Ash Sluicing: Water, Slurry Flow and Pump Power

Water, slurry flow and density and pump power for hydraulic ash disposal from the ash rate, slurry concentration, solid density and pump head.

Method: Slurry mass and volume balance (definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Ash to dispose	20.000	t/h
Slurry concentration by mass	20.000	%
Ash particle density	2,200.0	kg/m³
Water density	998.00	kg/m³
Pump head (metres of slurry)	60.000	m
Slurry pump efficiency	60.000	%

Calculated results

Parameter	Value	Unit
Water flow	80.000	t/h
Slurry density	1,120.4	kg/m³
Concentration by volume	10.186	%
Slurry flow	89.251	m³/h
Pump power	27.241	kW
Water per tonne of ash	4.0000	kg/kg

Notes for this case

- Check the line velocity with the slurry transport calculator. The head is in metres of slurry; for coarse ash a slurry pump also gives less head and efficiency than on water, so derate the pump curve.

Formula and method

$$\dot{m}_w = \dot{m}_a \frac{1 - C_w}{C_w}, \quad Q = \frac{\dot{m}_a}{\rho_s} + \frac{\dot{m}_w}{\rho_w}, \quad \rho_m = \frac{\dot{m}_a + \dot{m}_w}{Q}, \quad P = \frac{\rho_m g Q H}{\eta}$$

$$C_v = \frac{\dot{m}_a / \rho_s}{Q}, \quad \frac{\dot{m}_w}{\dot{m}_a} = \frac{1 - C_w}{C_w}$$

Variables

$\dot{m}_a$	Ash to dispose	kg/s
C_w	Slurry concentration by mass	-
ρ_s	Ash particle density	kg/m³
ρ_w	Water density	kg/m³
H	Pump head, metres of slurry	m
g	standard gravity, 9.80665	m/s²
η	Slurry pump efficiency	-
$\dot{m}_w$	Water flow	kg/s
ρ_m	Slurry density	kg/m³
C_v	Concentration by volume	-

Q	Slurry flow	m³/s
P	Pump power	W
$\dot{m}_w/\dot{m}_a$	Water per tonne of ash	kg/kg

Method and standards

Slurry balance.

Assumptions and limits

- Uniform slurry. The head is in metres of slurry; no derating of pump head or efficiency for solids is applied.

References

- Slurry mass and volume balance (definitions)

Report details

Report reference	FCC-K8C6-Y757 (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/fuel-ash-handling/ash-sluicing-water

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.