

### 6. When should I use terminal stud adapters?

Lead side terminal adapters should be used for testing side terminal batteries so that the tester can make a good connection. Only use clean, lead stud adapters to ensure an accurate test. Steel bolts will not provide accurate readings for all battery test methods, and should never be used. In addition, always tighten stud adapters using a wrench to ensure a good connection.

Group 31 batteries have small lead studs with a steel threaded bolt extruding. Always install lead female stud adapters over the bolts and tighten down to the lead for best results. Testing on the steel thread will cause inconsistent readings and may cause inaccurate test results.

### 7. Can I test Gel batteries using conductance?

Although Midtronics digital battery testers are designed for automotive battery applications, they can be used to test Gel batteries. However, because of the battery's composition, the battery should be fully charged before testing. If the battery has a CCA rating it should be used to perform the test. If no CCA rating is available, an appropriate reference value can be estimated by testing 2 or 3 good Gel batteries that are fully charged and using 85% of the average of the CCA measurement as the reference value for testing other batteries of the same type.

### 8. What about charging?

Midtronics battery testers use conductance to test discharged batteries to determine the condition of the battery as received. However, when a battery is shown to be good, but in a low state of charge, the battery must be fully charged before returning it to service. In addition, since the condition of some batteries will be charge and retest, the battery must be fully charged before retesting. If the test decision is bad cell or replace, do not charge the battery. Charging a battery with one or more bad cells could cause an explosion and serious harm to the user.

### 9. How do I remove surface charge while testing with a conductance tester?

Removal of surface charge is not normally required when using a Midtronics digital battery tester for testing batteries out of the vehicle. By measuring the conductance of a battery as received, Midtronics testers are able to determine the battery's true state of health and state of charge. Surface charge does not affect the reading, as long as the charging is complete and the battery is fully charged. The after charge prompt tells the tester the battery is fully charged, and the tester judges the battery condition assuming full charge.

When testing in the vehicle, the vehicle's high-beam headlights should be turned on for a minute, turned off, and the battery allowed to recover for another minute. This process ensures that a recent jump-start will not adversely affect the tester reading. In addition, the Micro 450 and later models automatically detect when it is necessary to remove surface charge and prompt the user through the process.

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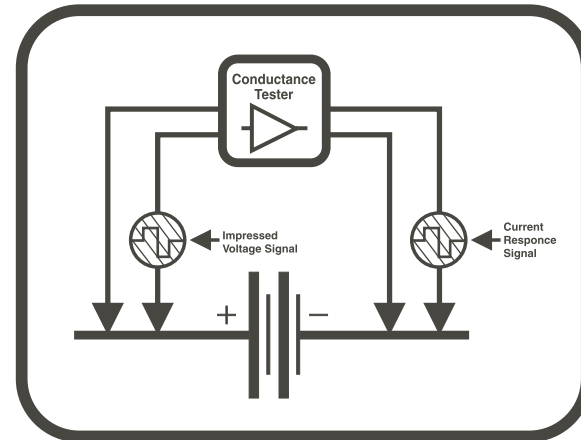
# Battery Conductance

## Transportation Battery Testing

# Questions & Answers

## 1. What is Conductance?

Conductance is a measurement of the battery's ability to produce current. To measure conductance, the tester creates a small signal that is sent through the battery, then measures a portion of the AC current response. Conductance is a measure of the plate surface available in the battery, which determines how much power the battery can supply. As a battery ages, the plate surface can sulfate or shed active material, which adversely affects its ability to perform. In addition, conductance can be used to detect cell defects, shorts, and open circuits, which will reduce the ability of the battery to deliver current. Using conductance, Midtronics testers are able to determine the battery's true state of health.



## 2. How does it compare to load testing?

A standard load test is a measure of the voltage drop when a load equal to one half of the battery's CCA rating is applied for 15 seconds. To be considered good, the voltage must not drop below 9.6 volts. To use a load tester accurately, the battery must have at least 75% state of charge, normally correlated to 12.4 volts or more. In addition, the battery must be at room temperature, or the operator must compensate the readings to determine if the battery is good or bad.

In comparison, a Midtronics tester can be used to test the battery as received. This allows tests to be performed immediately without waiting from 8 to 24 hours for the battery to be charged. The Midtronics tester provides a nearly instantaneous decision so that the technician knows immediately if the battery is the problem or if other system diagnostics are necessary to find the real problem.

