

STAINLESS VALVE CO.

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Monday, May 12, 2008



Our production is certified ISO9001:2000 / Certificate No.: QEC16133

Anti-Scale Valves

by

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In various industries there are valve applications where the standard valves used do not function satisfactorily. When scale is formed on the moving elements of ball valves or gate valves the consequence is either blocking of the valve movement or damage to the valve seats and consequent leaking through the valves.

A development of AS Stargate-O-Port® valves was carried out in 1995, which lead to a good performance in pulp manufacturing. Later the same principle was used in the food industry. The most impressive application was in mining, where standard valves had to be exchanged every two weeks, whereas the Anti-Scale valves are in operation now for three to four years without any need for refurbishment. The increased production by eliminating downtime has paid many times already for the investment in the valves.

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1. Introduction

In applications of valves in the process industry there are many challenges to be met, corrosion, abrasion, pressure shock waves, temperature shocks just to mention a few. Less frequently but often with more critical consequences an effect is found in scale formation in valves. Another problem is the dealing with sticky flow media. Both these effects usually lead to problems with the performance of valves and often also have a severe effect on the safety of personnel.

The consequences of these effects are often damage to the valve seats when the valves are actuated, which then leads to leakage through the valves. Deviation in the process, inconsistent quality of the produced material, loss of energy and increased production cost are the result.

The most critical consequence may be experienced when the valves cannot be operated at the required time. This can lead again to inconsistent quality of the produced material, possibly loss of a major amount of product and even worse possibly hurting persons when the valves have safety functions.

In any case the affected valve applications have to be analyzed and solutions to be found in order to minimize the effects of scaling and sticky materials.

2. Stargate-O-Port® Valves

About 30 years ago Stainless Valve Company first developed a valve called Big Blow. A pulp mill had a severe problem using ball valves on as blow valves on batch digesters. The life of the ball valves was between two months and two weeks. This unacceptable performance of the ball valves called for the development of a valve, which today usually has a service life between refurbishments of about 3 years or more, depending on the piping system.

Meanwhile the same basic principle is used for our O-Port valves for other applications in many different industries, like power generation, food, oil and gas, petrochemical and others.

Much was learnt from the blow valves and applied to the development of modern O-port valves for other applications. The basic principle of the valves is the same.

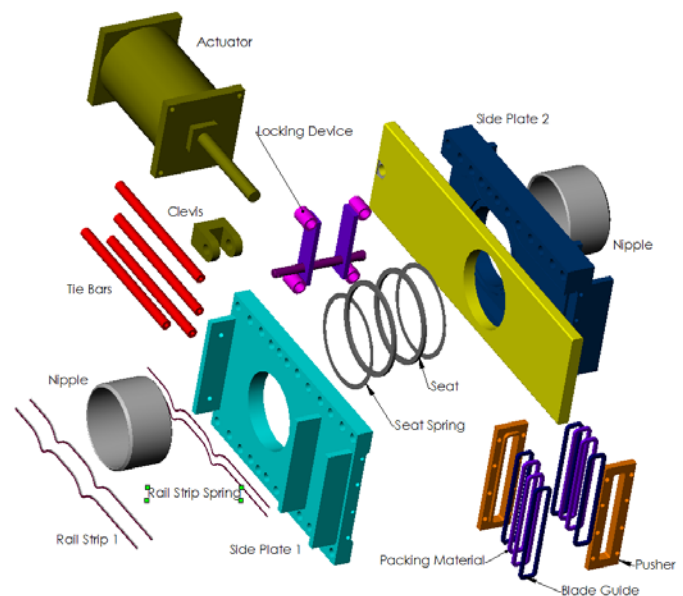


Figure 1 An exploded view of a 12" 900# valve

Figure 1 shows the valve body, consisting of the side plate 1 and 2, the blade (yellow) and the various sealing elements. The blade reaches through both ends of the valve body.

This Is NOT A Knife Gate Valve

We always have to stress this point. Very often the O-Port valves are thought to be knife gate valves. That is wrong; in fact the O-Port valves are in their function more similar to a ball valve than to a knife gate valve. The O-Port valves are also called through-port valves and slide gate valves. One major difference is that the blade reaches through both ends of the valve body.

At both ends of the valve body stuffing boxes, which we call packing glands, contain the blade guides. They are usually made of glass-filled Teflon. Their function is to properly position the blade inside the valve body and

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to support the blade against the forces generated by the pressure differential between the upstream and the downstream side of the valve.

In this way the function of the packing material is only to seal the valve inside to the outside and not to support the blade. This is very important for a long service life of a valve. The separation of guiding and sealing guarantees, that the packing material is not compressed axially by the pressure differential on one side, creating a leak path on the other side.

