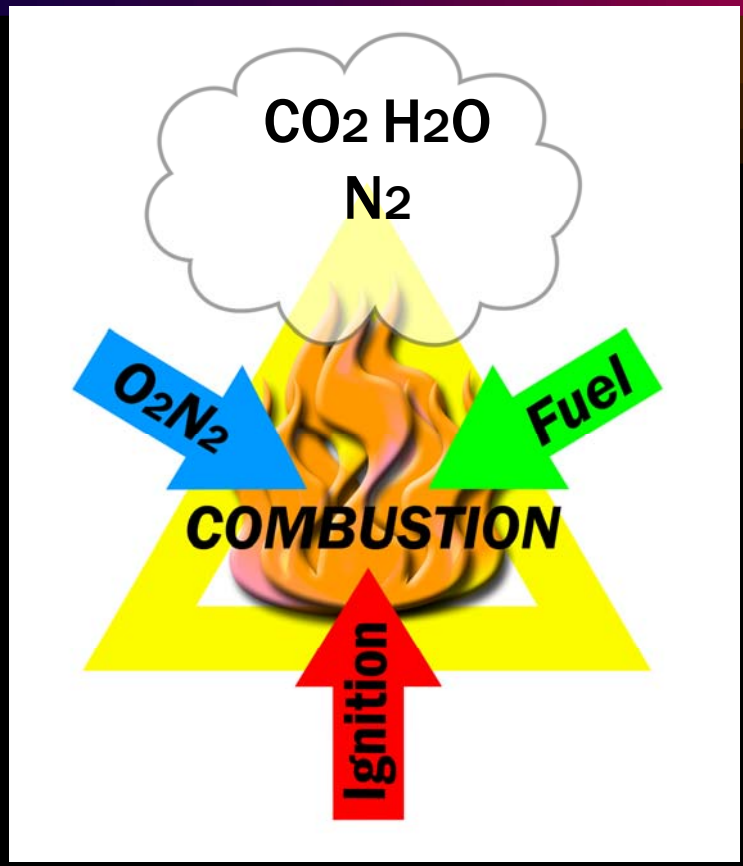
COSA

Carbon Monoxide Safety Association

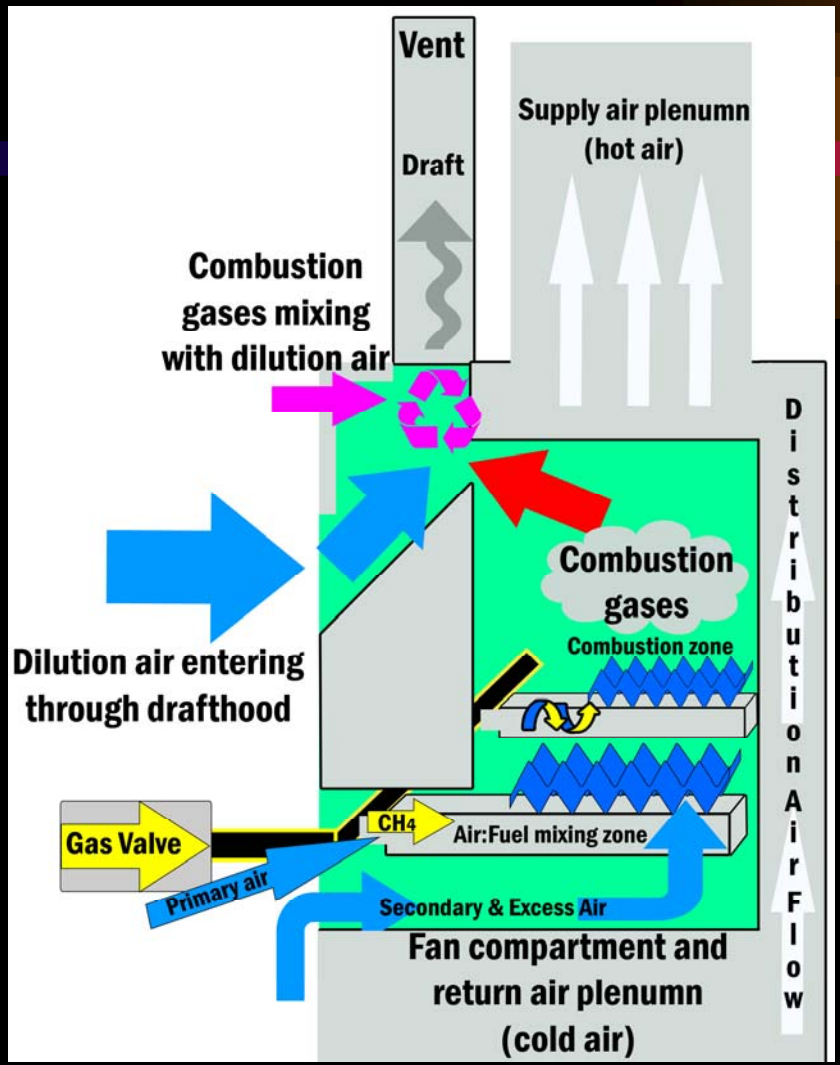
Erik Rasmussen
(866) 408 8122

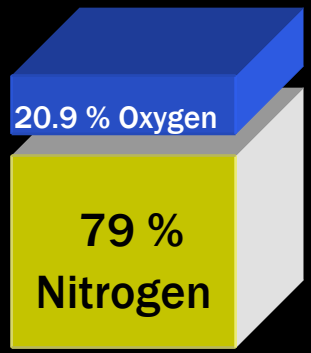
