Furnace Wall Heat Storage and Steady Loss

Heat stored in a furnace wall at steady temperature profile and its steady conduction loss, showing how much a batch furnace must reheat its lining each cycle.

Method: Stored and conducted heat of a furnace wall

Input parameters

Unit system: SI

Parameter	Value	Unit
Wall area	80.000	m²
Lining thickness	230.00	mm
Lining density	2,000.0	kg/m³
Lining specific heat	1.0000	kJ/(kg·K)
Lining conductivity	1.1000	W/(m·K)
Hot face temperature	1,000.0	°C
Cold face temperature	100.00	°C
Initial (ambient) temperature	30.000	°C

Calculated results

Parameter	Value	Unit
Heat stored in the wall	19,136	MJ
Steady conduction loss	344.35	kW
Storage equal to hours of steady loss	15.437	h
Lining mass	36.800	t

Notes for this case

• Linear steady profile: mean wall temperature (T_h + T_c)/2, stored heat ρcAL(T_mean − T₀); steady loss kA(T_h − T_c)/L. Dense brick stores many hours' worth of loss, which batch and intermittent furnaces lose every cycle; low-density fibre linings store a small fraction, so they suit intermittent firing even if their steady loss is similar.

Formula and method

$$Q_s = \rho c A L \left(\frac{T_h + T_c}{2} - T_0 \right), \quad \dot{Q}_l = \frac{kA(T_h - T_c)}{L}$$

Variables

A	Wall area	m²
L	Lining thickness	m
ρ	Lining density	kg/m³
c	Lining specific heat	J/(kg·K)
k	Lining conductivity	W/(m·K)
T_h	Hot face temperature	K
T_c	Cold face temperature	K
T_0	Initial (ambient) temperature	K
Q_s	Heat stored in the wall	J
$\dot{Q}_l$	Steady conduction loss	W
$Q_s/\dot{Q}_l$	Storage equal to hours of steady loss	s

m	Lining mass	kg

Method and standards

Wall storage.

Assumptions and limits

- Single uniform layer at steady state.

References

Stored and conducted heat of a furnace wall

Report details

Report reference	FCC-FBST-WF7B (the same inputs always give the same reference)
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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/materials/steelmaking-foundry/furnace-wall-heat-storage

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.