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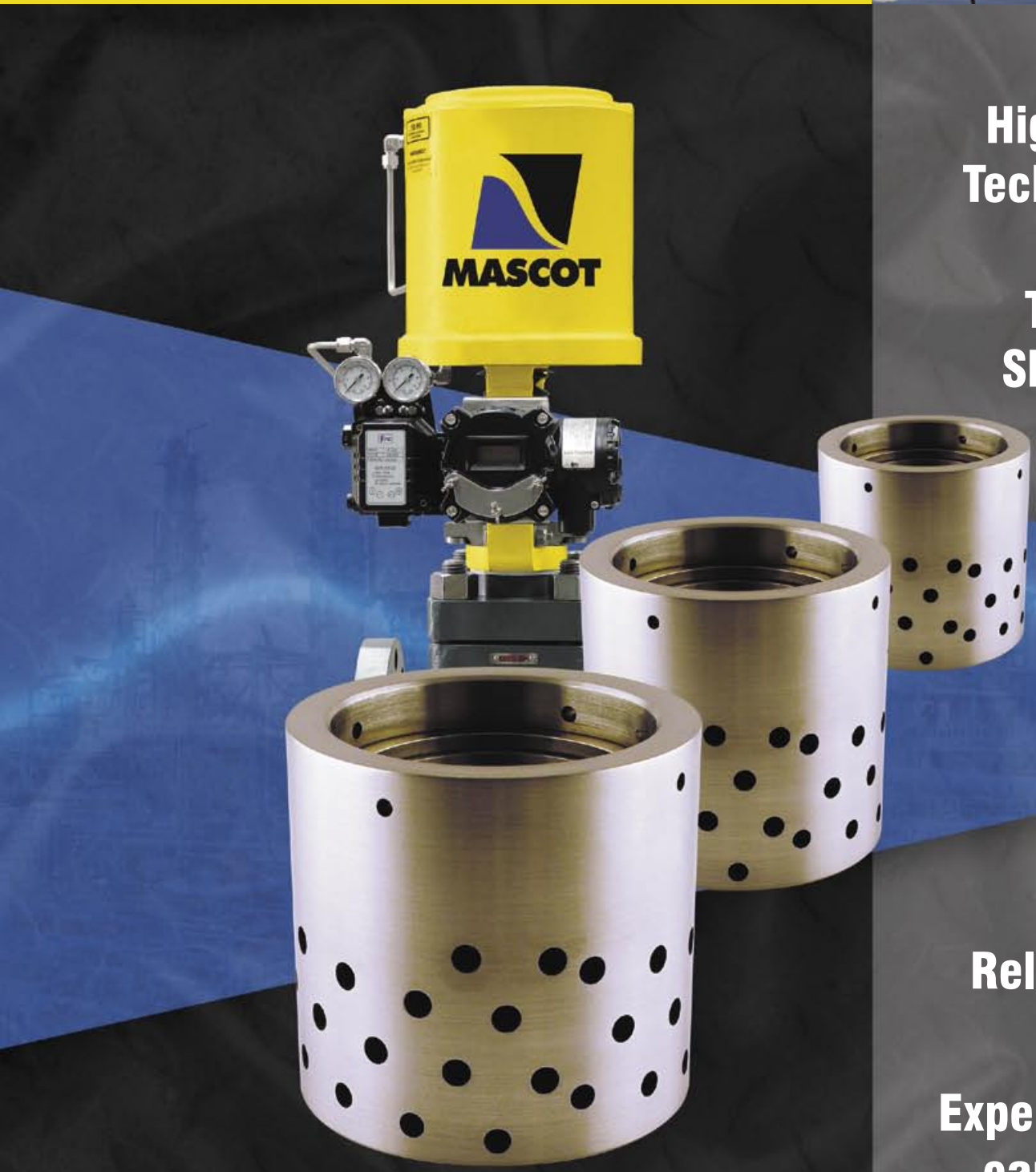


High End Technology

Tight Shutoff

Reliability

Expertise you can trust

Severe Service Control Valves

Forward

MASCOT Industrial is a market leader in Severe Service control valve technology. We manufacture and market a range of specialized valve trims and devices to control or eliminate various problems encountered in process plants such as noise, cavitation, flashing, erosion and corrosion.

Introduction

Historically there has not been a great deal of difference in the way specifications are written for “General Service” and “Severe Service” control valves. Yet by its very name Industry recognizes that Severe Service applications are just that...absolutely Severe Service.

