Airflow Sciences Corporation

Innovative Mixing Device Reduces Thermal Stratification in Ductwork

Case Study

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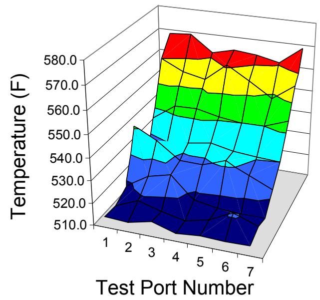

Figure 1 - Temperature distribution before mixer installation

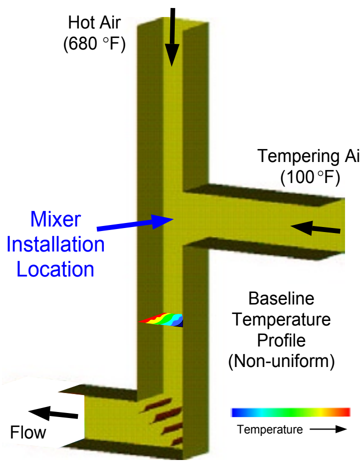

Figure 2 -Schematic of geometry

Flow Temperature Stratification Before and After Mixing Device Installation		
Pulverizer Inlet Measurement	Before	After
Average Temperature	534 ˚F	573 ˚F
Minimum Temperature	512 ˚F	568 ˚F
Maximum Temperature	574 ˚F	581 ˚F
Maximum ΔT	58 ˚F	13 ˚F

Figure 3 - Field test results

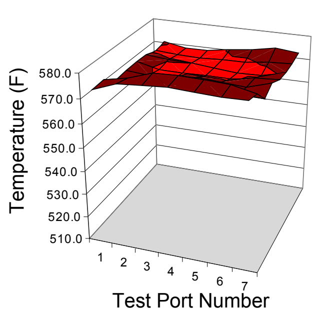

Figure 4 - Temperature distribution after mixer installation

ATCO POWER's Sheerness Station in Hanna, Alberta is a pulverized coal plant producing 750 MW of power. Sheerness was experiencing temperature stratification in its pulverizer inlet ductwork. As shown in Figure 1, temperature deviations of up to 58°F were measured. In addition to reducing drying efficiency downstream, such imbalances can lead to safety issues.

The temperature stratification was a result of merging two flow streams. Incoming flow from the air heater provides the thermal energy for drying of the coal as well as the required transport mechanism. The inlet air temperature is controlled using a tempering stream of ambient air, as seen in Figure 2.

To resolve the stratification problem, ATCO installed an air mixer device designed and patented by Airflow Sciences Corporation (ASC) of Livonia, Michigan. A computational fluid dynamics (CFD) model was used to optimize the mixer design for ATCO's specific duct system geometry. A key consideration was to generate the mixing with minimal system pressure drop.

After installation of the ASC mixer, the temperature distribution was remeasured. The temperature deviation was reduced considerably with the mixer in place, to 13°F. Results are shown in both Figures 3 and 4. It should be noted that the difference in average temperature is due to operational considerations. The additional pressure loss caused by the mixer was barely measurable at 0.1 inches of water.

Kevin Burgemeister, Plant Engineer at Sheerness, has this to say regarding the installation and operation of the device:

> "We were looking for a device that would provide an even temperature distribution to a temperature compensated airfoil in order to provide more reliable airflow control to our Pulverizers. The air mixing device from ASC provided the temperature profile we were seeking while the simple construction and ease of installation made this a cost effective solution."

The techniques described here may be applied to any situation where flow streams of differing temperature and/or chemical content need to be combined and mixed in an efficient manner. The design parameters of the mixing device may be optimized using CFD (as in the ATCO case) or may be estimated using engineering experience (to reduce costs). The resultant improvement in mixing can be used to improve efficiency, increase throughput and reduce safety concerns.