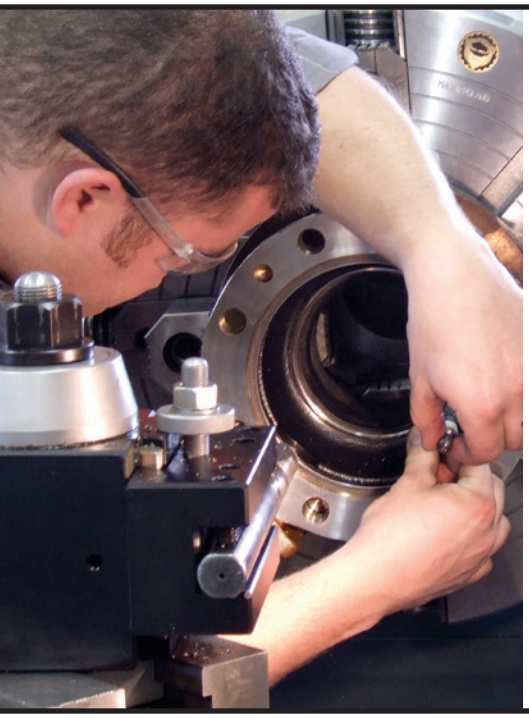
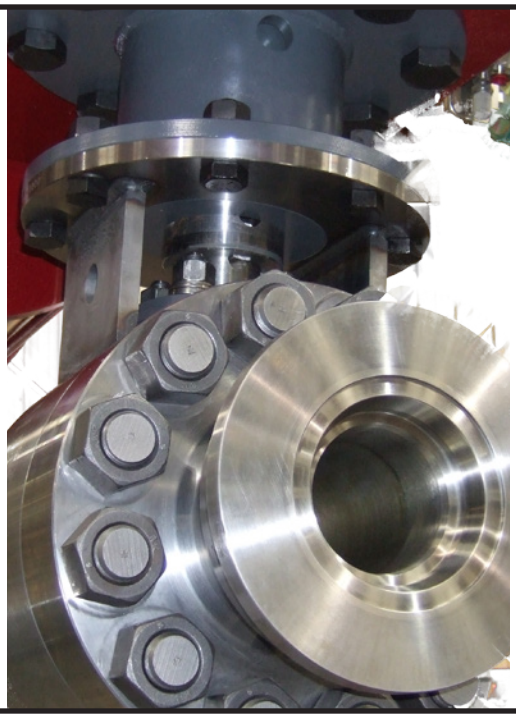
Engineered Valve Solutions

for Severe Service Applications





MOGAS®

SEVERE SERVICE BALL VALVES

Quality and Integrity

A MOGAS Commitment

Severe plant conditions can quickly turn into severe consequences for your business. That's why companies worldwide turn to MOGAS Industries — the leading provider of severe service, metal-seated ball valves. Combining over four decades of experience with the most advanced manufacturing practices available, MOGAS helps ensure **process integrity, uptime reliability** and **personnel safety.** The result — immediate business efficiencies and **lower total cost of ownership** in the long term. In short, MOGAS valves perform in the harshest environments so your company can too.

V. Louis Mogas, founder and Chairman of MOGAS Industries, Inc. (on left) and Matt Mogas, President and CEO. Together, they have led the company to become a global leader in isolation and control valve solutions for severe-service applications.

MOGAS Facts
Founded May 17, 1973

Office Locations
Headquarters — Houston, Texas USA
Perth, Australia
Beijing, China
Leicester, England
Edmonton, Canada
Dubai, United Arab Emirates
Singapore

Officers
V. Louis Mogas, Chairman
Matt Mogas, President & CEO

Number of Employees
250+

Through better design and manufacturing practices, MOGAS valves deliver performance, safety and reliability. If an application exists that calls for a severe service valve, chances are MOGAS has engineered a product that is up to the task. Because we work in partnership with our clients, many of our design advancements are the direct result of creating and customizing a solution that specifically addresses their unique process or problem.

Our portfolio of valve products enables clients to choose the design, trim, materials and coatings that best fit their application. MOGAS is always ready to help in the valve selection process with our engineers and industry managers who can guide clients to a tailored, application-specific solution.

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Industries We Serve

Solving Severe Service Situations

MOGAS **excels in the harshest industrial environments**, where valve failures can ruin plant efficiency, ravage profitability and threaten employee safety. We maintain one singular focus — to solve the most severe service challenges with superior metal-seated ball valves, specifically designed for the harshest, most demanding industry applications.

Power Generation

MOGAS capably solves issues that routinely plague power plants — valve leaks, seat erosion, blown packing and the inability to isolate critical equipment — all of which contribute to significant heat loss, safety concerns and plant inefficiencies.

