

Powder and Bulk Engineering

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- Case history: Shaft seal ensures safety, saves money
- Choosing a bin vent

PNEUMATIC CONVEYING

Case history

Seals secure safety and savings

A manufacturer of extruded specialty catalysts replaces its mixer's packing glands with custom shaft seals to ensure a safe operating environment.

Grace Davison's history began in 1832 when Irish immigrant William T. Davison started a company in Baltimore, Md., to process old bones and oyster shells into fertilizer. Today, Grace Davison is the second largest continually operating chemical company in the US and one of the world's leading manufacturers of silica-based adsorbents and related products.

In Chattanooga, Tenn., W.R. Grace & Co., one of Davison's research and manufacturing plants, spends its days and nights producing extruded specialty catalysts for the refinery, chemical, and environmental control industries. The plant handles dry aluminas, clays, zeolites, and silicas and mixes them with potentially hazardous chemicals. These chemicals have federally regulated dust exposure limits. Exposure above these limits can put workers' health at risk. This limitation posed a problem when packing glands in the plant's mixer consistently leaked, creating the potential of exposing workers to the hazardous chemicals.

Powder runs right out

To extrude the specialty catalysts, all the ingredients have to be mixed well. The plant uses a twin-shaft sigma blade mixer to accomplish this. The mixer has two shafts that penetrate the vessel walls. To prevent material leakage at the points where the shafts pass through the mixer walls, the machine was equipped with four standard packing glands, one on each shaft end. Each packing gland consisted of a cylindrical packing box fastened to the vessel end where the shaft passed through and a gland follower to compress the packing against the shaft, preventing leakage. When material began to leak, the gland follower was tightened, squeezing the packing harder against the shaft and renewing the seal.

Eventually, the fine, abrasive powder in the mixer would wear out the packing in the glands, causing dry, fluidized 10-micron powder to run out of the mixer like water, potentially creating an environmental hazard for workers.



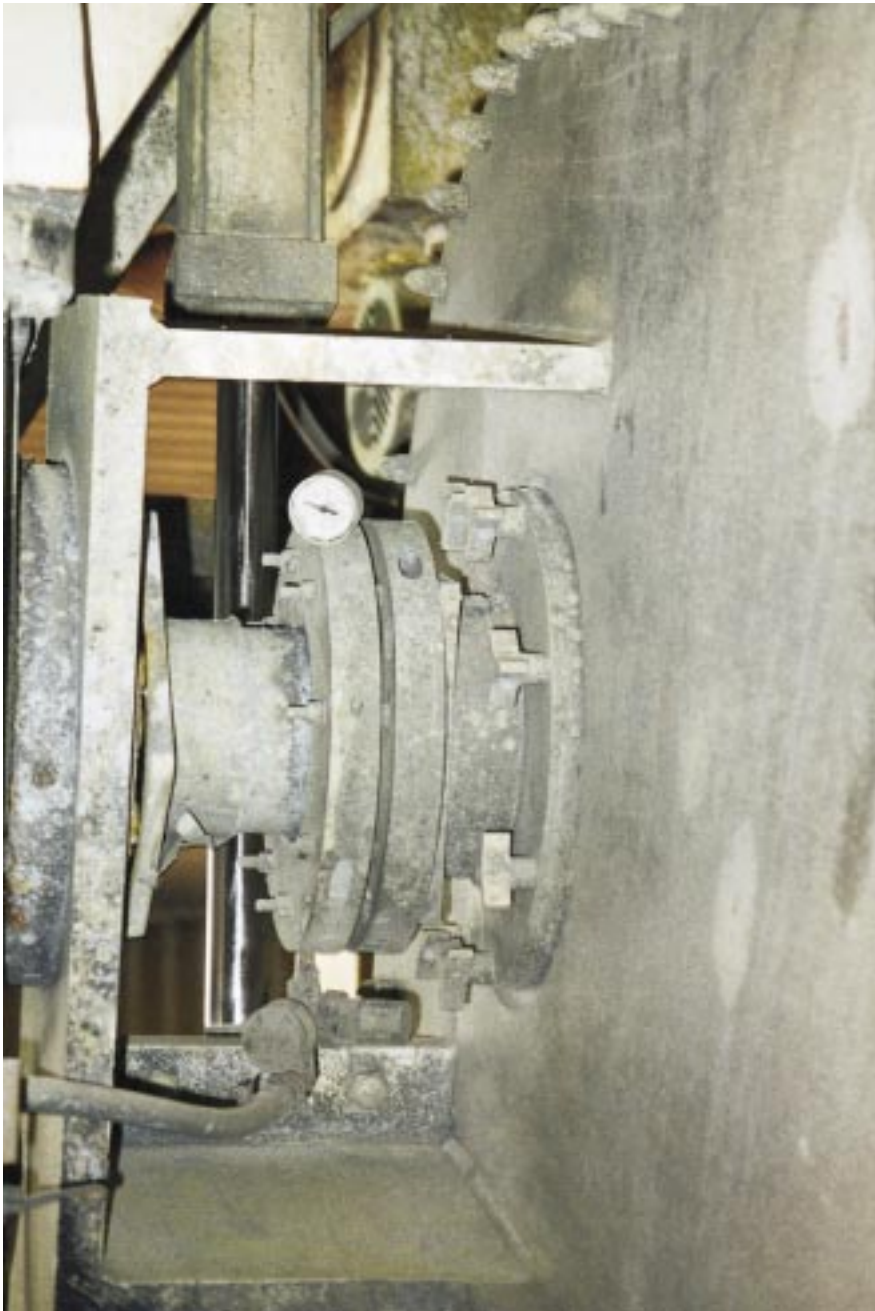
Michael Keslin, production manager at W.R. Grace, can now wear normal work clothes when operating the plant's sigma blade mixer.

