Bagasse Combustion: Air, Flue Gas and CO_2 (Hugot)

Air and flue gas per kg of bagasse, gas composition and dry CO_2 for an excess-air factor (Hugot 41.27–41.39), and excess air from measured CO_2.

Method: Hugot; Handbook of Cane Sugar Engineering; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Bagasse moisture	48.000	%
Air factor (actual / theoretical air)	1.5000	
Measured dry CO_2 (for the reverse check)	13.000	%

Calculated results

Parameter	Value	Unit
Air per kg bagasse	4.4928	kg/kg
Air per kg bagasse, Nm³/kg (0 °C, 1 atm)	3.4710	
Wet flue gas per kg bagasse (ash included, as Hugot)	5.4928	kg/kg
Wet flue gas per kg bagasse, Nm³/kg (0 °C, 1 atm)	4.4176	
Dry flue gas per kg bagasse, Nm³/kg (0 °C, 1 atm)	3.4419	
N_2 by mass	63.057	%
O_2 by mass	6.3104	%
H_2O by mass	14.311	%
CO_2 by mass	16.322	%
Dry CO_2 by volume	13.144	%
Air factor from the measured CO_2	1.5203	

Notes for this case

- Hugot's bagasse: C 47, H 6.5, O 44, ash 2.5 % of dry matter; 5.76 kg (4.45 Nm³) of air per kg dry bagasse. Best CO_2 12–16 %, 25–60 % excess air.

Formula and method

$$P_a = 5.76(1-w)m, \quad P_g = P_a + 1, \quad V_{gs} = 4.45(1-w)m - 0.056(1-w), \quad \gamma = \frac{0.87(1-w)}{V_{gs}}, \quad m_\gamma = \frac{0.196}{\gamma} + 0.0126$$

Variables

w	Bagasse moisture	-
m	Air factor (actual / theoretical air)	-
γ	Measured dry CO_2 (for the reverse check)	-
P_a	Air per kg bagasse	kg/kg
V_a	Air per kg bagasse, Nm³/kg	-
P_g	Wet flue gas per kg bagasse (ash included, as Hugot)	kg/kg
V_g	Wet flue gas per kg bagasse, Nm³/kg	-
V_{gs}	Dry flue gas per kg bagasse, Nm³/kg	-
x_{N_2}	N_2 by mass	-
x_{O_2}	O_2 by mass	-
x_{H_2O}	H_2O by mass	-

x_{CO_2}	CO_2 by mass	-
m_γ	Air factor from the measured CO_2	-

Method and standards

Hugot's combustion balance for bagasse of standard composition.

Assumptions and limits

- Hugot's average composition; complete combustion.
- P_g = P_a + 1 is Hugot's form and counts the ash with the gas; the mass fractions are from the gas components only, so they differ slightly.
- Volumes in Nm^3 at 0 °C and 1 atm.
- A note appears when the air factor from the measured CO_2 differs from the one entered by more than 10 %.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 41
- combustion of bagasse
- eqns 41.13 and 41.27–41.40
- pp. 918–923

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/sugar-ethanol/steam-power/bagasse-combustion-hugot

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.