Blowdown Flash and Quench Water to a Discharge Temperature

Flash steam and residual water from boiler blowdown in a flash vessel (IF97), and the cold water to mix in so the drain leaves below a discharge temperature.

Method: Flash and mixing energy balances with IAPWS-IF97 enthalpies; the discharge limit is the user's consent value

Input parameters

Unit system: SI

Parameter	Value	Unit
Blowdown flow	1,500.0	kg/h
Drum pressure (absolute)	46.000	bar
Flash vessel pressure (absolute)	1.0132	bar
Allowed discharge temperature	60.000	°C
Cooling water temperature	30.000	°C

Calculated results

Parameter	Value	Unit
Flash steam	471.83	kg/h
Residual water from the vessel	1,028.2	kg/h
Quench (cooling) water	1,375.7	kg/h
Total drain	2,403.8	kg/h

Notes for this case

- Recovering the flash steam and passing the residual water through a heat exchanger first cuts both heat loss and quench water.

Formula and method

$$x = \frac{h_f(p_d) - h_f(p_v)}{h_{fg}(p_v)}, \quad \dot{m}_c = \dot{m}_b(1-x)\frac{h_f(p_v) - h(T_d)}{h(T_d) - h(T_c)}$$

Variables

$\dot{m}_b$	Blowdown flow	kg/s
p_d	Drum pressure (absolute)	Pa
p_v	Flash vessel pressure (absolute)	Pa
T_d	Allowed discharge temperature	K
T_c	Cooling water temperature	K
$\dot{m}_f$	Flash steam	kg/s
$\dot{m}_l$	Residual water from the vessel	kg/s
$\dot{m}_c$	Quench (cooling) water	kg/s
$\dot{m}_t$	Total drain	kg/s

Method and standards

Energy balance.

Assumptions and limits

- Adiabatic vessel; the flash steam leaves the vessel (vented or recovered). If it is condensed into the drain, the quench water needed is higher.
- The residual water is mixed with the cooling water at atmospheric pressure; with a pressurised flash vessel, any second flash when the water is let down to the drain is not modelled.

References

• Flash and mixing energy balances with IAPWS-IF97 enthalpies; the discharge limit is the user's consent value

Report details

Report reference	FCC-8ZG0-V18M (the same inputs always give the same reference)
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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/water-treatment/blowdown-quench-water

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.