Dead Weight Safety Valve Load

Dead weight a safety valve needs to lift at a set pressure: the steam force on the valve area less the weight of the valve and its weight carrier.

Method: Force balance (statics, textbook)

Input parameters

Unit system: SI

Parameter	Value	Unit
Blow-off pressure Enter the gauge set pressure. An absolute value is turned to gauge with the standard atmosphere, which is wrong at altitude.	7.8453	bar g
Valve diameter (area the steam acts on)	50.000	mm
Mass of the valve and weight carrier	5.0000	kg

Calculated results

Parameter	Value	Unit
Valve area	19.635	cm²
Steam force on the valve	1,540.4	N
Total mass to be lifted (F / g)	157.08	kg
Dead weight to add	152.08	kg

Notes for this case

- Dead weight valves suit only low pressures and small valves: the weight grows with pressure × area.

Formula and method

$$F = (p - p_{atm})\,\frac{\pi d^2}{4}$$

$$m_t = \frac{F}{g}, \quad m_d = m_t - m_v$$

Variables

p	Blow-off pressure	Pa
d	Valve diameter (area the steam acts on)	m
m_v	Mass of the valve and weight carrier	kg
A	Valve area	m²
F	Steam force on the valve	N
m_t	Total mass to be lifted (F / g)	kg
m_d	Dead weight to add	kg

Method and standards

Force balance on the valve at the lift point.

Assumptions and limits

- Static balance; friction neglected.
- Principle calculation, not a code sizing: accumulation, overpressure and the difference between seat and bore area are not considered.
- Gauge pressure is taken relative to the standard atmosphere; enter the gauge set pressure directly.

References

- Force balance (statics, textbook)

Report details

Report reference	FCC-HTGX-HMFY (the same inputs always give the same reference)
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Calculator	Dead Weight Safety Valve Load
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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/boilers/dead-weight-safety-valve

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.