

Measuring Combustion Efficiency on Atmospheric Boilers & Furnaces



Application Note #HV-13-0717

How is Combustion Efficiency Properly Measured on Standard Atmospheric Boilers & Furnaces?

Combustion efficiency is a measurement of how well any given fuel is being burned and converted into useful energy (e.g.: heat). The calculations are based on 3 **MAJOR Factors**:

1. Chemistry of the burned Fuel (e.g. Propane, Natural Gas, Oil, etc)
2. The CO₂ percentage by volume after the combustion process
3. **The NET temperature between the Stack Gas & the Primary Air being used**

Since the **NET** Temperature is a KEY parameter in Combustion Efficiency calculations, this will explain how the **ΔT** is measured. When testing most common **Atmospheric** boilers, furnaces, & water heaters, our Combustion Analyzers use its own Built-In **Internal temperature sensor** to measure the Room's actual Ambient Temperature (T_a) because the room air is used as the Primary Air being fed into the system for combustion. When the probe is placed in the stack, the analyzer measures the Flue Stack Temperature (T_g) simultaneously with the ambient air. As listed above, the Combustion Efficiency is calculated by the **NET** differential temperature of the Primary Ambient Room temperature and the Flue Stack Temp.

See this example:

(E.g. 320 °F in the Stack – (minus) the Ambient 80°F = **ΔT of 240°F**). Our combustion analyzer automatically takes this ΔT calculation which is then also automatically combined with the analyzer's CO₂ reading and the Chemistry of the type of fuel being burned (Natural gas, Oil, etc) to fully calculate, display and record the Appliance's **Combustion Efficiency**.

Atmospheric System Example (Natural Gas Appliance)

Stack Temperature = **320°F**
&
CO₂ Measurement = **10%**

Analyzer uses Internal
Temperature Sensor for
Room Air Temperature = **80°F**



ΔT of 240°F

If CO₂ is 10%, based on ΔT of 240F & Natural Gas chemistry then

Combustion Eff = 85.8 %

Losses = 14.2 %