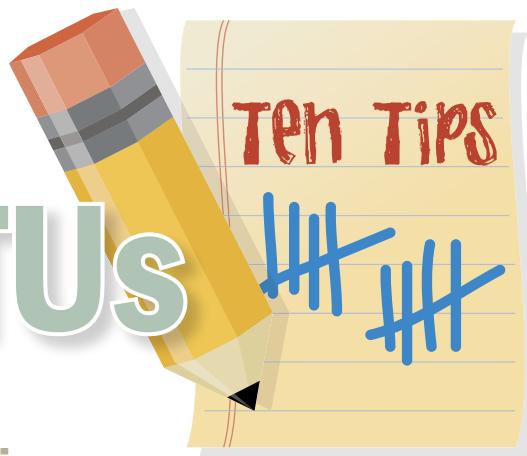


the Art of Chasing BTUs



Maximize the energy efficiency of your boiler by selecting, maintaining, repairing and optimizing your system.

By Eric A. Kessler, Clayton Industries

With today's energy costs, understanding the efficiency of a boiler may be the most important factor in the purchasing decision. There are many types of boilers on the market and each has its own attributes. How they manage basic combustion, the heat exchanger design and other unique design characteristics, combined with the overall design of the steam system, result in a boiler's overall efficiency. Understanding all the efficiency claims and how to compare various boilers will lead you to the correct purchase decision. And, once you have made your selection, there are a few important aspects of your boiler that contribute to its overall efficiency that require your ongoing attention.



1 A Few Points Matter

The annual fuel bill for a boiler can easily be two to three times the installed cost of the unit. Boilers with just a few percentage points better efficiency can generally pay for themselves the first year in energy savings, and the savings are ongoing.

2 Size for Actual Use

In industrial uses, most boilers are oversized for the application and operate at less than optimal efficiency. Conventional firetube boilers maintain peak efficiency at 100 percent firing rate; they lose efficiency as firing rate decreases. Steam generators

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maintain a flat efficiency curve with peak efficiency at any firing rate.

3 Maintain Proper Combustion

Excess air is required for combustion. Low excess air increases carbon monoxide (CO) and sooting. However, too high excess air uses energy and lowers efficiency. Seasonal changes in temperature and barometric pressure can cause excess air to fluctuate 5 percent to 10 percent.

Too much or too little fuel with the available combustion air can result in unburned fuel and carbon monoxide generation. A very specific amount of oxygen (O₂) is needed for perfect combustion, and additional (excess) air is required for good combustion. Too much additional air can contribute to CO generation, lower efficiencies and, perhaps, unsafe conditions with heating equipment not lasting beyond its full service life. Carbon burned to carbon dioxide (CO₂) will produce more heat per pound of fuel than when CO or smoke is produced.

4 Weigh Linkage-Less Designs

Recently introduced linkage-less combustion control systems with servo motors controlling the air/fuel mixture ensure proper combustion based on standard environmental conditions. An additional oxygen sensor in the stack can help the system control the excess air based on changes in the environment.

5 Maintain Water Treatment

All boilers require proper water treatment to maintain peak efficiency and ensure long tube life. Soft water is required so that the water sides of the tubes do not accumulate scale. Scale accumulation is one of the major causes of reduced efficiency. Just 0.125" of scale can reduce efficiency by 3 percent.

6 Monitor and Manage TDS

Regular water treatment and monitoring also ensure that you are operating at the recommended level of total dissolved solids

(TDS) for your type of boiler. Solids are controlled by blowdown, which essentially sends BTUs to the drain. Too little blowdown and the high TDS will cause foaming and carryover in conventional boilers. If your TDS is lower than recommended, you may be blowing down excessive water and wasting energy and chemicals.

7 Install Stack Economizers

All boilers exhaust gases hot enough to be productive and improve the overall efficiency of the steam system. Standard stack economizers can be used to preheat the boiler water, either before it enters the feedwater tank or before it enters the boiler. These types of economizers usually can improve the boiler's efficiency by 3 percent to 4 percent.

Condensing stack economizers take substantially more heat out of the exhaust stream than standard economizers and can heat water to approximately 104°F (40°C). Efficiency gains of up to 15

percent are common. These systems are particularly attractive when there is a great demand for hot water in the process or elsewhere in the facility.

8 Bring Back the Condensate

Many older steam systems do not have condensate return pipes, or there are numerous leaks in the return system. Once the steam has done its work and condensed, there is still substantial energy contained in the liquid. To maximize process efficiency, this condensate should be returned to the feedwater tank and reused through the boiler. The energy in the condensate will greatly reduce the amount of steam required to preheat the feedwater as well as reducing the amount of softening and chemical treatment that would be required for fresh makeup water.

9 Maintain and Repair Promptly

To ensure long system life, maintain the steam traps regularly and repair leaks



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Steam System Facts and Figures

Steam systems account for 30 percent of total energy consumption in industry. A recent DOE study states that system improvements can increase efficiency by 10 to 15 percent.

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promptly. When a steam trap fails, it allows steam to blow through along with the condensate. This loss of steam represents a substantial energy loss.

Steam is a valuable commodity and the higher the pressure, the higher its value. It is important to repair steam leaks as soon as they occur. A leak not only wastes energy but also boiler water and chemicals, and leaks can be dangerous to people and equipment. Steam that leaks through a 0.25" hole can waste up to \$2,000 per month in energy.

10 Insulate Pipes and Fittings

Though adequate insulation usually is part of new steam systems, older systems may not be sufficiently protected from heat losses. Any surface over 120°F (49°C) should be insulated, including boiler surfaces and steam and condensate piping and fittings. Insulation frequently becomes damaged or removed during maintenance and is not replaced. Steam leaks also can damage insulation. Insulation on a typical 6" gate valve can save \$300 per year. Installing and maintaining 90 percent efficient insulation on piping can save tens of thousands of dollar every year.

In conclusion, significant opportunities exist for saving energy in our steam systems. Selecting the right boiler for your needs and designing and maintaining the overall steam system will result in lower overall operating costs. **PH**

Eric A. Kessler is a regional sales manager with Clayton Industries, City of Industry, Calif., a manufacturer of equipment for the generation of industrial steam. For more information, call (626) 435-1200 or visit www.claytonindustries.com.