# Condensing Boiler Systems

Many of us frequently hear the term "condensing" boiler and we have heard that they are supposedly more efficient than the "old-style" boilers. But, do we really understand what condensing means and, perhaps more important, are we really getting the efficiency advertised?

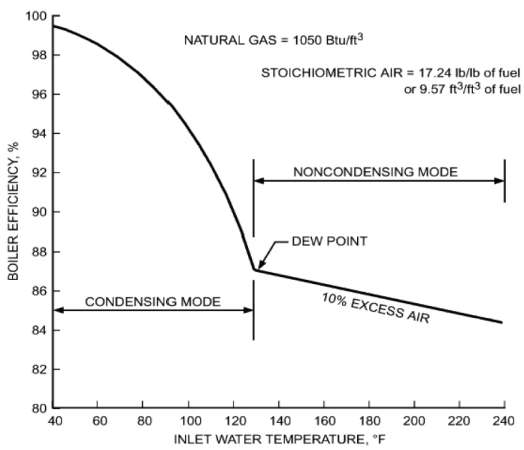
## How Condensing Works

"Condensing" is not a moniker created by boiler manufacturers; it is actually the physics term we learned in school. It refers to the phase change water goes through when it changes from a gas to a liquid. When HVAC boilers burn natural gas, water vapor is a byproduct of that combustion process. Inside the boiler, these hot combustion gases are meant to lose energy to the water on the opposite side of the heat exchanger wall, so it may be circulated through the building for heating. But, if that water is cold enough (roughly 120°F), it could cause the water vapor to lose enough energy to turn to liquid water or condense. This is the same process that happens to your cold glass outside on a summer's day.

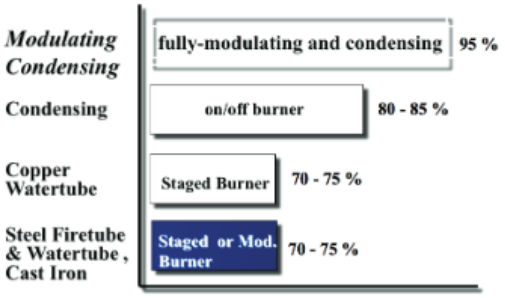
### How Does That Make the Condensing Boiler More Efficient?

For a non-condensing boiler, all the energy is transferred through a sensible heat exchange (temperature change). In a condensing boiler, when the water vapor in the flue condenses to a liquid, that phase change from a high energy state to a low energy state releases additional energy to be exchanged and, in essence, "squeezing" more energy from the combustion prducts than without condensing.

So, if you are getting more energy from the same amount of combustion fuel, you are getting higher *combustion efficiency.* **The key to realizing this efficiency is operating the return water termperature to the boiler as low as practical (at least below 120°F).**




**Effect of Inlet Water Temperature on Efficiency of Condensing Boilers**




**Typical Seasonal Efficiencies**

## Other Factors Affecting Boiler Efficiency

How you operate the burner may also make a big difference in the realized efficiency of your boiler. The seasonal efficiency (energy consumption over time) of a boiler may be substantially increased by modulating (varying) the firing rate as opposed to on/off or staged firing. Turning down, or modulating, your flame to match the load you need is very cost effective: you burn only what you need.

## Summary

In many ways, choosing a boiler is like buying a boat: there is no perfect one for all situations. Consider the application and how you intend to use it. At Heat Transfer Sales, we represent a variety of boiler manufacturers simply because different products suit different needs. Consult with your sales engineer for more information about our boiler options.

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