

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.

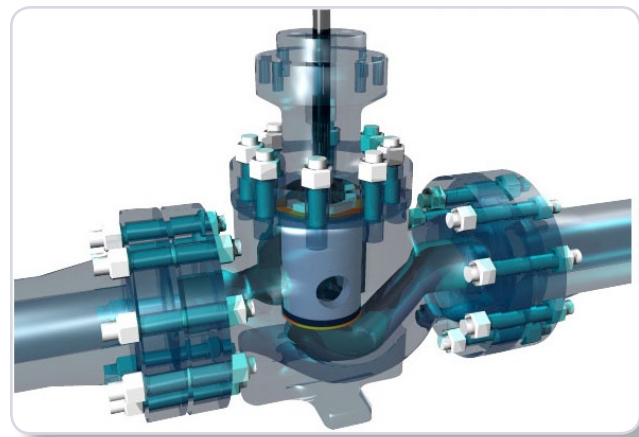
## Look to Emerson for Cavitation Solutions

Cavitation is the formation and subsequent collapse of vapor bubbles in liquid flow streams, and is a major source of damage to control valves and adjacent piping. There are several types of cavitation, but in process control only vaporous cavitation is important. The pressure conditions and fluid state necessary for cavitation to occur are well documented.

Cavitation can quickly damage a control valve, initially with loss of shutoff or minor loss of control, and can progress to complete destruction of the trim and loss of containment by the valve body and pipe. For these reasons it must be controlled. Because cavitation is related to choked flow, many less refined valve selection tools only predict cavitation based on choked flow.

Emerson understands that cavitation damage potential is a function of many other factors. These include inlet pressure and pressure drop, flow rate, fluid properties, presence of particulate, body geometry, materials, and trim style. To accommodate these factors, the Fisher valve product line includes several trim designs for both sliding stem and rotary shaft valves. This breadth assures a solution regardless of the other requirements of the application.

Not all cavitation problems can be predicted from valve data sheets. That is because valves are often used in service conditions that differ from those originally specified or were not predicted during the initial valve selection. Emerson engineers and technicians worldwide



are trained to recognize cavitation problems and resolve them in the most effective manner.

Emerson has numerous tools available to the process engineer to better understand the mechanics of cavitation. 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/CavitationDemo/Pages/FisherssCavitationDemo.aspx>.

We invite you to discuss cavitation with your local Emerson sales engineer and learn how Emerson has the expertise and range of valve solutions to meet your specific needs.

# Selecting the Right Cavitation Control Solution is Critical to Achieving Good Control and Valve Life

Selecting the correct technology to solve cavitation problems is not always a straight-forward process. Valve users should exercise caution when a supplier proposes the same technology for all of their cavitation issues. For example, cavitation in dirty liquids requires a different solution than with clean liquids. Often, cavitation solutions are proposed for applications that are actually flashing or outgassing, either because of misunderstanding the application or because the supplier may have only one solution. Fisher valve solutions are tailored to the application. They take into account the characteristics presented by the different application phenomena.

Cavitation in clean fluids is prevented by staging the pressure drop in the trim to ensure that it does not drop below the vapor pressure. Fisher® Cavitrol™ III has proven successful in clean fluid applications for many years. The pressure drop is staged to ensure that the last stage sees only a small pressure drop and that the lowest pressure in the trim remains above the fluid vapor pressure.

When the fluid contains particles such as sand, coke, catalyst, etc, the valve design needs to account for erosion to exposed surfaces. Fisher NotchFlo™ DST uses pressure staging to control the fluid pressure and carefully designed flow passages to manage fluid velocity. This is a common problem in applications such as produced water in oil and gas production, or high-pressure separator applications with catalyst fines in refining installations.

The complex make-up of fluids found in some applications contain products that cavitate, vaporize, and have dissolved gasses all in the same flow stream. The solution must take into account all of these conditions, especially the increased volume that comes from the vapor or released gasses. The Fisher DST-G control valve is custom designed for each application and uses multiple stages to reduce the effects of the flashing or outgassing.

