# V-LOG®

Masoneilan®

# ENERGY MANAGEMENT TECHNOLOGY

DRESSER

# Masoneilan®
## Experience, Knowledge, Technology

Masoneilan with 25 manufacturing units worldwide, supported by an integrated network of sales offices, provides the widest range of control valve solutions and services on a global scale. The broad portfolio of products from Masoneilan consists of general service and severe service control valves, actuators, pressure regulators and valve mounted smart instrumentation and accessories. This breadth of offering allows Masoneilan to provide the Best Fit solution for virtually every process control application.

BEST FIT valve solutions from Masoneilan, including industry leading designs such as the LincolnLog® liquid letdown control valve, range from butterfly valves to customized solutions such as patented V-LOG® labyrinth trim technology. Masoneilan ensures that customer needs, most notably control performance, shut-off reliability and life cycle cost effectiveness are all optimally satisfied by the Best Fit valve solution. Leading product technology coupled with application expertise are the key enablers to the Best Fit approach.

## INTEGRATED SMART ENGINEERED BEST FIT SOLUTIONS

Masoneilan provides leading micro-processor based field instrumentation technology that maximizes plant operating margins by improving process yields, while reducing plant operating and maintenance costs. Award winning HART® communicating Smart Valve Interface (SVI®) and Fieldbus Valve Positioner (FVP®) digital positioners from Masoneilan help users realize improved asset effectiveness resulting in higher returns on investment. These digital positioners deliver improved process yields through patented tuning algorithms that optimize valve control performance.

FLEXIBILITY is built into the digital instrumentation offerings from Masoneilan. FVP and SVII mount on any control valve/actuator and interface effectively with any HART or Foundation Fieldbus® distributed control scheme. Functional Flexibility is gained from Masoneilan's smart instrument companion software such as ValVue®, which monitors real time device status. In addition, ValvKeep® valve database management and AMS Snap-on™ asset management software provide a comprehensive view into valve asset maintenance history and performance trends. These software support tools in conjunction with the advanced diagnostic capabilities of the smart devices help realize significant cost savings in operations and maintenance.

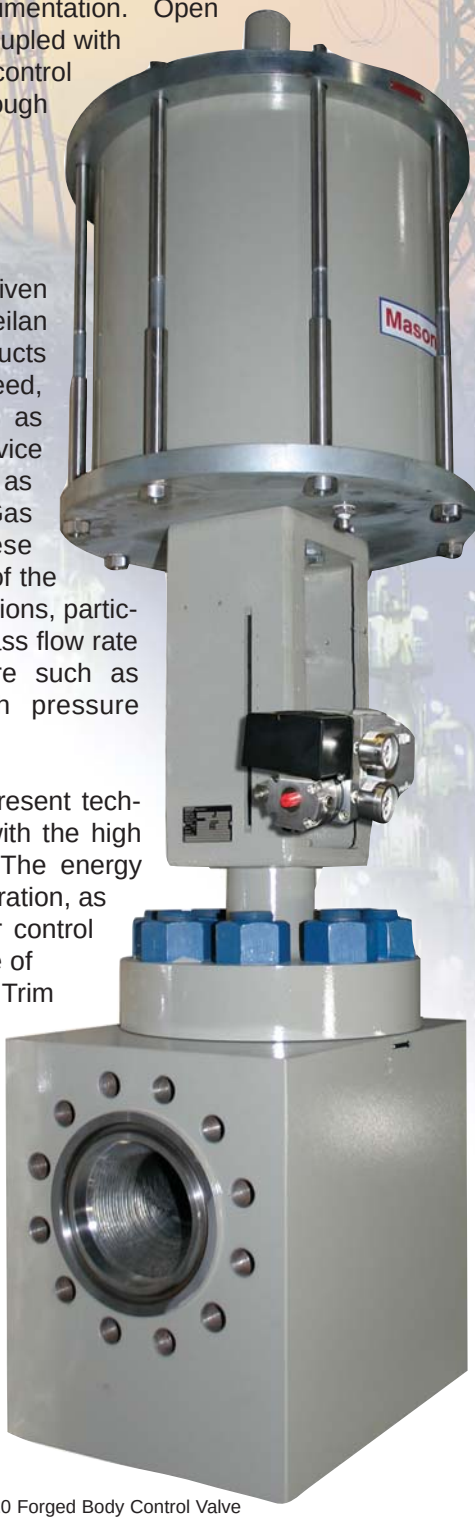

## CUSTOMER FOR LIFE

To fully leverage these operating margin improvement tools, Masoneilan provides comprehensive local support through fully authorized repair and service centers (MARCs - Masoneilan Authorized Repair Centers) and through affiliated Dresser Direct service centers. These global service organizations are driven by a "Customer for Life" philosophy, which comes to life through a comprehensive suite of aftermarket services: OEM Rapid Parts, on-site diagnostics, service and repair.

## COMPETITIVE ADVANTAGE is driven by Smart Engineered Technology - a combination of Masoneilan®'s Best Fit valve solutions and Flexible digital instrumentation. Open design architecture, greatest breadth of valving products and services, coupled with best in class control performance set Masoneilan apart from all other control valve manufacturers. The bottom line is improved business results through cost effective, reliable, high performance control.

## DESIGN INNOVATION and a pioneering spirit has driven Masoneilan over its 120-year history. Valve design innovation at Masoneilan is evidenced by the extensive portfolio of field proven engineered products Masoneilan has developed for the most severe applications. Indeed, Masoneilan has long served as the benchmark for severe service innovation in industries such as Power Generation, Oil & Gas Production and LNG. These industries are home to many of the toughest control valve applications, particularly those involving large mass flow rate and high differential pressure such as compressor anti-surge, high pressure vents and turbine bypass.

