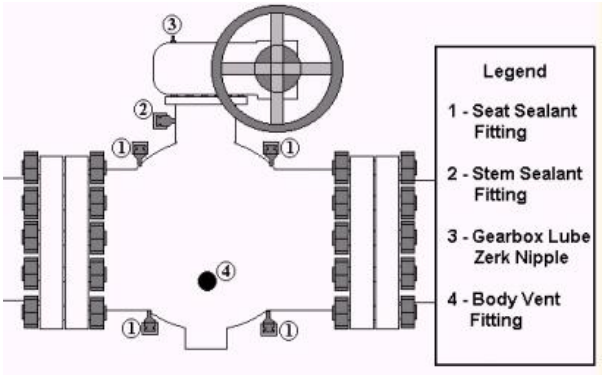
Chapter 13

Welded Body Ball Valve Maintenance

The welded body ball valve is very popular in the oil and gas industry for several reasons:

- Welded body construction (as compared to a bolted body design) is more compact.
- The body draining feature allows the valve maintenance technician to test each seat rings sealing ability with the ball in either the full open or full closed positions. This is accomplished by opening the body vent fitting which de-pressurizes the valve body cavity (inside each seat ring). By learning how to properly use the valve body vent fitting the technician can judge how effective the present maintenance program is and whether or not additional maintenance is necessary.
- Sealant injection fittings access directly to each seat ring. This enables the technician to top-up the quantity of lubricant inside the valves sealant injection system on a periodic basis. Valve cleaner can also be injected into these fittings to flush out the old grease in the valve and to clean critical seal faces on the ball. Heavier sealants are also injected through the sealant injection fittings during an emergency when a critical seal is required.
- Ratcheting seats are unique to the Cameron® welded body ball valve. A cog attached to the valve stem reacts with teeth cut on each seat ring which rotates both seat rings each time the valve is cycled to the closed position. After (24) twenty-four closings each seat ring has rotated 360° degrees. This feature is an advantage to the technician. If an acceptable seal can not be achieved after cleaning and relubricating the valve, rotate the valve a few times. This ensures the seat ring and ball face seal at new positions. If a wire draw is present across the seal face, the cut on the seat ring and ball face would not realign for (24) twenty-four more cycles. The ability to achieve a seal through the use of heavier sealants is significantly increased if the technician can reduce the size of the leak path by 50% by simply cycling the valve.



Fitting Identification

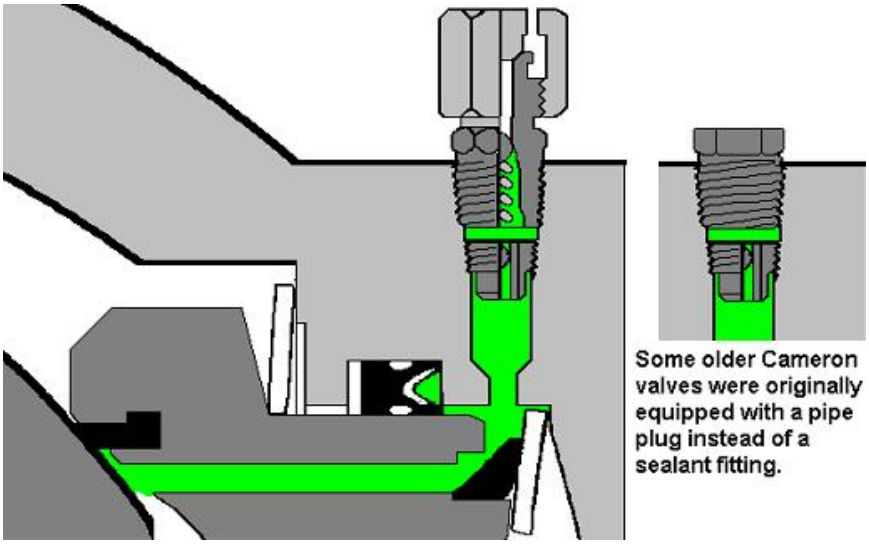
Cameron® has a reputation for manufacturing a high quality valve. The welded body design means the valve must be cut open in order to replace damaged seat rings and balls. This type of repair is very expensive and the valve must be returned to the factory for repair. Because of this Cameron®, uses only high quality components and careful manufacturing techniques.

