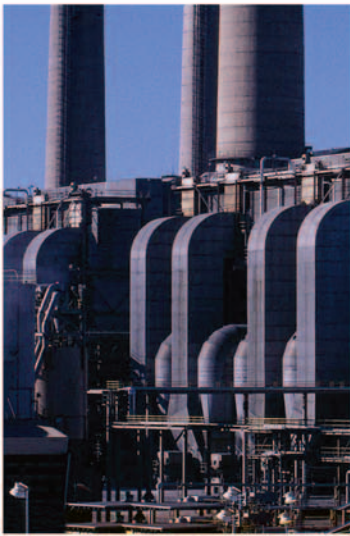
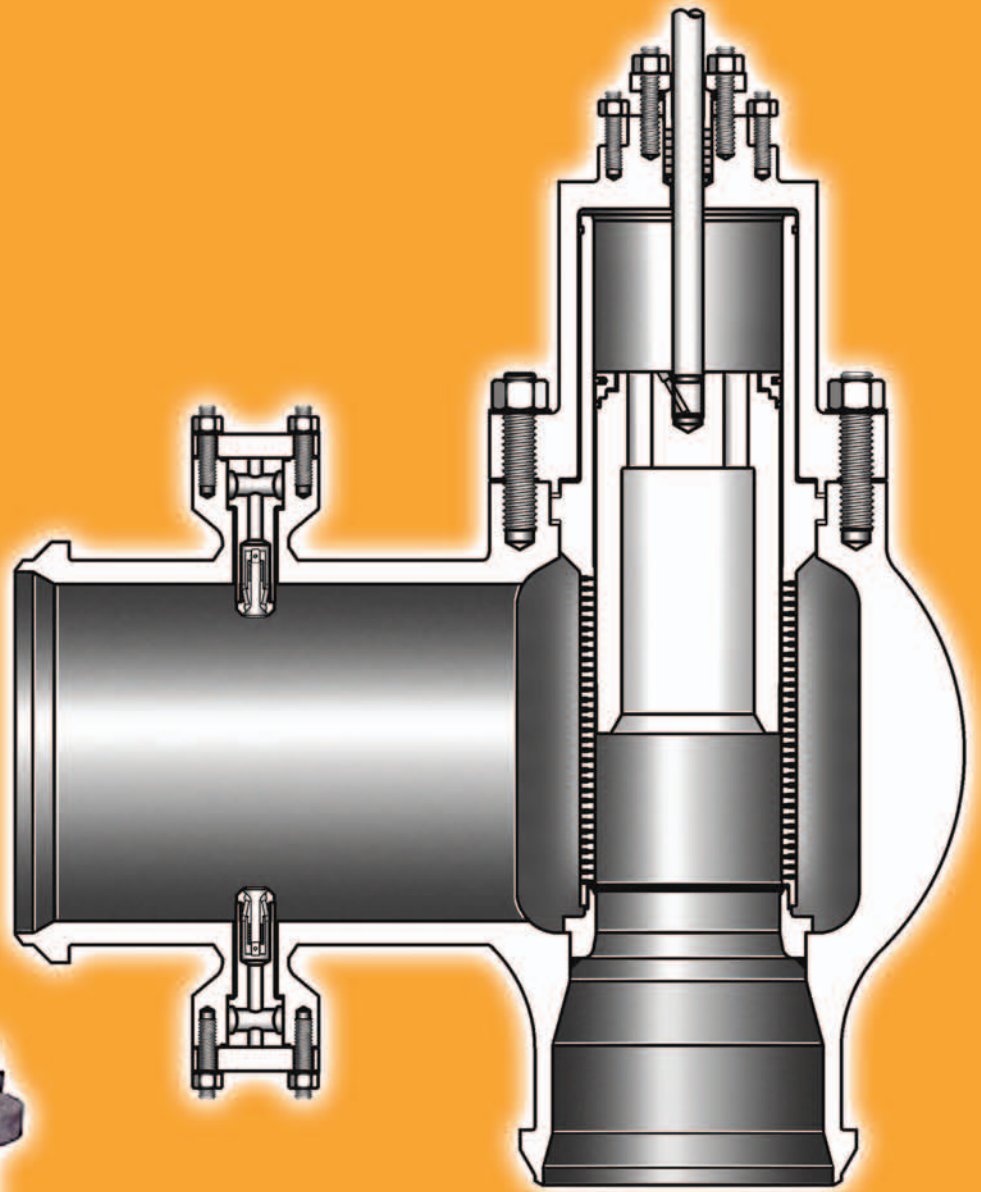


