Predictive Maintenance Inspection

Power Walkdown

- *Reduce Operation and Maintenance Costs*
- *Increase Reliability and Efficiency*
- *Assure Safety*
- *Validate Valve Replacement*

A MOGAS power walkdown identifies valve leakage issues and their severity. Our report provides data so you can prioritize critical issues immediately, while budgeting and scheduling potential problems for a more appropriate time.

Severe service valves, and the equipment they protect, represent significant capital investments in your plant. To protect those investments and the improve performance of your facility, we offer the MOGAS power walkdown — an inspection of your critical valves using contemporary technology and technical experience.

Reducing Costs through Increased Efficiencies

Reduced operation and maintenance costs can increase process **reliability**, resulting in greater **efficiency** and **profits**. Plants using high-volume steam should routinely check their valves for leaks, and repair or replace inefficient ones. Adoption of a MOGAS power walkdown can result in substantial cost **savings**, higher system reliability and increased personnel **safety**.

When performing a MOGAS power walkdown, our experienced inspectors will use a proven process:

Capture valve performance data, such as temperatures along the bore path.	**Analyze** the information gathered from the valve performance data and visual inspection.	**Report** findings on our Unit Walkdown Report and, upon request, our Power Walkdown Thermography Inspection Report.	**Recommend** action to repair or replace underperforming valves.

MOGAS® SEVERE SERVICE BALL VALVES

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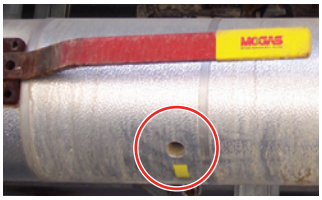
Predicting Maintenance Improves Profit and Safety

A MOGAS power walkdown inspection is the first step to a more profitable and safe plant. Typically before inspection, we establish a database from a pre-inspection survey. This survey is made up of valves that you've identified as being the most important—usually drain and vent valves. With this list, our inspection time is decreased by up to 50%.



With consent, a small incision may need to be made through the insulation to record a temperature. We will consider every non-invasive method prior to cutting any insulation. In instances where there is no direct valve access, openings around the stem or downstream in the pipe run will be used.

Inspecting Your Plant

The inspection is usually set approximately 3–6 months prior to a planned outage. Our walkdown professionals can concentrate on a specific part of the station, certain types of valves, or a complete plant diagnosis. Ideally, your plant operator, reliability team member or plant employee would escort our inspectors to help locate the valves and satisfy safety regulations.

In addition to **capturing** thermal efficiency readings during the predictive maintenance inspection, we also perform a **visual inspection** to ensure that:

- Valves are installed with the correct orientation
- Stem scribe lines are accurately aligned or that the valve is fully closed
- Appropriately designed valves are installed in the proper application
- The actuator is mounted correctly
- Joints, body and packing are void of leaks

Depending on your plant policies, corrective actions recommended from our visual inspection can be immediately addressed during the inspection if desired.

While suggestions and on-the-spot test results can be given, a more thorough, **analytical report** is provided, usually within 10 days of the walkdown. This report provides performance data to quickly remedy crucial issues, while non-urgent action can be budgeted and scheduled. A single report can show the results of several walkdowns, profiling individual valve performance and identifying trends. Our **recommended action** to replace a valve is validated with statistical data within the report.

The Value of Predictive Maintenance

Predictive maintenance (PdM) evaluates the condition of equipment by performing periodic or continuous (online) equipment condition monitoring. The ultimate goal of PdM is to perform maintenance at a scheduled point in time when the maintenance activity is most cost effective and before the equipment loses optimum performance.