A load test produces heat and sparks, this can be dangerous around a previously charged battery, where flammable hydrogen gas from the charging process may ignite and cause an explosion. This can occur in batteries with open circuits and low electrolyte levels.

In comparison, the Midtronics test is passive so there is no sparking or heat generated, resulting in a test that is completely safe to perform anywhere, even in front of a customer. In addition, because there is no heat, the technician can test as many batteries as required without waiting for the tester to cool down with no internal damage to the tester from excessive heat. Midtronics testers last longer than adjustable load or fixed load testers with electronics. The Midtronics tester's internal electronics are not exposed to heat, which may accelerate the aging process on the equipment.

A standard 1/2 CCA load test must be performed manually. The user must be able to judge the proper load and timing to ensure an accurate test and that the battery is not damaged because an excessive load is applied for too long a period of time.

A Midtronics tester takes away the guesswork because the tester does all the work. The technician inputs the battery's rating and presses the start button.

A decision is generated in seconds, eliminating the largest cause of inaccurate testing - user error. There are no complex meters to interpret or charts to consult. The Midtronics test method makes it simple enough so that virtually anyone can be a battery test expert.

A recent study of 100 batteries tested using the Micro 400 and a 1/2 CCA load test help to illustrate the difference between these test methods. Of 100 batteries tested, the Micro 400 was able to make a decision 76% of the time,

while the 1/2 CCA test could only make a decision on 27% of the batteries before charging. This means the Micro was 3 times more decisive than the 1/2 CCA test. In addition, the test decisions according to the Micro and the 1/2 CCA load test were the same for 90 batteries, which means 90% correlation. Of the other 10 batteries, the Micro test decision was verified to be correct six times in tear-down analysis. Of the other four batteries, three were severely sulfated and one had an intermittent contact problem.

## 3. Can I measure the battery's actual CCA using conductance?

Midtronics testers output the battery's relative power in CCAs at the end of the test. This value is related to the actual power available in the battery in relation to that battery's rating. On average, a new battery's CCA as measured by a Midtronics tester will read 10-15% higher than its stated rating. As the battery ages, the CCA number measured by a Midtronics tester will decrease so it reads near its rating. While this value is not the same as a CCA test, it is the best available measure for showing a battery's current condition in relation to its rating.

For example, a 700 CCA rated battery measuring 525 CCA available power does not mean that the battery would pass a CCA test at 525 CCA. The available power reading shows that the battery is not able to perform up to its rated ability (700 CCA).

In comparison to another battery when fully charged, the 700 CCA battery measuring 525 CCA is not stronger than a 500 CCA battery showing 500 CCA available power when fully charged. The available power number is meant for comparison to its own rating. In fact, in this example the 700 CCA battery is failing to perform to its rating, while the 500 CCA battery is still working.

The actual SAE, CCA test is a manufacturing process control test applicable only on new, fully charged batteries. It does not produce an actual value, but is a pass/fail test. It measures the discharge load, in amps, that a battery can supply for 30 seconds at 0°F/-18°C while maintaining a voltage of 1.2 volts per cell (7.2 volts per battery) or higher. Thus, the CCA test shows the minimum power requirement for the battery as rated, which means a battery rated at 500 CCA must measure 7.2 volts or above for 30 seconds when a load of 500 amps is applied at 0°F/ -18°C.

## 4. Can I predict when a battery will fail using conductance?

While there is no precise way predict how much life remains in a battery, conductance can help identify batteries that have degraded. Since conductance relates to plate surface and the battery's ability to crank, the available power or CCA when compared to the battery's rating provides a good indication of its ability to perform. Since a new battery will normally read at or above its rating, a battery measuring below its rating when fully charged is degraded and has started down the battery failure curve. How long until the battery fails will be determined by vehicle use and exposure to weather extremes.

## 5. Can I test batteries in the vehicle using conductance?

Midtronics digital battery testers have several unique features to allow accurate testing while the battery remains in the vehicle, provided the engine is not running. If the battery posts are too dirty or heavily corroded, the tester will not allow a test and prompts the user to check the connection. In addition, all Midtronics digital battery testers can detect excess computer or ignition noise, which could interfere with a proper test. When detected, the tester will prompt the user to check for the cause and/or automatically retest to determine if the cause has been eliminated.

In the Micro 450 and 500 series, Midtronics testers offer a unique in-vehicle test algorithm that incorporates all previously mentioned features, while also providing an automated surface charge removal process, making in-vehicle testing fast and simple.