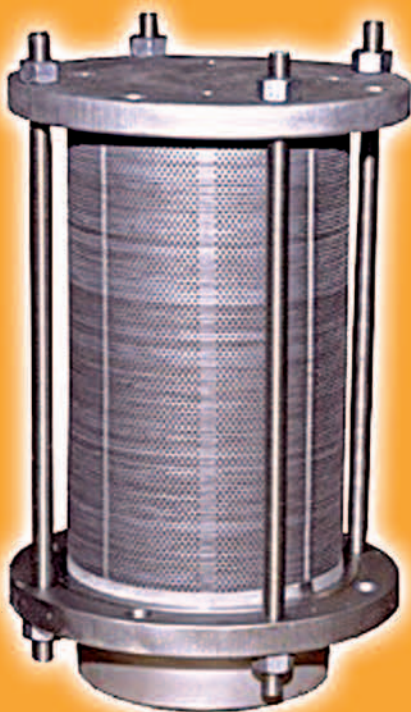
Fisher Power Industry Solutions

Powering Your Bottom Line





TBX - Turbine Bypass Valve



WhisperFlo® Diffuser

Key characteristics of TBX Valve:

- Low noise through full operation range with standard Whisper® III or WhisperFlo® trim.
- Precise spray water injection proven through extensive Computational Fluid Dynamics (CFD) and field analysis.
- Thermally compensated trim design for protection against thermal stresses and growth.
- All metal bore-seal design provides ANSI Class V shutoff standard.
- Complete customisation to match connection sizes and materials.
- High quality forged body construction for all applications.
- High performance actuation.

Power Plant Severe Service Applications

From simple to combined cycle, coal to nuclear...
Emerson's Fisher® technology and innovation
boost your plant efficiency and availability

THE CONDENSATE SYSTEM

- Condensate Recirculation Valve
- Deaerator Level Control Valve
- Experiencing oscillation and lack of control?
- Leakages in your boiler feedwater valves?

THE FEEDWATER SYSTEM

- Boiler Feedwater Recirculation Valve
- Boiler Feedwater Startup Valve
- Boiler Feedwater Regular Valve
- Difficulty in steam temperature control?

The demands placed on control valves within power generating systems vary drastically and can be formidable.

THE MAIN STEAM SYSTEM

- Superheater Attenuator Spray Valve
 - Reheater Attenuator Spray Valve
 - Turbine Bypass Valves
 - Deaerator Pegging Steam Valve
 - Soot Blower Valve
 - Sliding Pressure Control Valve
 - Boiler Start Up Valve
- Emerson Process Management, recognizes these challenges that customers face in improving their plant's operating performance and profitability. By incorporating the right control valve technology in the process, these challenges can be tackled effectively. Emerson's Fisher® has the right solutions to these and even more demanding severe service needs.

THE HEATER DRAIN SYSTEMS

- High Pressure Heater Drain Valve
- Low Pressure Heater Drain Valve

SPECIAL/SEVERE SERVICE

- Desuperheaters
- Custom made to meet difficult applications

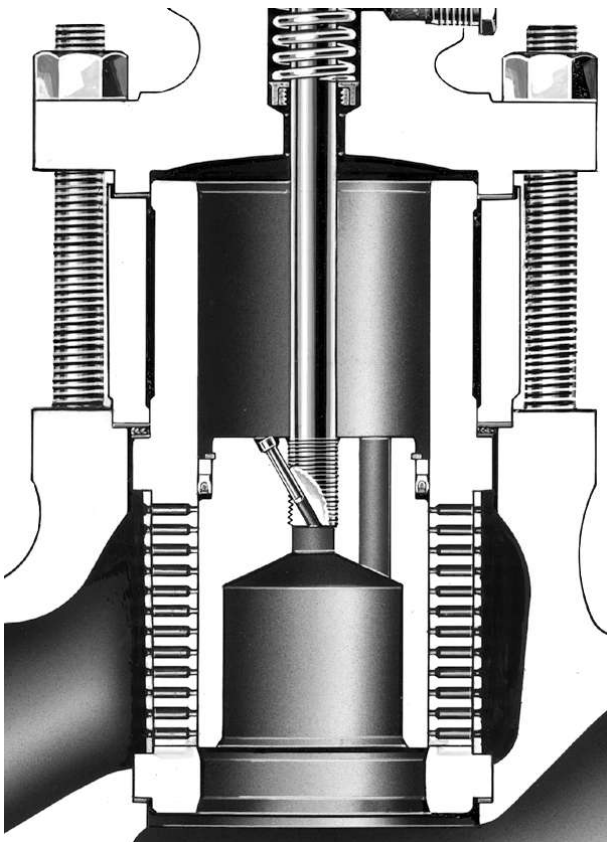
The Condensate System

Condensate Recirculation Valve

The centrifugal condensate pump must have a continuous minimum flow to prevent overheating and cavitation.

▶ This application requires tight shutoff to combat seat erosion and avoid energy-wasting leakage. Typically a Class 600 Design ET or EWT with Cavitrol® III 2-stage trim is a preferred solution. This combination can provide protection against cavitation along with tight shutoff.