The double seats seal against the flow through the valve in both directions. The valves do not have a preferential flow direction.

The dark brown parts are called the pushers or followers. These parts apply pressure against the blade guide/packing material set. This force expands the packing material and in this way seals around the blade.

Development carried out by Stainless Valve Company and New England Braiding Company resulted in packing material, which forms well around the blade and has certain elasticity. This elasticity is important to accommodate the elastic deformation of the valve body and packing gland under pressure.

Figure 2 shows an 8" 150# valve which has some similarity to a knife gate valve, but again it is in its function completely different from a knife gate valve. This valve has the same 150# service (PN10) face-to-face dimension of a knife gate valve, but that is as far as the similarity goes. Different from a knife gate valve the blade passes through both ends of the valve body and is well guided at both ends in the packing glands. The blade has a hole in the middle, which is either lined up with the pipe or moved inside the valve body. The valve has spring loaded double seats for a class VI shut-off independent of the pressure differential across the valve. The sealing around the blade is the same as explained above.

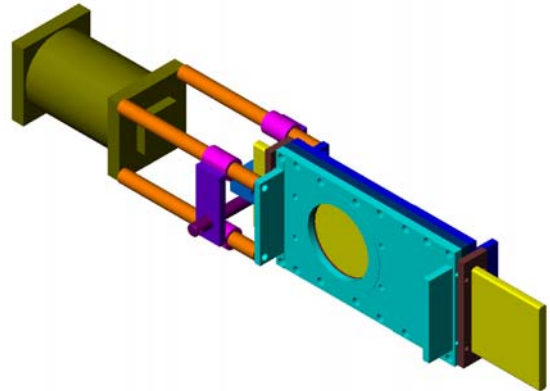


Figure 2 An 8" 150 # Stargate-O-Port® Valve

3. AS-Stargate-O-Port® Valves

The special aspect of the AS-Stargate-O-Port® valve is the combination of coatings and seats in order to eliminate the negative aspects of scale formation or sticky flow media.

There is a variety of different coatings, which can be applied to the blade. We found the best coating to be used for low temperature applications to be the "High-Build". It is a Teflon-based coating, which creates a barrier between the blade and the flow media. The "High-Build" has a good adhesion to the blade but the flow media respectively the scale does not stick to the "High-Build". This makes it possible for the seats to wipe the blade clean when the valve is actuated.

For high temperature applications mostly a Nickel-based coating is used. Again the desired property is a low coefficient of friction between the coating and the flow media.

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4. Advantages over different Valve Types

We now want to discuss the advantages and disadvantages of different valve types.

- 4.1. Proper actuation of the valve is guaranteed because no material is pushed into the bottom of the valves, which would prevent proper closing. A knife gate valve or a butterfly valve cannot handle solids because they get trapped between blade respectively disc and the seats.
- 4.2. The valves have a class VI shut-off, independent of the pressure differential between upstream and downstream side. The tightness of the shut off does not depend on a pressure differential between the upstream and downstream side.
- 4.3. The O-port valves do not need lubrication because there is no metal-to-metal contact between blade and body.
- 4.4. The valves can be used as shut-off valves, flow control valves and line blinds. Knife gate valves or butterfly valves cannot be used as line blinds, because there is always a force component opening the valves from the line pressure. In case of ball valves the outside indicators can show a closed position but in the inside the ball may be in a completely different position. The stem may be twisted, broken or there may be play between ball and stem.
- 4.5. Even in a partially open position the O-port valves have a straight flow direction, different from ball valves where the flow is re-directed twice.
- 4.6. The seats of O-port valves are not in the flow path. In case of a ball valve in a partial open position the flow hits directly the seats, causing premature wear.
- 4.7. Short face to face dimension, a fraction of the space requirement of ball valves in the flow direction. On the other hand the O-port valves require more space perpendicular to the flow direction.
- 4.8. Foreign matter does not get jammed between the gate and the body in O-port valves, because there is only a very small space between blade and side plate. This prevents seat damage so that the valve always seats and seals well. Over 97% of the body thickness is solid material, resulting in a very stiff valve body. 3% or less are the gaps between the blade and the side plates.
- 4.9. The O-port valves guarantee long leak free operation, through the valve and from the valve body.
- 4.10. Pressure shock waves, aggressive flow media are well handled by the O-port valves.
- 4.11. The O-port valves can be installed in any position in the pipe; they do not have a preferential flow direction. Liquid, gas and solid flow media are handled easily by the O-port valves. The valves are the choice for handling solids in flow media.
- 4.12. Scale forming flow media or sticky substances can be handled easily by the AS version of the O-Port valves with the proper choice of coating and seat materials.

5. Applications

5.1. Food Industry

An SVC customer contacted us about an application where valves only lasted a maximum of 6 weeks. In use were half-ball valves in an application, where the valves had to shut off against nitrogen gas at 750 psi pressure. The valve was a 4" valve for 1500# service.

