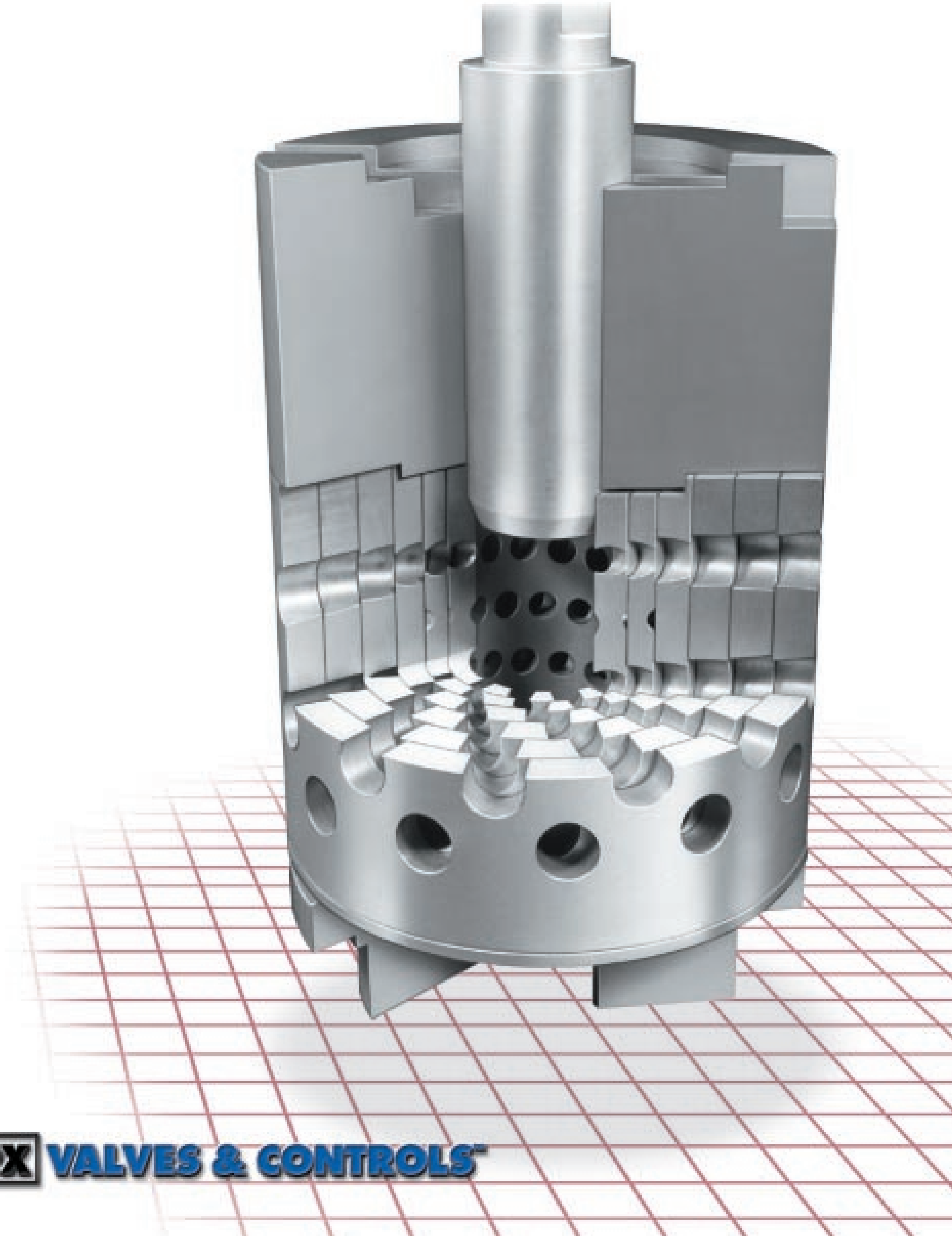
COPES-VULCAN®

HUSH® TRIM



SPX VALVES & CONTROLS™

HUSH® TRIM

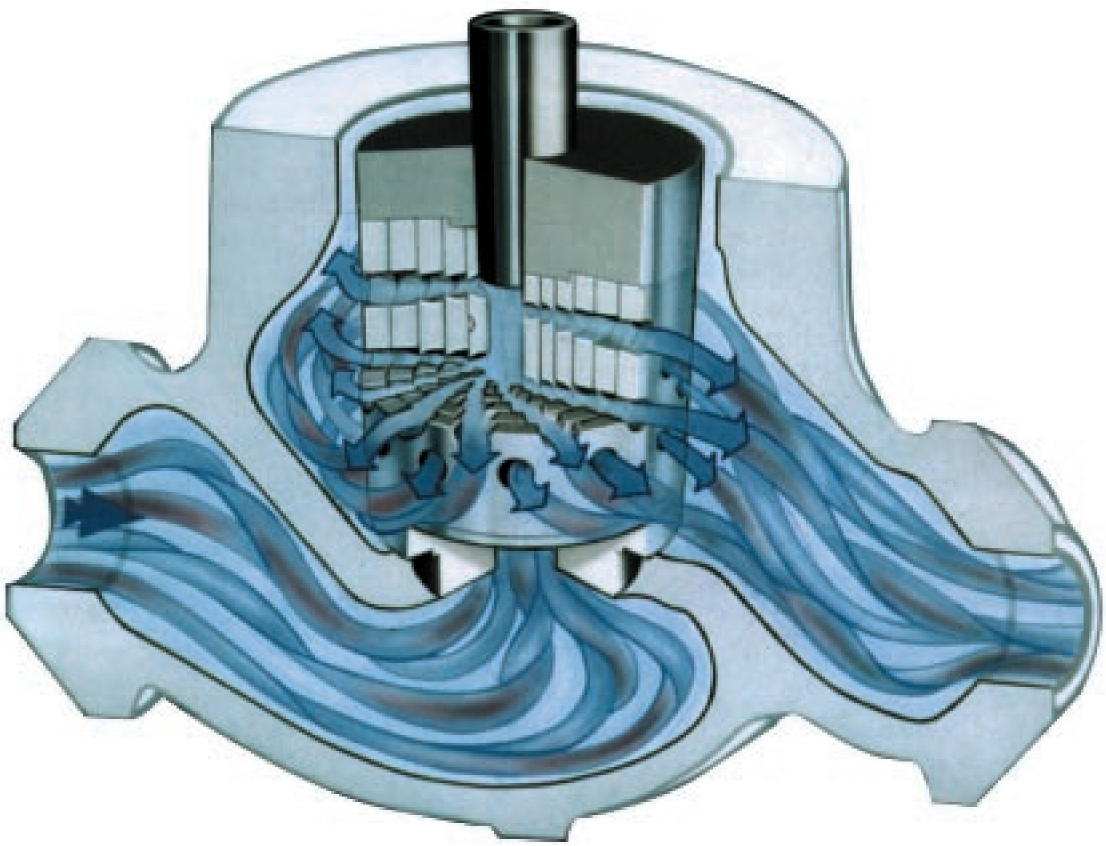
HUSH® Trim is an innovative concept in control valve trims designed by Copes-Vulcan for high pressure drop liquid, gas and steam applications. Cavitation, excessive leakage, hazardous noise, vibration and mechanical failures which cause high maintenance and excessive downtime can be eliminated with HUSH Trim.

Principle of Operation

HUSH Trim is a cage guided type and provides excellent control for compressible and non-compressible fluid applications by directing the flow through a series of staged pressure drops. This unique trim eliminates cavitation in liquid flow and provides multiple pressure breakdown for noise attenuation in critical pressure drop compressible fluid applications.

The trim assembly consists of a number of nested concentric cylinders, each having a series of radially drilled holes. The orifice areas are developed by arranging the cylinders, one within the other, in an offset manner so that a series of restriction (pinch areas) and expansion areas occur in series. The total pressure is thus reduced in stages.

The timed series of holes form a multiple helix pattern. Opening of the plug affects several holes at any one time eliminating the digital effect and providing smooth control and excellent rangeability. Fluid discharges from the trim in a parabolic pattern, creating a swirl around the cylinder assembly. Thus, any possible damage from direct impingement of the fluid on the valve body walls is eliminated.



For Liquid Service

One of the major causes of control valve failure, when using conventional designs, is the severe damage inflicted on trim parts and valve body by cavitation.

Cavitation is the result of the collapse of vapor bubbles close to metal surfaces such as the trim or valve body. As the liquid enters the trim, the velocity increases and pressure decreases. If there is sufficient heat in the liquid and if the pressure decreases to the vapor pressure, bubbles form. Downstream, pressure starts to recover and these randomly formed bubbles will collapse, generally close to the trim or walls of the valve body. Very high local stresses are generated. In addition, the random position and frequency of these implosions can generate mechanical vibration, valve and pipe line instability and noise.

