MTS FSE MODULAR TRAINING

Accumulators

June 8, 2015 rev C

be certain.

Accumulators

- HPU's and HSM's frequently contain accumulators. They can also be found directly attached to an actuator or as a stand alone component.

- An accumulator serves important functions:
  - Stores hydraulic energy.
  - Controls fluctuation of the hydraulic pressure.

- An accumulator in the pressure line supplies short duration instantaneous demand for oil

- An accumulator in the return line damps the pulsing effect caused by "slugs" of fluid being injected into the line as the actuator moves. Movement of hoses or hammering of hard lines is also reduced.

Accumulator Types

- Accumulators are available in many different styles
  - The most common styles used at MTS are the Piston and Bladder type accumulators
  - They perform the same function but are constructed differently

Piston Accumulator

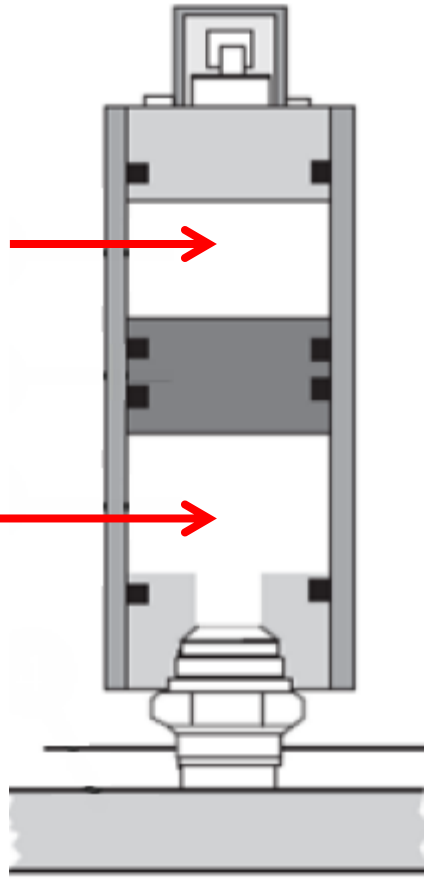
Bladder Accumulator

Accumulator Construction

» Accumulators consist of a nitrogen gas section and an oil section

Gas Section

Oil Section



Accumulator Operation

- Accumulators are found on the HSM which is close to the actuator or directly attached to the actuator on some high performance systems
- Inserting accumulators into the hydraulic lines permits some fluid to be stored under pressure a short distance from the servovalve and actuator.
- When the servovalve opens and line pressure begins to drop, the accumulator in the hydraulic service manifold (HSM) or on the actuator immediately supplies part of the fluid volume and maintains the line pressure.
- When the servovalve closes, the hydraulic power unit (HPU) recharges the accumulator, causing fluid in the lines to remain in motion.

