

Fisher® Cavitation-Control Technologies

Solutions to Cavitation Problems



Severe Service



Control Valve Cavitation

Cavitation is a concern for plant operators and maintenance personnel because it can reduce plant availability and profitability. Cavitation not only decreases flow capability through control valves, but it may also cause material damage, excessive noise, and excessive vibration.

A wide range of Fisher® cavitation-control technologies are available for clean and dirty service. Included in this brochure are images of Fisher technologies with descriptions, specifications, and proven results.

Hydrocarbon and Petrochemical Industries

Hydrocarbon and petrochemical industries are built on reliable liquid process control. Typical fluids include: crude oil with multiple chemical compounds and particulate, highly refined single compounds such as butane, and complex intermediates.

These fluids are transported and processed in a variety of ways. Applications are driven by pump, reaction, or vertical head. In all cases, the process equipment must be correctly sized and selected to attain the best loop control, minimize process variability, and deliver the best process results.

Cavitation is an unintended occurrence in many of these processes. Mixture hydrocarbons, such as crude oils, may have less damage potential than a similar application on water, but highly refined fluids, such as gasoline blends, can cavitate with the same damage potential as water. Crude oils often carry particulate that will plug the small flow passages in some cavitation-control designs.

Supporting hydrocarbon and petrochemical industries with cavitation solutions requires a broad range of valve designs covering clean to dirty fluids, benign to very corrosive fluids, and flow rates requiring NPS 1 to 48 and larger.

Power Industry

All power or process steam plants, whether traditional coal fired, integrated gasification combined cycle, nuclear, or combined cycle, have the potential to experience cavitation and its related effects. This is due to the high-pressure water and pressure drops experienced in applications such as boiler feedwater startup, pump recirculation, and desuperheater spraywater. The negative effects of cavitation in these applications can be effectively combated by utilizing one of the many Fisher technologies.

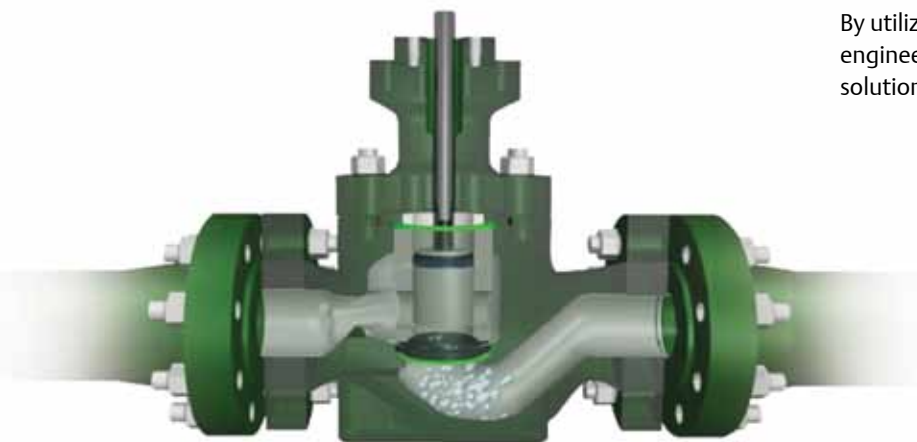
Special consideration should be given to the chemistry of the water as well as the presence of particulate, which is common in these applications. For example, the use of R30006/CoCr-A in boiler feedwater may be acceptable depending on the amount and type of amines present. The use of anti-cavitation trims should be evaluated based on the presence of particulate, weld slag, and magnetite. A variety of trim styles, such as Fisher dirty service trims, are available to prevent damaging cavitation while passing large particulate.

Process facilities don't have to be limited by the damaging effects of cavitation. Emerson Process Management provides proven, engineered solutions for these applications utilizing Fisher technologies.

Additional Industries

Process industries such as mining, pulp and paper, life sciences, and food and beverage experience cavitation challenges. These industries use steam for motive force or process heating. Steam generation requires high-pressure water and involves processes that can cavitate. Fluid control applications may combine cavitation with: high viscosity, multi-phase fluid; corrosion; or coking or plugging fluid.

Emerson Process Management has Fisher control valves for all these challenges, which are similar to those shown in this brochure but with variations in geometry and materials. By utilizing local application engineers and experienced design engineers, Emerson Process Management can deliver a custom solution for your special application.

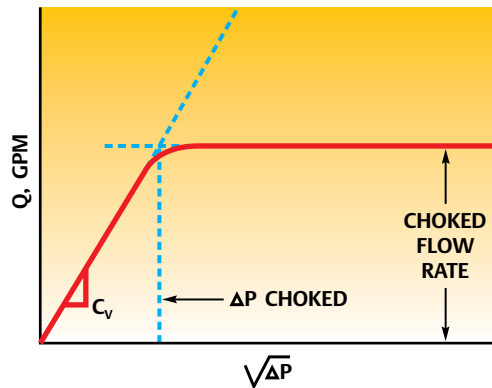


**View an animation video on cavitation
at www.FisherSevereService.com.**

Science of Cavitation

Cavitation and Choked Flow

Cavitation is a purely liquid flow phenomena—gases cannot cavitate. Choked flow may occur as a result of cavitation. Choked flow occurs when the normal relationship between flow and increased pressure drop is broken. With choked flow, an increase in pressure drop by decreasing the downstream pressure does not result in more flow through the restriction.



