Valves for Slurry Transport
Engineered Solutions for the Mining & Minerals Industry
The MOGAS tracking seat design results in the only true bi-directional ball valve for slurry transport pipelines.
Over 84 percent of installed MOGAS valves—across all industries—are used in solids handling applications.

MOGAS has been providing slurry pipeline valve solutions in some of the toughest applications and remote locations worldwide for over three decades. Large pipeline valves (36-inch and larger), small drain valves and high pressure block valves are just some of the types of mining valves MOGAS designs and manufactures.

In the metals and minerals market, valves must operate dependably for long periods of time. Rugged forgings with severe service metal balls and seats ensure a reliable operation for handling particulates and sludge.

All of these factors can cause operation and maintenance challenges where dependable operation is paramount for optimal performance. **Total cost of ownership** becomes critical to equipment selection.

When considering the many demanding applications associated with a slurry pipeline, the slurry rheology is a major concern. The deformation and flow of slurry not only affects the pipe materials, pumps, and choke systems, but the valve stations as well. The rate of flow, particulate size and composition (along with concentration levels) can cause operational difficulties—whether the slurry is homogeneous, heterogeneous or complex. Allowances for pigs through the valve’s bore is another important operational concern. With the **dependable sealing** capabilities of the **tracking seat design**, the CST valve makes MOGAS the obvious choice for uni-directional and bi-directional slurry pipeline applications.
These 24-inch ASME 900 Class ball valves in a Chilean choke station have a stroke time of 45 seconds to handle copper concentrate with an average flow rate of 1167 liters / second.

These 8-inch ASME 900 Class copper slurry valves have been cycling about 40 times per month against 1500 psi, without failure, since 1999.

Absolute reliability for these large bore isolation valves is very important due to the punishing effects of slurried ore, as well as the fact they are located 1,430 meters above sea level.

The MOGAS bi-directional tracking seat design means less equipment to buy, less equipment to fail, and less equipment to repair.
MOGAS Isolation Design
Solves Common Valve Concerns in Slurry Transport Process

**Dependability. Reliability. Confidence.**

All of these attributes are necessary when considering isolation valves for slurry transport. Whether there is a need to isolate a particular piece of equipment or segregate sections of the pipeline for inspection or repair, steadfast isolation is a serious requirement. Large size valves in remote locations must perform each time they are called upon, regardless of the frequency of operation or the tortuous media. MOGAS has designed the CST valve specifically with these concerns in mind.

1 **Bi-directional tracking seat design**
   - Belleville-shaped seat spring maintains constant sealing contact between ball / seats, preventing media contamination during pressure shifts
   - Seating surfaces are protected from erosion in the fully opened or closed position
   - Field replaceable seats minimize repair time

2 **Wide seat sealing surface**
   - Wide sealing area creates low stress seal, which is key in high cycle applications
   - Mate lapping across entire seat face is proven by “blue” test
   - Sharp leading edge design of seat ring “wipes” sealing surface each time the valve is operated

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**MOGAS was first to successfully introduce metal-seated ball valves in the severe service applications of slurry transport pipelines.**

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**MOGAS CST Valve**
Sizes: 2 to 36 inch
Full-bore custom sized to match piping

Pressures: ASME 150–2500 Class
3 Dual-guided stem design
   - Eliminates lateral movement of the valve stem
   - Inner stem bearing serves as lower stem guide and thrust bearing, while flange bushing serves as upper stem guide
   - Inner stem bearing prevents migration of abrasive and erosive media into the packing box
   - Flange bushing eliminates side-thrusts and packing deformation caused by side-loading from actuator

4 Forged body / end connections
   - Greater wall thickness in critical areas provides longer valve life in erosive slurries
   - 316 SS overlay in both seat pockets

5 Heavy-duty mounting bracket
   - Provides structural support for actuator mounting
   - Bracket is permanently attached to valve body and machined afterwards to ensure precise alignment
   - Maintains proper stem and flange bushing alignment, eliminating side-loading of stem

6 Floating ball design
   - Rotates within its own sphere, therefore does not need to displace solids
   - Does not require lubrication system to operate

Features Not Shown
   Optional materials to handle corrosion / erosion
   - Liners and inlays can be applied to the through-bore or wetted surfaces of the valve upon request
   - With numerous mines using saltwater as the aqueous source for slurry, forged solid duplex stainless steel or titanium materials should be specified

Reliable coating
   - HVOF (which is mechanically bonded) Chromium Carbide coatings are applied to overcome erosion
Only the MOGAS tracking seat design provides true bi-directional shutoff without using a check valve.

MOGAS CST Bi-directional Seat Design

In a bi-directional ball valve application, pressure reversal will cause the ball to shift within the body. If a gap forms between the ball and seat sealing surfaces, particles could enter and quickly develop into severe erosion due to the high pressure of slurry transport applications.

The MOGAS CST bi-directional seat design is engineered to maintain constant contact between the ball and seats during this shift, ensuring continuous wiping action that leaves the sealing surfaces free of solids.