Routine Maintenance Procedures

Applying a small quantity of fresh lubricant / sealant and cycling the valve periodically can add years to the effective service life of the valve.

When valves leave the factory they are often filled with a light petroleum grease containing inhibitors to prevent corrosion to the internal components of the valve during shipping and storage. Quite often the valve will sit on the ground at the construction site for months or even years before being installed in the pipeline. The valve is then installed and the line hydrostatically tested and pigged to clean the construction materials, line scale and other contaminants from the pipeline system. Most seat and seal face damage has occurred even before product has been introduced to the pipeline.

The proper lubricant is one which is insoluble in the product flowing through the valve. It must be stable over a broad temperature range and resistant to shearing of the gel structure because of the high injection pressures usually required to push fresh lubricant to seat rings.



Sealant System Cross Section

Routine maintenance often consists of topping-up the sealant system with a small quantity of fresh lubricant / sealant. The valves sealant injection system is a system of grooves, channels and riser pipe assemblies through which the lubricant / sealant travels. Each time the valve cycles, a small amount of lubricant / sealant is lost downstream. By keeping the sealant system topped-up at all times, the risk of contaminants finding their way behind the seat ring is greatly reduced. Learn how to properly read the injection gauge on the gun or pump to judge when the sealant system is full. Once filled, the lubricant / sealant will act as a hydraulic medium and force the seat ring hard against the ball. At this point the injection gauge will rise rapidly. Stop pumping and watch how slowly the gauge settles back down. Gauge pressure will eventually equalize with line pressure.

The quantities required to top-up the sealant system vary greatly depending on how often the valve cycles, the product flowing through the valve, temperature and the type of lubricant / sealant selected. Some pipeline companies have deemed a quantity equal to 1/8 of the capacity of the sealant system injected twice annually sufficient for most pipeline block valves in clean natural gas service. Because compressor suction and discharge valves cycle more frequently, they require more maintenance. Compressor discharge valves should see even more maintenance due to the higher operating temperatures.

Proper Cleaning Techniques

When topping-up the sealant system fails to achieve the desired results, rotate the valve a few times so the seat rings are realigned, then top-up again. If the body cavity still will not blow down, it may be time to inject valve cleaner.

The best results are achieved by cycling the valve to the closed position. Make sure the valve is fully closed as the seat ratchets do not engage until the valve is 7/8 closed. The last 1/8 turn usually becomes more difficult as the ratchets engage and the seat rings begin to turn.

When valve is fully closed, begin injecting valve cleaner. Rock the valve on and off the full closed position to ensure the valve cleaner cleans critical seal points evenly. The sealant capacity for Cameron® ball valves is approximately (1 oz.) one ounce per inch of valve size into each seat ring. Remember to include the quantities contained in the riser pipe assembly (generally (2 ozs.) two ounces per foot on each 1/2" I.D. riser). A (10") ten inch valve would require (10 ozs.) ten ounces of cleaner into each seat ring. If the valve were buried (8') eight feet an additional (16 ozs.= 1 pound) sixteen ounces would be required into each riser pipe. When the sealant system becomes completely full with valve cleaner, the injection gauge will begin to drop and will fall more quickly when pumping stops.

Many Cameron® valves have sealant fittings on both sides of each seat ring. In this case inject 1/2 the required quantity into each sealant injection fitting. If buried, remember to add the riser pipe quantities (generally (2ozs.) two ounces per foot on each 1/2" I.D. riser).

Leave the valve cleaner in the valve from (30) thirty minutes to a few hours or even several days on problem valves**.** Remember to rock the valve while continuing to inject additional quantities of valve cleaner to clear obstructed channels inside the valve.

Be patient; the valve cleaner often takes time to clean seal faces thoroughly.

