Check valve sizing is more important than you think

Proper sizing can avoid costly problems

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INTRO:

It is surprisingly common for check valve sizing to be an afterthought in the flow control/fluid process industries. Often marketed together with gate and globe valves, check valves are such a small part of the gate, globe, and check valve market that many engineers in the field don't even think about their sizing. It is usually check valve failure that prompts engineers to seek technical support. Even then, they may not consider that sizing is the underlying issue.

Check valves serve essential functions; they're primarily used to prevent the reverse flow of media – liquid, gases, and steam, typically – but can also be used for vacuum breaking, low-pressure relief, line isolation, manifolding, media injection, and many other applications. By allowing flow in one direction only, check valves prevent damaging backflow and some styles can prevent hydraulic shock, otherwise known as water hammer.

There are different items to consider when sizing a media-actuated check valve vs. other types of flow control valves that utilize externally actuated methods. Systems operate more effectively and reliably when check valves are properly sized. Correctly sizing valves protects them from preventable problems such as wearing prematurely or breaking apart, which can disrupt processes and cause damage to other equipment and components.

Correctly sizing valves protects them from preventable problems.

"The cause of check valve failure is not necessarily a bad valve; oftentimes, improper valve selection for the application is the underlying issue." observes Brian Strait, Business Development/Marketing Manager at Check-All Valve Mfg. Co. (www.checkall.com), a provider of in-line, spring-loaded, poppet-style check valves.

WHY IS OVERSIZING A PROBLEM?

Valves that are oversized can experience a significantly shorter lifespan due to premature wear, potentially leading to complete failure. If they come apart, they can damage or destroy more expensive components upstream or downstream – normally downstream of the check valve – resulting in costs that are far greater than a simple valve replacement. A telltale sign of oversizing is when the check mechanism rattles and chatters because it is not fully opening and closing properly.

WHY IS UNDERSIZING A PROBLEM?

Undersized check valves can create a choked flow condition, which means a process doesn't get the flow of media or pressure it needs downstream of the check valve. When the valve is too small, it will interfere with the performance of the intended function.

Because the system can't operate effectively, it can put more strain and stress on the source of the flow, such as a pump.

Furthermore, when a check valve is undersized or has too heavy of a spring, the checking mechanism may not perform as desired. Even if the valve size matches the line size, the flow capacity is less than required for the application, causing choked flow. As a result, it will not produce the flow of media needed downstream to accomplish the intended function. For example, a system requiring 100 gallons per minute (GPM) of flow and 50 pounds per square inch (psi) of pressure to operate effectively may fall short with undersized check valves or improperly selected springs.

INCENTIVES FOR ACCURACY

A common adage says the final cost of a valve is much more important than the first cost of a valve. "In other words, if you install an inexpensive commodity valve that must be replaced frequently, it will likely cost more in parts and labor then using a performance check valve made to meet the application needs," says Strait.

Properly sizing check valves:

- Improves valve operation, promoting a longer life cycle
- Minimizes the frequency, costs, and duration of valve maintenance, repair, and replacement
- Reduces downtime from valve failure and consequential equipment damage or destruction
- Enables adequate flow and pressure to operate at optimum performance

Sizing is highly dependent upon the type of valve.

"Paying a little more for a valve that's going to last a long time and never have any issues will cost much less over time," adds Strait.

HOW TO GET SIZING RIGHT

Sizing is highly dependent upon the type of valve. For most flow control valves (gate valves, globe valves, ball valves, etc.), it is simply based on the size of the line. Also, these valve types are manually throttled. With the turn of a handle, a ball or gate valve's opening

mechanism can be manipulated as much as needed to achieve the desired pressure loss and/or flow coefficient (Cv). Because of this capability, using these valve types with a flow capacity well in excess of what is needed for the application, is oftentimes desired.

For example, if a valve Cv of 100 is required for an application to achieve the desired flow and pressure drop of the media, then it is okay to use a valve that is 150 Cv capable if it can be throttled down to 100 Cv by turning the handle. Manually operated valves, such as ball valves, are much less sensitive to varying flow conditions.

On the other hand, a check valve is automatic, whereby it is activated by flow conditions. This makes accurate valve sizing more important. For spring-loaded check valves specifically, proper spring selection is essential for optimum valve performance.

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When it comes to spring-loaded check valves or any sort of check valve that is operated by the media, the media's function is what opens the valve; no external controls are involved. Whether the media is a gas or liquid is important in sizing. With gas sizing, pressures and temperatures must be considered. With liquid sizing, temperature has little effect because it doesn't affect the compressibility. Pressure cannot compress liquid, but it can compress or expand gas.

The spring setting (also known as spring cracking pressure) is equal to the minimum pressure differential it takes to initially open the valve. Some additional amount of pressure differential and flow is needed to open a valve fully, but if the spring is too heavy, it will not fully open, and ultimately will rattle, chatter, and may wear out prematurely.

With the above points in mind, the basic steps to properly size a check valve include:

- Determine the line size, media, and temperature of the application.

- Determine the flow and pressure of the system.
- Calculate the required Cv based upon the application flow conditions.
- Choose the right spring and valve style and size with proper Cv to make sure the valve operates properly in the system.

Industry standard sizing formulas are available to assist with the calculations.

"It is highly important to make sure you have the right components working with the media so that the media can fully open and fully close the valve by flow and pressure differential," explains Strait. "Normally, you'll want to get the minimum setting to make sure it opens fully and yet takes as little pressure away as possible." An exception is when an application requires the check valve to hold back a certain amount of pressure to make a pump operate more effectively, for example.

IMPORTANCE OF AN EFFECTIVE SUPPLY PARTNER

The amount of time lost to correct a problem depends on how fast the valve provider can supply properly selected product for the application. Check-All Valve Mfg. Co. has some of the fastest lead times in the industry. The company focuses strictly on spring-loaded check valves and stocks a myriad of valve and spring options.

Expert advice is another quality sought of valve partners, whether for troubleshooting or specification advice. Look for a provider who can help ensure your systems operate as best they can, as efficiently as they can, and as economically as they can with properly selected and sized check valves.

ABOUT CHECK-ALL VALVE MFG. CO.
Check-All Valve is dedicated solely to the design and manufacture of spring-loaded check valves. Internationally recognized for quality, innovation, and cost efficiency, our check valves are rugged, efficient, and built to perform to their specifications. Most lead times are less than one week.