Tracking Seat Design

Normal Pressure

During normal pressure, the ball shifts toward the primary sealing seat (normally oriented downstream). The seat springs behind each seat apply the needed force to maintain constant contact with the ball. In addition, the primary sealing seat employs an o-ring to provide a secure seal between the seat and body.

Reverse Pressure

During reverse pressure, the ball shifts toward the secondary seat. Again, the seat springs behind each seat apply the needed force to maintain constant contact with the ball, while the o-ring provides a secure seal between the seat and body.
Typical Seat Designs Used for Slurry Transport

Slurry transport operating challenges are similar—but the engineered designs to handle them are not. Below are some comparisons of different sealing designs that are used in severe service ball valve applications.

Locked-in Seat Design

Integral Seat Design

**Integral seat designs do not allow bi-directional shutoff without a downstream check valve to prevent back pressure.**

Normal Pressure

Uni-directional *locked-in* seat designs or *integral* seat designs are sometimes incorrectly used in bi-directional applications.

Reverse Pressure

With reverse pressure, locked-in seat designs or integral seat designs will form a gap between ball and seat, allowing *particles* to enter the sealing area and create *leak paths* and / or *severe erosion*. 
### Engineered for Extreme Conditions

**Today’s Innovation, Tomorrow’s Standards**

**Type**
Ball valve with dual seats and single, floating ball design. Uni- or bi-directional sealing, as specified. Ball and seats to be matched sets, and interchangeable for valves of the same bore size. Seats must be field replaceable.

**Model**
CST

**Size**
2-inch to 36-inch

**Class**
ASME 150–2500 Class

** Ends**
RF Flanged

**Bore**
Full bore / Reduced bore / Ball bore to match specific pipe inside diameter. (Smooth transition from connecting pipe inside diameter to ball bore to be provided.)

**Actuator**
Manual Operator / Electric / Hydraulic (as required by customer)

### Materials and Options

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Optional</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Material</td>
<td>Coating</td>
</tr>
<tr>
<td><strong>Body / End</strong></td>
<td>ASTM A105 Carbon Steel with 316 SS overlay in both seat pockets (+ 0.5 inch into nozzles)</td>
<td>—</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td></td>
<td>Optional hard surfacing, weld inlays or liners may be added to flow path for applications with highly erosive characteristics.</td>
</tr>
<tr>
<td><strong>Gasket</strong></td>
<td>Proprietary Elastomeric O-ring</td>
<td>—</td>
</tr>
<tr>
<td><strong>Ball</strong></td>
<td>17-4 PH</td>
<td>HVOF-applied Chromium Carbide</td>
</tr>
<tr>
<td><strong>Downstream Seat</strong></td>
<td>17-4 PH</td>
<td>Chromium Carbide</td>
</tr>
<tr>
<td><strong>Upstream Seat</strong></td>
<td>17-4 PH</td>
<td>Chromium Carbide</td>
</tr>
<tr>
<td><strong>Load Spring</strong></td>
<td>17-4 PH</td>
<td>—</td>
</tr>
<tr>
<td><strong>Stem</strong></td>
<td>17-4 PH</td>
<td>—</td>
</tr>
<tr>
<td><strong>Stem Packing</strong></td>
<td>Molythane PolyPak</td>
<td>—</td>
</tr>
<tr>
<td><strong>Stem Seal Bearing</strong></td>
<td>Proprietary Elastomeric Seal</td>
<td>—</td>
</tr>
<tr>
<td><strong>Body Bolting</strong></td>
<td>A193 Gr. B7 / A194 Gr. 2H</td>
<td>—</td>
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*Field replaceable seats minimize repair time.*
Big Valves
For Large Pipelines

Long distance slurry pipelines for moving mineral concentrates over rugged terrain is often more economical than trucking or rail due to topography constraints and environmental concerns. To capitalize on these investments, the pipe sizes are maximized. The various elevations and distance involved make pipeline operations challenging. Therefore, large bore valves with dependable performance become vital to the success of the whole transportation process.

Simply taking a commodity valve and trying to “size it up” to a large bore valve will not ensure the proper longevity or operational performance when needed. This is where experience makes the difference. With over 35 years of manufacturing, installing and maintaining large severe-service valves, MOGAS provides a high level of confidence and support for operators in the slurry transport markets.

Many design considerations are needed for each valve component before simply enlarging a smaller size valve. For example, this 36-inch bore is considerably larger compared to the 24-inch ball, while the stem slots have different ratios due to performance requirements.

Experience makes the difference when designing and manufacturing large-bore ball valves.

This bi-directional 30-inch ASME 900 Class metal-seated ball valve stands ready for testing prior to shipment to South America.
Uni-directional Design
Drain, Vent and Instrument Isolation

Maintaining the pressure and velocity flow in a mineral slurry pipeline is crucial. Thus, the ability to drain either pressure or slurried media from the pipeline is an important part of the operational process. While MOGAS provides dependable large bore isolation valves, they also engineer and manufacture smaller, robust drain valves built for reliability and safety. Quick quarter-turn ball valves that can handle corrosive and erosive media are needed throughout the pipeline system.

