Part Load: Sliding Pressure versus Throttle Control

HP turbine inlet temperature and isentropic drop at part load with throttle control and with sliding pressure, and the feed pump work saved.

Method: Part-load comparison with IAPWS-IF97 and flow-proportional stage pressures

Input parameters

Unit system: SI

Parameter	Value	Unit
Rated main steam pressure	160.00	bar
Main steam temperature	540.00	°C
Rated HP exhaust pressure	40.000	bar
Load (flow) fraction	60.000	%
Feed pump efficiency	80.000	%

Calculated results

Parameter	Value	Unit
Turbine inlet temperature, throttled	512.61	°C
HP isentropic drop, throttle	402.10	kJ/kg
HP isentropic drop, sliding	420.79	kJ/kg
HP drop gain by sliding	4.6476	%
Feed pump work saved per kg	8.9219	kJ/kg

Notes for this case

• Throttling keeps boiler pressure at p_0 and drops it in the control valves at constant enthalpy, cooling the steam slightly and wasting availability; sliding pressure lets boiler pressure fall with load (turbine stage pressures scale with flow) and keeps full temperature. HP exhaust pressure is taken proportional to flow in both. Feed pump work saved ≈ vΔp/η with feedwater at about 180 °C. Throttle response is faster, so many units use modified sliding pressure.

Formula and method

$$p_1 = Lp_0, \quad \Delta h_s = h(p_1, \cdot) - h(Lp_x, s_1), \quad \Delta w_{fp} = \frac{v(p_0 - p_1)}{\eta_{fp}}$$

Variables

p_0	Rated main steam pressure	Pa
T_0	Main steam temperature	K
p_x	Rated HP exhaust pressure	Pa
L	Load (flow) fraction	-
η_{fp}	Feed pump efficiency	-
$T_{1,thr}$	Turbine inlet temperature, throttled	K
$\Delta h_{s,thr}$	HP isentropic drop, throttle	J/kg
$\Delta h_{s,sl}$	HP isentropic drop, sliding	J/kg
$\Delta h_{sl}/\Delta h_{thr} - 1$	HP drop gain by sliding	-
Δw_{fp}	Feed pump work saved per kg	J/kg

Method and standards

Part-load control.

Assumptions and limits

- Stage pressures proportional to flow; HP section only; IAPWS-IF97.

References

Part-load comparison with IAPWS-IF97 and flow-proportional stage pressures

Report details

Report reference	FCC-EVW4-WCF3 (the same inputs always give the same reference)
Generated	23 November 2026, 17:43 UTC
Calculator	Part Load: Sliding Pressure versus Throttle Control
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 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/steam-turbines/sliding-vs-throttle-pressure

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.