



Valves for Chemical / Petrochemical Processes

Engineered Solutions for the Chemical / Petrochemical Industry

MOGAS[®]
SEVERE SERVICE BALL VALVES

***MOGAS metal-seated ball valves have proven successful
in these processes and more:***

Acetic Anhydride

Isocyanate

Molten Salt

Methyl (MECL) / Dichloronethane (DCM)

Olefins

Polyethylene

Polypropylene

Polysilicon

Purified Terephthalic Acid (PTA)

Raffinate

Vinyl Chloride Monomer (VCM)

...while handling these conditions and more:

Abrasive silica

Corrosive attacks

Fugitive emissions

High cycling

High velocity of rock hard particulates

Lethal media

Liquified wax

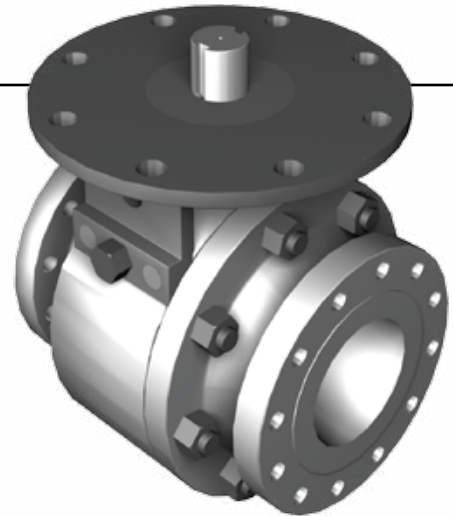
Molten slurry

Corrosive acids.

Erosive particulates.

Extreme operating conditions.

Critical safety applications.



All of these severe services can be found in Chemical and Petrochemical processing plants worldwide. Along the many miles of piping, each plant requires dependable isolation of critical equipment and control of process flow, coupled with reliable vent and drain valves. A valve's performance ensures not only the integrity of the process and safety of plant personnel, but also the volume and rate at which the plant can produce products—thus generating revenue and enhancing profitability.

MOGAS has been involved with these types of processing plants for several decades. Each process has unique chemical characteristics where a valve's construction materials and necessary coatings must be carefully selected. A comprehensive analysis of the individual process and media—combined with years of research & development, engineering, manufacturing and service support—enables MOGAS to provide valve solutions that are ideally designed to meet your specific requirements.

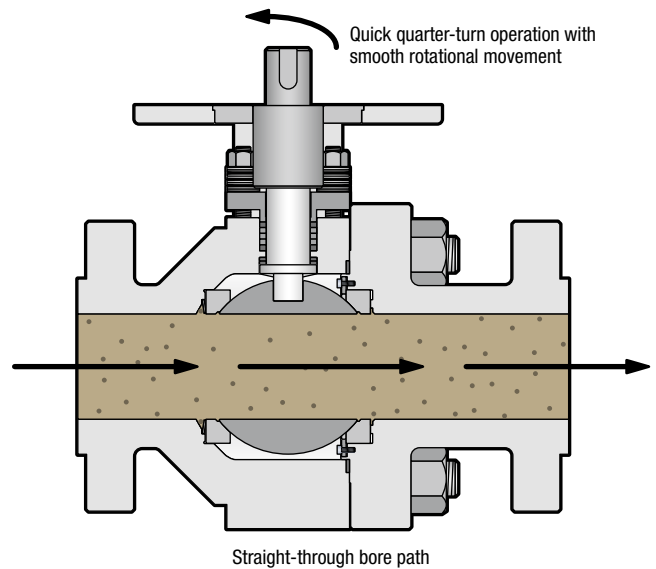


Ball Valve Advantages

Compared to Gate and Globe Valves

When it comes to valve types, there are distinctive differences in design, intent and purpose. Whether a valve has rotary operation or linear action is a critical part of the **longevity** and **performance** of the valve in severe services. Exposed sealing mechanisms versus protected sealing surfaces can make a big difference. Commodity valves manufactured for clean environments at ambient or low temperatures are simply not engineered to withstand the strenuous demands of extreme operating conditions.

Serious industrial processes require serious valve choices. Understanding the fundamental differences in valve types can assist with those important decisions.



Ball Valve Advantages

Recessed seats are protected from continual exposure to the process flow

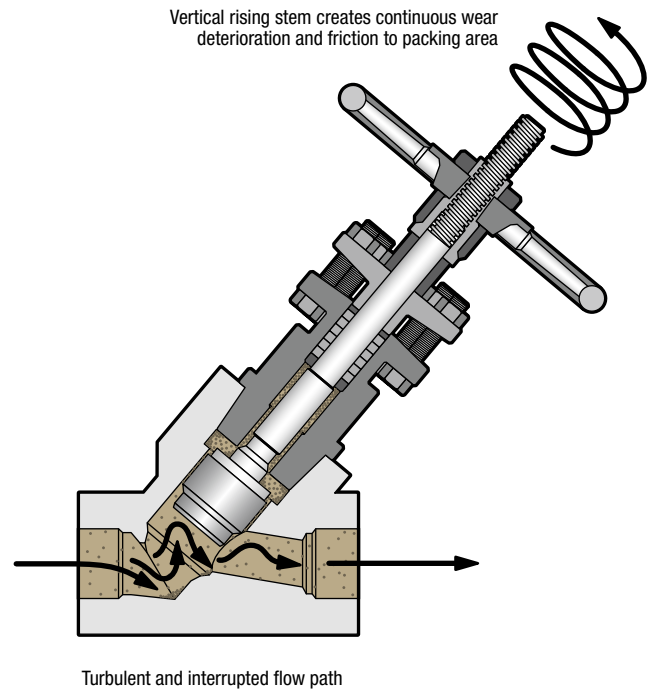
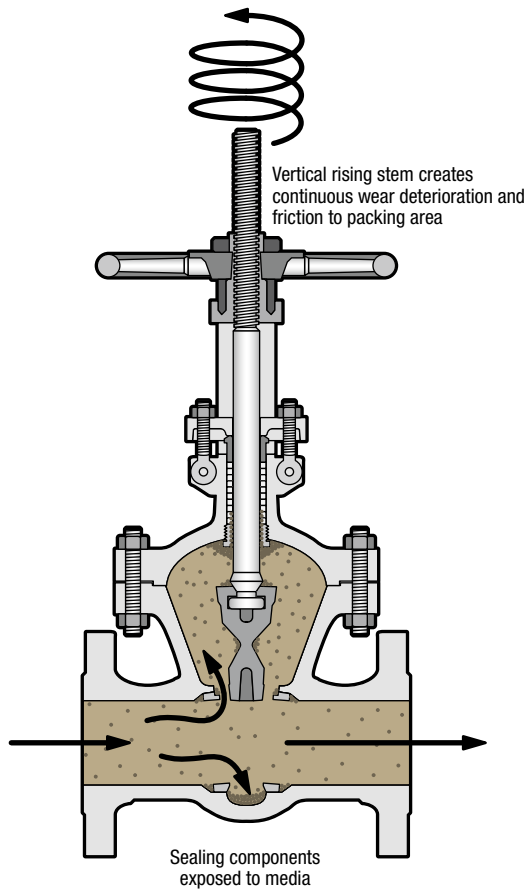
Ball is wiped clean with each operation of the valve

Rotates on own axis, thus no volumetric displacement

Packing area is protected from potential media erosion, maintaining integrity of stem seal area while reducing risk of fugitive emissions

Non-rising stem design meets EPA VOC packing leakage standards for greater number of cycles

Pressure-assisted sealing



Gate Valve Disadvantages

Sealing components in the line of flow lead to potential wear and corrosion attack

Geometry of the exposed sealing surface wears and loses the ability to hold tight seal

When operated, flow path is interrupted causing volumetric displacement of the process fluid which must occur from behind the plug back into the flowstream

Multi-turn rising stems can pull destructive catalyst and pipe scale up through the interior diameter of packing area leading to possible hazardous atmospheric leaks

A sliding stem valve will not provide the length of service life or number of cycles due to the stem moving through the packing box along with the process fluid

Relies on vertical thrust by the stem to drive the sealing plug into the seat

Globe Valve Disadvantages

Damage to sealing surfaces due to exposure of the seats when the valve is open

Sealing trough / rib erodes over time and can capture flow particles

When operated, flow path is interrupted causing volumetric displacement of the process fluid which must occur from behind the plug back into the flowstream

Multi-turn rising stems can pull destructive catalyst and pipe scale up through the interior diameter of packing area leading to possible hazardous atmospheric leaks

A sliding stem valve will not provide the length of service life or number of cycles due to the stem moving through the packing box along with the process fluid

