Chapter 14

Bolted Body Ball Valve Maintenance

There are many manufacturers of bolted body ball valves and many different styles and designs. As far as the valve maintenance technician is concerned, there are two basic designs which require periodic maintenance. The two-piece and three-piece bolted body ball valve manufacturers generally do not provide seat sealant injection systems except in valves larger than 4" (unless the valves are custom ordered).

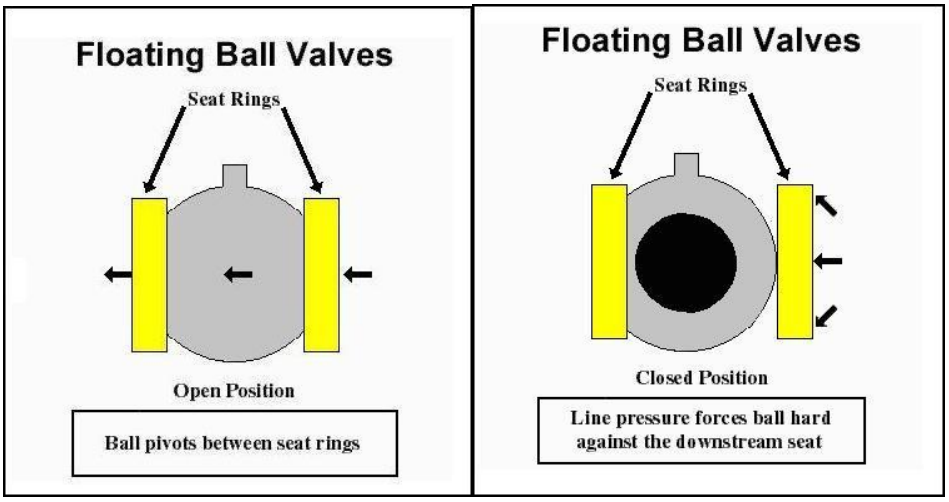
The two-piece body is commonly found on small diameter valves (under 6" six inch) although some of the early designs were made considerably larger. In other words, the ball is secured at the top with no bottom trunnion.

NOTICE that there are no springs associated with the seat rings. In this design the seat rings are in a fixed position, and the ball is allowed to float.

Two-Piece Bolted Body Ball Valves

In order to seal this type of valve, first cycle the valve to the closed position. The line pressure will push the ball hard against the downstream seat ring. Because the upstream seat ring and body cavity are exposed to the upstream line pressure, there is no provision to bleed the valve body cavity to test the valve seat ring seal integrity.

Some two-piece bolted body ball valves have either a trunnion mounted ball or a floating ball design. Obtaining a seal can be somewhat tricky with the floating ball style. In cases where there are (2) two sealant injection fittings and they appear to be accessing each seat ring, proceed as follows. The seal is obtained by line pressure forcing the ball against the downstream seat ring. Where the sealant actually enters the seat ring becomes very important (see illustration). Assuming the sealant enters upstream of the PTFE insert as with a conventional ball valve, any sealant injected into the downstream seat ring would be lost downstream of the seal face and would be ineffective. When injecting sealant into the upstream seat ring we can assume the ball has lifted away from the upstream seat ring as it is forced hard against the downstream seat ring. In order for the sealant to be effective, it MUST travel around the circumference of the ball in order to find the downstream seal face. It may take a considerable quantity of sealant before any results are obtained, but a seal should eventually be achieved.



