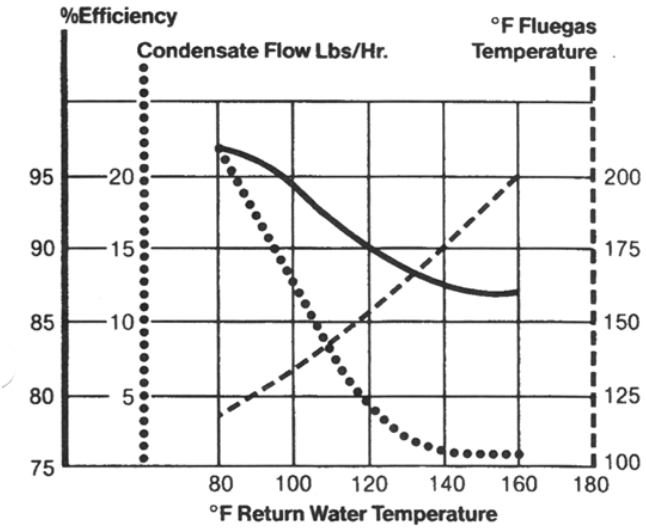
JB Tech Talk No. 22: To Condense…or not to Condense

When you buy a new vehicle the window sticker tells you what the average fuel consumption should be. We all know that you'd have to drive it like a proverbial little old lady to get that number; no speeding, no AC cause you'll 'catch your death', don't use the signal lights, etc. If you drive it like you stole it then 'your results may vary'.



It's the same with condensing boilers that advertise efficiencies as high as 98%. The reality, illustrated by the chart* to the left, is that those numbers are only achievable if the boiler return water is ≈ 80 °F (27 °C). The boiler **will not condense at all** if the return water is **at ≈ 130 °F (54 °C) or higher**, in which case it's an expensive mid-efficient boiler.

Condensing gas furnaces will always condense because the return air entering the furnace is ≈ 70 °F (21 °C). There is no practical way to make it not condense, so it's hard to screw up.

Systems with condensing boilers, on the other hand, are easy to screw up and often are. To drive the return water into the condensing range at most operating conditions, the load system connected to the boilers has to be designed to achieve that.

I've seen new designs with condensing boilers that use design *average* supply water temperature of 170 °F (77 °C) or even higher, low design water temperature drop, and design return water temperature well above the condensing range. They use reset control, so the water temperature will be lower in mild weather but depending on the type of terminal units there's a limit to how low it can go and still maintain comfort. There are also other factors that will work against keeping the boilers well into the condensing range.

There are a lot of things to consider when designing a system that will make condensing boilers deliver consistent high efficiency, but it can be done. If not, would it be any worse to use a good power vented mid-efficient boiler? I think that's a valid question.

**This chart is for a 300 MBH boiler from a particular boiler manufacturer. I've always liked it because it does a good job of showing the relationship between return water temperature, efficiency, condensate flow, and flue gas temperature.*