Torque seated to activate seal — thermal cycling relaxes stem

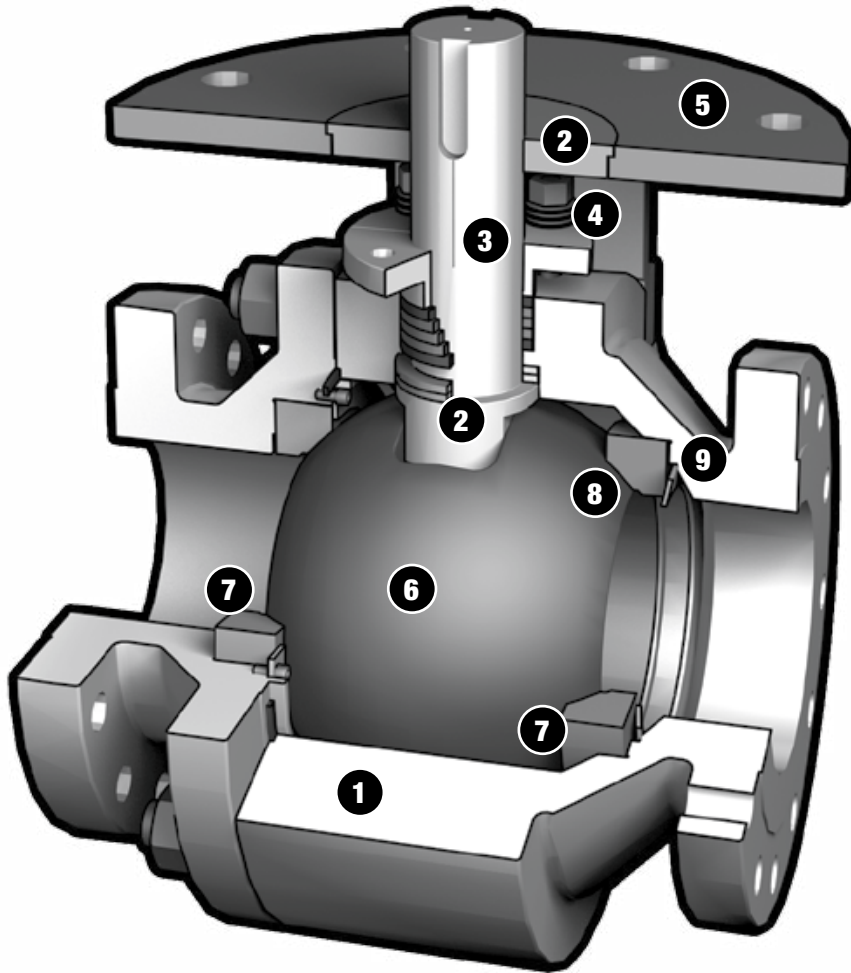
Dependable Design

Solves Isolation Challenges

To ensure the operational efficiency and safety of chemical and petrochemical processing facilities, equipment isolation is critical. Quick, quarter-turn rotary isolation valves that provide **absolute shut-off** and **reliable sealing** make MOGAS the perfect solution for these tough installations.

Exposure of isolation valves to aggressive wear in extremely corrosive environments demands mechanical integrity, enhanced reliability and maximum life. The **application-specific materials and coatings** of MOGAS valves provide enhanced erosion and corrosion resistance, reduce refurbishment costs, and extend valve life and run times—which means **reliable endurance of critical path valves**.

The superior design and quality of MOGAS valves reduce maintenance and eliminate valve related downtime—providing a greater overall return on investment.

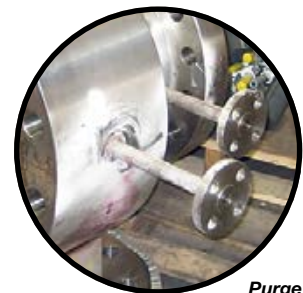


Note: Application-specific exotic materials could include Hastelloy®, Incoloy, Inconel®, Monel®, Tantalum, Titanium, or others.

Optional inlays, liners and purge ports are available as required.



Inlays



Purge Ports

Item	Valve Features	Operational Benefits	Value to Plant Performance
1	Forged body & end connections	Greater wall thickness in critical areas	Valve integrity under severe conditions
		Corrosion allowance	Longer valve life
2	Dual-guided stem design	Eliminates lateral movement of stem	Prevents stem packing leaks and meets Category M requirements
	Inner stem seal bearing	Serves as lower stem guide and pressure-energized stem seal	Prevents media access to packing box and meets Category M requirements
		Acts as coated thrust bearing with low friction coefficient, minimizing overall valve torque	Prevents galling, binding and side-loading of stem
	Valve stem bushing	Serves as upper stem guide, securing true positioning for valve stem in packing chamber during actuation	Eliminates side-loading during actuation Prevents stem packing leaks and risk of fugitive emissions
3	Blowout-proof stem design	One-piece design meets industry safety standards	Withstands severe service torques and maximum working pressures
4	Live-loaded packing	Ensures constant packing energization	Prevents stem packing leaks and risk of fugitive emissions
5	Heavy-duty mounting flange	Minimizes stresses and maintains precise stem alignment	Supports actuators for proper operation
6	Floating ball design	Rotates within its own sphere	Does not displace solids
		Straight-through bore path	Sealing surfaces not exposed to damaging effects of media
		Locked-in downstream seat	Prevents build-up behind downstream seat Upstream seat configuration ensures evacuation of media during cycling
7	Independent replaceable seats	Field replaceable, minimizing repair times	Reduces repair costs
8	Wide seat sealing surface	Seats are mate-lapped to ball for 100% contact at all times	Reliable isolation
		Provides greater sealing contact area	Greater sealing integrity to withstand minor scratches or abrasions
		Sharp leading edge on seats	Cuts through viscous media to wipe clean sealing surface of ball with each operation
9	Pressure-energized sealing	Belleville-shaped seat spring maintains constant sealing contact between ball & seats	Ensures correct position, seal and proper loads at all times

Rotary Control Technologies

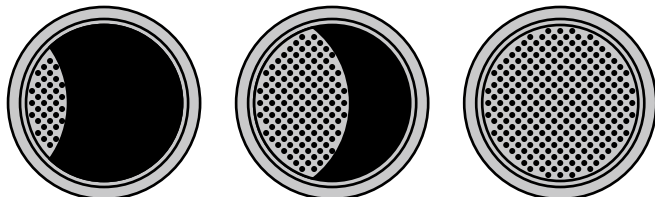
Flexibility for Demanding Environments

In the harsh environments associated with chemical / petrochemical processes, control valves are a vital part of the numerous control loops found within the plant. These important valves control gases, liquids, steam or chemical compounds by maintaining pressure, flow levels or disseminating the energy of pressure differentials to ensure the integrity of the process. They must be designed to avoid fugitive emissions and dependably handle lethal applications and often caustic media.

Variable Trim Technology

The MOGAS family of control valve technologies gives you complete **flexibility** for your application. The patented FlexStream® technology expands upon the MOGAS ball valve's proven strengths by adding the capabilities of **precision modulation**, exceptionally **high rangeability** and **characterization**.

Flexible design comes from the **variable construction** of the internal trim. The trim is custom engineered to suit high pressure differential (ΔP) applications by changing the number of openings, the style of letdown passages (straight-through or tortuous path) and the percentage of the bore that is filled. The complete valve assembly can be manufactured as a floating or trunnion ball design in a 2-piece or 3-piece forged body construction, using a variety of corrosion resistant materials and coatings to meet the demands of severe process flow components.



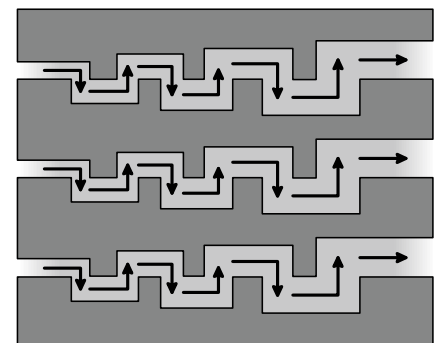
Variable trim technology tailors the percentage of filled bore to application-specific requirements. These examples show a range from 10 percent filled to 100 percent filled.



FlexStream technology uses a varying number of passageways engineered within the bore, custom designed to suit high pressure differential applications, providing better control of velocity / noise / vibration / erosion / cavitation.

Controlling Velocity

Pressure can be reduced by turning the fluid flow through a right angle, which absorbs energy and controls velocity. By cascading the pressure over a number of right angle turns, the pressure drop at each stage is evenly distributed. The tortuous path expands at each right angle to ensure velocities remain equal through the turns, even though the fluid is expanding—eliminating any potential damage. The larger the pressure drop, the more turns are required to control velocity.



This cross-section view of passageways shows how multiple right-angle turns are used to better control velocity in larger pressure drops.



Live-loading maintains proper pressures on application-specific stem packing and anti-extrusion rings.