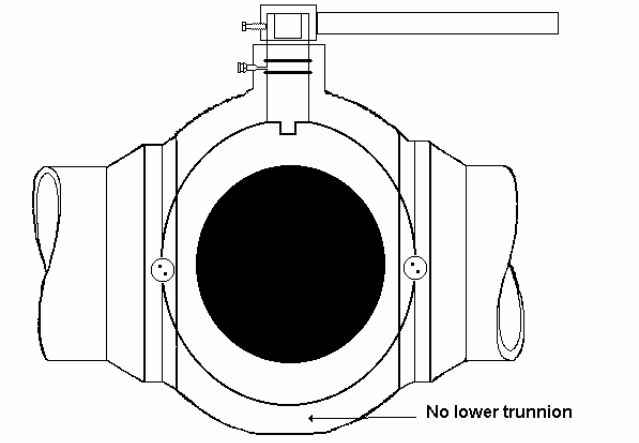
Floating Ball Valves

In cases where there is just one sealant injection fitting and it appears to be accessing the body cavity, the seal will be achieved in much the same way. In this instance less sealant will be required because the injection point is closer to the downstream seal face.

If the valve continues to leak, it may be because the valve seal faces require cleaning. Inject the valve cleaner into the sealant fittings. Substantially more will be required upstream of the seal face. The best results are achieved by allowing the cleaner to soak for a few hours to overnight in problem valves. Again, considerable quantities will be required in order to have any effect. Displace the cleaner by cycling the valve a few times. The cleaner will be washed downstream. The cycling action should scrape the softened build-up away from the seal face area. Follow up by injecting your regular lubricant / sealant into the upstream fitting. If the regular sealant is not effective, cycle the valve a few times, then inject a heavier sealing compound such as Sealweld® # 5050 Ball Valve Sealant.

Sealweld® # 5050 Ball Valve Sealant is very effective at obtaining a reliable seal when the regular lubricant / sealant is no longer effective. If the valve leak does not diminish after injecting # 5050 it may be that the seat ring is not aligning against the ball properly. This is a more common occurrence on valves with O-rings as opposed to valves with ridged PTFE or Nylon seals. Occasionally one hard blow with a rubber mallet against the top of the upstream flange will cause the seal ring to realign properly.

It can be confusing when there is equal pressure both upstream and downstream of the valve being serviced. When the valve is closed and the body cavity is vented, then both seat rings act the same as the upstream seat ring.



Line Pressure Pushes The Ball Onto The Downstream Seat Ring

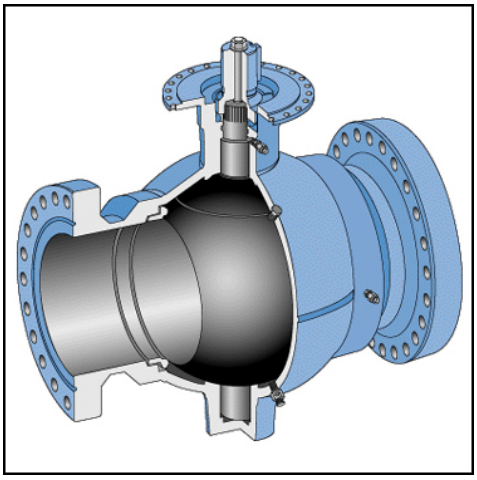
It is possible to lock-up the valve after venting the body cavity. This is caused by the line pressure pushing both seat rings hard against the ball. This is a more common problem on high-pressure or large diameter valves. To unlock the seat rings, equalize the pressure in the body cavity by introducing line pressure into the body cavity through an auxiliary inlet. It is possible to jack the seats off the ball by injecting grease into the body cavity. It will take a substantial quantity because the hole in the ball must be filled as well.

***NOTE**: Be very careful not to over-pressure the body cavity as it could rupture the body casting.*

Maintenance Instructions For the Grove B-5 Ball Valve

Introduction to Ball Valves in Natural Gas Pipelines

BEFORE commencing work on any valve that is under pressure obtain the required **"Hot Work" permit** from the control room supervisor or similar authority.



Cross Section of Grove B-5 Ball Valve

Find out the nature of the product in the pipeline, does it contain hydrogen sulfide gas or other toxic components? Are you working in a confined space, is emergency breathing equipment required? What is the pressure in the pipeline? Do you have the authority to interrupt flow when cycling the valve to the closed position? Who is working downstream, do you have permission to open valves that are normally closed? What other workers are in the immediate area, are they aware that you may be releasing gas to atmosphere, is there a spark hazard from the other workers activities? Ask these specific questions and write down the response.