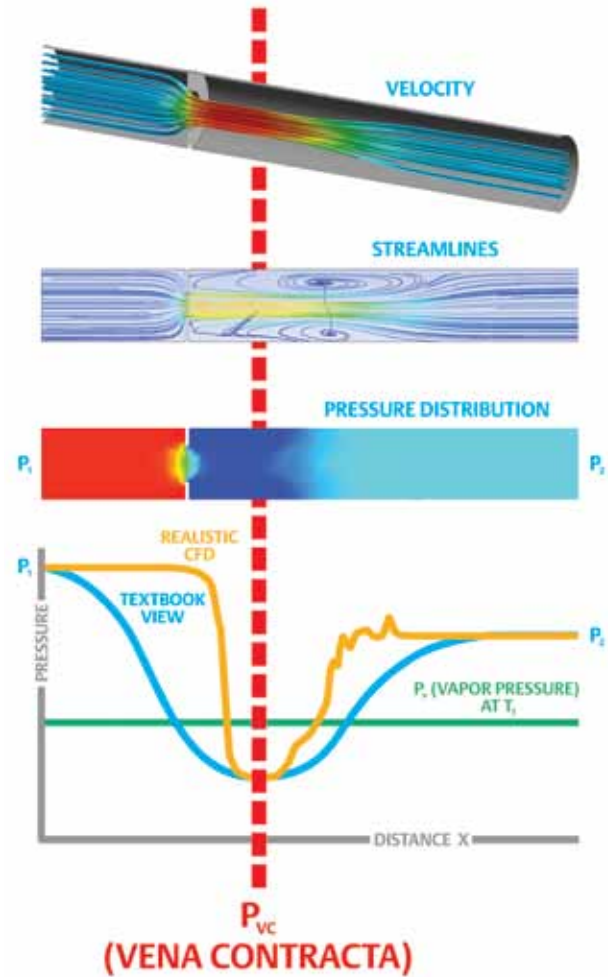
Basic valve sizing equations imply that, for a given valve, flow should continually increase by simply increasing the pressure differential across the valve. In reality, the relationship given by these equations holds true for only a limited range. As the pressure differential is increased, a point is reached where the flow increase stops. This condition of limited maximum flow is known as choked flow.

Consider the simple restriction shown to the right. The pressure of the liquid, P , is plotted as a function of the distance, X , through the restriction. As a liquid passes through a reduced cross-sectional area, velocity increases to a maximum and pressure decreases to a minimum. As the flow exits, velocity is restored to its original value while the pressure is only partially restored, thus creating a pressure differential across the device.

There is a point along the flow path called the vena contracta, where the flow area and pressure are at a minimum and the velocity is at a maximum. When this point is reached, the local pressure may drop to or below the vapor pressure of the liquid, forming vapor cavities. The density of the liquid-vapor mixture continues to decrease until the compressible choked flow limit is reached.

The distance from the restriction to the vena contracta will vary with the pressure conditions and type of restriction. After the vena contracta, the liquid pressure will recover to or below the downstream pressure. If the downstream pressure is higher than the vapor pressure, the vapor cavities will collapse. This is cavitation. If the downstream pressure stays at or below the vapor pressure, the vapor cavities do not collapse and the vapor expansion continues. This is known as flashing.

As the pressure recovers, the vapor cavities implode, forming high-speed, destructive microjets and localized shock waves. Either of these mechanisms, when located near the material surface, can cause severe damage to valve elements such as the plug, seat, body, and associated pipe.



The model above depicts mean fluid pressure. Flow through control valves causes significant deviations from the mean pressure. Deviations include instantaneous pressure fluctuations associated with fluid turbulence, and low pressures in the cores of vortices and eddies associated with boundary-layer separation, free shear zones, stagnation regions, and re-entrant zones. These explain some of the differences seen between the textbook view represented by the blue line and realistic computational fluid dynamics represented by the yellow line. These phenomena can produce local pressures significantly higher or lower than the mean pressure, sufficient to initiate cavitation in very localized regions. Typically, cavitation begins before the minimum mean pressure is reduced to the vapor pressure.

Standard liquid sizing fully accounts for the capacity concern associated with choked flow and prevents undersizing the valve. Additional empirical information is required to predict different levels of cavitation.

Effects of Damage

Factors Affecting Cavitation Damage

Cavitation doesn't always cause damage when it occurs. The extent of cavitation damage is a function of the following factors:

- **Intensity/magnitude of pressure drop** – Greater drops in pressure increase the potential for damage.
- **Materials of construction** – Hardened materials reduce damage. Examples include R30006/CoCr-A, nickel-chromium-boron alloys, hardened S44004 stainless steel, hardened S17400 stainless steel, and hardened S41000/S41600 stainless steel.
- **Time of exposure** – The longer cavitation occurs in an area, the more likely it is to result in damage.
- **Quantity of flow** – Cavitation issues generally scale with flow rates. A larger flow rate means more fluid is available to cavitate and there is a greater potential for cavitation damage.
- **Valve/trim design** – Fisher control valve trim can be selected to combat the damaging effects of cavitation using isolation or elimination techniques.
- **Leakage while closed** – If seat leakage occurs when a valve is closed, the liquid moves quickly from a high-pressure area to a low-pressure area, which may result in cavitation and potential damage.
- **Fluid** – Fluid behavior should be considered in trim selection. For instance, water in a power plant behaves differently than crude oil for the same service conditions.

Material Damage

Physical damage to a control valve due to uncontrolled cavitation is a concern because of the high maintenance cost, inconvenience, unpredictability, and unplanned downtime. Damage can consist of a mechanical and selective chemical attack on the material surface.

Typically, cavitation damage is characterized by a very irregular, pitted, rough appearance. Valve parts with extensive damage may have large amounts of material missing.

The mechanical attack can occur in two forms: microjet impingement and shockwave impingement. Microjet impingement causes erosion of the material surface. Shockwave impingement causes material deformation and failure.

A chemical attack occurs when the protective, passive oxide layer is physically removed from the base metal during the mechanical attack. The base material is left vulnerable to further chemical attack.

The science of vapor cavity nucleation, growth, collapse, and rebound is at the core of cavitation damage. Rather than go through the science, the focus will be on how to reduce cavitation effects. Further information is available by contacting your local Emerson Process Management sales office.

There are several factors that determine a material's performance in a cavitating situation, including its toughness, hardness, and corrosion resistance in the application environment. These factors are discussed in the materials of design section.

