

# Face to Face

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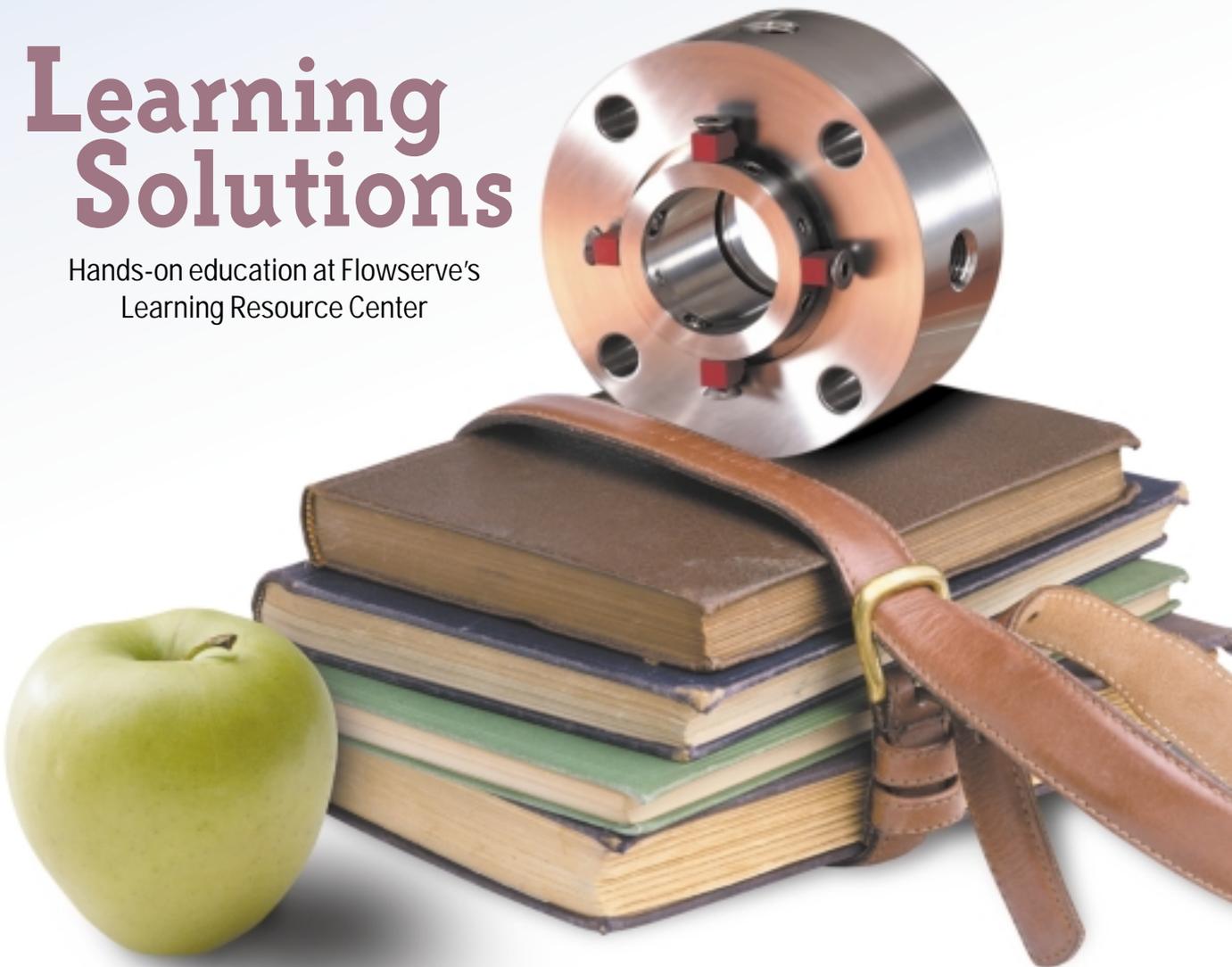
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## Learning Solutions