Organize a **"Tail Gate" Safety Meeting** with your fellow workers to discuss the job, the objectives, safety concerns and emergency response activities. Discuss the use of hand signals so that communication can continue while the venting procedure is in progress. Determine the direction of the prevailing wind in relation to gas venting activities.

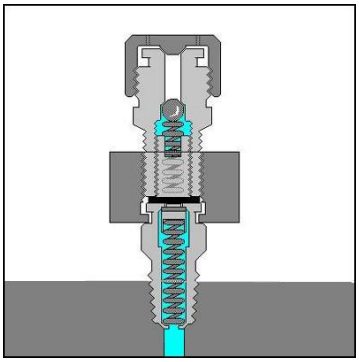
On Arrival at the Valve Site

NOTE: A sealant injection fitting is normally installed in conjunction with an opposed U-cup type stem seal. A Grove vent plug or slotted plug is normally installed in conjunction with dual O-ring stem seal configuration.

1) Identify the valves to be serviced.
2) Record the nameplate information from the manufacturers nameplate on the side of the valve and power operator in the valve report.
3) Locate and identify the different external fittings on the valve:
   a) Stem sealant fitting, Grove vent plug or slotted plug
   b) Seat sealant injection fittings
   c) Giant buttonhead without steel cap
   d) Giant buttonhead, with threaded steel cap (metric or American Standard)
   e) Body vent fitting
      i) with Allen head screw
      ii) bolt head type
      iii) small diameter ball or plug valve
   f) Pressure relief valve - at or near the top (stem end) of the valve. In natural gas service the relief valve may be replaced with a threaded pipe plug. Replace only with written authorization from your Engineering Department and only if safe to do so.
   g) Threaded plugs at different locations
4) Make a sketch of the valve layout at the valve site, number each valve. Make notations of the direction of gas flow to orient yourself to upstream and downstream valves and seats. Make a notation of the compass directions (define which direction is north).

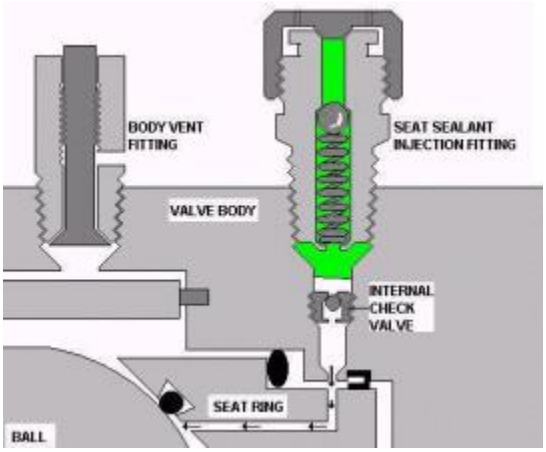
Routine Maintenance Procedures

If the seat sealant injection fitting is leaking gas to atmosphere, or before injecting valve cleaner, attach a Sealweld® Leak-Lock device to the leaking buttonhead fitting. Should the original check valve and / or internal check valve fail or leak, this adapter will stop any leakage to atmosphere and provide an auxiliary check valve device.



Flow Wolf Leak – Lock #1

Inject a small quantity of synthetic valve lubricant sealant such as Sealweld® Total-Lube # 911 or Sealweld® Equa-Lube Eighty into the seat sealant injection fittings with a high-pressure sealant injection pump.



Cross Section of Seat Sealant Injection System

Watch the high-pressure gauge on the sealant pump very closely. Normally the gauge will climb steadily as pumping continues. Keep injection pressures below 6,000 PSI. Stop pumping (between strokes if using manual injection pumps) and watch the needle on the gauge drop. The needle should drop slowly. If the gauge drops rapidly, this may be an indication that the seat sealant system is empty or low of sealant. Inject additional sealant and continue watching the gauge.