Severe service applications present technical challenges associated with the high energy of the flow stream. The energy related issues of noise and vibration, as well as stringent demands for control performance, often dictate use of V-LOG® Energy Management Trim to meet these challenges. Benefiting from a very scalable trim design architecture, V-LOG offers a customized solution for a broad set of severe compressible fluid and liquid applications. Each V-LOG solution is designed to meet customer requirements including tight shutoff, fast opening speeds, operational stability and precision control over a wide range of operating conditions.




SE-20 Forged Body Control Valve

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# Energy Management Principles

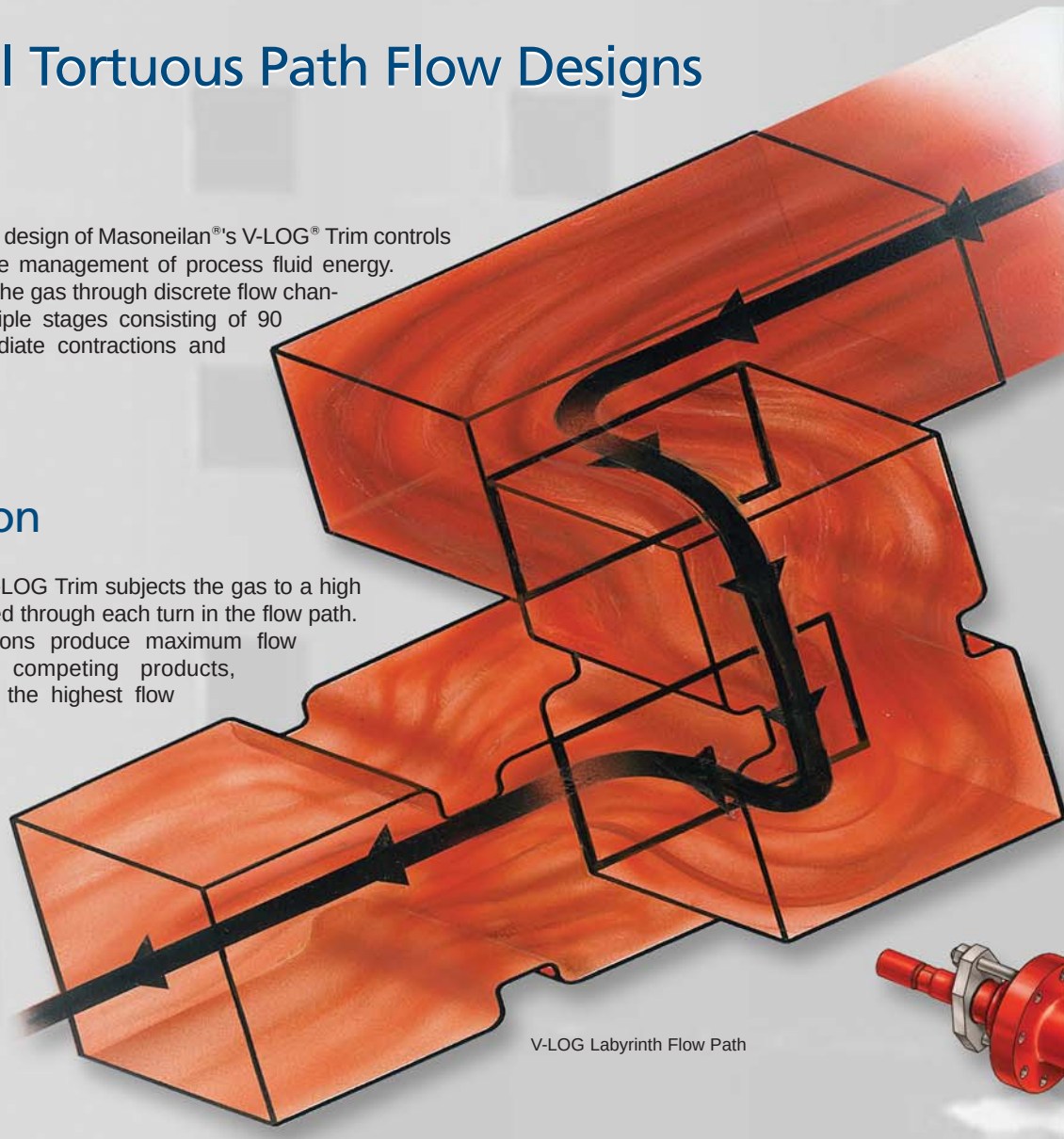
## 3-Dimensional Tortuous Path Flow Designs

The 3-dimensional tortuous path design of Masoneilan®'s V-LOG® Trim controls pressure reduction through the management of process fluid energy. This is accomplished by directing the gas through discrete flow channels that are designed with multiple stages consisting of 90 degree turns along with intermediate contractions and expansions in the flow area.

## Pressure Reduction

The labyrinth flow path of the V-LOG Trim subjects the gas to a high level of friction as it is redirected through each turn in the flow path. V-LOG's patented flow contractions produce maximum flow resistance. In fact, among competing products, Masoneilan's V-LOG Trim yields the highest flow resistance per stage.

The enhanced flow geometry of the V-LOG trim creates a series of kinetic energy losses, followed by partial energy recoveries at each stage. This gradual letdown process is highly effective for noise attenuation due to the staged reduction of the fluid pressure.