Accumulator Operation

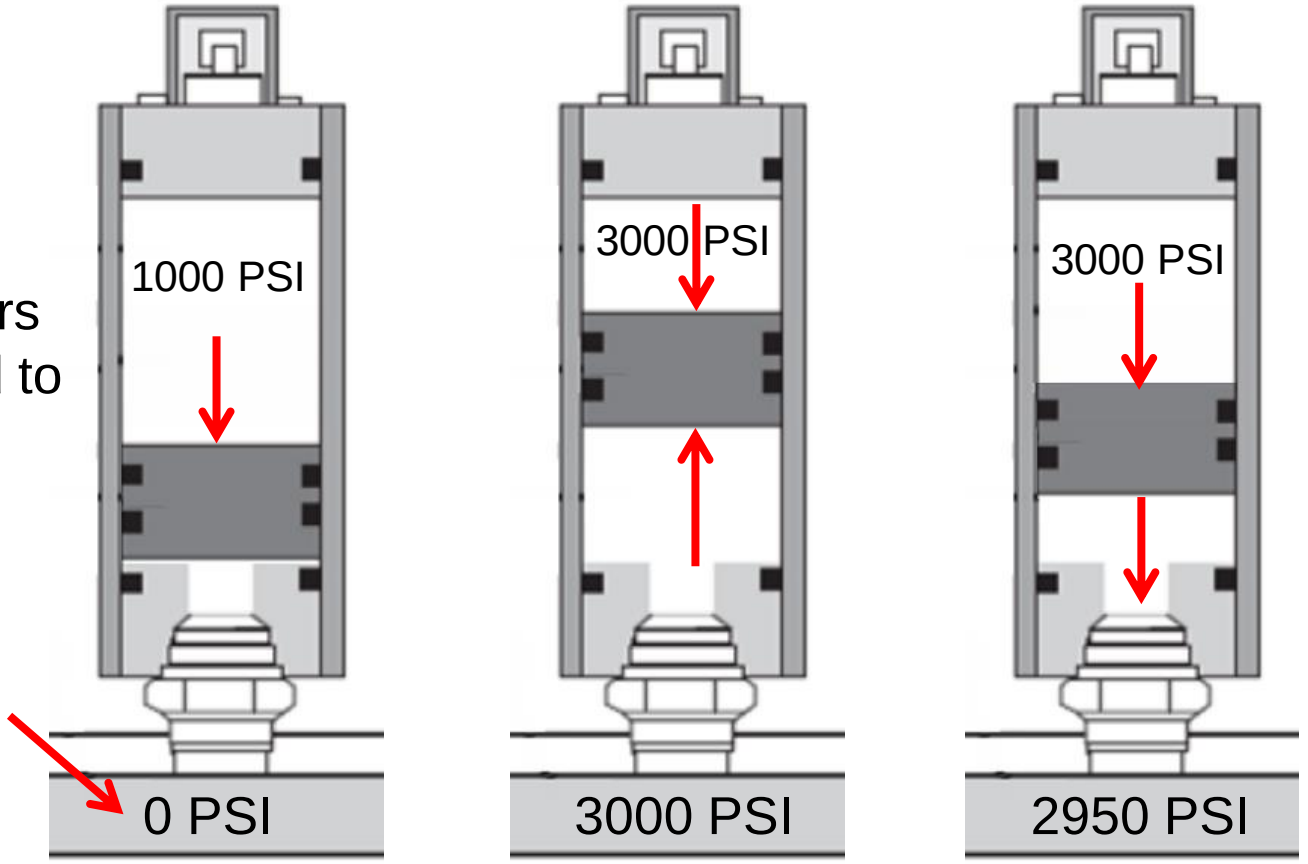
HPU OFF – Piston moves to bottom of travel

HPU ON – Forces piston up compressing gas until pressure equalizes

Pressure drop due to demand – Piston moves down supplying oil

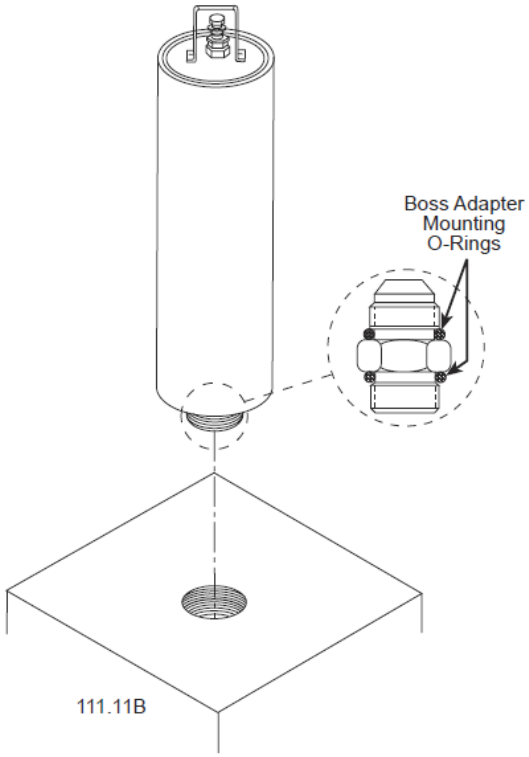
Pressure Accumulators pre-charged to 1000 PSI

