

MEASURING PRIMARY AIRFLOW

The Challenge

The objectives in the power industry today are twofold; to lower emissions, and increase plant performance. Precise measurement of combustion airflow and fuel rates positively contributes to achieving those objectives by providing the information needed to optimize stoichiometric ratios and facilitate more complete, stable combustion.

The main functions of primary air are to dry the coal and then pneumatically convey the pulverized coal from the mill to the individual burners. Primary air also determines coal particle velocity at the burner exit, in part defining the flame position relative to the burner tip and impacting flame stability, both key factors in achieving optimized burner performance. Excessive primary air contributes to high NO_x formation and tube erosion,

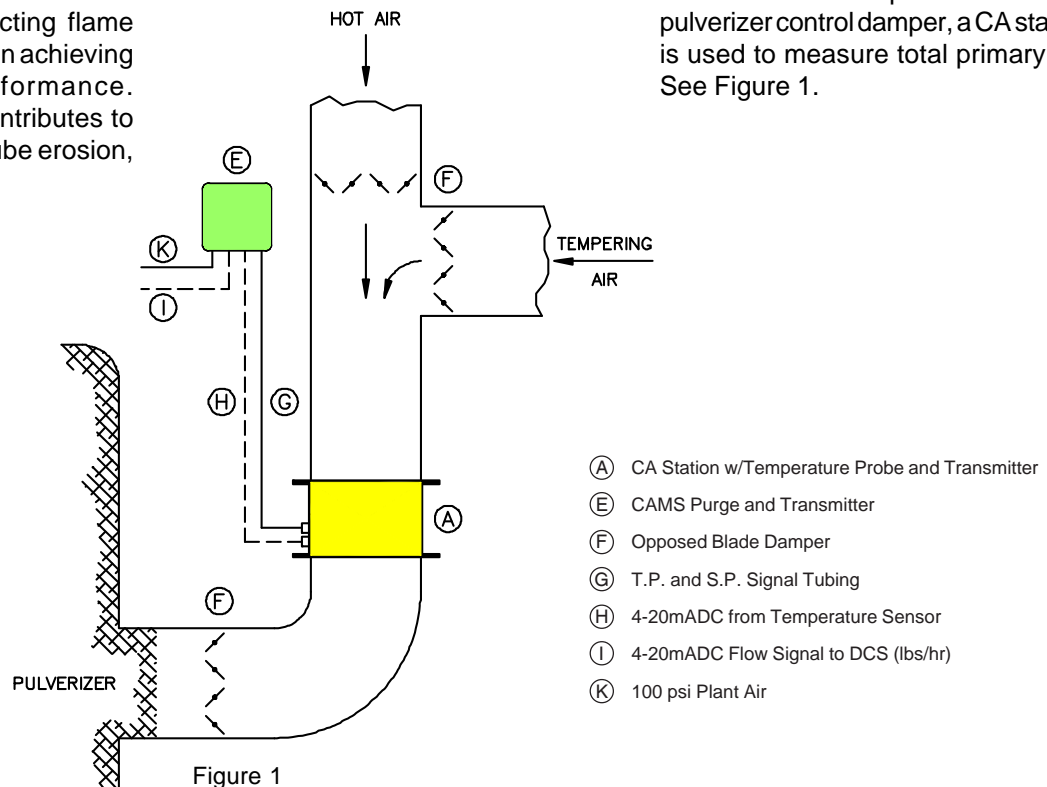
while insufficient primary air results in slagging, coal layout, pipe fires, "eyebrows", and burner pluggage.

Usable measurement of primary air cannot be obtained from existing devices such as venturis, foils, jamb tubes, etc., or instrumentation such as thermal anemometers due to limited available straight duct runs, low flow rates, broad turndown range and high concentrations of airborne particulate (flyash). The need is airflow instrumentation capable of overcoming these challenging operating conditions, to optimize both mill operation and burner performance.

The Solution

Ductwork providing primary air to a pulverizer typically has limited straight runs, control dampers, and a convergence point of hot and tempering air, all of which make the selection and placement of the airflow measurement device(s) critical to the success of the installation. The following three examples show the use of Fechheimer-Pitot Combustion Air (CA) stations and/or VOLU-probe/SS arrays, and their optimum locations.

In applications with at least 1½ diameters of straight duct run between the hot air/tempering air mixing point and the elbow upstream of the pulverizer control damper, a CA station is used to measure total primary air. See Figure 1.



The Solution (con't)

Where insufficient straight duct run exists downstream of the air mixing point, or separate measurement of hot and tempering air is desired to control mill outlet temperature, CA stations or VOLU-probe/SS arrays can be installed in both air ducts upstream of the control dampers, one duct diameter for the CA Station and two diameters for the VOLU-probe/SS array. See Figure 2.

the CAMS enclosure the pressure signals plus airflow temperature are converted by the CAMM into a density compensated lbs/hr mass flow output to the DCS. When two flow elements are supported by a single CAMS, both the individual and summed mass flow outputs are made available to the DCS.

The CAMM also manages the AUTO-purge™ system used to keep the airflow station or probe array sensing ports and signal lines clear of accumulating fly

ash. The purge cycle can be configured to operate on a programmable interval or initiated via a dry contact from the DCS. During the purge cycle the CAMM maintains a locked signal output to the DCS while providing a dry contact notification of purge cycle start and finish.

