Fuel Equivalence: How Much Fuel B Replaces Fuel A

Rate of a second fuel that delivers the same useful heat as a first fuel, from both calorific values and the boiler efficiency on each.

Method: Useful heat balance between two fuels (definition)

Input parameters

Unit system: SI

Parameter	Value	Unit
Fuel A rate	4.0000	t/h
Fuel A GCV	23,000	kJ/kg
Efficiency on fuel A (on GCV)	82.000	%
Fuel B GCV	9,600.0	kJ/kg
Efficiency on fuel B (on GCV)	70.000	%

Calculated results

Parameter	Value	Unit
Fuel B rate	11.226	t/h
Tonnes of B per tonne of A	2.8065	

Formula and method

$$\frac{\dot{m}_B}{\dot{m}_A} = \frac{GCV_A \eta_A}{GCV_B \eta_B}$$

Variables

$\dot{m}_A$	Fuel A rate	kg/s
GCV_A	Fuel A GCV	J/kg
η_A	Efficiency on fuel A	-
GCV_B	Fuel B GCV	J/kg
η_B	Efficiency on fuel B	-
$\dot{m}_B$	Fuel B rate	kg/s
$\dot{m}_B/\dot{m}_A$	Tonnes of B per tonne of A	-

Method and standards

Useful heat balance: the same steam output needs the same useful heat, $\dot{m}_B GCV_B \eta_B = \dot{m}_A GCV_A \eta_A$.

Assumptions and limits

- Same steam output.
- Calorific values and efficiencies must share one basis: gross values with efficiencies on GCV (as labelled), or net values with net efficiencies. Mixing a GCV with a net efficiency gives a wrong ratio and cannot be detected.

References

- Useful heat balance between two fuels (definition)

Report details

Report reference	FCC-X9XS-4980 (the same inputs always give the same reference)
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Calculator	Fuel Equivalence: How Much Fuel B Replaces Fuel A
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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/boilers/fuel-equivalence

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.