CFB Loop Seal: Standpipe Diameter and Seal Dimensions

Standpipe diameter for the solids flow per cyclone at a chosen solids velocity, loop seal length and breadth, and the opening height (Basu Eqs. 8.12–8.14).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Solids circulation flux in the furnace	15.000	kg/(m²·s)
Furnace cross-section	60.000	m²
Number of cyclones (loop seals) Rounded to a whole number.	3.0000	
Voidage of solids in the standpipe	50.000	%
Particle density	2,500.0	kg/m³
Solids velocity in the standpipe Basu suggests about 0.15 m/s and never above 1 m/s.	0.15000	m/s
Horizontal solids velocity through the opening	0.10000	m/s

Calculated results

Parameter	Value	Unit
Solids flow per loop seal	1,080.0	t/h
Standpipe diameter	1,427.3	mm
Loop seal length (2.5 d_s)	3,568.2	mm
Loop seal breadth (1.25 d_s)	1,784.1	mm
Height of the opening	1,345.2	mm

Formula and method

$$W_s = \frac{G_s A_f}{n_c}, \quad d_s = \sqrt{\frac{4W_s}{\pi(1-\varepsilon_s)\rho_p V_s}}, \quad L = 2.5\,d_s, \quad B = 1.25\,d_s, \quad h_o = \frac{W_s}{(1-\varepsilon_s)\rho_p V_h B}$$

Variables

G_s	Solids circulation flux in the furnace	kg/(m²·s)
A_f	Furnace cross-section	m²
n_c	Number of cyclones (loop seals)	-
ε_s	Voidage of solids in the standpipe	-
ρ_p	Particle density	kg/m³
V_s	Solids velocity in the standpipe	m/s
V_h	Horizontal solids velocity through the opening	m/s
W_s	Solids flow per loop seal	kg/s
d_s	Standpipe diameter	m
L	Loop seal length (2.5 d_s)	m
B	Loop seal breadth (1.25 d_s)	m
h_o	Height of the opening	m

Method and standards

Basu's loop seal sizing: the solids flow per loop seal sets the standpipe diameter at the chosen solids velocity (Eqs. 8.12–8.13), the seal length and breadth follow Basu's proportions, and the opening height gives the chosen horizontal solids velocity (Eq. 8.14). The

number of cyclones is rounded to a whole number.

Assumptions and limits

- Guideline proportions, not mandatory.
- Warnings appear for a standpipe solids velocity above 1 m/s and a horizontal velocity outside 0.05–0.25 m/s. The opening height is not checked against the seal dimensions: check it fits below the weir.

References

- Basu
- Circulating Fluidized Bed Boilers: Design
- Operation and Maintenance (Springer, 2015)
- ch. 8
- Eqs. (8.12)–(8.14) and guidelines L = 2.5 d_s
- B = 1.25 d_s

Report details

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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/loop-seal-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.