CFB Wall Layer (Annulus) Thickness

Thickness of the down-flowing solids layer on CFB furnace walls from equivalent diameter and voidage, or from height alone (Basu Eqs. 2.22–2.23).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Equivalent (hydraulic) furnace diameter, 4A/P	9.0000	m
Cross-section average voidage at the height	99.000	%
Furnace height	30.000	m
Height of interest above the distributor	20.000	m

Calculated results

Parameter	Value	Unit
Layer thickness from voidage (Eq. 2.22)	478.80	mm
Layer thickness from height (Eq. 2.23)	161.19	mm

Notes for this case

- Large CFB boilers show wall layers of 70–350 mm; the layer carries most of the heat to the water walls.

Formula and method

$$\delta = D_{eq}[0.008 + 4.52(1 - \varepsilon_{av}(z))], \quad \delta = 0.00385 H \exp\left(1 - \frac{z}{H}\right)$$

Variables

D_{eq}	Equivalent (hydraulic) furnace diameter, 4 × cross-section ÷ perimeter	m
$\varepsilon_{av}(z)$	Cross-section average voidage at the height	-
H	Furnace height	m
z	Height of interest, measured up from the distributor (grid)	m
δ_1	Layer thickness from voidage (Eq. 2.22)	m
δ_2	Layer thickness from height (Eq. 2.23)	m

Method and standards

Basu's Eqs. (2.22)–(2.23).

Assumptions and limits

- Large boilers.
- The two equations are separate fits and can differ by a factor of about three at the same height; Eq. 2.22 reflects the local voidage you enter, Eq. 2.23 only the height. Prefer Eq. 2.22 when the voidage is known.
- Eq. 2.22 is outside its range when it gives a layer thicker than the furnace radius (voidage below about 0.9); a warning is shown.

References

- Basu
- Circulating Fluidized Bed Boilers: Design
- Operation and Maintenance (Springer, 2015)
- ch. 2
- Eqs. (2.22) and (2.23) (Johansson et al. 2005, 2007)

Report details

Report reference	FCC-N7YQ-G4QY (the same inputs always give the same reference)
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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-wall-layer-thickness

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.