Case history

Chemical producer shifts course with automated diverter valves

Conveying line plugging and maintenance costs lead a producer to retire their manual diverter valves.

Melamine Chemicals, Inc., Donaldsonville, La., is the fifth-largest producer of melamine crystals worldwide and one of only two US producers. The producer estimates that it supplies about 50 percent of the domestic melamine market.

Melamine is a white crystalline specialty chemical that looks like a combination of table sugar and flour. Melamine is used in producing paints, wood adhesives, laminates, molded products, polyurethane foam, and other products. The chemical is a plastic resin that helps make products more malleable, fire retardant, or scratch resistant.

At the chemical producer's plant, melamine is produced by reacting liquid urea, a fertilizer high in nitrogen, with ammonia. The resulting slurry is purified by removing byproducts and ammonia. The slurry then goes to a crystallizer, which forms melamine crystals. The crystals are dewatered by a centrifuge and then sent to a hot air dryer. The resulting powder is pneumatically conveyed to four 1.5-million-pound-capacity storage silos.

Pneumatic conveyors can simultaneously transfer melamine from any two silos, through diverter valves, to two packagers or one packager and one filler. The melamine is packaged in 25-kilogram and 50-pound paper bags and in 500- to 4,000-pound FIBCs. The chemical is also shipped in bulk by truck and railcar.

Similar diverging and converging valves cause mixups

In the past, the diverter valves on the pneumatic conveying lines were

Melamine powder is routed from storage to filling and packaging by diverter valves. Ray Duet inspects a vertically mounted, three-way valve.

spread over a wide area and were hand-activated with a 2-foot lever. Switching required one or two operators to identify, locate, and switch valves as needed for each packaging scenario.

Several conveying lines were switched at line-switching stations by disconnecting a flanged hose from one line and connecting it to another. Switching hoses was an arduous, time-consuming task that was prone to spills. Spilled product had to be collected and reprocessed.

Valves needed periodic replacement, which didn't always go smoothly, explains project and maintenance engineer Carl Schroeder. "Diverging and converging valves looked similar in the warehouse, so if a mechanic changed one out in the middle of the night, and he was rushed because the system was down, he could inadvertently grab the wrong one and install it. Product would flow well until someone attempted to divert the flow. Then the backwards-installed valve would choke up. The valve's ball or plug would jam, shutting down the line." Besides these concerns, the diverter valves were extremely expensive to maintain. When a valve failed, rebuilding it cost $8,000.

Another recurrent frustration stemmed from operators diverting product to the wrong destination. Because the conveying system was intricate and diverging and converging valves looked similar, operators sometimes activated the wrong valve and misrouted the product. If the line wasn't feeding an operating filling or packaging system, the line would plug and valves wouldn't operate, requiring line cleanout. Each time a valve jammed, it took several operators to clear the line and switch the valve to another position.

"To clear plugged conveyor lines, operators would jog the air blowers in an effort to avoid breaking the line at the couplings," says Schroeder, "because the line break caused product spillage, which required cleanup and

The chemical producer's conveying system is intricate; in the past, operators could activate the wrong diverter valve and misroute product.

The chemical plant installed many four-, three-, and two-way diverter valves. Carl Schroeder is shown with a horizontally mounted, four-way unit.

reprocessing. The problem with jogging the blower was that occasionally melamine powder blew back into the blower's rotating lobes. This caused an expensive blower repair or replacement because of wear in the lobes' tight tolerances. The damage could happen in a matter of a few hours. If we got a lot of blowback, damage was instantaneous as the lobes jammed up with product."

Diverter valve tested

Over the years, plant engineers tested various valves but were unable to find one that could more efficiently handle their product.

In 1993, frustrated with the system, chief mechanical inspector Ray Duet contacted a local equipment supplier for assistance. "They brought out a two-way Wye Line diverter valve. We disassembled the valve and examined its operating principle," says Duet. The diverter valve uses a sliding blade to provide a positive material and air shutoff, eliminating cross contamination and buildup beyond the closed port.

