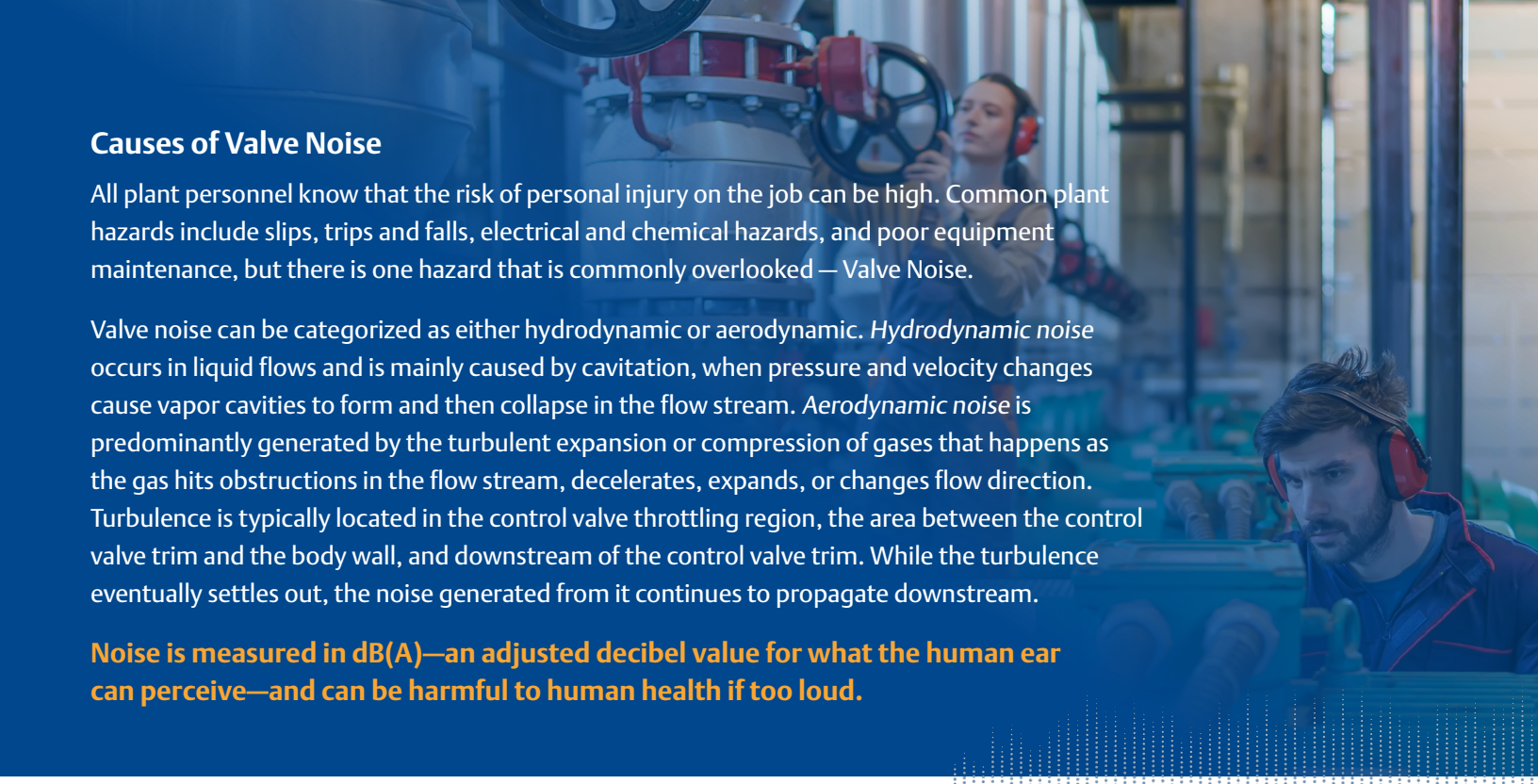
Mitigate Industrial Valve Noise With Emerson's New Fisher™ Whisper™ Technology

Valve noise is a persistent issue within industrial settings that can have adverse effects. Emerson is combatting noise with new technologies that contribute to a safer working environment, protect the communities in which we live, and aid businesses in avoiding EPA fines. Before delving into each product, it's important to understand the causes of valve noise, their implications, and the various mitigation methods.



Causes of Valve Noise

All plant personnel know that the risk of personal injury on the job can be high. Common plant hazards include slips, trips and falls, electrical and chemical hazards, and poor equipment maintenance, but there is one hazard that is commonly overlooked — Valve Noise.

