Q&A Session for Prioritizing Efficiency, Reliability & Safety Enhancements

Q: What is the formula for calculation efficiency loss when the stack gases are 40°F where can find that 1%?

A: The 40 degree number is a rule of thumb stemming from the Fuel to steam or hot water efficiency calculations found in the ASME Power Test Code as it relates to either the input-output or heat loss methods of calculating efficiency. It is actually the inverse relationship of what the efficiency gain would be with a combustion air increase of 40 degrees. In this case it would improve by 1%. However, when the firing rate is bench marked along with the boiler's operating pressure/temperature and the ambient temperature in the boiler room (say 80 degrees F), the temperature rise in the stack then equates to an approximate loss of 1%.

Q: What temp did you recommend in the feed water?

A: As hot as possible while considering the operating pressure/temperature in the boiler. This is why it is wise to consider a high pressure return system in high pressure steam applications. Remember, this condensate has probably been deaerated, and/or chemically treated while containing much of the sensible heat required to provide a pound of steam at the pressure required. Every 10 degree increase equals a 1% pickup in efficiency.

Q: All motors made in the USA have to be high efficiency motors in accordance with EPACT. So inefficient motors are only in the older systems (prior to 2006).

A: This is an excellent point raised; however, EPACT is a reference for motors covered by NEMA MG-1 Table 12-11, and the requirement seems to vary based upon motor HP and number of poles.

Q: is the efficiency loss rated and calculated for all types of fuel, oil, gas and propane in that 1% margin you mentioned?

A: Actually the efficiency of boilers firing oil or propane are higher than the same boiler firing natural gas because of the hydrogen/carbon ratio being the highest with natural gas, and causing higher moisture losses. The efficiency difference varies based on firing rate, but can equal several percent.

Q: Can you vary the flow of water through a hot water boiler based upon delta T? Would this reduce pumping energy and increase thermal efficiency?

A: When you increase the delta t in the system you indeed lower the pumping rate and thereby reduce the pumping energy. Two primary cautions: The heat exchangers in the system need to be checked to assure the lowering of velocity will not affect the heat exchange rate, and secondly, the boiler(s) is capable of accepting the lower return temperatures. Concern here is with thermal shock and possible condensing in noncondensing boilers.

Q: What is the better stack temperature for a boiler working at 100 PSI?

A: A boiler operating at 100 psig has a saturated temperature of 338 degrees F. A well tuned and clean boiler will operate approximately 50 – 100 degrees above that temperature based on a firing rate from low (390) to high fire (440).

Q: The efficiency changes you're talking about, what does that account for? Are these changes to combustion efficiency, thermal efficiency, or fuel to steam efficiency?

A: Fuel to steam efficiency is what I was referring to which accounts for combustion losses as well as radiation and convection losses.

Q: What are the typical maintenance activities and frequency for firetube boilers?

A: Suggest you contact your local CB Representative or contact CB Marketing directly requesting the "Boiler Room Guide" (CB 7853) which will spell things out in detail. Not enough room to answer in this format.

Q: I inspected a boiler about a month ago, both cold and hot test preparations were followed well. After a week the boiler developed a bulge on one corrugated ring. What could be the cause? I relate this with what you have mentioned on diffuser and burner positioning. Could it be the burner flame aimed at the affected area, thus excessive heat caused the bulging?

A: This could be the answer and is what we refer to as flame impingement wherein the flame is actually touching the metal causing excessive heat leading to waterside steam blanketing limiting the amount of heat absorption. Suggest the waterside of the bulging surface be checked for scaling which will greatly impede heat transfer, again causing overheating

Q: What is the range of turndown for a "high turndown" burner for example on a 200 HP boiler?

A: Normally 10:1

Q: Can you repeat your point on the 1:3 ratio in savings of the VFD - can you return to that slide to show those numbers?

A: The entire presentation is recorded, and can be viewed on our website.

Q: what is the impact on boiler life running natural gas vs #2 oil?

A: Should be no difference if the boiler is properly tuned and well maintained both waterside and fireside.

Q: What are the operation ranges in low pressure boilers for the following: Salinity, PH, TDS, Temp, and Conductivity?

A: Giving a rule of thumb here may be very misleading, and quite frankly, this is not our area of expertise. Suggest you contact a reputable water treatment consultant to give recommendations based on your specific water chemistry.

Q: Is it possible to work the boilers with oxygen below 3% with natural gas?

A: Not recommended because of the high probability of the burner going excessively rich because of atmospheric conditions beyond your control. This could lead to a serious fireside explosion. The 3% Oxygen level (15% excess air) keeps the burner in an efficient yet lean state in order to compensate for these uncontrolled variations.

Q: You talked about moisture losses, can you be more specific?

A: The significant amount of hydrogen in natural gas when combined with the oxygen in the combustion air creates water which is reduced to a gas as the heat of combustion takes place. This gas is then reduced to a liquid (condensation) when reaching dew point while exiting the stack. This then releases the latent heat (BTU's) which was derived from the burner as it burned the fuel.

Q: You said as the linkage controlling air ages, it gets "sloppy" throwing off the fuel/air ratio costing a loss in efficiency. Can't you just replace the single point positioning system rather than going to a new parallel positioning system?

A: Yes, you can, but my suggestion is to switch to PP as it gives you much better repeatability.

Q: Do all boilers lose efficiency as the firing rate is reduced because of the excess air climb?

A: most do, but there are boilers that can hold the EA to very low levels throughout turndown. THE CBEX is an example.

Q: What did you mean by "burner pull back" causing diffuser damage?

A: As the firing rate reduces some burners lose stabilizing air at the front of the burner allowing it to pull back and overheat the diffuser. This is normally an adjustment problem of the fuel air ratio and/or diffuser placement.

Q: We have our safety valves manifolded into a common vent through the roof. Problem?

A: Could very well be. That vent has to be of adequate size to relieve both valves and be supported. I'd suggest venting each valve separately.

Q: Will an Oxygen Trim system tune my boiler?

A: No, the boiler has to be tuned for the trim system to work properly. It will then compensate for the variances of temperature, barometric pressure and relative humidity.