

# Simple Technology Worth Its Weight in Refined Precious Metals

AIR-OPERATED DOUBLE-DIAPHRAGM PUMPS HOLD THEIR OWN AGAINST ABRASIVE AND CORROSIVE FLUIDS



Scott Schmidt, president of Catalyst Refiners' catalyst operations, next to an all-new All-Flo air-operated double-diaphragm pump. Catalyst Refiners' silver-based catalyst recycling operations are powered throughout the facility by diaphragm pumps.

## Introduction

For more than a decade, All-Flo Pump Co. of Grand Terrace, California, has produced air-operated double-diaphragm (AODD) pumps that improve the flow of productivity in the Institute, West Virginia, facility of Catalyst Refiners, Inc. The company, a wholly-owned subsidiary of Ames Goldsmith Corp., is a leading recycler of silver-based catalyst used to produce ethylene glycol, a key raw material in industrial chemical production.

AODD pumps provide cost-effective and reliable service to industries for a wide range of fluid handling applications—even those involving abrasive slurries and harsh chemicals. All-Flo AODD Pumps have proven especially effective in precious metal refining operations, which involve chemicals such as nitric acid.

Catalyst Refiners serves major ethylene oxide catalyst producers. In addition to processing standard ethylene oxide catalysts, Catalyst Refiners recovers silver from both distressed and wet catalyst, with a high level of efficiency. The company has developed innovative product outlets for the final stripped substrates, keeping all residual carrier from landfills. Scott Schmidt, president of Catalyst Refiners' catalyst operations, has been overseeing the West Virginia facility since July 1999, just a few months after it began operation. He moved there from

the company's home office in Glens Falls, New York. The company also has operations in Taiwan.

It didn't take long for Schmidt to discover that Catalyst's existing pumps—used to move chemicals and slurries in the refining process—were difficult to maintain and repair. They caused frequent interruptions in production. In 2000, he began searching for recommendations for replacement pumps that would provide more reliable service and would be easier and less expensive to repair.

Catalyst tested five recommended brands of AODD pumps before choosing All-Flo. Schmidt said All-Flo AODD Pumps won for superior performance, ease of use, and cost of maintenance and repair.

## Finding Solutions

Schmidt has since come to appreciate not only the design, quality, and technical features of the AODD pumps but also the pump manufacturer's commitment to solving customers' problems. For example, the stainless steel ball seats of Catalyst's stainless steel AODD pumps wore faster than anticipated, decreasing the pumps' effectiveness. They were being worn by the abrasive silver particles in the solutions and slurries pumped through the plant.

Schmidt inquired whether the worn stainless steel ball seats could be replaced with seats made of Kynar® PVDF (polyvinylidene difluoride)—a highly resistant thermoplastic used in some All-Flo pumps. The representative took the suggestion to All-Flo engineers and they quickly came through with PVDF replacements. "Their customer service is top-notch," Schmidt said.

Except for one electric pump, Catalyst Refiners' West Virginia plant uses only All-Flo AODD pumps—about fifty. The Glens Falls plant uses seventy-five to eighty All-Flo pumps. Catalyst uses 1-, 1½-, and 2-inch stainless steel pumps and ¼-, 1-, and 2-inch plastic pumps to handle a variety of jobs and chemical compatibility issues.

## Air-Operated Double-Diaphragm Pump Advantages

### Simple Design Means Reliable Operation

The air section, or engine, of the AODD pumps consists of very few moving parts – the fewest of any pump on the

market. With fewer moving parts, the pumps are less at risk of break down and more likely to provide uninterrupted service.

### Ease of Maintenance and Operation

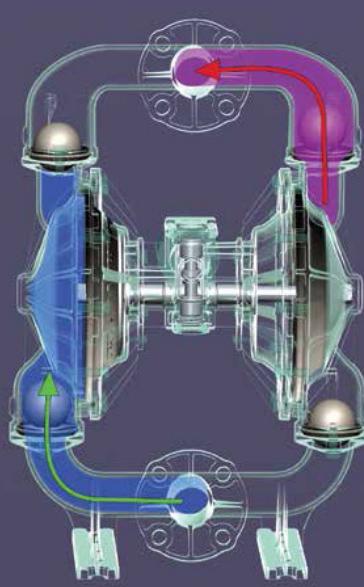
Because they have fewer parts, the pumps are easier to maintain and repair. The process of tearing down, cleaning and reassembling the pumps takes just 45 minutes, a significant time savings from the previous pumps. That's important for the facility, which has been operating 24/7 for the past two years and which completed a \$1.6 million expansion in 2011 to meet the increased demand of a long-term catalyst refining contract.

As the pumps are powered by air pressure, they can be deadheaded without pump damage, unlike an electric centrifugal pump—a convenience that operators appreciate.