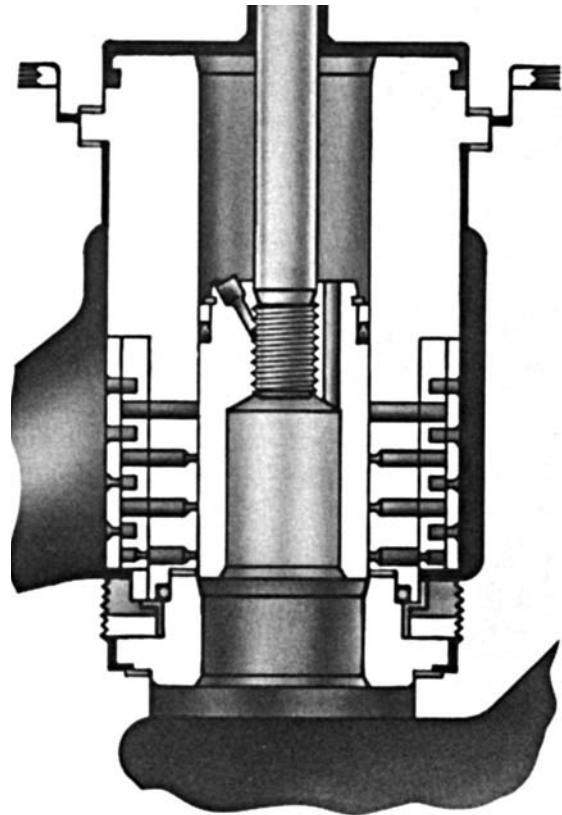
Another serious concern is excess vibration. Cavitrol® III 2-stage trim can prevent cavitation, and vibration levels can be significantly reduced.



Cavitrol® III 2-Stage, EWT body (section cut)

Deaerator Level Control Valve (DALC)

This valve should be capable of providing high flow at full load and be protected from severe cavitation, especially during startups.



Cavitrol® III Characterised Trim

▶ Typical valve selections range from a medium sized Design ET to a large Design EWT with Cavitrol® III characterized trim. Such trims have a combination of anti-cavitation orifices at low travel and unrestricted standard holes for higher travel to give very large rangeability.

As such, this special trim enables the offering of a one valve solution instead of the combination of a small and large valve.

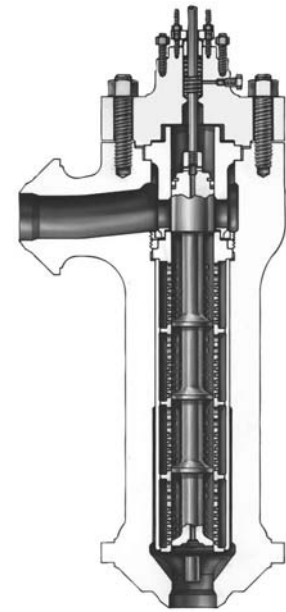
The Feedwater System

Boiler Feedwater Recirculation Valve

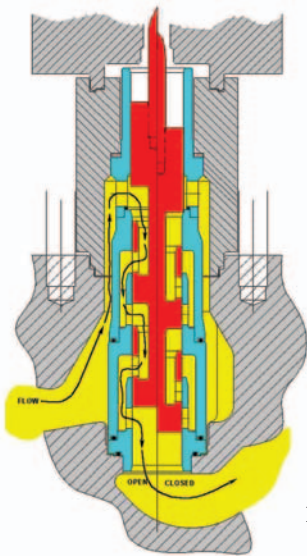
This valve faces the most severe service conditions of any control valve in a power plant. Designed to protect the feedpump by ensuring adequate feedwater flow, it must control pressure drops approaching 380 bar (5500 psi). Without proper selection, high energy cavitation occurs and quickly destroys the valve's trim.

▶ Fisher solutions to such high pressure drop are as follows:

- Pressure drops < 209 bar (3000 psi), a Design HPT/EHT with Cavitrol® III 3-stage trim
- Pressure drops < 276 bar (4000 psi), a Design HPT/EHT with Cavitrol® III 4-stage trim
- Pressure drops < 414 bar (6000 psi), Design CAV 4
- High pressure drop (combined cycle process) with magnetite scaling that may clog up holes in a conventional anti-cavitation trim. The DST/Notchflo™ trim can allow flows with particulates of up to $\frac{3}{4}$ inches (19mm) in diameter.



CAV4 with Cavitrol® IV Trim



Dirty Service Trim (DST)

Boiler Feedwater Startup Valve

The startup valve will face very much the same service conditions as the boiler feedwater recirculation valve. It will experience high inlet pressure, full drop and thus needs anti-cavitation trim and tight shutoff. Therefore, a Cavitrol® III characterized cage must be used since pressure drop changes at all valve travels.

