

The Emerson severe service team provides global customers with Fisher® severe service control valve solutions. Whether it is severe service applications for the power, hydrocarbon, chemical or pulp and paper industry, these technical experts deliver sound solutions to address critical applications for aerodynamic noise, cavitation and out-gassing issues, as well as particulate erosion. Please visit our website or contact your local Emerson Process Management sales office for more information on how the severe service team can help you.

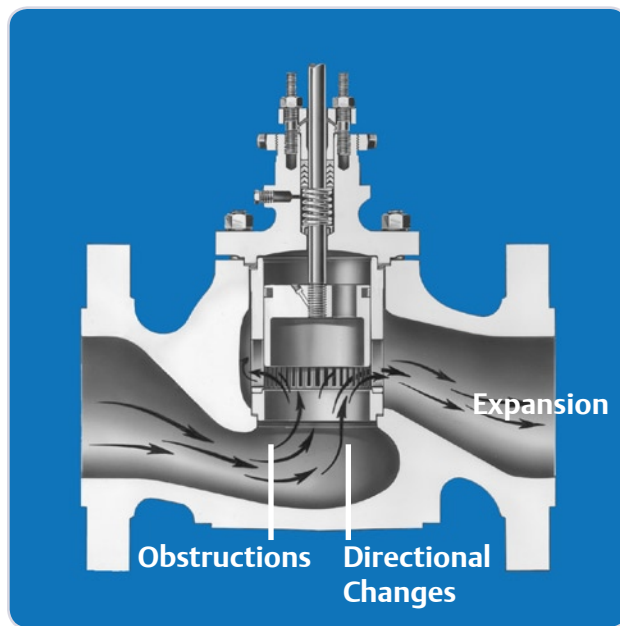
Look to Emerson for Control Valve Noise Solutions

Noise generated by control valves can come from multiple sources that contribute to the overall noise level. Mechanical noise sources include piping and plug instability noise. More prevalent is aerodynamic noise that is generated by the release of energy from the pressure drop of the fluid, flow turbulence, flow path obstructions, rapid expansions or decelerations of the flow, or directional changes.

To effectively combat aerodynamic noise, it is important to understand its two main sources. The first is noise contributed by the turbulent energy released as the pressure of the fluid drops at the trim. This noise is reduced by using abatement trim that combats the noise through pressure staging, frequency shifting, and jet interaction prevention.

The second source of aerodynamic noise occurs in the expansion area downstream of the trim, which can arise when the valve outlet is smaller than the downstream pipe diameter. Here, the velocity-related turbulence generated by the expanded valve outlet acts as an independent noise source that can exceed that of the trim. In effect, two noise sources exist in series.

Tests conducted at the Emerson Innovation Center in Marshalltown, Iowa, USA, demonstrate that significant expansion noise occurs at fluid velocities that exceed 0.3 Mach. Effective noise prediction must account for the expansion area of the valve and this factor is included in the IEC 60534-1 noise standard and in all Fisher noise prediction methods. In extreme cases, expansion noise can lead to valve, pipe, and other component failures. For valves that experience fluid velocities less than 0.3 Mach, no expansion noise contribution should be expected and standard trim noise prediction techniques are sufficient.



Proper valve sizing is important as a means to combat expansion noise. When noise exceeds customer acceptable levels, or 110 dBA, valves with larger expansion areas may be needed. An alternative is to use a diffuser downstream of the valve to increase back pressure, which effectively reduces the required outlet area and slows the fluid velocity to less than 0.3 Mach.

Emerson has numerous tools available to the process engineer to better understand the mechanics of noise. One of these is an animation available for viewing in four languages on our website at: <http://www2.emersonprocess.com/en-US/brands/fisher/SevereService/NoiseDemo/Pages/FisherSSNoiseDemo.aspx>.

Fisher® Noise Control Products - Engineered to Fit the Need

Control valve noise is due to high pressure drops and high mass flow involving liquids, gases, vapors, or steam through the valve. Noise is managed by treating it at the source and/or the path that it travels. Emerson offers these Fisher® trim products to treat source noise in globe and angle valves: Whisper Trim™ I, Whisper Trim III, and WhisperFlo™ trim. These products feature linear characteristics as standard and can be customized based on specific requirements. We recommend the use of these trims with flow-up valve designs to get the best noise attenuation.

