Battery Charging Time and Charge Energy

Time to recharge a battery bank from its capacity, depth of discharge, charging current and charge efficiency, with the C-rate and the energy drawn from the charger.

Method: Ampere-hour balance

Input parameters

Unit system: SI

Parameter	Value	Unit
Battery capacity	200.00	Ah
Depth of discharge to put back	80.000	%
Charging current	20.000	A
Charge (ampere-hour) efficiency Lead-acid batteries are lower than lithium-ion; from the battery maker.	85.000	%
Average charging voltage	27.600	V

Calculated results

Parameter	Value	Unit
Charging time	9.4118	h
Charge to put in	188.24	Ah
Charging rate (C-rate, per hour)	0.10000	
Energy delivered by the charger (DC side)	5.1953	kWh

Notes for this case

- Constant-current estimate: the last 10–20 % of charge is slower once the charger switches to constant voltage.

Formula and method

$$Q_{in} = \frac{C \cdot DoD}{\eta_c}$$

$$t = Q_{in} / I$$

$$I/C, \quad E_{in} = Q_{in} U_c$$

Variables

C	battery capacity	C (A·s)
DoD	depth of discharge to put back	-
I	charging current	A
η_c	charge (Ah) efficiency	-
U_c	average charging voltage	V
t	charging time	s
Q_{in}	charge to put in	C
I/C	charging rate, per hour	1/h
E_{in}	Energy delivered by the charger (DC side)	J

Method and standards

The charge removed is capacity times depth of discharge; more must go back because of charge inefficiency. At constant current the time is charge over current; energy is charge times average charging voltage.

Assumptions and limits

- Constant-current estimate.

- Charge efficiency from the battery maker.
- E_in is the DC energy into the battery; the energy from the mains is E_in divided by the charger (rectifier) efficiency.
- The C/3 warning is an indicative screening level, not a standard limit; the battery maker's maximum charging current governs.

References

- Ampere-hour balance

Report details

Report reference	FCC-EHSX-PBEJ (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Battery Charging Time and Charge Energy
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/electrical/batteries-ups/battery-charging-time

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.