RSVP-ST Valve
Sizes: 1/2 to 2-1/2 inch
Pressures: ASME 150–4500 Class

Features & Benefits of RSVP-ST Valves

1 Stem & packing arrangement
   • Live-loading
   • Quarter-turn, non-rising stem does not deteriorate packing
   • Extensive packing box
   • Dual anti-extrusion rings keep packing in place

2 Sturdy mounting bracket
   • Designed to support actuator in any position

3 Mechanical precision stop
   • Prevents turning ball 180 degrees
   • Eliminates misalignment

Features Not Shown
Corrosion resistant ball & seats
   • Mate lapped ball / seat combination delivers outstanding sealing performance
   • Seats are protected from abrasive flow in open / closed position

Seat spring
   • Assisted by line pressure, provides a constant mechanical force on ball against seat to maintain seal
When hydrotransporting mineral concentrates such as copper, nickel, iron or gold, the long distant slurry pipelines most often will require various types of pump stations. When the topography cannot accommodate a gravity flow pipeline, either centrifugal pumps or positive displacement pumps must be used.

When maintenance is required on an inoperable pump, a reliable isolation valve is required on the suction and discharge sides of the pump to prevent the slurry from creeping into the pump. The flow will be diverted to other trains of piping to maintain operational efficiencies. These valves must isolate against full operating pressure of the abrasive media. With the MOGAS CST bi-directional seat design, the seat tracks with the ball for 100 percent contact.

<table>
<thead>
<tr>
<th>Valve Specification</th>
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<tbody>
<tr>
<td><strong>Valve Number</strong></td>
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<td>1</td>
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<td>3</td>
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<td>4</td>
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</table>
When engineering a long-distance pipeline with significant changes in elevation and diverse terrain, choke stations become an integral part of the design. Choke facilities are used for reducing pressure in a slurry pipeline and provide back-pressure necessary to prevent slack flow in the pipe.

The isolation valves used at the choke station must operate under high differential slurry flow conditions. When closed, dependable isolation with no leak-by is critical to the overall operation of the slurry pipeline. With the MOGAS CST bi-directional seat design, the seat tracks with the ball for 100 percent contact. This prevents build-up behind the downstream seat and ensures evacuation of solids around upstream seat during cycling.

### Valve Specification

<table>
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<tr>
<th>Valve Number</th>
<th>Valve Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Choke Station ESD Valve</td>
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<td>2</td>
<td>Instrument Isolation Valve</td>
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<td>3</td>
<td>Instrument Bleed Valve</td>
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<td>4</td>
<td>Drain Valve</td>
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<td>5</td>
<td>Emergency Dump Valve</td>
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<td>6</td>
<td>Choke Loop Cut Valve</td>
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<td>7</td>
<td>Choke Loop Seal Valve</td>
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<tr>
<td>8</td>
<td>Choke Loop Isolation Valve</td>
</tr>
<tr>
<td>9</td>
<td>By-pass Isolation Valve</td>
</tr>
<tr>
<td>10</td>
<td>Main Slurry Line Isolation</td>
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</table>
The ability to consistently isolate pre-determined sections of a slurry pipeline or isolate major equipment can help eliminate unnecessary expenses. Another means to optimize operational profits is using pipeline intelligent gauges, or “pigs”, to provide inspection of the internal piping.

For slurry pipelines that must be pigged, full bore ball valves are used, as they allow free passage of the pigs. These pig launching and receiving stations are at regular intervals along the pipe, often in remote locations. A reliable trip isolation valve and pipeline block valve with quick quarter-turn operation is required for each station. With a MOGAS metal-seated ball valve, the recessed seats are protected from continual exposure to the abrasive process flow and pigging operations. Also, the sharp leading edge design of the seat ring “wipes” the sealing surface each time the valve is operated to eliminate any troublesome build-up.

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Service
Global Capabilities

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

Annual maintenance costs on installed MOGAS valves is less than 1 percent of initial 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
Total Cost of Ownership
Not All Valves are Alike

Total Cost of Ownership
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. In the case of large pipeline valves, this concern becomes magnified. The availability of the hydrottransport system and the operational integrity of the pipeline directly affect a company’s bottom line.

Price versus Operational Availability
Management only wants to invest in equipment that allows them to make money. This means presenting technical features and benefits in a way that helps them understand the return on investment or the avoidance of outrageous loss of revenue. Below is an example of what it could potentially cost a company when an underperforming valve purchase is made.

Question
How much money could be lost if a pipeline has to be down due to valve failure?

Answer
If you have a 36-inch slurry transport pipeline that runs at $120,000 per hour, and it takes 24–48 hours to change out a valve—the answer is a staggering **$2.9 – 5.8 million**! (This doesn’t even include the cost to get the replacement valve to the remote location, personnel time, etc.)

Potential Lost Revenue

<table>
<thead>
<tr>
<th>Hours</th>
<th>$2.9 M</th>
<th>$3.6 M</th>
<th>$4.3 M</th>
<th>$5.0 M</th>
<th>$5.8 M</th>
</tr>
</thead>
</table>

How much money will it cost you to choose a valve that does not perform when needed?
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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