Dependable Emissions Control

With the safety of plant personnel and fugitive emissions paramount to all plants, the MOGAS stem design has proven a reliable choice. Potential fugitive emissions can occur wherever there is a requirement to provide a seal between the process fluid and the external environment. Live-loaded packing and anti-extrusion rings, combined with application-specific stem packing, ensure a leak-free stem—even during large temperature and pressure fluctuations. Linear rising stem valve designs have an extremely difficult time maintaining a leak-free stem seal due to high friction, shaft wear, erosion and backlash.

Accurate Sizing

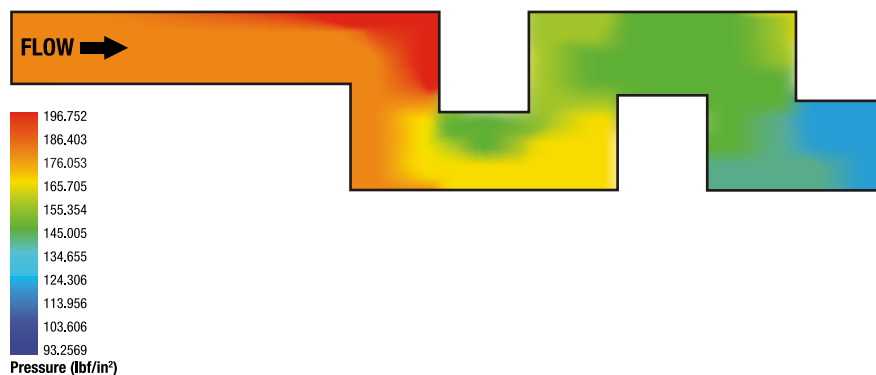
As with most control valves, the initial sizing and selection process is carried out on customized computer software. Often incomplete requirements can result in improper sizing—providing opportunities for control valve failures. MOGAS has developed a customer-friendly sizing program which has been verified by an authorized third party for accuracy, taking into account the guidelines provided by the relevant ISA and IEC standards developed for control valve selection.

The final selection process takes into account a combination of information provided by the computer and application engineering knowledge provided by MOGAS. In-house Computational Fluid Dynamics (CFD) are used to precisely determine the amount of letdown stages needed per application.

Computational Fluid Dynamics (CFD) is a sophisticated, computationally based design and analysis technique that ensures the valve meets environmental regulations and industry compliance prior to construction.

As indicated in this CFD of a FlexStream flow passage, the pressure decreases at each right-angle pressure reduction stage.

Sample of Computational Fluid Dynamics



Engineered Products

Application-specific Customized Designs

Each chemical / petrochemical process is unique and often requires customized valves that just can't be found in a standard equipment catalog. With decades of validated design and fabrication experience, MOGAS is often asked by end users to engineer a one-of-a-kind solution. Not every original equipment manufacturer (OEM) has the skills and experience to commit to an extensive development program. MOGAS has always welcomed these types of challenges and has worked closely with licensors and end users to create dependable results.

MAX-Series for Customized Solutions

These valves are engineered for unique operational requirements and involve strong collaboration between engineering, operations, maintenance and manufacturing. All MAX-Series valves are in compliance with industry standards and codes.



This special linkage allowed one flow line to run while the other was isolated. This enabled the operators to open two valves and close two valves in a single operation.

Special Linkage (Dual Valves, Quad Valves)

These valve configurations may involve multiple severe service valves that need to operate in a specific sequence or operate in such a manner that some are automatically closed when others are opened.

Special Automation

Often rapid operation, high cycling or even dimensional requirements will call for a unique automation package. MOGAS works closely with clients to ensure the demanding automation needs for their severe service valves are successfully achieved.



3, 4 or 5-Way Diverter Valves

When diverting the flowstream in different directions or to different locations, a dependable no leak through diverter valve is crucial to mitigate any deadhead and / or reversal of flow. The ability to handle a rotary-operated stream separation is critical to the reliability of the process as well as the safety of the plant. This often simplifies or eliminates the number of valves needed.

This 8-inch ASME 600 Class 4-way switching valve maintains >90 percent flow area of full bore during mid-stroke. It also has the flexibility of valve placement (horizontal or vertical mounting position) to help minimize capital piping expenditures.

Ultra High-pressure Valves

Extremely high pressures require extreme engineering and proven manufacturing skills to mitigate any process / personnel safety concerns. Often chemical / petrochemical isolation valves must provide tight shut-off for severe operating conditions, as well as potentially toxic chemicals.

Isolating under extreme gas pressures (over 42,000 psi), this 1-inch Special Class CA-1AS was modified to dependably isolate in both high pressure and high temperature. MOGAS was chosen as this company's valve partner when the MOGAS valve lasted three times longer than previous valves.



Unique Bore or Inlet / Outlet Sizing

Special piping or process requirements often create operational challenges for severe service valves. Dimensional sizing constraints often limit commodity valves. MOGAS has been able to offer uniquely fabricated and manufactured ball valves that meet operational specifications, maintain process integrity, fit mechanical dimensions and honor deadlines.



Nicknamed the "trumpet" valve due to its unique inlet size compared to its outlet size (28 x 14-inch), this ASME 300 Class CA-DRI metal-seated ball valve was an innovative solution to a customer's unusual configuration needs.

One-of-a-Kind

Custom requests are part of our legacy. MOGAS has been in the business since 1973, engineering and fabricating that one exclusive valve that is a non-standard crucial component for your operating system. Unique bore sizes, different end connections and special trim materials are easily accomplished through our engineered products group.



This 3-inch ASME 300 Class "one-of-a-kind" valve was built for a customer requiring customized fabrication and linkage. This 2-way valve, with piping entering the valve from the bottom, has two balls located within the valve body that open / close in an alternating fashion.

Proven Coatings

Not All Coatings are Equal

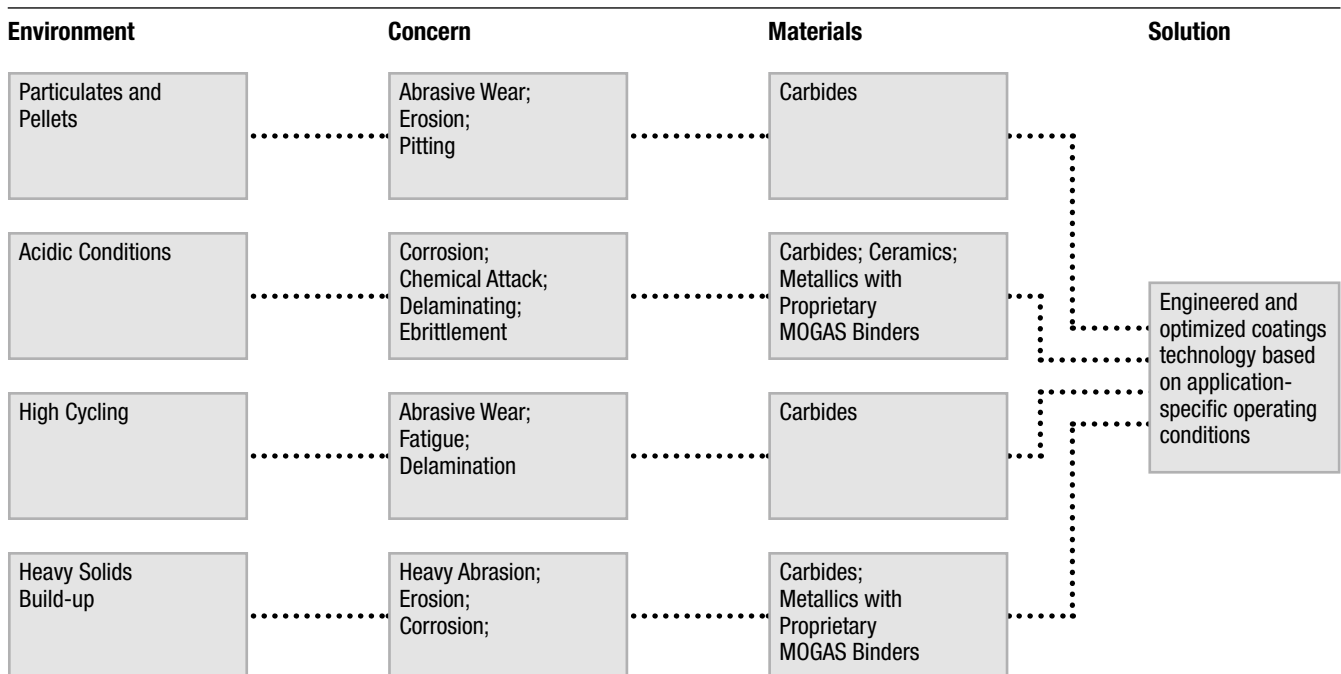
Harsh acids. Pounding pellets. Abrasive media. High cycling.

