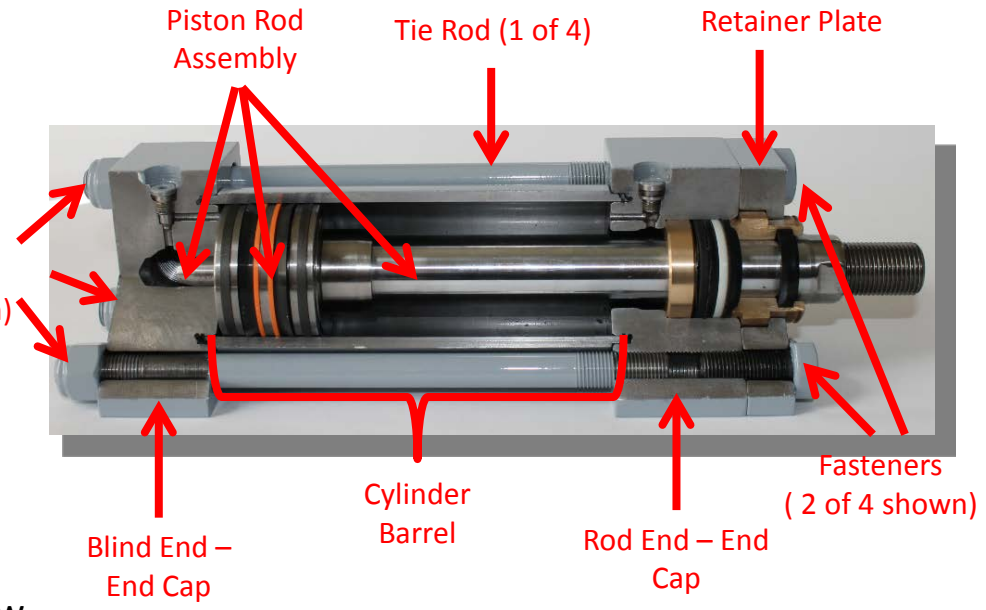


1. Starting Point

- Cylinder Completely Disassembled and Cleaned

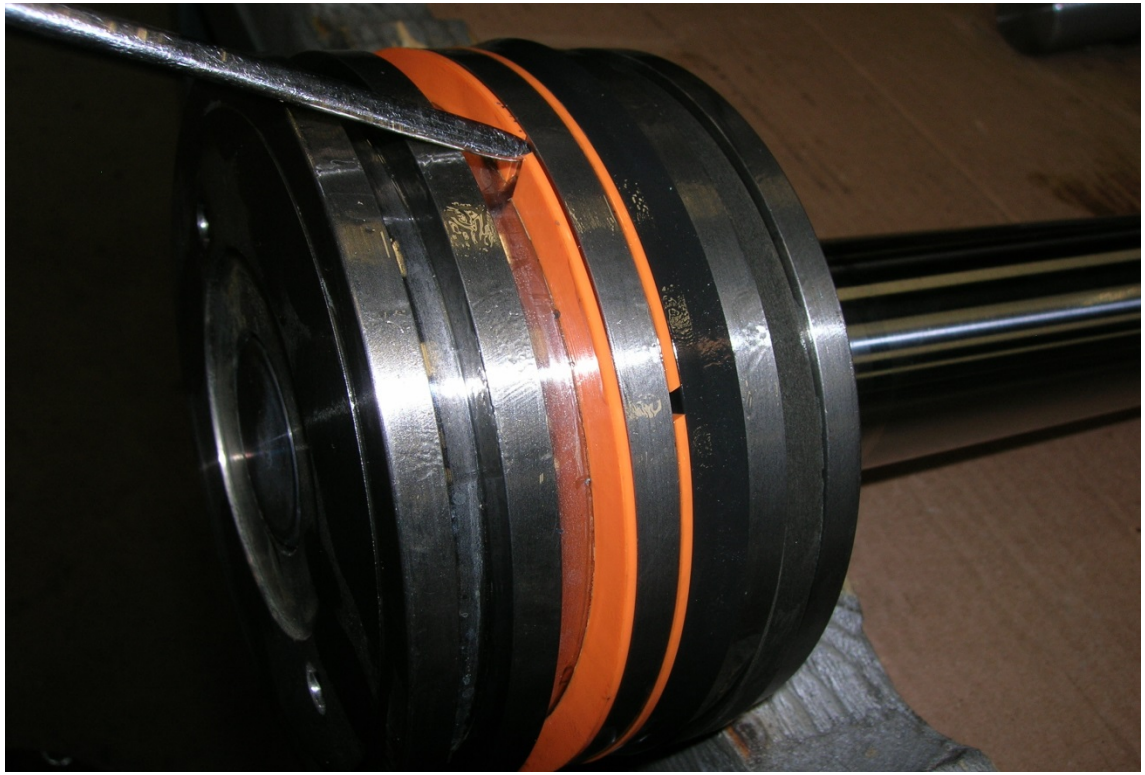
- Parts:
  - End Caps
  - Cylinder Barrel
  - Tie Rods
  - Piston Rod Assembly
  - Retainer Plate
  - Fasteners
  - Seal Repair Kit

  (Recommend replacing all seals with new seals)



Seal Repair Kit

2. Putting Seals on Piston
2.1 Install Back-Up Ring



Note the use of a plain flat tipped screwdriver with the corners rounded off and smoothed out.

2. Putting Seals on Piston
2.2. Install Piston Cup Seals

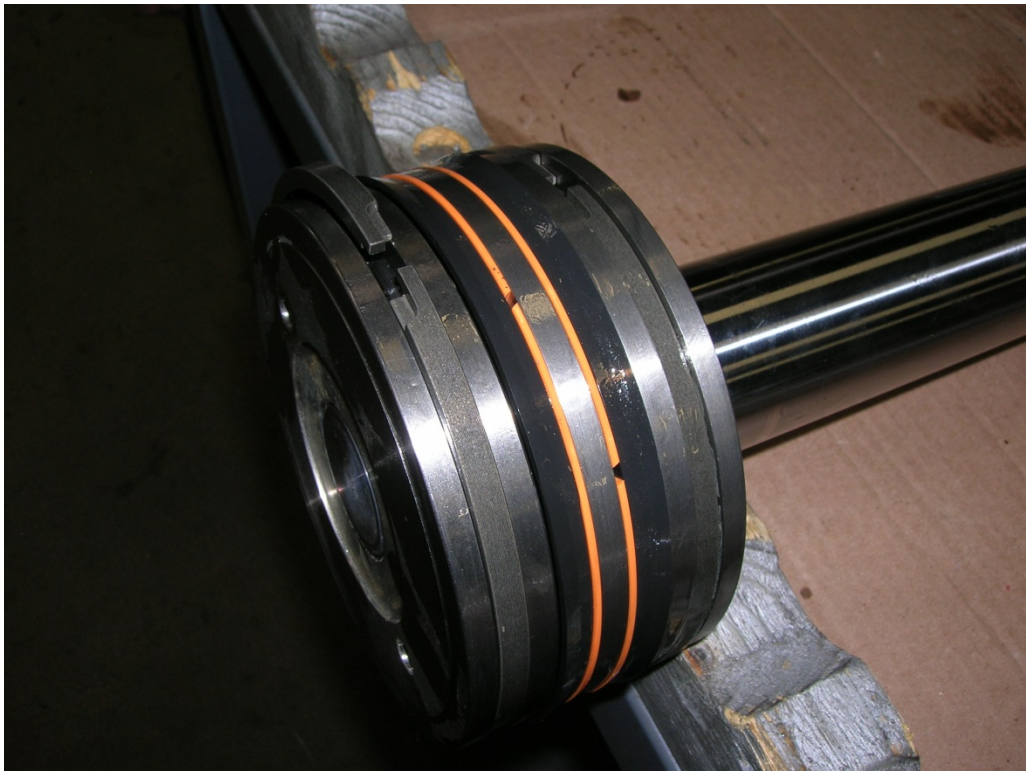
Cup seals can be stretched with the rounded off screwdriver to install in the piston grooves.