Combustion & Carbon monoxide



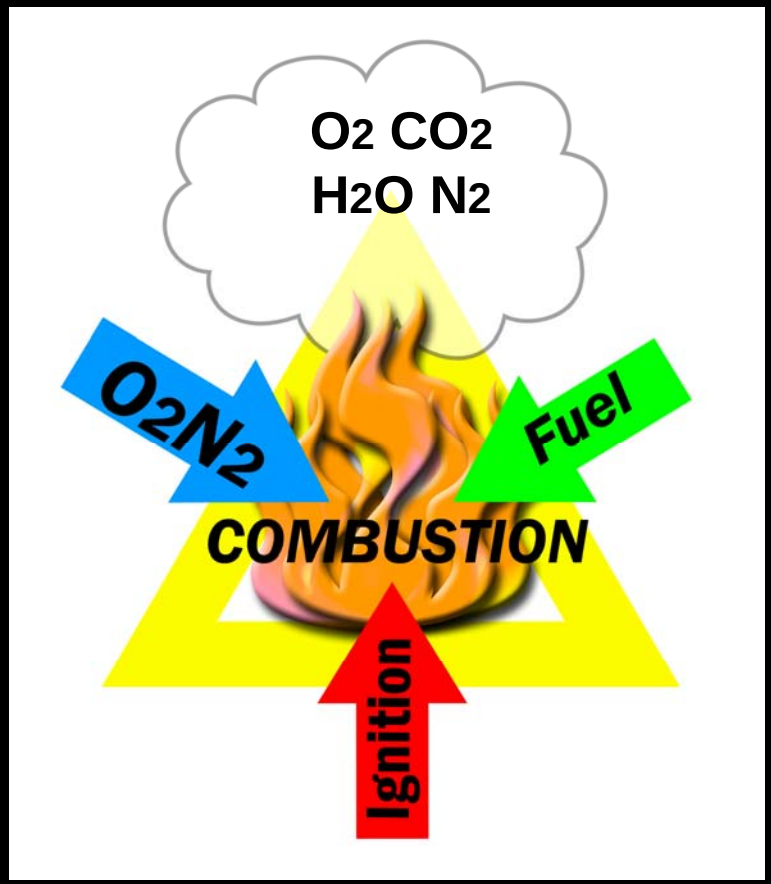
Air Required For Combustion

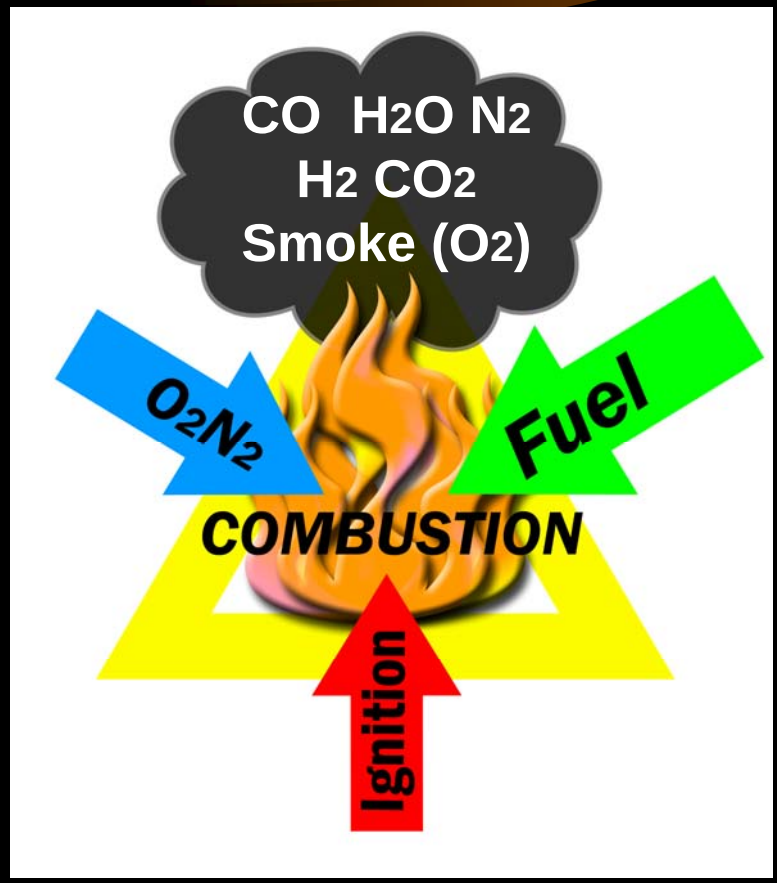
- Primary
- Secondary
- Excess
- Dilution



