APPLICATION NOTE

Flue Gas Desulfurization

Industry: Power Generation
Product: RotaMASS Coriolis Flowmeters

Introduction

Fossil fuels have long been used as a heat source in power generation. Coal is one of the more common fuels, but environmental concerns have led to a great deal of time, effort and money being spent on the reduction of pollutants resulting from the use of coal. High levels of SOx emissions have been linked to the production of "acid rain", a condition where water vapor and sulfur compounds released with the stack gas combine to acidify rainfall, sometimes far downwind of the plant. This process has been linked to deforestation and impact to the environment on a large scale.

In an attempt to reduce acid rain, emission controls were tightened and the use of high sulfur coal as a fuel for power generation was banned. An unanticipated side effect of that restriction is that SOx emissions may actually increase when low sulfur coal is used. The reason for this counterintuitive result lies in the operation of the electrostatic precipitators (ESPs) used to control stack emissions. For that reason sulfur is actually added to the stack gas to help in the reduction of SOx emissions. Tight control of the sulfur addition is essential to maintaining emissions control, optimizing efficiency and avoiding sanctions such as fines for violating emissions standards.

Application

SO_2 is an acid gas and the typical sorbents used to remove the SO_2 from the flue gases are alkaline. Lime slurry is sprayed directly into the stack gas and absorbs SO_2. When wet scrubbing with a $Ca(OH)_2$ (lime) slurry, the reaction produces $CaSO_3$ (calcium sulfite).

$$Ca(OH)_2 \text{ (solid)} + SO_2 \text{ (gas)} \rightarrow CaSO_3 \text{ (solid)} + H_2O \text{ (liquid)}$$

The scrubbed gas then passes through the ESPs.

ESPs use a series of charged wires and electrode plates to generate a spark or electrical field across a gap. As the stack gas passes through the ESP, fly ash particles are charged as they move over the charging wires. They then pass through an electrical field and accumulate on grounded collection plates. Vibration is used to dislodge the ash from the plates, where it's moved to a collection system and is eventually used in drywall, fly ash cement and other uses.

ESP efficiency can be affected by changes in the quality of the coal being burned, the loading of the boiler and resultant changes in burner efficiency, changes in stack gas temperature, velocity of the stack gas through the ESPs and other related conditions. The

result can be that fly ash is not collected and passes through the system and out of the stack. Another result is unacceptable SOx emissions resulting in violation of regulatory emission levels and possible sanctions. A common way to augment system efficiency is through the injection of sulfur just before the ESPs.

Georgia Power Plant Bowen is a 4 unit coal fired power generation station with a peak output of 3250 megawatts. It is the second largest coal fired plant (based on output) in the country. The turbine room can be seen in figure 1.

Fig. 1

Molten sulfur addition to increase ESP efficiency has been used at Plant Bowen for some time. As molten sulfur is a corrosive product and has to be maintained between 245° F and 275° F, it can be a difficult measurement application. A meter from a leading coriolis manufacturer had been tried, but numerous problems were encountered. An unstable zero and frequent signal dropouts led to a lack of confidence in the meter's reliability.

Solution

The meter was replaced with an insulated, steam traced RotaMASS coriolis flow meter which has performed well since commissioning. RotaMASS is an excellent choice for this application. The key to the RotaMASS success is its self draining design, which when mounted vertically also allows any air to escape up through the meter. The previous flow meter used a delta shaped tube design which is not self draining and traps air easily, making it prone to stalling and dropouts. There is no way to orient the meter to allow trapped air to exit the meter. With the RotaMASS parallel "U" tube design, vertical installation allows air to pass easily through the meter, preventing entrainment issues and interruptions in the measurement.

Fig. 2

Fig. 2A

Notice the extra angle iron used to install the previous meter (Figs. 2 and 2a). This was required to combat the effects of vibration on the meter's output. The RotaMASS installation requirements are less stringent and the meter is lighter and has a smaller footprint (Figs. 3 and 3a). The RotaMASS unique "box in box" design isolates the tubes from any vibration that might interfere with the measurement (Fig. 4). Since this installation was on top of a tank, a rock solid mounting was not possible but still RotaMASS was immune to the vibration.

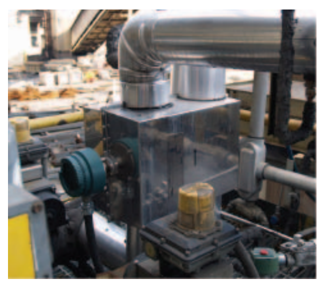

Fig. 3

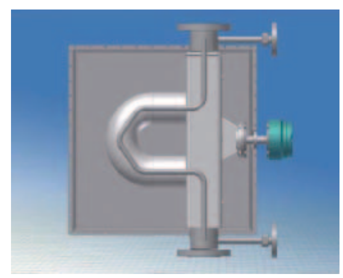

Fig. 3A

The factory installed insulation jacket with steam tracing comes ready to go, out of the box. The outer stainless steel case remains cool to the touch; an important feature when operating at high temperatures. RotaMASS comes from the factory with the steam trace lines, insulation and outer housing installed.

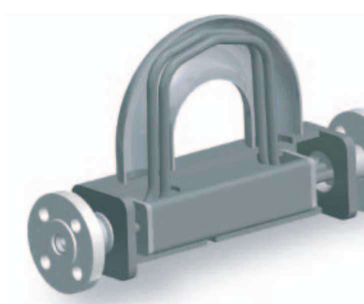

Fig. 4