MOGAS® SEVERE SERVICE BALL VALVES

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Getting a Clearer Picture of What's Going On

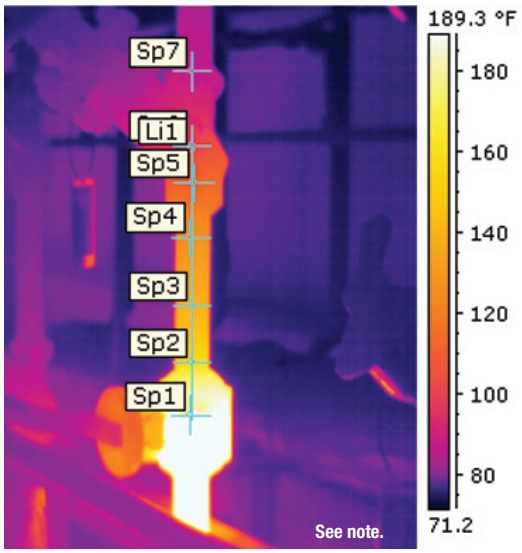
MOGAS power walkdown inspectors use several tools to measure energy transference, or radiant heat, associated with a problem valve:

- Our high-temperature **infrared camera** captures and stores temperature data—up to 2190 F (1200 C)—and valve parameters. Its touch-screen technology saves text, markers and sketches, which can be layered over the thermal image. Additional analysis tools, as well as voice and text comments, assist advanced post processing and report writing.
- For jobs requiring temperature measurement in hard-to-reach spots, our **infrared thermometer's** enhanced optics measure temperatures up to 1400 F (760 C), storing them for future recall.
- A resistance **temperature detector** (probe) is used for point sampling, especially where insulation prevents infrared detection.

A Picture Says a Thousand Words

With a MOGAS power walkdown, you can instantly visualize and verify thermal performances. Here are two examples where thermography captured exactly what is going on in the pipeline.

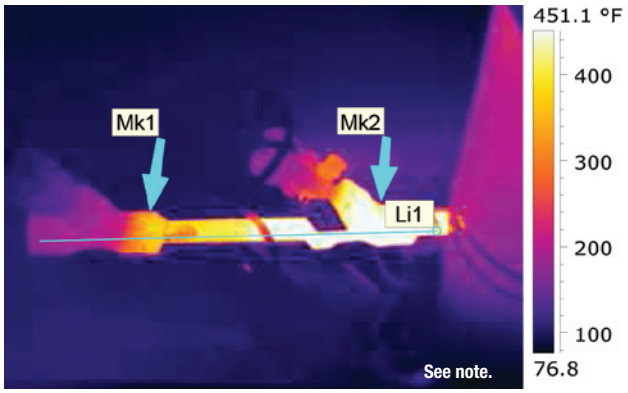
Valve is Proven Sealed



This review was to determine if the valve was leaking or if heat shown was radiant from downstream sources. There is a steady drop in temperature that appears to be the normal air cooling effect with no sign of circulation in the pipe.

If the valve (bottom) was leaking by, then there should be a slight strip of heat rising through the center of the pipe run from bottom to top.

Leak-by is Proven in Thermal Imagery



The above thermal image is of two traditional, globe drain valves in the closed position. Line 1 (Li1) is used to develop a histogram and heat profile. As can be seen from the image, the upstream valve (MK2) is experiencing complete leak-by. The downstream valve (MK1) is holding better than the upstream valve, but is also experiencing extreme leak-by.

This leak-by was evidenced by the temperature and visible steam at the outlet of the downstream valve.

Note: Temperature scale varies from photo to photo based on ΔT at location.

MOGAS® SEVERE SERVICE BALL VALVES

Predictive Maintenance Inspection

DATA SHEET

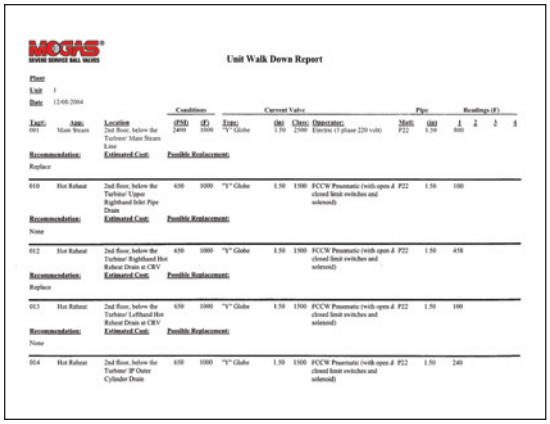
Power Walkdown

Reporting Results that Offer Solutions

There are two types of reports available from the power walkdown: a detailed **spreadsheet-style report** and a **thermographic report**. While all customers receive the detailed report, the second report is derived from an infrared camera showing thermography results of a specific valve, and is provided on request.