This valve plug has sustained extensive cavitation damage. It shows a complete loss of seating surfaces.



Emerson Innovation

Excessive Noise and Vibration

Cavitation can cause unacceptable noise and vibration. Although the noise associated with a cavitating liquid can be quite high, it is usually a secondary concern when compared to the material damage that can exist. Cavitation is frequently described as sounding like gravel in a pipe, but the character of cavitation noise can vary widely.

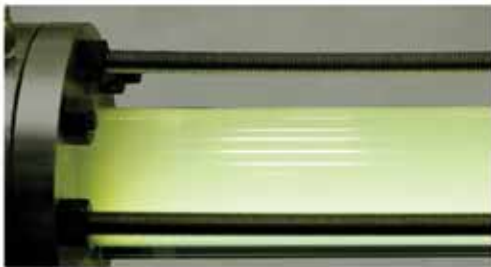
Damaging cavitation can take place without noise, and the level of noise and vibration from a control valve may not always coincide with the cavitation damage level.

Vibration resulting from cavitation may be more prevalent than cavitation damage. It can affect the valve positioner, linkage, tubing, and adjacent pipe.

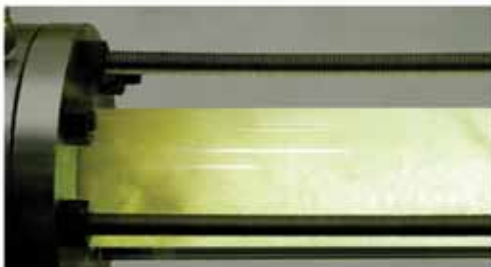
Fisher® Technology Development

The Emerson Innovation Center for Fisher Technology in Marshalltown, Iowa, USA, is home to the world's largest flow lab used to evaluate control valves. It incorporates flow testing capabilities up to NPS 36 and 240 bar (3,500 psig). Final control elements are tested in conformance to IEC and ISA standards in real-world plant conditions to ensure production reliability, efficiency, environmental compliance, and safety.

Emerson engineers conduct tests that analyze cavitation, materials, fatigue, wear, high and low temperatures, valve actuators, valve instrumentation, seismic requirements, reliability, loop variability, leakage, hydrostatic forces, gaskets, seals, and control system compatibility. In the controlled lab environment, special tests are commonly performed to answer customers' questions.



Normal, turbulent flow in a transparent pipe.



Cavitation and turbulent flow vary with pressure drops.



Note the variation in flow fields between this image and the second image, despite identical service conditions.

Emerson engineers conduct noise and vibration tests on cavitating applications in many different ways. Transparent pipe allows visualization of the cavitation field. Cavitation demonstrations can be arranged with your local Emerson Process Management sales office.

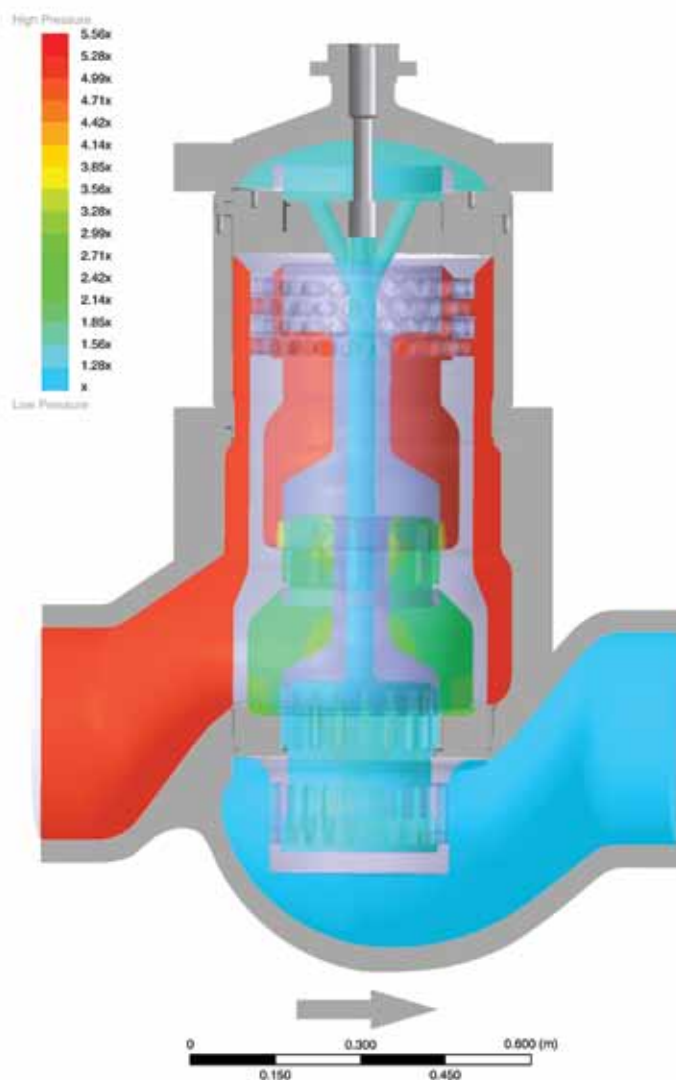


Matching Applications to Design

Valve Selection and Design

When service conditions and the process loop design are fixed, a control valve may have to operate at pressure conditions that normally result in cavitation. In such instances, source treatment will be needed.

Clearly, a single product design is not sufficient for the wide variation of applications across multiple process industries. Emerson Process Management uses multiple approaches to address application-specific issues. A large selection of Fisher cavitation-control technologies is utilized for clean and dirty services.



Pressure distribution through Fisher Dirty Service Trim in a NPS 16 easy-e™ valve body.