If the seat sealant system or sealant fitting is plugged, the gauge will climb rapidly and not drop off when pumping stops. If the viscous sealant is cold, it will not flow rapidly, be patient and watch the needle closely. If plugging is suspected, discontinue injecting sealant and switch to valve cleaner to clear the obstruction from the seat sealant system.

When the seat sealant system is full, the gauge will climb rapidly and drop very slowly when pumping stops.

Before cycling any valve - ALWAYS request permission from your supervisor, maintenance department and pipeline operations department. DO NOT cycle the valve while injecting cleaner or sealant. Stop pumping and relieve sealant pressure before cycling the valve.

Lubricate the bearings in the gear-set before cycling valve. Use a low pressure grease gun and inject a small quantity of Sealweld® Eterna-Lube 1000 anti-seize compound through the grease nipples at various locations on the gear-set.

Cycle the Valve

It is recommended to periodically cycle (rotate from closed to open or vise versa) every valve to keep it operating effectively. Verify with a supervisor that it is safe to do so.

Cycle the valve several times to spread the sealant around the seal face area. If the valve can not be fully closed (or opened) because of operational considerations, request permission to cycle the valve at least thirty 30° degrees (1/3 closed) and back to the full open (or closed) position.

Before opening the body vent fitting make sure the procedure is approved by supervisors. Inspect the work site, take notice of wind direction. Move all ignition sources upwind of the work site (welders, trucks, cars and other vehicles). Extinguish all sources of ignition, no open flames or cigarettes.

Wear good quality leather gloves as the escaping gas can cut skin quite easily. ALWAYS wear eye protection (goggles or safety glasses) and ear protection (ear plugs or ear muffs).

Notify your fellow workers that venting is about to begin. Wait for all workers get to a safe area with appropriate safety equipment and to indicate proceed by showing the thumbs up hand sign.

Draining the Body Cavity

Water (hydrates), compressor oil, gas condensate, and solid residue may collect in the body cavity from time to time.

It is recommended to open the body vent / drain fitting to bleed out these contaminants on a regular (annual) basis.

Draining the body cavity may take from several seconds to several minutes depending on the valve size and vent hole size in the body vent fitting. For large diameter valves a full port ball valve or plug valve is recommended or more rapid depressurization.

Keep in mind that the Grove B-5 valve is designed with a hole drilled through the top of the ball. This means that the ball must be in the fully closed position in order to drain the body cavity. If the body vent fitting is opened with the ball in the open position, high-pressure gas will escape to atmosphere from the pipeline through the 1/4" hole drilled through the top of the ball.

ATTENTION! - If hydrates are present in the gas, the body vent fitting or riser assembly may freeze off during high-pressure gas venting procedures. This may confuse the technician into mistakenly thinking the valve body has been completely de-pressurized. ALWAYS work the closing mechanism in the body vent fitting open and closed repeatedly, with zero leakage, before assuming the body cavity has been de-pressurized. Ice blockages may take time to thaw before a passage is re-opened. Work slowly and patiently to be sure the valve body is truly de-pressurized before disassembling any blow-down assembly components.

Drain the liquids into a portable scrubber or similar vented container or drum to avoid releasing these materials into the environment**.** Dispose of materials collected in a responsible manner.

Testing the Seat Seals

The internal sealing ability of the valve can be tested by cycling the valve to the closed position and opening the body vent / drain fitting.

This will usually take from several seconds to several minutes. As gas pressure drops the sound or pitch will also fall. If the seals are perfect, the body cavity will vent to (0 PSI) zero pressure and (0 CFM) zero gas leakage. If the valve has been in service for a number of years, a perfect seal may not be achievable. If the leak is small and steady, a small leak may be tolerated in certain situations.

