AFBC Bed Area from Superficial Velocity

Bed plan area of an atmospheric fluidised-bed (AFBC) boiler from the fluidising air flow, bed temperature and the chosen superficial velocity.

Method: Continuity with the ideal-gas law for air

Input parameters

Unit system: SI

Parameter	Value	Unit
Fluidising air flow	72,000	kg/h
Bed temperature	850.00	°C
Pressure above the bed (absolute)	1.0132	bar
Superficial velocity at bed temperature The boiler maker's design value for the bed material and fuel.	2.0000	m/s

Calculated results

Parameter	Value	Unit
Bed plan area	31.818	m²
Gas volume flow at bed temperature	229,086	m³/h
Side of an equivalent square bed	5.6407	m

Notes for this case

- Air volume is used; the gas in the bed also carries combustion products and fuel moisture, which add a few per cent for dry coal and 10 % or more for wet biomass, so the bed needs that much more area.

Formula and method

$$\dot{V} = \frac{\dot{m}_a}{\rho(T_b, p)} \qquad A_b = \frac{\dot{V}}{u_0} \qquad s = \sqrt{A_b}$$

Variables

$\dot{m}_a$	fluidising air flow	kg/s
T_b	bed temperature	K
p	pressure above the bed	Pa
u_0	superficial velocity	m/s
A_b	bed plan area	m²
$\dot{V}$	gas volume at bed temperature	m³/s
s	side of an equivalent square	m
ρ	air density at bed conditions	kg/m³

Method and standards

Air density at bed temperature by the ideal-gas law (dry air molar mass); volume flow over superficial velocity.

Assumptions and limits

- Air as the gas; uniform distribution across the bed. Combustion products and fuel moisture raise the gas volume a few per cent for dry coal and 10 % or more for wet biomass; allow for it in the area.
- The velocity is not checked against the bed material's minimum fluidisation or terminal velocity; a warning appears outside the usual 1–3 m/s of bubbling beds.

References

- Continuity with the ideal-gas law for air

Report details

Report reference	FCC-PS0Z-JB6A (the same inputs always give the same reference)
Generated	17 November 2026, 19:36 UTC
Calculator	AFBC Bed Area from Superficial Velocity
Method last reviewed	11 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/fluidised-bed/afbc-bed-area

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.