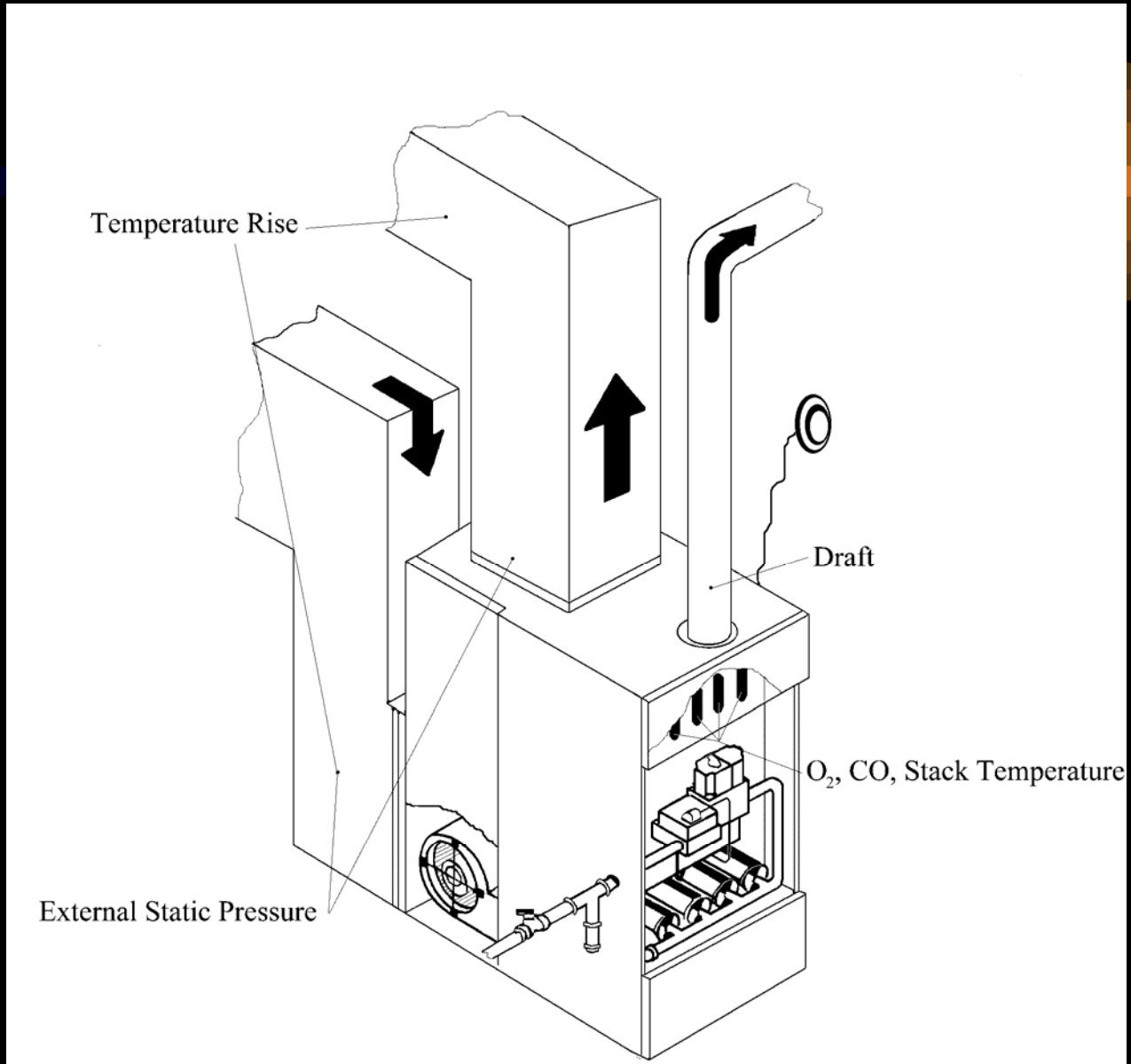


Complete VS Incomplete



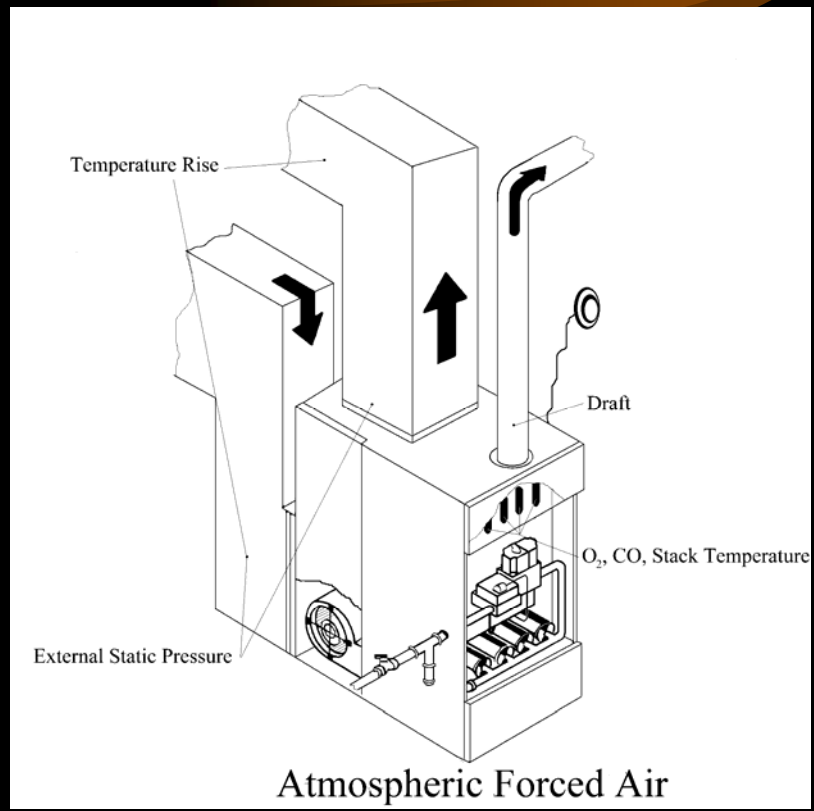


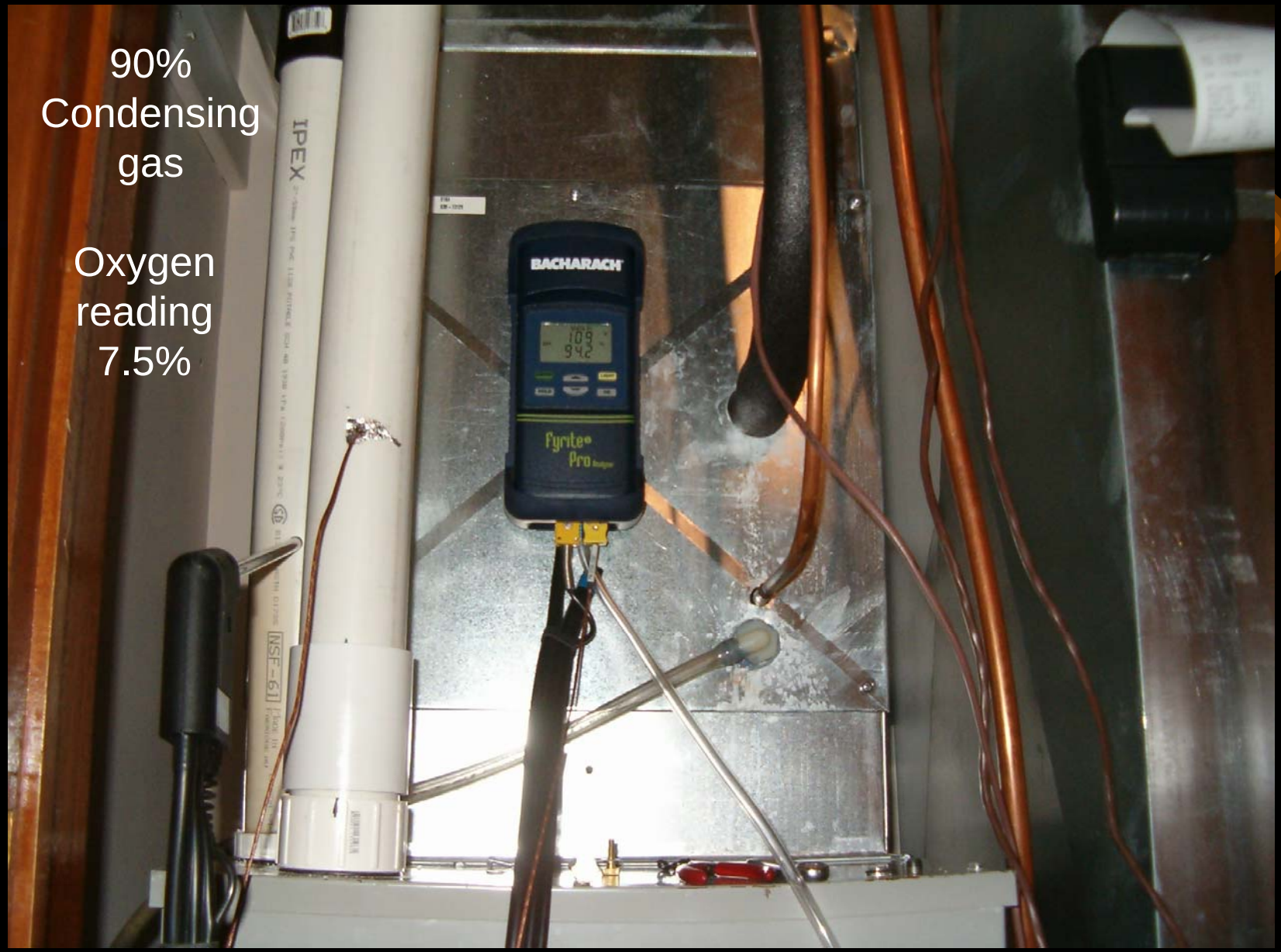