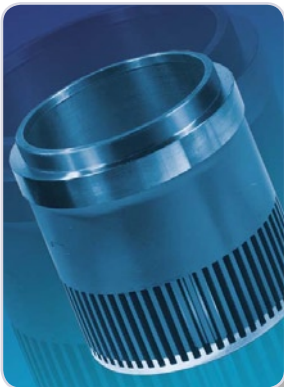
Whisper Trim I cages are designed with small vertical slots around the circumference of the cage to reduce flow turbulence generated within the cage flow passages. Whisper Trim I is interchangeable with standard trims and can give up to 18 dBA of noise attenuation compared to the same valve with standard trim. Whisper Trim I has the best noise attenuation if it is used in applications where the ratio of differential pressure to upstream pressure ($\Delta P/P_1$) is less than 0.65.

Whisper Trim III cages have multiple holes around the cage circumference. Attenuation is accomplished by splitting the flow through these holes (passages) and by shifting the noise to a higher frequency. The multiple passages break up the large turbulent stream into many small independent jets to obtain up to 30 dBA of noise attenuation compared to the same valve with standard trim. Whisper Trim III is well suited for high pressure drop applications with very large $\Delta P/P_1$ ratios. Customized cages with application-specific characteristics are available upon request.

WhisperFlo trim is a state-of-the-art, multi-path and multi-state trim. The cages provide greater capacity and noise attenuation than Whisper Trim I or Whisper Trim III cages. Up to 40 dBA of noise reduction is obtainable. WhisperFlo cages reduce noise using staged reduction of pressure, unique passage shape, jet independence, frequency spectrum shifting, and a complimentary body design.

The **V260** full-bore rotary control valve is designed for optimized pressure and flow control. An integral drilled-hole attenuator controls noise and vibration from high-pressure drop liquids and gases. Up to 20 dBA acoustical attenuation can be achieved for the V260A within a single stage construction. Dual-stage construction can provide up to 25 dBA attenuation. The attenuator is an integral part of the valve assembly. The seal wipes the ball surface, not the attenuator, promoting increased service life. The rugged design gives the structural reliability to use in various applications including entrained particles.

Diffusers offer another method for noise attenuation. A diffuser is a pressure-reducing device that is installed downstream from the control valve. The total system pressure drop is divided across the valve and diffuser. Up to 40 dBA noise attenuation is possible with properly sized and selected valve and diffusers. Two types of diffusers are available, the flat diffuser and the tube-and-shell diffuser for higher capacities. The Fisher 6010 tube-in-shell diffuser is an in-line diffuser with integral outlet head. Whisper Disk is an in-line flat diffuser that creates back-pressure and greatly reduces the noise level.



Whisper Trim I



Whisper Trim III



WhisperFlo Trim



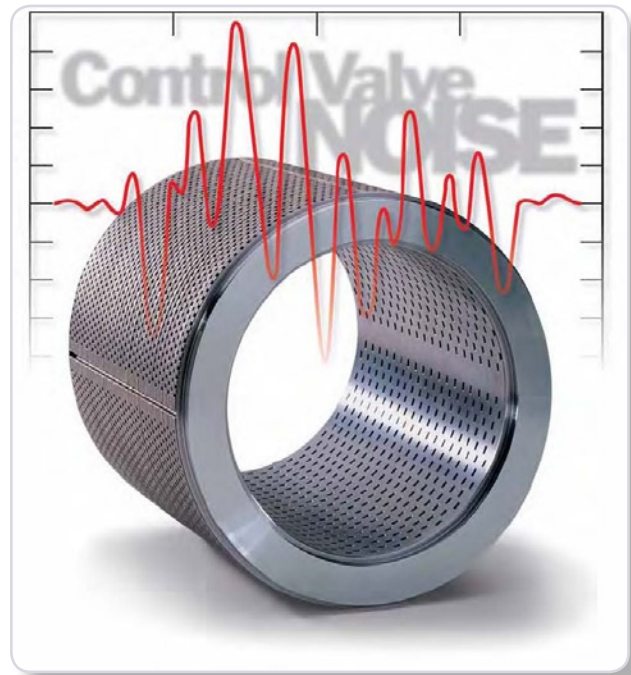
V260 Valve

Noise Abatement - Source Versus Path Solutions

These days, the question that all companies ask when looking for their process solutions is “What’s it going to cost me?” Every solution is a balancing act of performance versus return on investment, and aerodynamic noise abatement strategies are no exception. The many methods used to attenuate aerodynamic noise generally fall into two categories: source treatments and path treatments. Each method has an associated cost and benefit and the choice comes down to which solution best meets the requirements of the project.

