



## Walker Process Equipment Type EB HeatX Hot Water Boiler Control Strategy Options

### **1. The Application**

The primary use of the WPE boiler/heat exchanger (EB) is to burn Digester Gas produced in an anaerobic digester to recover the energy from that resource and provide a hot water supply to heat the digester and/or provide heating for other uses e.g. building heat. The design includes several control options for that gas fired or gas/fuel oil fired boiler.



### **2. Control Strategies**

There are 3 alternate strategies to control the fuel being burned in the boiler.

**Switch Over:** The switch over strategy will burn either digester gas or the alternate fuel. The pressure of the primary fuel, digester gas, is measured in the digester. If the pressure is at least at or above a setpoint, the boiler burns only digester gas. If the pressure drops below setpoint, the boiler closes the digester gas supply and switches over to burn only the alternate fuel. When the digester gas pressure is again built up above setpoint, the boiler closes off the alternate fuel, purges the boiler and switches to digester gas. If the boiler water temperature is below its setpoint, that fuel is burned to raise the water temperature. If the water temperature is at or above setpoint, the control system turns off all fuel and purges the boiler. When the water temperature drops below setpoint, the controls restart the boiler burner.



Blend-In: The blend in strategy is only available with natural gas as the alternate fuel. If digester gas is not available at the setpoint pressure, the natural gas is automatically blended in to make up the difference to reach the proper fuel supply rate. Like the switch over strategy, if the boiler water temperature is below its setpoint, fuel is burned. If the water temperature is at or above setpoint, the control system turns off all fuel and purges the boiler. When the water temperature drops below setpoint, the controls restart the boiler burner.

Modulated Blend-In: This strategy adds additional control to blend-in controls. It has the same fuel selection control as the blend-in above but rather than the on/off temperature control mode, a 3-mode PID (Proportional-Integral-Derivative) control loop modulates the fuel flow to maintain water temperature. With a modulating burner there are two setpoints, an upper setpoint to turn the burner off and a lower setpoint to set the burner to the 100% firing rate. As the boiler water temperature begins to drop closer to the lower setpoint, a gradual increase in fuel flow is provided. As the water temperature begins to increase to the upper setpoint, fuel flow is not suddenly shut down but is gradually reduced. When the boiler has reached the upper temperature, the burner shuts down. This additional control sophistication provides two benefits to the boiler operation.

### **3. Benefits of Modulated Blend-In Control**

First, a 3-mode PID control loop provides more precise maintenance of the control loop set point than simple on/off control. Second, and of greatest importance to the HeatX equipment, the benefit from this control strategy, results from the reduction in thermal shock on the boiler.

Substantial thermal stress is imposed on a boiler's fire tubes and furnace tube every time a boiler is fired up from a non-burning state or cooled upon boiler burner shut down.

The boiler's firing components operate at about 500°F. Each time the control system turns the burner off the boiler control system purges the boiler and exhaust stack with ambient air. That purge suddenly reduces the temperature of the firing chamber to about 180°F. When the water temperature control calls for more heat and the boiler is re-fired, the components see another sudden temperature change, back to the firing temperature. These sudden thermal heating/cooling cycles stress the ceramic refractory, furnace tube and the fire tubes which, over time, will reduce the operating life of the components.

The addition of the modulated flow controller reduces the number of cycles of boiler shut down and start up; thus extending the equipment's life. As an additional plus, the initial cost increase to upgrade to the Modulated Blend-In control strategy over the other choices is modest.

For questions about or inquiries for retrofitting the Modulated Blend-In Control to your existing HeatX equipment or to specify a new boiler heat exchanger, please contact Walker Process Equipment through our website: [www.walker-process.com](http://www.walker-process.com)