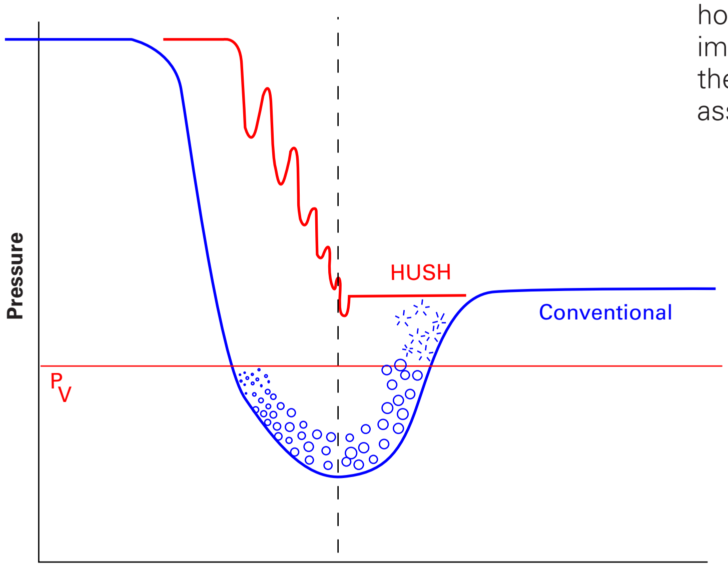
Aerated liquids are particularly troublesome especially if the pressure drop is significantly high. Identical problems of cavitation will occur and an added problem — corrosion. Very often the outlet of the valve body and downstream piping will suffer corrosion damage.

HUSH Trim provides a solution to these problems. This unique design controls flow and velocity of the liquid through many orifice openings and stages of pressure drop. Flow enters the valve from under the main seat, which is from inside the cylinder assembly and moves toward the outside. Multiple helical patterns of holes in each cylinder provide the basis of the design. The number of cylinders control the number of stages of pressure drop. Through a computer program, each application is tailor-made to fit the situation.

The vena-contracta for each stage of pressure drop is the pinch area formed between the inter-section of each cylinder and associated drilled holes. Copes-Vulcan’s engineering experience has shown that the last few stages of pressure drop are the most critical, especially if the final pressure is close to vapor pressure. The largest share of the overall drop is taken at the first stage. Each subsequent stage takes a proportionately smaller drop until the liquid pressure eases into its final operating condition.

Flow from inside out is very important as any potential problem of cavitation or aeration is directed away from the valve seat. The flow pattern through each series of holes forms a parabolic curvature as liquid discharges from the cylinder assembly. Since there are many holes along the parabolic flow path, no direct impingement of harsh liquid is directed onto the walls of the valve body. The HUSH cylinder assembly therefore acts like a fine shower spray.

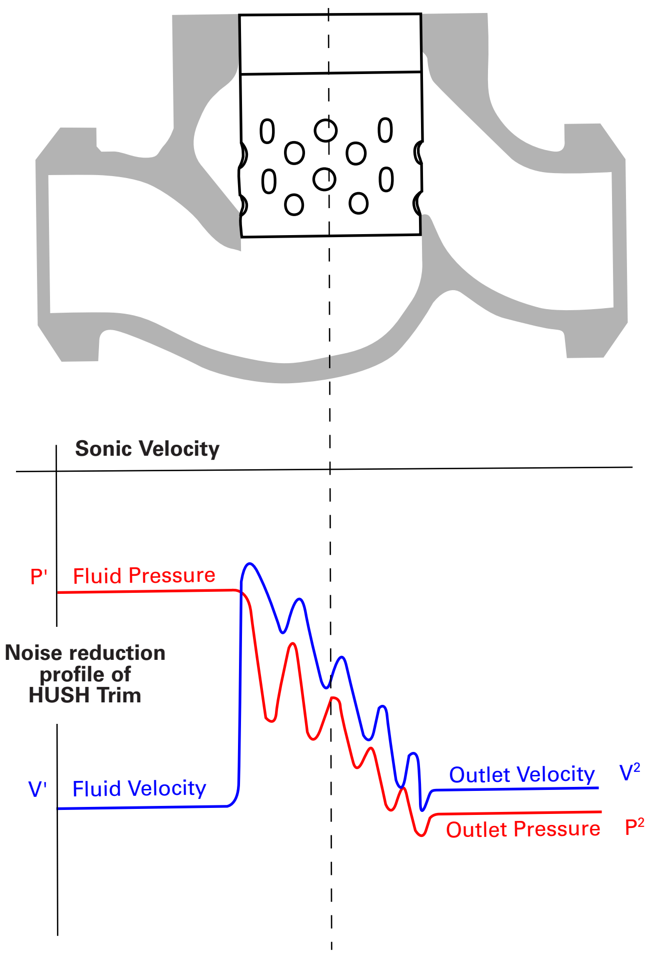
Pressure Drop Profile



Conventional trim allows damaging cavitation to occur when the pressure drops below the vapor pressure of the liquid. HUSH Trim is designed so that the pressure at the last stage of drop is not at or below the vapor pressure. Cavitation therefore cannot occur.