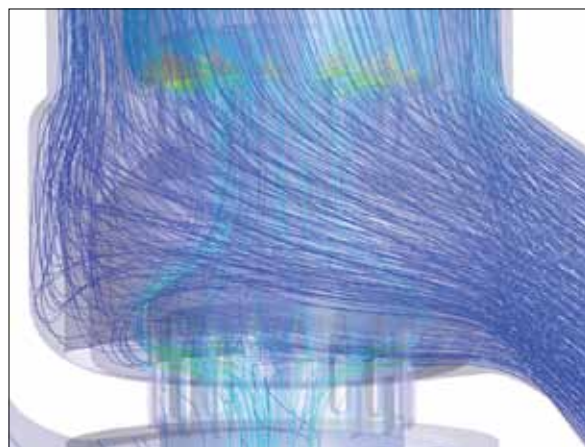
Application experience, knowledge of cavitation science, and the effect of valve size, type, trim style, geometry, and materials are all critical to providing reliable solutions. Standard or custom Fisher control valves with anti-cavitation trim can be used to control cavitation.

Fisher anti-cavitation trim styles utilize multiple techniques such as pressure staging, jet formation control, and flowstream manipulation to control cavitation and prevent its damaging effects.

Materials of Design

Since the standard materials used in valve bodies are relatively soft, selection for cavitation resistance must rely on factors other than hardness. In general, as the chromium and molybdenum contents increase, the resistance to damage from cavitation increases. Thus, the chromium-molybdenum alloy steels have better resistance than the carbon steels, and stainless steels have an even better resistance than the chromium-molybdenum alloy steels.

Materials commonly used for cavitating services are R30006/CoCr-A, nickel-chromium-boron alloys (solid and overlays), hardened S44004 stainless steel, hardened S17400 stainless steel, and hardened S41000/S41600 stainless steel.



Detailed view of the flow pathlines through the trim.

Plant Designs that Prevent Cavitation

Cavitation Coefficient

The Fisher cavitation coefficient indicates the potential for damaging cavitation in a control valve. It is dependent on several factors:

- Valve/trim style
- Service conditions
- Fluid properties
- Intensity/magnitude of pressure drop
- Materials of construction
- Length of exposure
- Quantity of flow

The Fisher cavitation coefficient predicts the onset of cavitation-related damage. It is available for every Fisher cavitation-control product throughout its full, intended application range.

Other vendors utilize similar application guidelines. The user is cautioned to always use the guideline associated with the chosen vendor. The coefficient is not interchangeable.



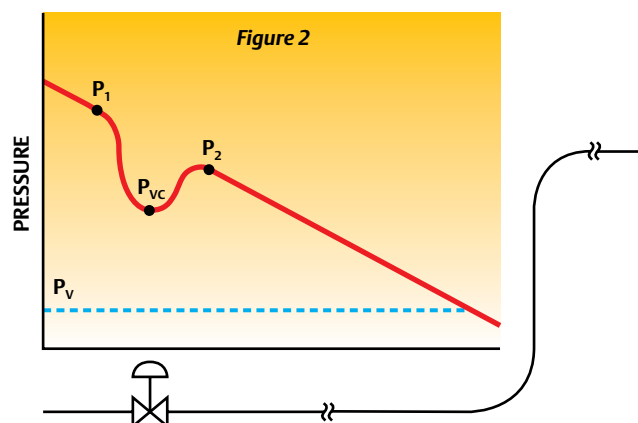
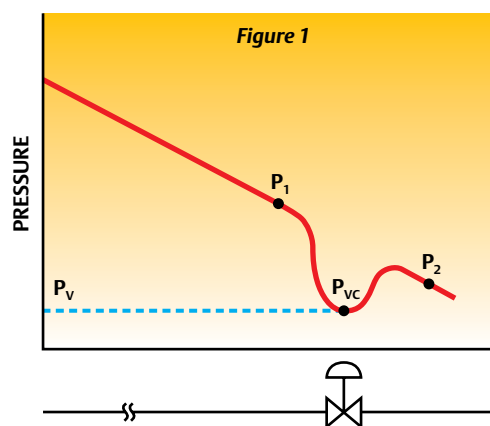
Predicting the onset of damaging cavitation is an arduous task. Emerson Process Management's field experience, research capabilities, and subject matter expertise in fluid behavior help improve the ability to predict damaging cavitation.

Process Loop Design

Flow conditions that will produce damaging cavitation can often be avoided at the design phase of a project by giving proper consideration to service conditions and the process loop design. Process loop design can influence cavitation in a control valve. Figure 1 shows a valve installation and pressure plot where the majority of the pipe system is upstream of the valve. Looking at the pressure along the pipe or loop, the valve is positioned where P_2 is close to P_v and the likelihood of cavitation in the control valve is high.

In Figure 2, the valve has been relocated so the majority of the system is downstream. Now P_2 associated with the valve is higher and thus much different from P_v , therefore the likelihood of cavitation is much lower. This demonstrates the value of locating the valve to leverage the natural pressure distribution in a system. These simple diagrams show only pipe but the effect of all system elements—such as reactors, vessels, and pumps—must be considered in a loop pressure review.

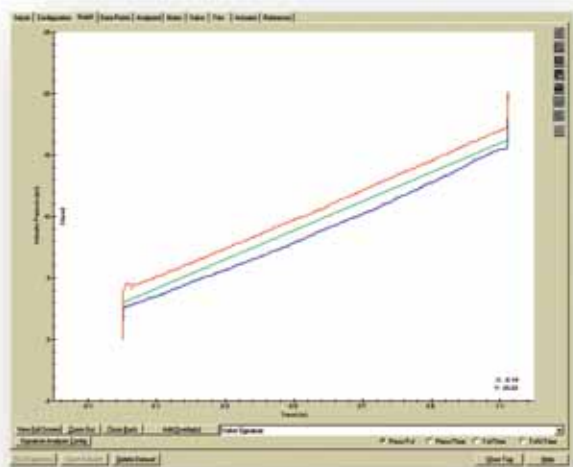
If valve placement is not flexible, flow resistance can be added downstream of the control valve utilizing an orifice plate or a second valve. Fluid pressures within the valve increase and it will experience less pressure drop. However, this technique may simply displace cavitation from the valve to the downstream restriction and may not effectively control the cavitation in the system. This may also increase valve size, as less pressure drop is available to process the same amount of flow.



