Passive Cell Balancing Current, Time and Heat

Balancing current through a bleed resistor, time to remove a state-of-charge imbalance, energy wasted and heat per cell for passive balancing of a battery pack.

Method: Passive (dissipative) cell balancing

Input parameters

Unit system: SI

Parameter	Value	Unit
Cell capacity	50.000	Ah
Imbalance to remove	5.0000	%
Cell voltage	3.7000	V
Bleed resistance	33.000	Ω
Balancing duty cycle	80.000	%

Calculated results

Parameter	Value	Unit
Balancing current	89.697	mA
Charge to remove	2.5000	Ah
Balancing time	27.872	h
Energy dissipated	9.2500	Wh
Heat per balanced cell	0.33188	W

Notes for this case

• I_b = D·V_c/R_b; t = C·ΔSOC/I_b; the removed charge is burned as heat. Typical passive balancers bleed 50–200 mA, so large cells take many hours to correct a few percent; active (charge-shuttling) balancers are used where imbalance builds faster or efficiency matters.

Formula and method

$$I_b = \frac{D V_c}{R_b}, \quad t_b = \frac{C \Delta SOC}{I_b}, \quad E_b = C \Delta SOC V_c$$

Variables

C	Cell capacity	C
ΔSOC	Imbalance to remove	-
V_c	Cell voltage	V
R_b	Bleed resistance	Ω
D	Balancing duty cycle	-
I_b	Balancing current	A
ΔQ	Charge to remove	C
t_b	Balancing time	s
E_b	Energy dissipated	J
P_b	Heat per balanced cell	W

Method and standards

Cell balancing.

Assumptions and limits

- Constant cell voltage during balancing.

References

Passive (dissipative) cell balancing

Report details

Report reference	FCC-KM76-W166 (the same inputs always give the same reference)
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Calculator	Passive Cell Balancing Current, Time and Heat
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Software release	FireCAD Calc, release of 22 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/cell-balancing-time

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.