Unit Power Walkdown Report

- Current **tag information** to identify valve. MOGAS inspectors will replace this tag if it's in poor condition, or will assign a new tag if none exists.
- A description of your valve's **application** in relationship to the equipment it serves.
- Descriptive visual **location** of valve.
- **Valve specifications**, such as pressure, temperature and size.
- **Actuator** type.
- **Pipe specs**, such as material and size.
- Multiple **temperature readings** along the line can be made. Also, as part of a regular walkdown program, prior readings are recorded to build a history of valve performances. This 'trending' method allows you to predict maintenance and avoid unplanned maintenance outages.
- If your existing valve is affecting your plant's efficiency, MOGAS will suggest a **replacement** and its cost.



MOGAS SEVERE SERVICE BALL VALVES

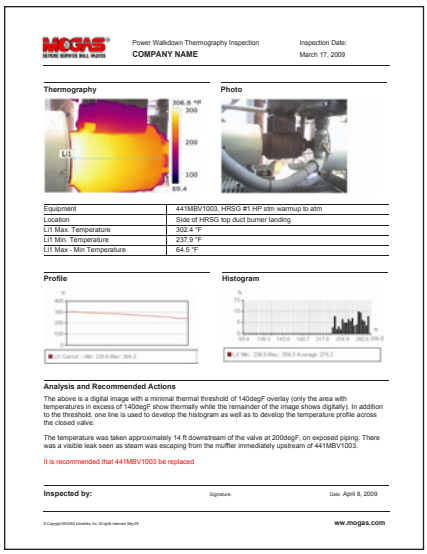
Unit Walk Down Report

Plant:
Unit: 1
Date: 12-08-2004

Tag#:	App:	Location	Conditions (PSI)	Conditions (F)	Current Valve Type:	Current Valve	Current Valve	Current Valve Operator:	Pipe Matl:	Pipe (in)	Readings (F) 1	2	3	4
001	Main Steam	2nd floor, below the Turbine/ Main Steam Line	2400	1000	"Y" Globe	1.50	2500	Electric (3 phase 220 volt)	P22	1.39	800			
Recommendation: Replace		Estimated Cost:		Possible Replacement:										
010	Hot Reheat	2nd floor, below the Turbine/ Upper Righthand Inlet Pipe Drain	650	1000	"Y" Globe	1.50	1500	FCCW Pneumatic (with open & closed limit switches and solenoid)	P22	1.50	100			
Recommendation: None		Estimated Cost:		Possible Replacement:										
012	Hot Reheat	2nd floor, below the Turbine/ Righthand Hot Reheat Drain at CRV	650	1000	"Y" Globe	1.50	1500	FCCW Pneumatic (with open & closed limit switches and solenoid)	P22	1.50	458			
Recommendation: Replace		Estimated Cost:		Possible Replacement:										
013	Hot Reheat	2nd floor, below the Turbine/ Lefthand Hot Reheat Drain at CRV	650	1000	"Y" Globe	1.50	1500	FCCW Pneumatic (with open & closed limit switches and solenoid)	P22	1.50	100			
Recommendation: None		Estimated Cost:		Possible Replacement:										
014	Hot Reheat	2nd floor, below the Turbine/ IP Outer Cylinder Drain	650	1000	"Y" Globe	1.50	1500	FCCW Pneumatic (with open & closed limit switches and solenoid)	P22	1.50	240			

Power Walkdown Thermography Report

- **Infrared thermography** provides a visual reference and detects valve temperatures within a predicted range along the bore path.
- The **maximum and minimum temperature** along the bore path is displayed as data in a table—the difference is calculated.
- A **temperature profile** and **histogram** are also calculated to better show the heat distribution along bore path.
- After our temperature readings and visual inspections, we analyze the effectiveness of your valves and **recommend actions** accordingly.