Some suppliers have only one technology that they try to adapt to these different flow characteristics, risking that the trim will not perform as expected. This can result in problems affecting plant operation such as limited valve life, poor control, rapid trim or body wear, or sudden valve failure. Emerson valve engineers fully understand the characteristics of each fluid type and can propose the best solution to handle each of your needs.



*Cavitrol™ III trims are designed for cavitating liquid applications in various globe and angle valve bodies. They are used extensively in the power, process, oil production, chemical refining, and other industries.*



*Modified Fisher HP high-pressure globe and block forged valves with 4-stage NotchFlo DST offer control of high pressure drop liquids (up to 2600 psi) while avoiding the damaging effects of cavitation.*



*Dirty Service Trim for outgassing applications (DST-G) is a multi-stage anti-cavitation trim. It is used in services where the fluid has dissolved gases within the fluid that come out of solution due to a reduction in pressure and may also contain entrained particulate. DST-G is frequently used in high pressure drop applications up to 2500 psi in the refining and oil and gas industries.*

# Power Plant Reduces Maintenance Costs Using Fisher® Cavitrol™ IV Trim

A combined-cycle power plant located in Japan was experiencing erosion damage in the main boiler feedwater valve which caused flow problems and the plant maintenance team was repairing or replacing the valve trim every two years.

That feedwater system used a two-valve configuration consisting of a startup valve and a main valve for base-load operation. The non-Fisher valves used anti-cavitation trim that was not solving the flow or erosion problems. Plant personnel contacted the Emerson Process Management business partner in Japan, Nippon Fisher, for a solution. An analysis of history data by Nippon Fisher engineers showed that the valves were not designed for the wide rangeability conditions of high pressure drop at minimum flow and low pressure drop at maximum flow.

Nippon Fisher proposed using a single Fisher CAV4 valve (which uses Cavitrol IV trim) as a solution for both the startup and main valves to eliminate controllability problems arising from load transfer between two valves. Cavitrol IV trim uses an anti-cavitation design for protection against high pressure drops and has sufficient capacity for low pressure drops. The trim  $C_v$  characteristics could also be matched to the process requirements thereby improving valve operating range.

The CAV4 valve was installed in the boiler feedwater line and has resulted in lowered maintenance costs while providing the necessary anti-cavitation protection. The valve has operated for three years since installation with no erosion damage. Plant personnel are pleased with the reduced noise and vibration, and better control.

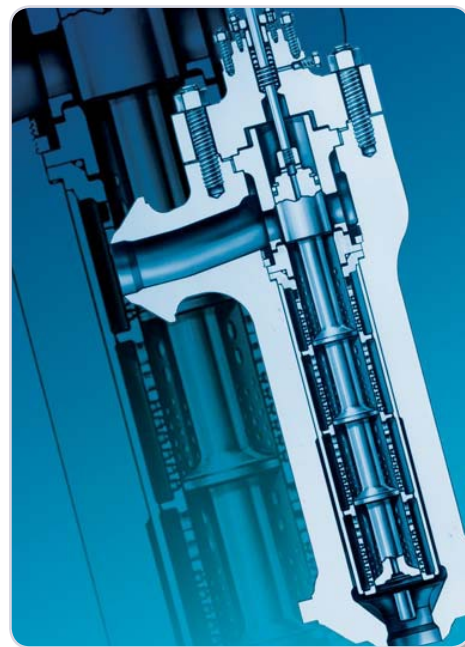
## Fisher® Cavitrol™ IV Trim Technology Overview

A properly sized Fisher CAV4 valve with Cavitrol IV trim eliminates damaging cavitation and its resultant noise and vibration through a unique expanding flow area design. Each Cavitrol IV trim stage has successively larger flow area. More than 90 percent of the overall drop is taken in the first three stages, where there is little danger of bubble formation, allowing a relatively low inlet pressure into the final stage. The pressure staging design and separation of shutoff and throttling locations prevent clearance-flow erosion.