If the sealant fitting or buried inner check valve is plugged from old dried sealant, it may take some time for the valve cleaner to soften the old material. If plugged, the gauge will climb quickly and will not drop off. If this occurs, keep the gauge pressure under 8,000 PSI and come back every few hours and try to push a little more cleaner into the sealant injection fitting. Many hand-held injection guns are capable of injection pressures of up to 15,000 PSI. If too much pressure is applied, the high pressure may blow the slug of sealant and the ball check out of the fitting and into the valve body. If this has occurred, as you attempt to remove the grease gun from the fitting you may be exposed to full line pressure. To reduce the risk of this occurring, install a Leak-Lock on the plugged sealant fitting so that if the ball check in the sealant fitting is lost, you can stop line pressure from escaping with the ball check in the Leak-Lock. Leak-Locks are available for both small (Part number D-LL#2) and giant buttonhead fittings (Part number D-LL#1) A special Cameron® adapter (Part number D-CAM-SO) is available which screws onto the Cameron® small buttonhead with cap fitting and adapts it to a giant buttonhead so you can use your regular grease gun coupler. This will keep line pressure from escaping.

NEVER attempt to remove a sealant injection fitting from a valve which is under pressure.

The sealant channel accesses the seat ring area upstream of the seat insert. This means that the sealant fitting accesses the pipeline upstream of the ball / seat sealing interface. Even if the valve is closed and the valve body vented to atmosphere, there is still pressure under the sealant fitting if there is pressure in the pipeline. Make sure there is no pressure in the pipeline upstream and downstream of the valve before attempting to remove the sealant injection fitting.

DO NOT rely on the inner check valve located under the sealant fitting to hold back line pressure. These small check valves become damaged easily and are seldom reliable.

Adding Fresh Lubricant / Sealant

Once the cleaning function is complete it is necessary to refill the sealant system with the required lubricant / sealant. The same calculations used for injecting valve cleaner are applicable (one ounce per inch (1oz. / in.) of valve size into each seat ring plus riser pipe quantities). When the seat sealant system is full, the injection gauge will climb steadily and drop off more slowly when pumping stops.

Open the valve body vent fitting and de-pressurize the body cavity to judge the results of cleaning and re-lubricating. When working in high-pressure gas service use of ear protection is recommended while doing this procedure. Open the body vent fitting slowly and as the noise pitch drops, continue opening the body vent fitting in small increments. Occasionally a piece of ice or sealant may obstruct the passage in the body vent fitting. ALWAYS open and close the body vent fitting several times before assuming the body cavity has been de-pressurized.

REMEMBER to close the body vent fitting BEFORE cycling the valve.

If cleaning, re-lubricating and cycling the valve have not stopped the leakage, check that the valve stops are clean of dirt, rust, paint or other foreign materials and that the valve is truly open or closed. It should not be necessary to adjust the valve stop adjustment screws found on many gearboxes after the initial setup or when the valve is first installed. When the technician is sure the valve has been cleaned, re-lubricated and the valve stops clean, if leakage is still a problem it is then time to inject a heavier sealant.

Seat Sealing Procedures

With the valve in the full open or full closed position the body vent fitting can be opened and the body cavity of the valve drained. This enables the technician to test each seat rings sealing ability.

If testing with the valve in the open position, inject lubricant / sealant very slowly. If possible leave the body vent fitting open so that the lubricant / sealant is drawn over the damaged seat ring insert.

Sealweld® Services Division offers valve seat leakage testing. Leakage into the valves body cavity is measured using a small turbine gas meter attached to the valves body vent fitting. The turbine gas meter is attached to a hand-held computer which calculates volumes in cubic feet, liters or cubic meters at time intervals of minutes, hours or days. A print-out from the computer provides before and after servicing leakage volumes. We developed this system of calculating valve leakage rates for customers overseas as a method of accurately designing an effective preventive valve maintenance program.

In order to acquire accurate meter readings we have designed a new style of body vent / drain valve which features a threaded vent hole so the meter can be attached with no leakage. The threaded vent hole also allows us to pipe the leakage outside the building so that emergency shut-down equipment is not triggered by escaping gas.