Manufacturer's Specifications



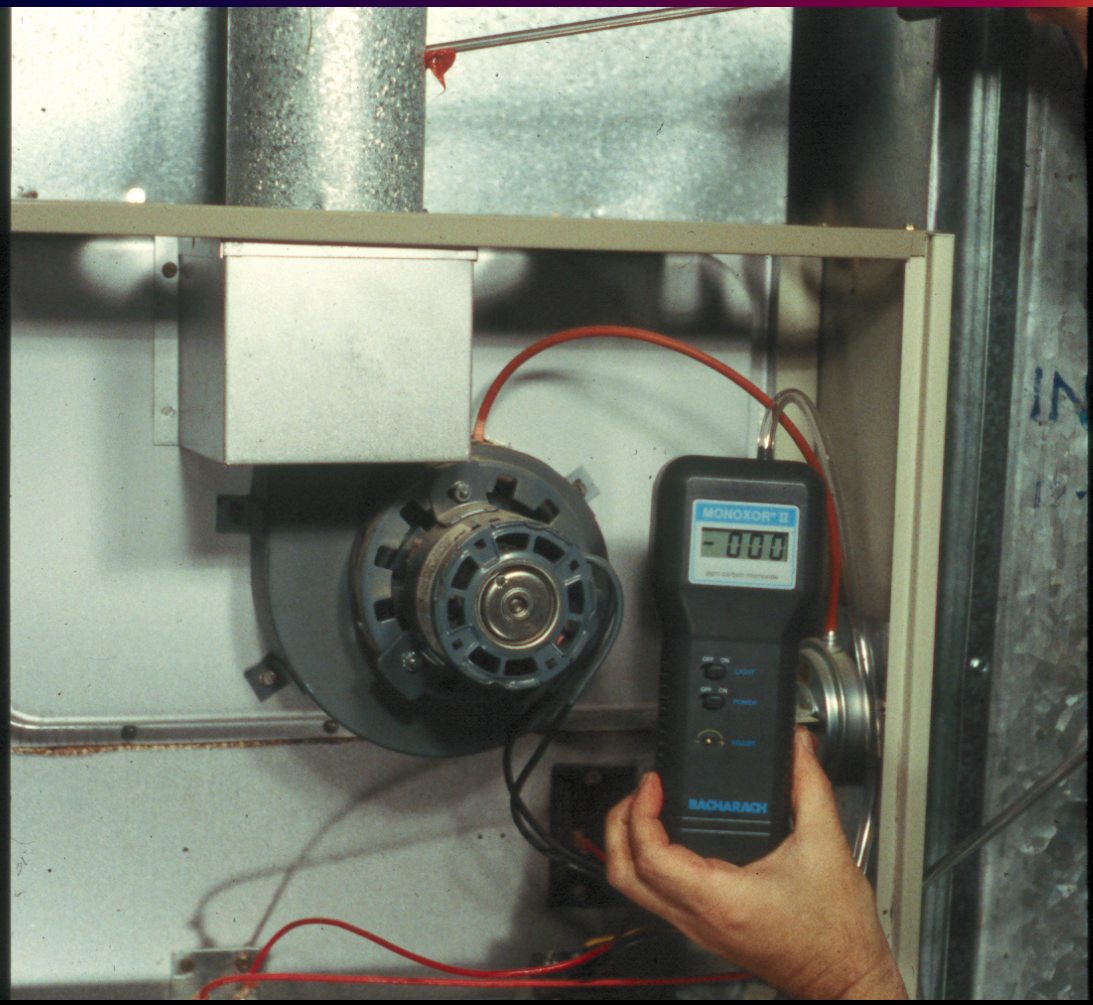
Tests / Setup

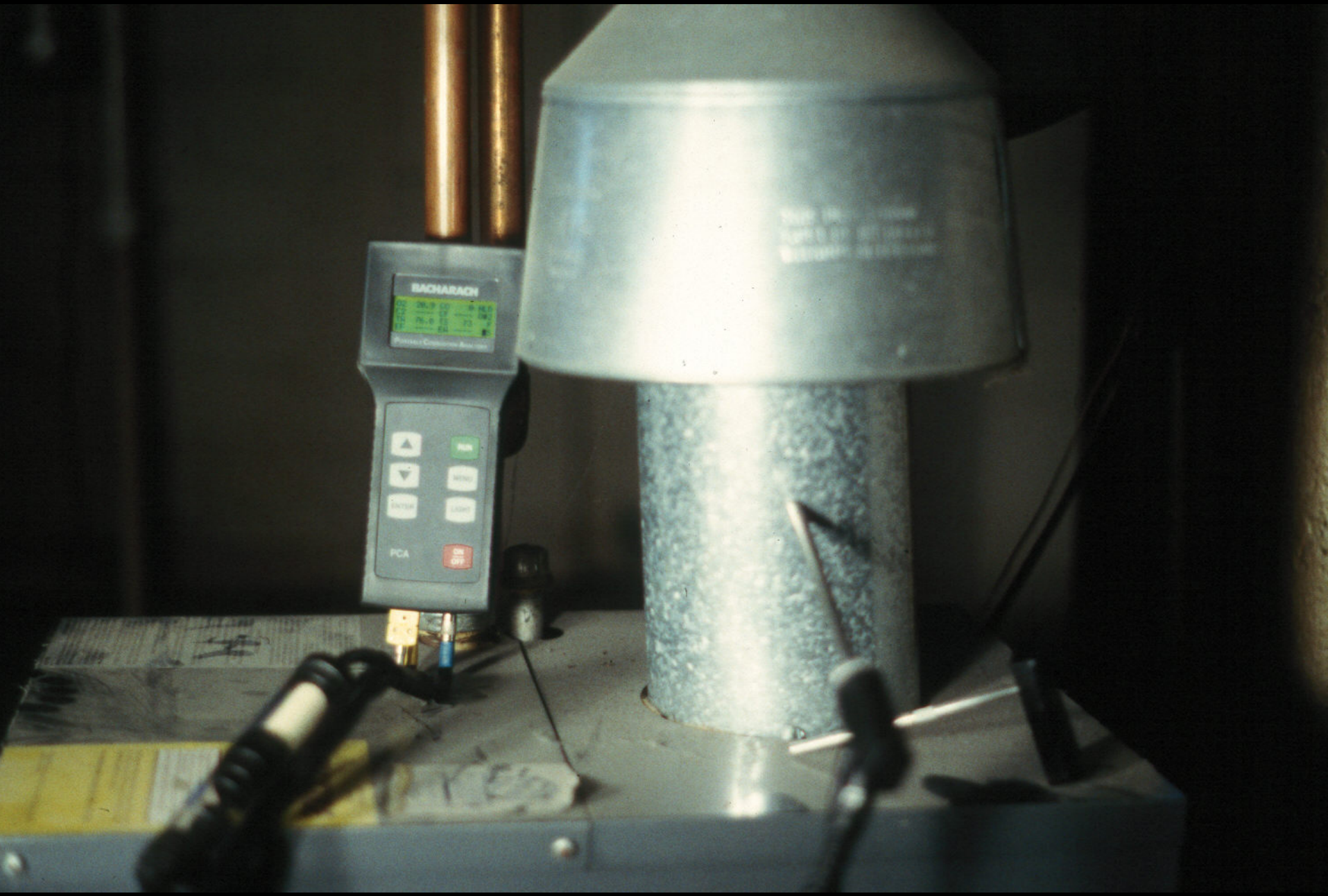
- Fuel Pressure
- Draft
- Smoke Fuel oil
- Carbon Monoxide
- O2 / Co2 / Excess Air
- Draft / Smoke
- ESP / Delta T / etc…

