Case history

Blender's shaft seals serve and protect

A dry food mix company solves a costly ribbon blender sealing problem by installing custom-engineered shaft seals.

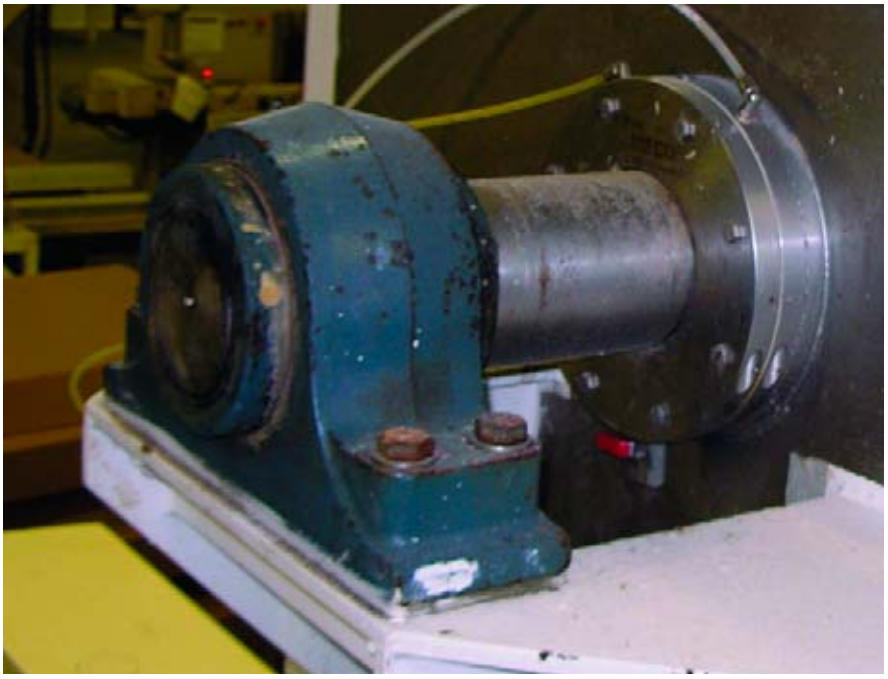
Operators at Blendex Co., Louisville, Ky., were having a problem sealing the blender it uses to make specialty mixes. "We blend a variety of dry food mixes," says Wayne McDowell, vice president of operations, maintenance, and engineering at Blendex. "But three of them — sirloin seasonings, yogurt mixes, and drink mixes — were causing substantial problems during production. The culprit ingredient in all three of these mixes is sugar." The sugar would heat, melt, and become impacted in the blender's seals, requiring massive amounts of maintenance and frequent seal replacement.

Mixing a specialty batch

Blendex is a contract processor of dry powdered food mixes and custom-blends more than 200 different formulas of batters, breading, beverages, marinades, and seasonings for leading food companies. The company has 11 blenders in its plant, but only one blender, referred to by operators as blender 11, is used to make the odd, challenging, or specialty mixes involving sugar.

To make a mix in the specialty blender, operators first inspect and sift all required ingredients according to the mix's recipe. The ingredients are then manually loaded into the 100-cubic-foot, 4,000-pound-capacity stainless steel Lowe blender. Once it's loaded with all the ingredients, blender 11 is turned on. At the end of the blend cycle, the mix gravity-discharges out of the blender and into a packaging machine.

"We package twenty-, twenty-five-, or fifty-pound bags," says McDowell. "In total, a typical batch cycle takes about one hour because it takes about thirty minutes to load and run the blender and thirty minutes to package the final product."



This custom-designed seal installed on the blender's shaft uses a driving elastomer to protect the shaft from abrasion and eliminate material leaks.

Sugar creates a mess

The company was encountering several problems when processing the sugar products in blender 11. The blender's 5-inch-diameter horizontal shaft was sealed on each end with a stuffing box filled with standard V-ring Teflon-coated chevron seals. During blending, the sugar would heat up and become impacted in the seals. The heated sugar caramelized and flowed between the seals, destroying them. Then, after the sugar cured and cooled, it became concrete-hard and was extremely difficult to remove.

After two or three cycles of making a product containing sugar, maintenance crews would have to climb up on ladders and either replace the Teflon seals or disassemble the seals to clean them out. "Our operators had to cook and heat and hammer and beat the blender to get the seals out," says McDowell. "And in that process, we were jeopardizing the blender's construction, and the shaft was being scored from the sugar's abrasion. Toward the end, it took two or three operators about two hours to get the seals out, clean the area, install new seals, and get the blender back online."

The company runs on a standard production schedule of four 10-hour days per week, with Fridays being used for any necessary overtime. Because of the problems with the sugar products, blender 11 was typically run on Fridays because not enough batches could be completed during the standard work week. The blender could run only seven to eight batches per 10-hour day.

The amount of downtime and the resultant overtime were mounting concerns for the company. "We have an overhead rate of about fifty-five to seventy dollars an hour," says McDowell. "When we ran sugar products, we'd easily be down six to eight hours every week just on that blender. And we not only lost the downtime trying to repair it and clean it, we lost the product that we couldn't produce in it." In addition, when the company had to replace the seals, it cost approximately $300 to $400 a set, and the company was replacing the seals frequently. Says McDowell, "We were lucky to get through three cleanings a set before the seals had to be replaced. It probably averaged out to about one set replacement a week.

