Exhaust Gas Heater for Hot Water or Thermic Fluid

Heat from an exhaust cooled to a stack limit, the hot water or thermic fluid flow it heats through a temperature rise, and the cold-end approach check.

Method: Energy balances (definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Exhaust flow	11,000	kg/h
Exhaust specific heat	1.1000	kJ/(kg·K)
Exhaust in	450.00	°C
Exhaust out	230.00	°C
Liquid specific heat Water about 4.19, thermic fluids 2.2–2.8 kJ/(kg·K).	2.5000	kJ/(kg·K)
Liquid in	150.00	°C
Liquid out	280.00	°C

Calculated results

Parameter	Value	Unit
Heat transferred	739.44	kW
Liquid flow	8.1908	t/h
Cold-end approach (counter-flow)	80.000	K
Hot-end approach	170.00	K

Notes for this case

- Check the exhaust outlet against its acid dew point and the thermic fluid film temperature in the hottest rows; neither is checked here.

Formula and method

$$Q = \dot{m}_g c_{pg} (T_{g1} - T_{g2}), \quad \dot{m}_l = \frac{Q}{c_{pl}(T_{l2} - T_{l1})}$$

Variables

$\dot{m}_g$	Exhaust flow	kg/s
c_{pg}	Exhaust specific heat	J/(kg·K)
T_{g1}	Exhaust in	K
T_{g2}	Exhaust out	K
c_{pl}	Liquid specific heat	J/(kg·K)
T_{l1}	Liquid in	K
T_{l2}	Liquid out	K
Q	Heat transferred	W
$\dot{m}_l$	Liquid flow	kg/s
$T_{g2} - T_{l1}$	Cold-end approach (counter-flow)	K
$T_{g1} - T_{l2}$	Hot-end approach	K

Method and standards

Energy balance with approach checks.

Assumptions and limits

- Counter-flow; no losses. A temperature cross at either end is rejected; a cold-end approach under 20 K gives a warning.
- The acid dew point at the exhaust outlet and the thermic fluid film temperature are not checked.

References

- Energy balances (definitions)

Report details

Report reference	FCC-3CPZ-J4B6 (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/hrsg-waste-heat/exhaust-liquid-heater

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.