Boiler System Checklist

- [ ] **Install Small Modular Boilers**
Evaluate the opportunity to install multiple small boilers to meet the heating load of a given facility. It is more efficient to operate smaller boilers when the heating load is 25% to 50% of the design capacity than it is to use one large boiler to meet a partial load. Specify minimum boiler efficiency at 89% (annual fuel utilization efficiency [AFUE]).

- [ ] **Install a Condensing Gas Furnace**
For smaller facilities, condensing gas furnaces should be installed that have efficiencies on the order of 92% to 96%. Small condensing gas furnaces are a great application for small facilities and can reduce overall natural gas use at a small facility by 10% to 20%.

- [ ] **Install Condensing Boiler Systems**
Evaluate the opportunity to install multiple condensing gas boilers to meet the heating load of a given facility. Condensing boilers have good part-load efficiencies and can have overall efficiencies as high as 98%. In addition to the condensing boiler installation, 180/120°F heating coils (60 deg delta) should be installed with a supply water temperature reset.

- [ ] **Convert Three-Way Hot Water Valves to Two-Way Valves**
Check the configuration of each hot water valve on each heating coil (includes air handling units, fan coils, etc.). If three-way valves and constant volume pumps are installed, convert the valves to two-way and install variable frequency drives on hot water pumps. Once the valve configuration is confirmed as correct, check that the static pressure setpoint controlling the pump variable frequency drives isn't set artificially high.

- [ ] **Reset Hot Water Supply Temperature and Pressure Based on Heating Coil Valve Position**
Adjust the hot water supply temperature and loop differential pressure based on the heating coil valve position. The hot water supply temperature should be reset based on manufacturer's recommendations for the particular boiler. The control algorithm should be set up such that the coil with the largest cooling load maintains the valve at 90% open.

- [ ] **Perform Combustion Efficiency Analysis and Install Automated O_2 Trim System**
The efficiency of the combustion process is typically measured through the percent oxygen (O_2) in the exhaust gas. The amount of oxygen (or excess air as it is often called) in the exhaust gas is defined as the amount of air above that which is theoretically required for complete combustion. The boiler can be tuned by adjusting the air-to-fuel ratio linkages feeding the boiler burner. Combustion analysis and tuning should be conducted at least twice a year. For larger boilers, greater than 300 hp, a stack gas oxygen analyzer can be installed to continuously monitor excess air and adjust the boiler fuel-to-air ratio for optimum efficiency.

- [ ] **Use Effective Boiler Management Techniques**
Operating on high fire settings or installing small boilers can save more than 7% of a typical facility's total energy use. Doing comprehensive tune-ups and correcting excessive air losses, high stack temperatures, and excessive smoking can result in fuel savings of up to 20%. Installing insulation on all hot water and steam pipes over 120°F will ensure that excessive heat is not lost in transmission.

- ☐ **Set a Maintenance Schedule for the Boiler**
  Periodic maintenance of a boiler should be scheduled to ensure that the boiler is operating at peak efficiency. Peak efficiency can be achieved by optimizing the air-to-fuel ratio by using an oxygen trimming system. It is also important to clean the fire side and water side of the boiler to make sure that there is no buildup of slag and scale to inhibit the transfer of heat. Checking the water quality is also important to limit the buildup of scale.

- ☐ **Install Automatic Steam Trap Monitors**
  Malfunctioning steam traps can waste much energy. An automatic monitor can handle up to 16 steam traps and detect malfunction, allowing the steam traps to be repaired before a large amount of energy is lost.

- ☐ **Consider Using a Solar Ventilation Preheating System for Combustion Air**
  Using solar ventilation preheating will decrease the amount of energy needed to heat combustion air. The solar preheating system requires no maintenance and has a quick payback (6 to 7 years in some cases).

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