Hold-Up (Bulk) Capacitor for a Power Interruption

Capacitance needed to keep a load running for a hold-up time after the supply drops, from the load power, efficiency and the starting and minimum capacitor voltages.

Method: Capacitor energy balance for hold-up

Input parameters

Unit system: SI

Parameter	Value	Unit
Load power	60.000	W
Hold-up time	20.000	ms
Capacitor voltage at the start	380.00	V
Minimum voltage the converter accepts	300.00	V
Converter efficiency	90.000	%

Calculated results

Parameter	Value	Unit
Required capacitance	49.020	µF
Energy delivered by the capacitor	1.3333	J
Fraction of the stored energy used	37.673	%

Notes for this case

• Energy balance ½C(V₁² − V₂²) = Pt/η. Add margin for capacitor tolerance (−20 %) and ageing, and check the capacitor's ripple current rating.

Formula and method

$$C = \frac{2Pt_h}{\eta(V_1^2 - V_2^2)}$$

Variables

P	Load power	W
t_h	Hold-up time	s
V_1	Capacitor voltage at the start	V
V_2	Minimum voltage the converter accepts	V
η	Converter efficiency	-
C	Required capacitance	F
ΔE	Energy delivered by the capacitor	J
$1 - (V_2/V_1)^2$	Fraction of the stored energy used	-

Method and standards

Energy balance of a discharging capacitor.

Assumptions and limits

- Constant-power load, ideal capacitor.

References

Capacitor energy balance for hold-up

Report details

Report reference	FCC-ZPT9-20HA (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Hold-Up (Bulk) Capacitor for a Power Interruption
Method last reviewed	17 November 2026
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/electronics/hold-up-capacitor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.