Note: Cup should be outward facing with B/U rings on the backside of cup

2. Putting Seals on Piston
2.3 Install Cast Iron Ring

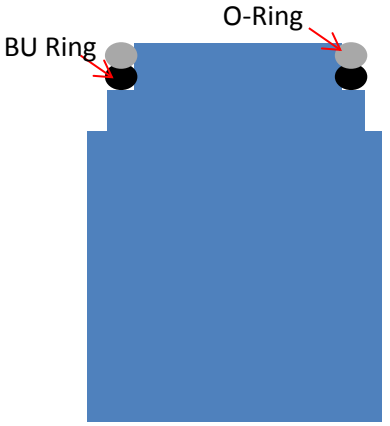
Carefully expand the ring to fit over the piston OD and fit into the groove. Be careful not to over expand the ring as this may split the ring.

2. Putting Seals on Piston
2.4 All Piston Seals Installed



Installation of seals and cast iron rings completed.

3. Installing Blind End Tube Seals
3.1 Install Tube Seal Back Up Ring

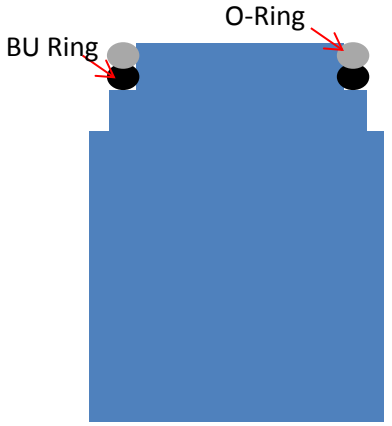


The back-up ring is installed first on the end of the tube.

Note: The correct location for installation is the smallest diameter of the barrel.

Note: Only install seals on one end of the tube at this step. Other side will be added later in the procedure.

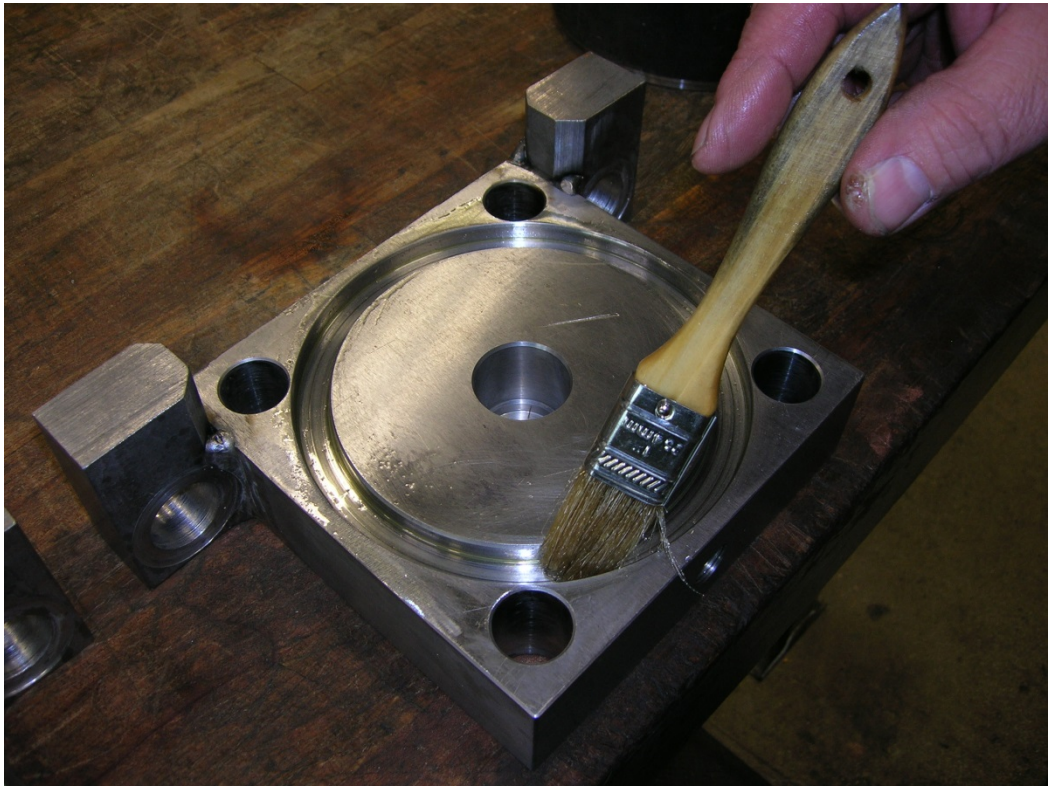
3. Installing Blind End Tube Seals
3.2 Tube Seal Installation



Install o-ring on top of back-up ring and lubricate before assembly with end cap.

Note: Lubricate with hydraulic system fluid or light grease compatible with system hydraulic fluid

4. Installing Tube into Blind End-End Cap
4.1 Lubricate Tube Grove



Lubricate tube groove before installing tube.

Note: Lubricate with hydraulic system fluid or light grease compatible with system hydraulic fluid

4. Installing Tube into Blind End-End Cap
4.2 Set Tube in End Cap Grove

Set tube in end cap groove.

4. Installing Tube into Blind End-End Cap
4.3 Seat Tube

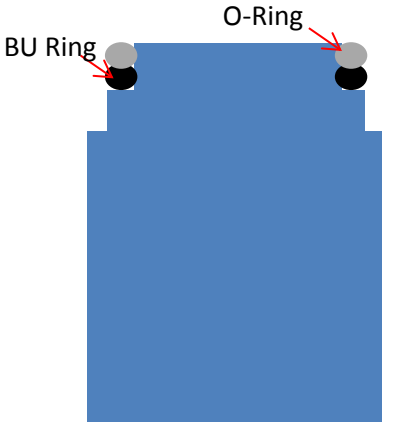
Gently tap the tube with a plastic or rubber mallet until tube bottoms out in groove.