Metals & Minerals

For decades, our severe service ball valves and technically superior coatings have continually and successfully performed in the punishing conditions of autoclave, slurry transport pipelines and direct reduction of iron applications worldwide.

Oil & Gas Production

Valve conditions in the oil and gas industry can be unforgiving, including cryogenic, high temperature, high pressure, solids and high cycles. MOGAS developed FlexStream® and RotaryTech™ Control Technologies specifically for modulating applications that require extreme pressure letdowns.

Refining

Our severe service product line continually brings unmatched quality and reliability into the harsh conditions common to refineries. As these processes push isolation and rotary control valves to the limit, MOGAS will be there to help refineries meet the challenge.

Petrochemical / Chemical

Processes used by the petrochemical and chemical industries vary greatly, with applications using acidic, corrosive and abrasive media. MOGAS designed and engineered valves that offer emergency capabilities that surpass the most rigorous demands of the industry.

Specialty Industries

When conventional valves cannot withstand the demands of extreme, highly critical applications or punishing conditions, leaders in the food processing, aerospace and pulp and paper industries look to MOGAS to help ensure the integrity of their equipment and processes.

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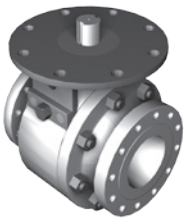
Quarter-Turn Isolation

Proven Design for Extreme Conditions

MOGAS valves have outperformed others worldwide in some of the most severe service conditions, including:

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



C-Series

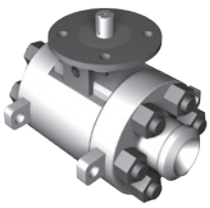
Dependable Isolation

- Valve engineered specifically for customer application
- Blowout proof stem
- 2-piece or 3-piece forged body
- ASME 150 – 4500 Class
- 1/2 – 36 inch or larger

RSVP

Innovation by Design

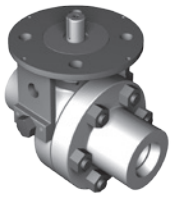
- Mechanical precision stop
- Forged uni-body design
- ASME 600 – 4500 Limited Class
- .38 – 1.5 inch bore



SC-3 Piece

Flexibility of In-line Repair

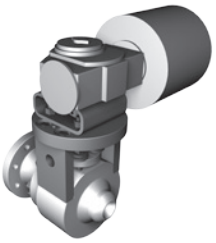
- In-line repairable
- 3-piece forged body
- ASME 1500 – 4500 Class
- 2 – 24 inch bore



GEN-X

Full Bore

- Designed to meet TDP-1 1998
- 2-piece cast body
- ASME 600 – 1500 Limited Class
- 2-inch full bore



PORV

Prevents Excessive Pressure

- Power Operated Relief Valve, ASME “V” Stamp
- Complete with automation package
- Proprietary coating
- ASME 1500 / 2500 / 4500 Class
- 2-1/2 – 4 inch

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Rotary Control Technologies

Flexibility for Demanding Environments

The MOGAS family of control valve technologies gives you complete **flexibility** for your specific 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**.

Variable Trim Technology

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)
- the percentage of the bore that is filled.

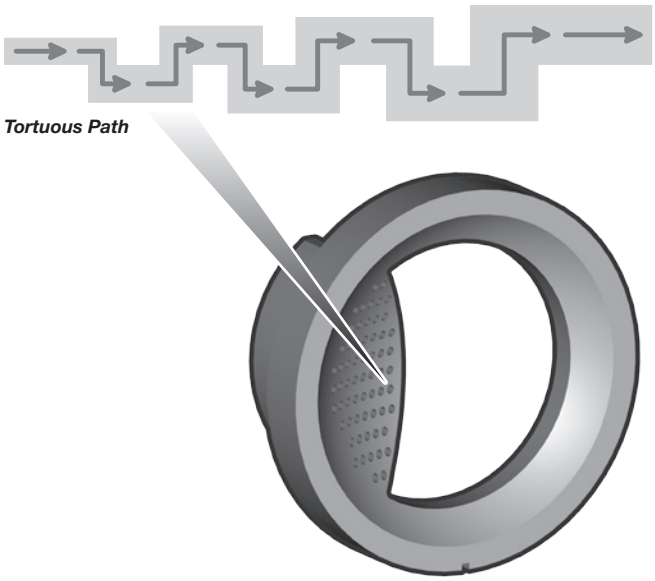
Variable trim technology tailors the percentage of filled bore to application-specific requirements. These examples show a range from 10 percent filled to 100 percent filled.

Application-Specific Design

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.

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 turn to ensure that any increases in volume (due to pressure reduction) are accounted for, and velocity does not increase through the passageway—even though the fluid may be expanding, eliminating any potential erosion. The larger the pressure drop, the more turns are required to control velocity.