▶ The normal recommendation is a small Design HPT/EHT with Cavitrol® III 3-stage characterized trim. The material should be chosen to avoid the use of Alloy 6. This is because hydrazine (N₂H₄) used to remove oxygen in the deaerator will break down the chrome-cobalt molecular structure in Alloy 6 (CoCrA).



8" - 14" EHT valve

Boiler Feedwater Regulator Valve

This control valve requires wide rangeability while controlling feedwater flow to the boiler and it comes into operation after boiler has started up. The pressure drop experienced by this valve is relatively lower and does not require any anti-cavitation trim.

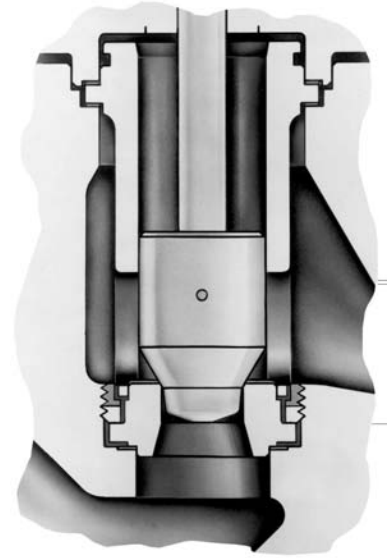
▶ Fisher designed the large, high capacity Design EHT with modified equal percentage characteristic to handle the large flow and rangeability required.

The Main Steam System

Superheater Attenuator Spray Valve

This valve controls the amount of water to be injected into the steam line, gaining maximum efficiency from the steam without damaging the delicate blades of the turbine.

- ▶ Fisher's solution to this application is: Design HPS/EHS with Micro-Form™ trim. This trim is used since the flow rates are fairly small and it gives excellent control characteristic. Tight shutoff is required to eliminate unwanted spraywater flow and allow for the best possible efficiency of the HP turbines.

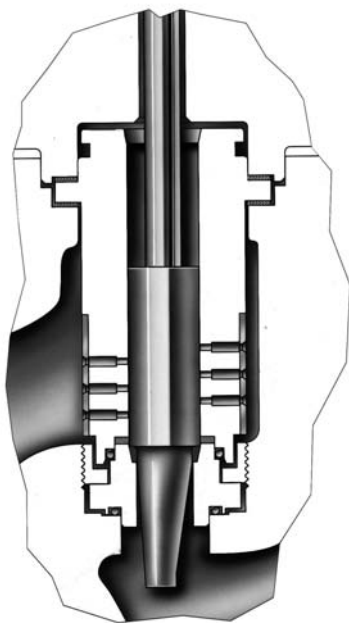


EHS with Micro-Form™ trim

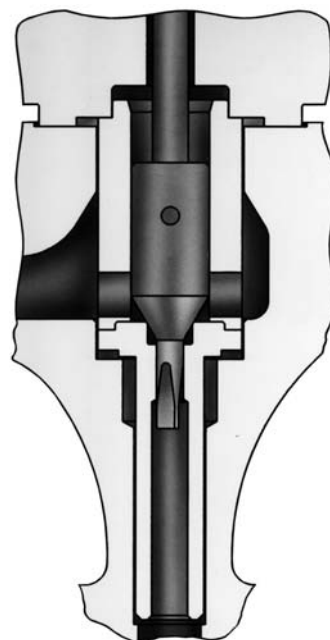
Reheater Attenuator Spray Valve

This is a tough application involving cavitation and low flow rates. Water from the feedwater pump is being dumped to the reheat steam pressure before entering the low pressure turbine. When the pressure drop is between 159 bar (2300 psi) to 248 bar (3600 psi), cavitation will occur and threaten the seating surfaces of the valve.

- ▶ To meet the combined requirement of cavitation and low flow rate control, Fisher developed a unique trim, Cavitrol® III Micro-Flat™, for the design HP Series Valve.



CAV III with Micro-Flat™ trim



Micro-Flat™ trim

Turbine Bypass Valve

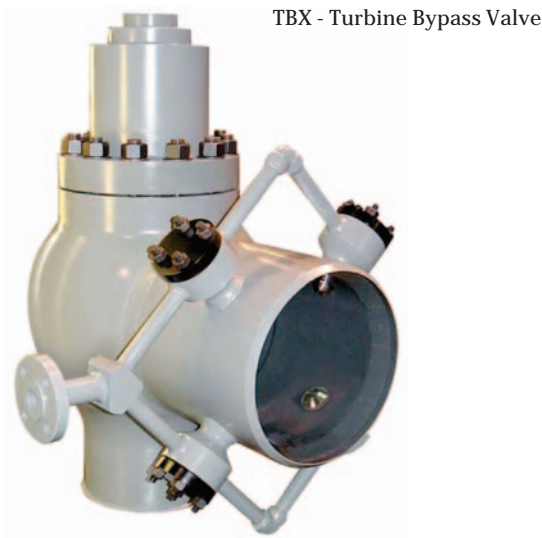
Sophisticated turbine bypass system is increasingly used to save energy, allow quicker startup and cope better with load rejection. The valve allows quick load change on the turbine, bypassing it during startup and emergencies. Integral desuperheating functions are necessary to control steam temperature and protect reheater piping and the condenser. Damage to downstream piping and condenser due to excessive valve noise is a major concern.