Are You Willing to Take the Risk?

FIELDVUE™ Performance Diagnostics

Reliability is a key requirement for all process facilities. FIELDVUE™ digital valve controllers installed on Fisher cavitation-control valves protect your process by giving a view of operating characteristics such as supply pressure, control signal, friction, and seat load. FIELDVUE Performance Diagnostics run continuously, analyzing valve and actuator data while the valve remains in service. If problems are detected, information can be directed to the appropriate personnel automatically, when installed in a PlantWeb™ system. These notifications help you keep the control valve and the process loop functioning optimally.



Reliable Cavitation Control

Emerson Process Management was a pioneer in understanding cavitation-related problems in control valves. Through this understanding, Emerson Process Management has lead the way in engineering and manufacturing cavitation-control trims that solve customers' issues.

Correct engineering and manufacturing of anti-cavitation trims is critical to their overall operation and life expectancy. Holding tight tolerances, selecting correct materials, and correctly staging the pressure drop can be the difference between extended trim life or an unplanned shutdown.



Confidence in cavitation solutions relies on true OEM engineering and manufacturing specifications. Non-OEM solutions may appear to offer cost-effective solutions in the short term, but introduce new risks of unexpected shutdowns and lost production. Are you willing to take this risk?

Emerson Process Management provides the quality, accuracy, and engineered solutions demanded by these difficult cavitation services. Local service is provided before and after the sale. Emerson Process Management sales offices are backed by global manufacturing sites that can effectively manufacture, measure, and assemble these highly-engineered solutions. No matter where your Fisher cavitation-control technology is manufactured, product quality remains the constant that our engineers demand and our customers deserve. Parts and services are available to minimize downtime and maximize throughput.

If you have an existing installation with a cavitation problem, or you want to ensure that your next installation will not experience its damaging effects, contact your Emerson Process Management sales office. You will receive the support needed to accurately size, select, and install the solution to your cavitation problem.

Comprehensive information on cavitation is available from your local sales office or from www.FisherSevereService.com.

Cavitrol™ III trim

is used for cavitating liquid applications in various globe and angle valve bodies. Cavitrol™ III trim can effectively eliminate cavitation damage.

The cage contains a multitude of specially shaped holes; the hole shape reduces fluid turbulence. In addition, the holes are radially aligned to flow from one restriction to another. This action is pressure staging, dividing the total drop into smaller increments. Both features dissipate the fluid pressure and prevent cavitation.

- 1, 2, 3, or 4-stage trim
- Globe or angle body
- ASME Class 300 - 2500
- NPS 1 - 24
- Flow-down design
- 276 bar (4000 psi) pressure drop limit
- ANSI/FCI Class V shutoff

The optional Protected Inside Seat technology, shown right, has seating surfaces on the inside tip of the valve plug and the radius in the groove of the seat ring, so shutoff surfaces are not exposed to potential erosion.

- 2, 3, or 4-stage trim
- Globe or angle body
- ASME Class 900 - 2500
- NPS 2 - 6
- Flow-down design
- 276 bar (4000 psi) pressure drop limit



PROVEN RESULTS

PRODUCTION:	Co-generation power.
APPLICATION:	Boiler feedwater drum level system.
CHALLENGE:	Seat leakage due to cavitation and frequent trim replacement.
SOLUTION:	NPS 6 Fisher HPT valve with 4-stage Cavitrol III trim and Class V shutoff.
RESULTS:	Operating time increased by 50% and control was improved.

GX Valve with Cavitrol™ III Trim

lowers hydrodynamic noise and vibration by utilizing a proprietary drilled-hole shape and spacing. The special hole technology and flow-down design reduces and isolates cavitation to prevent damage. Cavitrol III technology is used without altering the integral GX bonnet design.

- 1-stage trim
- Globe body
- ASME Class 150, 300
- DN 25, 40, and 50 (NPS 1, 1½, and 2)
- Flow-down design
- 27.6 bar (400 psi) pressure drop limit
- ANSI/FCI Class V shutoff



PROVEN RESULTS

PRODUCTION:	Fertilizer.
APPLICATION:	Make-up water.
CHALLENGE:	Control of low-intensity cavitation.
SOLUTION:	Fisher GX valve with Cavitrol III trim.
RESULTS:	Long valve life in a compact package.

Cavitrol™ III Micro-Flat Trim

is a combination of distinct technologies. The cage, plug, and seat ring are designed and manufactured as a unit. The benefit is cavitation control for high pressure drops at very low flow rates. The trim package also incorporates a protected seat for long shutoff life.

- 2, 3, or 4-stage trim
- Globe or angle body
- ASME Class 300 - 2500
- NPS 1, 1½, and 2
- Flow-down design
- 241 bar (3500 psi) pressure drop limit
- ANSI/FCI Class V shutoff



PROVEN RESULTS

PRODUCTION:	Oil and gas.
APPLICATION:	Methanol injection.
CHALLENGE:	Very low flow, high pressure drop, cavitation, and vibration.
SOLUTION:	Fisher Cavitrol III Micro-Flat trim.
RESULTS:	Provided accurate, low-flow control and prevented cavitation.

Micro-Flat Trim

utilizes a cavitation-control mechanism consisting of special flow paths to prevent impingement on critical trim components.

Micro-Flat trim is intended for low-flow applications in the flow-down direction only. The trim design does not eliminate cavitation but controls where it occurs to minimize damage.

Micro-Flat trim features a protected seat design to maximize seat life in cavitating environments.

The trim is available in hardened materials only, such as R30006/CoCr-A and S44004. These materials are needed to provide wear resistance between the plug and seat ring. An outlet liner is provided to protect the valve body.