MOGAS SEVERE SERVICE BALL VALVES

Power Walkdown Thermography Inspection
COMPANY NAME

Inspection Date:
March 17, 2009

Thermography

Photo

Equipment	441MBV1003, HRSG #1 HP stm warmup to atm
Location	Side of HRSG top duct burner landing
LIt Max. Temperature	302.4 °F
LIt Min. Temperature	237.9 °F
LIt Max - Min Temperature	64.5 °F

Profile

Histogram

Analysis and Recommended Actions

The above is a digital image with a minimal thermal threshold of 140degF overlay (only the area with temperatures in excess of 140degF show thermally while the remainder of the image shows digitally). In addition to the threshold, one line is used to develop the histogram as well as to develop the temperature profile across the closed valve.

The temperature was taken approximately 14 ft downstream of the valve at 200degF, on exposed piping. There was a visible leak seen as steam was escaping from the muffler immediately upstream of 441MBV1003.

It is recommended that 441MBV1003 be replaced

Inspected by:

Signature:

Date: April 8, 2009

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MOGAS® SEVERE SERVICE BALL VALVES

Predictive Maintenance Inspection

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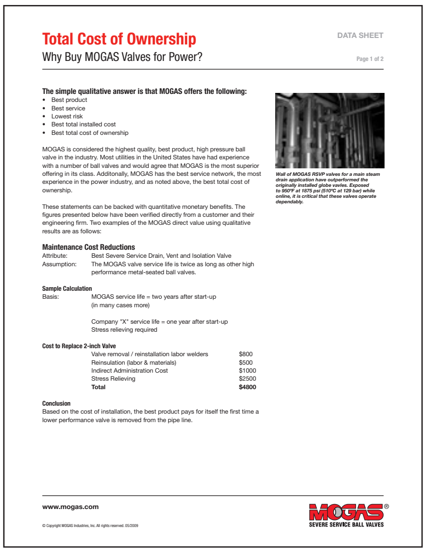
Benefiting from the Total Cost of Ownership

A MOGAS severe service ball valve is considered the highest quality, best product in its class, with the **lowest** total cost of ownership. The MOGAS valve service life is often more than **twice as long** as other high-performance, metal-seated ball valves. Not only will your plant benefit by **reduced valve maintenance** costs, but also by **reduced operational costs**. The MOGAS valve will provide a tighter shutoff, maintaining a higher heat rate and demonstrating a better overall plant thermal performance.



Total Cost of Ownership

Why Buy MOGAS Valves for Power?

DATA SHEET

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The simple qualitative answer is that MOGAS offers the following:

- Best product
- Best service
- Lowest risk
- Best total installed cost
- Best total cost of ownership

MOGAS is considered the highest quality, best product, high pressure ball valve in the industry. Most utilities in the United States have had experience with a number of ball valves and would agree that MOGAS is the most superior offering in its class. Additonally, MOGAS has the best service network, the most experience in the power industry, and as noted above, the best total cost of ownership.

Wall of MOGAS RSVP valves for a main steam drain application have outperformed the originally installed globe vavles. Exposed to 950ºF at 1875 psi (510ºC at 129 bar) while online, it is critical that these valves operate dependably.

These statements can be backed with quantitative monetary benefits. The figures presented below have been verified directly from a customer and their engineering firm. Two examples of the MOGAS direct value using qualitative results are as follows:

Maintenance Cost Reductions

Attribute: Best Severe Service Drain, Vent and Isolation Valve

Assumption: The MOGAS valve service life is twice as long as other high performance metal-seated ball valves.

Sample Calculation

Basis: MOGAS service life = two years after start-up (in many cases more)

Company "X" service life = one year after start-up
Stress relieving required

Cost to Replace 2-inch Valve

Valve removal / reinstallation labor welders	$800
Reinsulation (labor & materials)	$500
Indirect Administration Cost	$1000
Stress Relieving	$2500
Total	**$4800**

Conclusion

Based on the cost of installation, the best product pays for itself the first time a lower performance valve is removed from the pipe line.