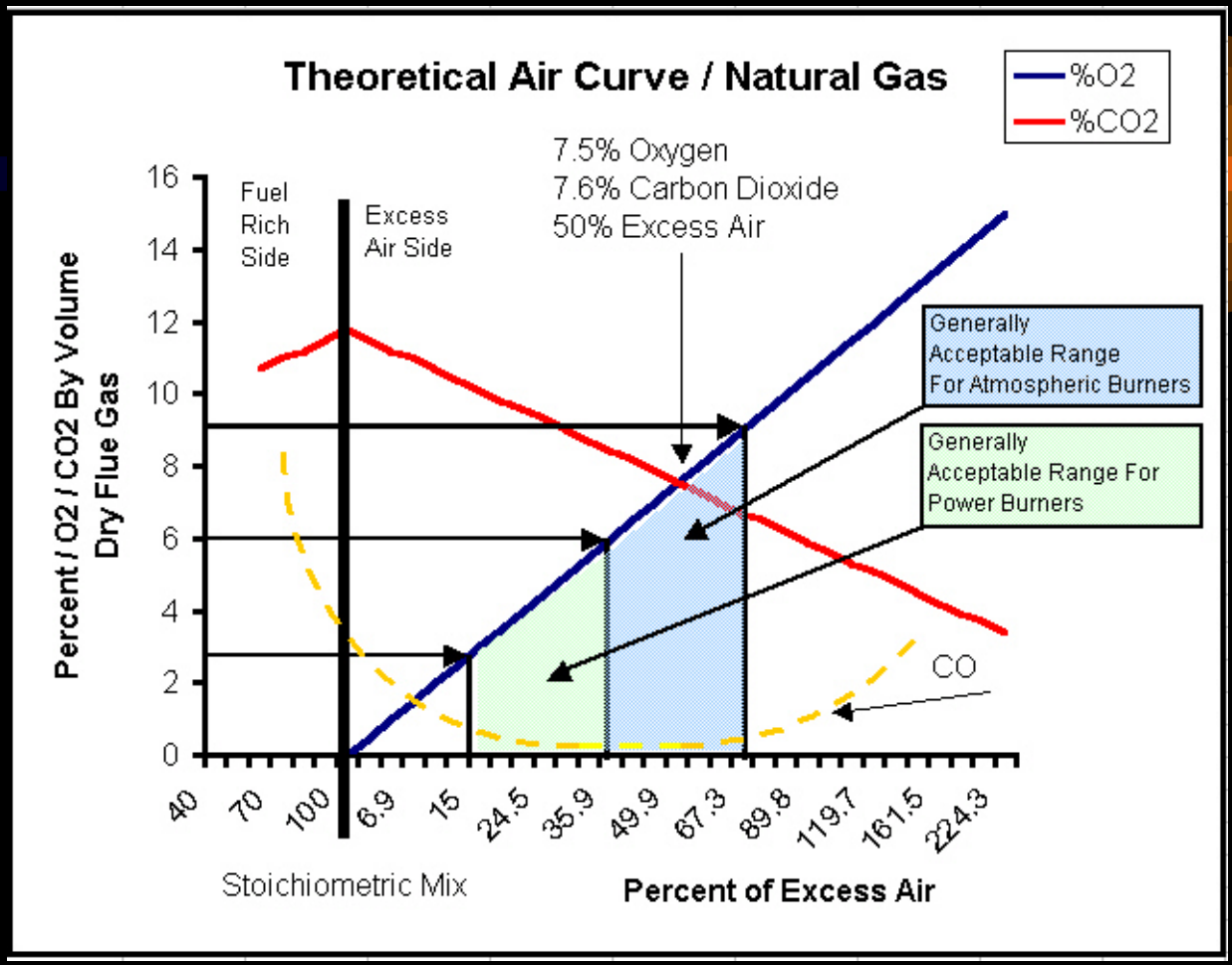



90%
Condensing
gas
Oxygen
reading
7.5%
IPEX
BACHARACH
Fyrite
Pro
NSF-61

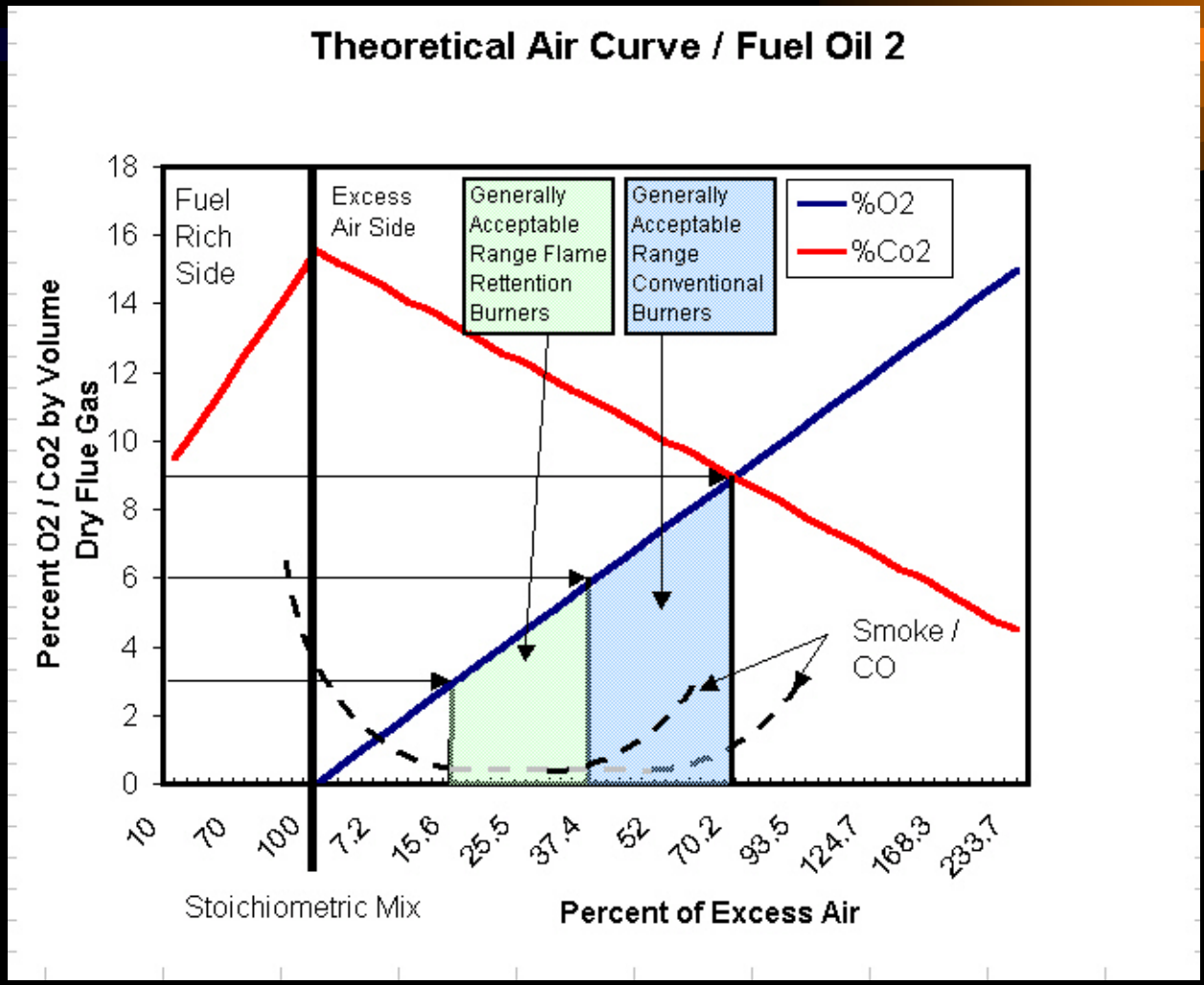
80%, Mid Efficiency, Fan Assist, Forced Air Furnaces




