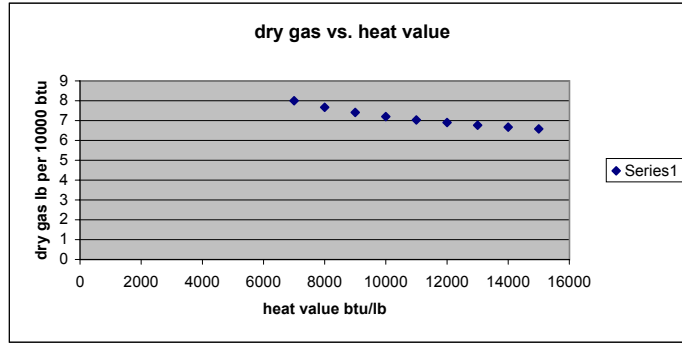


btu/lb	dry gas
7000	8
8000	7.67
9000	7.41
10000	7.2
11000	7.03
12000	6.9
13000	6.77
14000	6.67
15000	6.58



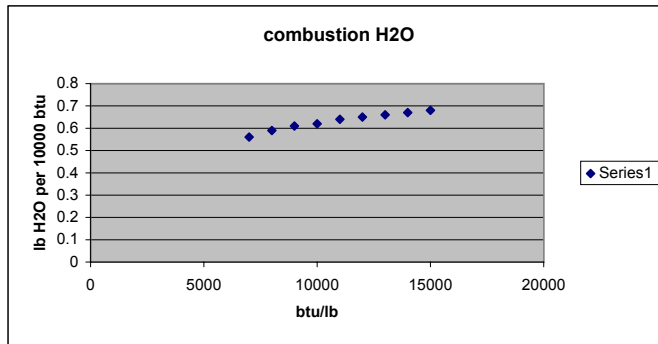
lb dry gas per 10000 btu = $24.1939164 - 1.8387301 * \ln(\text{volatile heating value}) = 7.63$

Q =	C %	H2 %	O2 %	S %	Cl %	N2 %	control			
	30.28	4.41	46.07		0.25	0.83	0.82	82.66	4500 btu/lb	2500 kcal/kg

solid waste (wet feed)	9190 lb/h	100.0 tons/day	(if it were to run around the clock, i.e. 24 hours)		
percent moisture	25 %	moisture rate =	2297.5 lb/h	dry feed =	6892.5 lb/h
percent ash as fired	20 %	ash rate =	1838 lb/h		
		volatile = dry - ash =	5054.5 lb/h		

total heating value as charged	41358069.46 btu/h	41.36 Mbtu/h	
volatile heating value	8182 btu/lb	->	7.63 lb dry gas per 10000 btu
dry gas produced	31546 lb/h dry gas		

btu/lb	combustion H2O lb per 10000 btu
7000	0.56
8000	0.59
9000	0.61
10000	0.62
11000	0.64
12000	0.65
13000	0.66
14000	0.67
15000	0.68



$y = a * x^2 + b * x + c = 0.35030303 + x * 3.8214 / 10^5 - x * 1.093 / 10^9 = 0.59$
0.59 lb per 10000 btu

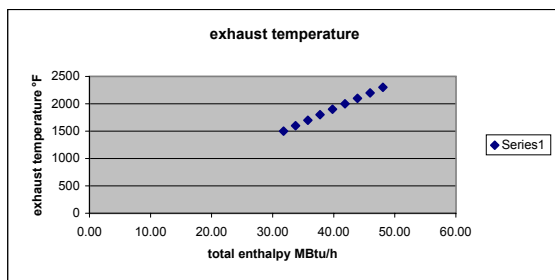
combustion H2O produced	2439 lb/h moisture	
dry gas + combustion H2O =	33985 lb/h	
100 percent air requirement =	28930 lb/h	
total air fraction	1 +	100 % excess
total air =	57860.8 lb/h	2
excess air =	28930 lb/h	
entering air humidity	0.01 lb moisture per lb dry air	
moisture in	579 lb/h	
total H2O out	5315 lb/h	(=feed moisture+combustion moisture+ air humidity)
total dry air out	60476 lb/h	(=dry gas produced + excess air)

