Battery Capacity for a DC Load Duty Cycle

Battery ampere-hour capacity for a DC duty cycle of up to three load periods, with temperature, ageing and design factors and depth of discharge.

Method: Ampere-hour sizing with temperature; ageing and design margins (IEEE 485 factors; definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Load current, period 1	60.000	A
Duration of period 1	1.0000	min
Load current, period 2	20.000	A
Duration of period 2	120.00	min
Load current, period 3	100.00	A
Duration of period 3	1.0000	min
Temperature correction factor (rated capacity at 25 °C; 1 at or above 25 °C)	1.1100	
Ageing factor	1.2500	
Design margin	1.1000	
Usable depth of discharge	80.000	%

Calculated results

Parameter	Value	Unit
Load ampere-hours	42.667	Ah
Rated capacity, ampere-hour estimate (check by IEEE 485 for short high currents)	81.400	Ah
Highest load current	100.00	A

Notes for this case

• Ampere-hour method; it does not capture the extra capacity needed for short high-current periods (the IEEE 485 section method does, using the maker's discharge curves). Check the battery can deliver the highest current to the end voltage.

Formula and method

$$Ah = \sum I_i t_i, \quad C = \frac{Ah \cdot k_T k_A k_D}{DoD}$$

Variables

I_1	Load current, period 1	A
t_1	Duration of period 1	s
I_2	Load current, period 2	A
t_2	Duration of period 2	s
I_3	Load current, period 3	A
t_3	Duration of period 3	s
k_T	Temperature correction factor (rated capacity at 25 °C)	-
k_A	Ageing factor	-
k_D	Design margin	-
DoD	Usable depth of discharge	-
Ah_{load}	Load ampere-hours (charge)	C (shown in Ah)

C	Rated capacity, ampere-hour estimate	C (shown in Ah)
I_{max}	Highest load current	A

Method and standards

Ampere-hour method.

Assumptions and limits

- Ampere-hour basis: the result is a first estimate. Short high-current periods (breaker trip and close, motor starts) need more capacity than their ampere-hours suggest; confirm the size by the IEEE 485 section method with the maker's discharge curves.
- Rated capacity referred to 25 °C; the temperature factor is 1 or more (a warmer room is not credited).

References

- Ampere-hour sizing with temperature
- ageing and design margins (IEEE 485 factors; definitions)

Report details

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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/electrical/batteries-ups/battery-capacity-duty-cycle

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.