V-LOG Labyrinth Flow Path

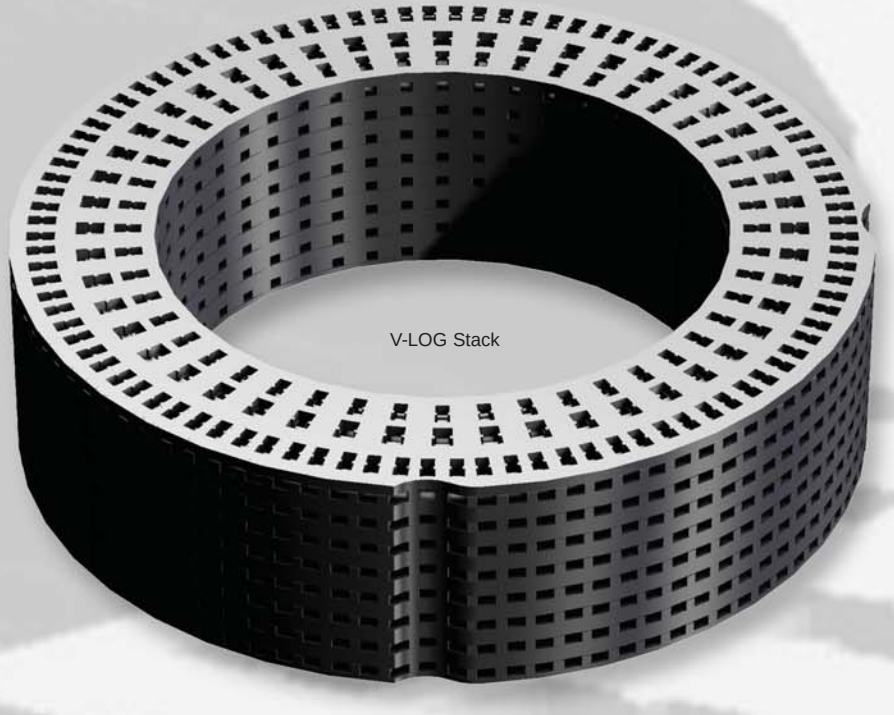
## Velocity Control

Each stage of the V-LOG Trim is designed with an expansion in flow area, which is essential for managing fluid velocity that would otherwise increase as the pressure is reduced across each stage. The expanding area is designed to compensate for the volumetric expansion of the gas, preventing any increase in the kinetic energy as the pressure is reduced.

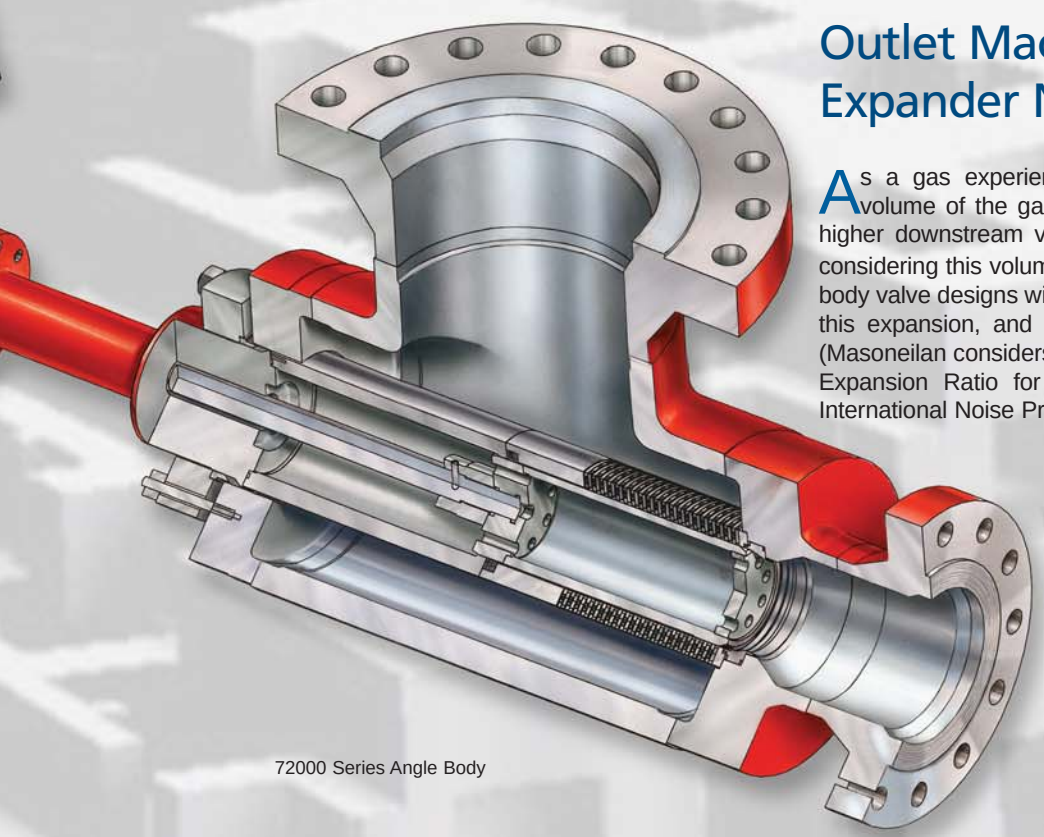
Trim velocity control is important for maintaining low aerodynamic noise levels within the valve body and trim. High velocity trim exit flow will yield high magnitude sound waves, which lead to valve body vibration in high-pressure letdown applications.

