

Ensure Your New Valve Station is Well Thought Out

Control valves are pivotal components of municipal water systems, playing a crucial role in regulating water pressure and flow to ensure a stable supply. Their widespread presence in these systems highlights their critical role in the operational integrity and dependability of water distribution networks. Selecting the appropriate valve size is not only essential for optimal functionality but also for the longevity of the valve's service life.

By Mark Gimson, Director of Marketing and International Sales – Cla-Val

It is equally important to consider the working environment for the personnel tasked with valve maintenance, ensuring it is conducive to efficient and safe operations. Proper sizing of control valves is paramount, as it directly influences efficiency, control precision, safety, and cost-effectiveness of the water distribution system. By adhering to these best practices, control valves can deliver years of reliable service, contributing to the seamless operation of water distribution infrastructures.

A well-designed valve station requires planning that considers the following:

1. Sizing your valve

Most valve stations in municipal water situations are pressure-reducing valves. Selecting the right size is important, as problems can arise from incorrect sizing. Rather than sizing the valve based on the size of the line, it is necessary to consider flow, pressure, and velocity. Knowing the size of the water main, and the maximum, average, and minimum flow demands, one can move forward in the valve size selection. Some manufacturers have a sizing software program that makes it quick and simple to size a valve correctly but understanding what the program is considering is useful.

A sizing software program will select a valve size based on the maximum required flow the valve has to pass, based on the minimum system differential pressure. This will be the upstream pressure minus the required downstream pressure that the reducing valve will be set at. The program will consider the velocity passing through the valve; it is best to limit this to 20 feet per second (6 m/s) in valves operating continuously. In valve stations, it is common to have two control valves in parallel. The larger valve on the main line is designed to take care of peak flows, while the smaller second valve on a bypass will take care of low flows. Typically, the smaller bypass



A well planned out valve station, has good access for maintenance

valve will be sized to handle approximately 20% of the peak flow.

The smaller valve is also set slightly higher in pressure than the large valve. This allows the smaller valve to open first in the sequence, followed by the large valve as flow increases. The smaller valve is also the last to close as flow diminishes. This bypass line also offers redundancy as either of the valves can be used to supply the network while the other is being serviced. This is particularly important where it is not possible or practical to shut off the main water supply for periods of time.

Some manufacturers have software to support valve station design and allow engineers to consider the impact of velocities, among other things. Often, the velocity in a bypass valve can be excessive, potentially causing damage to the small valve and increasing loud noise levels. Using software, a designer can specify the use of a transition device that will bring the main line valve into operation before high velocities are reached, which is often before the lower pressure setting of the larger valve.

2. The risk of cavitation

Anytime there is an application where reductions from a higher pressure to a lower pressure, and that ratio is greater than 3:1, there is a real risk of cavitation.

This phenomenon will destroy a valve over time due to erosion and can create noise and vibration in the pipeline that may be a problem for nearby residents. However, unlike in days past when multiple valves would have to be installed to stagger the pressure drops, this can now be achieved through an anti-cavitation trim. This is a specific trim consisting of two stainless steel cages with slotted openings or drilled orifices that contain the cavitation in the center of the cages, eliminating disastrous erosion issues.

It is always recommended to run a cavitation software program to determine if cavitation will be a problem, and this should be a program specific to the manufacturer's valve. Generic programs are available but often do not account for the actual body shape of the valve.

3. Options to customize

The real advantage of diaphragm-actuated globe valves is that one can have a pilot system tailored to a specific application. Numerous features can be added to give a custom solution that provides real operational benefits.

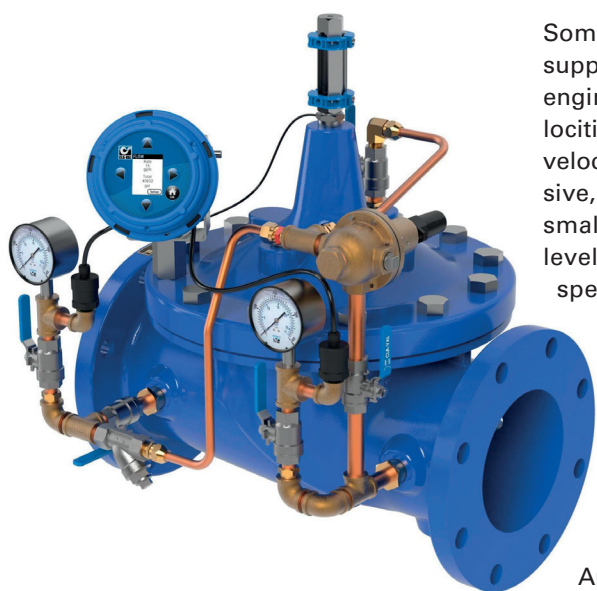
Stainless steel pilot systems are popular and the price differences to brass/bronze or copper is not prohibitive. In addition, it should last longer, particularly in harsher environments. Pilot systems can be installed on either side of the control valve, so give some thought

both to the location for accessibility with ladders and also clearance for maintenance. Pilot tubing is frequently stepped on or knocked because of poor placement – with a little forethought, this is avoidable.

