Stack Gas Reheat after a Wet Scrubber

Heat to reheat saturated flue gas above its dew point and the steam it takes at a heating pressure (IF97), against stack condensation and plume.

Method: Energy balance; latent heat from IAPWS-IF97

Input parameters

Unit system: SI

Parameter	Value	Unit
Wet flue gas flow	110.00	t/h
Wet gas specific heat	1.1000	kJ/(kg·K)
Reheat temperature rise	20.000	K
Heating steam pressure (absolute) Absolute: add the atmospheric pressure (about 1.013 bar) to a header gauge reading.	6.0000	bar

Calculated results

Parameter	Value	Unit
Reheat duty	672.22	kW
Steam condensed	1,160.3	kg/h

Notes for this case

- A gas–gas heater using the hot inlet gas avoids steam but adds leakage and corrosion risk.

Formula and method

$$\dot{Q} = \dot{m}_g c_p \Delta T, \quad \dot{m}_s = \frac{\dot{Q}}{h_{fg}(p_s)}$$

Variables

$\dot{m}_g$	Wet flue gas flow	kg/s
c_p	Wet gas specific heat	J/(kg·K)
ΔT	Reheat temperature rise	K
p_s	Heating steam pressure (absolute)	Pa
$\dot{Q}$	Reheat duty	W
$\dot{m}_s$	Steam condensed	kg/s

Method and standards

Energy balance on the gas with a mean wet-gas specific heat; the steam condensed is the duty over the latent heat at the heating pressure (IAPWS-IF97).

Assumptions and limits

- No droplets carried. Gas leaving a wet scrubber usually carries droplets that must be evaporated before its temperature rises; that heat can be large and is not included, so allow for it or use the mist eliminator maker's carry-over.
- Dry saturated heating steam in, saturated condensate out, no heater loss: superheat in the steam or subcooled condensate lowers the steam needed.
- The heating steam pressure is absolute.

References

- Energy balance; latent heat from IAPWS-IF97

Report details

Report reference	FCC-FQ0P-W9GY (the same inputs always give the same reference)
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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/emissions-stacks/stack-gas-reheat

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.