Application Note

Boiler Combustion Air Flow Measurement

- **Industry:** Power
- **Product:** DPharp Pressure Transmitter, EJA-E and EJX-A series

▪ Introduction

Draft is the differential caused by the flow of hot gas through a furnace. On a vertical petrochemical heater, it is the differential between the furnace inlet (bottom) and the stack. This differential is caused by the restrictions of the tubes and the the preheater in the bridge wall section before the stack. Draft will increase as firing rate increases and will decrease as firing rate decreases. It is an indication of air flow through the burner throats or total gas flow through the furnace.

▪Application

Boiler air flow (or air flow on a forced or balanced draft furnace) may be measured with a pitot tube, air foil section, or any calibrated flow restricting device located in the duct that leads from the forced draft fan to the windbox. (The windbox is the area behind the burner throats that supplies combustion air to the burners.) The differential across the windbox to the furnace can be as high as 25" H_2O, but is not used because each time a register is adjusted, the flow relationship to delta P changes.

On many boilers, air flow is the measured differential between the furnace inlet and the boiler outlet. This takes the differential of the hot gases as they flow through the furnace, across the convection section, and out of the stack. In most cases, the differential ranges from 0.5 to 2.0" H_2O.

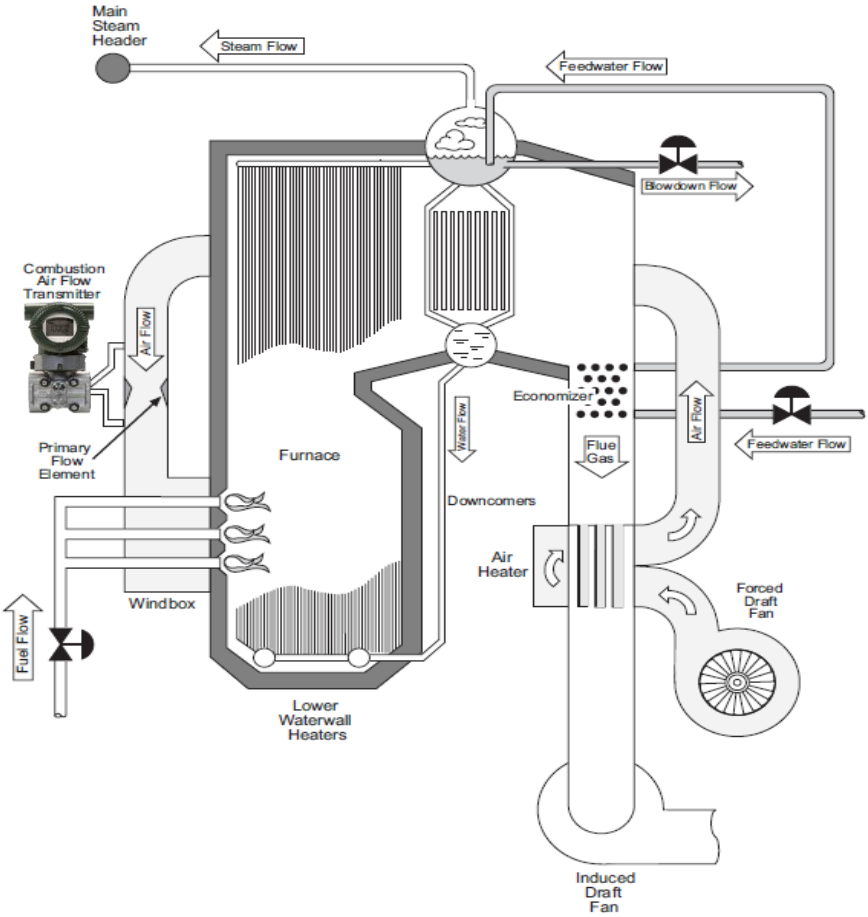

Figure 1: *Typical Boiler Combustion Air Flow Measurement* PAG504-01.a

Most transmitters use a standard capsule, which may be selected for linearity, plus a high gain amplifier to achieve 4-20 mADC output for such a low differential. If the gain is ten, then any normal capsule errors are multplied by ten. A capsule that has a ±0.1% drift now has a 1% drift. Since flow "squared" equals differential pressure caused by a flow restriction, the square root must be extracted, and at the low end, this 1% drift can cause a 10% flow error. If the transmitter is not designed to be sensitive at the low end, there will be a low end cut-off, usually at 1%.

▪Yokogawa Solution

There are very few draft range transmitters that perform well on this type of air flow measurement application. Yokogawa Industrial Automation's DPharp is excellent for this service since the zero is stable and it is not subject to temperature or static pressure drift, or zero shift, caused by the shock of furnace or boiler light-off. In particular, the EJA120E and EJX120A are designed for low pressure (draft) applications like the one described previously. The particular capsule and sensor design make the EJA120E and EJX120A transmitters more sensitive at low pressures across the full range of the capsule.