Michael Keslin, production manager at Grace, explains: “When the process begins, it’s just like mixing a cake — it starts out a dry powder, then it turns into paste. Well, the paste doesn’t leak very much, but the powder has a tendency to run right out. So you have powder leaking out of the mixer into the room. Because it’s a very fine powder, it’s not like spilling gravel, where it all ends up in a nice little pile on the floor. It disperses through the air, potentially exposing workers to the hazardous chemicals.”

To prevent the possibility of exceeding the federal safety guidelines, Grace workers were required to wear protective equipment, including air helmets and respiratory protection equipment.

In addition to the environmental hazards created by the leaking seals, each month Grace had to repack the seals. It took two workers one 8-hour shift to repack all four seals.

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Four custom shaft seals replaced the troublesome packing glands, improving environmental conditions and reducing maintenance costs and downtime.

Searching for a better seal

As powder continuously wore out the packing, Keslin says, "We tried different kinds of packing. If this one didn't work, we tried that one, and so on and so on; each failed in about a month."

While discussing his situation with a Davison employee in a different plant who had faced a similar situation, Keslin learned of the positive results his coworker achieved after switching to a Mecco custom shaft seal made by Woodex Bearing, Georgetown, Maine. Keslin approached the company, explaining that he needed a seal that was easy to maintain and had reasonable time between failures.

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He also described the material he was dealing with: "We told them it was a dry abrasive powder, 10 microns in size, and they said they had the perfect seal for the job."

Friction-driven seal tolerates shaft eccentricity

Mecco's Externally Adjustable Seal (EAS) custom shaft seal has separate inboard and outboard stationary faces (stators), which are drawn together to compress two rotating seal faces against a central driving elastomer. The driving elastomer wraps snugly

around the shaft. Through friction, it rotates with the shaft and also causes the rotating faces (rotors) to turn with it. When compressed, the driving elastomer provides the spring loading to maintain tight seal interfaces between each rotor and stator. In addition to providing motive force and spring force, the elastomer also prevents process material from leaking between itself and the shaft.

The rotating seal faces have a wide radius and the stators have large shaft clearance holes, which allow the shaft to rotate eccentrically up to 0.25 inch, without affecting the integrity of the seal interfaces. Should radial deflection of the shaft occur for any reason, the sliding seal faces will remain closed. This contrasts with the packing seals where packing was crushed and a leakpath opened when the shaft rotated eccentrically.

The seal also has an air purge. An annular rubber gasket acts as a bellows seal between the two stators and creates a small, sealed chamber or purge cavity around the two rotors and the driving elastomer. Compressed air is introduced into this chamber and maintained at a pressure slightly above the process pressure. As the seal wears, the constant air pressure in the purge cavity helps maintain seal face pressure, extending the time the seal can operate without leakage. By monitoring the pressure, the operator can determine when to tighten the seal before process material leakage occurs.

Installing the new seals

Jerry Chevalier, a Woodex sealing distributor from Mid South Mechanical Sealing, came to the Chattanooga Grace site to install the seals, which took about 8 hours. The installation went without a hitch. Keslin says,

"We turned the mixer on. It worked the first time. Then we adjusted the air pressure to ensure a small flow across the seal."

After installing the custom shaft seals, Grace's downtime was reduced by one shift per month.

The seals can be tightened with a wrench and returned to normal operation several times before the seal rotor faces wear away and the seal begins to leak. Once every six months, Grace adjusts the seals, a process which doesn't require any downtime.

When the seals need to be rebuilt, a Woodex field service representative returns to the site and rebuilds them. This occurs every four years. The only maintenance Keslin has to worry about is the air supply, which he says, "is simple to do and requires minimal maintenance."

Shaft seals improve air quality, save maintenance

After installing the custom shaft seals, Grace's downtime was reduced by one shift per month. In the past, the company spent \$3,000 a year repacking the old packing glands. After four years in operation, the custom shaft seals have saved the company \$12,000 in repacking costs. Environmental improvements also resulted from the new seal installation. The potential to expose workers to harmful dust has been eliminated and they can now wear normal work clothes.



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