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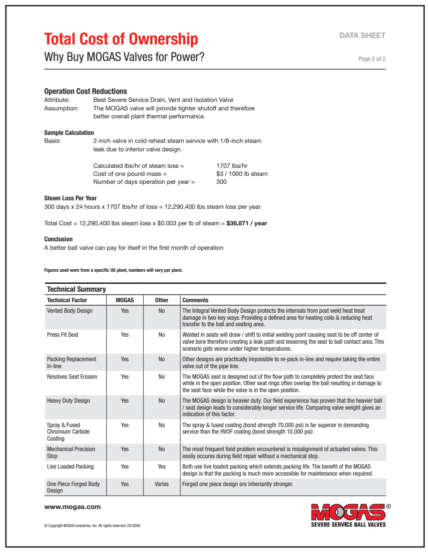
SEVERE SERVICE BALL VALVES



Total Cost of Ownership

Why Buy MOGAS Valves for Power?

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Operation Cost Reductions

Attribute: Best Severe Service Drain, Vent and Isolation Valve

Assumption: The MOGAS valve will provide tighter shutoff and therefore better overall plant thermal performance.

Sample Calculation

Basis: 2-inch valve in cold reheat steam service with 1/8-inch steam leak due to inferior valve design.

Calculated lbs/hr of steam loss =	1707 lbs/hr
Cost of one pound mass =	$3 / 1000 lb steam
Number of days operation per year =	300

Steam Loss Per Year

300 days x 24 hours x 1707 lbs/hr of loss = 12,290,400 lbs steam loss per year

Total Cost = 12,290,400 lbs steam loss x $0.003 per lb of steam = **$36,871 / year**

Conclusion

A better ball valve can pay for itself in the first month of operation

Figures used were from a specific US plant, numbers will vary per plant.

Technical Summary

Technical Factor	MOGAS	Other	Comments
Vented Body Design	Yes	No	The Integral Vented Body Design protects the internals from post weld heat treat damage in two key ways. Providing a defined area for heating coils & reducing heat transfer to the ball and seating area.
Press Fit Seat	Yes	No	Welded in seats will draw / shift to initial welding point causing seat to be off center of valve bore therefore creating a leak path and lessening the seat to ball contact area. This scenario gets worse under higher temperatures.
Packing Replacement In-line	Yes	No	Other designs are practically impossible to re-pack in-line and require taking the entire valve out of the pipe line.
Resolves Seat Erosion	Yes	No	The MOGAS seat is designed out of the flow path to completely protect the seat face while in the open position. Other seat rings often overlap the ball resulting in damage to the seat face while the valve is in the open position.
Heavy Duty Design	Yes	No	The MOGAS design is heavier duty. Our field experience has proven that the heavier ball / seat design leads to considerably longer service life. Comparing valve weight gives an indication of this factor.
Spray & Fused Chromium Carbide Coating	Yes	No	The spray & fused coating (bond strength 70,000 psi) is far superior in demanding service than the HVOF coating (bond strength 10,000 psi)
Mechanical Precision Stop	Yes	No	The most frequent field problem encountered is misalignment of actuated valves. This easily occures during field repair without a mechanical stop.
Live Loaded Packing	Yes	Yes	Both use live loaded packing which extends packing life. The benefit of the MOGAS design is that the packing is much more accessible for maintenance when required.
One Piece Forged Body Design	Yes	Varies	Forged one piece design are inheriantly stronger.

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SEVERE SERVICE BALL VALVES

For example: *A single valve in a cold reheat steam service with a 2-inch (50 mm) orifice and an 1/8-inch (3 mm) leak can release more than 1700 lb/hr (774 kg/hr) of steam. That could amount to a whopping $36,800 loss per year. Replacement of this single, inefficient valve would pay for itself within months.*

For full details, see our data sheet, ***Total Cost of Ownership****, at www.mogas.com*

MOGAS — Meeting Tomorrow's Challenges Today

MOGAS is known for partnering with its customers to meet the ever-increasing challenges of severe-service applications. And, we run every aspect of our company the same way we build our valves — with an unwavering commitment to quality and integrity.

SEVERE SERVICE BALL VALVES