



Boiler tuning helps to maintain high efficiency and ensures reliability and safety.

- Both steam and hot water boilers need to be tuned regularly.
- Tune the burner in spring and fall due to dramatic air temperature and density changes during these seasons.
- Tune the boiler when it is hot. A cold boiler will throw off actual operating O₂ and CO readings.

The Basic 10 for Boiler Tuning

Boiler tuning is necessary to maintain efficiency as well as to ensure reliability and safety. Tuning the burner during the spring and again in the fall is recommended because of the dramatic air temperature and density changes that occur during these seasons.

Both steam and hot water boilers need to be tuned regularly. It is important that a boiler is hot before it is tuned. A cold boiler will throw off the actual operating O₂ and CO readings.

Below are the conditions for a natural gas-fired boiler, which is warm, has a load and has a zero pressure reading on the boiler's steam gauge.

1. Insert the probe into the stack to monitor stack temperature, O₂ and CO readings.
2. Power the burner switch, and place the burner in the manual mode and at the low-fire point. The burner will now be under the control of the Burner Management System (Programmer), so expect it to go through its sequence of pre-purging and trial for ignition.
3. With a pressurized boiler, check the O₂ analyzer for the O₂ and CO readings. If the CO is above 50-100 parts per million, the burner is running rich, and either the fuel needs to be cut back or the air increased. A good excess air at low fire is between 5-8% O₂. Also, check the manifold pressure at the burner entrance to make sure it is within the operating parameters as detailed by the manufacturer to assure proper input.
4. Once low-fire is set, manually increase the firing rate incrementally while observing the flame and looking for signs of sooting or instability.
5. At the same time, watch the analyzer at each control point and make cam adjustments (and possibly linkage adjustments) to bring the fuel/air ratio as close to the goal as possible while maintaining safe firing conditions at all times. If the boiler can hold 3% O₂ or 15% excess air from medium to high-fire with no more than 50 PPM of CO, the adjustment tuning is excellent.
6. Take into consideration where the boiler fires most of the time. Set the combustion to the maximum efficiency at that particular rate while maintaining a safe margin of excess air.
7. Arriving at high fire, and making the adjustments along the way to the cam/linkages or actuators, check the manifold pressure again to ensure there is full input to the burner as defined by the manufacturer.
8. Manually bring the burner back to low fire, checking the combustion readings as it descends, and make minor tweaks as needed. During this time, watch the linkage movement on a single-point positioning system to ensure there are no hitches or slippage. Confirming this, switch the control from manual to automatic, allowing the burner to modulate on its own.
9. When the burner has reached its stability point with regard to load matching, watch the boiler pressure in relationship to the stack temperature. A well-tuned boiler/burner package will register a stack temperature between 50-100 degrees above the saturation or water temperature. Anything above this will indicate a dirty boiler or one that has flue gas bypass issues or is badly scaled.
10. Check the safeties, especially the low-water cutoff, the ALWCO and flame scanner.



A boiler that is out of tune increases operating expenses as energy exits through the stack. In addition, soot can build up to the point that the tubes overheat and crack or break from their welds, leading to extensive downtime and excessive repair costs.

To learn more about boiler tuning, watch [The Art of Boiler Tuning](#) webinar or contact a [Cleaver-Brooks representative](#).