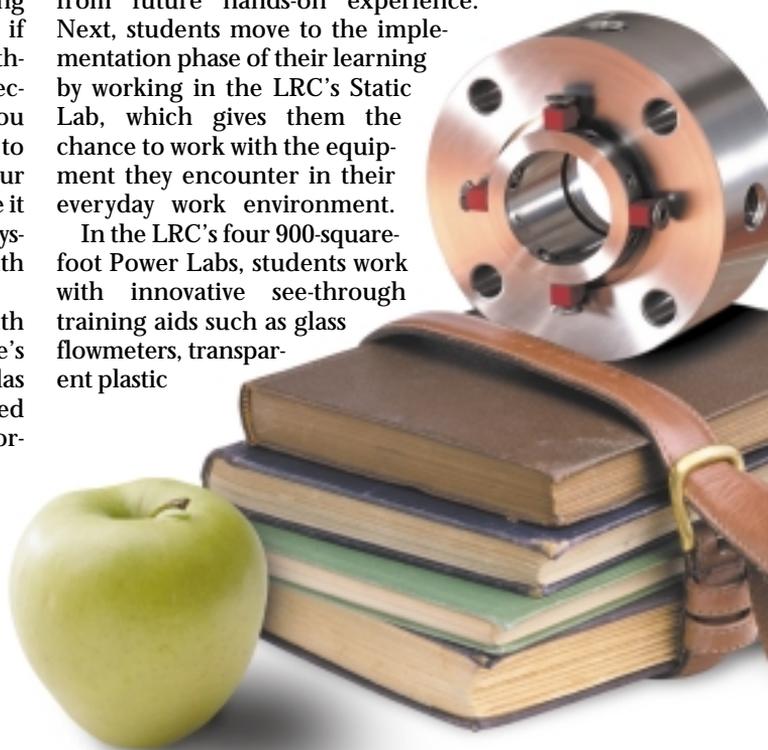
Hands-on education at Flowserve's Learning Resource Center



**A**re nagging maintenance problems in one of your plant's pumping systems causing costly failures and wreaking havoc on your organization's profits? What if you could tear apart an identical system—without affecting your plant's uptime—and effectively diagnose the problem? Or, perhaps you have an idea about how you might be able to improve the functionality and efficiency of your facility's fluid management system, but realize it would be financially impractical to take your system offline and foolhardy to experiment with the system's components.

Created to provide plant professionals with real solutions to these critical issues, Flowserve's Learning Resource Center (LRC) in the Dallas suburb of Irving provides an education-based program that gives students a hands-on opportunity to test their knowledge.

# Learning Solutions



classroom instruction that introduces theory and references needed to get the most from future hands-on experience.

Next, students move to the implementation phase of their learning by working in the LRC's Static Lab, which gives them the chance to work with the equipment they encounter in their everyday work environment.

In the LRC's four 900-square-foot Power Labs, students work with innovative see-through training aids such as glass flowmeters, transparent plastic

## Hands-on education at Flowserve's Learning Resource Center can improve your plant's competitive edge

"Our goal is to provide these users with the knowledge and skills for them to effect better, longer performance and improved maintenance in their own organizations, resulting in full value from their equipment," according to Gary Mendles, Director of Educational Services at Flowserve.

Putting instruction and theory into action, students move from the facility's classroom to its state-of-the-art labs where they can study, test, disassemble and reassemble more than 50 static pumps and 28 operating pumps that simulate the actual working conditions of today's chemical and processing plants, pipelines and oil refineries.

### Unique learning model

The LRC provides an uncommon third educational experience—experimentation. By testing their theories, participants validate past learning and discover what can't be taught in a classroom alone. The LRC's unique three-tiered adult learning model is implemented in three distinct facility areas: the classrooms, the Static Lab and the Power Lab.

First, students find out the "why" through

suction lines, extensive gauges, thermocouples, vibration monitoring equipment and unique clear acrylic pumps that allow students to look into the working mechanisms of the equipment.

What really closes the loop to complete this learning experience is the experimental or discovery phase. These hands-on experiments give participants the answers to "what if" scenarios. Mendles says, "During discovery, students recognize they have the skills to do what they want or need to do back home. The opportunity to experiment and change the flow characteristics of these pumping applications allows the students to see what will really happen if they put their solution ideas into action."

Shawn Bassiri, Process Area Specialist at DuPont's La Port, Texas facility, has sent many employees through the program. "It's a tremendous facility," Bassiri says, "because the programs provide an overview of the principles of pumps and hydraulics, and show participants how seals really work. They start at the basics and then go into more advanced applications. The LRC's clear epoxy casings on the pumps allow students to see exactly what happens when they experiment with the seals—for example, they are able

to see the immediate effects from temperature changes as well as the effects on the resultant life of the seals.”

