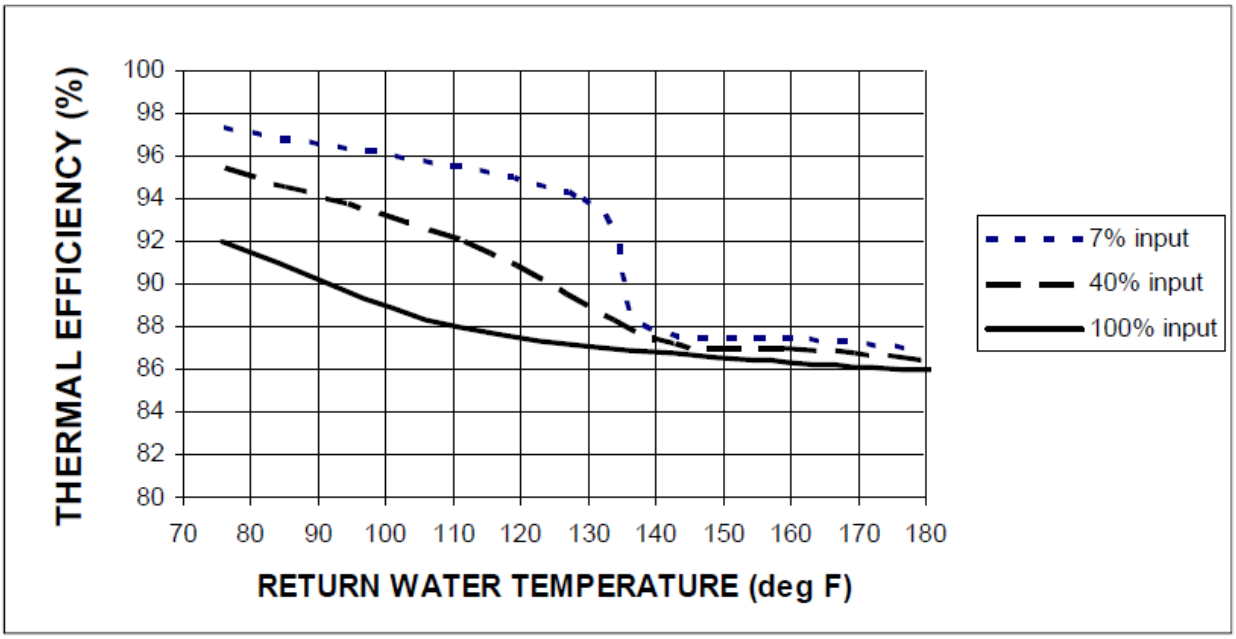
New Jersey's Clean Energy PROGRAM
Your Power to Save
njcleanenergy.com
New Jersey Board of Public Utilities
Office of Clean Energy

Pay for Performance Technical Tip

Modeling Condensing Boiler Measures

Background

Condensing boiler performance is dependent on return water temperature and variations in load. In general, the efficiency of a condensing boiler increases as return water temperature and part load ratio decreases. Below is a graph that demonstrates typical condensing boiler efficiencies at various return water temperatures and part load ratios. As depicted below, condensing boiler efficiency drops considerably when return water temperature is greater than 130°F.



Modeling Condensing Boiler Improvement

Existing Buildings

For measures involving installation of condensing boilers, existing return water temperature must be verified during the site visit and included in the ERP. If measurements of return water temperature were not performed during the site visit, 180°F supply and 160°F return water temperature must be assumed in the existing and proposed cases. Performance credit for lower return water temperature compared to the existing case may be claimed if documentation is submitted justifying the proposed supply and return water temperature (e.g. sequence of operations) and existing temperatures were verified. Refer to P4P Program Guidelines p. 4-25 to 4-26 for additional requirements related to modeling boiler measures.

New Construction

180°F supply and 130°F return water temperature must be modeled in the baseline per Appendix G, if boilers are a baseline requirement. The proposed design must reflect mechanical drawings and should not be modeled identically to the Appendix G baseline.