Each of these conditions can greatly affect the operations of mechanical equipment. The coatings used in the chemical / petrochemical industries (CPI) are often critical to not only the **performance of the valve**, but also the **longevity of the equipment** in that particular environment.

Often the success of a coating depends upon proper selection of the base material and the coating, along with the method in which the coating is applied—all as a complete system. MOGAS offers a range of mechanically and metallurgically bonded coatings, applied with absolute accuracy for optimum thickness while maintaining precise design tolerances and dimensions.

Through MOGAS, a wide selection of coatings are available to best serve each particular process area. Coatings must handle a variety of challenges such as erosion, corrosion, pitting, chemical attack / corrosion, wear, material build-up, etc. The abrasive and / or acidic nature of certain media and chemical agents create serious operating challenges in the chemical / petrochemical market—challenges that MOGAS meets head-on with experience, world class engineering and the very latest in material science.

MOGAS Coating Recommendations



Note: Coating application methodology (spray & fused, HVOF, plasma, laser, etc.) is determined by application-specific conditions.

Research and Development

To ensure the best coatings solutions are available for our customers, MOGAS has an ongoing research & development program that includes:

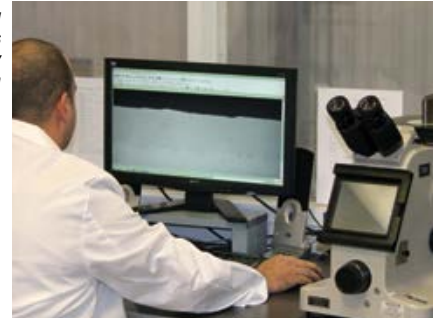
- continual field investigations
- coupon testing (with traceability to each coating batch)
- laboratory analysis
- collaborative alliances with selected authorized coaters

As part of ongoing research and development for coatings, MOGAS continually analyzes samples for strength and durability. Some examples of our testing and evaluation includes:

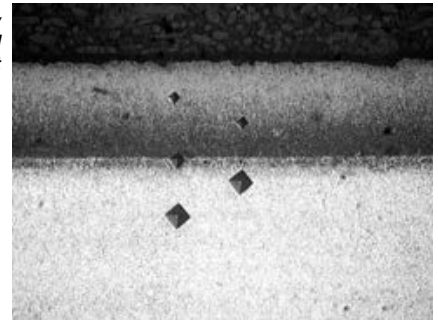
- Abrasion tests (ASTM G65)
- Slurry erosion tests
- Micro hardness tests (Vickers DPH300)
- Adhesion tests (ASTM C633)
- Corrosion tests
- Porosity analysis
- Impact testing
- Residual stress analysis
- Matching CTE

***Corrosion costs the
processing industries
over \$5.4 billion
annually.
– NACE International***

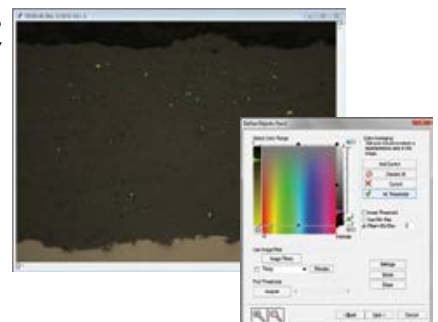
***Continual lab testing
and evaluation confirms
adhesion, compatibility
and wear for maximum
performance.***



***Hardness and sensitivity
to cracking are verified
using Vickers indent
microhardness testing.***



***Using proprietary software
programs, coating porosity
is analyzed and validated.***



Designed for Safety

Ensuring Confidence and Reducing Risks

Fugitive Emissions Control

Most chemical and process plants must adhere to strict legislative and safety requirements (such as ISO 15848-2) regarding fugitive emissions. Under these conditions, leaks to atmosphere—no matter how small—can grow into large concerns. The monitoring and control of these emissions has become a major focus for plant operators. Whether satisfying environmental, legislative or industry guidelines of agencies such as the EPA, TA-Luft, ASME and others, all valves must meet clearly defined requirements to handle the most common valve leak areas: stems and body gaskets.

Often a small drip, or even gaseous release, can harm the equipment, environment or plant personnel. With this in mind, MOGAS has engineered stem and body gaskets to reduce the risk of unanticipated emissions. Our ball valves have two independent stem seals, as well as special body gaskets, to ensure reliable sealing. These design features are discussed in more detail below.

Category M for Lethal Fluids

Category M for Lethal Fluids, per ASME B31.3 code, is defined as “a fluid service in which a single exposure to a very small quantity of toxic fluid, caused by leakage, can produce serious, irreversible harm to persons on breathing or bodily contact, even when prompt restorative measures are taken.” MOGAS metal seated ball valves have operated successfully for years in critical Category M applications such as acetic anhydride, phosgene gas and supercritical CO₂ systems.

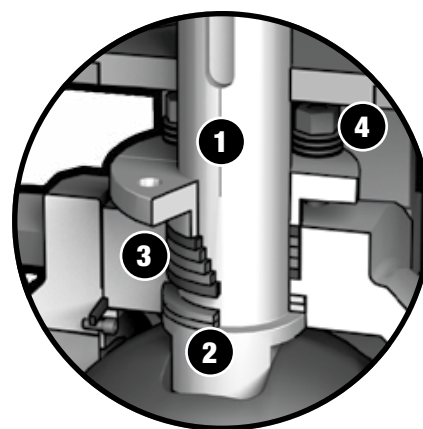
A special requirement of this code is the **stem seal design**. MOGAS has addressed this requirement by providing independent stem seals which include:

- pressure-energized and mate-lapped stem seal bearing
- stem packing that uses two anti-extrusion rings and three application-specific packing rings
- optional lantern rings, piped to a detector
- live loading system

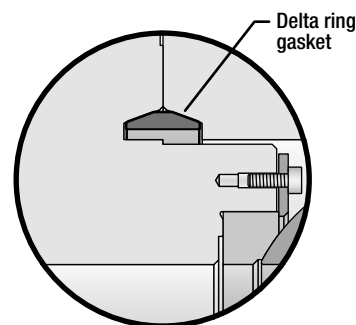
This MOGAS design meets all requirements of Category M specifications, without the use of expensive and high maintenance bellow seals—which have a limited cycle life.

Pressure Energized Gasket

Category M requires the use of “designs that increase gasket compression as pressure increases.” MOGAS provides a pressure-energized **delta ring gasket** for all Category M severe service ball valves. This solid metal, tapered ring combines high surface loading with the strength of the seal material to provide considerable stored energy and tight sealing—even in systems where vibration or thermal cycling might weaken other sealing components, leading to potential leak paths.



- 1 Stem
- 2 Stem seal bearing
- 3 Application-specific stem packing
- 4 Live loading system



Fire Tested for Dependable Performance

Fire in process plants can cause disastrous consequences—thus the necessity for various industry standards and specific end user requirements. The operation of valves, while in the midst of flames and extreme heat, is a significant part of any plant's safety program. MOGAS ball valves are designed to withstand the punishing effects of emergency fire situations.

Several sizes and ASME classes of MOGAS valves have been fire tested and qualified to meet these stringent requirements. Whether API spec 6FA or API 607, or particular customer fire test specifications, MOGAS works with end users to ensure all testing procedures are adamantly followed. After the burn is completed, both the operability and the performance of the valve are evaluated. When fire testing is complete, all documentation and certifications are available for review.

Safety Integrity Level (SIL) Certified

Industry experts began to address functional safety in process plants and formalize an approach for reducing risks with the development of IEC standard 61508. An emphasis on quantitative risk reduction, life-cycle considerations, general practices and equipment performance were all integral components to the evaluation. A SIL is a measure of a safety system's performance, in terms of probability of failure on demand. MOGAS C-Series severe service ball valves have been reviewed by Exida, a certification and research firm specializing in critical safety systems and related equipment, and have received a certification for certain failure rates.

Recently a 4-inch ASME 1500 Class MOGAS valve, along with a 10 inch ASME 600 Class valve, were sent overseas for a customer-specific fire test.



This 4-inch ASME 1500 Class ball valve was surrounded by high temperature fire for a pre-determined amount of time.



After time requirements were met, the fire was extinguished according to safety procedures.



The final step in the fire test was verifying the ability to operate the valve and documenting the valve's performance. The valve not only passed on the first attempt, but exceeded the customer's critical requirements.



Precision Cleaning

Cleanroom Services

Due to the serious and often potentially hazardous nature of some process media, it is crucial that equipment go through precision cleaning prior to installation. While the removal of combustible contaminants from components used in oxygen-enriched environments is critical to plant safety, precision cleaning is also necessary to keep impurities from corrupting the integrity of the chemical composition of the media.