4. Installing Tube into Blind End-End Cap
4.4 Visual Inspection

Tube is now seated into the groove of the end cap.

Visually inspect to ensure tube seal has not been damaged. The tube seal should not be visible. Look for signs of seal damage such as scrapings or seal parts. Replace if damage occurred.

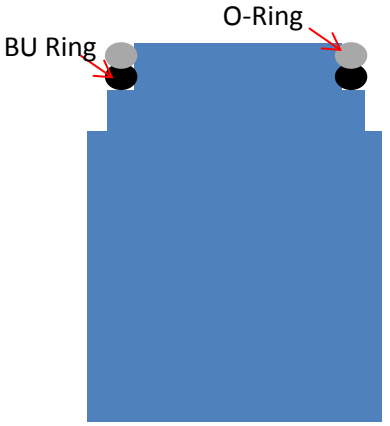
5. Installing Rod End Tube Seals
5.1 Install Tube Seal Back Up Ring



The back-up ring is installed first on the end of the tube.

Note: The correct location for installation is the smallest diameter of the barrel.

5. Installing Rod End Tube Seal
5.2 Tube Seal Installation



Install o-ring on top of back-up ring and lubricate before assembly with end cap.

Note: Lubricate with hydraulic system fluid or light grease compatible with system hydraulic fluid

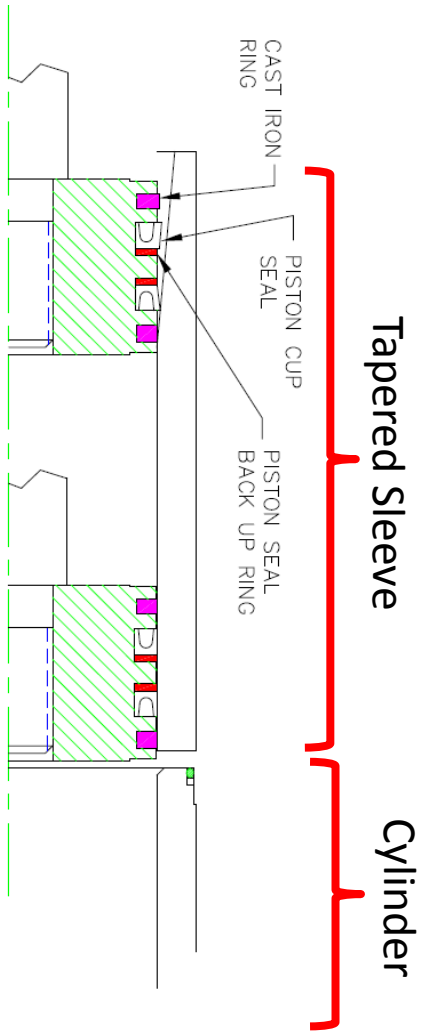
6. Piston Installation
2 Methods

6.1(Preferred) Using tapered sleeve

- A “Tapered Sleeve” is a tool used to compresses seals prior to entering the tube barrel
- Allows for easier installation
- Tapered Sleeves are available for purchase from Milwaukee Cylinder.
  - Or, Milwaukee Cylinder can provide you a tapered sleeve drawing

At the top of Tapered Sleeve, Piston seals begin to compressed

At the bottom of the Tapered Sleeve, seals are compressed and ready for insertion into the cylinder barrel



6.2 Alternate Procedure: Manual Seal Compression

- This procedure is used only when a tapered sleeve device is not available

6.1 Piston Installation Using Tapered Sleeve
6.1.1 Lubricate Piston Seals

Begin by lubricating the piston seals and cast iron rings.

Note: Lubricate with hydraulic system fluid or light grease compatible with system hydraulic fluid

6.1 Piston Installation Using Tapered Sleeve
6.1.2 Installing Tapered Sleeve

Apply lubricant to ID of tube, and then set the tapered loading sleeve on the tube.

Note: The large end of the taper is farthest from the tube.

6.1 Piston Installation Using Tapered Sleeve
6.1.3 Compressing Seals

Set piston rod assembly on open end of loading sleeve and carefully slide assembly into the tube.

6.1 Piston Installation Using Tapered Sleeve
6.1.4 Remove Tapered Sleeve

Remove tapered loading sleeve.

6.2 Piston Installation: Alternate Procedure
6.2.1 Lubricate Piston Seals

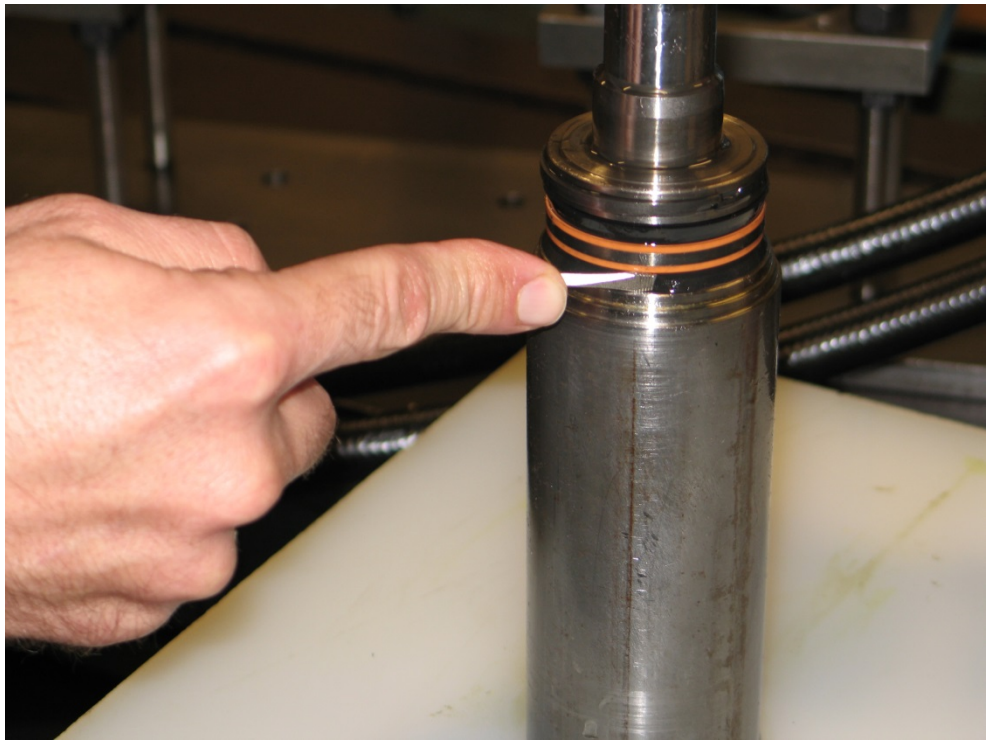
Begin by lubricating the piston seals and cast iron rings.