## Exit Flow Jet Spacing

By design the process fluid is precisely separated into discrete flow jets upon exiting the V-LOG® Trim channels. The proper sizing and spacing of these channels prevents the exiting flow jets from re-converging; thus producing lower amplitude sound waves with higher peak frequencies. These lower sound pressure and higher frequency waves result in lower acoustical coincidence with the surrounding system and downstream piping. This reduces both the overall noise level and vibration effect of the throttling process.



V-LOG Stack



72000 Series Angle Body

## Outlet Mach Number and Expander Noise

As a gas experiences a large reduction in pressure, the volume of the gas expands. This phenomenon will yield a higher downstream velocity if the piping is designed without considering this volumetric expansion. Masoneilan® offers angle body valve designs with expanded outlet areas to accommodate this expansion, and minimize the overall system noise level. (Masoneilan considers both Outlet Mach Number and the Outlet Expansion Ratio for system noise calculation, per the IEC International Noise Prediction Standard (IEC-60534-8-3).

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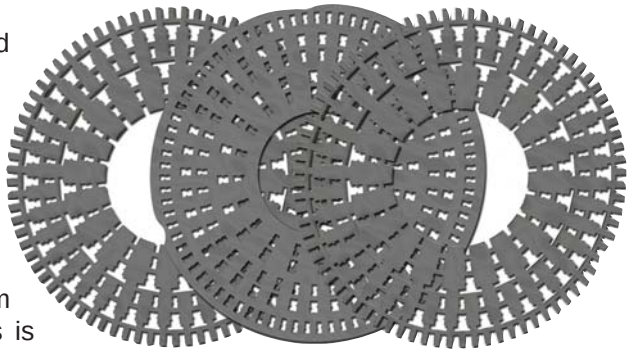
# Features & Benefits

## Manufacturing Technology

V-LOG disks are laser cut resulting in tight tolerances and smooth surfaces, which are required for throttling control. Precision cutting of the trim parts provides for the throttling area integrity that is necessary for fine control resolution and accuracy.

Prior to being secured through vacuum tight brazing, the V-LOG disks are stacked together and aligned using precision tooling. Each disk is designed with maximum surface area to ensure that a secure bond between disks is achieved during the brazing process.



Laser Cut V-LOG Disks

## Customized Flow Characterization

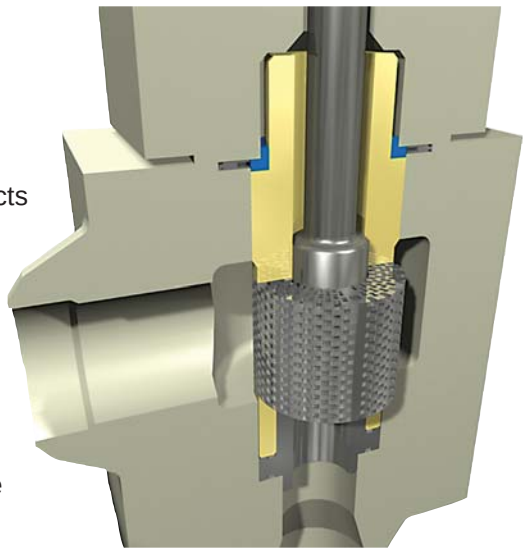
Each disk in the V-LOG Trim is laser cut with the ideal flow channel geometry to obtain desired controllability. In addition, the V-LOG stack may be manufactured using several design variations of laser cut disks to obtain the desired flow characteristic across the entire range of travel. For example, the stack design may be characterized to provide a highly resistant flow path (up to 40 stages) at low lift and less resistance as the valve opens further to its full capacity. Some designs may also combine V-LOG stacked disk technology with drilled hole or ported cage technology.

These combination trim configurations offer maximum rangeability with excellent control. This is especially important for applications requiring the control valve to throttle during start-up and while plant capacity is increased to full load production.

Characterized V-LOG & Ported Cage Design

## Tight Shutoff

Masoneilan® achieves tight shutoff in its full line of V-LOG products through seating surface geometry and material selection. Shutoff performance consistent with ANSI/FCI Class IV and Class V leakage, as well as MSS-SP-61 is available. Tight shutoff performance is critical for preventing loss of product especially in applications that vent to atmosphere or burn off in a flare stack. Long lasting tight shutoff is essential in turbine bypass and compressor surge applications to ensure critical equipment protection. To ensure overall long-term trim integrity V-LOG technology takes full advantage of hardened materials such as stellite and tungsten carbide where appropriate.



Brazed V-LOG Stack

| Features | Benefits |
| --- | --- |
| • 3-D Tortuous Path | Efficient scalable solution for high pressure drop applications. |
| • Patented Flow Contractions | Trim technology can be packaged in a variety of valve sizes and designs to provide the cost benefit of standardization and the reduced downtime associated with easy retrofit. |
| • Multiple Stages | Minimum system noise and vibration results in longer product life, lower life cycle maintenance costs and reduced risk of critical equipment downtime. |
| • Exit Flow Jet Spacing | |
| • Expanded Outlet | |
| • Laser Cut Disk | Trim integrity yields high control resolution and unequaled control accuracy for optimum process efficiency. |
| • Precision Alignment | Best-in-Class digital positioner control performance provides higher yield of "on-spec" product maximizing return on investment. |
| • Flow Channel Characterization | High rangeability satisfies varying process demands. The "two valves in one" approach yields initial purchase savings and reduces life cycle maintenance costs. |
| • Trim Technology Combinations | |
| • SVI® II Sensitivity and Accuracy | Performance reliability of integrated smart engineered control solutions results in faster start-ups and accelerated "time to revenue". |
| • Maximum Brazing Surface | Trim integrity and reliability minimizes maintenance and overall life cycle costs. |
| • Seating Geometry and Materials | Diagnostic information enables preventive maintenance and provides substantial life cycle cost savings due to less process downtime. |
| • Hardened Trim Materials | Reliable tight shutoff minimizes loss of revenue generating process fluid (steam, natural gas, etc.). |
| • SVI II Diagnostics | |