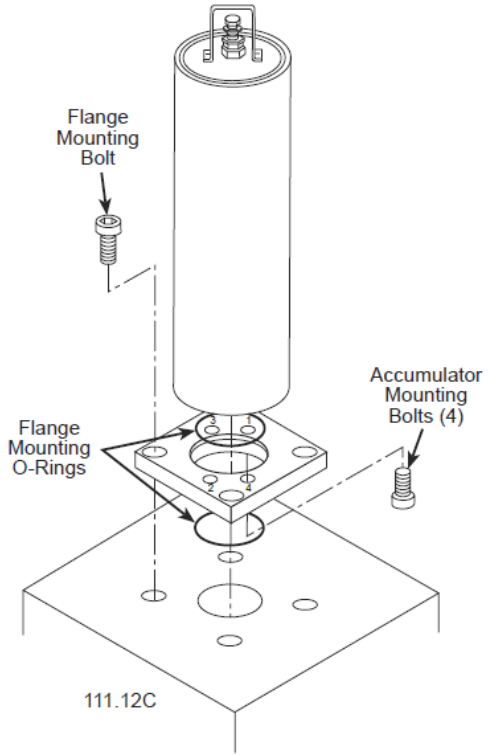
Hydraulic Pressure



Accumulator Mounting

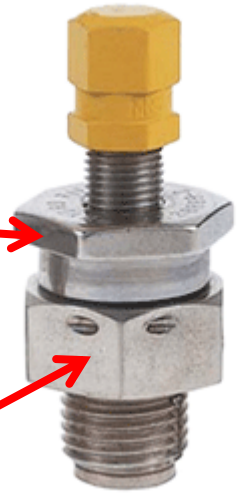
» There are 2 primary mounting methods MTS uses for accumulators
  - Boss fitting where the accumulator is screwed onto the manifold using a boss adapter and using O-Rings for the seal
  - Flange where the accumulator is bolted to the manifold using O-Rings for the seal





Valve Types

- MTS piston accumulators use a poppet style charging valve
  - These operate by tuning a hex nut to open or close the valve and allow Nitrogen in or out of the accumulator



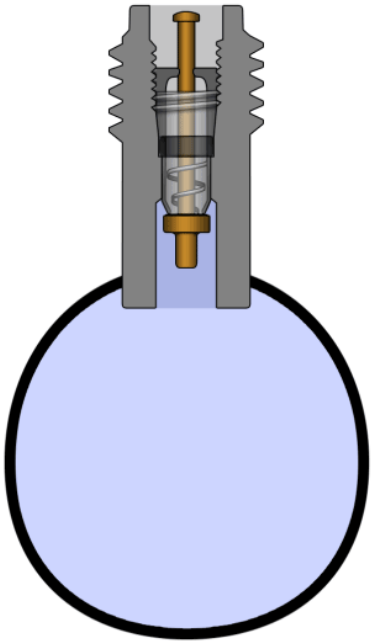
Opening Poppet Valves

- When Opening Poppet Valves, it is IMPORTANT that they be completely opened.
  - Loosen the charge port nut until loose / free-Spinning – Note that valve is **NOT** completely open at this point.
  - Continue to loosen until there is resistance using a wrench.
  - Continue until end-stop is reached.
  - Valve is now completely opened.

- **SAFETY NOTICE**: Accumulators where the valve is not opened completely will still have a charge in the piston and when opened will discharge rapidly and equipment / personal damage is likely.

Valve Types

- Most bladder type accumulators contain a core type charging valve
  - This operates like a tire valve on a car
  - The core in the center must be depressed to allow Nitrogen in or out of the accumulator
  - To open / close valve use T-Handle on top of charge kit chuck valve
  - Use only high pressure valve core. These are not the same as a standard core such as one used on a tire.



Replaceable Valve Core

Accumulator Charging Intervals

- Check the precharge pressure at periodic intervals. The length of time between checks depends on how the system is used.
- Start with one month intervals until you determine that another interval is more appropriate.
- Maintain a log book on the condition of the precharge at each check. Use this data to determine if the time between checks should be increased or decreased and if maintenance is required.
  - Precharge pressure generally OK = Increase interval
  - Precharge pressure generally low = Decrease interval
  - Precharge pressure generally high = Maintenance required