Note: Lubricate with hydraulic system fluid or light grease compatible with system hydraulic fluid

6.2 Piston Installation: Alternate Procedure
6.2.2 Cast Iron Ring Compression

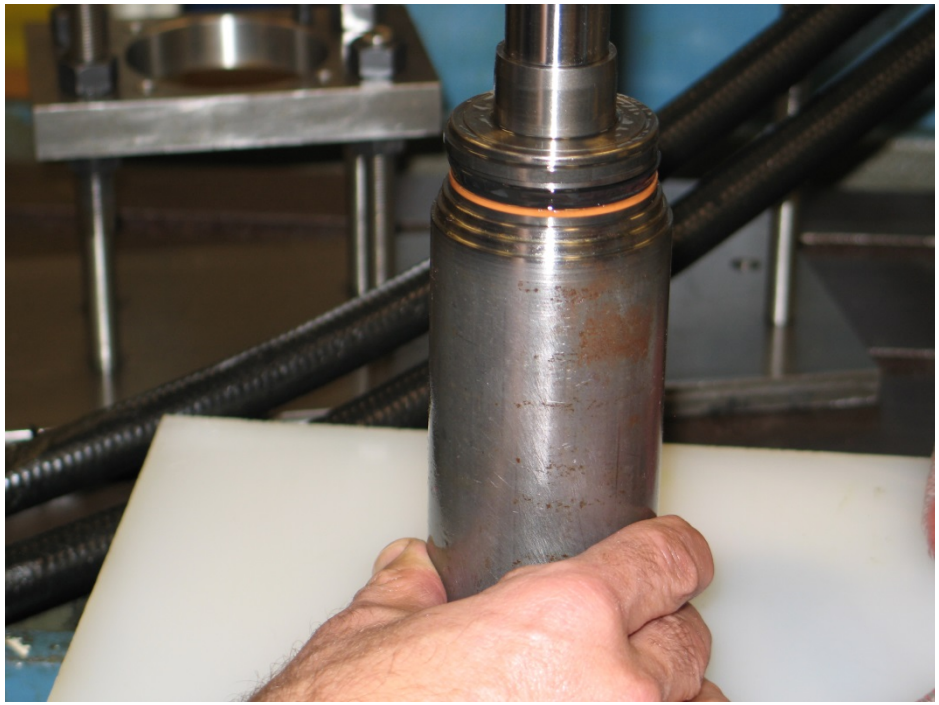
Apply lubricant to ID of tube, and set piston in tube on a slight angle. Squeeze the cast iron ring together at the Gap and push the piston down to the first piston cup seal.

6.2 Piston Installation: Alternate Procedure
6.2.3 First Cup Seal Compression



Using the rounded screwdriver work the piston cup seal into the tube

6.2 Piston Installation: Alternate Procedure
6.2.4 - 2nd U-Cup Ring Compression



Push the piston down into the tube up, inserting the 2nd cup seal, through to the last cast iron ring.

Note: Since the 2nd cup seal is facing outboard, installation is much easier than the 1st cup seal

6.2 Piston Installation: Alternate Procedure
6.2.5 - 2nd Cast Iron Ring Compression

Squeeze the cast iron ring together at the

Gap and push the piston down as done in previous step.

7. Final End Cap Assembly
7.1 Lubrication

Begin by applying lubricant to inner bores and tube groove.

Note: Lubricate with hydraulic system fluid or light grease compatible with system hydraulic fluid

7. Final End Cap Assembly
7.2 Installation

Set tube in end cap groove.

Note alignment with opposite end.

7. Final End Cap Assembly
7.3 Seating

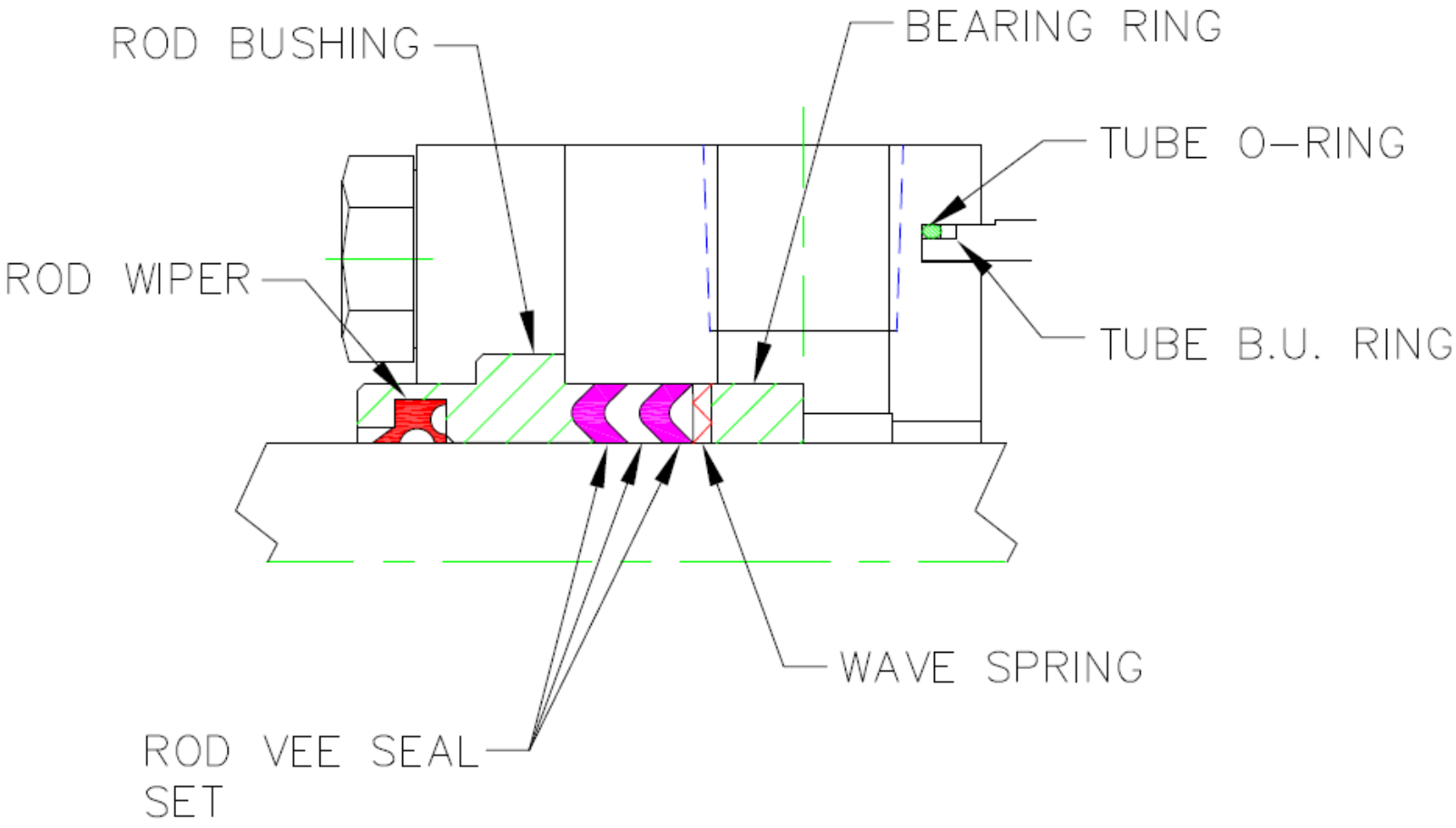
Complete end cap assembly by gently tapping with a plastic or rubber mallet until seated on tube.