The pilot system should always be installed with a strainer. This can either be a flow clean, internal style, or an external Y-strainer style. In tough applications, a water filter can be used. Pilot isolating valves are vital for maintenance and troubleshooting of the valve – even on the smallest of valve sizes.

There are other options to consider. A valve position indicator is very useful for operations personnel as it gives the ability to see the exact position of the valve during operation. If a remote signal is required this can be upgraded to a position transmitter supplying a 4-20 mA signal via SCADA, or a limit switch can be added to give an output for a position transmitter. Pressure transmitters can be added to give 4-20mA signals for both inlet and outlet pressures. This option is useful if the intention is to utilize a pressure management program in the future.

Also, consider options to provide more system control. A second pilot control can be added to give the ability to sustain upstream pressure. This is very useful in situations where there is a need to protect the upstream from being starved of pressure by high downstream



Accessory packages like the Cla-Val Model XP2F is a complete instrumentation accessory package

demand. If downstream surge could be an issue, a downstream surge pilot can be added to the reducing valve that will close the control valve quickly should the downstream pressure rise slightly above the pressure-reducing pilot set point.

Some manufacturers will offer package solutions – for example, the Cla-Val Model XP2F offers full instrumentation that includes upstream pressure, downstream pressure, valve position, instantaneous flow, and totalized flow. When deployed across the system network the XP2F package allows for insight into pressure, leakage, flow, and system distribution management. The inlet pressure, outlet pressure, valve position, flow, and totalized flow can be retransmitted to SCADA or the AMI System, and logged to the internal SD Card.

The possible additions are numerous and specific requirements should be discussed with the control valve supplier to ensure you get the full benefit of all that is available.