Since the valves had to seal against pressure from both sides the half-ball valves were from the beginning not the right product for the application.

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5.2. Valves for Scale-Forming Applications in a Gold Mine

But the main problem was constant damage to the highly polished ball and the seat, leading to unacceptable leakage through the valves after less than 3000 cycles. This problem stemmed from the powder material, which was passing through the valve and which stuck and accumulated firmly to the valve components and the seats.

5.1.2. SVC Solution AS-Stargate-O-Port® Valve

SVC has developed special valves, based on the well known Stargate-O-Port® valves, for scale formation or sticky materials. Testing several combinations of coatings and seats in the lab at SVC, a combination was found, which prevented the sticking of the powder to the valve blade and also not on the seats. Preventing the accumulation of compacted powder layers on the blade and the seats gave proper sealing characteristics of the valve. The valve was run for 15 000 cycles without showing any difference in performance and leak-proof-ness. Because of the space constraints at the customer's site the actuator was side mounted, which can be done because of the guiding system of the blade in the valve.

In the first week of 2000 SVC visited a gold mine and found that in a slurry application at the hydrometallurgy autoclave 12" knife gate valves were used, which had to be taken out of service every two weeks, because after that short time of service the valves could not be actuated anymore. The reason was severe formation of scale on all internal surfaces of the valves.

SVC suggested using the AS-Stargate-O-Port® valves for this application. In April 2000 the first valve, was installed and has been in continuous service now for almost four years with no need for taking the valves out of service, no need for removing scale.

Meanwhile more of the AS Stargate-O-Port® valves are in use successfully in this application.

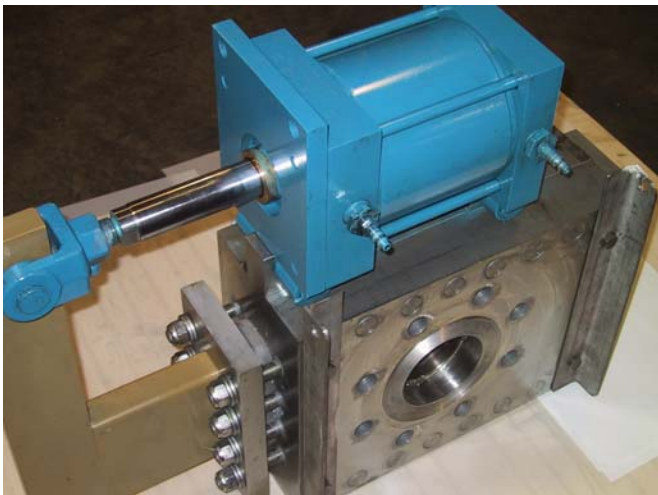


Figure 3 A 4" 1500# valve with side mounted actuator

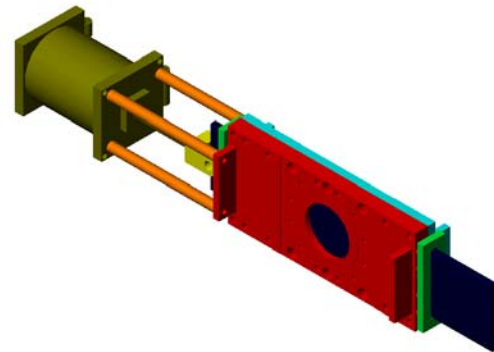


Figure 4 An 8" 300# AS-Stargate-O-Port® valve

5.3. Lime and Fly Ash Storage

Lime storage bins have usually some sort of shut off valve, mostly those valves stick because of the hygroscopic nature of the lime.

Often it takes hours of hard work with sledgehammer and come-along to open or close those valves.

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Because of an injury one of the SVC customers had contacted SVC to find out whether we have a solution for this problem. A concept was devised, the valve ordered and installed. It works since 1996 to the satisfaction of the customer, who meanwhile installed one more valve on another lime storage bin.

The same basic concept has also been used for fly ash. Fly ash from the boiler systems in the manufacturing is stored in bins, which are shut off in the bottom with an isolation valve. This valve allows the isolation of the rotary feeder valve/ screw feeder. The fly ash is fed through the rotary feeder and the screw feeder into a dump truck for disposal of the fly ashes.

The isolation valve has to deal with an abrasive material, which increases the internal friction in the valve. This does not allow a standard knife gate or others to function properly. Friction reduction and increased actuation force are necessary to have a well functioning valve for the isolation of the fly ash storage bins.

SVC has developed an AS-Stargate-O-Port valve, which meets these requirements. It is supplied with a hydraulic actuator and a hydraulic power pack.

These valves are also used successfully in power generating plants.