By opening the body vent fitting, the technician exposes himself to the product in the pipeline. This often creates a dangerous situation and extreme caution should be exercised. ALWAYS consult your companies operations manual for safe procedure advice before opening a body vent fitting. If in a building, this will probably trigger emergency shut-down equipment. ALWAYS notify the control room before attempting this procedure, turn off all vehicles and power sources and extinguish any open flames before opening a body vent fitting.

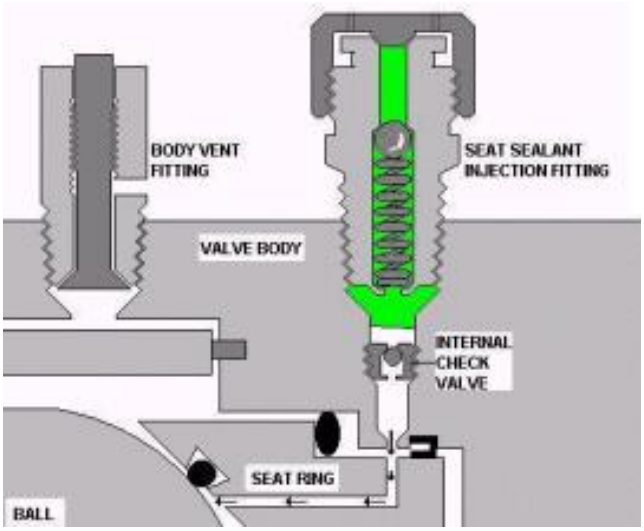
Maintaining a Seal

Achieving and maintaining a reliable seal is often a question of confidence which is only acquired through experience. When a problem leaking valve is found in the system, use this valve to practice your sealing techniques.

A typical situation is one in which the downstream side of the valve is de-pressurized and full line pressure is being held upstream of the closed valve. The valve has been cleaned and re-lubricated, still some leakage is still being realized through the open body vent fitting. At this point a heavier sealant can be injected.

Cameron® valves are trunnion-mounted or in other words the ball is in a fixed position and the spring loaded seat rings are allowed to float. In this application, the upstream seat ring is being pushed hard against the ball by line pressure. With the body vent open, the downstream seat ring is being pushed against the ball by the force of the seat ring springs.

The lubricant / sealant must be displaced before the heavier sealant fills the sealant system. The same calculations used for injecting valve cleaner are applicable (one (1 oz.) ounce per inch of valve size into each seat ring plus riser pipe quantities). Concentrate sealing efforts on the upstream seat ring at first. Inject sufficient quantities of sealant slowly so that the PTFE particles are distributed evenly. When the sealant reaches the seat ring, open the body vent fitting so that the PTFE particles are drawn over the damaged seat ring insert. Listen, as the leak diminishes stop pumping. The leak should decrease until it is a mere whisper.



Seat Ring Cross Section

Quite often a small amount of leakage will have to be tolerated. Efforts are now underway to use gas meters connected to the body vent fitting to arrive at some hard numbers as to how much leakage can be tolerated while keeping it safe to work downstream of the valve. At the present time the industry is dependent on the experience of the valve maintenance technician and his judgment as to whether or not it is safe to work downstream. When an acceptable seal is achieved, wait (10 – 20) ten to twenty minutes to make sure the seal is going to hold. The technician may wish to leave the body vent fitting open so that any upstream seat ring leakage is vented to atmosphere instead of downstream.

ALWAYS notify fellow workers of the leak and flag the area where the product is being vented.

Where possible, a blind flange should be installed downstream of the valve to ensure no product escapes into the section of pipeline being serviced.

More severely worn valves can be successfully sealed by using even heavier sealing compounds. These compounds often contain increased quantities of PTFE in various sized particles. The object being to build a small dam of PTFE particles which will stop the leakage. One of the consequences of using the extra heavy and double extra heavy sealants is the risk of plugging the sealant injection fitting or buried inner check valve with PTFE particles. The patented FLOW WOLF® sealant injection fitting and in-line check valve have been designed so they will not plug, even with these heavier sealing compounds. These fittings have to be installed before the valves are pressurized. Heavier sealants should be displaced with a lighter sealant or lubricant / sealant after the critical seal is no longer required to avoid plugging problems associated with the old style fittings.