		Base 60°F calcs	60 °F	15.6 °C	
shell cooled by	2298 SCFM	10338.8 lb/h air	leaving temperature	450 °F	232.2 °C
waste air heat loss =	976495 btu/h	0.98 Mbtu/h	leaving enthalpy	94.45	
ash rate =	1838 lb/h		leaving temperature	600 °F	315.6 °C
ash discharge loss =	238205 btu/h	0.24 Mbtu/h			
radiation loss =	620371 btu/h	0.62 Mbtu/h	radiation loss percent	1.5 %	
correction factor =	-561250 btu/h	-0.56 Mbtu/h	relative to 60°F		
total loss =	1273821 btu/h	1.27 Mbtu/h			
heat in flue gas = heat in - losses	40084249 btu/h	40.08 Mbtu/h			

	btu/lb	dry air out lb/h	btu/lb	moisture out lb/h	total enthalpy	
1500	369.37	60476	1775.52	5315	31775679.7 btu/h	31.78 Mbtu/h
1600	397.17	60476	1832.12	5315	33757765.7 btu/h	33.76
1700	425.08	60476	1890.11	5315	35753892.6 btu/h	35.75
1800	453.24	60476	1948.02	5315	37764713.2 btu/h	37.76
1900	481.57	60476	2007.17	5315	39792405.8 btu/h	39.79
2000	510.07	60476	2067.42	5315	41836226.4 btu/h	41.84
2100	538.72	60476	2128.7	5315	43894593.3 btu/h	43.89
2200	567.52	60476	2189.92	5315	45961712.6 btu/h	45.96
2300	596.45	60476	2252.6	5315	48044454.4 btu/h	48.04

Table 1.

enthalpy	°F
31.78	1500
33.76	1600
35.75	1700
37.76	1800
39.79	1900
41.84	2000
43.89	2100
45.96	2200
48.04	2300



exhaust temperature = A * enthalpy + B
 40.08 Mbtu/h -> **1908.6 °F** **1042.5 °C**

we want to reach **2000 °F** -> supplemental fuel needed to reach **41.84 Mbtu/h**
 the difference is = **1.75 Mbtu/h**

say we use fuel oil and total air **1.2 ->** 57578 btu/gal are available at **2000 °F**

fuel oil required =	30.4 gallons/hour	
air required =	3805.4 lb/h	125.062
dry gas produced =	3819.8 lb/h	125.537
H2O produced =	266.3 lb/h	8.751

total dry gas out with fuel	64295.8 lb/h
total moisture out with fuel	5581.7 lb/h
total air in	61666.2 lb/h

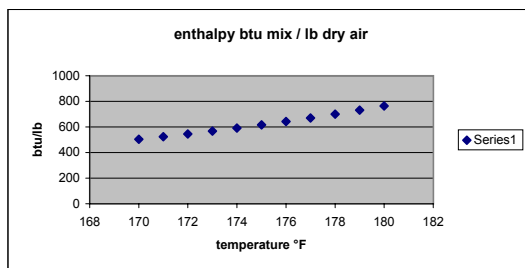
Outlet flue heat content with fuel **44.3 Mbtu/h** note: 139,703 btu per gal available

44.3 Mbtu/h -> **2117.6 °F** **1158.7 °C**

heat out btu per lb dry gas = outlet flue content with fuel / total dry gas out with fuel = **690 btu/lb**

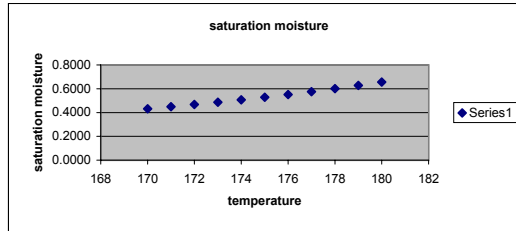
table 11.32

heat	
170	504.29
171	524.31
172	545.38
173	567.61
174	591.07
175	615.86
176	642.11
177	669.92
178	699.48
179	730.86
180	764.31



temperature = 0.03842923 * heat + 151.050901

temperature	saturation moisture
170	0.4320
171	0.4493
172	0.4675
173	0.4867
174	0.5070
175	0.5284
176	0.5511
177	0.5752
178	0.6008
179	0.6279
180	0.6560



saturation moisture = 0.02232181 * temperature - 3.3716 =

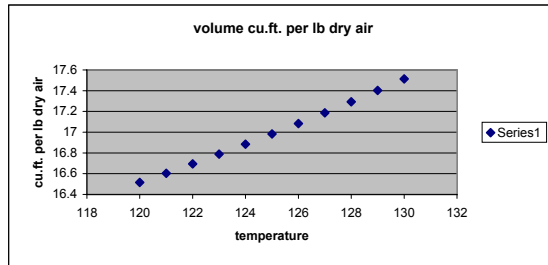
e.g.	adiabatic temperature	saturation moisture	
	690	177.5 °F	0.5916
		0.5916	

moisture flow = total dry gas flow with moisture * saturation moisture = 38039.43 lb/h

quench water = moisture flow - total moisture out with fuel = 32457.7 lb/h 64.9 gpm

outlet temperature, anywhere between 120 to 160°F, say **120 °F** 48.9 °C

120	16.515
121	16.603
122	16.695
123	16.789
124	16.885
125	16.983
126	17.084
127	17.187
128	17.293
129	17.402
130	17.514



16.515 cu.ft. per lb dry gas

CFMs = total dry gas out with fuel lb/h * cu.ft. per dry gas lb / 60 = **17697 CFM** 30068 m3/h