Control valve manufacturers are given great freedom in the way they interpret severe service control valve specifications. Many manufacturers utilize hard trim materials, the size of the valve exit or the size and schedule of the downstream pipe to substantiate their claims their valve / trim design won’t be damaged by cavitation in liquid service or won’t be noisy in gas service without a solid engineering basis. Valve selections are made on the basis of lowest cost with little consideration to the longer term effects which could potentially jeopardize plant safety and operation in the longer term

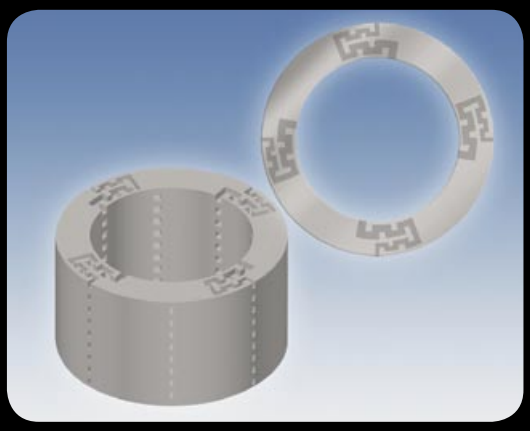
Industry, through the ISA, has recognized control valves with severe service trims and associated process piping systems can fail through erosion and fatigue caused by excessively high trim velocity head and control valve induced vibration. As a result the ISA has incorporated a Vibration and Erosion Limits clause into its Control Valve Technical Specification. This clause is of particular importance when specifying severe service control valves.

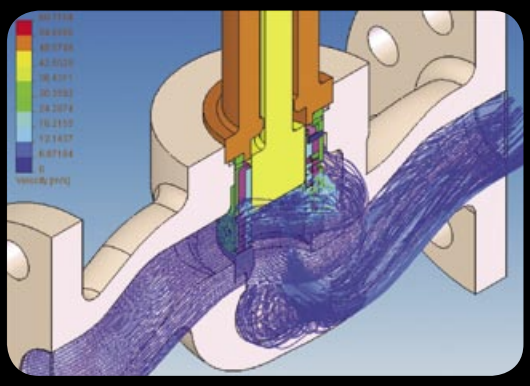
In Liquid service it limits the trim exit Velocity to 23 m/sec (75 ft/sec) for cavitating, flashing or erosive service.

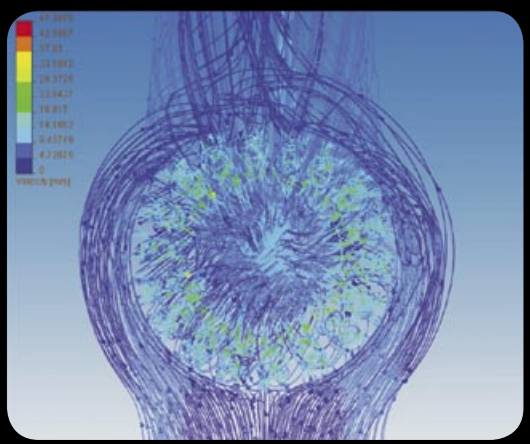
In Gas service it limits the trim exit Velocity Head to below 480 kPa (70 psia) through each pressure reduction stage of the trim, where Velocity Head (Vh) is a measure of Kinetic Energy such that:

$$Vh = \text{Kinetic Energy} = \rho V^2/(2g).$$

Limiting the trim exit Velocity Head to below 480 kPa (70 psi) ensures the amount of energy being dissipated through each pressure reduction stage of the trim is considered so as to avoid fatigue and failure of the valve and process pipe work caused by control valve induced vibration.







VC Velocity Control Severe Service Trims

Anti Cavitation Velocity Control – Liquid Applications

The VC Trim is used for liquid, applications where the pressure drop is high enough to cause severe cavitation and the energy being dissipated is significant enough to cause substantial damage to standard trims and pipe work.

The multi stage design of the VC Trim eliminates cavitation and ensures the trim exit velocity is maintained at acceptable levels.

As the liquid moves through the passages in the VC Trim the energy is dissipated through sharp direction changes, friction and turbulence.

The total pressure drop is distributed over a series of stages and cavitation is prevented from occurring by ensuring that the internal fluid pressure does not fall below the vapor pressure at any stage.

The design of the VC Trim provides sufficient number of discrete pressure reduction stages to maintain the trim exit velocity below 23 m/sec (75 ft/sec).

Noise Attenuation Velocity Control – Gas Applications

The VC trim is used for vapour and gas applications where the pressure drop is high enough to cause high noise levels and the energy being dissipated is significant enough to cause substantial damage to standard trims and pipe work.

The VC Trim divides the flow into many small streams and utilizes expansion and contraction, friction and changes in flow direction to convert the high upstream potential energy directly into heat. The multi stage design of the VC trim controls the Velocity Head through each stage of the trim at levels that do not create high noise or control valve induced vibration.