When piping is used to vent the body vent fitting or to equalize body pressure, it is important to be sure that pressure can not enter the valve body through these sources if workers downstream are depending on this

valve to hold. It is important to be sure that all the small valves on the piping system DO NOT leak or pressure could enter the valve body. On many designs the downstream seat is self relieving. This is a built-in safety feature so that the valve body will not rupture if over-pressurized (usually caused by the thermal expansion of liquids trapped in the valve body). This can also present dangerous problems for workers downstream of the leaking valve. If pressure is introduced into the body cavity, the springs holding the downstream seat will lift off at approximately 200 PSI in excess of line pressure, sending the leakage downstream. As long as the open body vent fitting can vent all the leakage into the body cavity, the downstream seat should remain intact.

Valves which require sealant in order to achieve an acceptable seal must be topped-up each time a seal is required. Once the valve has been cycled, the seal will be lost until sealant is re-injected and the seat testing procedure is repeated.

Stem Lubrication

The stem seals on a Cameron® valve are designed for many years of service with little or no maintenance. The stem area is sealed top and bottom with rigid graphite / PTFE type seal rings. Only small quantities of lubricant / sealant or sealant, if any, are required on a periodic basis.

Attach the gun onto the stem seal fitting and watch the injection gauge very closely. DO NOT EXCEED 2,000 or 3,000 PSI in the stem area. Usually (1 – 2) one or two strokes of a manual gun is all that is required. Stop pumping and watch how slowly the gauge falls. If both upper and lower seals are holding, the gauge should not drop at all. If the gauge drops slowly, give it another stroke of sealant and watch the results. If the gauge continues to fall, look at the top of the stem to see if sealant is present. If sealant is escaping from the top of the stem, tighten the cap screws that hold the top seal ring in place. If sealant continues to escape, the top stem seal ring should be replaced during the next shut-down. If sealant is not present and the gauge continues to fall, you may suspect the lower seal is damaged. If this is the case, slowly inject a heavier sealing compound until the leak reaches acceptable limits.

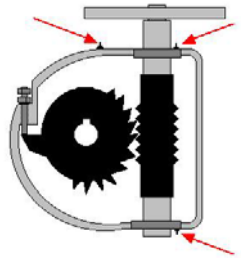
ALWAYS consult the proper Cameron® maintenance manual before attempting any mechanical repairs.

Gearbox Maintenance

Many Cameron® valves come equipped with manual gearboxes. Keep the gearbox filled with a high quality waterproof lubricant such as Sealweld® Eterna-Lube 1000. Replace damaged seals and O-rings as soon as they are discovered to prevent water from entering the gearbox and causing corrosion.

