



How-to Test it Yourself

Home appliances

Washer/dryer, dishwasher and kitchen appliances

perature comes in very handy. Some DMMs have the ability to measure temperature as one of the functions. For those that don't, a special adapter can be purchased to allow the use of temperature probes (thermocouples). One very common appliance depends on the proper regulation of heat: the oven. Using a thermocouple rated over 500 degrees F, attach the probe to your DMM or through an adapter if necessary. Position the thermocouple in the oven so that it does NOT get direct heat from the oven element(s). Use a cookie sheet if necessary to block direct heat from the element. Turn on the oven and set the temperature dial to say 300 F. Once the oven warms up to the selected temperature (oven starts cycling the heat) check the reading on the DMM. Watch the DMM reading through one or two cycles of heating. The reading should move around the desired heat setting by no more than 20 degrees. Larger differences may indicate a bad temperature sensor.

7. Motors:

Once it has been determined that voltage is being applied properly to a motor that is not turning, the windings can be checked using the continuity feature of the DMM. You can also identify the rare situation where the motor winding insulation breaks down and shorts to the motor case.

Measuring the continuity between the winding and the motor case identifies this problem. Disconnect the motor from the circuit. Using a DMM in the continuity mode, place one lead on the motor case and the other to one of the motor's input leads. The DMM should not indicate continuity (no audible signal). If it does, then the insulation of the motor windings may have broken down and has made a connection to the motor case.



Appliances #9

Typical Problems:

Most home appliances take AC voltage from the house supply and use it to make heat, light, turn a motor or, commonly, all three at the same time. The most common problems with household appliances are mechanical in nature: a broken or worn out component (such as a switch or motor), a loose wire, or a bad connection.

Task Summary:

Troubleshooting appliances comes down to checking for proper voltage at each circuit component and checking the integrity of components and connections. Home appliances run on the voltage coming from the AC outlets of the home. Most outlets supply 110 to 120 volts ac. However, an electric clothes dryer or stove outlet typically has two 120 volt circuits wired together to provide a supply voltage of 220 to 240 volts. For simplicity in this booklet, all measurement results assume a supply voltage of 120 volts. If you are working on an electric dryer or stove, you should substitute 240 volts in all the examples shown.

Electrical measurements are usually made inside the appliance so you will have to know how to remove the cover or access panel to the appliance. Some appliances, such as washers and dryers have moving components and belts that can grab and pinch clothing and body parts. If you have to work on equipment with power applied, take extreme care when reaching in to adjust or measure a component.

Recommended Tools:

You will need a DMM with all the basic measurement functions such as ac volts, dc volts, resistance, continuity, plus the added capability to measure ac current up to 15 amps and temperature. You may also need a current clamp accessory that measures ac current up to 50 amps. Alternatively, you can use a clamp meter that combines all the measurement capabilities listed above. It is assumed you have basic knowledge of how to make electrical measurements and how to operate a DMM and clamp meter. If not, you should start by reading "Basic DMM Measurements" and your DMM or clamp meter owner's manual.



Step by step troubleshooting:

1. Check the AC Supply Voltage:

To measure the AC supply voltage, first set the DMM function switch to ac volts and select a range greater than the voltage you expect to measure (greater than either 120 V or 240 V). Make sure the probes are in the proper jacks for measuring voltage. Locate where the wires from the power cord enter the appliance. There should be three wires coming from the power cord: black, white, and green. Black is usually the “hot” wire, white is usually “neutral”, and green should be ground. Place one probe of the DMM at the point where the black wire is connected, and the other probe at the point where the white wire is connected. You should read about 120 volts.

Now move the probe from the black wire to the green wire (keep the other probe on the white wire). You should read about zero volts. If your readings are reversed, either the outlet or the appliance is wired incorrectly. See the booklet “*Troubleshooting Electrical Outlets*” for more information. If you measure no voltage in either case, check to make sure the circuit breaker is ON. You could also have a problem in the power cord.

2. Checking The Power Cord:

Over time, and sometimes through accidents, the power cord can break internally while it appears perfectly normal on the outside. To check a power cord, first disconnect it from the outlet. Set your DMM to the resistance, or Ohms, function. Measure the resistance between each prong of the plug and the point where the power cord connects to the appliance. The flat, narrow blade on the plug should be connected to the black wire. The flat, wide blade goes to the white wire. The round pin connects to the green wire. A good power cord will have less than one ohm of resistance from the plug to the end of each wire. Anything higher than one ohm may indicate a cord that is starting to break down and could become overheated when in use. Replace the entire power cord if any wire shows high resistance.

3. Check the Current Draw:

Current draw is measured in one of two ways: using a clamp accessory attached to your DMM, or using a clamp meter.

To make a current measurement with a clamp accessory, insert the clamp leads into the current jacks of the DMM and set the DMM to the AC mA range. Clip the clamp around one conductor of the circuit to be measured. The current clamp will act as a step down transformer, taking the higher current and transferring it to a

much smaller current (usually 1000 to 1) which the DMM can handle. To make a current measurement with a clamp meter, set the meter to the AC current function and clip the jaws around one conductor. (see figure 1) The display will show the current being measured.

This is a good technique for determining if an electric dryer heating element is working. Start the dryer using a heat cycle. First check to be sure voltage is being applied to the heating element by taking a voltage measurement across the element. With the meter leads attached to the voltage input jacks, select the volts ac function. If the DMM is not auto-ranging, place the DMM in the highest range. Place a probe on each end of the heating element and adjust the DMM range for a full range reading. If voltage is present, then take a current reading using a clamp connected to the DMM. If the element is open and needs replacement, the current will be zero.