For Gas or Steam Applications

HUSH Trim was developed not only to prevent cavitation but also to attenuate noise generated by high pressure drop gas and steam applications. Conventional valves usually have one vena-contracta and if critical pressure drop is required, sonic velocity is generated. Turbulence and pressure changes in the downstream piping can become forcing functions and if the natural frequency of the system is close to the forcing function, resonance can occur. Not only will the system be noisy, but there is a risk that stresses produced by resonance could cause fatigue.



HUSH Trim controls the gas/steam velocity to sub-sonic values through each stage of drop. As in liquid applications, flow enters the trim from under the seats and into the cylinder assembly. This unique trim is designed so that gas/steam will not reach sonic velocity at any stage. Expansion of the gas/steam is allowed to occur immediately after the major restriction in each stage. Trim and valve size will depend on the number of stages of pressure drop and the size and number of holes required to pass the flow. In addition, by using a large number of small restrictions, the energy is broken, providing for a quiet valve. Noise level is generally maintained at 85dBA or less.

Advantages

- Resolves existing problems for both compressible and noncompressible fluid flow applications.
- Prevents cavitation from occurring.
- Prevents aerated liquids from corroding/eroding trim and valve parts.
- Provides zero leakage through soft seats (Max. 500°F, 260°C) for applications requiring tight shutoff.
- Prevents mechanical vibration and instability in all three planes "X-Y-Z".
- Minimizes plugging of trim by foreign matter in pipe line.
- Prevents sonic velocity from occurring within the valve.
- Generally limits noise to 85dBA or less.
- Provides high turn down — up to 75:1.
- Provides high reliability and maintainability.

Typical Applications

- Boiler feed pump recirculation — on/off or modulating and with zero leakage.
- Boiler feedwater start-up.
- Re-heat and super heat spray control.
- High pressure liquid, steam and gas applications.
- Aerated liquid applications.
- Condensate systems.
- Turbine Bypass to atmosphere or condenser.
- All fluids where velocity control is required to minimize vibration and noise.

Specifications*

Rangeability	up to 75:1
Flow Direction	under seat
Construction	cylinders are brazed together using a nickel alloy
Cage, Seat and Plug Material	420 stainless steel (malcomized for temperatures above 800°F [427°C])
Seat Leakage	metal seat — ANSI B16.104 up to Class V soft seat — ANSI B16.104 up to Class VI
Maximum Fluid Temperature	metal seat — 1050°F (566°C) soft seat — 400-500°F (204–260°C)
Minimum Fluid Temperature	metal seat — -20°F (-29°C) soft seat — -20°F (-29°C)

In order to determine the number of staged pressure drops for a given application, the below listed specifications are required for determining the number of cylinders, port diameters, trim size, Cv and valve size.

For Steam or Gas Applications

1. Allowable noise limit
2. Steam or gas flow rate
3. Pressure drop @ min. & max. flow
4. Outlet pressure @ min. & max. flow
5. Shutoff pressure
6. Temperature

For Fluid Applications

1. Valve pressure drop @ min. & max. flow
2. Shutoff pressure
3. Outlet pressure @ min. & max. flow
4. Flow rate (min. & max.)
5. Temperature (min. & max.)
6. Leakage rate

Liquid Trim Sizes	Maximum # of Stages	Steam & Gas Trim Sizes	Maximum # of Stages
2" 51mm	10	2" 51mm	6
3" 76mm	10	3" 76mm	7
4" 102mm	10	4" 102mm	7
5" 127mm	10	5" 127mm	8
6" 152mm	10	6" 152mm	9
8" 203mm	10	8" 203mm	9
10" 254mm	10	10" 254mm	9
12" 305mm	10	12" 305mm	9
14" 356mm	10	14" 356mm	10
16" 406mm	10	16" 406mm	10
–	–	20" 508mm	10
–	–	24" 610mm	10
–	–	28" 711mm	10

The number of holes and their pinch areas for each cylinder or stage will vary for each size trim and application. A detailed computer program for compressible and non-compressible fluids is utilized in obtaining data for optimum sizing of HUSH Trim.

* For estimating purposes only — certified specifications furnished per individual job.

Sales and Service

For information about our worldwide locations, approvals and certifications, and local representatives, please visit our web site.

Web Site: www.spxvalves.com **E-Mail: info@spxvalves.com**

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