# Capacitor Discharge Resistor for a Safe Voltage

Largest discharge resistor that brings a capacitor down to a safe voltage within a set time, with the time constant, stored energy and continuous resistor loss.

**Method:** RC discharge

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Capacitance | 400.00 | µF |
| Initial (peak) voltage | 650.00 | V |
| Safe voltage | 50.000 | V |
| Time allowed to reach the safe voltage | 60.000 | s |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Largest resistor that meets the time | 58.481 | kΩ |
| Time constant RC | 23.392 | s |
| Stored energy | 84.500 | J |
| Continuous loss at the initial voltage | 7.2246 | W |

### Notes for this case

• A capacitor discharging through R decays as V = $V_0$e^(−t/RC), so reaching V_s by time t needs R ≤ t/[C ln($V_0$/V_s)]. A permanently connected resistor dissipates $V_0^2$/R all the time, so choose the largest value that meets the time. Power factor capacitors are commonly required to fall to 75 V within 3 minutes, and DC bus capacitors in drives to a touch-safe level (about 50–60 V) within a stated time. Use resistors rated for the full voltage and the pulse energy.

## Formula and method

$$R_{max} = \frac{t}{C \ln(V_0/V_s)}, \quad E = \frac{1}{2} C V_0^2$$

### Variables

| | | |
|---|---|---|
| $C$ | Capacitance | F |
| $V_0$ | Initial (peak) voltage | V |
| $V_s$ | Safe voltage | V |
| $t$ | Time allowed to reach the safe voltage | s |
| $R_{max}$ | Largest resistor that meets the time | Ω |
| $\tau$ | Time constant RC | s |
| $E$ | Stored energy | J |
| $P_R$ | Continuous loss at the initial voltage | W |

### Method and standards

Bleeder resistor.

### Assumptions and limits

- Ideal capacitor and resistor; no other load on the capacitor.

### References

RC discharge

## Report details

| | |
|---|---|
| Report reference | FCC-F0FM-NQ5Y (the same inputs always give the same reference) |
| Generated | 23 November 2026, 17:42 UTC |
| Calculator | Capacitor Discharge Resistor for a Safe Voltage |
| 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/circuits/capacitor-discharge-resistor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.