Path treatment is a measure taken to increase the resistance of the noise path to prevent the noise from reaching the environment. Examples of path treatments are heavy-walled pipe, acoustic diffusers, and acoustic absorbent materials such as pipe insulation and in-line silencers. Some of these can be relatively inexpensive methods of reducing noise. The weakness of path treatments is that both the fluid stream and the piping itself are very effective noise transmission paths. Therefore, using heavy schedule pipe or external pipe insulation is only effective in the region it is applied, and transmitted noise can still be a problem beyond this region.

Source treatment is a measure taken to reduce the amount of noise generated by the source rather than treating the symptoms of the noise. This is generally



more desirable. The most common form of source treatment is special control valve trim that is designed to reduce the noise generated in the valve. Emerson Process Management has several engineered valve trim solutions to solve all ranges of noise attenuation needs.

Emerson Expertise Key to Reducing Excessive Noise in Hydrocarbon Processing Plant

A hydrocarbon processing plant received ongoing complaints of excessive noise at their fence line. Plant personnel tried repeatedly to isolate the noise source, but were hindered because the noise was emanating from an area of the plant that contained many flowing systems as well as rotating equipment.

The Emerson Local Business Partner (LBP) was contacted and provided with an independent noise consultant’s report regarding the noise problem. The LBP concluded that the noise was coming from an area that contained eight control valves. Engineers from Emerson’s Fisher division were contacted and provided with detailed process and piping information for analysis. They confirmed that the eight control valves were a potential source of the noise problem, but needed additional

information in order to recommend a solution. The factory engineers travelled to the plant and conducted a series of vibration tests to isolate the noise source.

At the conclusion of the testing and data analysis, a recommendation was made to replace the eight stem-guided control valves with more stable cage-guided control valves. Measurements taken after the new valves were installed showed a significant reduction in noise levels both in the immediate vicinity of the valves and at the plant fence line.

Keys to the success of this project were the ability of the Fisher factory and LBP engineers to analyze and identify the noise source onsite and recommend a solution.

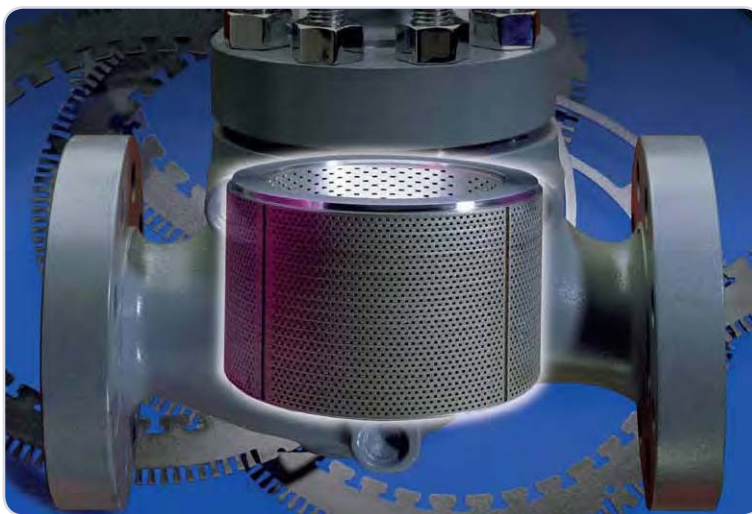
Excessive Noise Eliminated in Refinery Using Fisher® WhisperFlo™ Trim and PULSCO Silencer

A refinery located in Singapore was experiencing loud noise levels generated by a steam vent valve and silencer. The noise level measured 110 dBA and could be heard as far away as 200 meters from the surrounding fence line, posing an environmental sound hazard and putting the plant in jeopardy of being penalized by the local regulatory authority. The plant had received numerous complaints and the maintenance team was tasked to resolve the issue. The goal was to reduce the noise level at the fence line to 76 dBA or less. Maintenance personnel contacted Emerson Process Management in Singapore to help solve the problem.

After reviewing the application and process conditions, the Emerson team proposed a complete noise attenuation system to replace the existing valve and

silencer. The existing valve was upgraded to a Fisher EWD valve with WhisperFlo trim and the old silencer replaced with a PULSCO vent silencer. PULSCO blowdown vent silencers and line silencers provide the solution to high intensity, broadband noise associated with pressure relief systems and gas/steam line turbulence. The PULSCO design reduces low frequency noise by converting it to high frequency waves through expansions and contractions in pressurized diffuser and plenum sections. High frequency noise is then easily absorbed by the acoustic packing in the tube module.

Upon installation, the actual noise measured at the fence line was lower than 76 dBA and the customer is pleased with the Emerson solution.



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