Accumulator Charging

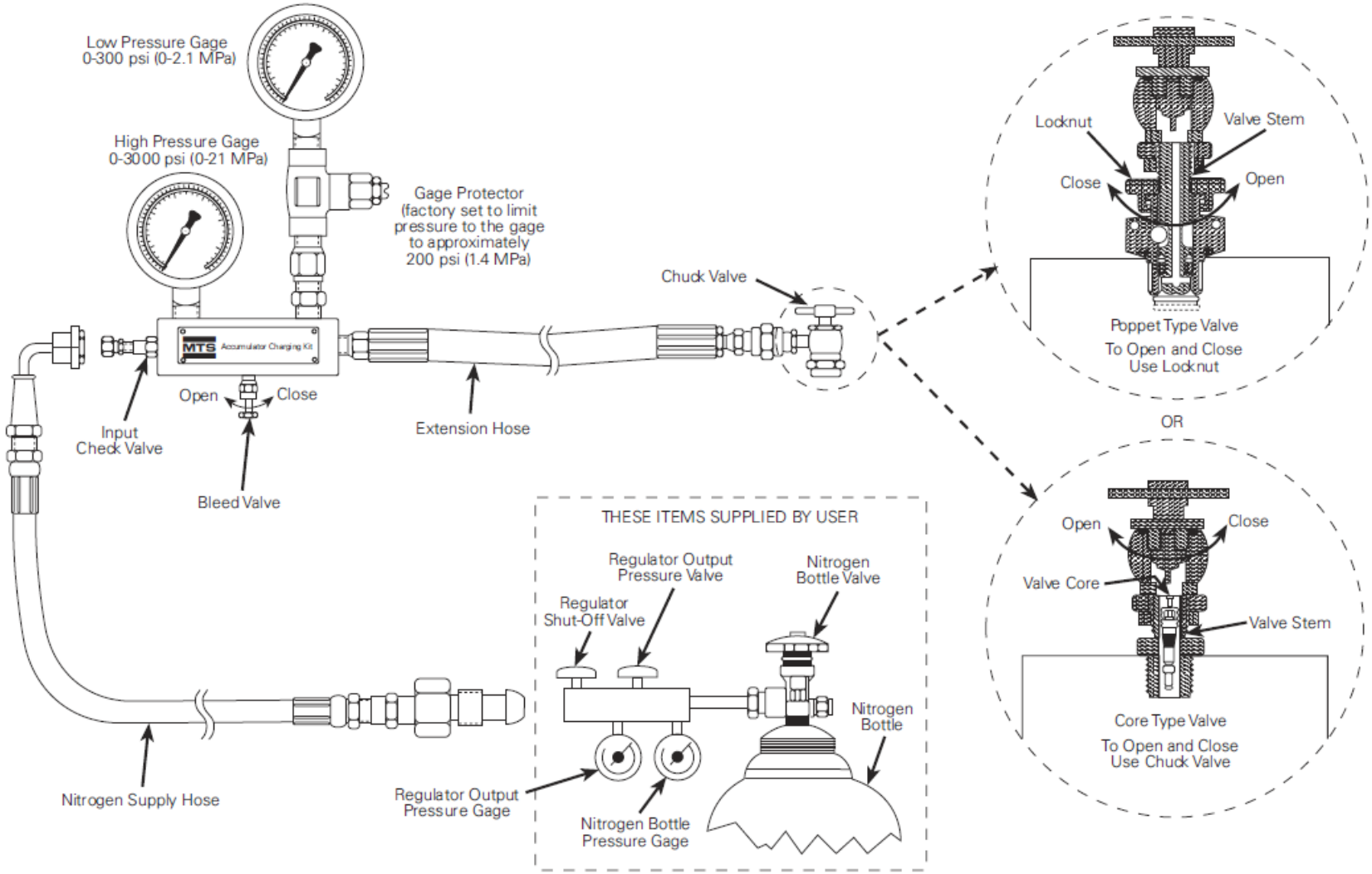
- Standard charging pressures for accumulators. May be changed as required.
  - Pressure = 1000 PSI
  - Pilot Pressure = 1000 PSI
  - Return = 45 PSI
- Oil pressure must be off to charge accumulator
- Charge with accumulator charge kit
  - MTS part number 376986-01

Charging Gas

» ONLY USE DRY NITROGEN GAS

- Use of ANY gas other than dry nitrogen can cause severe injury and/or damage to equipment!

Charging Kit Components



Charge Verification Procedure

- Ensure that system hydraulic pressure has been reduced to zero before proceeding.
- Close the bleed valve on the accumulator charging kit. Remove the protective cover and valve stem cap from the accumulator.
- Connect the charging kit chuck valve to the accumulator valve stem.
- Open the accumulator valve
  - For Poppet style valve use an open-end wrench, turn the locknut counterclockwise on the accumulator valve assembly to open the valve.
  - For core type valves turn the T-Handle on the top of the charging chuck clockwise to open the valve.

Charge Verification Procedure

- Read the pressure on either the high or low accumulator charging kit pressure gage.
- If Pressure is satisfactory close the charging valve
  - turn the locknut clockwise for a poppet style valve
  - Turn T-handle counterclockwise for core style valve
- Open the bleed valve on the accumulator charging kit
- After pressure drops to zero remove the chuck valve from the accumulator
- Replace the valve stem cap and protective cover on the accumulator.

