

## Stack Temperature & Efficiency: The Relationship

Appreciating the relationship of stack temperature to boiler energy efficiency boils down to a matter of degrees Fahrenheit (F). The key is understanding the basis by which one can properly evaluate the condition.

Most people understand that stack temperatures which are excessively high typically indicate that Btu's (fuel dollars) are emitting out the stack and are not being applied to productive use in the process or comfort heating load. This might be true or it might not-- it depends on the criteria by which the gross stack temperature is derived.

To best understand how stack temperature affects efficiency, you need to be aware of three (3) essential criteria that form the baseline, and from here establish whether or not your boiler is losing efficiency, needlessly.

The criteria are

1. Operating pressure
2. Firing Rate
3. Ambient temperature in the boiler room

### OPERATING PRESSURE

The operating pressure of the boiler coincides with a specific saturated steam temperature. For instance, 100 psig is the same as 338 degrees F.

Normally, as the operating pressure increases, the stack temperature in a clean, well-tuned boiler will also increase, anywhere from 75 to 100 degrees over the saturated steam temperature. As an example, a 350-horsepower boiler burning natural gas, firing at 100%, 10 psig operating, and with an 80 degree F ambient, will indicate a stack temperature of approximately 320 degrees F. This equates to a boiler efficiency of about 85%.

Raising the operating pressure to 125 psig under the same conditions increases the stack temperature to approximately 453 degrees F, reflecting an efficiency of approximately 83% in the clean, well-tuned boiler.

### FIRING RATE

If we are looking at stack temperature as one of our primary indicators for determining boiler efficiency, it is imperative to realize the lower the firing rate in a boiler, the lower the stack temperature will be. This is because you are putting less heat into the heat exchanger (boiler).

### AMBIENT TEMPERATURE

This is the temperature in the boiler room that adds to the gross stack reading. As the ambient temperature climbs, so does the stack temperature indication on the gage.

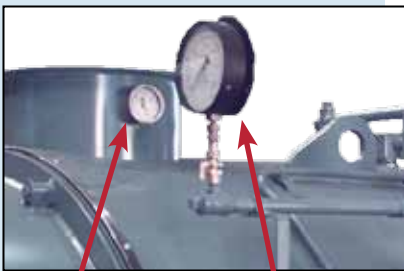
Being aware of these criteria, and applying (logging) them will now put you in a position to properly evaluate stack temperature and its effect on efficiency.

It is extremely important that the baseline begins with a clean well-tuned boiler. After that is confirmed, then log respective stack temperatures against the criteria noted above. For every 40 degree F elevation above the baseline, you have lost one percent in efficiency.

It's all a matter of degrees...



Get the best efficiency from your boiler by understanding stack temperature. (CBEX Premium Boiler pictured above)



Stack Thermometer

Steam Pressure Gauge