Chapter 11

Valve Maintenance Techniques

Reliable valves are one of the most important safety components in the plant or pipeline.

It is the responsibility of the valve technician to make sure that every valve turns easily and seals in an emergency.

Turning or cycling the valve periodically is just as important as injecting lubricant. External stem corrosion can dramatically shorten the service life of the valve. ALWAYS examine for evidence of rusting, periodically apply rust penetrant and anti-seize type grease to achieve extended service life.

*You can build a safe, cost and time effective, **Valve Maintenance Program** with the **Sealweld®** **ValvePro®** series of software solutions.*

Perform an audit on every valve and build a data base describing each valve, its performance and preventative maintenance history.

ALWAYS read the valve manufacturers owners manual before commencing any maintenance procedure.

Valves have different types of internal sealing mechanisms. Some key points to remember are:

- Gate valves are typically downstream seating. API or wellhead-type gate valves typically DO NOT have any provision for internal seat pressure relief. Always use extreme caution when injecting grease or sealant into these types of gate valves. DO NOT over-fill the valve with grease or the valve body may rupture. Some of the larger pipeline type gate valves may have a self relieving upstream seat ring and may be equipped with a seat sealant system similar to ball valves.
- Floating Ball Valves (without internal trunnion) are typically downstream seating. These valves typically DO NOT have a provision for de-pressurizing the body cavity.
- Trunnion Mounted Ball Valves come in a variety of seat sealing configurations. The term Double Block and Bleed has been misinterpreted by valve manufacturers and pipeline operators alike. Most trunnion mounted ball valves feature bi-directional sealing, meaning the valve will isolate line pressure in either direction. Some valves have the capability to test the seat seals by depressuring the body cavity in either the full open or full closed positions. Other valves such as the Grove B-5 can only de-pressurize the body cavity in the full closed position. Trunnion mounted ball valves are typically upstream seating. The two most common seat sealing designs are those that have a self-relieving downstream seat ring, and those that have a bi-directional or independent sealing (not self relieving) downstream seat ring, like the Grove B-5. These differences can become important when sealing a valve in an emergency.

The addition of the body vent fitting feature in pipeline ball and gate valves has enabled the valve technician to determine the effectiveness of his maintenance techniques. By evacuating the body cavity between the two valve seats, the technician can determine if the valve seats are holding a seal. If leakage persists, the technician can usually judge which seat is passing by listening or waiting for the leak to diminish as sealant is injected into each seat ring.

For valves in gas service, Sealweld® has recently developed and is field testing a turbine gas meter which connects to the valves body vent fitting. This new tool enables the valve technician to take an accurate metered reading of gas volumes out through the valves cavity. The test can be performed both before and after servicing each valve and is used to determine the effectiveness of your current maintenance program. A hard copy printout is provided which can be collected over a period of months or years for long term maintenance analysis.

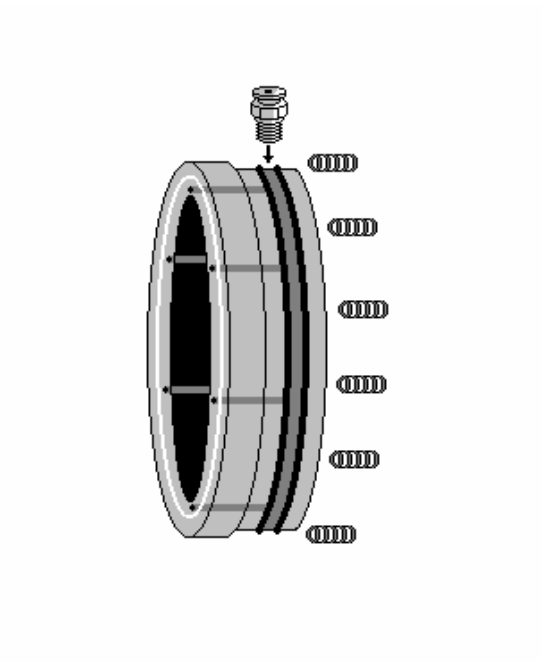
To Grease or Not to Grease, Is Often the Question

Some valve manufacturers (usually the ones who do not manufacture their own line of lubricant / sealants) claim that you do not need to lubricate a valve until it leaks. This would be similar to waiting for a bad compression test before changing the oil in your new car. By the time the problem is realized the damage is done.

By filling the valves seat sealant system with an insoluble valve lubricant / sealant, you accomplish several things.