Decrease Charge Pressure

- Follow Charge Verification procedure to attach chuck and open charging valve
- Slowly open the bleed valve on the accumulator charging kit until gas begins to escape. When the pressure reading on the appropriate pressure gage drops to the level required, close the bleed valve.
- Close the charging valve. Open the charge kit bleed valve.
- After pressure drops to zero remove the chuck valve from the accumulator
- Replace the valve stem cap and protective cover on the accumulator.

Increase Charge Pressure

- Follow Charge Verification procedure to attach chuck and open charging valve
- Connect the nitrogen supply hose from the supply bottle pressure regulator output to the input check valve on the charging kit.
- Monitor the pressure gage and adjust the regulator output pressure valve to the required level.
- When the pressure is at the required level close the charging valve.
- Close the regulator valve. Open the charge kit bleed valve.
- After pressure drops to zero remove the chuck valve from the accumulator
- Replace the valve stem cap and protective cover on the accumulator.

Return Line Accumulator

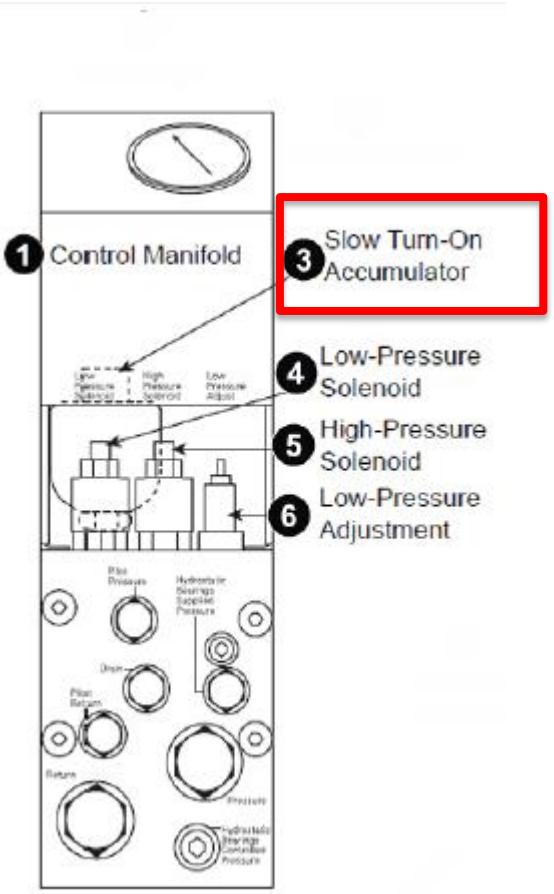
- The oil column in the return line will expand and collapse as the system cycles. This can increase degradation of the oil.
  - This also adds stress to the hoses.
- Proper tuning of the return accumulator can eliminate this.
- If the pre charge is to high or to low, then the accumulator will have limited effect on the system.
- An indicator of a poorly tuned accumulator is audible clicking sound when cycling or the return hose moving with the frequency of the test.

Return Line Tuning

- With hydraulic pressure removed from system, adjust the pre charge to 200 PSI.
- Remove the charging kit from the system.
- Apply high pressure and start the dynamic test.
- Slowly reduce the pre charge until the audible sound is extinguished and then just beginning to be heard again or the hose starts to flex.
- Stop test, and remove the hydraulic pressure.
- Reattach the charging gauge to the system.
- Observe the Pre charge pressure. This the critical pressure of the return line accumulator
- Add 5 PSI to the charge.
- Remove the charging kit.

Special Purpose Accumulator

- Small volume accumulators such as those used in hydraulic service manifolds in the slow turn on circuit cannot be effectively checked.
- Doing so will exhaust a large majority of the nitrogen gas resulting in low charge reading.
- For proper nitrogen charge level of HSM slow turn on accumulator refer to appropriate product manual.



Piston Accumulator – Oil on Gas Side

» Piston-type accumulators may collect hydraulic fluid in the gas section, which then reduces the gas volume of the accumulator.

» The fluid should be purged from the gas side if a pressure check procedure shows one or more of the following:

- A consistent trend of pressure being higher than expected.
- Precharging requires smaller volumes of gas than expected to obtain a desired pressure level.
- Fluid is expelled from a gas valve during gas venting.