7. Final End Cap Assembly
7.4 Visual Inspection

Tube is now seated into the groove of the end cap.

Visually inspect to ensure tube seal has not been damaged. The tube seal should not be visible. Look for signs of seal damage such as scrapings or seal parts. Replace seal if damage occurred.

8. Installing Rod Bushing & Seal
8.0 Reference Drawing



Reference this drawing for seal location and orientation

8. Installing Rod Bushing & Seal
8.1 Wave Spring Installation

Next step install wave spring over rod & into end cap bore.

8. Installing Rod Bushing & Seal
8.2 Rod Bearing Installation

Next step apply lubricant on the rod bearing and install over the rod & into end cap bore.

8. Installing Rod Bushing & Seal
8.3 Lubricating First Rod Seal

Next step apply lubricant on the first rod seal vee ring and male adapter.

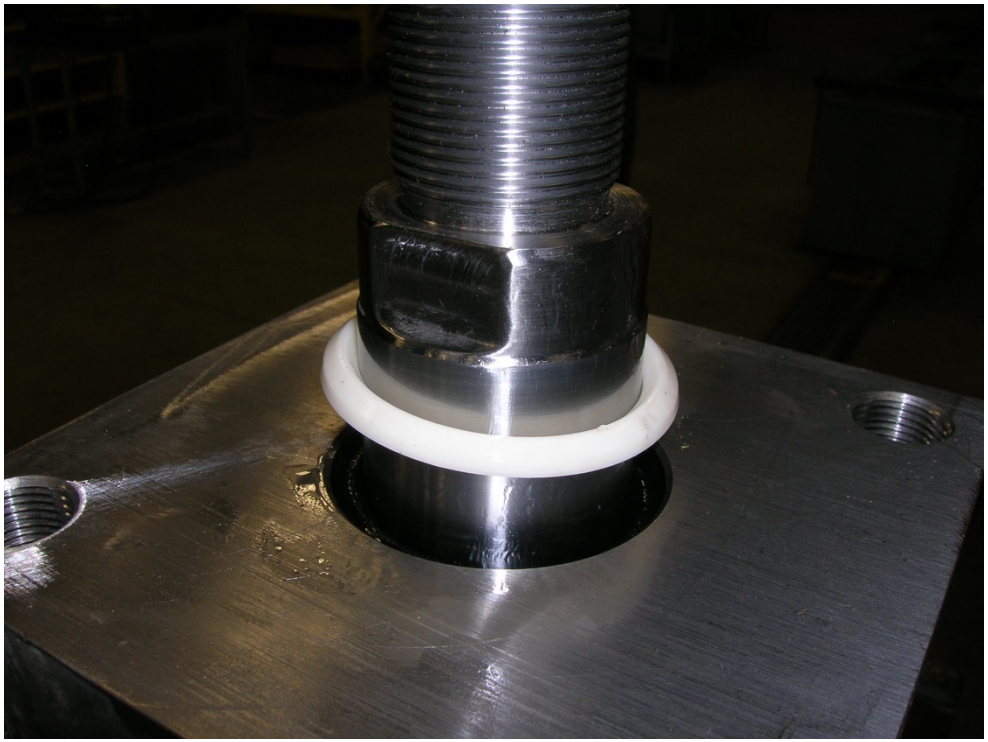
Note: The “V” always is positioned outward facing

8. Installing Rod Bushing & Seal
8.4 First Vee Ring Installation

Next step install vee ring over rod & into end cap bore.