BACHARACH
RUN
ENTER
PCA
ON
OFF

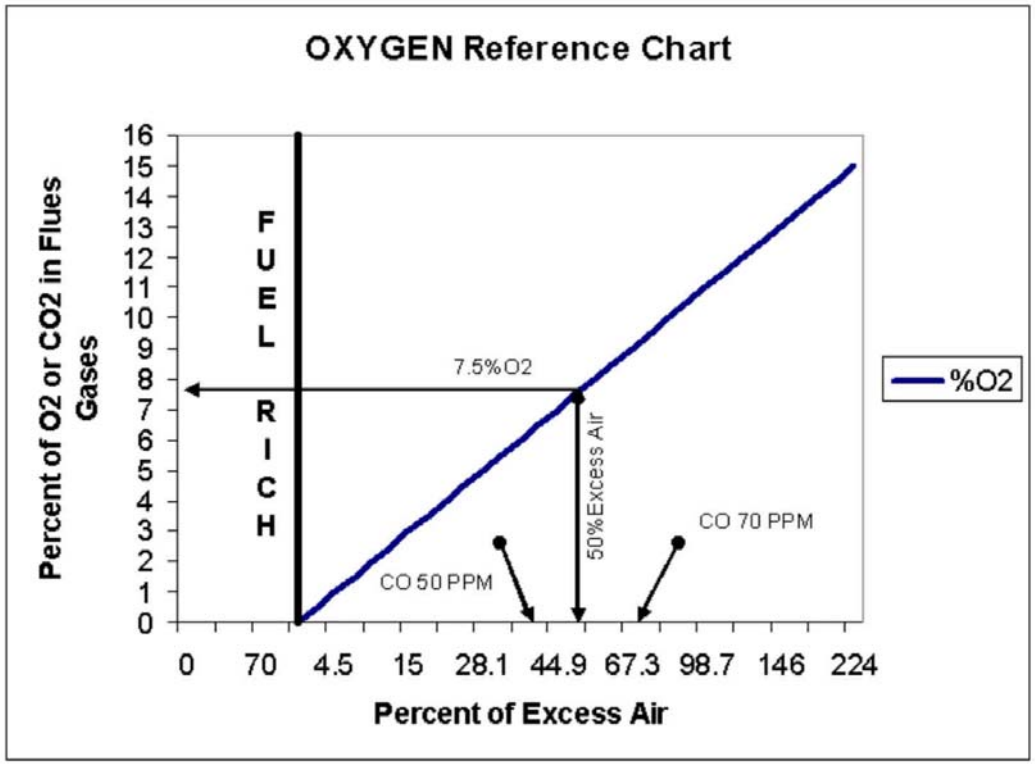

Theoretical Air Curve / Natural Gas
%O2
%CO2
7.5% Oxygen
7.6% Carbon Dioxide
50% Excess Air
Fuel Rich Side
Excess Air Side
Generally Acceptable Range For Atmospheric Burners
Generally Acceptable Range For Power Burners
CO
Percent / O2 / CO2 By Volume Dry Flue Gas
16
14
12
10
8
6
4
2
0
40
70
100
6.9
15
24.5
35.9
49.9
67.3
89.8
119.7
161.5
224.3
Stoichiometric Mix
Percent of Excess Air

Measuring O2 in combustion analysis provides greater precision in establishing the relationships of O2/ CO2/ Excess Air for accurate monitoring of burner performance.



Customer Name Mary Jane Watson
Location 999 Hillcrest Ave, Trenton
Unit Identification # 1 York Mid Efficiency
Burner Performance Documentation. Technician Name Fire Guy

Date 1/02/2002
Time 1:31 PM
Analyzer Serial # eu1107



Measured Combustion Test Results

Fuel Type NG / LPG	NG
Stack Temp ºF	324
AMB Temp ºF	74.4
Oxygen %	7.5
CO Air Free PPM	25
Efficiency %	82.4
Excess Air %	49.8
Breach Draft WC”	-.03
Over Fire Draft WC” Power Burners only	N/A

Additional information

Temperature Rise ºF	55
External Static Pressure	.5
Gas Pressure	3.5
Indoor Ambient CO Level PPM	0

Generally Acceptable Combustion Test Results Natural Gas Atmospheric Burners, Boilers, Mid EFF, Fan Assisted MID EFF and Condensing Units.
Oxygen (6% to 9%)
Stack Temperature (325ºF to 500ºF)
Condensing Stack Temperature (< 145ºF)
Carbon Monoxide Air Free (Recommended to be Less Than 100 PPM Air Free) ANSI Standard < 400 PPM AF