First of all, by filling the series of grooves, channels and passages you reduce the possibility of foreign materials and other contaminants finding their way behind the seat rings and becoming trapped there. On many seat ring designs the lubricant / sealant can also act as a hydraulic medium and actually force the seat ring hard against the ball, thus improving the technicians ability to achieve a seal. Should contaminants become trapped against the seal face they will do considerably less damage if they are lubricated than if you cycle the valve against them in a dry condition. Torque values will be greatly reduced through the periodic introduction of fresh lubricant. As a result, there will be less wear on seals and actuators It is very difficult for a dry seal to hold for a long period of time. Water can also act as a sealant if the leak path is small enough. Even a small leak can cut out soft PTFE or nylon seating materials if allowed to leak long enough.

Seat ring inserts and O-ring materials can become stuck to seal faces and may tear when the valve is cycled if not properly lubricated. By keeping the seat sealant system full, you greatly reduce the risk of methanol or other corrosion inhibiting chemicals affecting the seat sealing O-rings which can shrink, crack or otherwise fail and lead to uncontrollable leakage.



The argument against the introduction of valve lubricant / sealants is that they may eventually break down and that in some cases this can lead to seat leakage. In other words, once you begin using lubricant / sealants you can not stop. The injection of a very small amount of lubricant / sealant each time the valve is cycled will prolong valve service life dramatically while preventing the hardening or drying of old lubricants.

You may notice that many small diameter valves DO NOT have a seat sealing system. Because of this, these valves either are repaired or replaced when they begin to leak. This would be an undesirable alternative when working with expensive large diameter pipeline valves. Just the cost of draining the product in the pipeline leading up to the valve makes this an uneconomical proposition. The price of periodically injecting a small amount of lubricant / sealant is a mere fraction of what the repair or replacement would cost.

Typical Seat Ring Sealant System

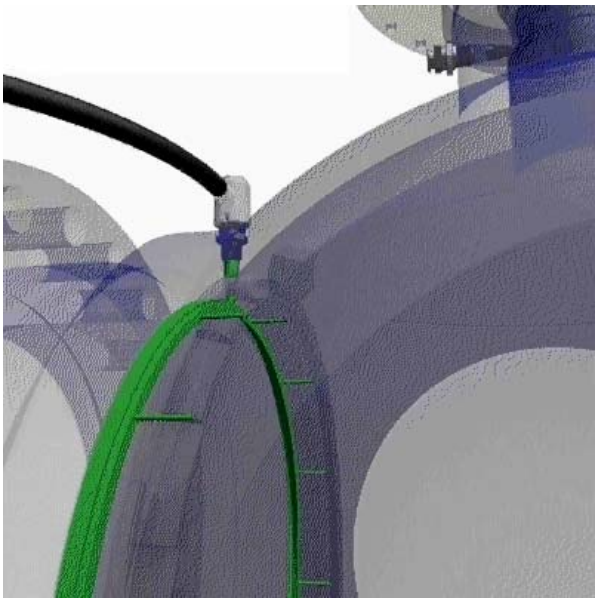
The cost of the sealant and manpower required, is insignificant compared to the cost of shutting down the line, draining, excavating and replacement valve costs. Sealweld® presented a discussion paper on this subject at the Onshore Pipeline Cost Reduction Conference & Exhibition in Amsterdam in April of 2000. Contact Sealweld® for a copy of the Study of the Economic Benefits of Valve Commissioning During Pipeline Construction.

There can be problems caused by using the wrong type of lubricant / sealant in some services. In a worst case, we have seen examples of a lubricant / sealant (in high temperature service) polymerize and bake hard into a rubber-like substance. When the lubricant / sealant goes hard it can prevent the seat rings from traveling like they should which can make the valve hard to turn and / or not seal properly. If you have any concerns over which lubricant / sealant you should be using contact your nearest Sealweld® office for product suggestions.

Routine Maintenance Procedures

Routine valve maintenance often consists of periodically topping-up the valves sealant system in order to keep fresh lubricant / sealant at the seal face. The illustration below details the route the cleaner or lubricant / sealant must travel in order to reach the seal face passage.

The quantity of lubricant / sealant required to top-up can vary greatly depending on how long it has been since the valve was last serviced, the type of lubricant / sealant being used, the type of valve, cycle frequency, the product flowing through the valve and its temperature.