MOGAS offers **on-site precision cleaning** of valves and critical parts to ensure your components are prepared in **compliance** with all major industry standards and delivered within contractual agreements. With over 3,000 square feet of clean environment, our facility is capable of handling **heavy components** while adapting to **various shapes and sizes**. As part of our stringent cleaning procedures, verifiable absence is determined through the use of **qualitative** and **quantitative** inspections. Each job is fully documented to define, control and monitor processes such as material flow, cleaning details, inspection results, packaging and labeling.

Facility Highlights

- Certified ISO 6 (Class 1000)
- Flexibility to handle larger shapes, sizes and weights
- In-house lab provides analytical verification
- Fugitive emissions testing
- Pressure testing
- Quick turnaround
- Complete job documentation
- Environmentally accountable



Precision cleaning—such as oxygen, aqueous and ultrasonic cleaning—of valves and critical parts reduce non-volatile residue to acceptable ISO standards.



Emissions testing using clean, dry nitrogen or helium is used to shell test and seat leak test the valve in both directions, when appropriate.



Stringent cleanroom processes for oxygen cleaning will effectively prepare parts for an oxygen-enriched environment.

Pumps

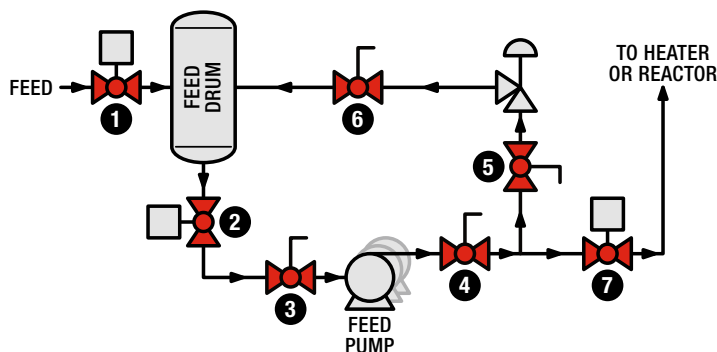
MOGAS Valve Applications

Process plants use pumps to move feedstock, intermediates and products throughout a system. To keep the process running smoothly, proper operation of pumps play a vital role. From time to time there can be operational upsets or mechanical failures of the equipment, requiring isolation for repair or safety reasons. When called upon, the associated valves must be trustworthy to maintain proper operating pressures and system integrity.

Application Parameters

- For a series of pumps, there are redundant isolation valves on both the suction and discharge sides
- Valves must provide tight shutoff for the equipment to be serviced
- To modulate discharge and hold back pressure, a control valve is used to prevent equipment damages and maintain pump efficiency rates

Feed Pump



Valve Specification

Item	Application	Qty
1	Inlet Feed Drum Isolation	1
2	Feed Drum Emergency Block	1
3	Feed Pump Suction Block (Common per pump)	2-3
4	Feed Pump Discharge Block (Common per pump)	2-3
5	Recycle Inlet Block	1
6	Recycle Outlet Block	1
7	Chopper / Backflow Block	1

Compressors

MOGAS Valve Applications

The chemical / petrochemical industries can put compressors through a variety of extreme conditions, from high pressures and temperatures to gases with aggressive and toxic components. Several different types of compressors are used to move the flow along while reducing the volume of the compressible fluid. This activity usually results in increasing temperature (release of energy) and pressure at the compressor discharge. Because of demanding specifications, strict safety requirements, substantial purchase costs, and the need for long periods of dependable operation, it is crucial to maintain a constant flow rate for protection against damaging flow surge.

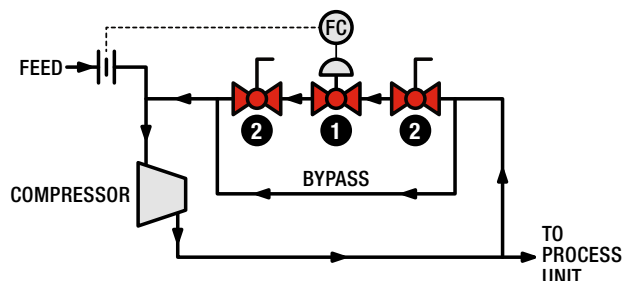
Compressor Anti-Surge Solutions

Surges or pressure upsets can cause significant equipment damage, wasted energy and process variations. This fluctuation happens when the pressure on the discharge side is different than the pressure produced by the compressor. This surge phenomenon can happen rapidly and cause the flow to reverse momentarily.

MOGAS rotary control ball valves offer quickness and reliability—capable of stroking to a fully open position in less than a second. Using FlexStream® control technology, these valves are designed to control high ΔP in liquids, gases and multi-phase flow to combat energy consumption, velocity, cavitation and noise.

Performance Features of FlexStream® Control Technology	
Noise Abatement	Up to 85 dBA during recycle, 105 dBA at trip instance
Stroke Open / Close	Open in less than 1 second / Close in less than 5 seconds
Oversizing Factor	1.8 to 2.5 times the maximum calculated Cv
Overshoot	Within 1 percent
Emissions	Fugitive emissions mitigated

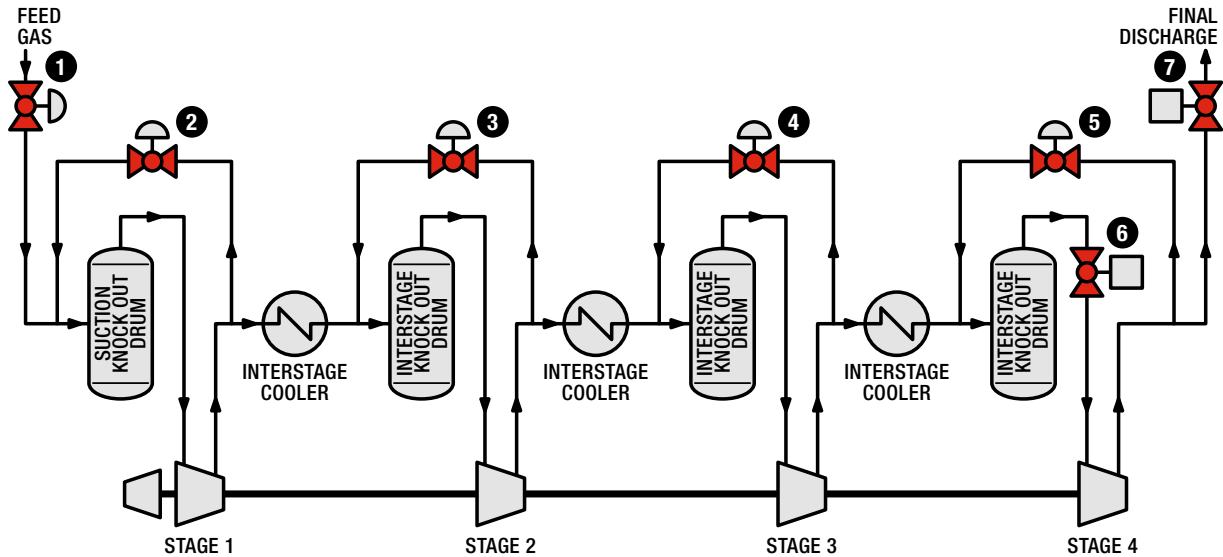
Compressor Anti-Surge



Valve Specification

Item	Application	Qty
1	Compressor Surge Control	1
2	Manual Isolation	2

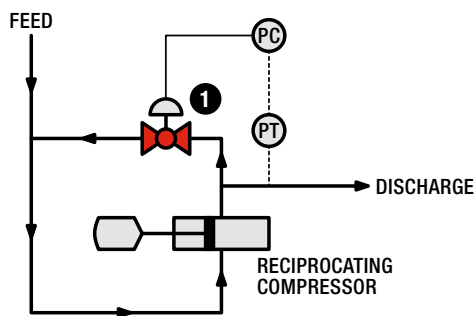
Multi-Stage Centrifugal Compressor Surge Control



Valve Specification

Item	Application	Qty
1	Suction Throttle Control	1
2	Stage 1 Surge Control	1
3	Stage 2 Surge Control	1
4	Stage 3 Surge Control	1
5	Stage 4 Surge Control	1
6	Suction Emergency Block (Common for all stages)	4
7	Discharge Emergency Block (Common for all stages)	4

Reciprocating Compressor



Valve Specification

Item	Application	Qty
1	Pump Pressure Relief	1

Furnaces and Sootblowers

MOGAS Valve Applications

Industrial furnaces provide heat for processing, and vary as to function, types of fuel and method of introducing combustion air. Furnaces are generally designed with a goal of enhancing product yield while improving furnace thermal efficiency and maximizing high heat transfer. For those plants with a furnace and sootblower system, any associated valves will be exposed to an extreme environment involving high temperatures, as well as potential abrasive scale and particulate build-up.