Unlike other linear cage-style anti-cavitation trim sets, there are no flowing conditions where pressure can go directly from upstream to downstream. The CAV4 valve can also use special characterized cages that are available to provide excellent rangeability for specific system requirements.

### Features

- Patented pressure-staging design and separation of shutoff and throttling locations decrease clearance-flow erosion and provide longer trim life.
- Soft metal-to-metal seat provides tight shutoff without the need for periodic lapping.
- Expanding flow area design takes advantage of the liquid's ability to undergo a greater pressure drop in initial stages without cavitating.
- Special characterized cages provide customer specified rangeability for specific system requirements.
- Quick disassembly with easy access to valve trim and valve plug seat for reduced maintenance downtime.

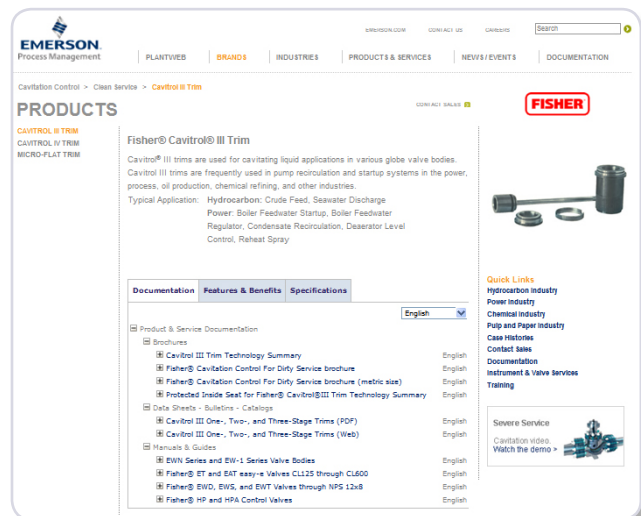
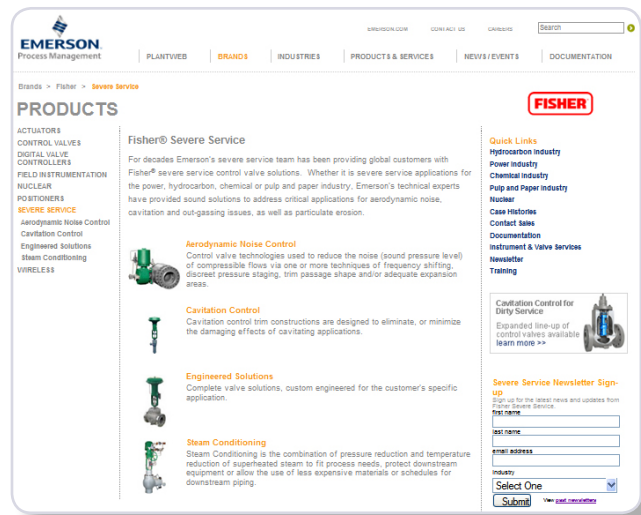


# Explore Our Severe Service Website for Answers to Your Severe Service Problems

If you haven't explored the Fisher Severe Service website, you're missing out on some important information. You can get to the website either from [www.Fisher.com](http://www.Fisher.com) or directly at [www.FisherSevereService.com](http://www.FisherSevereService.com). Once there, you can access a wealth of information including:

- Product literature such as brochures, technology summaries, and manuals covering aerodynamic noise control, cavitation control, engineered control valves and actuators, and steam conditioning. Much of it is available in several languages.
- Application literature covering the hydrocarbon, power, pulp and paper, chemical, and nuclear industries.
- Case histories documenting how severe service products have helped companies solve tough application problems in a variety of industries. Currently, 94 are available.
- Sales contact list for locations around the globe to help you locate your nearest Fisher service and repair site.
- Newsletter archive for past and current copies of the *Severe Service Journal*.
- Animation demonstrations for cavitation and noise that can be viewed on-line or downloaded.
- Sign-up for the *Severe Service Journal*. The process is quick and easy and ensures that you'll receive issues by email as soon as they are released.

You can also quickly access links to Emerson Instrumentation & Valve Services and training websites that directly support severe service products. So visit the site today and see what you've been missing.



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