The VC Trim is also a technically superior and cost effective alternative to conventional noise abating devices (ie silencers) in gas and vapor atmospheric vent applications. The VC Vent Stack effectively performs the duty of both the pressure let down valve and the atmospheric silencer, eliminating the need for the atmospheric vent silencer altogether. The VC Vent Stack is installed downstream of the valve, reducing the required size of the valve body and as a silencer is not required the total weight of the “system” is greatly reduced. This provides significant savings to otherwise expensive construction and formwork required to install large and heavy silencers.

VC Trim Design

MASCOT Industrial utilises computer aided design and state of the art flow modeling software to accurately calculate the process velocity at all points within the VC trim and valve body.

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Anti Cavitation Trims

CAVFLO Trim

CAVFLO Trim is used in liquid applications to protect control valves from cavitation damage.

The CAVFLO Trim controls where the cavitation vapor bubbles collapse keeping them away from valve components. It works by reducing the flow into many small flow streams through the carefully engineered holes in the CAVFLO trim.

The design of these holes ensures that the vena contracta and the formation of cavitation vapor bubbles occurs as the flow exits the retainer. The flow streams are directed into the center of the trim, where opposing streams collide allowing the cavitation vapor bubbles to collapse harmlessly against themselves, away from valve components.

CAVFLO trim fits standard GFLO bodies and can be supplied with =%, linear or bi-linear flow characteristics.

TAPERFLO Trim

TAPERFLO Trim is used for small Cv liquid applications where the pressure drop is high enough to cause cavitation and the energy being dissipated is high enough to cause substantial damage to standard trims.

The TAPERFLO trim gradually reduces the energy of the incoming liquid to prevent cavitation from occurring. The design provides a sufficient number of discrete pressure reduction stages to ensure the internal pressure of the liquid never falls below the vapour pressure.

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Noise Attenuation Trims

MEGAFLO Trim

MEGAFLO trim is used to reduce control valve noise to acceptable levels in high pressure drop gas applications.

The MEGAFLO attenuator design consists of a series of retainers which can reduce noise levels by up to 30 dBA.

Noise attenuation is achieved by staging the pressure drop not just across the plug and seat but also across the holes in each of the retainers and by controling the turbulence carried into the downstream piping using the following mechanisms:

- Staged Pressure Drop
- Small Flow Streams
- Accoustice Impedance

MEGAFLO Plate Diffuser

The MEGAFLO Plate Diffuser is used to reduce control valve noise and valve exit velocity to acceptable limits.

The MEGAFLO plate diffuser is installed in the pipe work immediately down stream of the control valve.

Noise attenuation is achieved by staging the pressure drop using the following mechanisms:

- Staged Pressure Drop with Control Valve
- Small Flow Streams
- Acoustic Impedance

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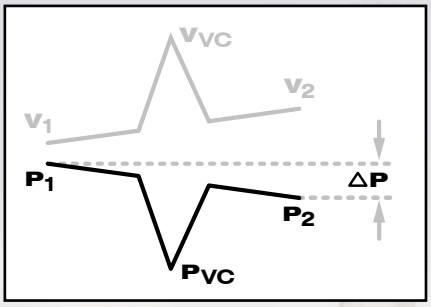
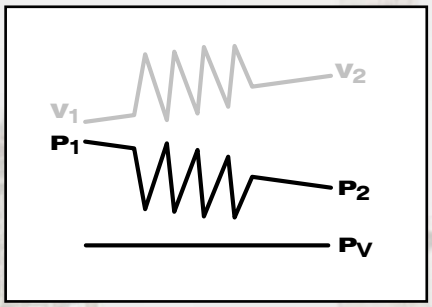


Pressure Profile - single seated valve



Pressure Profile - Multistage Trim

P_1	Upstream Pressure
P_2	Downstream Pressure
ΔP	Valve Pressure Drop
P_{VC}	Pressure at Vena Contracta
P_V	Vapour Pressure
v_1	Inlet Velocity
v_2	Outlet Velocity
v_{VC}	Velocity at Vena Contracta

Severe Service Valves

By utilising mechanisms that convert pressure directly into other forms of energy without passing through a region of low pressure and high velocity, it is possible to eliminate cavitation in liquids, and substantially reduce noise levels in high pressure drop gas applications.

Proper control valve selections will ensure that the required energy can be dissipated without exceeding the maximum vibration levels in the piping system and without exceeding the wear properties of the trim material. The selected control valve trim design shall facilitate maximum reduction of control valve induced vibration and trim wear.

Control valve vibration and trim erosion can be reduced by multi-stage mulitpath trim designs. In order to minimise vibration, the control valve trim design should be based on ISA Guideline Compliant Specification, edition 1998, Clause 5.3.2.

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