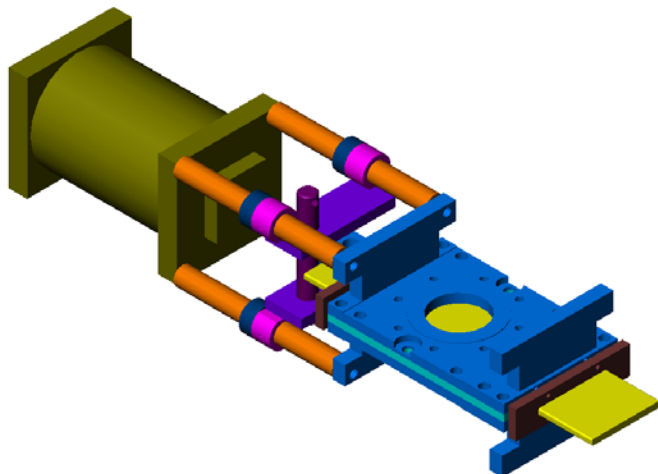


Figure 5 A 4" 150# Fly Ash valve for up to 1200 deg F

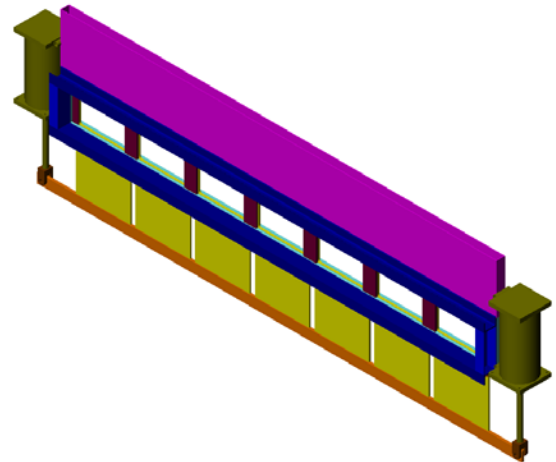


Figure 6 A 175x 14.75 valve with 7 compartments for fly ash

5.4. Liquor Heater Valves

During the last 8 years Stainless Valve Co. has done some work with several customers on the application of our AS-Stargate O-Port® valves in liquor heater applications.

At a given time two of the heaters are heating the black liquor going to the continuous digester and the third heater is being acid cleaned. Typically once a week the heaters are switched. The previously cleaned liquor heater comes online and another of the two heaters is valve being cleaned. In these cycles every liquor heater is running for two weeks and then cleaned in the third week.

The main problem with liquor heater valves is scaling. When scaling happens on ball valve valves either the ball valve does not actuate at all after a short time or the scaling destroys the seats of the ball valve.

The AS-Stargate O-Port® valves feature a special coating to reduce friction and adhesion of scaling on the blade and a sufficiently large size actuator to

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CONCLUSION

guarantee proper actuation of the AS-Stargate O-Port® valve.

At the first customer's site the AS-Stargate O-Port® valve together with a competing ball valve were installed in spring of 1995 side-by-side on two liquor heaters.

After one year in operation the customer decided to use the AS-Stargate O-Port® valves on all the liquor heater applications. Several more AS-Stargate O-Port® valves are meanwhile in operation successfully at this site.

Because of recommendations from this mill, other mills in the same organization are meanwhile using our Stargate O-Port® valves successfully for liquor heater applications.

The first liquor heater AS-Stargate O-Port® valve is in service at the second mill since about the beginning of 1997. Several more valves are in operation in other mills since beginning of 1998.

The Stargate-O-Port valves have been developed to allow the use in demanding applications, where scale formation and sticky substances can prevent standard valves from performing properly. The anti-scale Stargate-O-Port valves have been used in various industries with remarkable results.

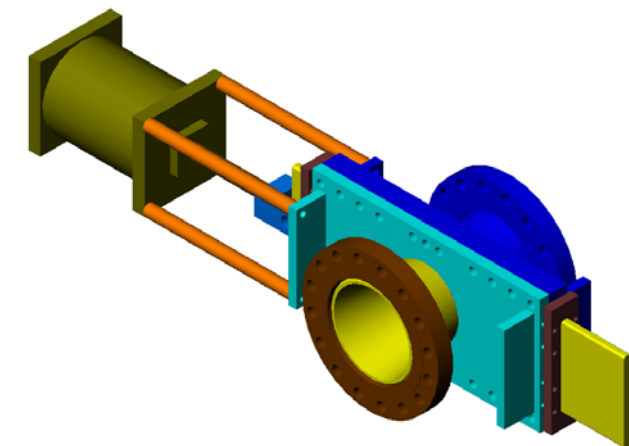


Figure 7 An 8" 300# valve body with 10" flanges