Valve noise can be categorized as either hydrodynamic or aerodynamic. *Hydrodynamic noise* occurs in liquid flows and is mainly caused by cavitation, when pressure and velocity changes cause vapor cavities to form and then collapse in the flow stream. *Aerodynamic noise* is predominantly generated by the turbulent expansion or compression of gases that happens as the gas hits obstructions in the flow stream, decelerates, expands, or changes flow direction. Turbulence is typically located in the control valve throttling region, the area between the control valve trim and the body wall, and downstream of the control valve trim. While the turbulence eventually settles out, the noise generated from it continues to propagate downstream.

Noise is measured in dB(A)—an adjusted decibel value for what the human ear can perceive—and can be harmful to human health if too loud.

Negative Implications of Valve Noise

Valve noise can not only damage hearing and facility equipment, but it can also increase the risk of receiving government noise regulation fines. The Centers for Disease Control and Prevention (CDC) states that "about 22 million workers are exposed to hazardous noise on the job each year." Prolonged exposure to noise levels produced from control valves above the recommended NIOSH exposure limits for occupational environments can contribute to irreversible hearing loss. This makes it more difficult for workers to perform their jobs successfully and impacts their ability to function in daily life.

Additionally, valve noise negatively affects reliability as it can damage the internal components of the valve and piping downstream. Noise levels that exceed 110 dB(A) may cause valve damage and require noise attenuation. Equipment damage that occurs from valve noise includes fretting corrosion (also called friction oxidation or wear oxidation) and grain-boundary cracking and corrosion. Fretting corrosion is common near cavitating valves and describes the wear between two contacting surfaces when they are subjected to vibration. Grain-boundary cracking and corrosion occur due to high-amplitude vibrations that microscopically flex the metal valve parts and pipe walls. Furthermore, they can potentially contaminate the process and reduce the quality of the overall product depending on its purity requirements.

Equipment damage can cause output delays, decreases in availability, and unplanned downtimes, costing both time and money. Research suggests that the average cost of unplanned downtime in large corporations is $260,000 per hour.*

Valve noise can also put companies at risk of regulatory fines, as well as incurring complaints from neighboring residential or commercial areas. Current OSHA requirements state that 85 dB(A) is the maximum noise level allowed during an 8-hour shift; above that, a worker needs hearing protection. The (CDC) cites that "53% of noise-exposed workers do not wear hearing protection." In addition to noise within the facility, the EPA recommends a noise level limit of 55 dB(A) outdoors to protect neighboring communities. As the population grows, people are starting to move closer to processing plants. Operating at a noise level that is disruptive to the surrounding community will cause those living or working around the plant to complain and potentially result in regulatory action.

*Aberdeen Strategy & Research

Valve Noise Mitigation

There are many ways to mitigate noise and Emerson has recently released a number of new additive-manufactured technologies to address these challenges. The new Fisher NXG globe valve trim, NXV rotary valve trim, and WhisperTube modal attenuator mitigate aerodynamic noise with exit jet independence, pressure management, unique flow passage shapes, and destructive interference. Let's take a look at each of these products.

Additive Manufacturing, known as 3D printing, is the process of creating three-dimensional objects by layering or adding material, layer upon layer, to build up the final product. This stands in contrast to traditional subtractive manufacturing methods, where material is removed from a solid block to achieve the desired shape. Additive manufacturing has gained significant popularity due to its versatility and the ability to produce complex geometries with high precision.

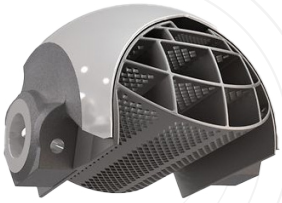
Fisher™ Whisper™ NXG Trim

The Fisher Whisper NXG Trim reduces noise caused by globe valves and has 20% more flow capacity than other globe valves, without compromising noise reduction. This allows for the use of smaller valves, saving space available in the facility. It also allows for up to 30 dB(A) noise reduction.

The Fisher Whisper NXG Trim has a lattice trim designed by additive manufacturing and allows for efficient jet management. Tested with laser shadowgraphs, the printed lattice design more efficiently disperses exit flow within the valve than standard machined holes, thus decreasing noise. Additionally, the lattice design reduces shear jet forces and increases flow capacity beyond the capabilities of typical drilled hole noise control trim designs.

The Fisher Whisper NXG globe valve trim is compatible with gas, vapor, or steam, and is available for multiple common valve sizes. It also has exceptional wear resistance due to its hardened materials of construction and offers easy inspection and maintenance.

