

MAKING THE MOST OF BOILER INSPECTIONS

KEY CONSIDERATIONS GOVERNING THE EXAMINATION OF SMALL FIRETUBE UNITS

Summer is the perfect time to inspect a boiler, sizing up its energy use, carbon footprint, and overall ability to support a process reliably and safely. Once inspected, a boiler must be restarted and tuned properly to ensure maximum performance.

This article discusses key considerations governing the annual inspection of firetube boilers ranging in size from 100 to 1,000 hp and 3,450 to 34,500 lb of steam per hour.

FIRE-SIDE

Once a boiler is opened for inspection, the first order of business is assessing the condition of the fire-side of the unit:

- Are the refractory and insulation in good condition? If the refractory shows evidence of serious cracking (1/4 in. or more) or deterioration, which can lead to overheating and metal fatigue/failure, patch it with cement or plastic and lightly wash-coat it.
- Do the pressure-vessel and heat-transfer surfaces show signs of poor combustion (sooting) and possible metal fatigue and weldment cracking? Sometimes, these are evidenced by rust formation, the result of water leakage when the boiler cooled (metal contraction) and still was under pressure. A hydrostatic dye test under pressure will manifest such leakage.

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When soot is found on fire-side surfaces, it is time to retune the burner, making sure the fuel/air ratio properly tracks the turndown of the burner from low to high fire. Often, that is

all that is required to eliminate the problem and substantially improve combustion efficiency. However, you also might want to consider installing independent motorized actuators, removing much of the linkage assembly, to prevent slippage and hysteresis. Additionally, an oxygen-trim system may be considered to continuously compensate for variances in ambient-air temperature, barometric pressure, etc. Both of these retrofits are relatively inexpensive and can, under the right operating conditions, reduce fuel usage by 5 to 10 percent over the course of a year.



Proper burner tuning helps to enable optimum operation.

WATER SIDE

Once a boiler is drained, it is time to inspect the water side of the vessel, looking for signs of excessive scale (1/8 in. or more), corrosion, and pitting of metal.

When problems related to the water side of a boiler are discovered, it is imperative that a water-treatment consultant be engaged. Failure to remedy a problem quickly can result in major repair costs and downtime or complete loss of a boiler's pressure vessel.

SAVING ENERGY

If a boiler's pressure vessel is in good shape, with only minor scaling (magnetite) and no evidence of weldment deficiencies and pitting, it likely has many years of life left in it. As such, it is

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A system audit is a way to identify energy losses.

Savings Beyond a Boiler

Once a boiler has been opened, cleaned, inspected, and closed, and the burner has been tuned or retrofitted, a full audit of the steam system should be considered.

A steam-system audit includes the assessment of load profiles and pressures to determine if economizers and other ancillary equipment would accelerate payback. Also, it takes into con-

sideration piping and steam-user systems, evaluating if they can be upgraded for energy and process-improvement reasons.

A full steam-system audit goes beyond a boiler, identifying ways to save up to an additional 30 percent in annual fuel costs, "cash on the floor" that can come back to a business a hundredfold year after year.

an excellent candidate for upgrading, especially if its capacity meets current and anticipated process and heating needs.

The upgrading of an old but serviceable boiler with the latest advances in burner and control technology may be just what the doctor ordered when it comes to saving energy and improving reliability. This might be a good time to add other fuel-saving enhancements, such as a feedwater economizer or blowdown heat-recovery system. The options are considerable, leading to thousands, if not hundreds of thousands, of dollars in fuel savings annually.

SYSTEM CUT-IN AND RECOMMISSIONING

Once a boiler has been cleaned, inspected, and closed, it should be restarted and tuned by a qualified technician, one with the experience to properly set the controls and adjust the burner to maximize fuel-to-steam efficiency.

The tuning of a burner requires a load allowing the boiler to fire throughout its operating range while the burner-management system controls the various operating and safety sequences and checks. For this to occur, the boiler needs to be reintroduced to the system in a precise manner, one ensuring safety and system integrity.

Once a boiler is safely online, the burner can be tuned for optimum operation. This requires skill and understanding and is not for amateurs. It also requires proper tools. One such tool is the combustion analyzer, which is used to check products of combustion as a burner modulates between low and high fire. Properly adjusted burners maintain a given fuel/air ratio from low to high fire, limiting the amount of excess air and maximizing combustion efficiency. With gas, excess air normally is in the 10-to-20-percent range; with oil, it normally is in the 20-to-25-percent range. Another benefit of a well-tuned combustor is that it burns cleanly, eliminating excessive soot formation on fire-side surfaces while keeping carbon-monoxide levels as close to zero as possible and below 50 ppm.

After adjusting a burner, a technician makes sure the operating, modulating, and high-limit controls are set properly, ensuring adequate system response and continuity between boiler cycles. He or she also checks the operating pressure and firing rate against the boiler's stack temperature. Depending on the operating pressure and firing rate, a well-tuned, efficient boiler should have a stack temperature 50 to 150°F above the saturated-steam temperature. A 40°F elevation will result in a 1-percent loss in efficiency.

SUMMARY

Following the foregoing suggestions is an excellent way to get on the path of proper asset protection, utilization, and fuel conservation, conservation that puts considerable cash back into your business while playing a key role in protecting the finite resources we so often take for granted, the fuel we burn, and the air we breathe. It starts with awareness, followed by the will to make it happen.

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