CFB Furnace Wall Heat Transfer Coefficient (Dutta and Basu)

Heat transfer coefficient to CFB furnace water walls from average suspension density and bed temperature (Dutta and Basu), with the heat the walls absorb.

Method: Basu; Circulating Fluidized Bed Boilers: Design; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Average suspension density	15.000	kg/m³
Bed temperature	850.00	°C
Constant (5 general, or calibrated)	5.0000	
Water wall area (projected)	2,000.0	m²
Wall (fluid) temperature	300.00	°C

Calculated results

Parameter	Value	Unit
Heat transfer coefficient	253.16	W/(m²·K)
Heat absorbed by the walls	278.48	MW

Notes for this case

- Basu calibrates the constant from a measured boiler: 224 W/m²·K at 15 kg/m³ and 850 °C gives 4.4.

Formula and method

$$h = C\,\rho_{avg}^{0.391} T_b^{0.408}, \quad Q = h A_w (T_b - T_w)$$

Variables

ρ_{avg}	Average suspension density	kg/m³
T_b	Bed temperature	K
C	Constant (5 general, or calibrated)	-
A_w	Water wall area, projected (flat) area of the membrane wall	m²
T_w	Wall (fluid) temperature	K
h	Heat transfer coefficient	W/(m²·K)
Q	Heat absorbed by the walls	W

Method and standards

Dutta–Basu empirical correlation.

Assumptions and limits

- Commercial CFB boilers; gross correlation. The source gives no explicit validity range; values above the 100–250 W/m²·K typical of the upper furnace occur in the denser lower furnace, so check against a measured boiler (calibrate C).
- The area must be on the basis the coefficient was derived on (projected membrane-wall area); using the full tube surface overstates the heat by roughly the ratio of tube to projected area, about 1.4.

References

- Basu
- Circulating Fluidized Bed Boilers: Design
- Operation and Maintenance (Springer, 2015)
- ch. 3
- Eq. (3.28) (Dutta and Basu 2002) and its worked example

Report details

Report reference	FCC-QMKF-XAJE (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	CFB Furnace Wall Heat Transfer Coefficient (Dutta and Basu)
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 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/cfb-bed-wall-heat-transfer

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.