

Are Breadboard Resistors Useful for Some Voltage Limits?

Yes, **breadboard resistors** are rated for specific power dissipation limits (typically $\frac{1}{4}$ watt or $\frac{1}{2}$ watt). The **voltage applied across the resistor must not exceed its power rating** to prevent overheating or failure.

Can You Use a 220Ω Resistor for 5V on an LED?

Yes! To determine if a **220Ω resistor is suitable** for a 5V LED circuit, we use **Ohm's Law**:

$$I = \frac{V}{R}$$

Case 1: 5V Power Source

- Assuming a typical **LED forward voltage = 2V** (for red LEDs).
- Voltage drop across the resistor: $5V - 2V = 3V$.
- Current through the LED:

$$I = \frac{3V}{220\Omega} \approx 13.6mA$$

This is **safe** because most LEDs operate at **10-20mA**.

Power Dissipation in the Resistor

$$P = V * I = 3V * 13.6mA = 0.041W$$

Since this is **well below the 0.25W rating**, the resistor **works fine**.

Can You Use a 220Ω Resistor for 20V on an LED?

Now, let's check for **20V**.

Case 2: 20V Power Source

- LED forward voltage: **2V**
- Resistor voltage drop: $20V - 2V = 18V$
- Current through the LED:

$$I = \frac{18V}{220\Omega} \approx 81.8mA$$

This is **too high**! Standard LEDs are designed for **10-20mA**, so this could **burn out the LED**.

Power Dissipation in the Resistor

$$P = V * I = 18V * 81.8mA = 1.47W$$

This **exceeds the 0.25W rating** of a standard breadboard resistor, **causing it to overheat and possibly burn**.

Solution for 20V Circuit

To keep the LED safe at **20V**, choose a higher resistance. For **20mA max current**:

$$R = \frac{V}{I} = \frac{18V}{0.02A} = 900\Omega$$

A **900Ω resistor** would be much safer.

Conclusion

✅ 220Ω is fine for 5V, but dangerous for 20V.

❌ For 20V, use at least 900Ω to prevent LED and resistor damage.

[How to calculate Resistor Wattage | The importance of wattage in Resistors](#)

[Power Dissipation In Resistors, Diodes, and LEDs](#)