### Interactive training

Flowserve also takes training to the next level through its Educational Services Certified Training program, an interactive competence-based equipment-intensive certification program for engineers and specialists. Students are certified on the standards required by OSHA that meet a specified body of knowledge in areas such as pump assembly and disassembly, proper mechanical seal installation, calibration and repair and control valve position.

The program’s goal, according to Lee E. Christensen, Ph.D. and Flowserve’s Education Organizational Development Specialist, is to develop the program’s participants in two ways:

through quantifiable knowledge attainment and skill improvement. Certification includes complete documentation of a student’s skill level. “In the end, we are certifying that skills have been attained and the student is able to perform certain competencies,” Christensen said. “The value of the training for the customer’s organization

is measured in behavioral changes the student is able to demonstrate on the job.”

Students return home to their plant, examine their equipment, evaluate their procedures, develop an improvement strategy and prepare a reliability self-audit.

Christensen notes that “many of the students are maintenance engineers or operators who have dealt with the product, but were not involved with the product’s original selection. When they go back to their organization, they are equipped to better understand the installed



The classroom sessions form the basis for understanding in the laboratories.

base by going through the questions and becoming familiar with their own situation. In terms of reliability, they can look at worst performance over time, do a case study, identify commonalities of failure, and make corrections that improve their system’s reliability.

“For sustainability, we seek to establish a long-term learning alliance so we can provide skill improvement and continue to validate that the skill improvement actually benefits the customer in a way that meets their expectations,” notes Christiansen.

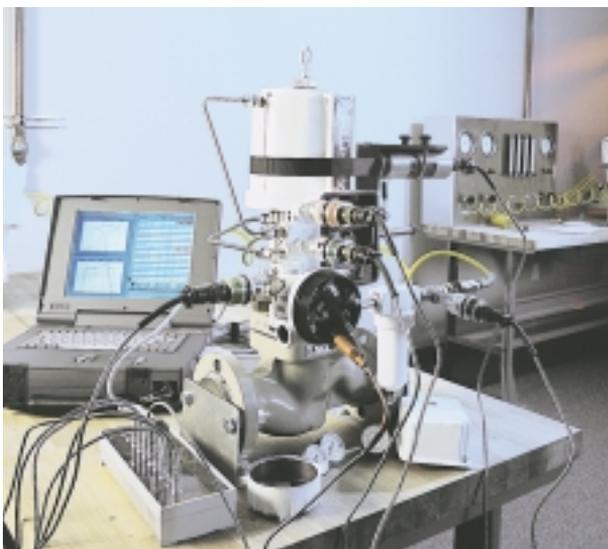
### Positive ROI

Mendles puts this learning in a customer’s perspective. “Students return with the skills to increase their company’s competitive position, he says. “If a student comes to the LRC, identifies a glitch in his system back at home, and implements a response to correct the problem, that avoidance of failure provides the customer with a positive return on investment.”

Bassiri agrees. “Because pump seals are a major portion of a plant’s maintenance budget, the potential for savings in this area is significant. Avoiding seal problems frees up labor, improves up time, and eliminates contamination on the path, which has environmental ramifications.”

But for Bassiri and DuPont, the real payoff comes through a more focused eye on the future. “Eliminating seal problems frees human resources to address long-term strategies and moves the organization away from working in a reactionary mode,” he said. “And in order to make a quantum leap, you need to first be standing on solid ground.”

*For more information about the programs at Flowserve’s Learning Resource Center, send an e-mail inquiry to [ESG@flowserve.com](mailto:ESG@flowserve.com) or through the company’s Web site at [www.flowserve.com](http://www.flowserve.com). Flowserve’s Educational Services Group also can be reached at 800/446-0401. \**



Students learn all aspects of the instrumented equipment.

# When the pressure is on, use a single-stage seal

This is the secret to record-setting performance

**W**hen a processing facility in Ohio needed a new high-pressure compressor, Sundyne Compressors, a division of Sundyne Corporation, Arvada, Colo. and a Hamilton Sundstrand United Technologies subsidiary, was the supplier of choice. The design criteria for the unit dictated gas seals and an operating pressure in excess of 4,000 psi. In this pressure regime, the standard approach to shaft sealing is a multi-stage seal. The customer had a one-year lead-time for the project.

