

Powder and Bulk Engineering

Case History

Flavor producer solves sticky situation with valve

Switching to sanitary disc valves helps powder discharge smoothly and cleanly from a flavor producer's ribbon blenders.

WILD Flavors Inc., based in Erlanger, Ky., is the North American headquarters of the German company, the WILD Group- WILD is one of the largest suppliers of flavors and ingredients for the food and beverage industries worldwide, with facilities and satellite offices in more than 60 countries and a work force of more than 1,700 in production, development, research, and sales. The company produces more than 500,000 metric tons of flavors for several sectors of the food industry, including alcoholic and nonalcoholic beverages, dairy and ice cream, bakery and confectionery, cereals and snacks, and meat and savory foods.

At WILD Flavors, spray-dried ingredients, dry seasoning blends, and various beverage and meat-flavored powders are manufactured in one of two ribbon blenders and discharged to a packaging line. The process begins when raw materials (powders) for a product recipe are distributed to a ribbon blender on one of the mixing lines. A valve is attached to the blender bottom to control the flow of powder past a rare-earth magnet directly under the valve. The rare-earth magnet removes any ferrous metal contaminants in the powder. From the rare-earth magnet, the powder enters a metal detector that identifies any remaining metal contaminants. The powder then flows into a vibratory screener that removes lumps to ensure that the powder meets size specifications. Next, the powder flows by gravity to a packaging line where it's deposited in plastic-lined boxes of various sizes for shipment.

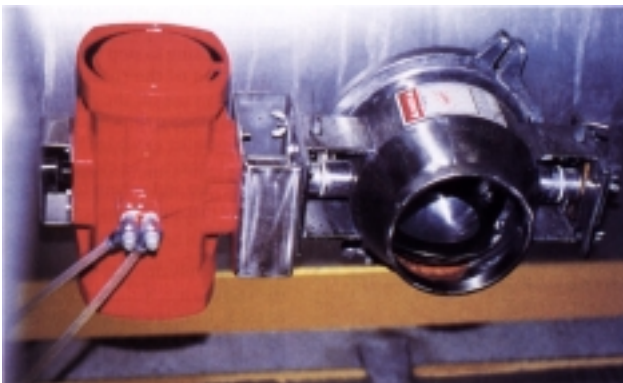


Unobstructed-flow geometry and quick, clean assembly sold WILD Flavors on the sanitary disc valve (top left) for its powder-blending process.

Gumming up the works

New products introduced by the company in 1998 contained powder that was more hygroscopic and sticky, causing a problem with the knife-gate valve at each ribbon blender bottom. The knife-gate valve worked like a horizontal guillotine. The valve was attached to a flange at the blender bottom. A knife blade, actuated by an air cylinder, traveled back and forth through Teflon guides on either side of the valve. The blade opened and closed the valve as it moved.

The hygroscopic powders began to clump, jamming and binding the knife blade as it slid through the Teflon guides. To solve the problem, workers tried loosening the guides to prevent the blade from seizing. But the clearance was too big, and powder leaked through, creating dusty working conditions. Workers had to frequently stop or slow down production to disassemble, clean, and adjust the valve. Cleaning required that workers completely disassemble the valve with various tools, including four different wrenches just to remove the flange at the blender bottom. Finally, with the valve completely unbolted and with the blade removed, they could clean the valve cavity. Reassembly was similarly complicated, time-consuming, and labor-intensive.



The sanitary disc valve's rotating sphere releases, then cleanly cuts off, powder flow.

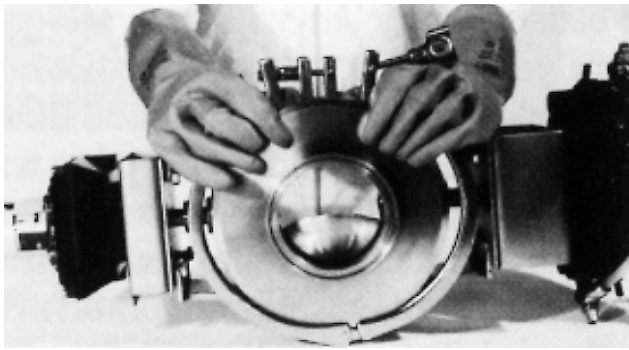
The search for a better valve

The valve problem affected two ribbon blenders at the plant. Jim Hendrickson, WILD Flavors' manager of maintenance and engineering, realized he needed a different valve for both blenders. With the help of consulting engineer Erik Ludvigsen of Cincinnati-based E.L. Consulting, Hendrickson began research to find the right valve.

From the beginning, the two men knew they were looking for a valve that wouldn't be affected by clumping powder and would provide easier disassembly and cleaning. They looked at both a full-ball valve and a butterfly valve, neither of which proved satisfactory. The full-ball valve is heavy and cumbersome, and it contains an uncleanable hidden space between the wall of the valve housing and the ball. The butterfly valve has a rotating vane in the middle, restricting the flow of material to each side and creating a potential for bridging.

Workers had to frequently stop or slow down production to disassemble, clean, and adjust the knife-gate valve.

