Gas Flow: Nm³/h to Actual m³/h and kg/h

Converts a gas flow in normal cubic metres per hour to actual m³/h at line pressure and temperature, to mass flow and to standard m³/h at 15 °C, with densities.

Method: Ideal gas law

Input parameters

Unit system: SI

Parameter	Value	Unit
Normal flow (0 °C, 1.01325 bar)	10,000	Nm³/h
Molar mass of the gas Air 28.96; natural gas about 16–19; flue gas about 29–30.	28.960	kg/kmol
Line pressure (absolute)	2.0000	bar
Line temperature	150.00	°C
Compressibility factor	1.0000	

Calculated results

Parameter	Value	Unit
Actual flow at line conditions	7,848.4	m³/h
Mass flow	12,921	kg/h
Standard flow (15 °C, 1.01325 bar)	10,549	m³/h
Density at normal conditions	1.2921	kg/m³
Density at line conditions	1.6463	kg/m³

Notes for this case

- Normal and standard conditions are taken as ideal gas (Z = 1); Z applies at line conditions only.

Formula and method

$$\rho_n = \frac{p_0 M}{R T_0}, \quad \rho = \frac{pM}{ZRT}$$

$$\dot{m} = \dot{V}_n \rho_n, \quad \dot{V} = \dot{m}/\rho$$

$$\dot{V}_s = \dot{m}/\rho_s \ (15\ °C)$$

Variables

$\dot{V}_n$	normal flow (0 °C, 1.01325 bar)	Nm³/s
M	molar mass	kg/kmol
p	line pressure, absolute	Pa
T	line temperature	K
Z	compressibility factor	-
p_0	normal pressure 101 325 Pa	Pa
T_0	normal temperature 273.15 K	K
R	universal gas constant	J/(kmol·K)
ρ_s	density at 15 °C, 1.01325 bar	kg/m³
$\dot{V}$	actual flow	m³/s
$\dot{m}$	mass flow	kg/s
$\dot{V}_s$	standard flow at 15 °C	m³/s

ρ_n	density at normal conditions	kg/m³
ρ	density at line conditions	kg/m³

Method and standards

Mass flow is the same in any units; normal and actual volumes differ by the density ratio from the ideal gas law (with Z at line conditions).

Assumptions and limits

- Ideal gas at the reference conditions; Z at line conditions.
- The FPS display unit "scfm" is the US standard cubic foot per minute (60 °F, 14.696 psia), converted from the normal state; it is about 5.6 % larger than ft³/min at 0 °C for the same mass flow.

References

- Ideal gas law

Report details

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Release checks	3 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/mechanical/fluid-mechanics/gas-flow-normal-actual

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.