optimal operation

By Brad Clarke

Maximizing the effectiveness of diaphragm-operated automatic control valves

Diaphragm-operated automatic control valves (ACVs) require reasonably clean water to function effectively and reliably. Having a strainer upstream of the actual ACV is important, as is having a smaller strainer located at the inlet of the pilot system on the ACV.

Strainers are required on the upstream piping to keep debris out of the ACV. Often with new construction, maintenance and upstream pipe bursts, a variety of contaminants and foreign objects can be introduced into the pipeline. Because ACVs often are 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 widely 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. This 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.

Strainer Styles

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

While the Y and H strainers have been popular for many years, the longer lay length and weight of these devices have proven to be limiting. While reliable, they can result in the requirement of a large concrete chamber and special lifting equipment, depending on size and corresponding weight, for routine maintenance.

The newer Z-style strainer can be an effective means of protecting downstream devices while presenting 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 result in smaller chambers and less concrete, yielding reduced initial capital costs. The light weight of the Z-style strainer also lends itself to easier maintenance. If the unit needs to be extracted from the pipeline, the lower profile and substantially lighter weight make it 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 the frequency of plugging.

Strainer Sizing

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

Valuable Features

When specifying a strainer, it is important to request a few key items that can help reduce or simplify maintenance. Make sure the strainer has two blowdown 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 and simply flush smaller debris from the upstream side of the strainer. If debris larger than the blowdown ports can pass, removing the top of the strainer and removing the screen to dislodge the material may be required. This is easily done without taking the main body of the strainer out of the pipeline.

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, an air release valve can be permanently mounted there. 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, two pressure gauges (or electronic pressure sensors if sensing remotely) can be utilized. This will indicate the degree of plugging as pressure differential increases, suggesting that a blowdown or cleaning of the strainer may be required.

Strainers for Pilot System

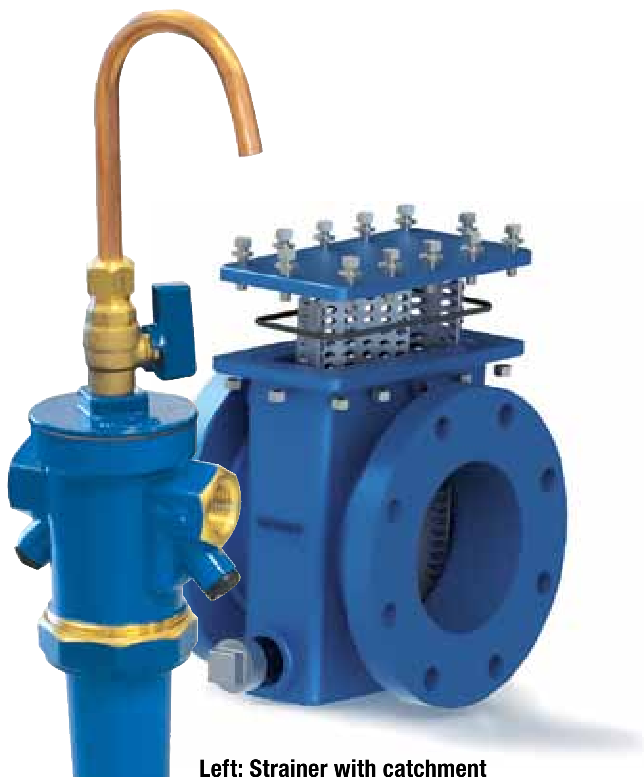
Another straining issue that often is neglected on an ACV or pressure-reducing valve is the smaller strainer that is located at the inlet of the pilot system on the upstream side of the actual valve. This prevents debris from entering the ACV pilot system and plugging small orifices within the pilot system, which can ultimately cause system failures. While most ACV manufacturers include these small strainers automatically, the strainers can often be overlooked or not included on smaller size pilot systems. Again, these strainers protect the pilot system and must be maintained. Regardless of the size, all pilot systems for ACVs should have these strainers.

External vs. 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—if debris, organics or items such as plastic bags were to become lodged around an inline strainer, there is absolutely no way to flush this externally. The entire valve would need to be decommissioned, disassembled and then inspected and the strainer cleaned.

Maintenance & Cleaning

Strainers require maintenance and cleaning, but the frequency is determined by the quality of the



Left: Strainer with catchment chamber shown on bottom
Right: Z-style strainer featuring reduced lay length and Z-style screen

Debris lodged in the lower guide and seat area of the ACV

water being strained. If a lot of debris is in the water, weekly or monthly cleaning may be required. If the water is very clean, the strainer may be cleaned once a year. This is determined by examining the strainer frequently when the valve is first installed. It is best to flush into a clean white bucket so debris can be viewed. Frequency of flushing can be determined when a trend is observed.

A partially 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 pressure was originally reduced from 120 psi (8 Bar) to 60 psi (4 Bar) and the strainer becomes plugged, the system 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.

Additional Options

If frequent cleaning of the ACV strainers is required, there are a number of options available that can reduce frequency of flushing or alternately offer 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 compared with the smaller traditional ACV strainer screen and allows for a lot more debris to be captured between flushings. Therefore, if a traditional strainer were plugging every month, the Arion strainer may be flushed every three months. Frequent initial inspection always is required to determine the frequency of flushing. When the Arion strainer requires flushing, simply open the ball valve that comes with the unit and flush the contaminated water to the atmosphere.

Another method for protecting the pilot system of an ACV or pressure-reducing valve involves taking a redundant or duplex approach. By installing two strainers that can be isolated from each other, an operator has the ability to switch quickly from one strainer to another, simply by opening and closing isolation ball valves. A ball valve also can be permanently installed for blowdowns on each of the strainers. Strainers still must be cleaned with some frequency, but a strainer is always available for backup and to immediately switch to if plugging occurs. If preferred, pressure gauges also can be utilized to view the pressure differential across the suspect strainer, which gives some indication as to the degree of plugging.

Another method of keeping the ACV strainers clean is to simply install an inexpensive ¾-in. 24V plastic irrigation solenoid valve on the outlet of the strainer and install a small battery operated irrigation timer nearby. The timer then can be programmed to come on for a given duration as frequently as required. This can be effective when strainers must be flushed frequently.

In Conclusion

A properly sized upstream strainer with valuable features can offer incredible protection for an ACV (pressure-reducing valve), turbine meter or any number of sensitive downstream devices. It is important to understand the various options that are available on strainers, such as blowdown 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 because of special equipment required. WWD

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