RYAN

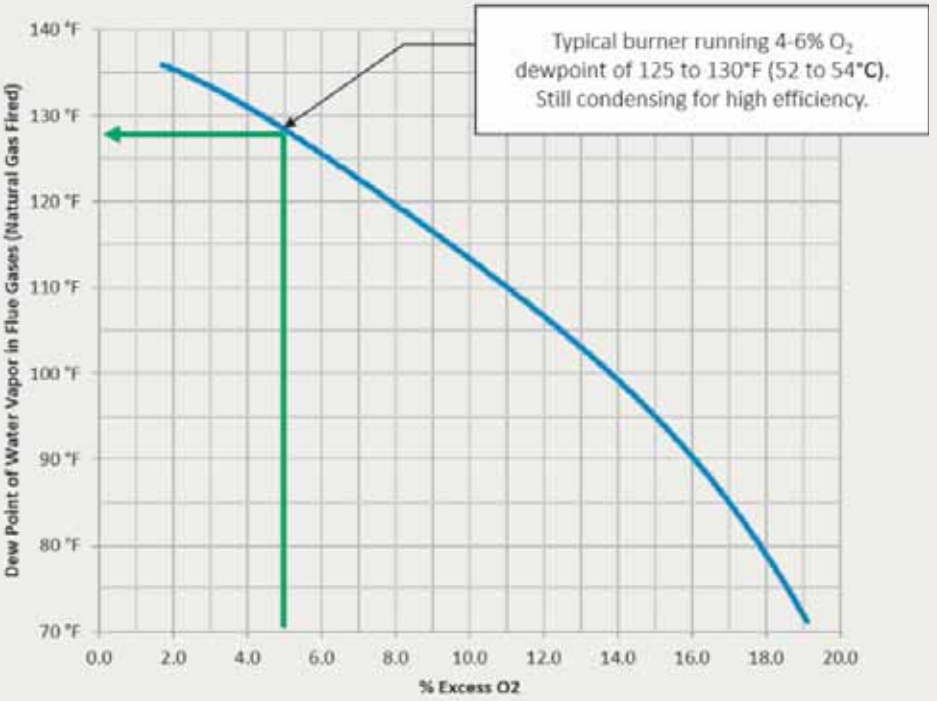
BOILERS/HEATING SYSTEM COMPONENTS

Must-know

Are your Condensing Boilers Actually Condensing? Combustion Matters

O2% control is important

Over the last 10 years we have seen the majority of our Hydronic systems now designed around Condensing Boilers with that comes the expectations of efficiencies (above 90%). Many factors affect or have an affect on what that efficiency is but one of the most important factors is air/fuel ratio control of your boiler (combustion system). This system will directly impact the real world application of that boiler's efficiency. This is especially true when it comes to the boilers that claim to have higher turndown with a negative regulation air/fuel control.



Every burner requires some excess air to maintain flame stability, ensure complete combustion, protect burner components, and limit emissions such as CO and NOx. The actual amount will vary, but for a typical natural gas burner found in a condensing boiler, you want this to be in the range of 4-8% O2 to allow for your boiler to actual condense.

Although excess O2 is required from a realistic standpoint due to the fact that Stoichiometric (perfect) combustion is only theoretical . Having too much will decrease combustion efficiency and lower flue gas vapor dewpoint temperature (condensing potential), causing the end user the cost of a condensing boiler but really only receiving the efficiency of a non condensing boiler Here, a 5% excess O2 ,which is typical of high fire, results in a dewpoint of around 127°F (53°C). Therefore, for a boiler to operate in full condensing mode in this case, the heating system return water must be below 127°F. See image above for graphical representation.