Generally Acceptable Combustion Test Results for Natural Gas Power Burners.
Oxygen (3% to 6%) units on Low Fire may have higher O2 readings.
Stack Temperature (275ºF to 500ºF)
Carbon Monoxide Air Free (Recommended to be Less Than 100 PPM Air Free) ANSI Standard < 400 PPM AF
(Always follow Manufacturers instructions PMI)

Combustion Efficiency

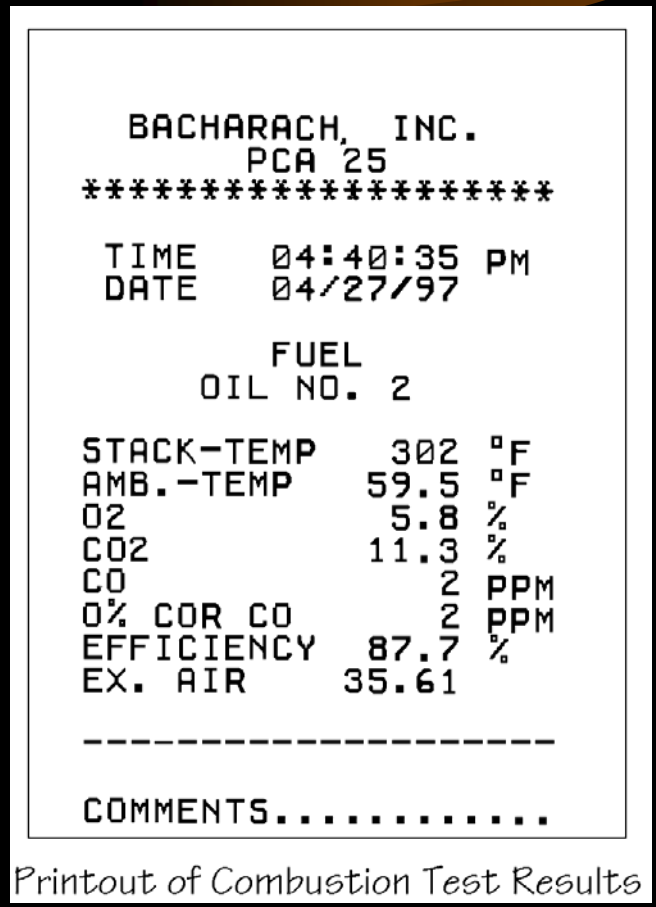
Based on:

- How much energy is in the fuel.
  - The net stack temperature
  - The percentage of O_2 or CO_2 in the flue gases.

Steady State Efficiency

Is only accurate when:

- O_2, stack temperature and CO readings are within manufacturers specifications.
- The stack temperature has stabilized.



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   BACHARACH, INC.
        PCA 25
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 TIME    04:40:35 PM
 DATE    04/27/97

        FUEL
     OIL NO. 2

STACK-TEMP    302  °F
AMB.-TEMP    59.5  °F
O2            5.8  %
CO2          11.3  %
CO              2  PPM
0% COR CO       2  PPM
EFFICIENCY   87.7  %
EX. AIR     35.61

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COMMENTS.............
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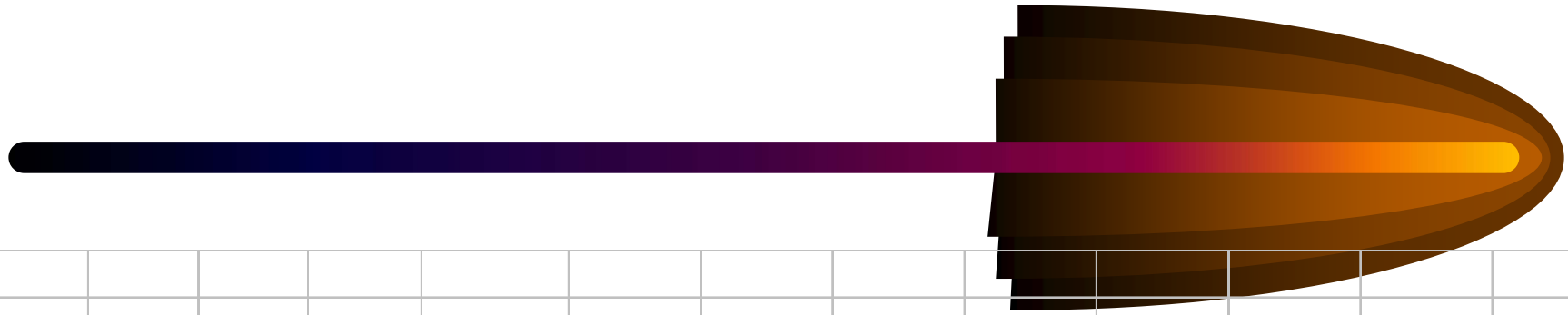
Printout of Combustion Test Results

Combustion Efficiency Increase



SAVINGS FOR EVERY $100 FUEL COSTS BY INCREASE OF COMBUSTION EFFICIENCY

Assuming constant radiation and other unaccounted-for losses

From an origi efficiency of..	To an increased combustion efficiency of...								
	55%	60%	65%	70%	75%	80%	85%	90%	95%
50%	$9.10	$16.10	$23.10	$28.60	$33.30	$37.50	$41.20	$44.40	$47.40
55%		$8.30	$15.40	$21.50	$26.70	$31.20	$35.30	$38.90	$42.10
60%			$7.70	$14.30	$20.00	$25.00	$29.40	$33.30	$37.80
65%				$7.10	$13.30	$18.80	$23.50	$27.80	$37.80
70%					$6.70	$12.50	$17.60	$22.20	$26.30
75%						$6.30	$11.80	$16.70	$21.10
80%							$5.90	$11.10	$15.80
85%								$5.60	$10.50