Straining To Make Diaphragm Operated Automatic Control Valves Effective

By Brad Clarke,VP Sales and Marketing, Singer Valve

Diaphragm Operated Automatic Control Valves (ACVs) require reasonably clean water to function effectively and reliably. Having a strainer upstream of the actual ACV is very important, but also having a smaller strainer located at the inlet of the pilot system on the ACV is also well advised.

Note the Y style strainers upstream of the ACV's and the small strainer on the inlets side of the ACV's (Pressure Reducing Valves).

Strainers are required on the upstream piping to keep debris out of the automatic control valve. Often with new construction, maintenance and upstream pipe bursts a variety of contaminants and foreign objects can be introduced into the pipe line. Since ACVs (often pressure reducing valves but other models as well) are often partially open while controlling flow or pressure, a restriction in the line can become a choking point for debris if no upstream strainer is present.

Many of the better known ACVs have a lower guide bushing in the seat area of the valve, which effectively becomes a strainer if there are no strainers located upstream which can create internal problems with the ACV. It is not uncommon to find wood, rocks, boots, tools or even animals wedged into the lower guide and seat area of the valve, effectively rendering the valve useless or worse, supplying over pressures and causing pipe bursts in extreme situations.

Example of debris being lodged in the lower guide and seat are of the ACV, Hail, Saudi Arabia

Contractor is relieved as the debris has been removed from the lower guide and seat area of the ACV, Hail, Saudi Arabia

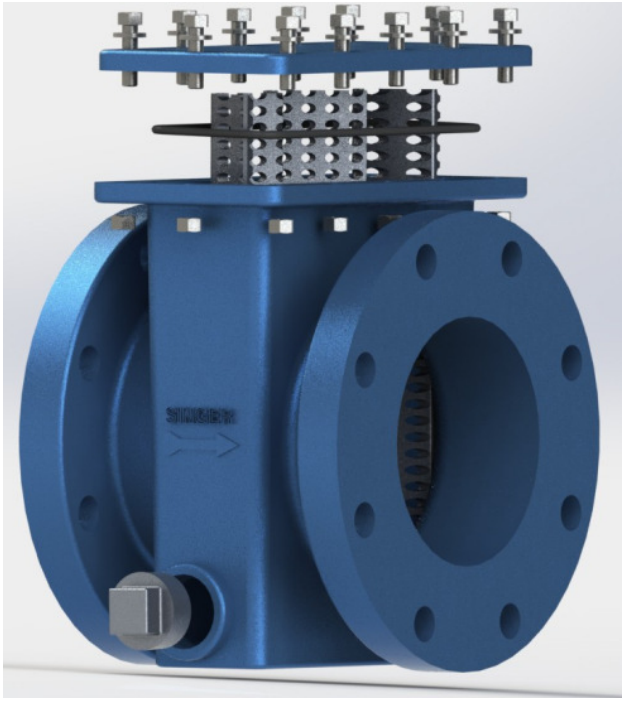
Photo of an inspection creeper or cart that was not removed from pipeline before commissioning and pressurizing the line. Again caught in the seat area of the valve, resulting in valve failure, California, USA.

Different Strainer Styles

There are numerous styles of strainers available in the market today, with the most common being Y strainers, H Strainers and Z style strainers. Strainers are also recommended for using upstream of a variety of devices including turbine meters. AWWA has standards in place (C701 & C702) relating to the surface screen area ahead of a meter. It is very important to make sure that a strainer selection is in compliance with these important standards particularly if being used in conjunction with meters that can be affected by turbulence as you will get false or inaccurate readings on your meters.

While the Y & H strainers have been very popular for many years, one of the limitations is the longer lay length and weight of these devices. While reliable they can result in a larger than necessary concrete chamber being required and special lifting equipment, depending on size and corresponding weight, for routine maintenance.

The newer Z style strainer can be a very effective means to protect downstream devices while having an absolute minimal lay length. The importance of the shorter lay length is that any reduction in space required by devices within the chamber can often result in smaller chambers and less concrete, resulting in reduced initial capital costs. The light weight of the Z style strainer also lends itself to easier maintenance, as if the unit needs to be extracted from the pipeline, the lower profile and substantially lighter weight makes this easier to lift and simply remove by hand depending on the size. The Z style screen also gives additional surface area across the screen which allows increased flow and reduces frequency of plugging.

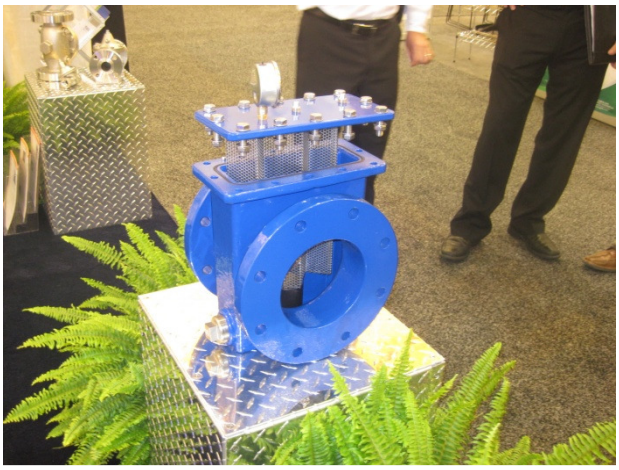


A ZS style strainer as manufactured by Singer Valve showing the reduced lay length and the Z style screen.