Micro-Flat cavitation trim is recommended for angle valve applications. In special cases, it can be engineered into a globe valve body.

- 1-stage trim
- Angle body
- ASME Class 150 - 2500
- NPS 1, 1½, and 2
- Flow-down design
- 51.7 bar (750 psi) pressure drop limit
- ANSI/FCI Class V shutoff



PROVEN RESULTS

PRODUCTION:	Power and process.
APPLICATION:	Desuperheating spraywater control.
CHALLENGE:	Low flow and high pressure drops.
SOLUTION:	Fisher Micro-Flat trim.
RESULTS:	Reduced vibration, improved control of low flows, and extended trim life.

NotchFlo™ DST Control Valve

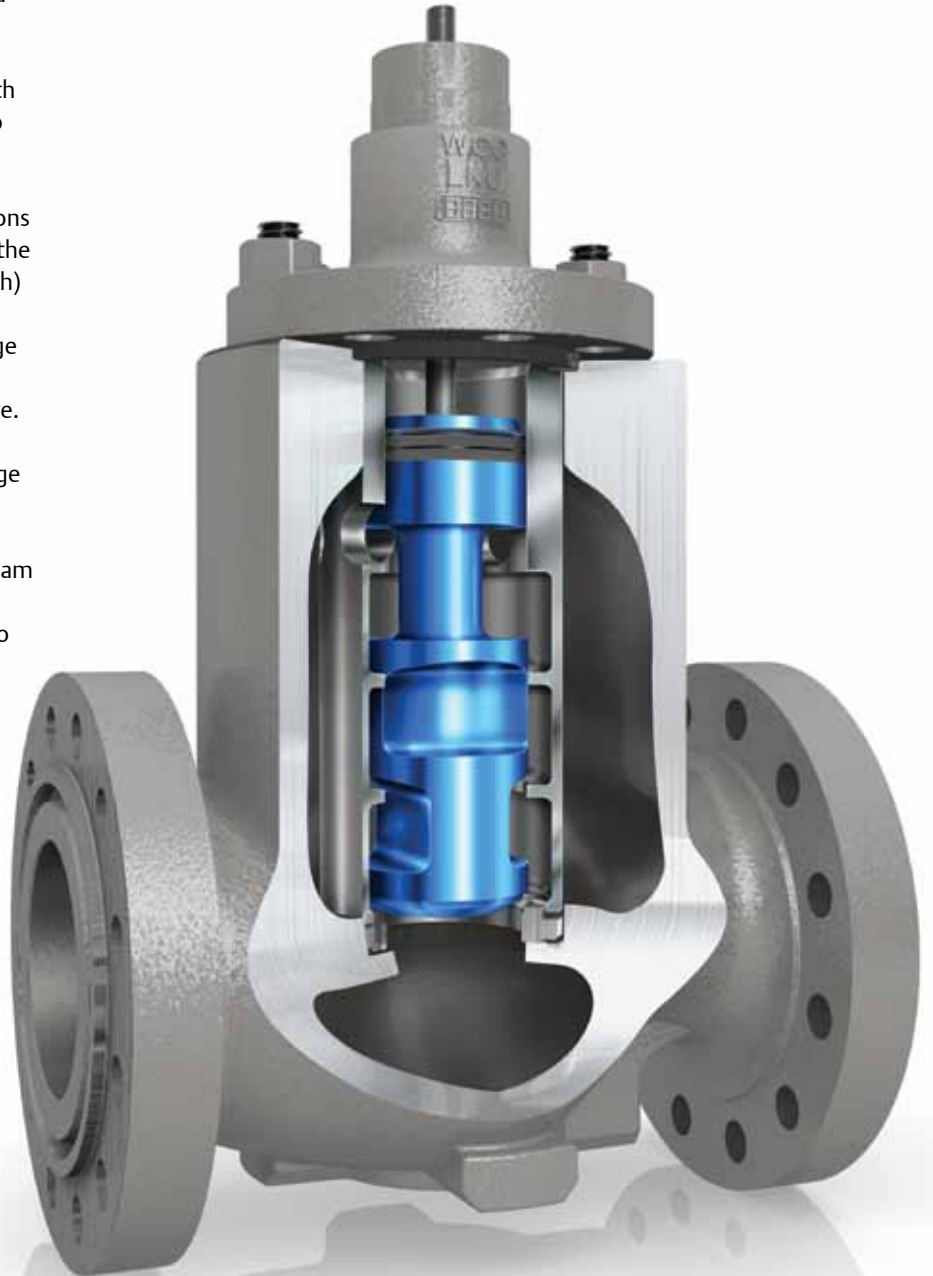
utilizes a multi-stage, axial flow path where fluid flow is parallel to the axis of the plug and cage.

Pressure reduction occurs throughout the length of the plug. Individual stages are not exposed to the full pressure differential.

NotchFlo DST trim uses a series of flow restrictions and expansions to control the pressure drop of the fluid. The notched plug allows up to 12 mm (½-inch) particulate to flow through the trim without plugging. The amount of pressure drop per stage is designed to prevent cavitation problems and minimize erosion issues on a properly sized valve.

Due to the need for tight shutoff, this multi-stage trim incorporates a protected seat design that separates the shutoff and throttling locations. All significant pressure drops are taken downstream of the valve seat. As a result, the seating surfaces are not worn away by throttling control action, so shutoff capabilities are extended.

- 3, 4, or 6-stage trim
- ASME Class 150 - 1500 globe body
- ASME Class 150 - 2500 angle body
- NPS 1 - 8
- Flow-up design only
- 290 bar (4200 psi) pressure drop limit
- ANSI/FCI Class V shutoff
- Ability to pass 12 mm (½-inch) particulate, depending on valve size



PROVEN RESULTS

PRODUCTION:	Ethylene and propylene.
APPLICATION:	Re-circulating, cavitating liquid with entrained solids at 103 bar (1500 psi).
CHALLENGE:	Seat erosion, noise levels up to 120 decibels, and pipe vibration.
SOLUTION:	Fisher NotchFlo DST control valve.
RESULTS:	Quiet operation, long seat life, and reduced lost product and flare emissions.