▶ Depending upon system requirement, Fisher offers a Design TBX steam conditioning valve which combines the noise abatement Whisper[®] III cage / WhisperFlo[®] technology with anti-flashing (AF) spray nozzles to provide accurate pressure and temperature control. The use of pneumatic actuator coupled with Fisher FIELDVUE[®] DVC positioner allows for quick and accurate control.

The patented, spring-loaded AF nozzles used in the TBX permits a high rangeability for optimum atomization, provides effective vaporization and prolonged equipment lifespan.



AF nozzle spray atomization under Computational Fluid Dynamics (CFD) analysis

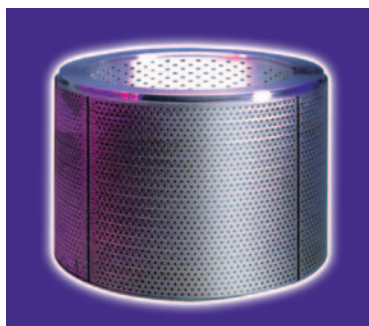


TBX - Turbine Bypass Valve

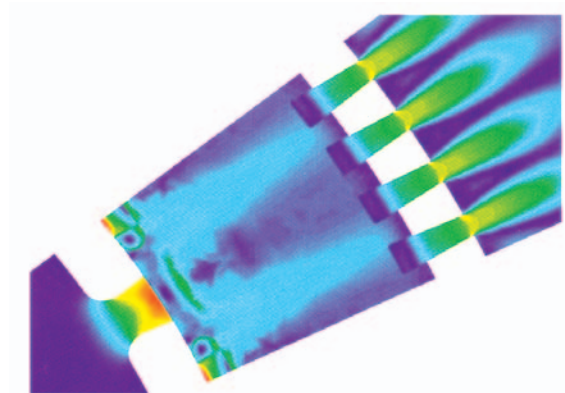
Deaerator Pegging Steam Valve

The deaerator mixes steam and feedwater to remove non-condensable gases, such as oxygen and carbon dioxide, which attack and corrode piping and boiler tubes. Hot pegging steam is mixed with feedwater in the deaerator. This brings the water in the deaerator to saturation temperature, thus liberating any dissolved non-condensable gases.

▶ Fisher offers a Design EWD with noise abatement Whisper Trim[®] III cage or WhisperFlo[®] for optimum noise control.



WhisperFlo[®] Trim

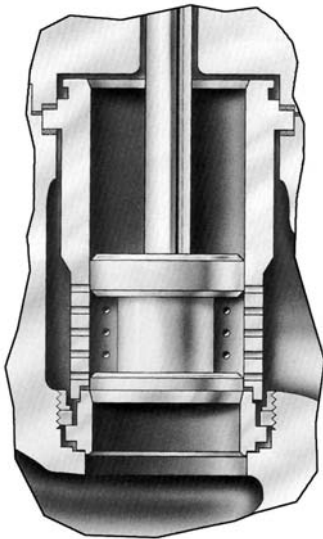


Flow through WhisperFlo[®] Trim

Soot Blower Valve

The efficiency of a boiler is highly dependent on effective heat transfer of the boiler tubes. The tubes are delicate and hot spots arising from soot buildup cannot be tolerated. Hence, air or steam is used to clean the carbon deposits from the tubes.

▶ Fisher's solution for soot blower valve is the Design HPS/EHS supplied with a drilled hole 'hung' cage in the flow up direction and an oversize valve stem connection. The 'hung' cage design allows fast expansion and contraction in the trim without producing undesirable thermal stresses that may cause leakages. This combination, known as soot blower trim, will provide tight shutoff and minimize wear, vibration and noise.



EHS with soot blower trim

Super Critical Boiler Power Plants: Sliding Pressure Control Valves

Super critical boiler power plants employ sliding pressure control strategies to improve the efficiency of cyclic operations. The trim utilized in this valve must provide noise abatement at low travel along with high rangeability and high capacity.

▶ Fisher offers Design EHD with characterized Whisper Trim[®] III or Whisper Trim[®] III hybrid

cage to meet the need of the this demanding service. This application normally requires 8" through 20" size valve. The valve plug is precisely contoured to eliminate instability and damaging vibration. The cage employs drilled holes at the low end to provide noise reduction. Milled cage window at higher travel allow matching valve capacity to the boiler's flow characteristics. The latest in alloy metal development is available to meet the high pressures and temperatures of supercritical boilers.