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.

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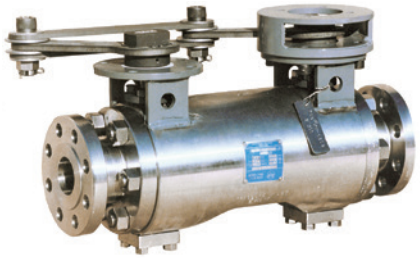
Engineered Products

Application-specific Customized Designs

Every process is unique and often requires **customized** valves that just can't be found in a standard equipment catalog. 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 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.

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.

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.

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.

Unique Bore or Inlet / Outlet Sizing
Special piping or process requirements often create operational challenges for severe service valves. MOGAS offers uniquely fabricated and manufactured ball valves that meet operational specifications.

One-of-a-Kind
Unique bore sizes, different end connections and special trim materials are easily accomplished through our engineered products group.

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Proven Coatings

Not All Coatings are Equal

Conditions such as abrasive media, high cycling and extreme temperatures can greatly affect the operations of mechanical equipment. Coatings are often critical to not only the **performance of the valve**, but also the **longevity of the equipment** in a 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. Challenges that MOGAS meets head-on with experience, world class engineering and the very latest in material science.

Research and Development

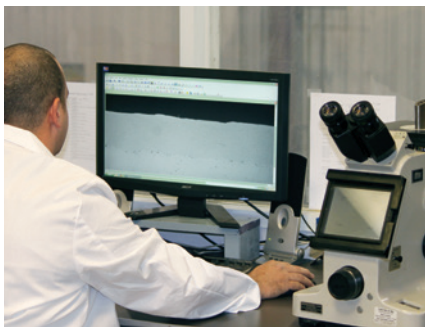
To ensure the best coatings solutions are available for our customers, MOGAS has an ongoing research & development program that includes:

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

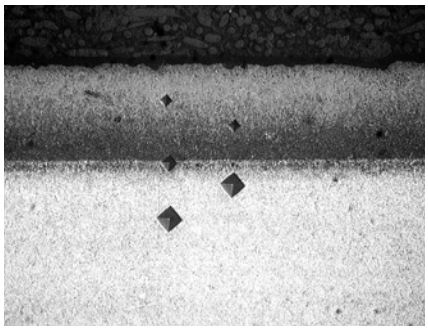
As part of ongoing research and development for coatings, MOGAS continually analyzes samples for strength and durability. Some examples of our testing and evaluation includes:

- Abrasion tests
- Slurry erosion tests
- Micro hardness tests
- Adhesion tests
- Corrosion tests
- Porosity analysis
- Impact testing
- Residual stress analysis

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



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.

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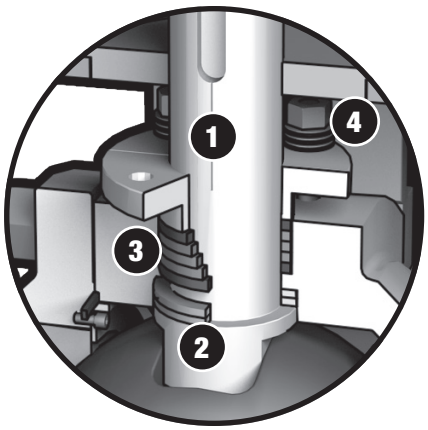
Designed for Safety

Ensuring Confidence and Reducing Risks

Fugitive Emissions Control

Most pipeline 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 gaseous release or small drip can harm personnel, equipment or the environment. 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.



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

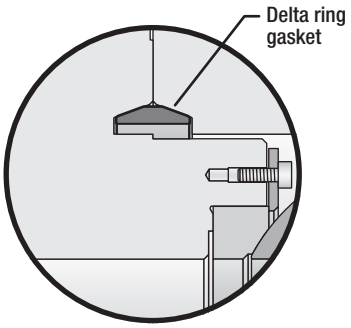
Stem Seal Design

A special safety feature is the **stem seal design**. MOGAS incorporates 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

Pressure-Energized Gasket

MOGAS offers a pressure-energized **delta ring gasket** for high-pressure applications. 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.



Safety Integrity Level (SIL) Certified

Industry experts began to address functional safety in facilities and pipelines while formalizing 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 based on the severe service applications that MOGAS isolating ball valves have been operating in over the past 40 years.

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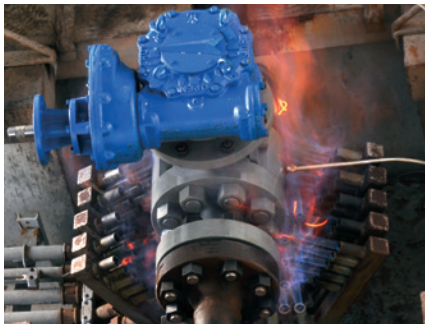
Fire Tested for Dependable Performance

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 standard 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.