Manual Seat Testing Methods

Be very careful and **always** wear good quality leather gloves. If the gas leakage is excessive you will not be able to hold your hand over the vent hole in the body vent / drain valve. Use common sense, if gas pressure is excessive do not place your hand into the gas stream. Escaping high-pressure gas will freeze the moisture in the surrounding air into tiny ice slivers that can pierce your skin causing great pain and discomfort.

A simple yet effective test is to place your gloved hand firmly over the open body vent fitting and stop all gas from escaping. Use only a reasonable amount of force when stopping gas flow, do not wrap your fingers around the body vent fitting. Now time the build-up of pressure by counting the seconds required before accumulated pressure forces your hand away from the vent hole.

If you can count to ten before your hand is pushed away, this is a very small leak, approximately 1 cubic foot per minute. If you can count to one before your hand is pushed away, this is a leak of approximately 10 cubic feet per minute.

Leakage rates below (30) thirty CFM are acceptable in many situations depending on the application. Use a gas measuring or metering devise to verify leakage rates that are close to the maximum allowable leak rate.

Sealing Leaking Valve Seats

Valve seat leakage may be due to a number of factors:

- The valve stops may be out of alignment. Inspect the valve stops and make sure the valve is fully closed. Misalignment by more than two or three (2 – 3°) degrees may expose the bore hole through the ball to the pipeline pressure resulting in continuous leakage.

Remember…it's a ninety 90° degree rotation from open-to-closed.

- Old sealant and other pipeline debris may have built-up contaminants in the seal face area.
- This build-up could prevent proper contact of the seal face between the ball and seat ring, resulting in seat leakage.
- The ball, seat ring or seal O-ring (elastomer) may be scratched, scared or otherwise physically damaged.

Troubleshooting Tips for Valve Leakage

The **first step** should be to visually examine the valve stops or valve position indicator. Notice the position of the indicator, it should be exactly ninety 90° degrees perpendicular to the orientation of the pipeline. If you are not sure if the valve is fully closed, loosen the lock nut on the valve position set screw and back off the set screw. ALWAYS mark the current position of the indicator then take the valve beyond its normal closed position.

Open the body vent fitting or leave the body vent fitting open when performing this procedure. Listen for the sound of escaping gas to increase, then decrease as the correct closed position is located.

When the leak rate is at its smallest, lock the valve stop adjusting screw nuts in position.

If the valve continues to leak at this point, inject a small quantity of sealant into the sealant injection fittings, one seat ring at a time.

The leakage could be caused by not having a sufficient quantity of sealant in the seat ring. A good rule of thumb is (1 oz.= 28 grams) one ounce of sealant per inch of valve size per seat ring. In other words: a (16") sixteen inch diameter valve would require approximately (16 ozs.= 1 pound) sixteen ounces of sealant into each seat ring to fill from empty. If the valve is buried, add (2 ozs.) two ounces of sealant per foot of 1/2" diameter riser pipe. Depending on the number of sealant risers and the design of the riser assembly, this can vary the quantity of sealant required.

Inject sealant slowly, it must pass through a series of machined grooves and narrow passages around the circumference of the seat ring before reaching the seal face. Listen for the leak rate to slow down as sealant reaches the leak point. This may help identify which side of the valve is damaged.

If injecting additional sealant is not successful it may be necessary to clean the seal face area.

The inside of the pipeline may be contaminated by left over construction debris such as welding slag, sand, dirt and sand blasting materials. Hydrostatic testing operations may introduce dirty water, sand and small stones into the pipeline. During the installation of actuators, and during hydrostatic testing operations the valves are cycled. Any dry contaminants will scratch and scar the sealing surfaces causing tiny leak paths.

Solid contaminants may become lodged in the small space at the back of the seat ring or inside the seat ring through the sealant passages. These contaminants can inhibit proper seat travel and even wedge the seat ring in an unusual position so that the seat insert is not making proper contact with the ball.

