Balanced Draught: ID Fan Pressure Required

Pressure the ID fan must develop in a balanced-draught boiler: furnace suction plus the gas-side losses of each section, less the stack's natural draught.

Method: Pressure balance along the gas path (balanced draught)

Input parameters

Unit system: SI

Parameter	Value	Unit
Furnace suction to hold The negative furnace pressure the control holds, typically a few mmWC.	4.9966	mmWC
Boiler passes, superheater and bank	91.774	mmWC
Economiser	40.789	mmWC
Air heater, gas side	61.183	mmWC
Dust collector (ESP, bag filter, cyclone, scrubber)	50.986	mmWC
Ducts, dampers, stack friction and exit loss	20.394	mmWC
Natural draught of the stack (from the stack draught calculator)	18.355	mmWC
Pressure margin Enter your specification's pressure margin, if any.	0	%

Calculated results

Parameter	Value	Unit
ID fan pressure required (with margin)	251.77	mmWC
Net requirement before margin	251.77	mmWC
Furnace suction plus losses	270.12	mmWC
Gas-side losses	265.13	mmWC

Formula and method

$$\Sigma\Delta p = \Delta p_1 + \Delta p_2 + \Delta p_3 + \Delta p_4 + \Delta p_5 \qquad \Sigma = p_f + \Sigma\Delta p \qquad \Delta p_{net} = \Sigma - \Delta p_s \qquad \Delta p_{ID} = \Delta p_{net}\,(1 + m_p)$$

Variables

p_f	furnace suction to hold	Pa
Δp_1	boiler passes, superheater and bank	Pa
Δp_2	economiser	Pa
Δp_3	air heater, gas side	Pa
Δp_4	dust collector	Pa
Δp_5	ducts, dampers, stack friction and exit loss	Pa
Δp_s	natural draught of the stack	Pa
m_p	pressure margin	–
Δp_{ID}	ID fan pressure required with margin	Pa
Δp_{net}	net requirement before margin	Pa
Σ	furnace suction plus losses	Pa
$\Sigma\Delta p$	gas-side losses	Pa

Method and standards

Steady pressure balance along the gas path of a balanced-draught unit: the ID fan supplies whatever the furnace suction and the losses need beyond the stack's natural draught.

Assumptions and limits

- All losses at the same (MCR) flow and gas temperatures.
- Losses scale with about the square of flow; at part load use the losses at that load.
- The pressure margin is your input (FireCAD default 0); the fan sizing applies its own flow margin. It is applied to the net requirement after the stack credit; some specifications apply it to the fan's own resistance before the credit, which gives a slightly higher pressure.
- Use the stack draught at summer conditions, the smallest credit.
- When the stack draught exceeds the requirement the ID fan pressure is shown as zero; the net requirement shows the surplus as a negative value.

References

- Pressure balance along the gas path (balanced draught)

Report details

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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/emissions-stacks/draught-balance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.