4. Checking Switches:

You can check switches in a couple of ways. The first way is to check both the input side and output side of the switch for voltage. Set the DMM to the AC voltage function. Touch one probe to ground (the metal frame of the appliance) or to the neutral connector on the power cord. Touch the other probe to the connectors on the switch, first one side, then the other. In

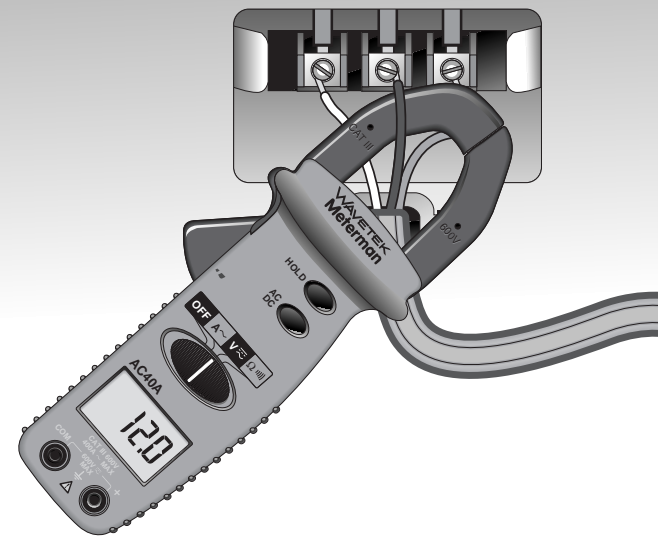


figure 1

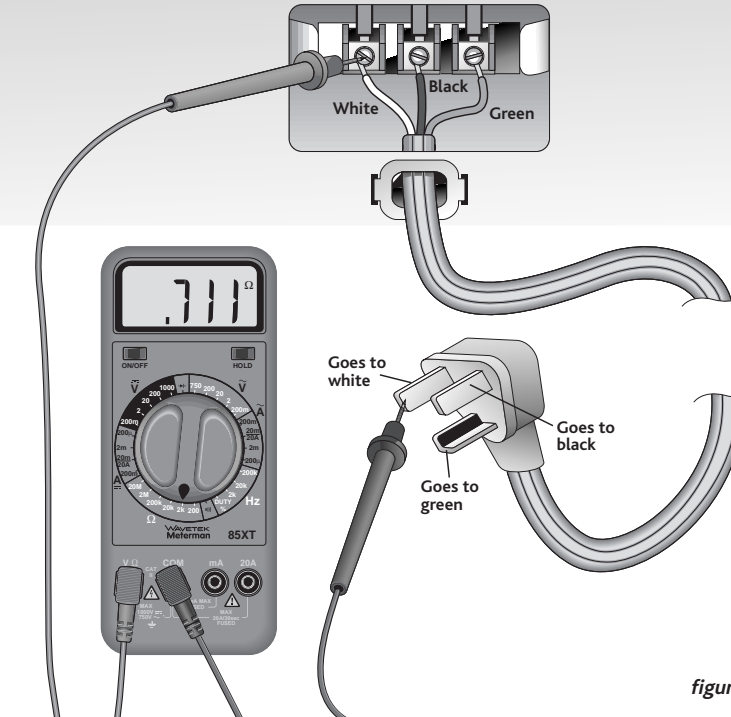


figure 2

Troubleshooting large home appliances

the “ON” position, the voltage should be present on both input and output lugs.

Another way is to check the continuity through the switch. Remove power from the switch first. Isolate the switch by removing the wire or wires from one side of the switch. Set the DMM to the continuity function and place one lead of DMM on the input lug and the other lead on the output lug. When the switch is on, the DMM should sound the audible continuity signal and the DMM should read about zero ohms. When the switch is off, the signal should stop and the DMM displays “OL”.

5. Connectors:

A lot of appliances use solder-less connectors to make the various interconnections inside the appliance. A special connector is crimped onto the end of a wire. The connector is then slipped onto lugs of switches, elements and other components of the appliance to complete the electrical connection. These connections can become loose. When they are loose, they present a higher than normal resistance to the current flowing through them and produce heat. Over time this heating corrodes the connection and increases the resistance even more, sometimes to the point that

they make an open circuit. With power removed, you can measure the continuity of the connections using the DMMs continuity feature. Open one end of the circuit by removing a connection from a component adjacent to the connection to be measured. With the DMM in continuity mode, place a lead on either side of the connection you are testing. The DMM should sound the audible continuity signal and the DMM should read zero ohms. Higher resistances may indicate a faulty connection.

6. Temperature:

For those appliances that generate heat, the ability to measure tem-

Work safely!



Electricity can be dangerous. Protect yourself and your home by remembering to follow a few simple rules when working with electrical circuits:

- Always turn the power off at the electrical panel before handling wires or terminals. Don't assume that you know which wire is hot! Use your meter to verify the power is off before handling any wires or terminals.

- Make sure your meter is working with a 3-point check: Measure a known live circuit, next measure the circuit you're working on and finally re-check the known live circuit.

- Use caution when measuring live circuits. Don't stand in water, use one hand to probe whenever possible, and don't wear metal jewelry.

- Only use a meter that has the proper voltage ranges for the job at hand and make sure the meter has the proper safety ratings and protection.

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