Gas DP Flowmeter Pressure and Temperature Compensation

Corrected flow of a gas through an orifice or other DP meter when the line pressure and temperature differ from the design values, for volume and mass flow.

Method: Ideal-gas density correction of a DP meter: q_m ∝ √(ρ Δp)

Input parameters

Unit system: SI

Parameter	Value	Unit
Indicated flow (at design conditions)	1,000.0	
Design pressure (absolute; shown as gauge, converted with 1.01325 bar)	5.9867	bar g
Design temperature	30.000	°C
Actual pressure (absolute; shown as gauge, converted with 1.01325 bar)	4.9867	bar g
Actual temperature	45.000	°C
Compressibility ratio (design / actual)	1.0000	

Calculated results

Parameter	Value	Unit
Correction for standard volume or mass flow √(p T_d Z_d / (p_d T Z))	0.90373	
Corrected standard volume or mass flow	903.73	
Correction for actual volume flow √(p_d T Z / (p T_d Z_d))	1.1065	
Corrected actual volume flow	1,106.5	

Notes for this case

- The meter reads √(Δp/ρ_design); the true flow follows the actual density, ρ ∝ p/(Z T). Expansibility and Reynolds-number changes are ignored.

Formula and method

$$Q_N = Q_{ind}\sqrt{\frac{p T_d Z_d}{p_d T Z}}, \quad Q_a = Q_{ind}\sqrt{\frac{p_d T Z}{p T_d Z_d}}$$

Variables

Q_{ind}	Indicated flow (at design conditions)	-
p_d	Design pressure (absolute; shown as gauge, converted with 1.01325 bar)	Pa
T_d	Design temperature	K
p	Actual pressure (absolute; shown as gauge, converted with 1.01325 bar)	Pa
T	Actual temperature	K
Z_d/Z	Compressibility ratio (design / actual)	-
k_N	Correction for standard volume or mass flow √(p T_d Z_d / (p_d T Z))	-
Q_N	Corrected standard volume or mass flow	-
k_a	Correction for actual volume flow √(p_d T Z / (p T_d Z_d))	-
Q_a	Corrected actual volume flow	-

Method and standards

Density correction of the square-root flow equation.

Assumptions and limits

- Ideal gas with a Z ratio; same Δp.
- Pressures are absolute; the gauge display is converted with the standard atmosphere, not the site barometer (enter absolute at altitude).
- Read Q_N if the meter is scaled in standard volume or mass flow, Q_a if it is scaled in actual volume flow.

References

- Ideal-gas density correction of a DP meter: q_m ∝ √(ρ Δp)

Report details

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

This calculator online

https://calc.firecad.com/instrumentation/flow/gas-dp-flow-compensation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.