Gas Burner Pressure on a Change of Fuel Gas

New burner supply pressure for the same heat input when the fuel gas changes (heating value and specific gravity), by Ganapathy's flow-resistance relation Δp ∝ W²/ρ.

Method: Ganapathy; Steam Plant Calculations Manual; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Burner pressure with the old gas	27.579	kPa
Old gas heating value (per standard volume, same reference as the new gas)	41.350	MJ/Nm³
Old gas specific gravity (air = 1)	0.60000	
New gas heating value	90.576	MJ/Nm³
New gas specific gravity	1.5000	

Calculated results

Parameter	Value	Unit
Burner pressure with the new gas	14.370	kPa
Volume flow ratio, new/old	0.45652	
Wobbe index ratio	1.3854	

Notes for this case

- Gases of equal Wobbe index give the same heat input at the same pressure; a gas of a different Wobbe index needs new orifices or a different regulator setting, and the air ratio must be reset.

Formula and method

$$\frac{\Delta p_2}{\Delta p_1} = \frac{S_2}{S_1}\left(\frac{HHV_1}{HHV_2}\right)^2, \quad WI = \frac{HHV}{\sqrt{S}}$$

Variables

Δp_1	Burner pressure with the old gas	Pa
HHV_1	Old gas heating value (per standard volume)	J/m³
S_1	Old gas specific gravity (air = 1)	-
HHV_2	New gas heating value	J/m³
S_2	New gas specific gravity	-
Δp_2	Burner pressure with the new gas	Pa
$\dot{V}_2/\dot{V}_1$	Volume flow ratio, new/old	-
WI_2/WI_1	Wobbe index ratio	-

Method and standards

Mass flow = Q/HHV × ρ_std; Δp = K W²/ρ with ρ ∝ S. Only the ratios matter, so both heating values must be on the same basis (both gross, per the same standard volume); the default values are Ganapathy's 1050 and 2300 Btu/scf (60 °F, 14.696 psia) converted to normal m³ at 0 °C.

Assumptions and limits

- Same burner and back pressure; same gas temperature. The burner pressure is the drop across the burner: with a pressurised furnace, or a fixed regulator or valve drop upstream, subtract those from the supply pressure first.
- Incompressible flow; above about 0.5 bar a note appears.

References

- Ganapathy
- Steam Plant Calculations Manual
- 2nd ed. (Marcel Dekker, 1993)
- Q2.05
- Eq. (7): $\Delta p = K W^2/\rho$

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/boilers-power-plant/combustion/gas-burner-pressure-fuel-change

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.