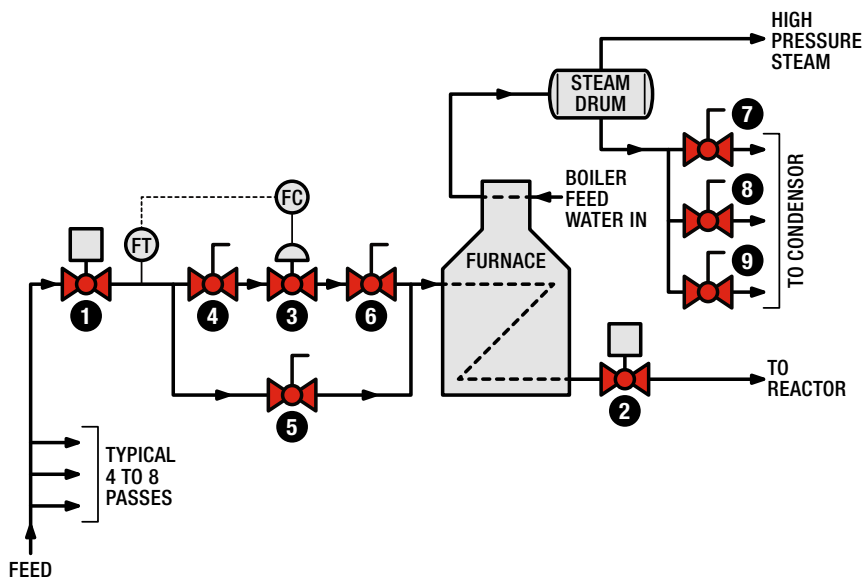
Due to these extreme temperatures, MOGAS metal-seated quarter-turn on / off valves are often chosen over temperature-limiting soft-seated valves or traditional gate valves that have exposed sealing surfaces. Frequently located at the bottom of the furnace, this hot and dirty location warrants a dependable valve that can endure such punishing conditions and requires low maintenance.

MOGAS valves have also been selected as part of the sootblower systems where ash and particulate build-up can be a major concern. Sootblowers use water, air or steam to remove deposits from the tubes—and these abrasive medias can be damaging to the sealing surfaces of isolation valves if left exposed. While in the open position, MOGAS ball valves' sealing surfaces are not subject to the grueling effects of these particulates. Also engineered into the valve design are features to handle any potential build-up. Specific coatings have been developed to handle the abrasive nature of these rigorous conditions as well.



This 12-inch ASME 300 Class valve was used for Vinyl Chloride Monomer (VCM) furnace isolation operating at 1200 F (650 C) with 120 psi (8 bar).

Furnace and Sootblower



Valve Specification

Item	Application	Qty
1	Inlet Heater Pass Isolation	4-8
2	Outlet Heater Pass Isolation	4-8
3	Heater Pass Flow Control	4-8
4	Upstream Block	4-8
5	Bypass	4-8
6	Downstream Block	4-8
7	Intermittent Blowdown	1
8	Continuous Blowdown	1
9	Boil Out	1

Reactors

MOGAS Valve Applications

Reactors are vessels designed to perform chemical reactions that take place in the presence of a catalyst between reactants in feedstock, or reactants in multiple feed streams. The activity in the reactor is the heart of the process and is constantly trying to maximize net present value for the given reaction by enhancing yield at optimum conditions. The chemical reactions occurring in the reactor may be exothermic or endothermic.

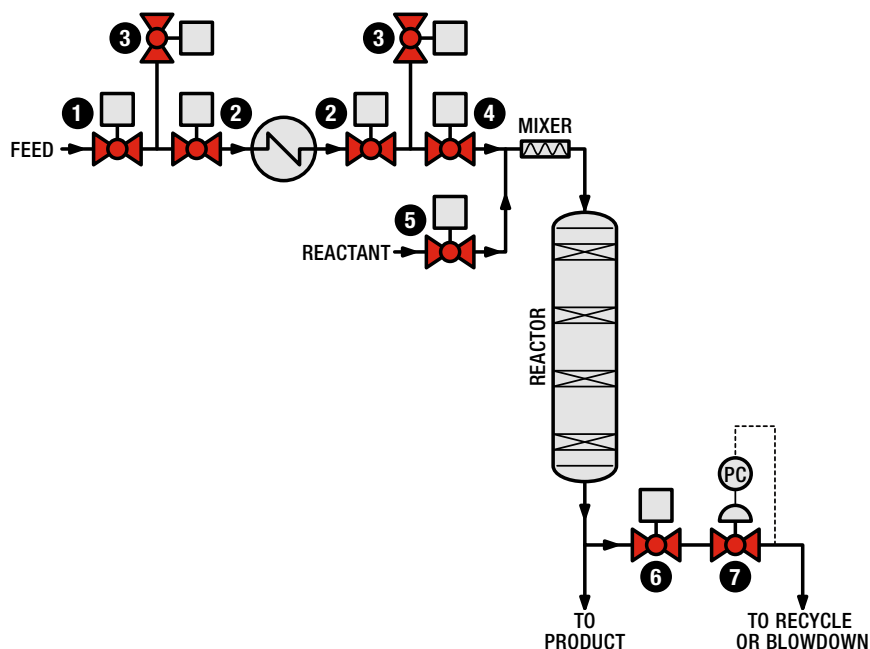
Severe service isolation valves are installed at both the beginning (injection) and the end (withdrawal) of the reactor. Those located at the end of the reaction process are usually subjected to harsh conditions that can be punishing to a common commodity valve.

Typical conditions that severe service valves must handle around the reactors can include:

- High temperatures / high pressures
- Abrasive media
- Viscous sludge
- Acidic liquids
- Velocity and / or volume concerns

Note: Many types of reactors are used for a variety of processes, with only a few common examples shown on these pages.

Fixed-Bed Reactor



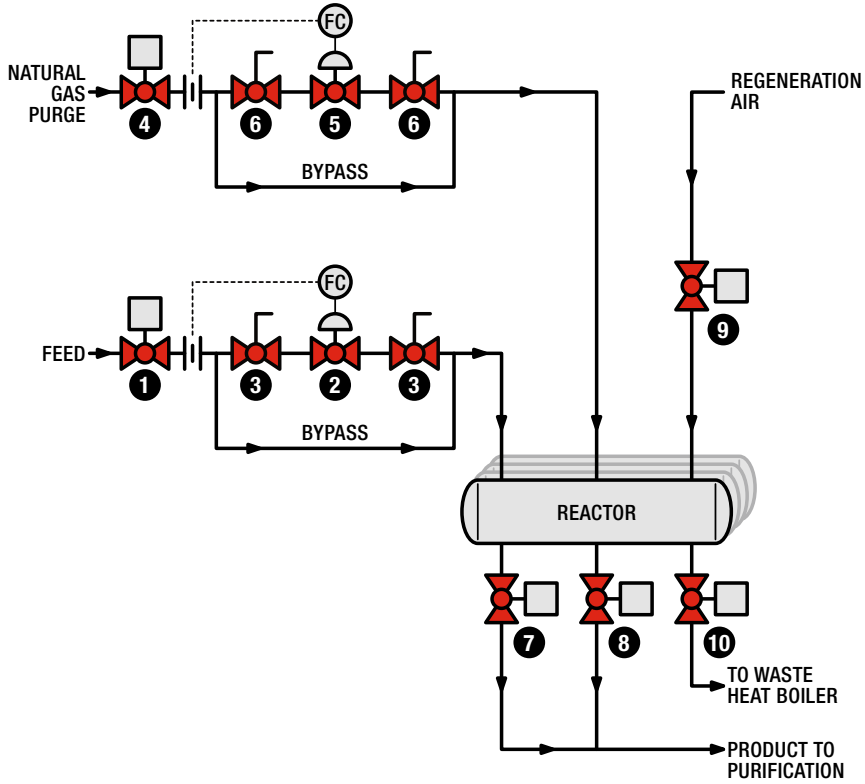
Valve Specification

Item	Valve Description	Qty
1	Feed or Cut	1
2	Isolation or Seal	2
3	Bleed or Vent	2
4	Mixer Reactor Isolation	1
5	Reactant Emergency Block	1
6	Product Emergency Block	1
7	Reactor Effluent Pressure Reduction	1

Reactors (continued)

