Solution Note

Honeywell

Reduce Installation Costs by 50% and Lower NOx With Honeywell Multivariable Technology

Problem: Accurate Combustion Air Flow Measurement

Accurate, reliable measurement of combustion air flow has long been an important element of any combustion control system. The air to fuel ratio directly affects both the efficiency and safety of boiler operation. Stoichiometric, or perfect, combustion combines the exact proportions of fuel and oxygen to obtain complete conversion of the carbon and/or hydrogen in the fuel. The ideal amount of air varies with the type of fuel, the boiler load, and the equipment design. Too much air —an 'air-rich' environment — results in energy lost up the stack. Insufficient air results in loss of heat generation due to incomplete fuel combustion, and also creates a safety hazard. Just the right *mass* of excess air is required to ensure that complete combustion occurs within the combustion chamber and to compensate for any delays in fuel-air ratio control action during load changes.

Most air flow measurement technologies in use today do not measure mass flow directly. Therefore, we must "compensate" a volumetric flow measurement, either by direct or inferred measurement, for those process conditions that affect the fluid density and mass flowrate. A 25°F change in air temperature can cause an error of over 8% in mass flow rate. Any deviation in line, or static, pressure from design conditions can also cause an error in the final flow rate measurement. A 0.25 psi change can induce an error of over 1% in the flowing density and the resulting air flow rate. Correction for these temperature and pressure effects is required to ensure accurate, mass-based measurement of combustion air flow.

NOx Control

Pollution reduction, particularly NOx control, has become increasingly important. Exceeding allowable limits can have significant operational and legal implications. Improving NOx control falls into two categories — initial prevention and post-combustion flue gas treatment. In many cases, the key to a successful NOx reduction program is control of excess air.

Most boilers operate at 18% - 30% excess air at full load depending on fuel type. How can this excess air level be significantly reduced without increasing operating risk? Flue gas monitoring of O2 and CO are commonly used, but **improving the accuracy of the air flow measurement** can aid tremendously in achieving this goal.

Overfire Air Controls reduce NOx emissions by diverting some of the auxiliary air needed for complete combustion of the fuel fired through the main windbox. The diverted air is routed above the burner locations to "stretch" out the flame and keep the overall combustion temperature down but still obtain full combustion of fuel. Accurate measurement and control of these air flows is critical to reducing NOx formation while maintaining optimal air/fuel balance.

Solution: Compensation for the Effects of Temperature and Pressure

The SMV 3000 Smart Multivariable Transmitter represents the next generation of smart transmitters. It measures differential pressure, static pressure, and process temperature (via a thermocouple *or* RTD). The transmitter's electronics uses these 3 measurements to calculate a highly accurate mass flowrate of combustion air.

Using dynamic flow compensation combined with its multivariable measurement capabilities, the SMV 3000 provides the most accurate DP-Flow solution available with the greatest flow turndown. Dynamic compensation includes compensating the combustion air flow rate for ongoing changes in discharge coefficient, thermal expansion factor, gas expansion factor and velocity of approach factor due to fluctuating process conditions.

And, the SMV 3000 can be digitally integrated into your plant control system to yield maximum benefits in installation and maintenance cost as well as performance.

Cost Effective Retrofit!!

The SMV 3000 is the perfect retrofit for your existing compensated air flow measurements. Many power plants use older ring-balanced transmitters that include a temperature-compensation “circuit” — an RTD or thermocouple positions a small motor that adjusts the flow signal. SMV 3000 allows you to quickly and easily replace this transmitter while re-using the existing Pitot tube or Annubar™ flow element and impulse lines to measure flow and pressure, the same RTD or thermocouple for process temperature, and the same wires to transmit the combustion air flow to the control room.

Solution Benefits:

Compensating your combustion air mass flow measurements using the SMV 3000 Smart Multivariable Transmitter provides:

- A highly accurate air/fuel ratio measurement
    - **Faster control response** time than with simple oxygen trim
- More precise control of combustion air flow
    - Improved boiler efficiency while **minimizing emissions and NOx creation**
- **Equipment savings of over 20%** versus traditional multi-instrument compensation
- Over **50% savings in commissioning and startup** versus multiple instrument compensation

With the ability to transmit not only the compensated flow rate but also the measured pressure and temperature, the SMV 3000 can provide additional data for real-time control of steam flow as well as performance-monitoring functions.

Other Uses of Smart Multivariable Transmitters in Power Plants

Where else can Smart Multivariable Transmitters be used in a power plant? Mass flow compensation may also be used for other applications, including fuel gas or fuel oil flow, steam flow, and boiler feed water flow. Smart Multivariable Transmitters can also perform pressure compensation of boiler drum level to quickly and efficiently compensate for variations in drum level measurement caused by “shrink” and “swell”.

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More Information

For more information on Multivariable Technology, visit www.honeywellprocess.com, or contact your Honeywell account manager.

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