The valve seats could have a varnish-like build-up caused by leaking oil from turbine / compressor seals or old dried valve grease or sealant. Sealweld® Valve Cleaner Plus has been specifically designed to soften the debris and varnish-like build-up that can occur inside natural gas pipeline valves.

Inject valve cleaner in sufficient quantity to displace the old sealant inside the seat sealant system (one (1 oz.) ounce per inch of valve size per seat ring). Allow the valve cleaner to soak inside the valve from one hour to

overnight if possible. Cycle the valve at least three (3x) times to distribute the cleaner around the seal face area. Top-up repeatedly to push the softened contaminants out of the tiny sealant passages and into the pipeline.

After soaking with valve cleaner, open the body blow down fitting and observe if the leak as diminished or increased. If the leak was caused by a build-up of varnish, the leak may be completely eliminated by cleaning. If the leak was caused by scars to the seating surfaces, the leak rate may increase as a result of cleaning.

Replace the valve cleaner by injecting fresh lubricant / sealant such as Sealweld® Total-Lube # 911. Inject the same quantity of sealant as valve cleaner (one (1 oz.) ounce per inch of valve size per seat ring plus riser pipe quantities). Cycle the valve at least (3x) three times to distribute the sealant around the seal face area. Inject very slowly, **do not** exceed 6,000 PSI injection pressure. It will take more time for the viscous sealant to fill the sealant passages.

If the damage is due to very small scars or seal face O-ring damage, Total-Lube # 911 will provide an effective seal for small scars to .010" and O-ring damage.

If the leak appears to stop, then kicks and becomes a larger leak or sputters, it may be necessary to inject a heavier sealant such as Sealweld® # 5050 Ball Valve Sealant. Inject the same quantity of sealant as you injected Sealweld® Total-Lube # 911 (one ounce per inch (1 oz. / inch) of valve size per seat ring plus riser pipe quantities). # 5050 Sealant will seal scars up to .030" through the use of specially processed PTFE flakes.

Sealweld® # 5050 is also available in XH (Extra Heavy Grade) and XXH (Double Extra Heavy Grade) for extreme seat scarring damage.

It is always recommended to start with a light grade sealant and gradually work up to the heavier sealants.

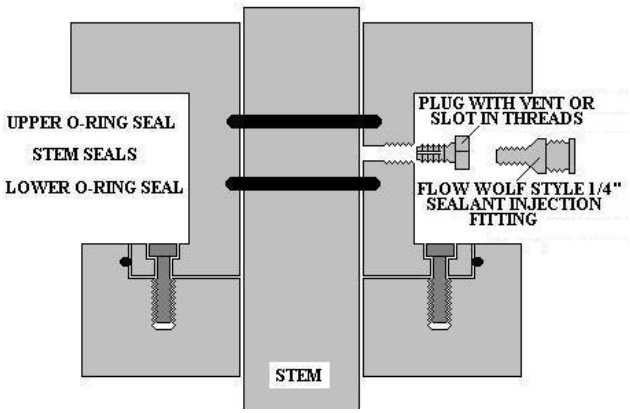
Additional Sealing Procedures for Emergency Situations

Because of the unique seat ring design, the Grove B-5 ball valve can have a special sealant compound (Sealweld® Chameleon Sealant) injected directly into the body cavity in order to effect a seal in an emergency.

You must keep in mind that this may require a substantial quantity of sealant, for instance a 16" diameter ball valve would require approximately (100) one hundred pounds of Chameleon Sealant to completely fill the hole in the ball and the body cavity. It is possible to over-pressure the body cavity, this procedure should only be performed by experienced professionals. Contact Sealweld® Services for additional information.

Stem Sealing Procedures

The B-5 ball valve may be equipped with any of a variety of stem seal configurations.



Stem Sealant System

The most common design features (2) two O-ring seals (see illustration). There may be a Grove vent plug or a vented plug (threaded plug with a slot cut along the threads) located between the (2) two O-rings. The plug may be unscrewed (1 – 2) one or two turns, if gas escapes this would indicate that the lower stem seal is worn or damaged. Tighten the plug back in place to energize the upper O-ring.