V-LOG®

# Liquefied Natural Gas

V-LOG technology can be applied throughout the entire Liquefied Natural Gas (LNG) process. From the gas production and receiving stage, through the compression and processing stages, the V-LOG technology is critical in keeping the plant running in a stable and continuous mode of operation. In addition, fast and precise control with actuator stroke speeds measured in milli-seconds ensures V-LOG suitability for compressor surge control. With expanded outlets, extension bonnets and energy management trim, V-LOG is often a Best Fit solution for the high fluid energy applications in LNG liquefaction and regasification processes.

## Vent-to-Flare

As a LNG train comes on-line, it is essential to achieve a stable and controllable gas flow prior to passing the gas into the separators, strippers, compressors, and other critical process equipment. The gas flow is passed through a vent-to-flare valve until the unit reaches the desired level of capacity.

The Masoneilan® 72000 series is available with single or double stage Lo-dB® trim, as well as V-LOG trim for higher pressure drop applications. These valves are available with a number of different instrument packages to meet various specifications, including a fast stroke of 1 second or less, or precise control with resolution to 1/10,000th of an inch.

| | |
|---|---|
| Reliable venting of gases in less than 1 second. | Protects costly down stream equipment and reduces downtime. |
| Class V and MSS-SP-61 tight shutoff. | Prevents loss of process flow increasing revenue. |
| Lo-dB and V-LOG Trims reducing the pressure drop across multiple stages. | Reduces noise through staged pressure reduction and minimizes velocity. |

72000 Series Angle Control Valve

# Compressor Recycle & Anti-surge

To achieve maximum efficiency, compressors are forced to operate as close as possible to their surge limits. With reduced surge operating margins the risk of control loop instability is magnified. The responsibility of providing a reliable system and ensuring the compressor is adequately protected rest with the supplier of the surge control valves.

Today, there is an increasing emphasis to combine these compressor recycle and compressor anti-surge functions into one single valve requiring very high turndown ratios and a wide range of operation.

Masoneilan®'s 72000 Series Control Valve can be specified with several features that are necessary to meet the demands presented by these severe service applications.

| | |
|---|---|
| Class V and MSS-SP-61 tight shutoff. | Reduces leakage to latter stages of the compressor system increasing efficiency. |
| Fast response, less than 1 second. | Prevents the compressor from going into a surge preventing down time and increasing production. |
| Precise positioning, quick response (3-5 seconds) through complete range of travel during recycle operation. | Reduces wasted process energy increasing profitability. |
| High turndown characterized trim. | Allows the use of one valve to control over the entire range of operation reducing initial cost. |
| Low noise trim. | Reduces the pressure drop across multiple stages, attenuating noise and vibration reducing maintenance cost. |

72000 Series Compressor Recycle Application

The reliability of the Masoneilan compressor anti-surge package is essential for LNG plant operation. The V-LOG® Trim manages the fluid energy as pressure is drastically reduced across as many as 40 stages, while the valve is fully stroked in as little as 1/2 second.

# V-LOG®

# Gas Production

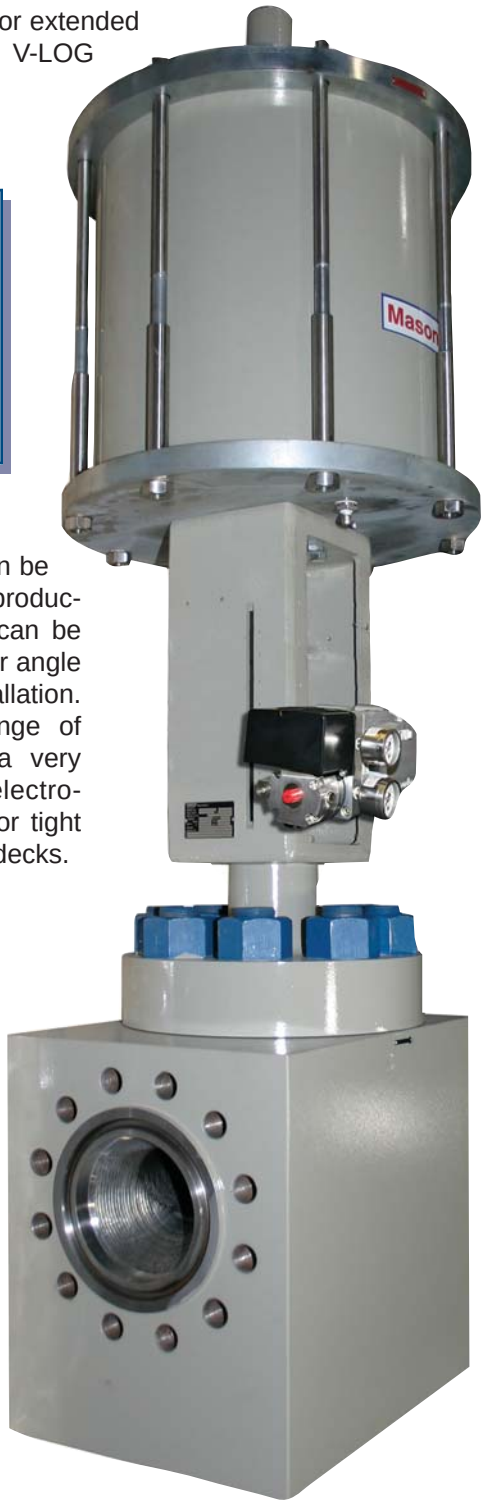
Oil and gas applications often involve extremely erosive flow streams, which dictate proper trim design and material selection. Many hardened materials, including full tungsten carbide trim in extreme cases, are used to provide a rugged barrier on critical surfaces for extended protection against entrained particles traveling within the flow stream. V-LOG technology is well suited for the challenges of highly erosive service.