Sizing
It is always recommended to check with manufacturers and review their sizing charts to ensure the strainer you specify can easily handle the maximum flow rate required through the strainer. With a properly sized upstream strainer you will easily prevent debris from entering the seat area of the ACV. All strainers have flow data to help select the correct size.

Valuable Features to Have
When specifying a strainer, it is important to request a few key items which can greatly help reduce or simplify maintenance. Make sure the strainer has two blow down ports available if possible (one on either side of the strainer). This allows you to simply remove a plug on either side of the Z strainer (or you may prefer to have ball valves installed to simplify the process) and simply flush smaller debris from the upstream side of the strainer. If you get debris larger than the blow down ports can pass, you may have to remove the top of the strainer and remove the screen to dislodge this material. This is easily done without taking the main body of the strainer out of the pipe line.

It is advantageous to have a plugged threaded port on the top cover which can be used as an air release location. If air issues persist you can permanently mount an air release valve at this location. It is beneficial to have two additional threaded ports on the top cover, one upstream and one downstream of the actual screen. By having these two additional ports you can utilize two pressure gages (or electronic pressure sensors if sensing remotely) which will indicate the degree of plugging as pressure differential increases, suggesting that a blow down or cleaning of the strainer may be required.



Notice additional ports on the top cover of the Z style strainer to allow for gages and/or air release.

Strainers for Pilot System

Another straining issue that is often neglected on an ACV or Pressure Reducing Valve is the smaller strainer that is located at the inlet of the pilot system on the upstream side of the actual valve. This prevents debris from entering the ACV pilot system and plugging small orifices within the pilot system that can ultimately cause system failures. While most ACV manufacturers include these small strainers automatically, they can often be overlooked or not included on smaller sizes. Again these strainers protect your pilot system and need to be maintained. Regardless of the size, all pilot systems for ACV's should have these strainers.

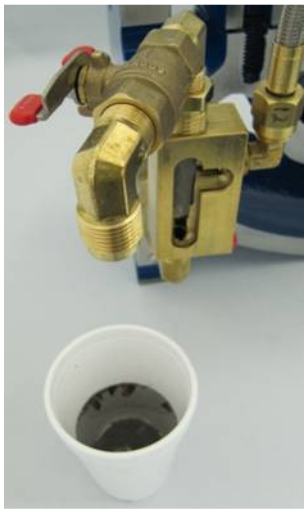
Notice the strainer on the cut a way valve on the upstream side of the valve (left side)

External versus Internal Strainer

The advantage of having an external strainer is that they are easily cleaned by simply removing a plug and flushing for a few seconds. A ball valve can be added to this device to make it even simpler. There are some manufacturers that provide an internal strainer in the flow path inside the ACV. One should be very cautious when accepting these types of strainers as if debris, organics

or items like plastic bags were to become lodged around an inline strainer, there is absolutely no way to flush this externally. The entire valve needs to be decommissioned, disassembled and then inspected and the strainer cleaned.

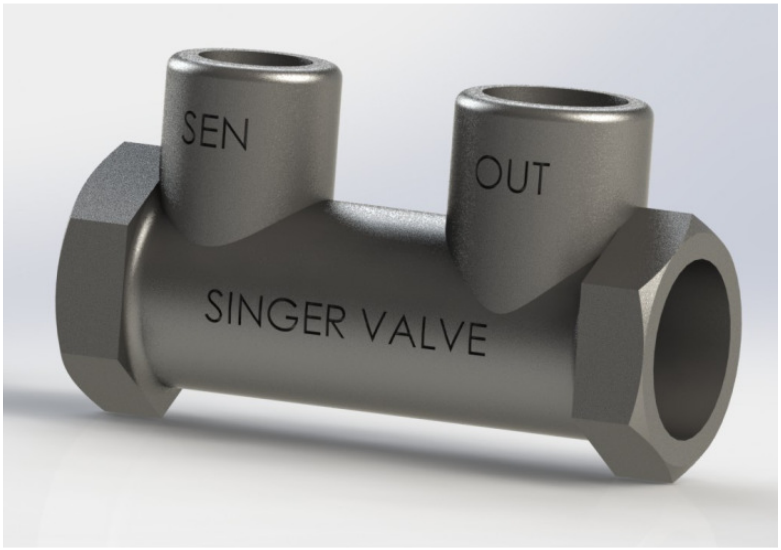
Maintenance & Cleaning
Strainers do require maintenance and cleaning, but the frequency is determined by the quality of the water you are straining. If you have a lot of debris in your water you may have to clean your strainer weekly or monthly, if you have very clean water you may clean your strainer once a year. This is determined by examining your strainer frequently when your valve is first installed. It is best to flush into a clean white bucket so you can view the debris and then determine the frequency of flushing, once you see a trend.