Piston Accumulator – Oil on Gas Side

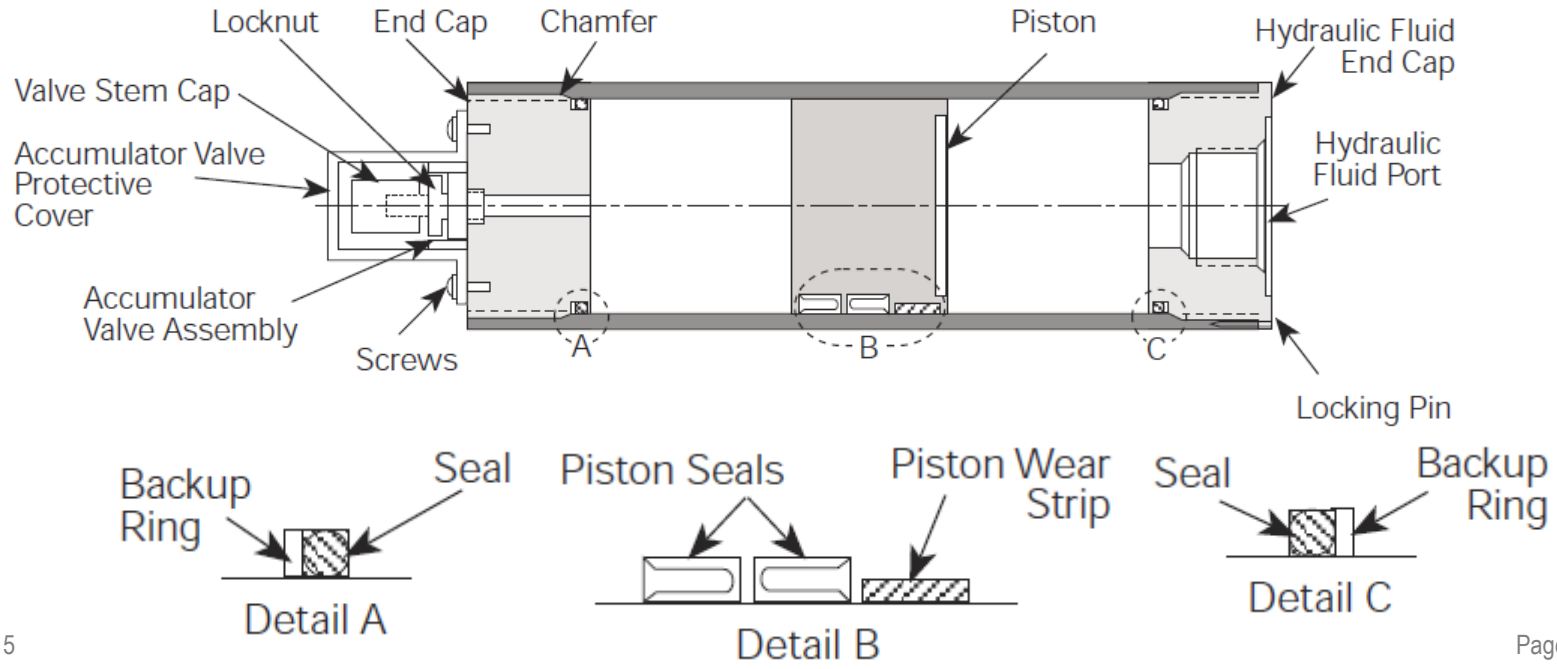
- If the valve stem of the accumulator is facing down, go directly to next step. If the valve stem of the accumulator is facing up or the accumulator is on its side, remove the accumulator and turn it so that the valve stem is facing down.
- Remove the accumulator valve protective cover and the valve stem cap. Securely position the accumulator with the gas valve down.
- Place a suitable container under the valve stem to capture any expelled fluid. Use an open-end wrench and open the locknut on the accumulator valve assembly two or three full turns. Allow gas pressure to reduce to zero and any hydraulic fluid to be expelled.
- Replace the accumulator and precharge the accumulator to the appropriate pressure.

Repair

» NEVER disassemble an accumulator that contains a nitrogen charge
  - Charge must be removed first

Piston Accumulator – Seal Replacement

- The piston contains seals and a wear strip
- Note: Remove only the Nitrogen-side endcap. Oil-side endcap is pinned and non - removable
- If charge is routinely low or there is regularly oil on the gas side the seals may need to be changed
  - See the appropriate product manual for seal replacement



Recommended Tools for Rebuild

- Adjustable Pin Wrench
- 40-80 mm for 2.5 Inch accumulators
- 80-125mm for 4 inch accumulators
- MTS P/N 010-099-317