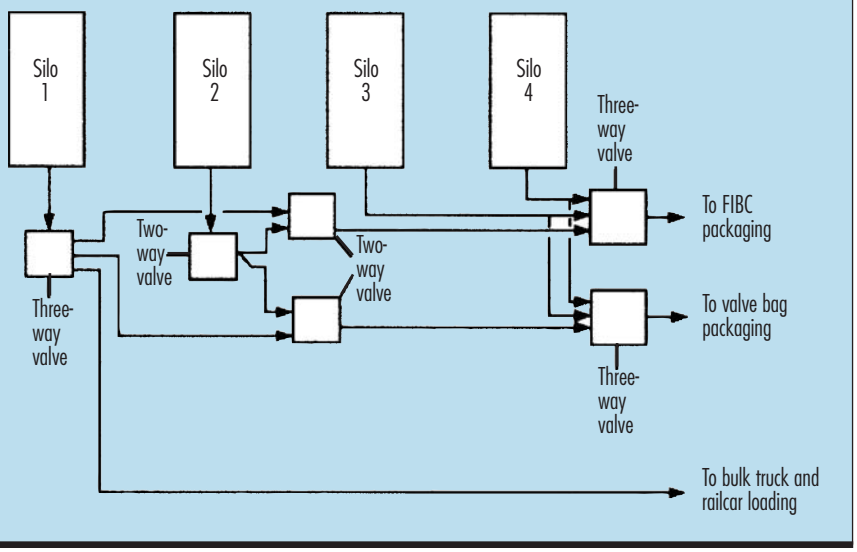
"We bought one of the valves and installed it for selecting between two converging silos' lines that feed a packaging system, [Figure 1] and it worked," Duet says. "This valve isn't sensitive to flow direction, so you can't put one in backwards. The valve can be installed in either a diverging or converging line. All you have to do is turn it around."

"You just decide, 'I want to go from this vessel to that vessel,' touch the screen, and the computer switches the valves."

Plant engineers were satisfied with the valve and liked the fact that purchasing a new one cost 50 to 75 percent less than rebuilding the old type. "So as time went on," Schroeder says, "whenever an application came up where an old valve failed, we replaced it with a Wye Line diverter valve. We did it piecemeal. Between 1993 and 1995 we removed all of the old type and added several four-, three-, and two-way diverter valves throughout the facility. The first valve

Figure 1

Pneumatic transfer to packaging via diverter valves



Henry Vadnais selects a silo and routes product with the accurate, efficient automation system.

was installed over 3 years ago, and it has never choked or failed."

The diverter valve creates negligible pressure drop in the pneumatic conveying system, which conserves power and improves transfer efficiency. Because the valve is used in both diverging and converging applications, the chemical producer can stock fewer spare valves and parts. The valve manufacturer makes ten variations of material handling valves, and Melamine Chemical uses five of them. The chemical producer's valves are activated with a small lever that pneumatically triggers the slide gate, and the valves can be automated by interfacing them with a PLC or computer.

In 1995 the producer modified the conveying system to adopt universally accepted packaging and loading standards. As part of this modification, they replaced the line-switching station connection points with diverter valves.

With valve replacement throughout the plant now complete, the producer automated valve control by interfacing the valves to their computer. An operator can now easily select the desired transfer scenario by mouse or touchscreen control. "It's simple," Schroeder says. "You just decide, 'I want to go from this vessel to that vessel,' touch the screen, and the computer switches the diverter valves; you don't need to be concerned about sending the product to the wrong destination." For protection against line jams or blower damage, the automated system locks out blower air pressure if a valve fails to position properly.

Producer satisfied with results

"The valve's main benefit is that because of its simple operation the system doesn't choke up," Schroeder says. The valve eliminates cross-contamination and blowback plugging problems. The remotely operated system cuts line-switching time from 45 to 2 minutes, and product spillage, cleanup, and reprocessing are eliminated.

"Money is always an important consideration, but I'll spend the money to get something that works. This system works."

Schroeder says the diverter valve has proven to be a low-maintenance item. "A simple visual inspection determines whether shim adjustment is required. And this type of valve doesn't require disassembly to adjust shims."

When deciding to update the conveying system, Schroeder looked at the big picture. "We needed something that worked. Money is always an important consideration, but I'll spend the money to get something that works. This system works. And we don't have the high maintenance costs — in either manpower or parts." Not only is the automated valve installation working for the chemical producer, it's paying for itself as well. Schroeder says the installation has cut operating costs by over $140,000 and maintenance costs by $96,000. **PBE**

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