| | |
|---|---|
| Stellite® clad guiding for corrosion and vibration resistance. | Trim integrity extends valve life and minimizes life cycle costs. |
| Inconel® clad valve bodies to provide long lasting reliability. | |
| Tungsten carbide trim and seat to protect against wear. | |

Wellhead choke applications are often an ideal service for V-LOG technology. These valves are API rated and designed with enlarged and expanding flow orifices to prevent blockage caused from loose debris picked up from the inside of the well. When enhanced with the hardness and ruggedness of tungsten carbide disks, V-LOG labyrinth trim yields extended life in these typically high wear applications.

A compact valve package can be a big benefit in offshore production facilities. V-LOG Trim can be fitted into a light weight globe or angle style body for ease of installation. Masoneilan also offers a range of actuation options, including a very compact self-contained electro-hydraulic option that is ideal for tight installations between platform decks.

Large Flow Path, Tungsten Carbide V-LOG Disks




SE-20 Forged Body Control Valve

# Gas Storage

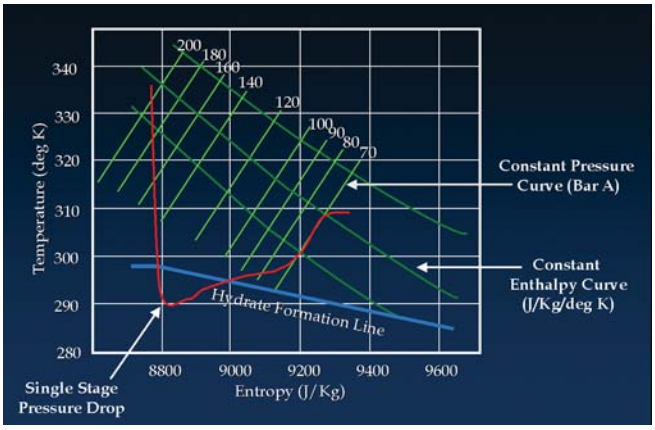
41000 Series with V-LOG® - Gas Storage Field

Gas delivery companies can quickly run out of capacity during peak seasons due to spikes in demand. To limit the risk of interrupted supply, gas reserves are typically stockpiled in underground salt caverns, mines, aquifers, depleted reservoirs and other natural storage facilities.

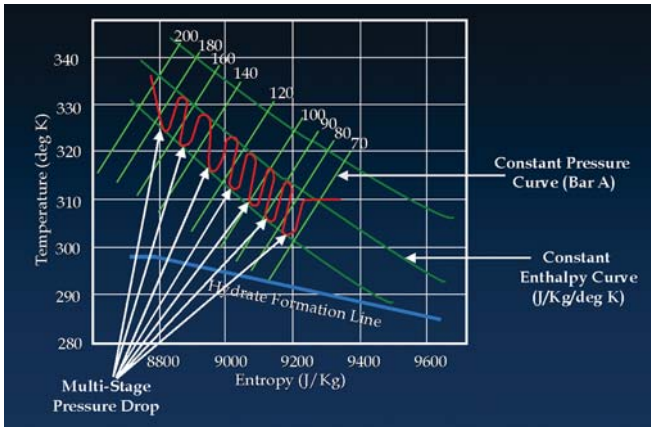
Natural gas is heated and compressed for delivery to these storage areas. This process is regulated by control valves to limit the formation of hydrates that can block small flow passages. To prevent this icing formation, gas companies must invest in large and expensive heaters to elevate and maintain the gas temperature about the hydrate level.

Multi-stage V-LOG Trim technology can be used to reduce gas pressure gradually across a smooth and controlled process. This gradual letdown process keeps gas temperature above the hydrate level without the assistance of additional heaters.

When peak season arrives, these storage reservoirs must be depleted to return gas to the pipelines for distribution. Because V-LOG Trim is capable of bi-directional operation, it is well suited for gas withdrawal. Furthermore, V-LOG Trim can be characterized to effectively manage both storage and withdrawal operations providing savings by limiting the number of valves and complexity of the control scheme. During the non-peak season, gas travels through valving with a small pressure drop and a very large Cv to fill the storage area. As the gas is later withdrawn from storage, it flows with a high pressure drop and a low Cv. A Best Fit solution for this application is a combination trim: V-LOG Trim at low lift and drilled hole or ported cage at high lift.




T & E diagram for Methane (single stage valve)




T & E diagram for Methane (multi-stage V-LOG valve)

V-LOG®

# Power Generation

Power plants are home to a variety of severe service control valve applications with high pressure drop ratios that may result in excessive levels of noise and vibration. Older power plants were outfitted with available severe service technology, namely drilled hole cage valve trim. In many of the most severe applications this trim technology only lessened the noise or vibration problem. Using the latest control valve technology V-LOG Trim, Masoneilan is able to eliminate the problems associated with the most demanding services in both new and old power plant designs.