MOGAS Valve Applications

Multiple Fixed-Bed Switching Reactors

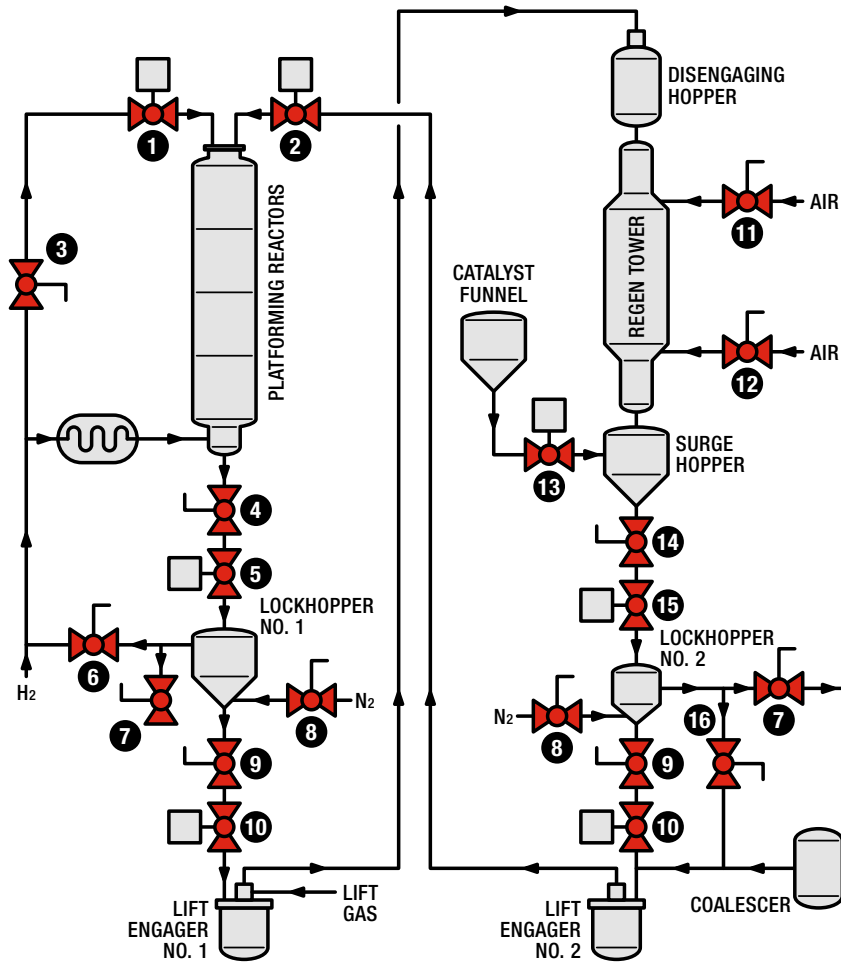


Valve Specification

Item	Valve Description	Qty
1	Feed Switching	1
2	Feed Control	1
3	Feed Manual Isolation	1
4	Natural Gas Inlet Purge Switching	1
5	Natural Gas Purge Control	1
6	Natural Gas Purge Manual Isolation	1
7	Reactor Effluent Switching	1
8	Natural Gas Outlet Purge Switching	1
9	Regeneration Air Switching	1
10	Regeneration Outlet Switching	1

Note: Valve quantities will depend on number of reactors.

CCR Reactor



Valve Specification

Item	Application	Qty
1	Reactor Overhead Purge (Automated)	1
2	Reactor Overhead Regeneration (Automated)	1
3	Standby Reduction Zone Purge (Manual)	1
4	Reactor Bottoms Unloading (Manual)	1
5	Reactor Bottoms Unloading (Automated)	1
6	Hydrogen Loading to Lockhopper 1 (Manual)	1
7	Hydrogen Vent for Lockhopper 1 & 2 (Manual)	2
8	Nitrogen Purge for Lockhopper 1 & 2 (Manual)	2
9	Catalyst to Lift Engager 1 & 2 (Manual)	2
10	Catalyst to Lift Engager 1 & 2 (Automated)	2
11	Air to Regeneration Cooler (Manual)	1
12	Air to Surge Hopper (Manual)	1
13	Fresh Catalyst Addition (Automated)	1
14	Regen Catalyst Unloading from Surge Hopper (Manual)	1
15	Regen Catalyst Unloading from Surge Hopper (Automated)	1
16	Pressure Balancing for Lockhopper / Lift Engager 2 (Manual)	1

Note: Valve quantities will depend on number of safety isolation configurations.

Exchangers

MOGAS Valve Applications

Exchangers are widely used for both cooling and heating large scale industrial processes. Heat exchangers work to stabilize the operation of the plant by recovering heat and transferring it to another part of the process. This practice saves money, as the heat supplied to other streams from the heat exchangers would otherwise come from an external source—which is more expensive and more harmful to the environment.

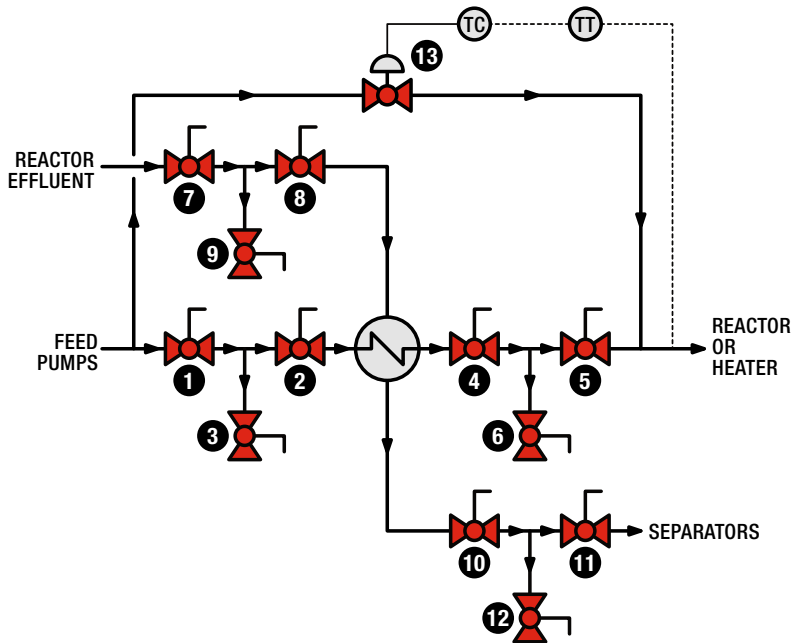
Because there are usually several interrelated exchangers in a system, any malfunction can be compounded. Due to the corrosive nature of much of the chemical / petrochemical media, maintenance of the exchangers is a continual concern. Isolation of the exchangers for repair, re-tubing or cleaning is imperative for the integrity of the process, and can have a direct impact to the operations budget. The ability to install these critical isolation valves horizontally or vertically is also an important factor in choosing the correct valve type. MOGAS quarter-turn metal seated ball valves can be installed in either configuration, reducing the need of numerous spare valves.

Typical tasks of exchangers in chemical / petrochemical plants include:

- Heating and cooling of acids and caustic solutions
- Cooling of highly viscous products
- Tempering and condensation of solvents, exhaust vapor and steam
- Cooling of water circuits

Challenge	MOGAS Solution
Aggressive medias	Design allows for a variety of trim material choices
Corrosion	Variety of proven coatings
Reliable Isolation	Robust metal sealing design ensures dependability
Variety of different heat exchanger design configurations	Flexibility of installing either vertically or horizontally with minimal impact to piping layout

Exchanger – Shell and Tube, Plate, Helical, etc.

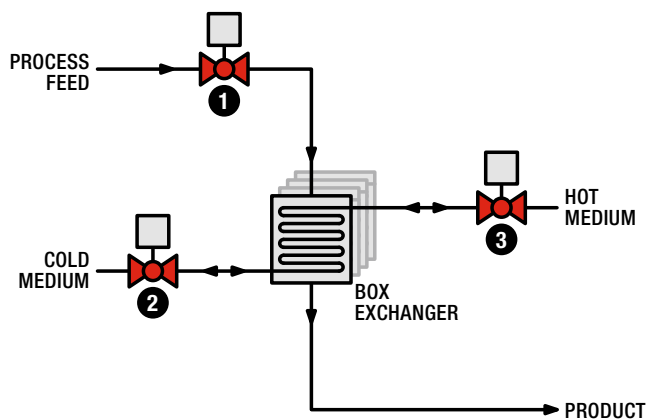


Valve Specification

Item	Valve Description	Qty
1	Primary Inlet Tube Side Block	1
2	Secondary Inlet Tube Side Block	1
3	Inlet Tube Side Drain	1
4	Secondary Outlet Tube Side Block	1
5	Primary Outlet Tube Side Block	1
6	Outlet Tube Side Drain	1
7	Primary Inlet Shell Side Block	1
8	Secondary Inlet Shell Side Block	1
9	Inlet Shell Side Drain	1
10	Secondary Outlet Shell Side Block	1
11	Primary Outlet Shell Side Block	1
12	Outlet Shell Side Drain	1
13	Tube Side Temperature Control	1

Note: Valve quantities will depend on number of exchangers.