Flushing into a clean white container to determine future frequencies of flushing

A partially plugged strainer or fully plugged strainer will result in an ACV or Pressure Reducing Valve failure. When the strainer becomes plugged water cannot enter the pilot system and move freely into the chamber above the diaphragm on the main valve. When this occurs the valve fails to a fully open position. If you were originally reducing pressure from 120 psi (8 Bar) to 60 psi (4 Bar) and your strainer becomes plugged, you will no longer be reducing pressure and may have the entire 120 psi (8 Bar) downstream causing pipe bursts or even hot water tank failures.

Example of a plugged screen, resulting in an ACV failure



New style stainless steel ACV strainer located at the inlet of the device, no lead as non bronze components

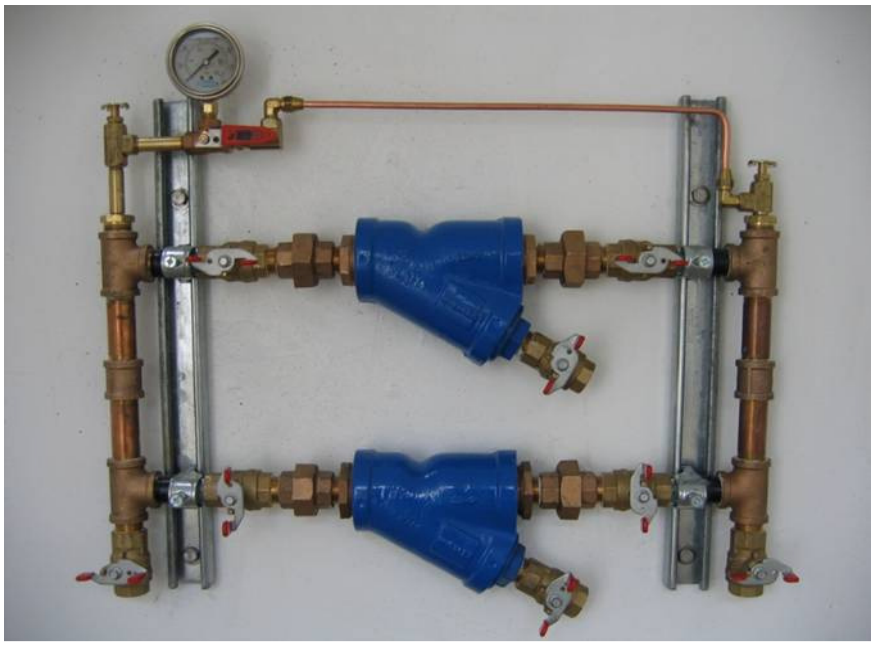
Additional Options
If you find that you have to frequently clean your ACV strainers, there are a number of options available which can reduce frequency of flushing or alternately give you some redundancy.

The first method is to replace the simple strainer with an Arion style strainer. This device is much larger than a traditional ACV strainer. The flow path through the strainer is designed in such a

way that when the water enters the strainer, the velocity slows down, allowing larger containments to drop into the collection chamber. The collection chamber is quite large as compared to the smaller traditional ACV strainer screen and allows for a lot more debris to be captured between flushings. So, if a traditional strainer were plugging every month, you may flush the Arion strainer every 3 months. Frequent initial inspection is always required to determine the frequency of flushing. When you do require the Arion strainer to be flushed, simply open the ball valve that comes with the unit and flush the contaminated water to the atmosphere.

Arion Strainer with catchment chamber shown on bottom, this is considered an upgrade over traditional ACV strainers.

Another method for protecting the pilot system of an ACV or Pressure Reducing Valve is by taking a redundant or duplex approach. By installing two strainers that can be isolated from each other, you have the ability to quickly switch from one strainer to another, by simply opening and closing isolation ball valves. You can also have a ball valve permanently installed for blow downs on each of the strainers. You still need to clean the strainers with some frequency, but you always have a strainer available for back up and to immediately switch to if plugging occurs. You can also utilize pressure gages if preferred to view the pressure differential across the suspect strainer which gives some indication on the degree of plugging.



Duplex strainer set up with built in manual redundancy.

Another method of keeping the ACV strainers clean is to simply install an inexpensive ¾" 24 volt plastic irrigation solenoid valve on the outlet of the strainer and install a small battery operated irrigation timer nearby. You can then program your timer to come on for a given duration as frequently as required. This can be very effective where you have to flush strainers frequently.

In Conclusion

A properly sized upstream strainer with valuable features can give you incredible protection for an Automatic Control Valve (Pressure Reducing Valve), Turbine Meter or any number of sensitive downstream devices. It is important to understand the various options that can be available on strainers like blow down ports, air release ports and pressure differential ports as these options affect ease of use and maintenance time and cost. Always consider lay length and weights as these items can contribute to initial capital costs and make maintenance costly with special equipment required.

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Author: Brad Clarke VP Sales and Marketing Singer Valve

Brad Clarke is the VP of Sales and Marketing for Singer Valve Inc, a global designer and manufacturer of automatic control valves. He has spent the last 35 years working in the water industry and has written and presented several papers around the world on key issues that improve the operation, conservation and management of water systems.