Today, Masoneilan® is solving noise and vibration problems in the most demanding applications through Best Fit application of either Lo-dB® or V-LOG trim technology.

## Vent-to-Atmosphere

Similar to the Vent-to-Fare application, the Vent-to-Atmosphere valve must contend with the problems of high-pressure, high noise and gas expansion. In most vent applications the process pressure is so extreme that conventional drilled hole cage control valves are not suitable.

Masoneilan's Best Fit engineered solution for this application is the 72000 Series Control Valve with V-LOG Trim in series with a downstream silencer. The 72000 is a rugged reliable solution that eliminates the inherent problems, extends valve life and minimizes costly process down time.

| | |
|---|---|
| Large valve body gallery minimizing trim exit velocity. | Reduces noise through staged pressure reduction and minimizes velocity. |
| Expanded valve outlet accommodating the volumetric expansion of steam. | |
| V-LOG Trim reducing the high pressure drop across multiple stages. | |

72000 Series Angle Control Valve

## Soot Blower & Auxiliary Steam

Depending on the power plant design, Soot Blower and Auxiliary Steam process applications can exhibit a wide range of pressure drops. Because of the wide range of pressure drop ratios, no one valve or trim design is best suited to serve all possible variations of Soot Blower and Auxiliary Steam process applications. Depending on the severity of the application, globe or forged bodies, single stage drilled hole cages (Lo-dB Trim) or V-LOG Trims may be applied.

SE-20 Forged Body Control Valve

Masoneilan's Flexible, Best Fit solutions for high pressure steam include:

| | |
|---|---|
| 21005 Cast globe or angle control valve to ANSI 2500 with single or double stage Lo-dB Trim. | Provides cost effective reliability because of the breadth of valve and trim options available for a variety of applications. |
| 41005 Cast globe or angle control valve to ANSI 2500 with single or double stage Lo-dB and V-LOG Trim. | |
| SE-20 Forged globe or angle control valve ANSI 4500 with single or double stage Lo-dB and V-LOG Trim. | |

# Turbine Bypass Systems

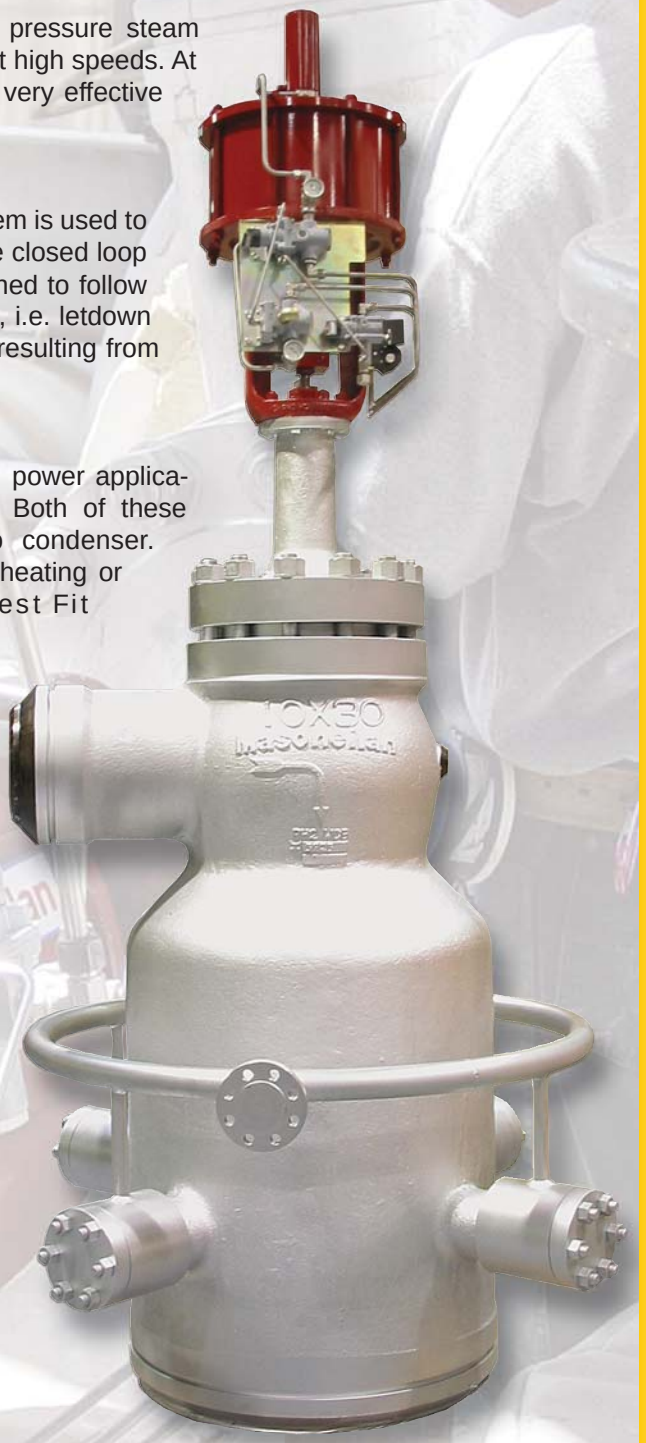
Steam turbine generators create power by passing high pressure steam through a series of stages that propel the turbine blades at high speeds. At high pressure drop ratios, the turbine design proves to be a very effective model for the pressure letdown process.

