Steam Leak Loss and Cost per Year

Steam lost through a leak or a failed-open trap orifice of a given size at line pressure, in kg/h and tonnes a year, and its cost (IAPWS-IF97, nozzle flow).

Method: IAPWS-IF97; Isentropic nozzle flow

Input parameters

Unit system: SI

Parameter	Value	Unit
Hole or orifice diameter	3.0000	mm
Steam pressure (shown as gauge)	10.000	bar g
Steam condition	Dry saturated	
Steam temperature (superheated only)	250.00	°C
Discharge coefficient About 0.6–0.65 for a sharp-edged hole; 0.8–0.9 for a trap orifice or short nozzle.	65.000	%
Isentropic exponent of steam 1.135 for dry saturated steam; 1.3 for superheated steam.	1.1350	
Pressure outside (absolute)	101.33	kPa
Hours a year the line is live	8,000.0	h
Cost of steam per tonne (your currency)	2,500.0	

Calculated results

Parameter	Value	Unit
Steam lost	26.207	kg/h
Steam lost per year	209.66	t
Cost per year (your currency)	524,140	
Choked flow (1 = yes)	1.0000	

Notes for this case

- Dry steam only: a leak or trap passing condensate flashes, and the flow can differ greatly.

Formula and method

$$\dot{m} = C_d A \sqrt{\frac{k\,p_0}{v_0}} \left(\frac{2}{k+1}\right)^{\frac{k+1}{2(k-1)}} \text{ (choked)} \qquad m_y = \dot{m}\,t_y \qquad C_y = \frac{m_y}{1000\ \text{kg/t}}\,c_s$$

Variables

d	hole diameter	m
p_0	steam pressure	Pa
state	saturated or superheated	–
T_s	steam temperature	K
C_d	discharge coefficient	–
k	isentropic exponent	–
p_b	outside pressure	Pa
t_y	hours per year	s
c_s	cost of steam per tonne	currency
$\dot{m}$	steam lost	kg/s
m_y	steam lost per year	kg

C_y	cost per year	currency
choked	choked flow flag	–
A	hole area	m²
v_0	IF97 specific volume	m³/kg

Method and standards

Isentropic nozzle flow of a perfect gas with the steam's IF97 specific volume (Zeuner exponent 1.135 for saturated steam).

Assumptions and limits

- Round hole; no upstream pressure drop; wet steam not covered. Condensate-laden leaks (real trap blow-through) flash in the hole, which changes the flow considerably.
- The steam pressure is shown as gauge in every unit system (bar g, kg/cm² g, psig).
- k should match the steam state (1.135 dry saturated, about 1.3 superheated); a mismatch is flagged.

References

- IAPWS-IF97
- Isentropic nozzle flow

Report details

Report reference	FCC-FM1A-TM0F (the same inputs always give the same reference)
Generated	17 November 2026, 19:36 UTC
Calculator	Steam Leak Loss and Cost per Year
Method last reviewed	12 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/steam-leak-cost

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.