Using the rounded screwdriver work vee ring into end cap bore

8. Installing Rod Bushing & Seal
8.5- 2nd Vee Ring Installation



Repeat previous procedure to install the second vee ring

8. Installing Rod Bushing & Seal
8.6 Last Vee Ring Installation

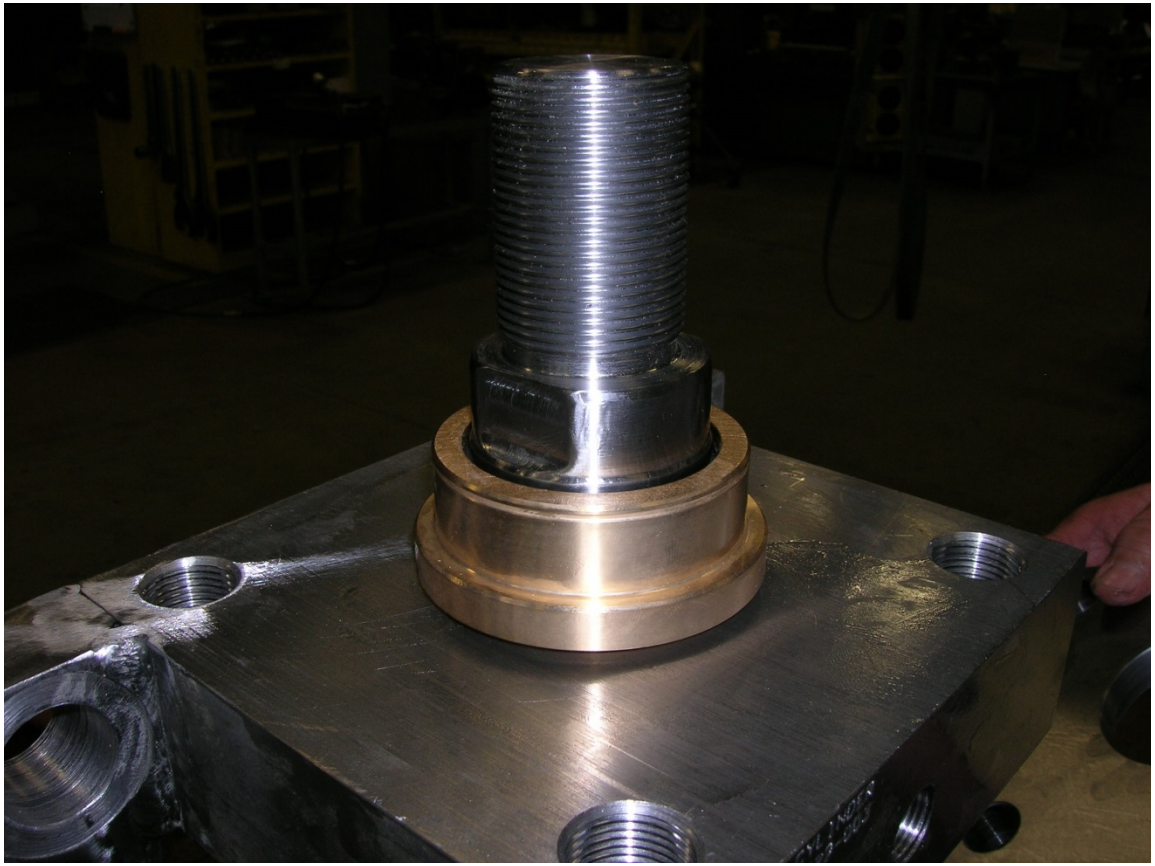
Install the third and last vee ring

8. Installing Rod Bushing & Seal
8.7 Rod Wiper Installation

Install the rod wiper into the grove in the rod bushing

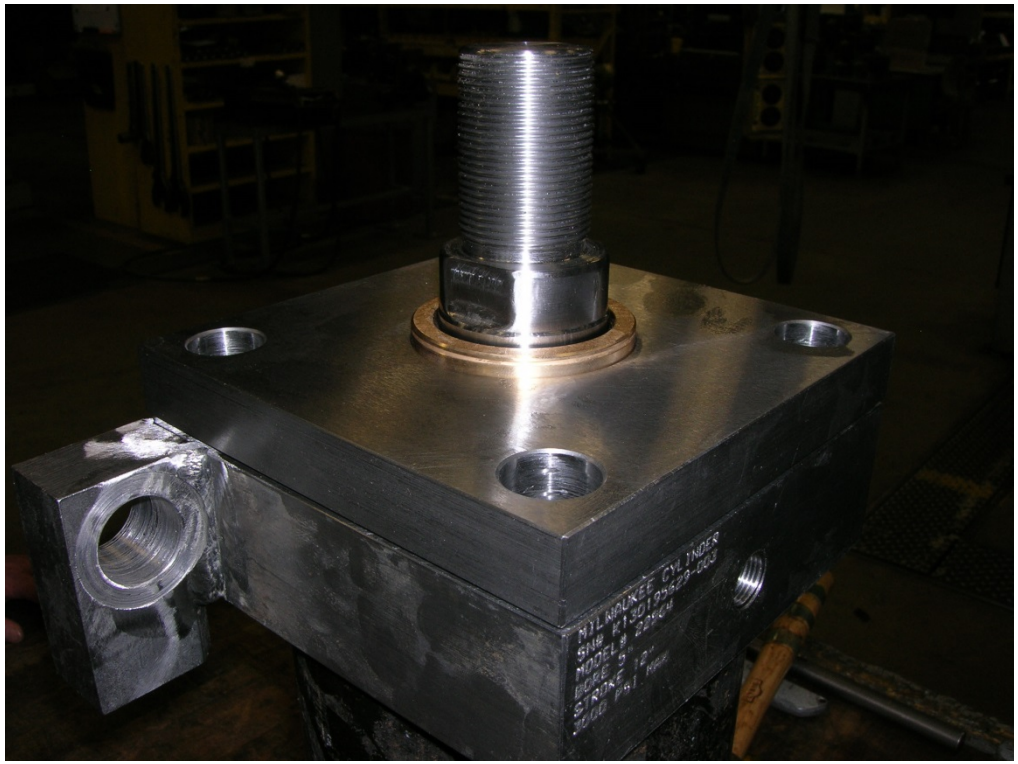
Note: Cup side faces into the cylinder

8. Installing Rod Bushing & Seal
8.9 Rod Bushing Installation



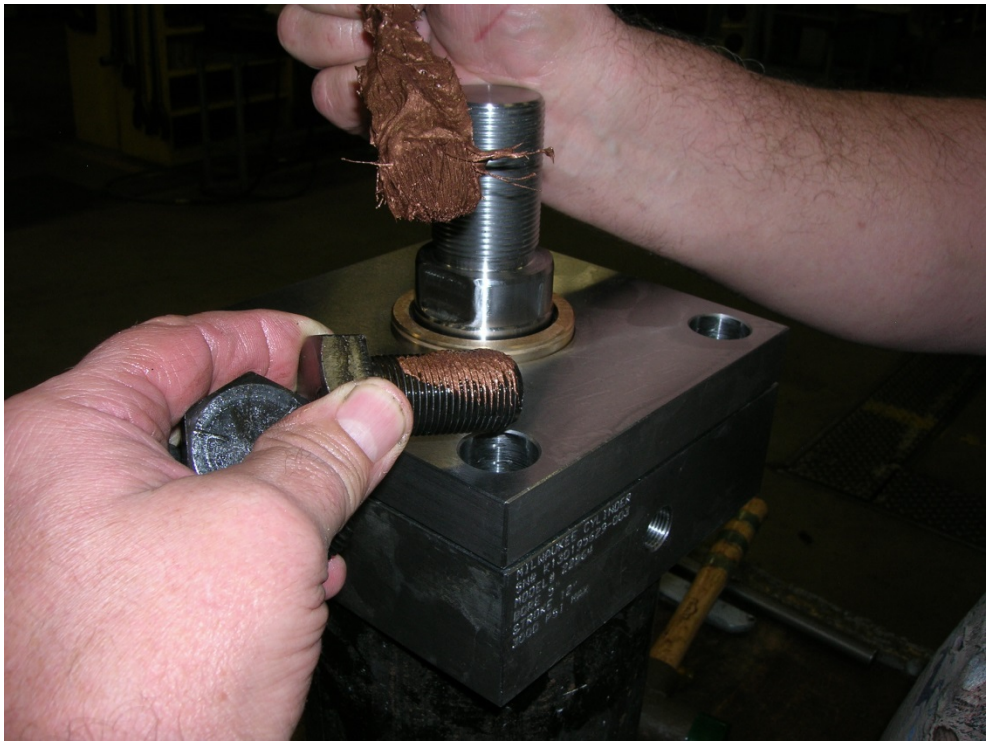
Next apply lubricant on the inside diameter of the rod bushing and install over the rod & into end cap bore.

9. Installing Retainer Plate
9.1 Retainer Plate Installation



Install the rod bushing retainer plate over the rod bushing

9. Installing Retainer Plate
9.2 Apply Anti-Seize Grease to Bolts



Apply anti seize grease to the retainer plate bolts

9. Installing Retainer Plate
9.3 Tighten Bolts Until Fully Engaged

Tighten all bolts moving diagonally across corners.