Fisher™ Whisper™ NXV Trim



The Fisher Whisper NXV Trim is designed to reduce noise caused by rotary valves and provides up to 80% more noise reduction than other rotatory valves, reducing valve noise by up to 20 dB(A). Because of this high level of noise reduction, rotary valves can be considered in processes where previously only globe valves would suit.

Additive manufacturing has allowed the Fisher Whisper NXV Trim to have complex geometries that improve its ability to manage flow and shift frequency, ultimately reducing the valve noise. Key noise-mitigating features of this rotary valve trim include optimized inlet contour, patented elliptical channels, and channel and hole enhancements.

The optimized inlet contour of the Fisher Whisper NXV Trim minimizes capacity reductions and noise due to turbulence. Additionally, there are no gaps between the trim and the ball ears, ensuring all flow passes through the noise control areas of the trim.

Patented elliptical channels change the shape of the flow stream as the ball rotates. This optimizes noise control by allowing for the best flow separation.

Channel and hole enhancements increase noise mitigation with minimal impact on valve capacity. The increased flow area of the holes between trim channels improves pressure distribution and reduces the velocities of the material flowing through the valve. Small holes are used in the design to shift the frequency of noise caused by the flow. Additionally, the rotary trim features a smaller channel height at the lower valve opening to increase flow separation, as this is where the noise is the highest.

The Fisher Whisper NXV Trim is compatible with gas, vapor, or steam, and is offered in multiple valve sizes and pressure class ratings.

Fisher™ 6060 WhisperTube Modal Attenuator

The Fisher 6060 WhisperTube Modal Attenuator provides full pipe noise attenuation for locations downstream of control valves, regulators, pressure safety valves, and other noise sources. It can be paired with any kind of control valve or piece of equipment used in compressible fluid service to mitigate process noise without additional pressure drop or impact on process flow. It allows for up to a 10-15 dB(A) noise reduction for fluid velocities less than 0.3 Mach. Key noise-mitigating features of this modal attenuator include specially engineered acoustic cavities, an unobstructed flow path, a straight-through design, and a drain channel.

Specially engineered acoustic cavities treat noise via destructive interference. A cylindrical perforated screen forms the primary flow path and serves as one of the cavity walls. Sound waves propagate through the screen into the internal acoustic cavities, which are at several different depths to provide noise reduction across multiple wave frequencies. The reflections produced from the wave propagation then reduce noise downstream through destructive interference.

An unobstructed flow path ensures that the manufacturing process will not be impacted, as the perforated screen's internal diameter matches the pipe's internal diameter throughout the full length of the device. This seamless screen integration prevents pipeline restrictions, pressure drops, and capacity reduction. Additionally, the symmetrical WhisperTube design allows for bi-directional noise attenuation.

A straight-through design and built-in drain channel resist pipe plugging and buildup. The full area design allows particulate to flow through unimpeded without risk of plugging and is compatible with pipeline pigging operations. The drain channel is cast internally to the body of the WhisperTube and interacts with each cavity, draining any liquid that should enter the process.

The Fisher 6060 WhisperTube Modal Attenuator is designed for a wide range of fluid flow rates, pressures, and temperatures and is easy to install both in vertical and horizontal directions. It is also simple to maintain with its removable stainless-steel screen.

The Future of Valve Noise Attenuation

The Fisher Whisper NXG Trim, Whisper NXV Trim, and 6060 WhisperTube Modal Attenuator all save space and capital without compromising on noise reduction. In addition to ensuring proper valve sizing and emphasizing the monitoring and maintenance of facility control valves, manufacturing personnel can use this new generation of noise attenuation solutions to greatly reduce valve noise and the consequences associated with it.

Contact Your Account Manager to Learn More About Our Next-Generation Whisper™ Technology

Experitec has served the industry for over 100 years, partnering with our customers to gain competitive advantages and unlock the hidden potential in their facilities. By optimizing operator and control performance, improving asset reliability, creating safer places to work, and helping clients reach their environmental and sustainability goals, Experitec is dedicated to achieving positive outcomes for the businesses we serve. Our unique long-term partnerships with Emerson and others enable us to connect customers with innovative technologies, subject matter expertise, and 24/7 lifecycle support and engineering services. As employee owners, the Experitec team is eager to partner with you on your next automation or reliability project in a positive, driven, and collaborative way. We have local offices in St. Louis, MO; Kansas City, MO; Memphis, TN; Calvert City, KY; and Decatur, IL; as well as warehouse and service locations in the surrounding areas.

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