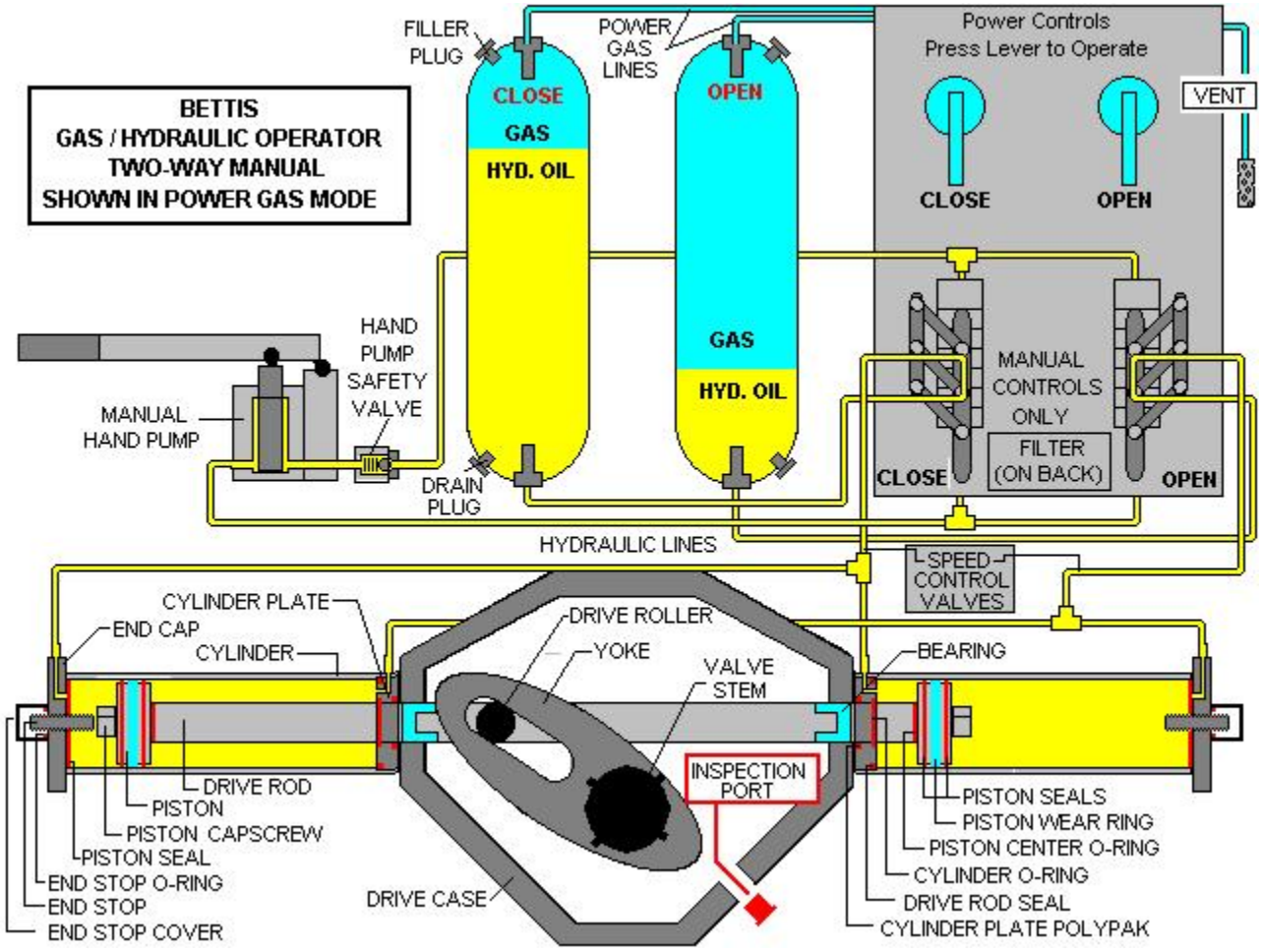
Keep the gearbox lubricant topped-up by injecting through the Zerk nipples located on the top, side or back of the gearbox. Be careful not to over-fill the gearbox or the weather seals can be blown out.

If high torque is twisting the gearbox and seals are failing to hold the gearbox oil or lubricant, Sealweld® D-1014 lubricant / sealant has been used successfully as a year-round gearbox lubricant / sealant.



Manual Gearbox

Instructions for Manual Operation of the Bettis® Rotary Gas / Hydraulic Actuator with Mode Selector



Bettis® Gas / Hydraulic Operator, Two Way Manual, Shown In Power Gas Mode

Switch To "Manual" position to lock out remote switching signal before proceeding with local manual operation

With Power Gas:

- Press upper left relay handle and hold to close line valve
- Press upper right relay handle and hold to open line valve

With Hand-pump (No Power Gas):

- Turn lower left valve handle and operate hand-pump to close line valve. Return valve handle to vertical
- Turn lower right valve handle and operate hand-pump to close line valve. Return valve handle to vertical

To Disarm Operator:

- Shut off power gas supply
- Press either upper relay handle to partway to bleed power gas
- Switch to Auto position and ensure lower valves handles vertical and gas supply valve open to resume unattended automatic operation

General Care and Appearance

Many companies like to keep their valves painted and looking new. Advise paint crews to tape over the nameplate before painting so that important information is readily available. Plastic caps are available from Sealweld® for giant buttonhead fitting protection. Keep paint, dirt and grime away from these important fittings. Tape up body vent fittings and oil the threads so they continue to operate reliably. Keep paint away from gearbox seals and exposed valve stems.