This 4-inch ASME 1500 Class ball valve was sent overseas for a customer-specific fire test. This valve not only passed on the first attempt, but exceeded the customer's critical requirements.

Quality Assurance / Quality Control

MOGAS maintains a fully implemented and certified Quality Assurance / Quality Control program. While MOGAS is certified to ISO 9001:2008 standards, we also reference many industry organizations for standards, codes and approvals, such as:

- API
- ASME
- ATEX
- CRN
- DIN
- FCI
- GOST
- IEC (SIL)
- ISA
- ISO
- NBBI
- PED
- TA-Luft
- TUV

MOGAS is dedicated to maintaining and continually improving their Quality Management System to satisfy the requirements of their customers and applicable industry standards.

API Spec 6A

Organizations applying for licensing under the API monogram program must develop and maintain a quality management system that complies with **API Q1** standards. MOGAS has been qualified and conforms to this standard, upgrading our total quality commitment to API Q1, which is even more demanding and detailed than the manufacturing processes of ISO 9001:2008. Successfully completing the API Spec 6A monogram program assures global users of our continued ability to meet the technical specification requirements of applicable products.

MOGAS has been granted authorization from the American Petroleum Institute to use the API Spec 6A monogram for product specification levels 1 through 3; License number 6A-1466

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:

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

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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

- *Improved Safety*
- *Enhanced Reliability*
- *Predictive Maintenance*
- *Anticipated Budget*
- *Less Downtime*
- *Value Pricing*

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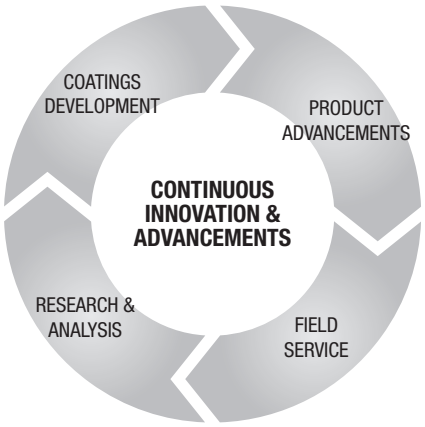
Total Cost of Ownership

Determining Economic Value of Investments

Total Cost of Ownership (TCO) analysis often shows there can be a large difference between the **price** of something and its **long term costs**. Several analytical methods can be used to justify the purchase of capital equipment—such as critical valves—but it really comes down to getting the **expected performance** you purchased.

The potentially diminished performance of a valve can cause a significant reduction in the plant's ability to generate revenue. When evaluating a financial investment, all aspects of **operating** and **maintaining** severe service valves should be just as important as the initial purchase price. To protect such economic considerations, original valve manufacturers need to validate their commitment to a specific market through continuous **innovation** and **advancements**, always seeking to **extend** the life of the valve.



Key Components to TCO

MOGAS integrates many activities into their daily business to help focus on providing the best metal-seated ball valve available in the world. Teams are dedicated to research and analysis, coatings development, and product advancements, along with asset management and field service agreements. Without these important capabilities to back up the purchase of a valve, ownership is similar to buying a car without any tires or a set of keys for the ignition. You bought it, but it is really not functional.

Discovering All the Numbers

When planning a severe service valve purchase, here are some important numbers to consider:

Purchase price (including actuation)	$ _____
Spare parts / replacement valve(s)	$ _____
Cost if critical path valve fails	$ _____
Inventory costs to stock / insurance costs	$ _____
Downtime / lost availability	$ _____
Service / removal & installation costs	$ _____
Value of plant / personnel safety	$ _____

This is just a partial list, but it emphasizes the importance of **total cost of ownership**, and understanding the true return on investment or the avoidance of outrageous loss of revenue due to downtime.

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Precision Cleaning

Cleanroom Services

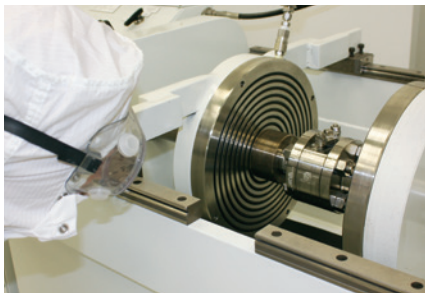
Due to the serious and often potentially hazardous nature of some process media, it is **crucial** that equipment go through **precision cleaning** prior to installation. While the removal of combustible contaminants from components used in oxygen-enriched environments is critical to plant safety, precision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

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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.

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1973 – 2013

40 YEARS

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MOGAS®
SEVERE SERVICE BALL VALVES