Dirty Service Trim (DST)

provides cavitation-control for applications with entrained particulate that could potentially plug the flow passages or cause severe erosion damage to conventional anti-cavitation trim.

The DST design uses a combined axial and radial flow path that features large openings allowing particulate up to 19 mm ($\frac{3}{4}$ -inch) in diameter to pass through the valve.

Due to the need for tight shutoff, this multi-stage trim incorporates a protected seat design that separates the shutoff and throttling locations. All significant pressure drops are taken downstream of the valve seat. As a result, the seating surfaces are not worn away by throttling control action, so shutoff capabilities are extended.

DST is an expanding flow area design. Each stage has a successively larger flow area. The result is very efficient operation, because typically 80% of the pressure drop is taken prior to the final stage where there is little danger of cavity formation. Consequently, a relatively low inlet pressure to the final stage is achieved.

- 2, 3, 4, 5, or 6-stage trim
- Globe or angle body
- ASME Class 150 - 2500
- NPS 1 - 24
- Flow-down or flow-up design
- 290 bar (4200 psi) pressure drop limit
- ANSI/FCI Class V shutoff
- Can be used in easy-e™, EH, EHA, EW, HP, and HPA valves
- Ability to pass 19 mm ($\frac{3}{4}$ -inch) particulate depending on valve size



PROVEN RESULTS

PRODUCTION:	Oil and gas production.
APPLICATION:	Produced water injection.
CHALLENGE:	High pressure drop, particulate, and tight shutoff needed.
SOLUTION:	Fisher Dirty Service Trim (DST).
RESULTS:	Cavitation control with no cage plugging, long-term shutoff, and extended time between shutdowns.

CAV4 Control Valve with Cavitrol™ IV trim

has an expanding flow area design. Each of the Cavitrol IV trim stages has a successively larger flow area. The result is very efficient operation because more than 90 percent of the overall pressure drop is taken in the initial stages where there is little danger of cavity formation. Consequently, a relatively low inlet pressure to the final stage is achieved.

Due to the need for tight shutoff, this multi-stage trim incorporates a protected seat design that separates the shutoff and throttling locations. All significant pressure drops are taken downstream of the valve seat. As a result, the seating surfaces are not worn away by throttling control action, so shutoff capabilities are extended.

- 3, 4, or 5-stage trim
- Angle body
- ASME Class 2500 - 4500
- NPS 2 - 10
- Flow-down design
- 552 bar (8000 psi) pressure drop limit
- ANSI/FCI Class V and VI shutoff



PROVEN RESULTS

PRODUCTION:	Coal-fired power plant.
APPLICATION:	Boiler feedwater recirculation service.
CHALLENGE:	538 bar (7800 psi) pressure drop water at 204°C (400°F).
SOLUTION:	NPS 10 Fisher block-forged valve with 5-stage Cavitrol IV trim.
RESULTS:	Withstood high pressure, prevented cavitation, and provided accurate control.

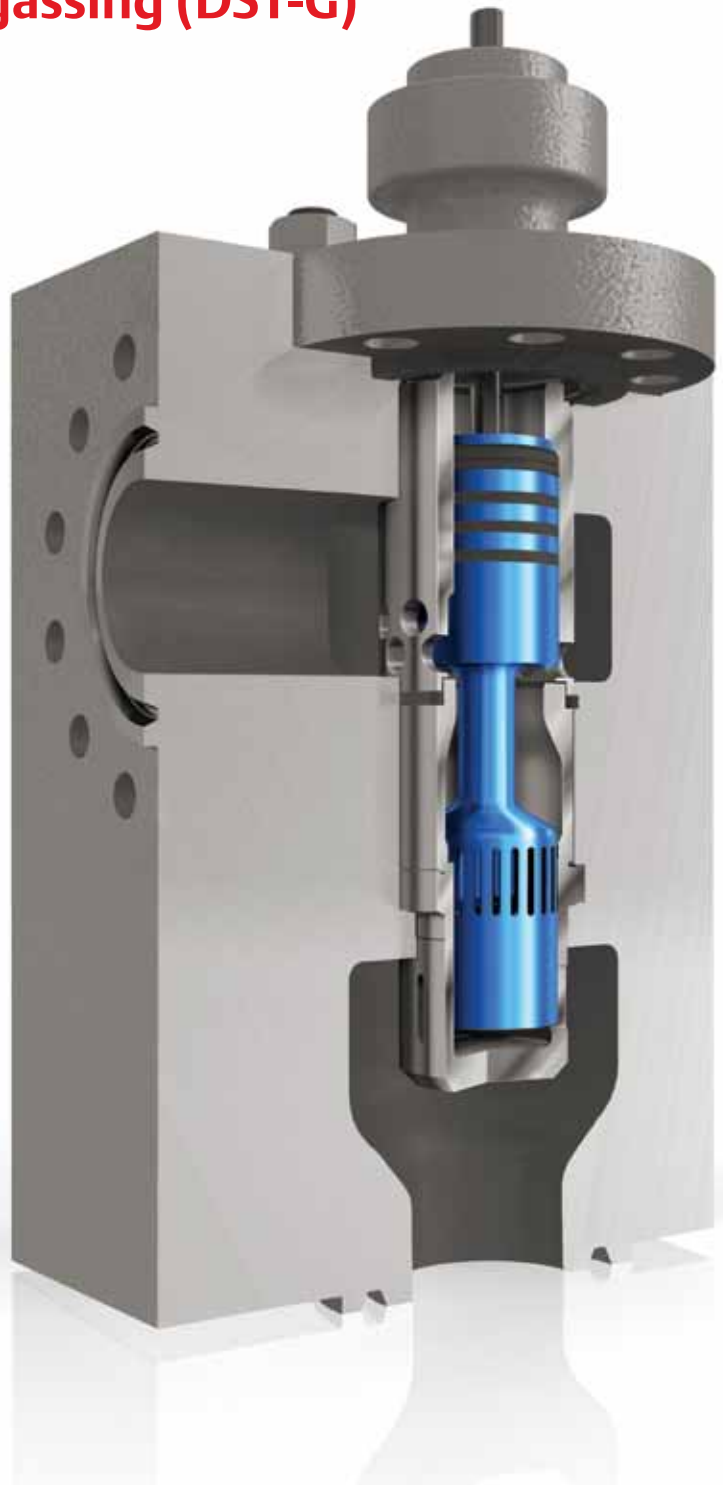
Dirty Service Trim for Outgassing (DST-G)