Boiler Startup Valves

The valve, which controls the startup sequence on super critical boilers, faces a variety of challenging service conditions. Historically, these valves have been unreliable causing chronic problems. However, new control valve designs incorporating the latest noise control, cavitation control, material and shutoff technologies are quickly changing this situation.

▶ Fisher offers startup valves for supercritical boilers made by Babcock and Wilcox, Combustion Engineering and Foster Wheeler. A variety of designs, both standard and specials, are used to accommodate such diverse but critical applications:

- Superheater bypass
- Flash tank pressure control
- Flash tank level control
- Boiler extraction
- Boiler throttle bypass
- Foster Wheeler "W" and "Y"
- Babcock boilers - BW201, BW401
- CD boilers - BT, BTB valves
- Babcock & Wilcox - BW360, BW361 valves



20" EHD with electric actuator

The Heater Drain Systems

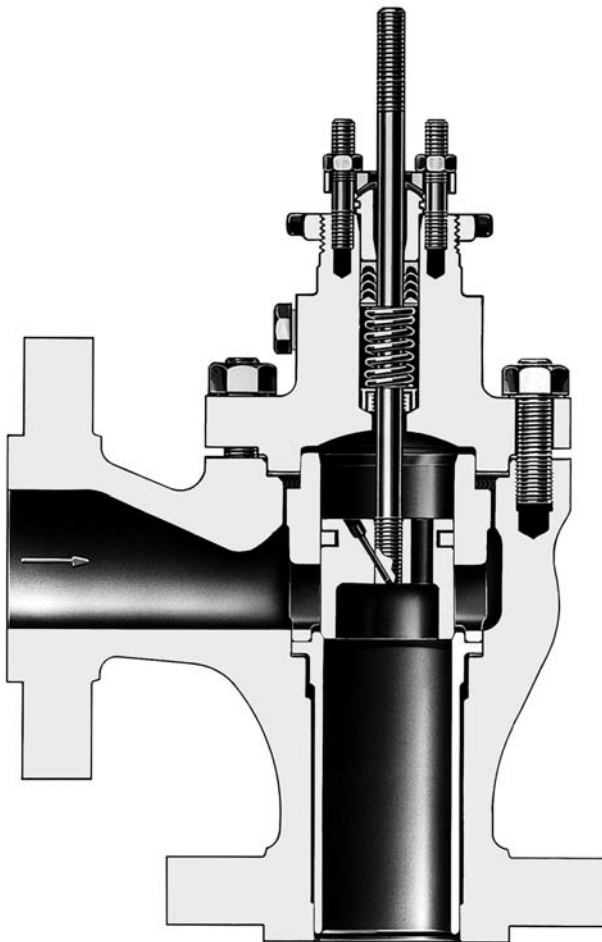
High and Low Pressure Heater Drains

Heater drain valves suffer severe flashing damage as water is being dumped to the condenser. Tight shutoff is required to prevent heat loss.

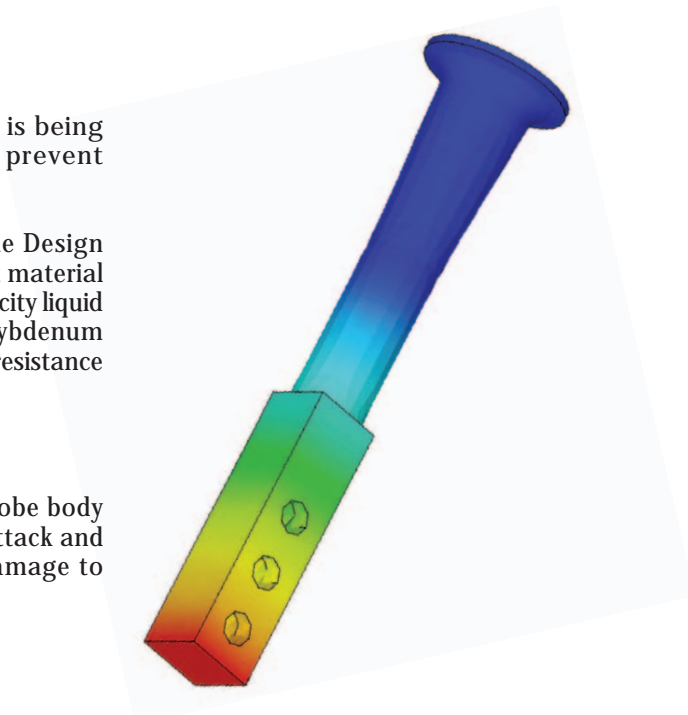
▶ For the high pressure heater drain system, an angle Design HPA/EHA or EA is recommended for combating against material erosion. This wear is caused by impingement of high velocity liquid droplets on the trim and body surfaces. Chrome-molybdenum WC9 materials have been widely used instead of C5 due to higher resistance to erosion, easier to cast, weld repair and manufacture.