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Blender 11 is a 4,000-pound-capacity ribbon blender that mixes up to 12 batches of specialty blends per day with the new shaft seals installed.

Even if we only mixed a sugar product once a week, we would be down the cost of the new seals and the labor, which is about five hundred dollars, plus the product loss. That's a substantial amount."

Search yields successful results

After experiencing these problems, the company decided to look for a change. First the company tried using rope packing and other mechanical seals from various suppliers, but none of those solved the problems. The company realized it would have to find a customized solution.

McDowell knew of a supplier that manufactured custom seals for blenders that handled problem ingredients. He had visited the supplier's booth at the 2002 Powder Show and had also seen the supplier's brochures featured in *Powder and Bulk Engineering*. McDowell contacted the supplier, Woodex Bearing Co., Georgetown, Maine, a manufacturer of custom seals and bearings. The supplier sent one of its reps, Jerry Chevalier of Mid South Mechanical Sealing, Chattanooga, Tenn., to meet with McDowell and determine the best solution.

Because Woodex was familiar with the problems sugar can cause in a ribbon blender and had designed seals for similar applications before, the supplier didn't have to test the company's materials. Blendex simply filled out a seal application data sheet, which asked questions regarding the application's material type, size, distribution, and moisture content; the shaft's condition and angular misalignment; the stuffing box's ID and OD; and more. From the company's data, the supplier put together a proposal for two of its custom-designed seals that required no modification to the existing blender.

The supplier delivered the seals in Fall 2003. Blendex installed them in less than 1 day, and Chevalier was on hand to offer pointers and assistance. During installation, the company also polished the shaft to reduce scoring caused by the old packing.

"The hardest part of the changeover was removing the old stuffing boxes," says McDowell. "We had to use steam and heat to soften the sugar enough so that we could remove the old packing. When that didn't work, we had to bring in a plasma arc torch. The torch got the old seals off in twenty minutes."

New seals solve the sugar challenge

The fully-split MECO AHS seals are suitable for food applications and ideal for mixers processing dry beverage, spice, and flavoring mixes where frequent product changes and washdowns are required. The seals eliminate the need to set seal face pressures, enabling trouble-free cleaning and sanitizing during changeover.

One custom-designed, 5-inch-diameter seal is installed on each end of the blender and fits snugly on the blender's 5-inch-diameter shaft. Each seal has two Type 304 stainless steel stators and two bearing-grade-polymer-filled PTFE rotors. The 10.25-inch-OD seals also have six PTFE-coated fiber gasket shims compressed between the two stators, and a white silicone driving elastomer.

The rotors can accommodate ⅛ inch of diametric shaft runout or misalignment and thermal shaft growth without affecting the seal interface integrity.

The rotors and the driving elastomer fit inside the stators in a recessed barrier. The driving elastomer wraps around and grips the shaft, protecting it from abrasion damage and blocking materials from migrating along the shaft. The elastomer turns with the shaft and drives the rotors to turn against the stators, forming a seal interface perpendicular to the shaft. Since there's no movement between the shaft and rotors, the only wear that occurs is on the seal interface between them. The rotors can accommodate ⅛ inch of diametric shaft runout or misalignment and thermal shaft growth without affecting the seal interface integrity.

The seals are purged with air, which creates pressure to push the rotor against the stator and close the sliding interface to stop any material from going into or out of the blender. The air is piped from existing plant air directly into the seal. Operators monitor the purge pressure to determine when seal wear has occurred: A regulator and gauge are attached to the air supply pipe, and another gauge is attached to a tapped hole in each seal. When any of the gauges read less than 5 psi, the corresponding seal needs adjusting. The typical airflow rate is approximately ¼ cfm.

"The six shims on the stators are used for adjustment," says Chevalier. "When a seal starts wearing out, the air pressure will drop. Once that happens, it's evident that the seal is losing air somewhere. Operators have to simply shut the equipment down and pull one of the shims out, which tightens the seal back up. And as long as the operators are diligent, there will never be a reason for product to leak out of the seals. The leak will be detected by the air gauges and be fixed before any product loss occurs."

A ⅛-inch O-ring is between the inboard stator and the blender's endwall, and leveling screws are used to mount the seal square to the shaft. These prevent the seal from warping, which would potentially allow leaks.

Shaft seals save worker's sanity

The seals have been running trouble-free since installation. "We've only had to make one seal adjustment in the seals' first twenty-four months of

service," says McDowell. "We simply removed one seal shim to make that adjustment. And there has been no maintenance required, which has definitely made our operators happy."

Blender 11 can now run up to 12 batches per day because no packing has to be replaced or changed out. The company pays for less overtime work since the production schedule can be completed in the regular 4-day cycle. And worker risk has been reduced, since no one is climbing up on ladders to pry at frozen packing glands.

Blendex is extremely happy with the seals. In fact, McDowell has received requests from operators to put the seals on another blender in the plant. Says McDowell, "Jerry's been a super guy to work with, very helpful. He was right on target with his analysis and solution." **PBE**

Note: To find other articles on this topic, look under "Valves" and "Mixing and blending" in *Powder and Bulk Engineering*'s Article Index at www.powderbulk.com or in the December 2005 issue.

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