Note: Only tighten until bolt is fully engaged. These will be torqued in the last step of the procedure

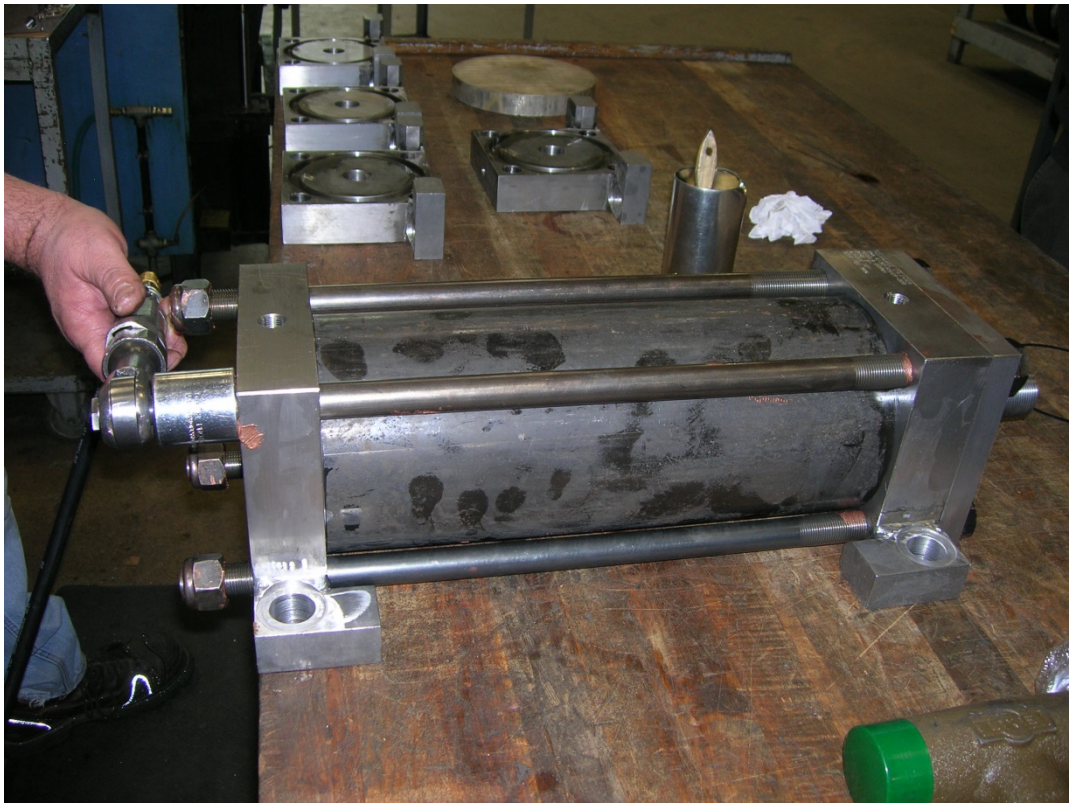
10. Installing Tie Rods
10.1 Nuts on Tie Rod

Begin by installing the tie rod nuts onto the tie rods.

Apply anti seize grease to the threads and to the face of the nuts

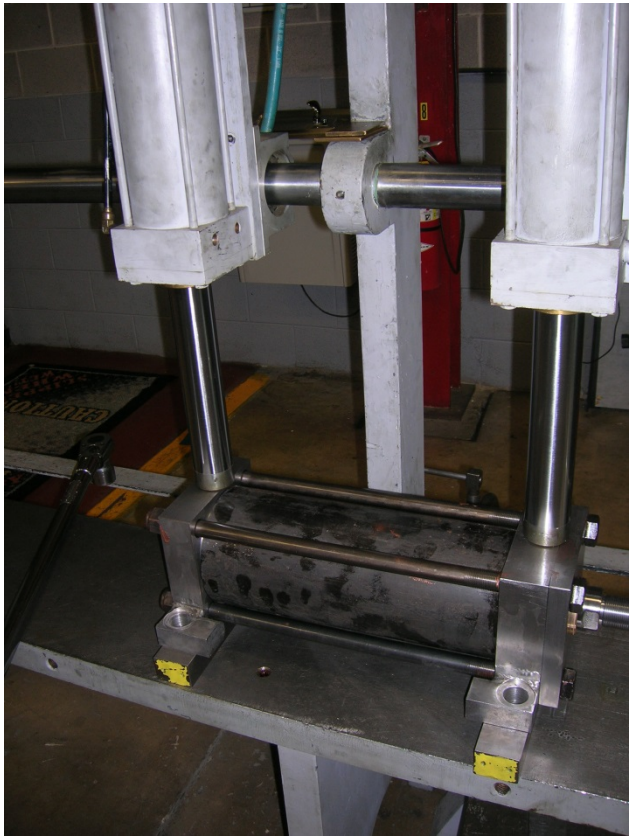
Note: Once nuts are fastened to the tie rod, ensure only 2-5 threads are protruding past the nut

10. Installing Tie Rods
10.2 Install Tie Rods to Rod End Cap



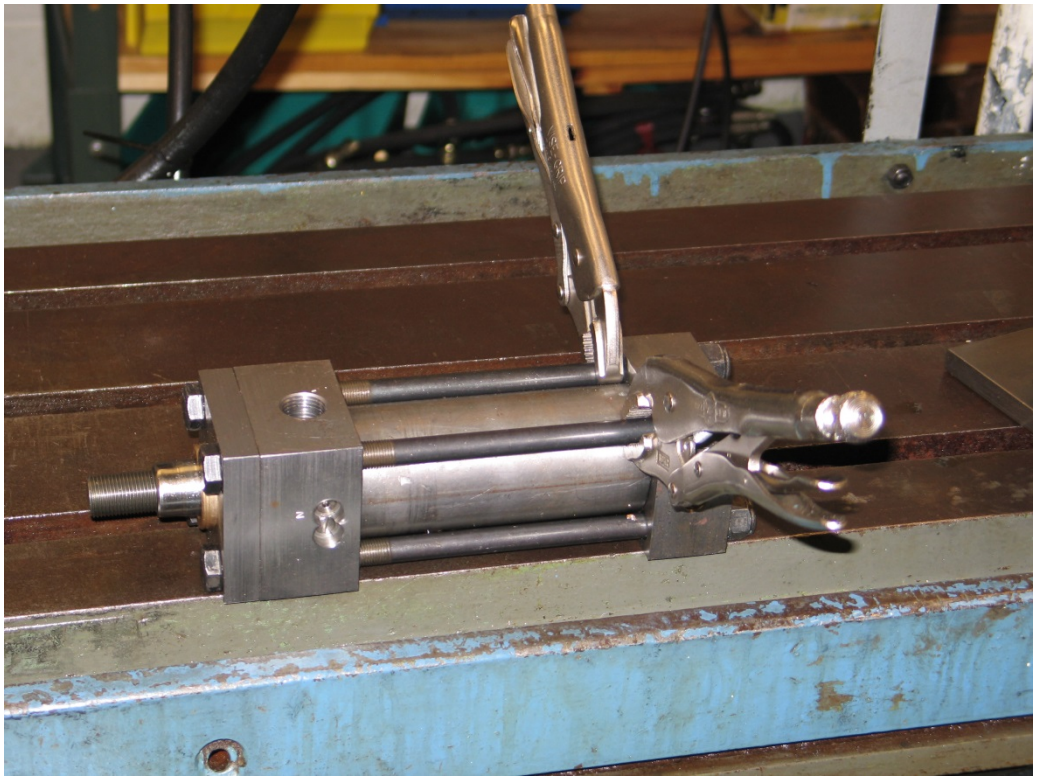
Install tie rods in cylinder and snug down

