

## Protecting A Power Plant's Damper Shafts

Written by Jane Alexander, Editor  
Friday, 01 February 2008 00:00

---



Fig. 1. Shafts on pneumatic cylinders that operate dampers in the bag house are protected with Gortiflex bellows to prevent condensation of corrosive gasses that could cause corrosion.

### **Less downtime. More uptime.**

Protective bellows installed on the damper shafts of the bag house at Xcel Energy's Sherburne County (Minnesota) Generating Plant (Sherco) are extending shaft life by minimizing corrosion from exposure to condensing flue gas and other contaminants. To fit the plant's four different shaft lengths, the bellows are made in stock-length modules and joined with backing plates for specific applications to reduce spare parts stocks and expedite repairs.

### **The problem**

Xcel Energy is a leading energy company that serves 3.3 million electricity customers and 1.8 million natural gas customers in 10 Western and Midwestern states. The Sherco plant is a coal-fired facility with two 750 MW units and one 940 MW unit. It goes without saying that this type of plant is especially interested in the reliability and availability of its process systems.

## Protecting A Power Plant's Damper Shafts

Written by Jane Alexander, Editor  
Friday, 01 February 2008 00:00

---

Sherco's 940 MW B&W unit, built in 1985, includes a reverse air-type bag house. In the reverse air design, flue gas from the boiler is filtered as it passes through the middle of the bags. As the cleaned gas passes through an outlet duct, the ash is trapped by the bags.

According to senior production engineer Lawrence Glass, the bag house compartments have two sets of dampers, which are basically large steel discs about six feet in diameter. One is an outlet damper, and the other is a reverse air damper. These are positioned in ducts that make it possible to isolate the compartment and control the air flow. When the outlet dampers are closed and the reverse air dampers are opened, the cleaned flue gas flows backward and cleans the ash out of the bags.



**Fig. 2. Close-up of bellows shows how sections can be joined to make different lengths instead of stocking bellows for each shaft length.**

The dampers are activated on a rotating cycle by pneumatic cylinders that are controlled by a programmable computer. Although the shafts only move approximately three or four times per hour, the repetitive motion along with insufficient clearance between the bellows and the shaft was causing the previous bellows to wear.

"These are dry scrubbers," Glass says. "We spray lime slurry into the flue gas and keep the temperature as close as possible to the dew point of 125 F so it doesn't condense. If one of the

## Protecting A Power Plant's Damper Shafts

Written by Jane Alexander, Editor  
Friday, 01 February 2008 00:00

---

bellows develops a hole and the air leaks in, it cools the gas below the dew point, and it condenses. Then it can cause the shaft to corrode so much that it breaks off." When this happens, he points out, it is necessary to retrieve the damper from the bottom of the flue gas duct about 30 feet below and re-install it with a new shaft.

### The solution

To reduce repairs and minimize future problems, Glass notes that the Sherco facility is replacing the carbon steel shafts with stainless steel and now using a modular approach to stocking and installing the bellows. As he explains it, the easiest way to replace the corroded 2" diameter shafts is to cut them off at the poppet, slide a hollow shaft over the stub and weld it in place. Since the new stainless steel shafts have an outside diameter of 2 ½ ", it has been necessary to redesign the bellows to accommodate the larger size.



Fig. 3. View inside the bag house shows some of the 200 cylinders that need bellows protection.

In the process of redesigning the bellows, Glass worked with A&A Manufacturing Co., Inc., of New Berlin, WI, a specialist in the design and manufacture of bellows, boots, way covers and many other protective components for machinery. Sherco uses A&A's Gortiflex® Molded Bellows that are manufactured from a continuous sheet of elastomer-coated fabric formed into a cover with only one diagonal seam. This delivers a completely sealed design similar to a

## Protecting A Power Plant's Damper Shafts

Written by Jane Alexander, Editor  
Friday, 01 February 2008 00:00

---

molded bellows—but does so without tooling or die charges.

The new bellows are sized with a 4 ½" inside diameter to allow more clearance over the shaft and prevent abrasion. Glass orders them in two different lengths that can be joined as needed to accommodate various Fig. 3. View inside the bag house shows some of the 200 cylinders that need bellows protection. shaft lengths, thus eliminating the need to stock quantities of many different sizes. Their flanged ends allow the sections to be bolted together with backing plates or mounted to the dampers.

While the new bellows design helps to avoid the wear that can cause holes and lead to corrosion, Glass also maintains that they are easier to replace if a hole were to develop. "The holes always occurred at the bottom end, and we had to throw the whole bellows away," he says. "Now, we can save money by just taking off the bottom piece and replacing it, which is another reason for buying them in sections."

Pressure differentials between the environment and the bellows are relatively low, possibly two or three inches of water, according to Glass. However, the pressure is positive at startup and then becomes negative during operation. To maintain the shape of the bellows under these changes, wire rings are inserted inside each convolution.

### **Maintaining system value**

The reverse air bag house design is not as widely used in power plants as the pulse-jet type, primarily because of its higher capital cost. Despite that fact, Glass says it is a good design with very low pressure drop, and the bag life is twice as long as on a pulse jet. He expects that the new bellows design will minimize the previous shaft corrosion problem and help maintain the value of the system. **MT**