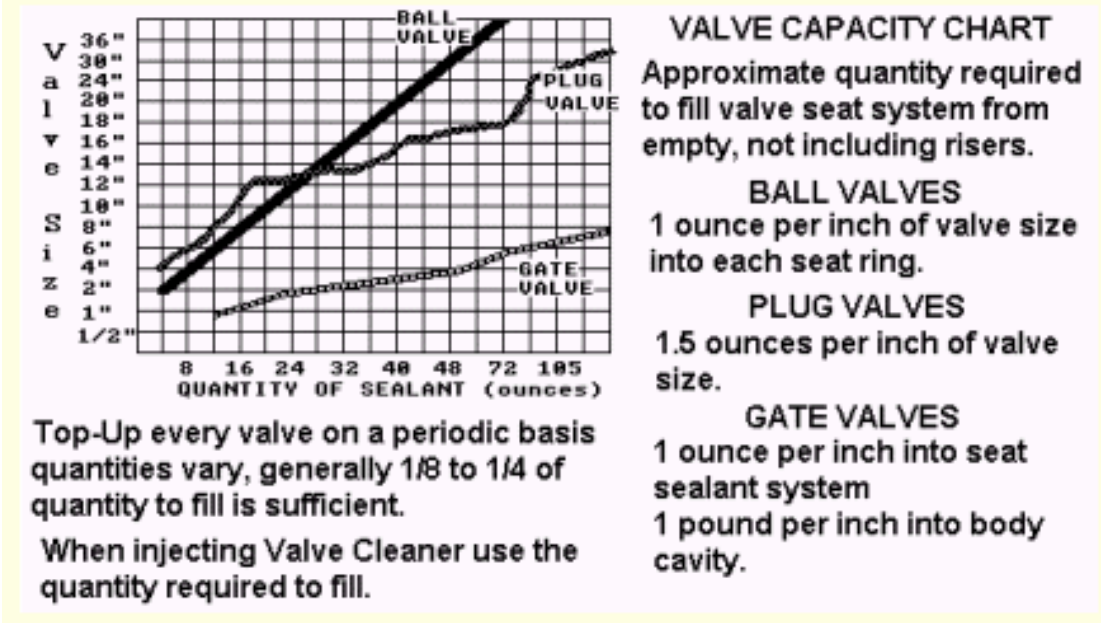


Valve Sealant System

Many companies wait for a problem to occur before considering servicing a valve. Waiting for a problem to occur may take several years and during that time many brands of lubricant / sealant may have dried out, decomposed or simply washed away. The lubricant / sealant can also polymerize. This hardened grease can restrict seat travel and hold the seat ring away from the seal face. This may result in an increase in torque and damage to soft seating materials and O-rings. If the lubricant / sealant has washed away, the void behind the seat rings could be filled with solid contaminants such as sand, dirt, slag, line scale, plastic coatings and even pieces of pipeline scraper pigs.

Full Service Maintenance

If topping-up the valve seat sealant system does not achieve the desired results, this is usually an indication that it is time to clean the valves seat sealant system. Sealweld® Valve Cleaner Plus is a combination of light oils, solvents, detergents and graphite particles with a minimum of thickeners. When injected into the valve, it softens and re-moisturizes the old dried greases, cleans important passages and channels and removes the varnish-like buildup which can occur on valves while in service. Allow the valve cleaner to soak in the valve for (30 – 60) thirty to sixty minutes. On problem valves which are seized or which have plugged sealant passages, allow the cleaner to soak overnight. To ensure proper cleaning action, cycle the valve a few times (where possible) and top-up the cleaner a few times to push contaminants away from seal faces.