Clean up excess valve cleaner and lubricant / sealant from sealant fittings and valve bodies. Remove all rubbish from the valve site.

Report any external leakage to your supervisor immediately.

If valves are to be wrapped or insulated, extensions to facilitate the lubricant / sealant fittings may be required. These extensions must be made from XH (schedule 80) pipe of a suitable grade depending on the service the valve is in. Make sure all connections are NPT. Many contractors have accidentally installed NPS (non-tapered) fittings by mistake.

Before Moving to the Next Valve

Return the valve to its original position**.** DO NOT jam the handle or gearbox back it slightly off the full open or full closed position so there is a little play in the gearbox.

Replace the caps onto the sealant injection fittings and stem sealant fitting then tighten firmly with a small wrench. Make sure the body vent fitting is closed before cycling the valve or introducing pressure to the system.

Mark your maintenance chart accordingly. If problems are discovered, mark the valve number and location for more attention during the next shut-down. If serious problems are discovered, note all the nameplate information (including the country where the valve was manufactured) and contact the manufacturer for additional information.

In Summary

Whenever servicing valves, rock the valve off its full open or full closed position (only when safe to do so) to keep the valve from being seized in one position. Rotate the valve fully closed at least once a year to move the seat rings to a new position.

The pressure MUST BE equalized on both sides of large diameter valves before they can be cycled.

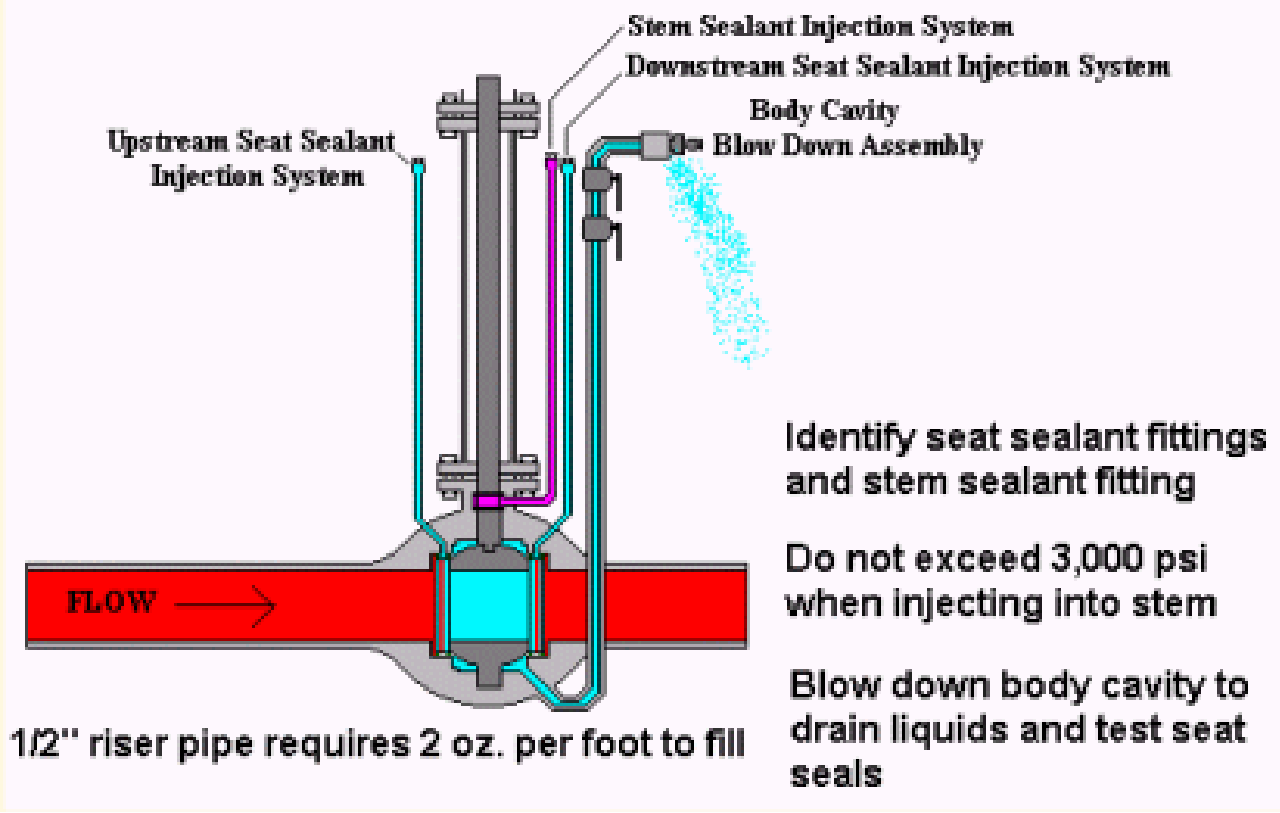
NEVER remove a sealant injection fitting or stem seal fitting from a pressurized system. The sealant injection fittings enter upstream of the seat rings. With the valve closed and the valve body de-pressurized, there is still full line pressure immediately under the check valve in the sealant injection fitting. DO NOT rely on the buried inner check valve to hold if the sealant injection fitting becomes damaged. Wait for the pipeline system to become de-pressurized before attempting to replace fittings. Beware of trapped pressure inside valve bodies, valve stems and sealant systems especially riser pipe assemblies. Remember**,** threads do not always weep or leak like they should in the presence of sealants.

