Steam System Best Practices
Document No. 6
Boiler Plant Efficiency Demands
Proper Plant Ventilation

Boiler Efficiency Demands Proper Ventilation

Proper ventilation is a must for boiler plants that are located in areas where colder weather is prevalent. During colder or inclement weather, plant personnel will reduce ventilation in the boiler plant by closing doors and windows to maintain internal boiler plant temperatures. This action (closing doors, windows and other openings) is typically done to satisfy personnel comfort and maintain a workable environment. Most boiler plant personnel have not been informed on how this action has such a dramatic effect on the combustion process and the tremendous loss of energy.

The combustion process requires three items; oxygen, fuel and temperature. The boiler combustion process requires a large volume of air, specifically for the oxygen in the air.

As previously discussed in PSE's newsletters in a description of air-fuel ratio, oxygen is a basic element in combustion. Improper ventilation in the boiler room may lead to oxygen starvation in the burner, which results in incomplete fuel combustion.

Loss of Boiler Efficiency (.05% to 12.4%)

The closure of the openings in the boiler plant can cause a negative pressure in the boiler plant. The negative effect is caused by the amount of air that is exhausted with the gases from the boiler combustion process exceeding the air makeup flow to the boiler room. This effect can reduce the required combustion air for the boiler operation, upsetting the air/fuel ratio and dramatically reducing efficiency.

Proper boiler plant ventilation insures maximum energy efficiency by ensuring sufficient oxygen (air) is available for complete fuel combustion. When the air supply is insufficient, the combustion process is incomplete or unburned fuel is lost in the exhaust gases into the atmosphere.

This loss can be from .05% to 12.4% loss of boiler efficiency depending upon how negative the pressure is in the boiler plant. Fuel pricing today, we can not afford to have any loss of efficiency.

How to Calculate for Correct Ventilation

The process for calculating the amount of air required for boiler plant ventilation is:

- Determine the maximum burner CFM (flow rate) requirement for each boiler
- Add all boilers' CFM requirements
- Total required CFM x 1.1 = required CFM for the boiler plant ventilation

This calculation process does not take into consideration any other equipment or applications that are located in the boiler plant (e.g., air compressors) that could add to the required amount of intake air. Always consult federal, state, and local codes that may supersede the recommended calculation for ventilating the boiler plant.

Best Practices:

1.) Review combustion air requirements for all boilers

2.) Insure air make up is designed for the operation

3.) Insure the air make up is at a proper temperature for plant personnel

4.) Check fuel/air ratio curves every three (3) months

Heating Boiler Air Makeup

There are several ways of tempering the make up air for the boiler plant operation.

Steam:

1.) Unit heaters

2.) Steam coils in air make up units

Boiler Exhaust Gases

The air makeup requires energy that could otherwise be used for the process applications. For this reason, it is a best practice to preheat the combustion air by absorbing heat that is otherwise wasted. This is commonly done through an air-to-air heat exchanger on the exhaust stack.

Using a condensing type exhaust air system to make up air heat exchanger or an exhaust gas system to make up water heat exchanger captures the wasted exhaust gas energy and reuses that energy to heat the makeup air.

Typical installations have less than a one (1) year pay back.

Limitations are for use on a natural gas boiler only, with research being done on other fuels.