10. Installing Tie Rods
10.3 Clamp Cylinder



clamp cylinder on flat surface

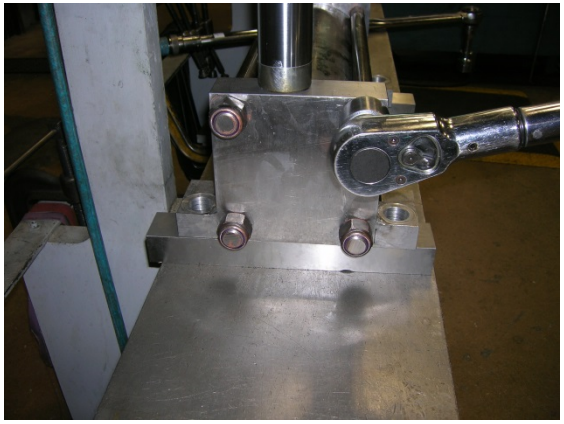
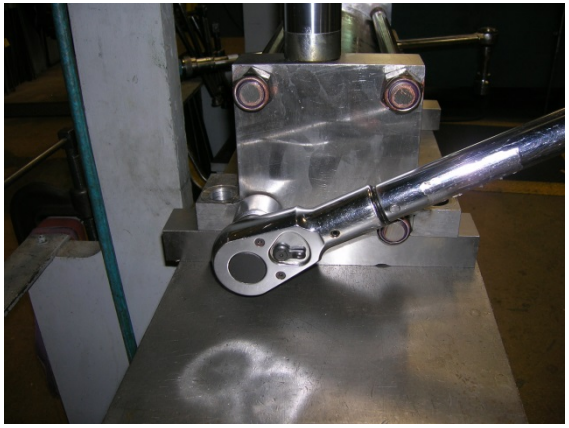
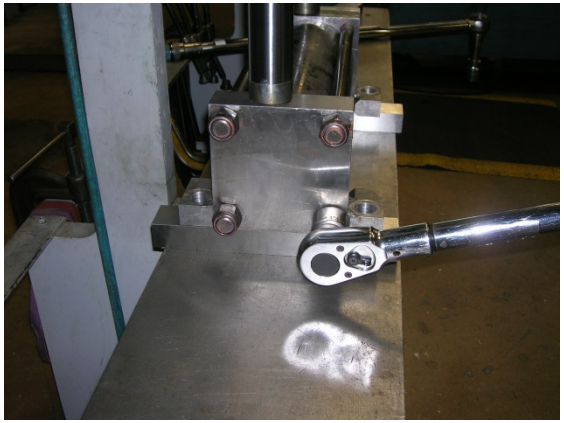
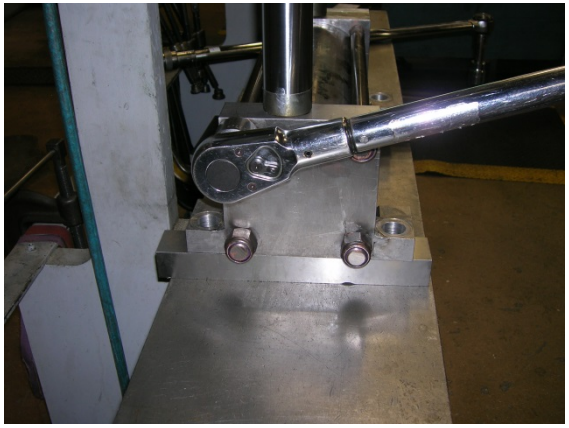
10. Installing Tie Rods
10.4 Clamp Tie Rods



clamp cylinder tie rods with a vice grip

To prevent tie rods from turning

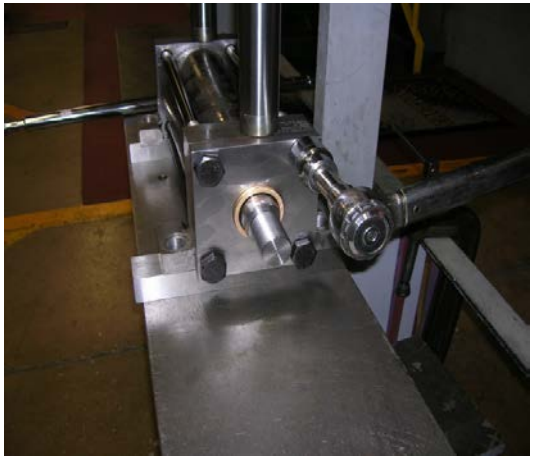
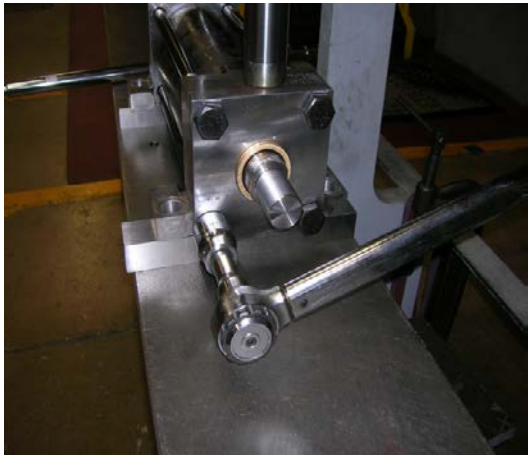
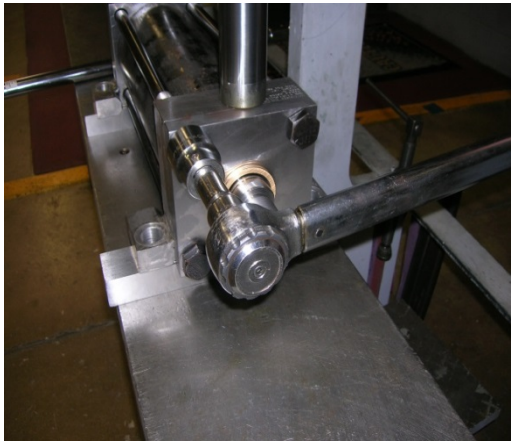
11. Final Torque
11.1 Torque Tie Rods

Torque all tie rod nuts moving diagonally across corners.

Note: Torque Specifications are available in the Milwaukee Cylinder Catalog

11. Final Torque
11.2 Torque Retaining Plate Bolts


Torque all retainer plate bolts moving diagonally across corners.
Assembly is now complete.
Note: Torque Specifications are available in the Milwaukee Cylinder Catalog
Note: Recommend conducting a pressure test and operational test