HRSG Gas Flow from Steam Output (Energy Balance)

Exhaust gas flow through an HRSG back-calculated from measured steam flow and conditions, feedwater and gas temperatures, for performance tests.

Method: Ganapathy; Industrial Boilers and Heat Recovery Steam Generators (Marcel Dekker, 2003); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Steam flow	31,162	kg/h
Steam pressure (absolute)	35.487	bar
Steam temperature (≤ saturation = dry saturated)	365.56	°C
Feedwater temperature	110.00	°C
Blowdown fraction	0	%
Gas inlet temperature	521.11	°C
Gas exit temperature	193.33	°C
Mean gas specific heat	1.1304	kJ/(kg·K)
Heat retention factor	99.000	%

Calculated results

Parameter	Value	Unit
Heat to steam and blowdown	23,175	kW
Gas flow	227,445	kg/h
Steam per kg of gas	0.13701	kg/kg

Notes for this case

- Gas flow in large ducts is hard to measure (3–5 % error per PTC 4.4); the energy balance gives a better figure. Then run an off-design simulation at this flow to judge whether the HRSG meets its guarantee.

Formula and method

$$W_g = \frac{W_s(h_s - h_{fw}) + bW_s(h_f - h_{fw})}{h_l \bar{c}_p (T_{g1} - T_{g2})}$$

Variables

W_s	Steam flow	kg/s
p	Steam pressure (absolute)	Pa
T_s	Steam temperature (≤ saturation = dry saturated)	K
T_{fw}	Feedwater temperature	K
b	Blowdown fraction	-
T_{g1}	Gas inlet temperature	K
T_{g2}	Gas exit temperature	K
$\bar{c}_p$	Mean gas specific heat	J/(kg·K)
h_l	Heat retention factor	-
Q_s	Heat to steam and blowdown	W
W_g	Gas flow	kg/s
W_s/W_g	Steam per kg of gas	kg/kg

Method and standards

Energy balance.

Assumptions and limits

- Steady state; mean c_p over the range.
- Feedwater must be liquid at the steam pressure, and the steam must carry more heat than the feedwater.

References

• Ganapathy
• Industrial Boilers and Heat Recovery Steam Generators (Marcel Dekker, 2003)
• Q8.45a–b (HRSG performance testing; gas flow from an energy balance); IAPWS-IF97

Report details

Report reference	FCC-N623-VV98 (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	HRSG Gas Flow from Steam Output (Energy Balance)
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/hrsg-waste-heat/hrsg-gas-flow-from-steam-data

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.