Boiler Make-Up Water Flow

Make-up water a boiler house needs from the steam flow, blowdown, condensate returned and other losses, with the feed water flow and daily volume.

Method: Mass balance on the feed water system

Input parameters

Unit system: SI

Parameter	Value	Unit
Steam generated	20,000	kg/h
Blowdown, as a share of steam	5.0000	%
Condensate returned, as a share of the steam reaching the users	60.000	%
Other losses, as a share of steam (vents, traps, leaks, soot blowing)	2.0000	%
Make-up water density (for the daily volume)	998.00	kg/m³

Calculated results

Parameter	Value	Unit
Make-up water flow	9,240.0	kg/h
Make-up as a share of feed water	44.000	%
Make-up water per day	222.20	m³
Feed water flow	21,000	kg/h
Condensate returned	11,760	kg/h
Blowdown	1,000.0	kg/h

Formula and method

$$B = bS \qquad C = rS(1-l) \qquad F = S + B \qquad M = F - C = B + lS + (1-r)(1-l)S \qquad V_d = \frac{M \cdot 86\,400\ \mathrm{s}}{\rho}$$

Variables

S	steam generated	kg/s
b	blowdown as a share of steam	–
r	condensate returned as a share of the steam reaching the users, $S(1-l)$	–
l	other losses as a share of steam	–
ρ	make-up water density	kg/m³
M	make-up water flow	kg/s
M/F	make-up as a share of feed water	–
V_d	make-up water per day	m³
F	feed water flow	kg/s
C	condensate returned	kg/s
B	blowdown	kg/s

Method and standards

Steady-state mass balance on the feed water system: water leaves as steam that is not returned, as blowdown and as losses; make-up replaces it.

Assumptions and limits

- Deaerator heating steam is taken from the boiler's own steam and returns in the feed water, so it does not change the make-up.
- Blowdown and other losses are shares of all the steam generated, deaerator steam included. The losses leave on the steam side, so the users receive $S(1-l)$ and the condensate return is a share of that.

- Steady state; storage changes are ignored.
- Water treatment plant losses (regeneration, reject) are upstream of the make-up and not included.

References

- Mass balance on the feed water system

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

https://calc.firecad.com/boilers-power-plant/steam/make-up-water-flow

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.