Fisher offers angle valves of sizes up to 10”.

For low pressure heater drain system, WC9 alloy Design EW globe body with hardened trim are preferred. The materials resist erosive attack and oversized end connections reduce outlet fluid velocity and damage to downstream piping.



Angle Type EAD



Finite element analysis of heat distribution for DMA-HTC Desuperheater

Desuperheaters

Fisher developed a range of desuperheater products to meet various desuperheating applications in HRSG, superheaters and reheater cooling for any line size and application.

The High Pressure and Reheat interstage attenuator applications typically experience severe conditions including high temperatures, high steam velocities and high thermal stress. In order to combat the rigors of such applications, Fisher developed the DMA/AF-HTC insertion style series of desuperheaters. The DMA/AF-HTC uses Fisher's proven type AF (anti-flashing) nozzles to deliver the required water for accurate temperature control. The DMA/AF-HTC is suitable for temperatures up to 649°C (1200 F) and standard pressure classes up to ANSI 2500.

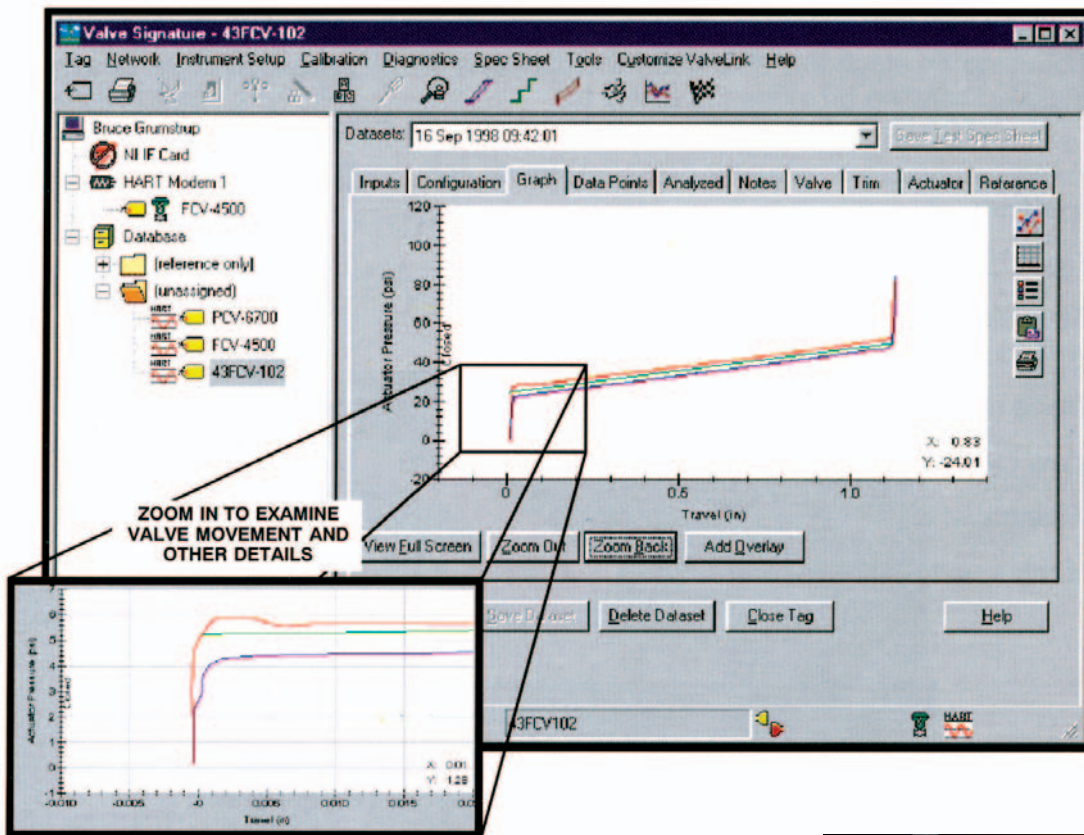
Special/Severe Service

Backed by more than a century of experience in demanding severe service applications, Fisher designs and produces customised special valves to meet customers' requirements.

Consider your control valve problems solved and your plant's performance increased. With Fisher.

Supporting Product Lines

- Fisher® Vee-Ball® segmented ball valves from 1" to 20"
- Fisher® éplug™ V500 eccentric plug rotary valves from 1" to 12"
- Fisher® éplug™ eccentric rotary plug valves from 3" to 12"
- The POSI-SEAL® high performance butterfly valve
- Fisher® Level-Trol® liquid level controllers and transmitters
- FIELDVUE® Digital Valve Controllers, a microprocessor based positioners that communicate using the HART® protocol



- AMS ValveLink® Software, a friendly programme on a personal computer for configuring, calibrating, and diagnosing using FIELDVUE® Digital Valve Controllers.
- PlantWeb®, a field-based, scalable architecture that enables one to interact with intelligent field devices using FOUNDATION™ fieldbus. Revolutionary improvements result in better process control, asset management and execution of complex control strategies. These advantages provide a better return on investments.