Since Flowserve is the leader in high-pressure seal technology, and since Sundyne is a Flowserve alliance partner, this project was an ideal opportunity for both parties to display technical superiority. Flowserve proposed a single-stage seal, a concept unheard of in the high-pressure industry.

The customer was not so optimistic but was willing to take only a very small risk. Darren Meyer, Compressor Seals Specialist at FSD in Carson, Calif., said, "Because the single-stage technology was unproven, the customer specified a compressor seal chamber that was large enough to accommodate the standard multi-stage pressure drop design, a strategy that offered a fall-back position should Flowserve not be able to perform as it claimed it could." Then, the customer also ordered a standard, triple-stage seal from another source.

## Technical problems

During operation, only a thin layer of gas separates the seal faces. As process gas is pressurized, its temperature rises. Depending on the compression ratio, the temperature rise can be hundreds of degrees.

At higher density, there is a greater weight of gas per unit volume. Since the heat of compression is a function of the weight of gas, the heating phenomenon is even more pronounced.

When operating at steady state conditions, the seal assembly achieves thermal equilibrium at an elevated temperature. However, there is a physical limit to the temperatures to which seal components can be subjected. The soft components and secondary gaskets can fail by melting or charring. There is also the risk that the metallic components may warp. Should either of these occur while the compressor is turning at nearly 17,000 rpm, the results will be predictably catastrophic.

## Designing for the "in service" conditions

The seal faces remain flat and perfectly parallel at operating conditions. Flowserve used finite element analysis to predict the deformation that would occur. This meant that, at room temperature, the seal faces are still flat but—without pressure and thermal stresses—no longer parallel. Rather, the faces form a V-shaped valley with no contact between them.

## Record-setting seal

The seal was designed, developed, manufactured and tested by the Flowserve facility in Dortmund, Germany. This type of design program normally requires three to four months for testing. When the manufacturing wrinkles were ironed out, there remained only one month for testing. According to Meyer, "The testing went so well that the new seal design proved itself capable of operating at these high pressures during the very first test cycle."

Other customers had expressed a need for single-stage seals that could operate at even greater pressure differentials. As part of the testing program, Flowserve successfully operated the new seal at pressures as high as 5,800 psi.

This is a typical bi-directional, hard-on-hard seal configuration. There is nothing magical about the design. Flowserve relies on high-level knowledge of seal design, which allows it to stay a step ahead of the competition. ✱

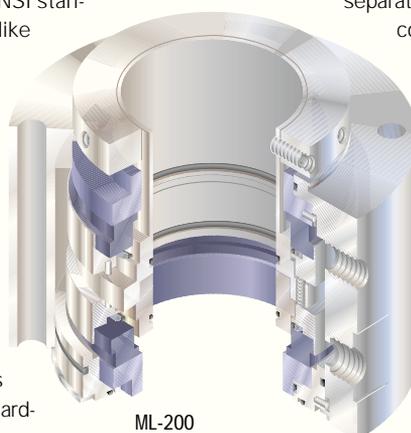


## Foreign agitators are no threat to Flowserve

### A new “three-in-one” concept infiltrates the European and Asian markets for double mechanical seals

In Europe, double mechanical seals conform to the requirements of Deutsches Institut für Normung (DIN). This is the German national standards organization that cooperates with the International Organization for Standardization (ISO) in the development of international standards. In Europe, and especially Germany, the DIN standards serve a function similar to that of the ANSI standards in the United States. Here, products that conform to the ANSI standards have become almost like commodity products. The situation is different overseas.

Original equipment manufacturers in Europe produce high-quality processing equipment, such as mixers and agitated vessels, for sale worldwide. Each mixer is custom-engineered and fabricated with components that conform to DIN standards. But, conforming to DIN standards does not imply dimensional standardization, as it does here.



ML-200

#### Vessel design

There are three places an agitator can be installed on a vessel. The top-mounted agitator accounts for an estimated 90 percent of the installed base. In this configuration, the seal typically resists only the vapors in the free-board volume of the vessel. When installed on the bottom of a vessel, the agitator seal must keep the process liquid contained. Finally, for the agitator mounted in the sidewall of a vessel, the seal holds back vapor or liquid, depending on the depth of the contained fluid. There are three seal types that can be used on agitators:

- Wet seals (MW-200).
- Dry contacting seals (MD-200).
- Dry non-contacting seals (ML-200).