Condensor Boxes



Valve Specification

Item	Valve Description	Qty
1	Feed Isolation	1
2	Cooling Medium Isolation	1
3	Heating Medium Isolation	1

Note: Valve quantities will depend on number of exchangers.

Separators

MOGAS Valve Applications

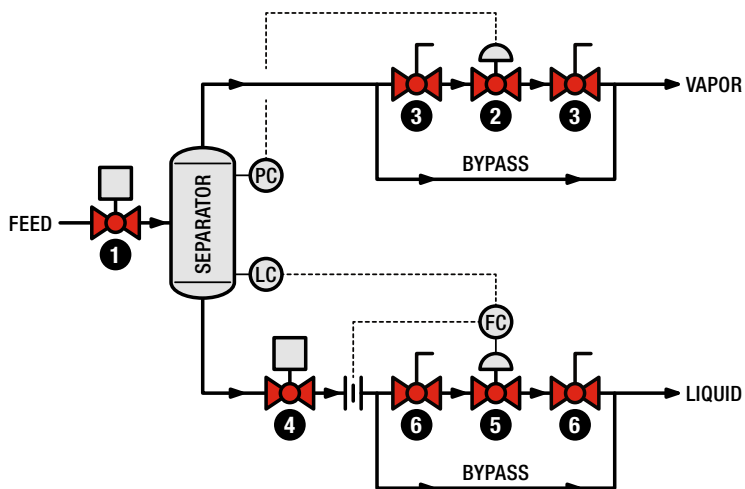
Separators can be both pre and post the furnace / reactor in order to separate phases or pre-filter the raw materials or feedstock as well as part of the extraction process. Usually there are multiple separator systems to handle the different phases of purification of the end product, as well as initiator recovery for recycling. Isolating the different separators for maintenance and repair requires a reliable isolation on/off valve.

Pre and post the separators can involve the entrance and exit of media at different velocities, temperatures / pressures, consistencies and textures. This part of the plant is subject to constant maintenance because the activity that takes place in the separators is critical to safe operation of the process, and can impact overall quality and operation. The isolation valves have to be able to handle everything from viscous sludge to high temperature / pressure to dangerous gases to punishing particulates. The quick quarter-turn non-rising stem design, coupled with unique

trim selection and dependable sealing, make the MOGAS metal-seated ball valve the preferred isolation valve choice.

Also associated around the separators are essential control valves. Often these valves are utilized in the leveling and de-pressurization systems that are connected to the separators. MOGAS control valves with FlexStream® rotary control technology usually have an overall footprint that is considerably smaller than the traditional linear control valve options, saving costly design space for extra piping.

Separator System



Valve Specification

Item	Valve Description	Qty
1	Feed Emergency Block Isolation	1
2	Pressure Control	1
3	Manual Isolation for Pressure Control	1
4	Product Isolation	1
5	Product Level Control	1
6	Manual Isolation Level Control	1

Note: Valve quantities will depend on number of separators.

Letdown Systems

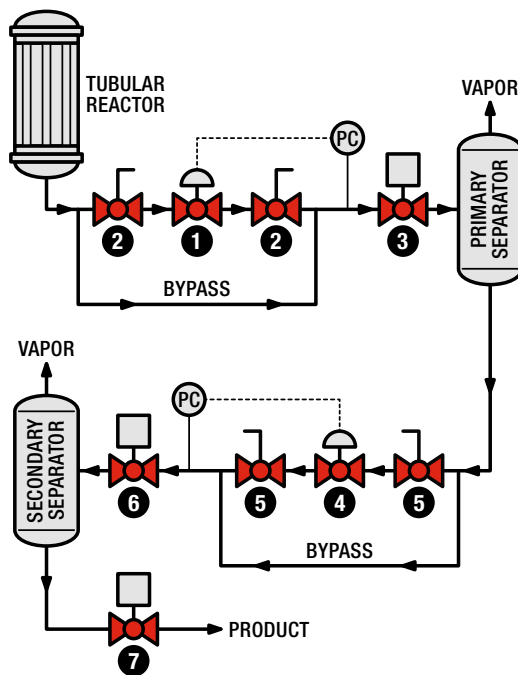
MOGAS Valve Applications

In most process plants there are single or multi-stage letdown systems between the furnace / reactor and the final end product. These systems reduce the pressure of the flow while maintaining the integrity of the media. By reducing the pressure, energy is released in several stages to stabilize flow before arriving downstream to the required product conditions or extrusion process.

Both control and isolation valves can be used in letdown systems depending upon media and process conditions. While reducing high pressures and / or velocities, these valves can be subject to not only turbulence, vibration and noise—but abrasion, corrosion and viscous sludge.

Because these applications endure rough wear, routine maintenance and inspection have traditionally been a major concern with linear control and isolation valves. Quarter-turn severe service ball valves and rotary control trims have proven performances in these rigorous applications.

Letdown System



Valve Specification

Item	Valve Description	Qty
1	Primary Letdown Pressure Control	1
2	Manual Isolation Pressure Control	2
3	Reactor Effluent Emergency Block	1
4	Secondary Letdown Pressure Control	1
5	Manual Isolation Pressure Control	2
6	Secondary Pressure Control Emergency Block	1
7	Product Emergency Block	1

Note: Valve quantities will depend on number of letdown stages.

Service

Global Capabilities



We provide exceptional service for unique locations—everyday, everywhere.

Service Excellence in Action

When you select MOGAS products, service is a big part of what comes with them. The MOGAS commitment to service means more than basic repairs. It also means timely access to our knowledgeable and experienced team of experts—anytime, anywhere in the world. And when our team becomes part of your team, you can trust that we will do everything we can to come through for you.

When you have a problem, our technical advisors get to the root of it. They will look at your entire application to accurately identify and solve the issue. Using a comprehensive approach helps you improve equipment reliability and operational efficiency, as well as reduce costs. Our core services include:



After years of use in a tough polymer application, this valve was returned to MOGAS Service facility for maintenance. Minimal repair was required before being re-installed.

Project Support

- Installation, startup and commissioning
- Shutdown planning and implementation
- Procurement and contract management

Preventive Maintenance

- Complete system inspection
- Routine maintenance, valve repacking
- Valve asset management

Repair, Refurbish & Customization

- 24-hour emergency response
- Troubleshooting
- Valve performance analysis
- 3D finite analysis
- High pressure testing
- Online repair documentation

Asset Management Plan

Optimize Your Investment

Getting more **value** for every dollar is now more important than ever. To help **minimize your total cost of ownership** while truly benefiting from predictive maintenance, MOGAS offers the **MORE™ Asset Management Plan**—a totally customizable valve purchase and service plan. Whether you buy a few valves or several hundred valves, you can choose from a variety of options to help optimize your investment.

On-site Services

- Start-up and commissioning assistance
- Field support and troubleshooting
- Quarterly walkdowns
- Major shutdown planning

Managed Inventories

- Revolving consignment inventory (located and managed at MOGAS facility)
- On-site inventory (for emergency use)

Walkdown Evaluations

- On-site inspection of installed valves
- Customized reports

Valve Management Program (Online)

- Initial setup, input, links to P&ID and maintenance reports
- Repair history
- Performance analysis reports
- Incident reports
- Valve repair cost
- Valve torques
- Revised bills of material
- Revised drawings
- Predictive / preventive maintenance recommendations

Certified Training

- Lunch-n-learns
- Valve installation & operation (hands-on)
- Maintenance & troubleshooting

Get **MORE™**...with **MOGAS®**

MANAGING OPERATION & REPAIR EXPENSES

- *Technical Assistance*
 - *Dependable Operation*
 - *Preventive Maintenance*
 - *Data Collection*
 - *Proactive Communications*
 - *Value Pricing*
-

Confidence for Tomorrow

A Warranty is Not a Performance Guarantee



CONFIDENCE

PREDICTABILITY

RISK FREE DECISIONS

IMPROVED SAFETY

ENHANCED RELIABILITY

LESS DOWNTIME

ANTICIPATED BUDGETS

Only from MOGAS

Due to continuous years of research and development, coating improvements, proven manufacturing techniques and application experience, we now offer an unprecedented application-specific PERFORMANCE GUARANTEE on our metal-seated isolation and control valves. Years of continual valve performance analysis, field reports and statistical service data from around the globe provide the information required to guarantee our valves for a performance time period. Now every MOGAS valve comes with a statistically driven, application-specific PERFORMANCE GUARANTEE...
plus a Lifetime Warranty on materials and workmanship.

Severe Service

The MOGAS Definition

- Extreme temperatures
- High pressures
- Abrasive particulates
- Acidic products
- Heavy solids build-up
- Critical plant safety
- Large pressure differentials
- Velocity control
- Noise control

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