

## Testing Non-Polarized Electrolytic Capacitors With Your Z-METER™

We all have heard about the growing use of capacitors in modern electronic circuits. You still cannot build an electrolytic capacitor into an IC. ICs need better power supply (B+), more bypassing, and better coupling.

Capacitors are available in many different types, including: mylar, ceramic, tantalum, electrolytic, paper, several poly versions, and oil filled, to name a few. Each type has different operating characteristics and applications. In this tech tip, we will talk about a specific type of electrolytic capacitor known as a non-polarized (or bi-polar) electrolytic capacitor.

### How To Recognize A Non-Polarized Electrolytic Capacitor.

Identifying a non-polarized electrolytic capacitor is half the battle. The non-polarized electrolytic capacitor can usually be identified by its shape and the lack of polarity markings. If you aren't sure, refer to the schematic of the circuit the cap is used in. Figure 1 shows several capacitor types, and labels them to help you identify capacitors used in modern circuits.

Notice that the non-polarized electrolytic capacitor looks similar to the polarized electrolytic capacitor, but there is one difference. The non-polarized electrolytic capacitor has no polarity markings.

### Where Are Non-Polarized Electrolytic Capacitors Used?

Non-polar electrolytics are typically used in circuits having no DC voltage or established polarity. Two common circuits that use the non-polarized electrolytic capacitor are audio crossovers and AC motor start circuits. These circuits use non-polarized electrolytics for inducing phase shifts or selective filtering.

### Non-Polarized Electrolytic Capacitors Act Like Two Polarized Electrolytics Back-To-Back.

A typical representation of a standard polarized electrolytic is shown in figure 2a. This drawing represents the effects the capacitor may show when used in-circuit. Electrolytics should always be installed with the correct polarity.

Let's discuss the drawing in figure 2a and see what each symbol represents.

**ERR (Equivalent reverse resistance):** This is the resistance of the capacitor when reverse biased.

**D1:** This diode represents that the capacitor's reverse current path is blocked when the cap is correctly biased. The reverse path is opened by D1 being reverse biased. And, the PIV of D1 is greater than the rated voltage of the cap.

**Z:** This diode represents the zener action the cap has when reverse biased. When enough voltage is applied to the cap, in the wrong polarity, the zener starts to conduct. The current flow is limited to the ERR of the cap.

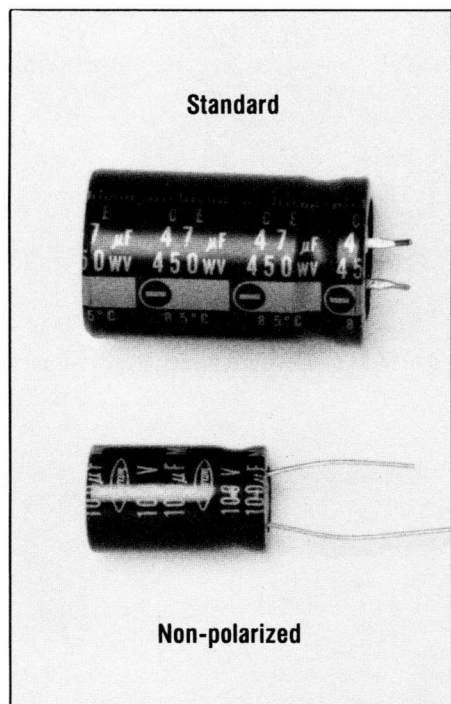
**ESR (equivalent series resistance):** This symbol represents cap's lead, foil, and connection resistance.

**EPR (equivalent parallel resistance):** The parallel resistance is the same as the leakage path for current when a DC voltage is applied to the cap in the correct polarity.

A non-polarized electrolytic capacitor is drawn in figure 2b. Notice the similarity between the standard polarized and the non-polarized electrolytic capacitor version. The non-polarized electrolytic capacitor is represented by connecting two standard polarized capacitors back-to-back. This means the negative polarity leads are connected. The value of a non-polarized electrolytic capacitor can be tested accurately with polarity in either direction. However, when testing the polarized electrolytic capacitor for leakage you must test it in both directions.