During start-up or upset conditions, the turbine bypass system is used to divert steam around the turbine maintaining stability in the closed loop system. For high pressure bypass, the V-LOG® Trim is designed to follow the same principles of pressure letdown as the steam turbine, i.e. letdown across multiple stages of expanding area to reduce damage resulting from sudden and severe pressure reduction.

The V-LOG Trim is ideal for supercritical and conventional power applications where there is no reheat section in the boiler. Both of these applications take steam at very high pressure down to condenser. Regardless of whether the bypass system involves desuperheating or not, V-LOG technology can be integrated into Masoneilan's Best Fit valve solution.

The Masoneilan® 84000 series SteamForm® valve uses patented desuperheating technology to meet the demands of turbine bypass.

- Expanded outlet to accommodate the change in steam density and minimize valve outlet noise.
- Low noise V-LOG Trim to reduce the pressure across stages.
- Class IV, Class V, and MSS-SP-61 tight shutoff.
- Fast stoking actuation package to prevent safety valves from lifting.



84000 Series SteamForm Control Valve

# Liquid V-LOG Technology

Liquid V-LOG technology is part of Masoneilan®'s family of Energy Management Solutions. This labyrinth trim technology is offered in many high-turndown, liquid applications, where special trim characterization is required to meet the full range of operating conditions.

Within a liquid V-LOG trim stack, each 90-degree turn in flow direction acts as a step reduction in pressure, simulating the gradual pressure reduction effect caused by head loss through a long radius pipe elbow. The gradual pressure reduction produces less pressure recovery per stage, thus eliminating the potential for cavitation.

A comparison between one-step and gradual multi-step pressure reduction solutions is shown in Figures 1 & 2. The direct pressure reduction scheme (Figure 1) results in a single, dramatic pressure drop and recovery, which can lead to cavitation if the initial drop falls below the fluid vapor pressure. In contrast, the high flow resistance of V-LOG tortuous path trim creates a multi-step pressure drop profile (similar to that shown in Figure 2). By managing the energy throughout the pressure reduction process, V-LOG technology can eliminate cavitation problems at the source.

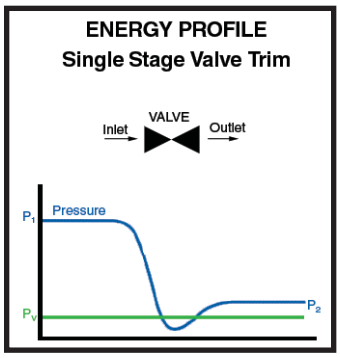


Figure 1

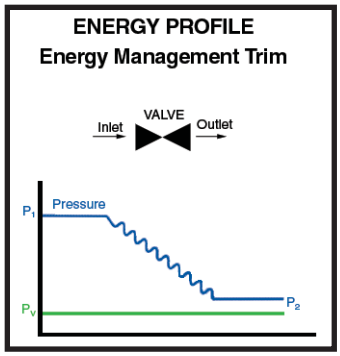


Figure 2

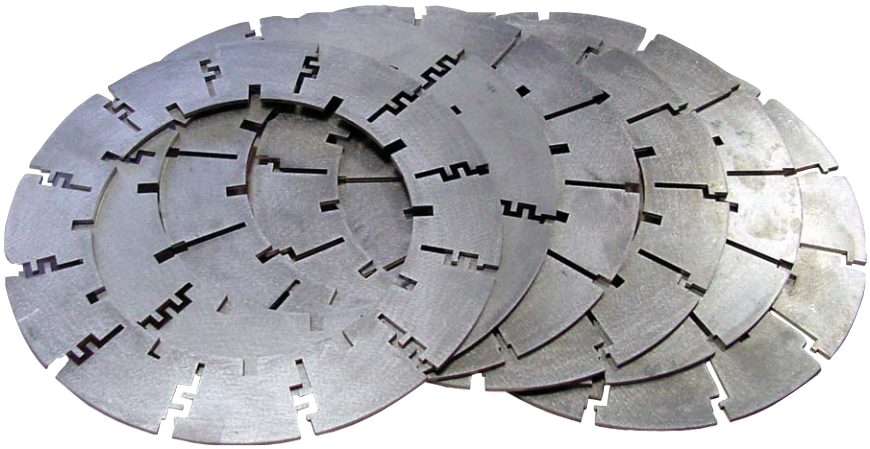
# Boiler Feedwater Start-up & Regulator Valves

Conventional power plants are often designed with feedwater systems using two separate control valves. The first control valve is used for start-up, as the conditions yield a low amount of flow with severe pressure drop. This start-up condition exhibits high cavitation risk and requires a very rugged valve solution. Typically a second control valve is used to regulate the feedwater conditions as the plant operates at full capacity. This valve experiences a much higher flow rate, but across a very moderate pressure drop. This main feedwater regulator valve does not experience cavitation.

In many of today's power plants, specifically the combined cycle plants, engineers often prefer to combine these two valves into a single control valve for ease of maintenance and simplicity of control scheme. Liquid V-LOG® technology is designed to manage and control process fluid energy over this wide range of operation. This involves characterizing the low travel range to include multiple stages of anti-cavitation stacked disk while drilled holes on the high range of travel provide for the large flow capacities required.

- Precision control using Masoneilan SVI®II smart positioner
- Class IV, Class V, and MSS-SP-61 tight shutoff
- Anti-cavitation V-LOG trim to reduce fluid pressure across multiple stages
- High turndown, characterized trim
    - Multi-stage liquid V-LOG at low lift for high resistance
    - Drilled hole or ported cage at full opening for high capacity

41000 Series Globe Control Valves



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