Desuperheater Spray Water Flow

Spray water needed to cool superheated steam to a target temperature in a desuperheater, attemperator or PRDS, from an energy balance with IAPWS-IF97 enthalpies.

Method: IAPWS R7-97(2012) IF97

Input parameters

Unit system: SI

Parameter	Value	Unit
Inlet steam flow	20,000	kg/h
Inlet steam pressure (absolute)	64.000	bar
Inlet steam temperature	480.00	°C
Outlet steam pressure (absolute) Equal to the inlet pressure for an attemperator; lower for a pressure-reducing and desuperheating station (PRDS).	12.000	bar
Outlet steam temperature (target)	250.00	°C
Spray water pressure (absolute)	80.000	bar
Spray water temperature	130.00	°C

Calculated results

Parameter	Value	Unit
Spray water flow	3,644.7	kg/h
Outlet steam flow	23,645	kg/h
Spray water per kg of inlet steam	18.224	%
Saturation temperature at the outlet	187.96	°C
Outlet superheat	62.035	K
Inlet steam enthalpy	3,370.1	kJ/kg
Outlet steam enthalpy	2,935.7	kJ/kg
Spray water enthalpy	551.64	kJ/kg

Formula and method

$$\dot{m}_1 h_1 + \dot{m}_w h_w = \dot{m}_2 h_2 \qquad \dot{m}_2 = \dot{m}_1 + \dot{m}_w$$

$$\dot{m}_w = \dot{m}_1 \frac{h_1 - h_2}{h_2 - h_w} \qquad \Delta T_{sh,2} = T_2 - T_{sat,2}$$

Variables

$\dot{m}_1$	inlet steam flow	kg/s
p_1	inlet steam absolute pressure	Pa
T_1	inlet steam temperature	K
p_2	outlet steam absolute pressure	Pa
T_2	outlet steam temperature (target)	K
p_w	spray water absolute pressure	Pa
T_w	spray water temperature	K
$\dot{m}_w$	spray water flow	kg/s
$\dot{m}_2$	outlet steam flow	kg/s
$\dot{m}_w/\dot{m}_1$	spray water per kg of inlet steam	–

$T_{sat,2}$	saturation temperature at the outlet pressure	K
$\Delta T_{sh,2}$	outlet superheat	K
h_1	inlet steam enthalpy	J/kg
h_2	outlet steam enthalpy	J/kg
h_w	spray water enthalpy	J/kg

Method and standards

Enthalpies from FireCAD's IAPWS-IF97 implementation (regions 2 and 3, or supercritical, for the steam as the state requires; region 1 for the spray water). The balance is the standard first-law statement for an adiabatic mixing device with no shaft work.

Assumptions and limits

- No heat loss from the desuperheater and piping.
- Warnings appear when the outlet pressure is above the inlet pressure or the spray water pressure is not above the outlet steam pressure.
- All spray water evaporates; the outlet is superheated steam.
- Inlet and outlet steam must be superheated; spray water must be liquid.
- A warning is given when the outlet superheat is below 5 K: the spray may not evaporate completely.
- At or above the critical pressure (22.064 MPa) there is no saturation temperature, so the saturation temperature and superheat are not shown.

References

• IAPWS R7-97(2012) IF97

Report details

Report reference	FCC-EQG3-2HQ5 (the same inputs always give the same reference)
Generated	17 November 2026, 19:37 UTC
Calculator	Desuperheater Spray Water Flow
Method last reviewed	10 November 2026
Software release	FireCAD Calc, release of 17 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/desuperheater-spray-water

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.