Result

These systems provide airflow measurement accurate to within ±3% of actual airflow over a 10:1 turndown range. The signals remain stable with zero drift, and due to AUTO-purge the flow elements can operate continuously within the heavy particulate environment. To date thousands of these systems have been installed within fossil fuel power plants to help reduce NO_x and CO, improve flame stability, avoid coal pipe layout, minimize LOI/UBC, increase combustion efficiency, and reduce waterwall corrosion.

Coal mass flow and particle velocity data from a Pf-FLO coal flow measurement system allow further optimization of primary air by providing the means of customizing a mill's PA to Feeder curve to meet the unique operating conditions of each power plant; curves that are dependent upon variable coal type, moisture content, coal pipe arrangement, and actual fuel distribution.

- (A) CA Station
- (B) CA Station w/Bellmouth
- (C) VOLU-probe/SS Array
- (D) Thermocouple Probe w/Temperature Transmitter
- (E) CAMS Purge and Transmitter
- (F) Opposed Blade Damper
- (G) T.P. and S.P. Signal Tubing
- (H) 4-20mADC from Temperature Sensor
- (J) 4-20mADC Flow Signal to DCS (lbs/hr)
- (K) 100 psi Plant Air

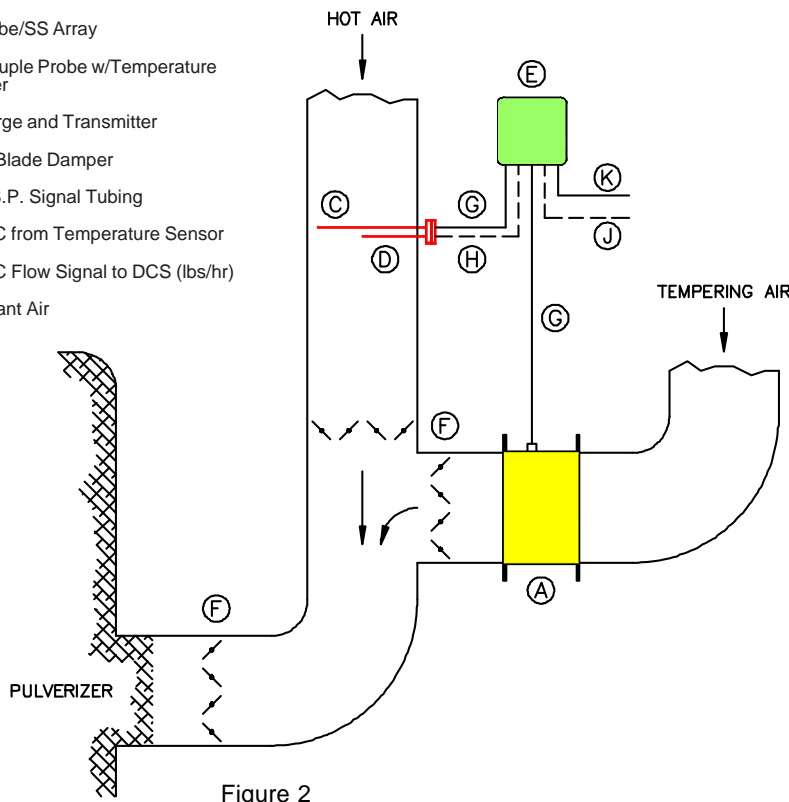


Figure 2

On exhauster mills the tempering air is often not ducted but instead enters via a "barometric opening" on the side of the ductwork. For this application an integrated bell mouth CA station with extended casing is utilized to create the necessary minimum run of straight ductwork needed to accurately measure the tempering airflow. A control damper can also be added. See Figure 3.

The total and static pressure signals from one or both CA Stations or VOLU-probe/SS arrays are routed to the Combustion Airflow Management System (CAMS) enclosure. Within

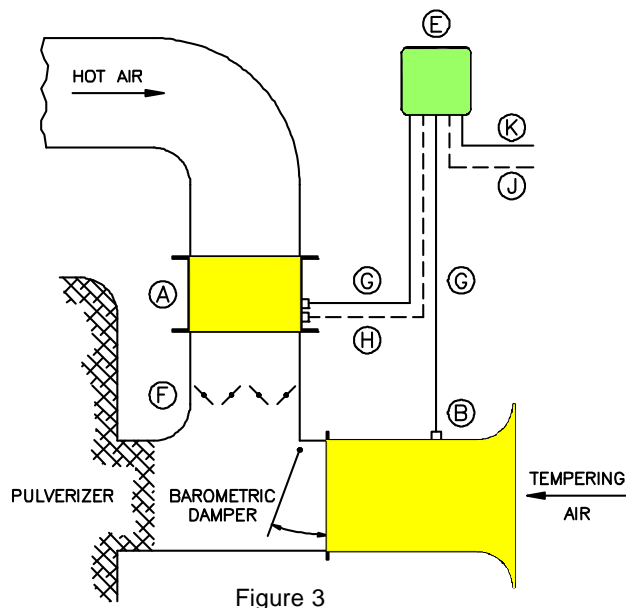


Figure 3