If valve leakage continues to be a problem, check the valve stops to ensure that the valve is fully open or closed. Occasionally dirt, grime and rust can build-up on valve stops and keep them from closing or opening fully. Cameron® normally provides plugs on the riser assembly which can be removed to visually examine the stops for build-up. If the riser is filled with oil or anti-freeze, this will need to be caught as the plug is removed.

Learn the capacities for topping-up and completely replacing the lubricant / sealant in the valves sealant system, including riser assemblies. DO NOT OVER-LUBRICATE**.** If topping-up does not accomplish the desired results, it may be time to clean the valve or switch to heavier sealant.

Cameron® uses a unique sealant injection fitting which is uncommon to industry standards. These small capped fittings should be replaced with Sealweld® fitting (Part number F-SC1/4BH) capped sealant injection fitting with giant buttonhead or a FLOW WOLF® (Part number F-FW1/2BH) with a reducing adapter to 1/4" NPT the next time the system is down and all pressure removed. When ordering new valves from Cameron®, insist on Sealweld® FLOW WOLF® fitting (Part number F-FW1/2BH) and in-line check valve be installed at the factory.

Older Cameron® valves have 1/4" NPT plugs screwed into the valve body where the sealant fittings should be. There is usually a buried inner check valve located under the plug. DO NOT remove the plug if there is pressure inner check or product in the pipeline. Wait until the pressure can be taken off the pipeline and remove the plug carefully. Install a new fitting instead of the 1/4" plug (Part number F-FW1/4BH-SS). Begin by injecting valve cleaner very slowly. Quite often the inner check is plugged and it may take some time to open a passage to the seat ring.



Buried Ball Valve

ALWAYS consult the appropriate Cameron® manual for advice on repair or parts information. Copies of most manuals are available from Sealweld® Services ValvePro® Reference Library at no charge.

Neglect is the principal cause of valve leakage. Once a valve is put into service a maintenance program should be started. Remember to keep topping-up the valves at regular intervals and inject valve cleaner whenever the valve will not seal or becomes hard to turn. A small amount of routine maintenance can keep ball valves operating reliably for years and even decades.