



GASEOUS FUELS (Formulae)

Combustion efficiency of gas fired appliances.

BUNTE formula: (sensible heat stack losses)

$$N = \frac{VCO_2 \times 1.357 \times (T - t) \times 100}{\frac{CO_2}{100} \times NCV^*}$$

N = loss %

VCO₂ = Volume in m³ of CO₂ for 1 m³ of gas in stoichiometric combustion

1.357 = Specific heat of flue gases (average) in kJ/Nm³

T = Smoke temperature in °C.

t = Ambient temperature.

NCV = Nett calorific value of fuel gas in kJ/Nm³

CO₂ = CO₂ measured in smoke.

% Combustion efficiency = 100 - N

Gas velocity in orifice

V = velocity m/s

H = Static pressure Pascal

$$V = \alpha \sqrt{\frac{2h}{\lambda}}$$

λ = Gas specific weight kg/m³

α = Contraction coefficient.

α = 0.75 for diameter equivalent to thickness of wall.

α = 0.65 for diameters substantially larger than wall thickness.

Example: BUNTE formula.

VCO₂ = 0.450

T = 220

t = 20

CO₂ = 7.5

$$\left. \begin{array}{l} \\ \\ \\ \end{array} \right\} N = \frac{0.450(220 - 20) \times 1.317 \times 100}{0.075 \times 15280} = 10.3\%$$

NCV = 15280

Example 2: Velocity in orifice.

h = 1000 Pa

λ = 1.2

α = 0.75

$$V = 0.75 \sqrt{\frac{2 \times 1000}{1.2}} = 30 \text{ m/s}$$