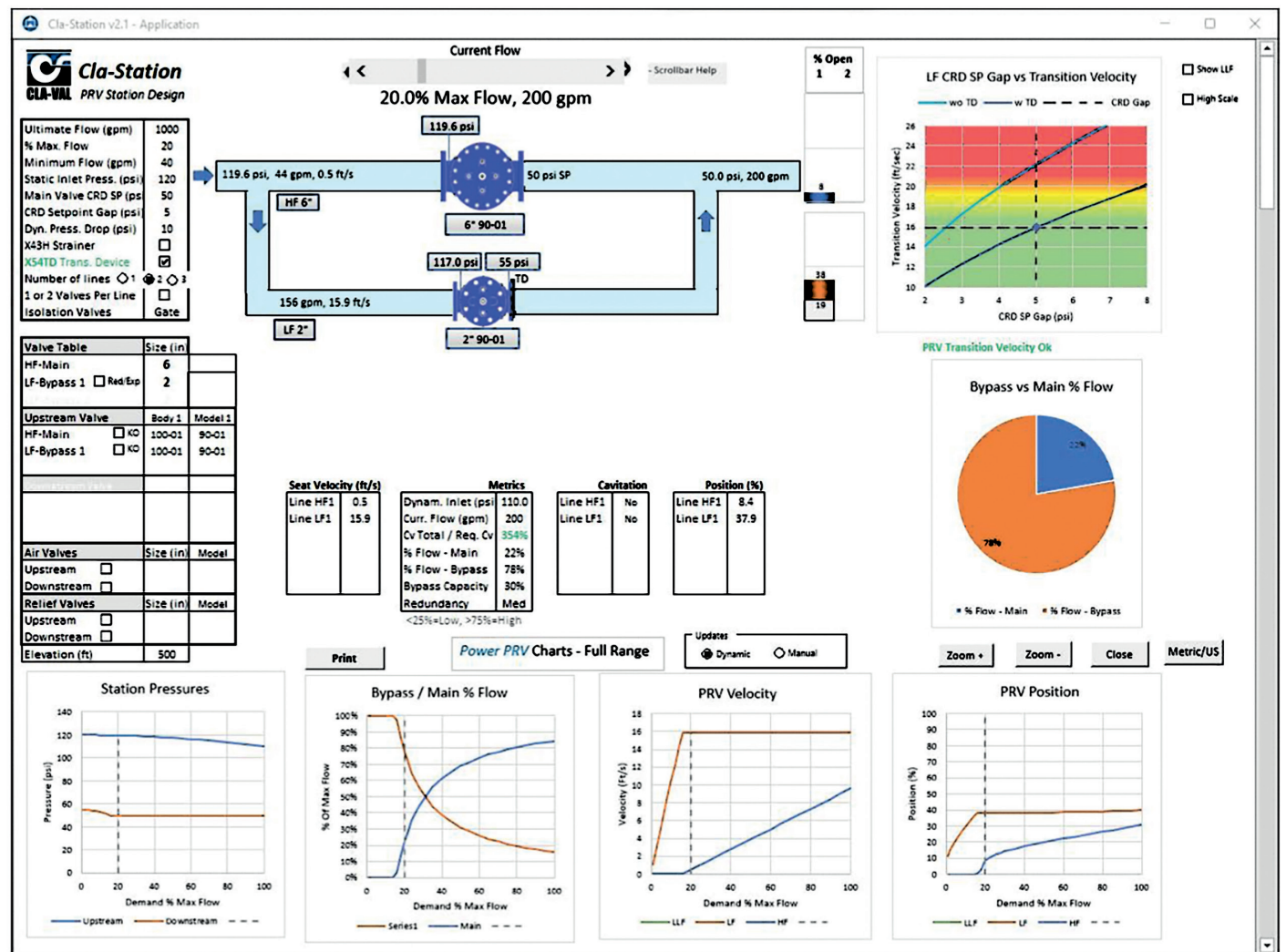
4. Layout of the valve station

There are some key items that every valve station requires, namely isolating valves, upstream and downstream of the control valves. These are required to allow for the isolation of the control valve when it is necessary to work on the control valve for maintenance. These valves can be either butterfly valves or gate valves and can be installed with handwheels or operating nuts depending on whether or not it is required to operate these valves from above ground. Most utilities will use non-rising stem gate valves as these are the valves that are typically located throughout the network. Everyone is familiar with them; however, if space or cost is an issue, butterfly valves can be used, as long as there is space between the butterfly and the control valve to allow clearance for any equipment in the control valve, such as insertion strainers or flow meters.

The importance of protecting the control valve from foreign objects in the pipeline cannot be stressed enough, and this is where a line strainer is an excellent addition to the station. While most water supplies have screening at the intake point, it is common for objects to be introduced into the network, either by insufficient flushing after piping work or even open pipe ends that can attract animals during development. Everything – from welding rods, fish, rodents, pieces of wood, and even expensive tools – has been seen.

Each station should be installed with pressure gauges, either on the pipeline or sometimes supplied with the control valve. It is necessary to know the outlet pressure to set the reducing valve, and having an inlet gauge also allows the operator to see what the conditions are upstream.

Air valves should be strongly considered for every valve station. The operation of reducing pressure naturally allows air to form in the pipeline and, if this is not removed downstream of the control valve, it will move down the pipeline and potentially cause issues elsewhere. A good practice is to install an air release valve on the upstream side of the control valve – this will eliminate the possibility of air entering the pilot system, which can be a problem.



Cla-Station is used during planning to determine the right valve size based on velocities

5. Practical and functional additions

Before a valve station is installed and operational, consider installing these items:

1. Lifting eyes in the ceiling above major pieces of equipment. If this is a concrete chamber, these need to be decided upon before the concrete is cast to ensure correct capacity. They will make maintenance a much easier task for the operations crew.
2. Spare pipeline connections, possibly for a hose bib connection. It is much easier to install before the line is pressurized.
3. A sump drain. Chambers can flood and getting water out can be an issue. This may be as simple as a daylight drain, or a sump with an electric pump may be required.
4. Protection from over-pressure for the downstream network. Consider adding a relief valve on the downstream piping inside the valve station. Typically, this valve will be a much smaller valve than the main line valve, and an angle style is most common. The outlet from this valve will require a drain connection to eliminate the flooding of the chamber, should the valve ever be utilized. However, it is a small valve compared to the potential damage that a burst water main may cause downstream.

While a valve station design is not necessarily difficult, poor design can certainly lead to operational issues down the road. Take the time to think it through and you will win friends in the operations department later. Regular maintenance, including inspections, calibration, and cleaning, is recommended to prevent malfunctions and extend the valve's lifespan.

ABOUT THE AUTHOR



Mark Gimson is Director of Marketing and International Sales for Cla-Val. As a mechanical engineer with 40 years in the water industry, Mark has a passion for expanding markets and understanding customer challenges to provide the optimal solution.

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