

ABB Pressure measurement – Diaflex® diaphragm coatings Coal pulverizing process

Industry: Power

Direct-mount seal pressure transmitters for pulverized coal processing

Many coal-fired power plants measure various pressures associated with their coal pulverizing mills. The red dots in the figure at right shows the typical locations for these measurements for a Raymond Bowl type mill:

- the pulverizing mill section
- the ductwork from the classifier carrying coal fines to the exhauster, and
- the exhauster -- the fan and ductwork carrying pulverized coal and fines to the boiler burners.

Optimizing mill operation

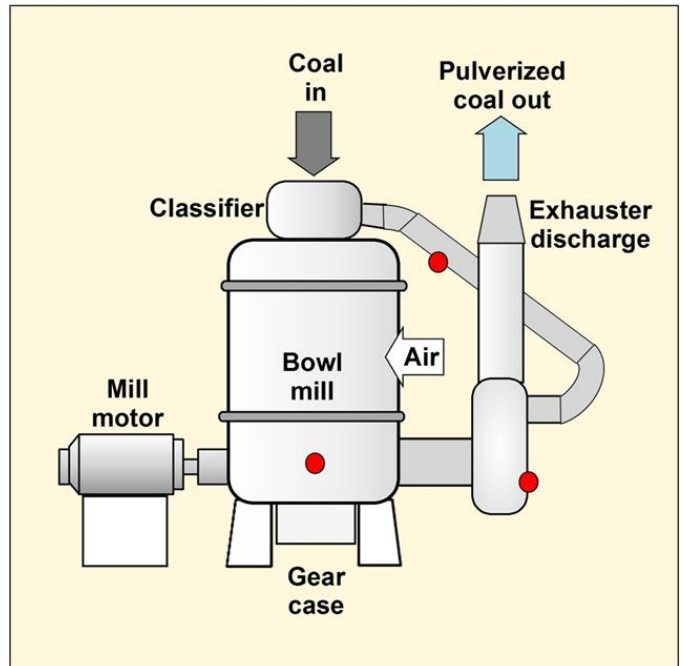
A certain "sweet spot" of pressure indicates smooth and proper operation of the mill, as well as the exhauster ductwork. The impulse lines that transfer the pressure signal to a rack of transmitters may be long -- 30 to 50 feet in some cases. The sensed pressure is often in the range of 30 to 40 inches of water column.

If the pressure drops, the mill could be plugged or the fuel supply cut short. Higher than normal pressure may indicate plugging of downstream coal ducts leading to the furnace. Improper pressures often lead to flame instability, productivity losses, and pollution.

Dealing with plugged impulse lines

Plant maintenance operations often have to deal with problems associated with the long impulse lines that run to the pressure transmitters. The lines may plug as often as once a week and even once a shift in some cases. A small air purging system in the sensing line may be present to provide positive pressure, attempting to keep the coal out of the sensing line. But wet coal following a rainstorm, for example, invariably leads to plugged lines. In the worst cases, maintenance technicians have to drill out impulse lines plugged with dried "mud."

Ideally, the pressure would be sensed directly, with the transmitter mounted on the mill, exhauster, or ductwork. This arrangement would eliminate the need for long, narrow impulse lines. But the pressure sensing diaphragm would have to withstand the severe abrasive effects from high-velocity pulverized coal.



Red dots indicate possible pressure measurement locations for coal pulverizing mill.

The ABB Solution: Diaflex-coated sensor diaphragm

This application calls for a transmitter with a direct-mount seal and non-standard pressure diaphragm that can withstand the severe abrasive effects from high-velocity pulverized coal. ABB's 2600T direct-mount seal pressure transmitters are available with diaphragms protected by a patented Diaflex coating. The diaphragm coating is a nano-structured material that has a hardness 4,000 hv, which is similar to diamond. The coated diaphragms may be mounted flush or extended to reach the processing area.

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A-P-Power_Diaflex_Coal_Pulverizing_A (9.21.10)



ABB 2600T pressure transmitter with direct-mount seal and Diaflex coated diaphragm. Transmitter is installed on the exhaustor of a coal pulverizing mill.

Diaflex consists of a quaternary coating based on titanium and silicon (SiTiN) of the nitrides class. Using a process called physical vapor deposition, ABB coats the transmitter's 316L stainless steel diaphragm seal to a thickness ranging from 3 to 5 μm . This deposition technique and thickness range provide the necessary flexing sensitivity to accurately measure pressure, while protecting the diaphragm from the abrasive effects of fast-moving coal particles. ABB's all-welded remote seal technology adds superior performance and reliability. The physical characteristics of Diaflex remain stable between $-100\text{ }^{\circ}\text{C}$ and $+700\text{ }^{\circ}\text{C}$ ($-148\text{ }^{\circ}\text{F}$ to $+1292\text{ }^{\circ}\text{F}$). But the transmitter's maximum working process temperatures are limited by the fill fluid.

Diaflex-coated diaphragms have proved their durability in this application. Installations have resulted in significant savings in maintenance hours and more efficient burner management.



Inspection of diaphragm after eight months of service shows no adverse effects from the abrasive nature of fast flowing pulverized coal.