A Guide to Fisher Nomenclature

Here's a brief explanation of the Fisher Product tradenames and designations used in this brochure.

TRIM DESIGNS

Cavitrol® III trim – Flow control cages are designed to prevent or minimize cavitation. In Cavitrol III trim designs, the pressure drop is staged across several concentric specially shaped orifices in series. Each of these restrictions dissipates a certain amount of the available energy and presents a lower inlet pressure to the next stage. Pressure reduction occurs in two, three or four unequal steps depending upon cage construction and is accomplished by increasing the flow area from stage to stage. This partial pressure drop in each stage prevents the liquid from falling below its vapour pressure, eliminating the formation of vapour bubbles. The CAV III trims can take up to 276 bar (4000 psi) of pressure drop.

Cavitrol® III Micro-Flat™ Anti-Cavitation Trim – This trim handles demanding applications where very low flows must be controlled in the presence of cavitation such as the reheater attemperator spray valve.

Cavitrol® IV – A patented pressure-staging design which provides cavitation protection for pressure drops of up to 414 bar (6000 psi). Conventional single seat design cannot effectively provide tight shutoff above 207 bar (3000 psi) due to clearance flow between the cage and plug. Such flow is so small and damaging that the cage is no longer effective. Trim life is lengthened in the Cavitrol IV design by separating the shutoff and throttling surfaces. The shutoff surface is upstream of the throttling seat and the upper cage is designed so that it takes very little pressure drop. The seating surface experiences relatively low flow velocities which combines with the hardened seat materials to provide excellent damage resistance even when the valve is used at very low valve travels. This unique trim is used in high pressure globe, angle or offset globe valve bodies.

DST/Notchflo™ Trim – A patented multi-stage, anti-cavitation trim for use in services where the fluid may have entrained particulates that could plug the hole passages in or cause erosion damage to conventional anti-cavitation trims. This trim is frequently used in high pressure drop applications up to 276 bar (4000 psi) and allows the passage of particulate up to a diameter of $\frac{3}{4}$ inches (19mm).

Whisper Trim® I Cage – Flow cage design that utilizes many narrow, parallel slots to minimize turbulence and provide a favourable velocity distribution in the expansion area of the valve.

It provides a multitude of low noise flow paths which combine to produce less overall noise (up to 15 dBA reduction) than standard cages.

Whisper Trim® III Cage – Flow cage which takes the full pressure drop in one or more steps. Fluid flows from inside the cage to outside through many orifices. Cage performance is tied closely to the spacing of these orifices which are engineered to break up steam flow stream turbulence and noise-producing interactions.

For many applications involving a high pressure drop to inlet pressure ratio, a baffle is installed outside the cage to reduce turbulence of the fluid jets exiting the flow cage. The result is up to a 30 dBA reduction in control valve noise.

WhisperFlo® Trim – The Whisperflo technology provides the highest level of noise attenuation by engaging a laser cut of stack plate trim with three dimension flow paths. This breakthrough in technology permits a noise reduction of -40 dBA based on the IEC noise prediction method. The technology can also be applied to vent diffusers and turbine bypass spargers.

Bore-Seal™ Trim – A high temperature tight shutoff trim sealing technology which can be applied in demanding applications such as turbine bypass valves and deaerator pegging valves.

BODY DESIGNS

Design TBX – Steam conditioning valve specifically designed for critical condenser dump applications. Provide maximum desuperheating spray for bypass applications.

Design E & EW – High capacity globe valves are designed to keep outlet velocities low to prevent noise and erosion. Features metal-to-metal seating for up to ANSI Class V shutoff capability.

Design EWN – These are high capacity globe valve specifically for use with Whisper Trim cages to provide noise abatement at high flows and large pressure drops. The EWN series can also be installed with CAV III trims for anti-cavitation applications.

Design HP & EH – These are high pressure globe valves with maximum pressure drop capabilities consistent with ANSI Class 2500.



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Emerson Process Management Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461
Singapore
T +(65) 6777 8211
F +(65) 6777 0947
www.EmersonProcess.com/Fisher

Emerson Process Management
Fisher Valve Division
205 South Center Street
Marshalltown, Iowa 50158 USA
T1 (641) 754 3011
F1 (641) 754 2830
www.EmersonProcess.com/Fisher

Emerson Process Management
rue Paul Baudry - BP 10
68700 Cernay
France
T +(33) (0)3 8937 6400
F +(33) (0)3 8937 6518
www.EmersonProcess.com/Fisher



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