According to Tom Bennett, Manager of Marketing at Flowserve, Flow Solutions Division in Kalamazoo, Mich., German equipment designers and specifiers historically prefer liquid-lubricated seals.

A wet seal in a top-mounted mixer holds back vapors because the pressure applied to the barrier fluid inside the seal exceeds the pressure in the vessel. The pres-

surized barrier fluid can migrate across the seal face and weep on the inside of the vessel. Designers use a sanitary gland or a debris well to capture such leakage. It can also be drained periodically using suitable piping and valves.

Dry, non-contacting seals on bottom-mounted agitators present a different problem. A process upset can force process fluid between the seal faces. No longer separated by a thin layer of gas, the seal faces come into contact with each other, thus compromising the primary seal. The outboard seal is now the primary defense against leakage until the seal cartridge is repaired.

Side-mounted agitators use either dry contacting or wet seals. Dry running seals use pressurized dry nitrogen, although some processes and applications need humidified nitrogen to maximize seal life. The faces in a dry contacting seal are generally fabricated of carbon and a preferred hard face. Since the faces physically touch each other in service, wear always produces some minute level of fine carbon particulates.

Some industries, such as pharmaceuticals, cannot tolerate any level of contamination. If carbon dust is unacceptable, the best option is a gas, non-contacting seal.

#### Retrofitting

Although German designers prefer wet seals, end users may find it necessary to use other styles. Even some European OEMs are slowly migrating to dry, non-contacting seals. Nevertheless, like every mechanical component, sooner or later a seal needs to be replaced. Unlike here, retrofitting a DIN-based agitator seal requires physical measurements of the old unit before a new unit can be selected.

Flowserve is the only supplier offering the three styles of seal that can be installed in the same cartridge housing. Users of DIN standard seals now can change seal types without having to modify the agitator or vessel. The Flowserve Series M DIN standard seals are currently available in sizes from 40 to 220 mm and will be formally introduced atACHEMA in May, 2000.

## There is another winner in the Flowserve family

### Taking customer service to new levels of excellence

**A**ir Products and Chemicals, Inc., Lehigh Valley, Pa., has recognized FSD Baton Rouge as a "Supplier of the Year." The award acknowledges the outstanding performance and service Flowserve provides in Air Products' St. Gabriel and Giesmar plants where Air Products manufactures amines and DNT.

Flowserve provides the mechanical seals on which the customer relies. Mike Reagan, Sales Engineer in the Baton Rouge office, visits each of these plants sometimes twice a week. During the visits, Reagan does whatever it takes to extend the life of seals, including performing seal failure analysis, inspecting pumps and making sure the correct seal support system is being used. Mike's objective is to make sure Flowserve seals last longer. He also tries to minimize the possibility of human error. As Reagan puts it, "This is consultative selling. You must support the product. You must apply it properly. You can't just throw it in."

When Reagan started servicing the account, Air Products had been using a mixture of non-cartridge-style mechanical seals.

When a seal needed to be replaced, the maintenance technician had to piece together individual parts. Seeing an opportunity to further his mission, Mike initiated a cartridge seal program, a move that eliminated at least 40 stock items, which simplified the maintenance inventory. Now, Air Products purchases and tracks only about a dozen part numbers that cover the entire range of seals being used at each plant.

In another winning move, Mike arranged for his customer to purchase the cartridge seals on consignment. Although the standby seals reside in the Air Products maintenance storeroom, the customer does not pay for them until they use them. Previously, Air Products maintained an inventory of no less than \$60,000-worth of parts for mechanical seals. Now, inventory levels are

somewhere between \$6,000 and \$8,000.

No one can foresee all the fluid handling components that will be needed over the course of a year. However, when special goods or services are required, it generally takes Reagan only about a week to arrange and complete needed repairs or to ship custom orders.

### Another source of cool profit

The cooling tower at the Giesmer plant has three cooling water pumps. These are large pumps whose shafts had originally been sealed with packing. Even with diligent attention and maintenance, the packing still leaked excessively.