A few years earlier, to avoid similar problems for blender discharge valves at another company, Ludvigsen had selected a disc valve from Roto-Disc, an industrial disc valve maker based in Cincinnati. The Roto-Disc valve consists of a segment of a sphere rotated through a quarter turn inside a machined-cast flanged housing. The housing is typically cast from aluminum, stainless steel, or Hastelloy. Captured in the housing's top is a replaceable seal, usually made of Teflon, machined to the radius of the sphere. The seal is pressed against the rotating sphere by a metal retainer ring that's held in place by cap screws, and 0.002-inch-thick



The sanitary disc valve has no bolts or cap screws. The cap securing the Teflon seal is held in place by a sanitary clamp ring that a worker can remove without using tools.

Teflon shim rings adjust the pressure of the seal on the sphere.

Two shafts, mounted in the housing and sealed by O rings on each shaft, support the sphere. Bushings for these shafts are made of Teflon, bronze, or other materials suited for high temperature. Taper pins secure the shafts to the sphere.

The disc valve can be actuated manually or by any quarter-turn actuator. This is typically an 80-psi air actuator controlled by a solenoid valve, but an electric or hydraulic actuator can be used. A position proof switch is frequently installed on the valve's undriven shaft for connection to automated systems. The position proof switch also has a Visual indicator that shows operators whether the switch is open or closed.

For discharge, the disc valve is completely open. Powder flow is unobstructed, and the spherically machined Teflon seat, mounted under the retainer ring, is protected from direct contact with powder. As the valve begins closing to stop flow, the wiping action of the rotating sphere smoothly cuts off the powder flow with no pinch points or opportunity for the powder to wedge between the seat and sphere. The closure is clean, and the seat and sphere form a positive seal that eliminates leakage.

To completely disassemble and clean the valve, a mechanic needs a variety of tools. Line operators need several different-sized wrenches to remove hex-head bolts that hold metal brackets for the position proof switch box on one end of the valve and the actuator and solenoid on the other end. They need a large wrench to remove large bolts from standard ANSI flanges that mount the valve to upstream and downstream equipment. The Teflon seal, secured by the metal retainer ring, holds a circle of cap screws on 1.5-inch centers, which require an Allen wrench to remove. The taper pins that secure the shafts must be driven out with a hammer and punch. In some cases, the valve may need to be moved and disassembled in a shop environment.

As the sanitary disc valve begins closing to stop flow, the wiping action of the rotating sphere smoothly cuts off the powder flow with no pinch points or opportunity for the powder to wedge between the seat and the sphere.

Ludvigsen recognized that the disc valve's unobstructed-flow geometry wouldn't be enough to completely solve WILD Flavors* problems. In cases where the company needed to make frequent product changeovers or where spoilage or microorganisms would be a concern, the disc valve's disassembly and cleanup time could exceed production runtime. But the disc valve manufacturer had the answer in the form of a new, lightweight, sanitary, and easy-to-assemble disc valve called the Roto-Clean disc valve.

The sanitary disc valve has basically the same design as the Roto-Disc valve: Both have the optional features of a visual indicator and position proof switch along with an air actuator and solenoid. However, these accessories are mounted to the sanitary disc valve with thumb screws that allow them to be removed without tools.

The sanitary disc valve has no bolts or cap screws. The Teflon seal rests inside the valve. It's secured in place with a cap, which is held to the body by a sanitary clamp ring that can be removed by hand without tools. As the clamp ring tightens, the Teflon seal is compressed against the sphere. In addition, the shafts are splined: that is, the shafts are fashioned with grooves designed to fit matching grooves in the bore of the sphere, eliminating the need for pins to hold the shafts in place. The clamp, seal, and splined shafts can all be removed by hand without tools. In fact, the whole valve assembly can easily be removed from the blender without disturbing electrical or pneumatic connections.

Choosing the sanitary disc valve

"Other options were less costly than the Roto-Clean disc valve," said Hendrickson. "But this valve meant a cleaner, more sanitary work area. The way the valve wipes itself as it closes makes it virtually self-cleaning, a critical factor for sticky or gummy products. When we do clean the valve, we don't need a mechanic. Our line operators can disassemble and reassemble it without using tools."

Hendrickson worked closely with the disc valve manufacturer to customize the valve inlet and outlet connections for the company's application. WILD Flavors also requested a design improvement: a shaft-locking pin to prevent unexpected rotation of the sphere during assembly or disassembly.

The disc valve manufacturer also worked with WILD Flavors to match the valve's top flange to the nonstandard existing flange on each blender bottom. Although the essence of the sanitary disc valve is complete disassembly without tools, the valve's inlet and outlet connections can be customized to the particular installation. Sanitary clamps, ANSI or other flanges, socking necks, and weld necks are all possible.

WILD Flavors purchased two Roto-Clean disc valves -one for each of the ribbon blenders. Two members of the company's in-house maintenance staff installed the valves between shifts with no problems and were able to complete both installations in 8 hours. WILD Flavors has had the valves in place for a year with no problems, and according to Hendrickson, is experiencing better-than-expected performance. "It's hard to quantify the results in terms of improved production and reduced downtime," he said. "But we definitely see these improvements. And of course, our I line operators are much happier now because they're working in a cleaner blending area. I would strongly recommend the sanitary disc valve to another company with similar issues."

PBE

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