Discharging Start and Run Capacitors

A capacitor is a device that stores electrical energy. You will find both a start capacitor and a run capacitor in the typical RV air conditioner. As their names imply, the start capacitor provides extra torque at startup for the compressor and run capacitors are designed for continuous duty on fan motors.

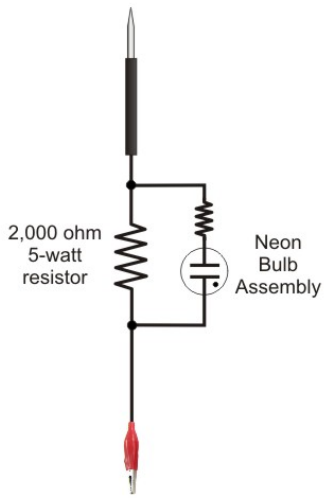
Start capacitors are removed from the circuit by a relay once the compressor motor reaches a predetermined speed. The compressor motor will run more efficiently without the start capacitor. Run capacitors are energized the entire time the motor is running. They maintain a relatively constant voltage supply and magnetic field in the fan motors, reducing energy consumption and heat.

It is the ability of a capacitor to store energy that makes them dangerous even after the power has been disconnected from the A/C unit. Normally run capacitors will be discharged through the motor windings when the power is off and start capacitors often have a resistor to bleed off the charge. But that is not always the case and no one can assume that a capacitor is not charged. It is important to always discharge capacitors before servicing a unit.

In the past, it has been recommended to discharge capacitors using a VOM, however modern VOM's have a high impedance that makes this process ineffective. RVIA no longer recommends using a VOM to discharge capacitors. Many service technicians will short the terminals with a screw driver to remove the charge. This procedure is not recommended. Under certain conditions this can cause the capacitor to swell or even explode as the electrolyte is heated by the rapid discharge of electricity. More typically, the terminals can be destroyed by the electric arc and the screw driver can become welded to the capacitor. Repeated discharging by shorting the terminals will destroy a good capacitor.

To maintain a safe working environment and protect themselves from shock, service technicians should use a capacitor discharge tool to remove the electrical current. Commercial capacitor discharge tools, or discharge sticks as they are sometimes called, can be purchased for this task. Commercial tools can cost as much as several hundred dollars depending on their capacity and features. Some very good commercial tools can be found for less than a hundred dollars.

As an alternative, a tool made specifically for the purpose of discharging capacitors found in RV air conditioning units can be assembled from a few simple components costing only a few dollars.



The pictorial schematic drawing shows the component layout of such a tool. A 2k 5-watt resistor is the main component that allows a controlled release of any electrical energy that may be stored in the capacitor. At one end the resistor is connected to an insulated alligator clip and the other end is connected to an insulated probe. Insulated test leads and a spare meter probe make perfect components for this application.

By itself the resistor would bleed the charge from the capacitor but there would be no indication that the unit is working. We recommend adding an indicator lamp for a visual confirmation. A small 120 VAC indicator lamp assembly can be purchased.

To use the tool, attach the clip to the common terminal on the capacitor and hold the probe to each of the other terminals. Any residual charge in the capacitor will normally be removed in less

than 2 seconds. A count to five while holding the probe on the terminal will assure the tool has had ample time for discharge. In use the indicator lamp may not flash, showing that the capacitor was discharged or had only a small residual charge. If the capacitor is fully charged the indicator lamp will quickly light and then go out. If the indicator lamp illuminates but does not turn off there is a problem with the resistor, such as an open conductor, and the tool is defective.

Constructing a Capacitor Discharge Tool

Construction of a capacitor discharge tool is straight forward and involves only soldering a couple of components together and protecting them in some way. Shown below are two approaches, but any type of protective cover or housing is suitable.

Components required:

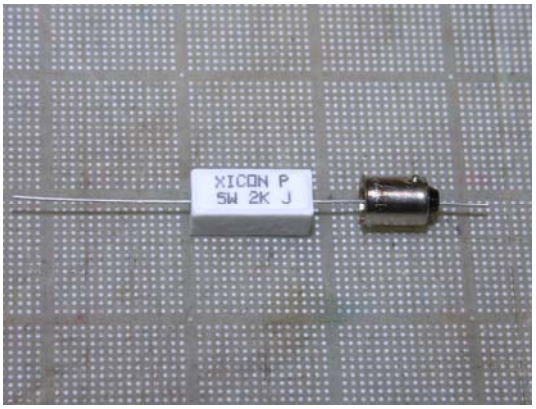
- 2,000 ohm 5-watt resistor. Any combination of resistors meeting this specification will do.
- Neon indicator lamp for 120 VAC.
- Test probe
- Test lead with clip

In the first example, the components were soldered together and then wrapped in electrical tape and covered in heat-shrink tubing.

To test the tool, place a VOM across the test probe and clip. There should be continuity and the value indicated on the VOM should be close to 2,000 ohms.

To test the indicator lamp, momentarily connect the device to a 120VAC source. The lamp will illuminate. Apply the 120 volt source for only one or two seconds.

In the second example, a 12-volt circuit tester was purchased and the components fitted into the hollow handle. The handle unscrews giving access to install the components.



The probe is molded into the handle and the most convenient way to make the electrical connection through the device was to solder the resistor into the bulb base after breaking out the glass and removing the stem. The resistor lead was passed through the base and a ball of solder added to make contact with the probe. Be sure to include the spring that was originally fitted between the bulb base and the probe to maintain firm contact.

The indicator lamp is placed across the resistor and the test lead is passed through the handle end. The components are soldered to the resistor lead and the assembly inserted into the handle.

Component sources:

2K ohm 5 watt wirewound resistor
www.parts-express.com
Part number: 015-2K

120VAC lamp assembly
Radio Shack
Part number: 272-0712

Circuit tester
Harbor Freight Tools
Item # 4288