Negative Regulation Combustion Platform

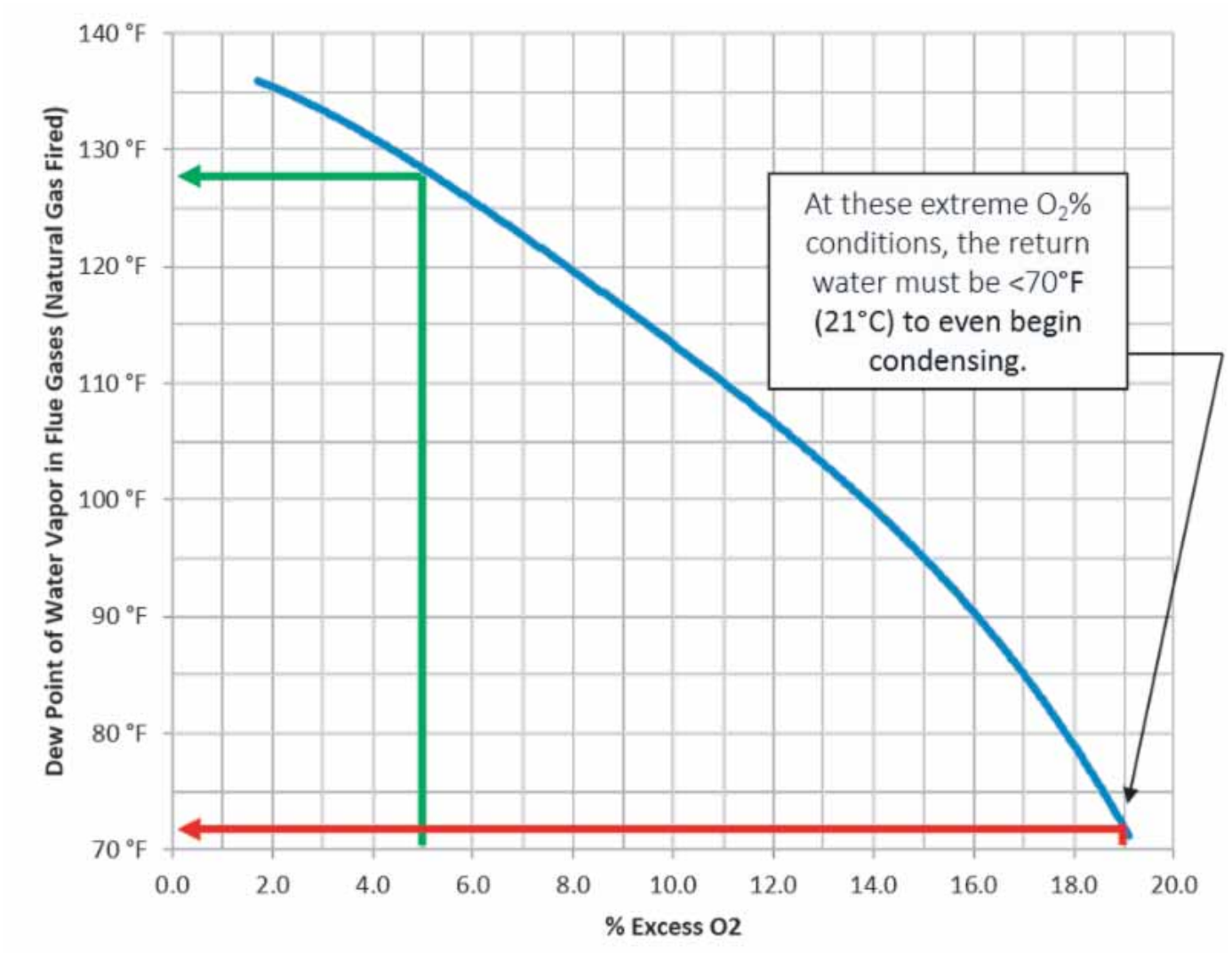
Most condensing boilers on the market today use negative regulation ("neg-reg") combustion control, where a fan speed signal is the only means of adjusting modulation rate. These systems do not directly control the fuel flow rate; rather, the gas valve is along for the ride, tracking behind blower suction pressure. Neg-reg has the favorable benefit of generally maintaining O2% with minor swings in air density, but the trade-off is sensitivity to changes in combustion air and stack pressures, calorific fluctuations of gas, loose repeatability tolerance, and poor resolution at low fan speeds.

Low fan speeds are a challenge for pressure-sensing neg-reg due to the square root relationship between pressure and flow. At 5:1 turndown, only 1/25th the pressure is measured, while at 15:1 turndown that drops to 1/225th. Such low pressures negatively impact the system's ability to "track" (i.e.maintain) a stable air/fuel ratio. The designer therefore boosts fan speed at low fire to help with combustion reliability; but this leads to

COMBUSTION

	Valve 1 Low Fire:	Valve 1 High Fire:
O_2 %	19.2%	10.2%
CO ppm	2	9
CO_2 %	1.2%	5.6%

	Valve 2 Low Fire:	Valve 2 High Fire:
O_2 %	8.3%	4.2%
CO ppm	0	12
CO_2 %	7.2%	8.2%



What this example shows is that although higher turndown is nice to have it is not practical to expect theses boilers to achieve this turndown if your combustion platform is wrong. In that we must control O2% in real time to actually make sure that these condensing boilers are actually condensing. As you can see from the example that the vast majority of the condensing boilers with high turndown are not actually condensing at all. **So my question to you is Why use or allow these boilers into projects at all as they are not meeting the standards or expectations of your customer or end user?**

Another item to consider is that most heating boilers are commissioned in warm weather at the end of summer. As the cooler weather of fall and winter rolls in, air density increases, which causes excess air to increase. This negatively impacts combustion efficiency and flue gas condensation dew point. It also causes a lot of these boilers to not light on during the winter months on the coldest of days when we really need the boilers to be working and thus we have an unhappy customer. Controlling our O2 will eliminate this problem and create the highest reliability of light off and keep our customers HAPPY AND WARM!

WHICH IS THE MOST IMPORTANT ITEM OF THEM ALL!!

SOLUTION

The Endura+ with Fulton's PURE Control™ completely solves all of these concerns by eliminating neg-reg, instead using high-precision discrete air and gas servo motor control with 0.2° accuracy optimized across ten combustion points. This system allows the boiler to achieve reliable turndown as high as 15:1 without resorting to excessively high O2% levels. Additional benefits include dependable ignition, and an integrated O2 Compensation system that automatically tunes the air/fuel ratio during operation.

This produces a boiler that will be more forgiving for changing operation conditions. A reliable boiler that will always start up during the winter months. Most importantly it gives you a boiler that actually is a Condensing Higher Turndown boiler as advertise. **Thus creating energy savings and happy customers!!**

New Product Alert:

VSRT steam boiler Now available up to 250 HP

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- Up to 86% efficiency
- ≥99.75% steam quality at 15 PSI
- Fully-wetted pressure vessel
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- Up to 10:1 turndown; fully modulated burner
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