Combustion Air Flow Measurement In Power Plants

The efficient operation of today’s power plant hinges largely upon accurate and repeatable measurement and control of various air and FGR inputs to the boiler such as:

- **Secondary Air Flow**: Controlled to maintain the desired stoichiometric fuel/air ratios. Very important to overall boiler efficiency and NOx reduction.

- **Primary Air Flow To Coal Mills**: Should be monitored and controlled to improve coal mill efficiency.

- **Overfire Air Flow**: Added to many boilers to reduce NOx emissions. Each OFA zone must have independent control.

- **Flue Gas Recirculation Flow (FGR)**: Mixes with secondary combustion air and reduces NOx emissions.

- **Air Flow To Individual Burners**: To improve combustion efficiency and reduce NOx emissions.

- **Flue Gas Flows**: For ammonia injection control in SCR units.
Limited Straight Run

Combustion air duct work is often large and available straight run is usually limited to two or three duct diameters. The resulting velocity profiles are distorted, turbulent, and therefore extremely difficult to measure accurately. One, two or four thermal dispersion probes within a given cross section are not adequate and must be tested at many boiler loads to insure accuracy at each flow rate. This testing involves days of pitot traversing at a significant cost before the results are obtained.

High Repeatability

Excellent repeatability is necessary if tight flow control is to be implemented. Flow meters such as venturis, air foils, and other differential pressure producing devices have low signal to noise ratios particularly when availability of straight run is limited. This high level of signal noise results in a somewhat nonrepeatable measurement.

Low Velocity Pressures

Differential pressures at maximum flow are often less than 0.5” H2O and are very difficult to measure using most standard DP transmitters. Typical flow turndowns of 3 or 4:1 will result in DPs at minimum flow rates of less than 0.1” H2O.

Contamination

Primary, Secondary, and Tertiary air is often preheated with Regenerative Air Heaters. Regenerative Heaters bring fly ash from hot flue gases into the combustion air ducts. This fly ash can coat or plug many flow meters affecting accuracy and reliability. FGR flow meters have the same type of coating and plugging problems.

The "Thermo" Solution

Limited Straight Run

The Thermo DSK1000 and NZP1000 Series Pitot Averaging Flow Sensors are ideally suited to combustion air flow. Both deliver superior performance with little or no straight run required upstream. Required accuracy, repeatability, straight run availability, and duct velocity will determine which is the better choice.

Thermo DSK1000 combines integral flow straighteners and a multi-point pitot array. The straighteners have a L/D (Length to Cell Diameter) ratio of 7 (or greater), building 7 or more diameters of straight run into the flow sensor. Typical installed accuracies are 2 -4% of reading.

Thermo NZP1000 combines integral flow straighteners and a "Nozzle-Pitot Array". The nozzle not only corrects disturbances in the velocity profile before it is measured by the pitot array, but also doubles the velocity at the point of measurement thereby quadrupling the velocity pressure. The NZP1000 requires no upstream straight run and is accurate to 0.5% of reading.

High Repeatability

Thermo's DSK1000 and NZP1000 provide highly repeatable measurements under adverse conditions. The integral flow straighteners and nozzle (NZP only) eliminate much of the turbulence that causes signal noise. Thermo's Air Flow Sensors are much more repeatable than insertion type pressure averaging devices, venturis, and thermal flow sensors in situations where a turbulent, distorted velocity profile exists.

Low Velocity Pressure

The Thermo's MST1000 Series Multivariable SMARTFLOW Transmitter is used to convert the low level differential pressure input into a 4-20mA output. The MST1000's "ultra low" DP Measurement capability provides excellent performance in spans as low as 0.007” H2O with an accuracy of ±0.15% of span.

Contamination

The MST1000 with the “continuous air purge option” (only on 0.25” H2O spans and higher) will prevent fly ash from plugging the pitot tubes and isolate the transmitter from potentially corrosive flue gases insuring long term accuracy and reliability. Some Primary Air Flow Measurement applications may require the use of the Thermo BDS1000 High Pressure Blowdown System. The BDS1000 supplies a high pressure blast of air at user programmable intervals to blow out the pitot array.

Mass Flow Measurements

Thermo’s MST1000 Series Multivariable SMARTFLOW Transmitter can be configured to correct volumetric flow measurements for changes in temperature and pressure and also accepts a second differential pressure transmitters for high turndown applications. Thermo’s Air Flow Sensors can also be optionally equipped with temperature and pressure measurements.

Thermo Electron Corporation

For over 20 years, Thermo Electron has been the recognized leader in the measurement of air/gas flow and very low differential pressure in industrial applications. Thermo offers a complete line of pitot/static probes and arrays, D.P. Transmitters, the unique Nozzle-Pitot flow sensor and a complete family of Current to Pressure (I/P) and Pressure to Current (P/I) transducers. Contact Thermo Electron, Thermo’s representative or visit our website, for further information, specifications and application assistance.

9303 W. Sam Houston Parkway S.  Houston, Texas 77099 USA  Telephone: (877) 290-7422  Facsimile: (713) 272-2273

www.thermo.com  Let us point you in the right direction.