Notice if gas is escaping out through the upper O-ring seal and into the gear-set or actuator. This would indicate that both O-rings are worn and / or damaged.

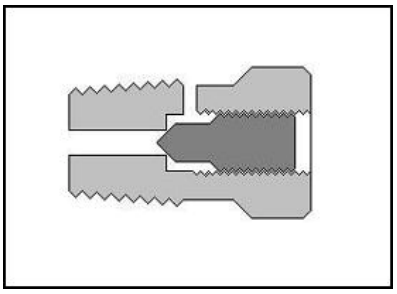
It may be possible to stop this type of stem leak by removing the vented plug and installing a sealant injection fitting. To **accomplish this safely**, the valve should be cycled to the closed position and the body cavity vented to (0 PSI) zero. It may be possible to remove the vented plug in the stem if a very small leak is present.

Use extreme caution and common sense.

With the body cavity vented and body vent fitting open, slowly remove the vented plug in the stem. Relieve the gas pressure slowly, work the vented plug in and out repeatedly until the plug can be safely removed.

Install a Sealweld® FLOW WOLF® type sealant injection fitting (part number F-FW 1/4 BH SS) into the valve stem where the vented (this fitting features a 1/4" NPT thread, different connecting thread sizes are also available). Tighten the new fitting in place.

Inject sealant (Sealweld® Total-Lube # 911 for small leaks, # 5050 Sealant for larger leaks) into the sealant fitting on the stem. Watch the pressure gauge on the sealant pump closely DO NOT EXCEED 3,000 PSI when injecting sealant. Excess pressure may force one or both of the O-rings out of the machined groove and lead to uncontrollable leakage.



Grove Vent Plug 1/4" NPT with Allen head

When the gauge reaches 3,000 PSI; stop pumping - then close the body vent fitting.

Cycle the valve back into the full open position to re-pressurize the body cavity and stem seal area. Watch the gauge on the injection pump closely. If pressure drops off, inject additional sealant, DO NOT EXCEED 3,000 PSI. It may be necessary to inject a heavier sealant such as Sealweld® XH # 5050 or XXH # 5050 if leakage persists.

Before Leaving the Valve Site

Use a penetrating type oil to spray the body vent fitting and any external moving parts. If the oil residue turns orange in color this may be an indication of rusting and corrosion. Clean up the affected area then apply Sealweld® Eterna-Lube 1000 anti-seize compound to prevent further deterioration. Make sure the body vent fitting is closed and sealing properly. Lubricate the bearings in the gear-set or actuator with Eterna-Lube 1000.

- Cycle the valve back to its original position.
- Tighten the steel caps back on the sealant injection fittings.

- Pick up your hand tools, sealant pump and adapters, secure in tool box.
- Clean up any sealant that may have been spilled or leaked.
- Clean up any rubbish at the valve site.
- Test for gas leakage to atmosphere from valves, fittings and flanges.

If the valve or valve yard is normally chained and locked, replace these items to their original position. If padlocks are used, spray the padlock with penetrating oil and open / close repeatedly to ensure easy operation.

*Store and retrieve all **preventative valve maintenance procedures** in **ValvePro®,** a Series of Software Solutions from **Sealweld®.***

Report Writing

Before leaving the valve site prepare your written report including the valve detail, work performed and results achieved. Refer to the samples for Service Report worksheets. Write down all results clearly so they can be read by all personnel.

Use the areas of the report marked "Comments**"** to detail any additional work to be performed. Use extra pages as required.

Keep copies of the reports in a binder that can be taken to the field by the valve technician during the next maintenance interval or during a pipeline emergency.

For additional information** including spare parts lists and repair procedures consult the **"Grove Series B-5, B-4B and B-4C Ball Valve Installation & Maintenance Manual Bulletin No. B-IRM 1/94 (2.5M)"