is a multi-stage control valve trim design. It is used in services where the fluid has dissolved gases that are released from solution due to a reduction in pressure. The fluid may also contain entrained particulate. DST-G is mainly used in refining, petrochemical, and oil and gas applications.

Outgassing can cause two types of damage. One type is cavitation, as discussed previously. The other is erosion from a rapidly expanding flowstream.

The DST-G trim employs the basic design from the standard DST trim, but utilizes a different design for the lower cage. The DST-G lower cage controls jet formation and discharge into the body to prevent vibration and erosion. The trim accomplishes all this while allowing large 6.35 mm (¼-inch) particulate to pass through.

- Multi-stage trim
- Angle body
- ASME Class 150 - 2500
- NPS 1 - 12
- Flow-down design
- 175 bar (2500 psi) pressure drop limit
- ANSI/FCI Class V shutoff



PROVEN RESULTS

PRODUCTION:	Oil refinery.
APPLICATION:	Hot, low-pressure flash drum.
CHALLENGE:	Outgassing, large particulate, and cavitation.
SOLUTION:	Fisher DST-G.
RESULTS:	Reduced vibration, enabled long seat life, and provided reliable, long-lasting throughput.

461 Sweep-Flo Angle Valve

is self cleaning with an expanded outlet. It is typically used in the chemical and hydrocarbon industries where cavitation control is required for residual oils that experience coking, have high particulate content and viscosity, and may outgas.

This cavitation-control valve construction consists of carefully designed flow paths that control impingement, and material selections aimed at maximizing corrosion and erosion resistance. For instance, trims such as S17400 stainless steel in a variety of heat treatments, tungsten carbide, R30006/CoCr-A, and others are common.

- Sweep-Flo angle body
- ASME Class 150 - 2500
- NPS 2x3, 3x4, 4x6, and 6x8
- Flow-down design
- ANSI/FCI Class V shutoff



PROVEN RESULTS

PRODUCTION:	Oil refinery.
APPLICATION:	Hot, high-pressure separator.
CHALLENGE:	A cavitating, outgassing, viscous fluid.
SOLUTION:	Fisher 461 valve with 316 SST R30006/CoCr-A hardfaced trim.
RESULTS:	Withstood high-pressure drop, outgassing, and cavitation issues plus provided accurate control.

Vee-Ball™ Control Valve with Rotary Attenuator

combines the efficiency of a rotary valve, with the energy absorbing capability of special trim, to provide improved performance for demanding applications. The Fisher rotary attenuator design can be utilized in liquid service to reduce cavitation and vibration effects.

The Vee-Ball with rotary attenuator has high application versatility and provides long service life.

Precise contouring of the V-notch ball provides an approximately equal percentage inherent flow characteristic, which is optimal for most flow control applications.

- 1-stage trim
- ASME Class 150, 300, 600
- NPS 4, 6, 8, 10, 12, 14, 16, and 20
- 52 bar (750 psi) pressure drop limit



PROVEN RESULTS

PRODUCTION:	Water treatment process.
APPLICATION:	Greywater flow control.
CHALLENGE:	Standard ball valve was cavitating, causing pipe vibration plus problems with the valve-mounted instrumentation.
SOLUTION:	NPS 10 Vee-Ball control valve with rotary attenuator.
RESULTS:	The rotary attenuator eliminated vibration and noise caused by vibration, and instrument issues were resolved.

V260B Ball Valve with Hydrodome Attenuator

provides improved performance for demanding applications such as pump bypass and pipeline take-off. The attenuator trim is designed for liquid service to help eliminate or reduce cavitation and associated pipeline noise and vibration.

The V260B is a full bore ball valve designed with features for optimized pressure, flow, and process control. An integral, drilled attenuator controls noise and vibration from high pressure drop liquids. The splined shaft connection to the actuator reduces lost motion.

The V260B with Hydrodome attenuator combines the efficiency of a rotary valve with the energy-dissipating capability of a special trim to provide improved performance for demanding applications. The valve is available with single and dual Hydrodome configurations.

The Hydrodome attenuator is active throughout the ball rotation for very demanding services or a characterized attenuator (as shown) is used to match the service conditions.

- 1 or 2-stage trim
- ASME Class 150, 300, 600, 900
- NPS 8, 10, 12, 16, 20, and 24
- 103 bar (1500 psi) pressure drop limit



PROVEN RESULTS

PRODUCTION:	Crude oil.
APPLICATION:	Delivery valve for pipeline take-off location.
CHALLENGE:	31 bar (450 psi), 120 decibels, and vibration.
SOLUTION:	NPS 12 Fisher V260 valve with Hydrodome attenuator.
RESULTS:	Uninterrupted service for 8 years and reduced noise to 90 decibels.



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Emerson Process Management
Marshalltown, Iowa 50158 USA
Sorocaba, 18087 Brazil
Chatham, Kent ME4 4QZ UK
Dubai, United Arab Emirates
Singapore 128461 Singapore
www.EmersonProcess.com/Fisher



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