### Linkageless Boiler Controls for Space Heating

**Description**

This measure is for a non-residential boiler providing space heating and currently having single point positioning combustion control. In single-point positioning control, the fuel valve is linked to the combustion air damper via a jackshaft mechanism to maintain correspondence between fuel and combustion air input. Most boilers with single point positioning control do not maintain low excess air levels over their entire firing range. Generally these boilers are calibrated at high fire, but due to the non-linearity required for efficient combustion, excess air levels tend to dramatically increase as the firing rate decreases. Boiler efficiency drops as the excess air levels are increased.

This measure was developed to be applicable to the following program types: TOS, RF.

If applied to other program types, the measure savings should be verified.

**Definition of Efficient Equipment**

To qualify the boiler burner must have a linkageless control system allowing the combustion air damper position to be adjusted and set for optimal efficiency at several firing rates throughout the burner’s firing range. This requires the fuel valve and combustion air damper to each be powered by a separate actuator. An alternative to the combustion air damper is a Variable Speed Drive on the combustion air fan.

**Definition of Baseline Equipment**

The baseline boiler utilizes single point positioning for the burner combustion control.

**Deemed Lifetime of Efficient Equipment**

The expected measure life is assumed to be 16 years.[[1]](#footnote-1)

**Deemed Measure Cost**

The deemed measure cost is estimated at $2.50/MBtu/hr burner input.[[2]](#footnote-2)

**Deemed O&M Cost Adjustments**

N/A

###### Loadshape

N/A

**Coincidence Factor**

N/A

**Algorithm**

**Calculation of Savings**

**Electric Energy Savings**

When a Variable Speed Drive is incorporated, electrical savings are calculated according to the “4.4.17 Variable Speed Drive for HVAC Pumps and Cooling Tower Fans” measure.

**Summer Coincident Peak Demand Savings**

N/A

###### Natural Gas Savings

Δtherms = Ngi \* SF \* EFLH / 100

Where:

Ngi = Boiler gas input size (kBtu/hr) = custom

SF = Savings factor

Note: Savings factor is the percentage increase in efficiency as a result of the addition of linkageless burner controls. At an average boiler load of 35%, single point controls are assumed to have excess air of 91%, while linkageless controls are assumed to have 34% excess air.[[3]](#footnote-3) The difference between controls types is 57% at this average operating condition. A 15% reduction in excess air is approximately a 1% increase in efficiency.[[4]](#footnote-4) Therefore the nominal combustion efficiency increase is 57 / 15 \* 1% = 3.8%.

= 3.8%

EFLH = Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use

100 = convert kBtu to therms

**Water Impact Descriptions and Calculation**

N/A

**Deemed O&M Cost Adjustment Calculation**

N/A

###### Measure Code: CI-HVC-LBC-V05-160601

1. Total number of hours for heating with a base temperature of 55°F for Chicago, IL as noted by National Climate Data Center [↑](#footnote-ref-1)
2. [↑](#footnote-ref-2)
3. Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Industrial, Commercial, and Institutional Boilers, Prepared by the Sector Policies and Programs Division Office of Air Quality Planning and Standards U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711, October 2010, Table 1. ICI Boilers – Summary of Greenhouse Gas Emission Reduction Measures, pg. 8 [↑](#footnote-ref-3)
4. Department of Energy (DOE). January 2012, Steam Tip Sheet #4, Improve Your Boiler’s Combustion Efficiency. Advanced Manufacturing Office. Washington, DC: U.S. Department of Energy. This value was determined as an appropriate average over the stack temperatures and excess air levels indicated. [↑](#footnote-ref-4)