PWR Steam Generator: Steam Flow, LMTD and Heat Transfer Area

Steam production, primary flow, log-mean temperature difference to boiling and the heat transfer area of a recirculating PWR steam generator.

Method: Heat balance and LMTD of a recirculating steam generator

Input parameters

Unit system: SI

Parameter	Value	Unit
Steam generator duty	750.00	MW
Primary pressure	15.500	MPa
Primary inlet (hot-leg) temperature	325.00	°C
Primary outlet (cold-leg) temperature	292.00	°C
Steam pressure	6.9000	MPa
Feedwater temperature	227.00	°C
Overall heat transfer coefficient	6,000.0	W/(m²·K)

Calculated results

Parameter	Value	Unit
Steam saturation temperature	284.86	°C
Steam flow (dry saturated)	1,502.7	t/h
Primary flow	14,243	t/h
Log-mean temperature difference	19.115	K
Required UA	39,237	kW/K
Heat transfer area	6,539.5	m²

Notes for this case

• Recirculating steam generator: the secondary side is taken at saturation throughout (feedwater mixes with recirculating water in the downcomer), so ΔT_lm = (T_h − T_c)/ln[(T_h − T_sat)/(T_c − T_sat)]. Blowdown and moisture carry-over are neglected. Water and steam properties from IAPWS-IF97.

Formula and method

$$\dot{m}_s = \frac{Q}{h_g(p_s) - h_{fw}}, \quad \Delta T_{lm} = \frac{T_h - T_c}{\ln \frac{T_h - T_{sat}}{T_c - T_{sat}}}, \quad A = \frac{Q}{U \Delta T_{lm}}$$

Variables

Q	Steam generator duty	W
p_p	Primary pressure	Pa
T_h	Primary inlet (hot-leg) temperature	K
T_c	Primary outlet (cold-leg) temperature	K
p_s	Steam pressure	Pa
T_{fw}	Feedwater temperature	K
U	Overall heat transfer coefficient	W/(m²·K)
T_{sat}	Steam saturation temperature	K

$\dot{m}_s$	Steam flow (dry saturated)	kg/s
$\dot{m}_p$	Primary flow	kg/s
ΔT_{lm}	Log-mean temperature difference	K
UA	Required UA	W/K
A	Heat transfer area	m²

Method and standards

Steam generator heat balance.

Assumptions and limits

- Saturated secondary throughout; dry steam.

References

Heat balance and LMTD of a recirculating steam generator

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

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Reopens the calculator with the inputs of this report.