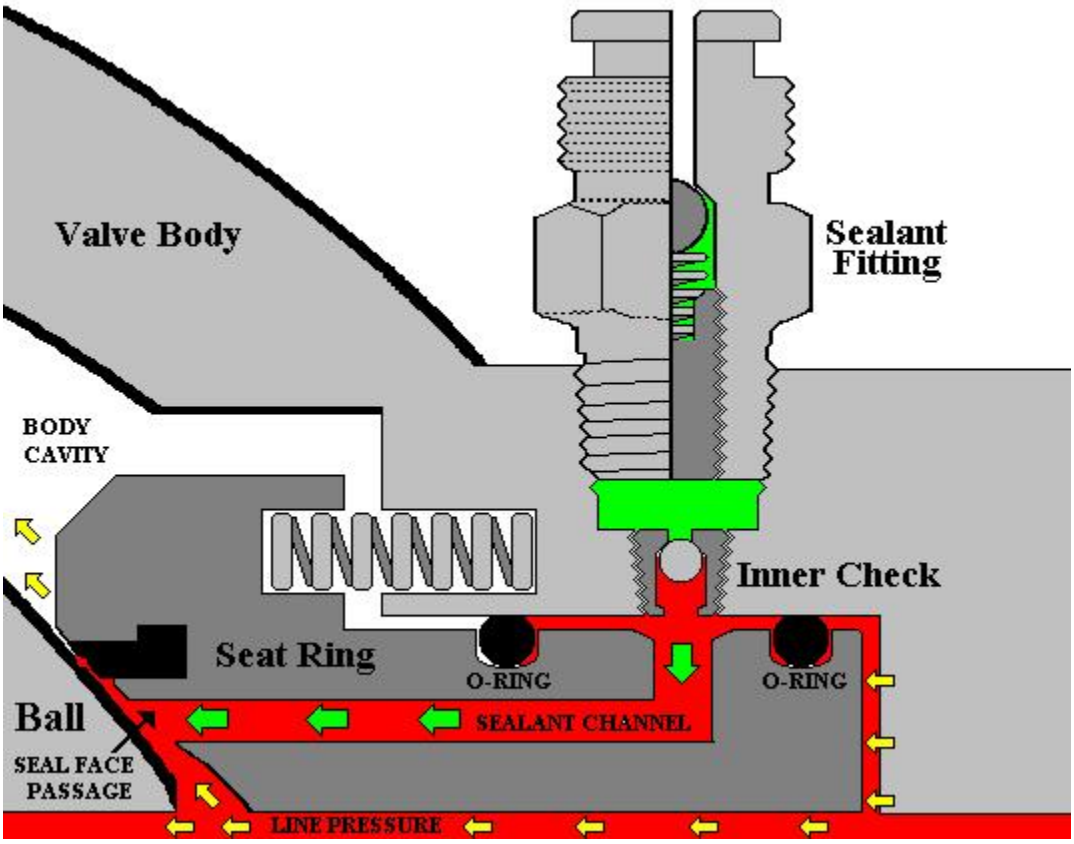
Valve Sealant Capacity Chart

The quantity of cleaner required is detailed on the above sealant capacity chart. Ball valves generally require one (1 oz.) ounce per inch of valve size into each seat ring. Riser pipe quantities are extra, generally (2 ozs.) two ounces per foot or (16 ozs.) sixteen ounces per eight foot riser. In other words, a thirty six 36" inch ball valve would require (36 ozs.) thirty-six ounces (= 2.25 pounds) into each seat ring plus an additional (16 ozs.= 1 pound) sixteen ounces into each of (4) four riser pipes. This quantity can be reduced by the quantity required to fill the riser pipes. Injecting (36 ozs.) thirty-six ounces of cleaner would fill the sealant riser lines, the seat ring passage and the sealant channel. Switch the pump back over to the lubricant / sealant and continue injecting (16 ozs.) sixteen ounces of lubricant / sealant. Stop the pump and allow the cleaner to soak in the seal face passages for up to (1) one hour. When you are satisfied that the cleaning action is complete, continue injecting (20 ozs.) twenty ounces of lubricant / sealant to displace all the cleaner. By opening the valves body vent fitting during the cleaning operation the cleaner is drawn over the seat insert and allowed to clean the important seal faces.

How Much is Enough?

Over-lubricating can lead to problems downstream if the line can not be pigged from time to time. Under-lubricating can lead to the deterioration of lubricant / sealants and the build-up of decomposed grease residue.

Ideally, the valve technician wants to keep the sealant passages filled with soft sealant as well as the area behind the seat ring, through the valve body, riser lines and sealant fitting. To accomplish this the technician must top-up the valve from time to time. In order to obtain the longest possible maintenance interval and to prevent over-lubrication, the lubricant / sealant must be resistant to breakdown from high-pressure injection, temperature variances (freezing), resistant to dehydration from natural gas and / or insoluble in the product flowing through the valve.



Typical Ball Valve Seat Sealant System

Notice on the illustration, that the seal face passage and sealant channel are exposed directly to line pressure. This is the most vulnerable portion of the seat sealant system. The lubricant / sealant can be scraped off by the seat insert as the valve is cycled washed away by high-pressure jetting action of the line pressure flowing through the valve and also contaminated by foreign materials flowing along the pipeline (scale, rust and internal plastic coatings).

By injecting sufficient quantities to replace the lubricant / sealant in the seal face passage you have probably displaced the foreign materials and refilled the area up to the seat insert. The quantity can vary depending on the exact seat ring design, generally 1/4 to 1/3 of the sealant system capacity. In other words, if a 36" ball valve holds (36 ozs.) thirty-six ounces into each seat ring then 1/4 would be (9 ozs.) nine ounces or 1/3 would be (12 ozs.) twelve ounces. By injecting these top-up quantities at least once a year most valves will operate and seal properly. Valves which cycle frequently or are closer to the compressor (because of increased temperature) should be topped-up more frequently.

Another good indication of the seat sealant system becoming full is to watch the injection gauge while topping-up. One of the best ways to practice getting the feel for when the seat sealant system is full, is to fill valves for the first time from a dry condition. As the passages become full, the lubricant / sealant will have more difficulty escaping, the injection gauge will begin to climb rapidly and will fall more slowly when pumping is stopped. This is not always a reliable method in cold climates where the increased lubricant / sealant viscosity can send confusing signals.