Modeling Inputs

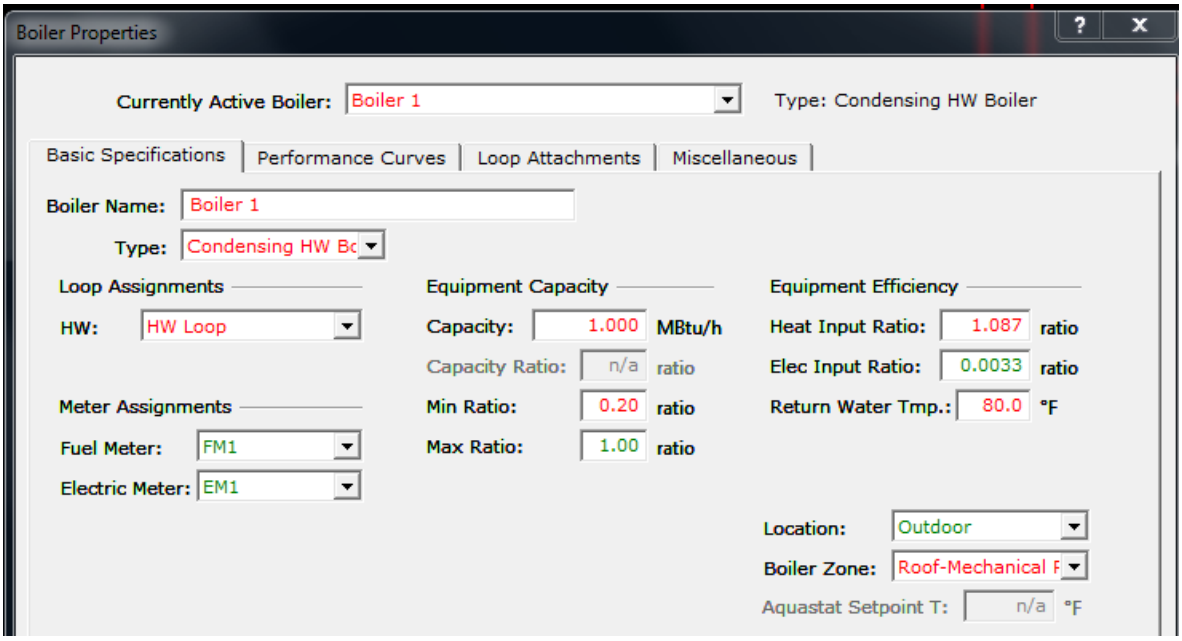
Design supply and return water temperatures must be explicitly entered into the simulation tool if the tool can automatically capture their impact on boiler efficiency (such as eQUEST). If the tool is not capable of automatically adjusting efficiency based on entered loop temperatures (such as TRACE), efficiency entered into the simulation tool must be adjusted manually to reflect manufacturer's performance data for the boiler at actual operating conditions.