A cooling water system is a closed system—the treated water recirculates continuously. The treatment chemicals were costing about \$5,000 a month, and that means money was dribbling out of every leaking shaft packing. Reagan found that it was possible to retrofit the pumps with mechanical seals without modifying the pumps. The seals halted the leakage immediately and Air Products found that the payback period was less than three months.



Pictured left to right:  
Purchasing Agent Roweena Chauvin;  
Mike Reagan: FSD;  
Mark Willard: Maintenance Manager.

### The votes are in

In managing its suppliers, Air Products tracks every relevant aspect of vendor performance. For example, Air Products monitors such factors as the undamaged delivery of the correct quantity, and quality of the correct items on the agreed date for the agreed price.

Not surprising, Air Products expects perfection from its suppliers, and Mike Reagan delivers it. Every month if a vendor flawlessly does what it promised, Air Products sends the supplier a letter announcing a 100-percent performance rating for the month. Quite simply, Mike Reagan and FSD Baton Rouge collected too many of these letters to go unnoticed. Hence, the formal recognition as "Supplier of the Year." ✨

# Presenting... Flowserve's GX-200 Gas Barrier Seal

The GX-200 combines an exclusive non-contacting seal face geometry and a reliable metal bellows design for zero emissions, increased energy savings, reliability and extended operation.

The GX-200's pressurized dual seal configuration makes it ideal for chemical processing, hydrocarbon processing, pulp and paper, pharmaceutical and food processing industry applications.

## Features/benefits...

- Advanced Pattern Groove System seal face pattern contains special shallow grooves to furnish both hydrostatic and hydrodynamic lift to the seal faces, reducing energy consumption during pump start-up and operation.
- Provides zero product emissions performance, even under off-design or dry-running conditions.
- Eliminates the cost of maintaining a liquid barrier system and eliminates contamination of the process by barrier fluid.
- Cartridge design and clean gas supply system make it easy to install and maintain.

## Operating parameters...

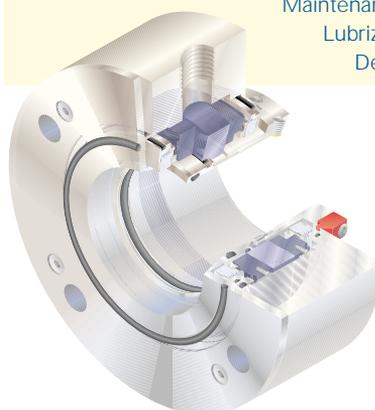
Temperature: -40 to 500° F (-40 to 260° C)  
 Product pressure: Full vacuum to 200 psig (14 bar)  
 Shaft speed: 500 to 7,000 fpm (2.5 to 35 m/s)  
 Sizes: 1.000 to 2.75 in. (25 to 75 mm)  
 Equipment: DIN, ISO and ANSI pumps with any seal chamber size; ANSI pumps with expellers; industrial fans and blowers

"We experienced four failures in one year due to dry-running the pump, off-design operation of the pump and polymerization of the process fluid around the seal, especially when particulates got stuck between the seal faces. More than one year after installing the GX-200, we have not had a single failure.

—Dominique Moreau  
 Mechanical Engineer  
 Rohm & Haas Bayport, Inc.  
 Pasadena, Texas

"We've been using gas seals for pumps located at the bottom of glass lined reactors. Single seals failed due to dry-running the pump and double seals failed because a derivative of the process fluid would heat up, causing free sulfur to precipitate out and plug up the seal. We've had the GX-200 gas barrier seal in place on eight pumps for more than a year with no problems.

—Al Lide  
 Maintenance Supervisor  
 Lubrizol Corporation  
 Deer Park, Texas



## GX-200 Field Installations

End User	Seal Type	Process Fluid	Equipment	Temperature	Speed
Lubrizol Deer Park, Texas	1.875" GX-200	Sulfurmonochloride, Isobutyl Alcohol	Durco Mk 2 Grp 2 Vertical Pump	120° F	1,750 RPM
Rohm & Haas Bayport, Inc. Pasadena, Texas	1.375" GX-200 BM 366794	Methyl Methacrylate	Goulds 3996 ST Vertical Pump	120° F	3,500 RPM
Rohm & Haas Texas, Inc. Deer Park, Texas	1.250" GX-200 BM 372205	Mix of harsh chemicals (26% sulfuric acid)	Union VCM Vertical Pump (modified)	212° F	3,500 RPM