Sample Combustion Calculations by weight method

Combustion calculations are starting point for Boiler or any Thermal equipment design. Here is a sample calcualtion done for Coal with a calorific value of approximately 7200 Kcal/kg (12960 BTU/Lb).

Coal composition in % is as follows :

Carbon , C - 76.0 ; Hydrogen, H2 - 4.1 ; Nitrogen , N2 - 1.0 ; Oxygen, O2 - 7.6 ; Suphur, S - 1.3 ; Moisture, H2O - 3.0 ; Ash - 7.0 ;
Excess Air : 30 %
Molecular Wt of C - 12 , O2 -32 , H2 - 2, S – 32
The Chemicals equations are as follows: C + O2 --> CO2 ; S + O2 --> SO2 ; H2 + O --> H2O

Comp	Wt.	O2 reqd	CO2	H2O	N2	SO2
C	0.76	2.0267	2.7867	-	-	-
H2	0.041	0.328	-	0.369	-	-
O2	0.076	(-0.076)				
N2	0.01	-	-	-	0.01	-
S	0.013	0.013	-	-	-	0.026
H2O	0.03	-	-	0.03	-	-
ASH	0.07					
	100.0	2.2917	2.7867	0.399	0.01	0.026

From the above table, Theoretical O2 required = 2.2917 kg/kg of coal
There fore, Theoretical dry Air required = 2.2917/0.23 = 9.964 kg of dry air/ kg of fuel
considering 30% Excess Air , Th air reqd = 9.964 x 1.3 = 12.9532 kg/kg
Wet air required (assuming 60% RH) = 12.9532 x 1.013 = 13.12 kg/kg of fuel
Gas composition :

Gas	Weight	%Wt	%WT/MW	%Volume
CO2	2.7867	19.832	0.4507	13.381
H2O	0.567	4.035	0.2242	6.655
SO2	0.026	0.185	0.0029	0.086
N2	9.9837	71.055	2.5376	75.339
O2	0.6875	4.893	0.1529	4.539
	14.0509	100.0	3.3654	100