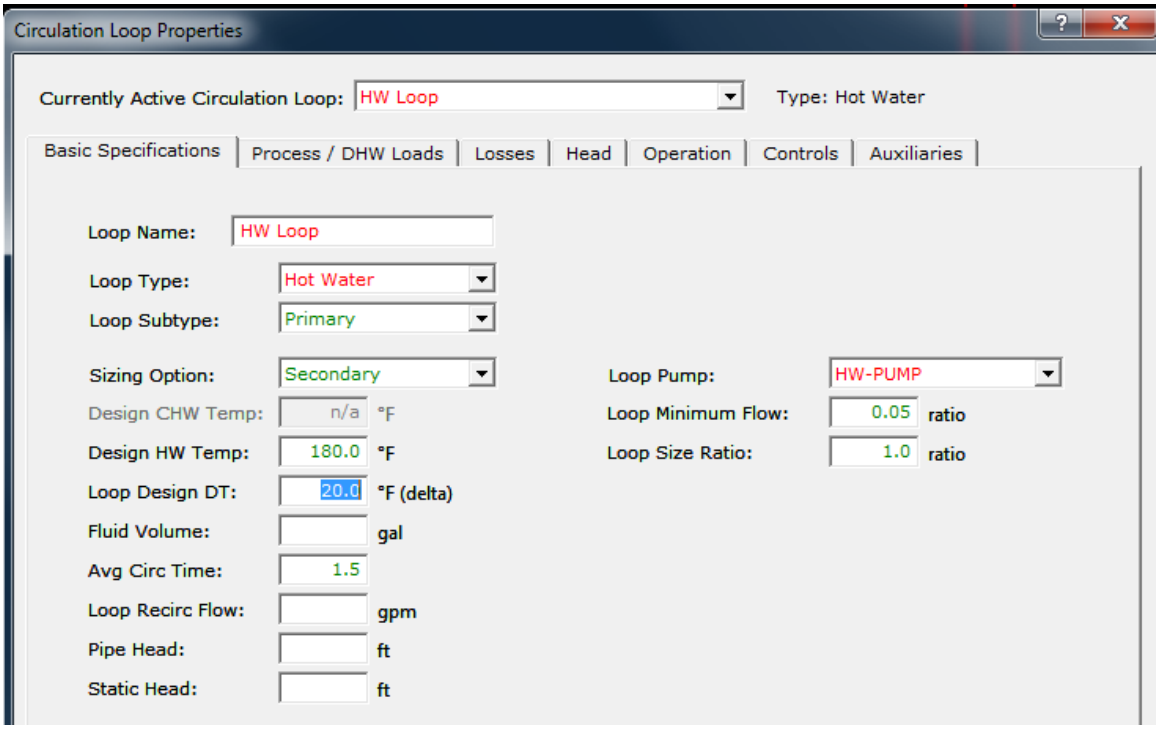
eQuest Example

The proposed scope of work includes the installation of a 1,000 MBH condensing boiler, which is rated at 92% thermal efficiency at 80°F return water temperature and at full load (i.e. AHRI rating conditions). Boiler literature states that condensing boilers can achieve efficiencies up to 98% thermal efficiency, which would occur at very low return water temperatures and part load ratios. The current design supply hot water temperature is 180°F, with 20°F design temperature drop.

The heat input ratio (HIR) for the condensing boiler must reflect the return water temperature input and full load capacity. Therefore, HIR of 1.087 (HIR = 1 / 92%) should be used in the simulation tool rather than HIR of 1.02 (HIR = 1 / 98%). When the equipment operates at part load, eQuest will capture boiler efficiency improvements.

Electric Input Ratio (EIR) should be left as the default to capture electricity usage associated with fans, controls, etc. Alternatively, EIR can be calculated using boiler specifications.





eQuest software contains default condensing boiler curves that can be used to simulate the improvement. However, several boiler manufacturers have performance curves readily available for their equipment. Custom performance curves may be simulated in the proposed case if the curves and curve formula are provided as part of the submission.

Trane TRACE Example

Using the example presented for eQuest, for existing buildings, if return temperature is unknown, then the boiler efficiency at 160°F must be assumed. While literature rates equipment up to 98% thermal efficiency and equipment operates at 92% efficiency at 80°F water temperature, 86% efficiency must be used in the model (refer to graph on page 1). If existing supply and return temperature was measured, then the efficiency at the proposed return water temperature may be modeled. For example, if the return water temperature is equal to 100°F, then 89% efficiency may be modeled.

Documentation Requirements

Cut sheets for the proposed condensing boiler with AHRI efficiency or AHRI certificate from ahridirectory.org must be submitted with the ERP.

For Trane projects, boiler curves must be submitted justifying proposed efficiency if modeled efficiency is greater than 86% thermal efficiency. Alternatively, the curve presented in this technical topic may be used and referenced in the ERP tables.

For eQuest projects, boiler curves must be submitted if credit is claimed using custom performance curves.

Additional Existing Building Documentation Requirements

Existing temperature measurements should be listed in the 'Additional Notes' column of the 'Boilers and Domestic Hot Water Heaters' table located in the 'Mechanical' tab of the ERP Tables.

If credit is claimed for reducing return water temperature, the temperature must be documented in the 'Measure Descriptions' tab and 'Changes Made to Previous Run' of the 'Measure Simulation' tab. Documentation must be submitted justifying the reduction in return water temperature (e.g. sequence of operations).