### Cost-Effective Materials

The Santoprene® diaphragms and balls of the All-Flo pumps Schmidt selected cost 75 percent less than those of the previous pumps that Catalyst used. Santoprene® performs well in a wide temperature range and offers excellent chemical resistance.

## The Air-Operated Double-Diaphragm Pump At Work



Simplicity is the hallmark of AODD pumps. They operate on the principle of positive displacement, using two diaphragms and two chambers with a common fluid inlet and outlet. The diaphragms, connected by a common rod, move back and forth in unison.

Powering the pump action, compressed air is directed through the air inlet. An air spool, one of the few moving parts in the mechanism, alternately directs the air flow behind each diaphragm, moving them back and forth.

On the suction stroke of one diaphragm, the lower ball valve of its chamber opens, while the top valve of the chamber closes. This action allows fluid to enter and fill the chamber through the open valve.

Then the air spool directs the flow of compressed air behind the other diaphragm, opening the top ball valve and closing the bottom ball valve, forcing the fluid out of the chamber through the outlet and on to the fluid's destination.

This same process occurs in the opposite chamber of the pump—and the cycle repeats until the air flow is stopped.

## Greater Efficiency

According to Schmidt, Catalyst's new fleet of pumps outperform the average AODD pump, using substantially less air. Schmidt estimates that a 2-inch All-Flo AODD pump moves 20 to 30 percent more liquid per amount of energy used. This reduces electricity costs, while allowing Catalyst to recycle more silver in less time.

## Leak-Reducing Design

The pumps' flange mountings minimize leakage—a critical feature when it comes to handling fluids that contain expensive precious metals like silver.

## Performance

Catalyst's pumps move a variety of slurries. In one case, a pump moves slurry containing 50 percent suspended solids through a 1.5-inch (3.8-centimeter) hose and up 11 feet (3.4 meter) into a 5000-gallon (roughly 19,000-liter) sludge accumulation tank. "That's a lot to ask from a pump," Schmidt said. He added that Catalyst also uses pumps to move a thick 50 percent solution of sodium hydroxide that is used in the recycling process. The pumps move can also move a silver nitrate solution with a specific gravity of 1.4, 125 feet (38 meters) across the plant floor into a holding tank. "That's far and above the specifications of the product," he said. Catalyst uses pumps to handle other chemicals in its processes, including 20 to 25 percent concentrations of nitric acid.

## New Pump Design

Catalyst is now beginning to move All-Flo 2-inch AODD pump design into its operations. The new model operates with about 7 pounds per square inch less air pressure, helping Catalyst take some of the strain off its compressors while pumping more gallons per minute. The new pump also delivers greater suction lift.

Other advantages include:

- Dimensions equivalent to other common diaphragm pump designs, allowing easy installation and interchange from other pumps. This reduces installation cost and eliminates the need for re-plumbing.
- Lower power consumption due to a high-efficiency, straight-line exhaust system
- Wide temperature operating range, from -40 to 212 degrees Fahrenheit (-40 to 100 degrees Celsius)

- Design that accommodates large suspended solids
- All-bolted construction that increases the ease of maintenance

## Spreading The Word

Other precious metal refiners have come to rely on All-Flo pumps, says Matt Kolb, sales engineer for Chesapeake Systems, LLC of Hanover, Maryland, a pump equipment distributor.

When one of Kolb's customers, a precious metal refiner located in Maryland, started experiencing problems with their current set of air-operated diaphragm pumps, they introduced All-Flo pumps into their operation.

One of the company's greatest challenges was that its existing pumps frequently stalled, interrupting refining processes. In addition to losing valuable production time, the refiner faced an even greater economic threat—potential loss of the precious metals it reclaims and refines for its industrial customers. Due to their rarity and demand in the marketplace, these metals command a high price. The loss of small quantities due to a malfunctioning pump or other processing problem is costly.

The All-Flo pumps have nearly eliminated the company's problem with air stalls. Due to their simplicity of design, the pumps have enabled the refiner to cut maintenance time and disruptions in service in half. Over the past two years, the precious metal refiner has gradually replaced all of its existing pumps—about one hundred in all. In addition, as the company has expanded, it has purchased only All-Flo pumps for its new processing systems.

Serving global markets, the refiner supplies precious metal-based chemicals and refines rhenium, ruthenium, silver, palladium, gold and other precious metals. Over the past three to four years, the company has experienced substantial growth, developing an infrastructure to handle small and large jobs for a diverse customer base that includes high technology electronics, semiconductor and micro-electro-mechanical systems (MEMS) sectors.

In precious metal refining operations, and other industries, time is money and reliable pumps are worth their weight in silver, gold, even rhenium.



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