### How To Test A Non-Polarized Electrolytic Capacitor With A Z-METER

You should only test for value and leakage, when testing non-polarized electrolytics. The non-polar electrolytic typically exhibits high levels of dielectric absorption



*Fig. 1: Non-polarized electrolytic capacitors can easily be identified because they look like standard electrolytics and they have no polarity markings.*

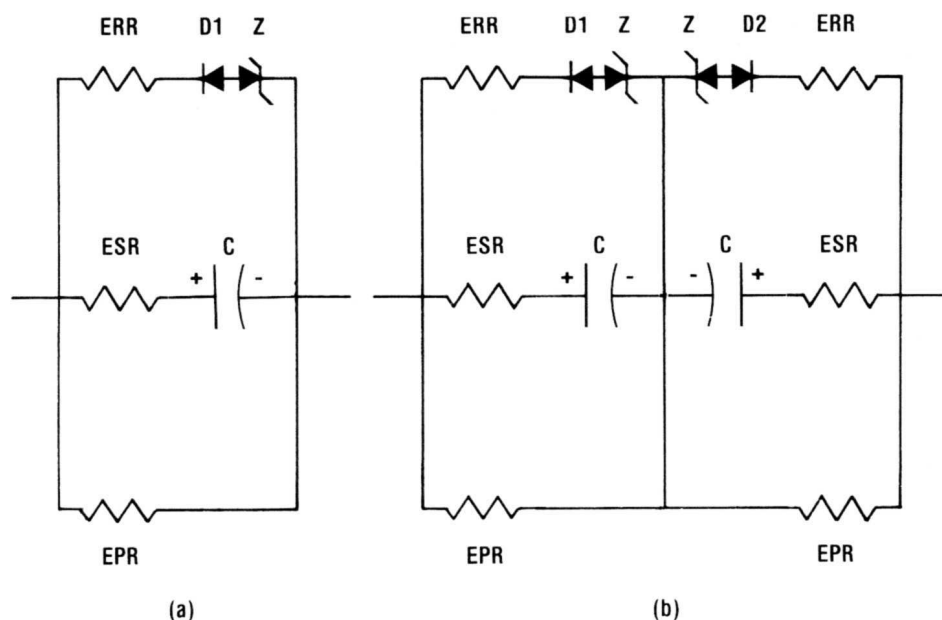


Fig. 2: (a) A schematic representation of a standard polarized electrolytic capacitor. (b) A schematic representation of a non-polarized electrolytic capacitor.

If both ends of the non-polarized electrolytic are insulated from the case, the maximum allowable leakage is the same as listed in the leakage chart for standard electrolytics of the same value and voltage. If one end is connected to the case, the allowable leakage is twice the maximum for a standard of the same value and voltage. Refer to figure 3 for examples.

**For more information,  
Call Toll Free 1-800-SENCORE  
(1-800-736-2673)**

**SENCORE**

3200 Sencore Drive, Sioux Falls, South Dakota 57107  
Fax: 1-605-339-0317 www.sencore.com

resulting from the reversed biased half acting like a diode and preventing the cap from discharging. Testing non-polarized electrolytic capacitors requires an extra test; you must test the leakage in both directions of polarity applied.

To test a non-polarized electrolytic:

1. Connect the test leads to the capacitor. (either polarity)
2. Press the CAPACITOR VALUE button on the Z Meter, and note if the value is within the tolerance of the capacitor.
3. Set the LEAKAGE VOLTAGE control to the rated voltage of the capacitor.
4. Press the LEAKAGE button, and note the reading on the Z Meter. Reverse the leads and again press the leakage button.

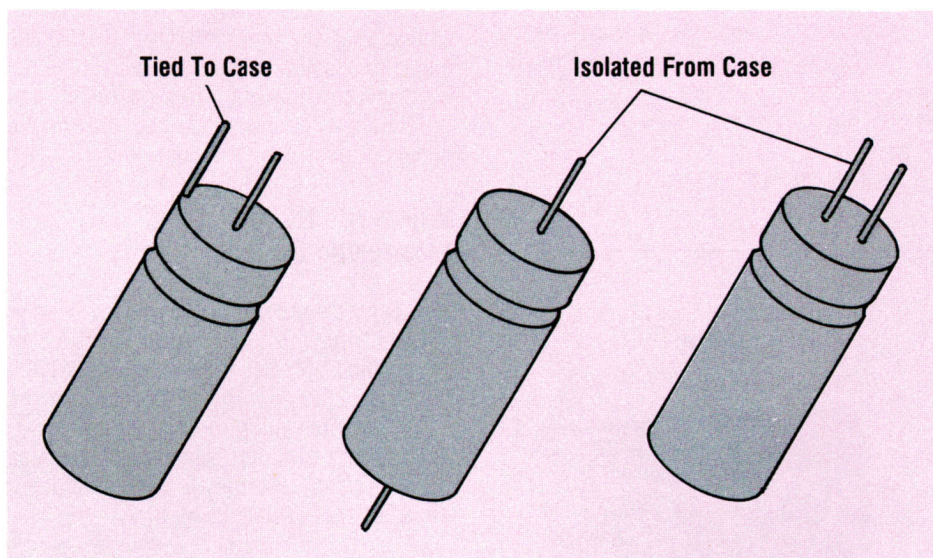


Fig. 3: A non-polarized electrolytic capacitor can either be isolated from the case, or it can have one of the leads tied directly to the case.

Z-METER is a trademark of Sencore, Inc.