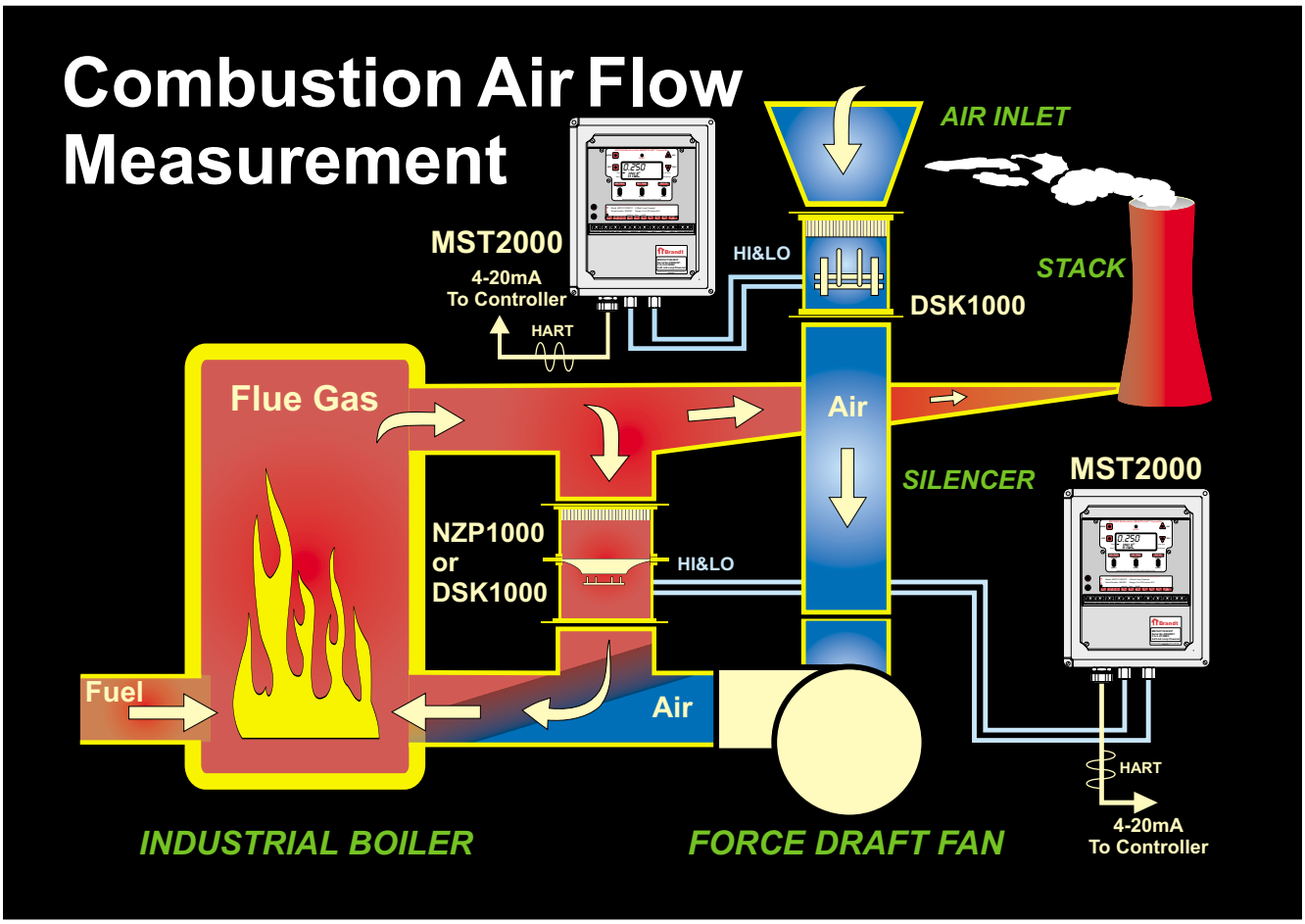

Application Bulletin No. 2

Combustion Air Flow Measurement For Industrial Boilers

Many industrial plants use fired process equipment to generate power or to contribute to manufacturing processes by burning, heating, or drying various products. Boilers, and other fired process equipment, require combustion control to regulate the amount of air and fuel, maximize combustion efficiency, and maintain safe operating conditions. By measuring air and fuel flows accurately and repeatably, the fuel to air ratio can be controlled such that:

- Complete combustion occurs thereby minimizing fuel wastes, air pollution, and the risks of secondary unwanted combustion (explosions).
- Energy losses from too much excess air escaping as hot flue gases are minimized.
- Operating costs are reduced.

