Boiler Efficiency at Part Load (Fixed and Proportional Losses)

Boiler efficiency at part load from the full-load efficiency and the share of losses fixed in kW (radiation, casing) rather than proportional to firing.

Method: Loss model: proportional losses (share of input) constant; fixed losses constant in kW (ASME PTC 4 radiation and convection loss concept)

Input parameters

Unit system: SI

Parameter	Value	Unit
Efficiency at full load	86.000	%
Fixed losses at full load (share of input)	1.5000	%
Load (share of full-load output)	50.000	%

Calculated results

Parameter	Value	Unit
Proportional losses	12.500	%
Fixed losses at this load (share of input)	2.9494	%
Efficiency at this load	84.551	%

Notes for this case

- Excess air usually rises at low load, raising the proportional losses too: this model is the minimum fall in efficiency.

Formula and method

$$L_p = 1 - \eta_{100} - L_f, \quad \dot{Q}_{in}(\lambda) = \frac{\lambda \eta_{100} + L_f}{1 - L_p}, \quad L_{f,\lambda} = \frac{L_f}{\dot{Q}_{in}(\lambda)}, \quad \eta_\lambda = \frac{\lambda \eta_{100}}{\dot{Q}_{in}(\lambda)}$$

Variables

η_{100}	Efficiency at full load	-
L_f	Fixed losses at full load (share of input)	-
λ	Load (share of full-load output)	-
L_p	Proportional losses	-
$L_{f,\lambda}$	Fixed losses at this load (share of input)	-
η_λ	Efficiency at this load	-
$\dot{Q}_{in}(\lambda)$	Heat input at this load, as a share of full-load input	-

Method and standards

Loss model (per unit of full-load input).

Assumptions and limits

- Proportional losses constant (as a share of input); excess air and stack temperature changes with load are ignored, so this is the minimum fall in efficiency.
- Above full load the model raises the efficiency slightly; in practice the stack temperature rises, so treat overload results with care.

References

• Loss model: proportional losses (share of input) constant; fixed losses constant in kW (ASME PTC 4 radiation and convection loss concept)

Report details

Report reference	FCC-QTXE-T9EG (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Boiler Efficiency at Part Load (Fixed and Proportional Losses)
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/boilers/part-load-boiler-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.