One method of improving combustion efficiency and reducing stack emissions is to recirculate flue gases from the stack to the boiler inlet ducting. The FGR, *or Flue Gas Recirculation,* and outside air mix makes up the total combustion air into the boiler. Outside air coming into the boiler and the FGR are measured and controlled independently.

Thermo Brandt

The Problems

Limited Straight Run

The outside combustion air measurement must be done prior to where the FGR line tees into the ducting. Very little straight run for the flowmeter remains between the fan discharge and the FGR line. The FGR flow sensor is typically placed between two elbows with little straight run separating them. This lack of straight run creates velocity profiles which are distorted, turbulent, and difficult to measure.

High Repeatability

Excellent repeatability is necessary if tight combustion control is to be obtained. 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 nonrepeatable measurement.

Low Velocity Pressures

Differential pressures at maximum flow are often less than *0.5" H_2O* and are very difficult to measure using most standard DP transmitters. Typical flow turndowns of 3 or 4:1 will result in differential pressures at minimum flow rates of *less than 0.1" H_2O.*

Contamination

The flue gases being recirculated may contain fly ash that can plug or coat the flowmeter, affecting accuracy and reliability.

The "Thermo Brandt" Solution

Limited Straight Run

For optimum performance, combustion air flow is measured with a Thermo Brandt **DSK1000** Pitot Averaging Flow Sensor in the fan inlet ducting immediately downstream of an inlet cone. In this configuration, the DSK1000 requires no upstream straight run and has an *accuracy of 1-2% of flow with a repeatability of 0.1-0.2% of flow*.

The FGR usually flows through a small circular duct and can be measured by a **DSK1000**, or the more accurate Thermo Brandt **NZP1000** Series Nozzle-Pitot Flow Sensor. Required accuracy, straight run availability, and duct velocity will determine which is the better choice.

Thermo Brandt's **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), effectively building 7 or more diameters of straight run into the flow sensor.

The **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** Flow Sensor *requires no upstream or downstream straight run and is accurate to 0.5% of reading*.

SIRA CERTIFICATION SERVICE SUPPLIER
QUALITY MANAGEMENT CERTIFICATE NO. 940099
ISO 9001

MD01-0002-00, July 1999 All Specifications Subject To Change Without Notice

High Repeatability

Thermo Brandt's **DSK1000** and **NZP1000** Series of Flow Sensors 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 Brandt's 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 Pressures

For the inlet air flow measurement, the **MST2400** Loop Powered, Mutlivariable SMARTFLOW Transmitter is used to convert the low level DP input into a 4-20mA output. The **MST2400** can be used effectively to measure full scale DPs as *low as 0.10" of H_2O with accuracies of 0.15% span (@ a 2.5:1 turndown).* The **MST2400** has a thermallly compensated output, is HART compatible and has a maximum turndown of 10:1.

Contamination

For the FGR flow measurement, the Thermo Brandt **MST2400** Multivariable SMARTFLOW Transmitter is recommended. It's *"ultra low"* DP measurement capability provides excellent performance in spans as low as 0.10" H_2O and for spans of 0.25" H_2O or higher, an optional *"continuous air purge option"* will prevent fly ash from plugging the pitot tubes . For extremely dirty applications, the **MST2400** can be fitted with an integral *"Programmable High Pressure Blowdown System*" to blow out the pitot array sensing ports at end user programed intervals.

Application Note

Mass Flow Measurements

Density corrected outputs, linear with mass flow are available. The Thermo Brandt **MST2000** Loop Powered Multivariable SMARTFLOW Transmitter, can correct volumetric flow measurements for changes in temperature and pressure and accepts dual (high & low range) DP transmitters for high turndown applications. Thermo Brandt Air Flow Sensors can also be optionally equipped with temperature and pressure measurements.

THERMO BRANDT INSTRUMENTS

For over 20 years, Thermo Brandt Instruments has been the recognized leader in the measurement of air/gas flow and very low differential pressure in industrial applications. Thermo Brandt offers a complete line of pitot/static probes and arrays, Multivariable & 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 Brandt Instruments, Thermo Brandt's representative or visit our website for further information, specifications and application assistance.

www.brandtinstruments.com

Let us point you in the right direction

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