



Diagnosing A Car Battery That Runs Down

by [Larry Carley](#) copyright 2019 AA1Car.com

You go to start your car and discover the engine won't crank because the battery is dead. Now what? You get somebody to give you a jump start, or you connect the battery to a charger and charge it up until it has enough juice to start your engine.

The next morning you go to start your car again, and the same thing happens. The battery has run down and the engine won't crank. What is wrong?

WHY A CAR BATTERY RUNS DOWN

A car battery can run down for any of several reasons:

- You accidentally left the lights on or some other accessory that pulls power from the battery even when the ignition key is off.
- The battery is not being recharged while the vehicle is being driven (you have a charging problem)
- There is a key off parasitic electrical drain on the battery because a relay is sticking, a module is not shutting down (going into "sleep mode"), or there is a shorted diode in the alternator.
- Your battery is old and will not hold a charge anymore. The battery needs to be replaced.

CHECK BATTERY VOLTAGE AND STATE OF CHARGE

The first things you want to check are the battery and the output of the charging system (alternator). One way to do this is to turn on the headlights. If the headlights come on with normal brightness, the no-crank problem is probably not the battery, but a bad starter relay or solenoid, a poor wiring connection between the relay/solenoid and starter, or a bad starter. If the headlights are dim or do not come on at all, you need to check battery voltage and charging output.

For this, you will need a voltmeter. Select the 12 or 20 volt scale, and connect the volt meter red positive test lead to the battery positive (+) terminal, and the black negative test lead to the battery negative (-) terminal.



Checking base battery voltage with a voltmeter.

A fully charged battery should read over 12.6 volts. If the battery reads 12.45 volts or less, it is low (less than 75 percent charged) and needs to be recharged.

Battery Voltage and State of Charge:

12.66v	100%
12.45v	75%
12.24v	50%
12.06v	25%
11.89v	0%

(NOTE: these readings are at 80 degrees F. Battery voltage readings will drop with temperature roughly 0.01 volts for every 10 degrees F.)

(At 30 degrees F. a fully charged battery will measure about 12.588 volts, and at zero degrees F it will measure about 12.516 volts.)

CHECK BATTERY CHARGING VOLTAGE

After charging the battery or jump starting the car, connect the voltmeter to the battery the same as before and not the charging voltage. A charging system that is operating

normally should produce about 13.8 to 14.3 or more volts at idle. If the charging voltage is less than 13.0 volts, the alternator is not putting out enough voltage and current to keep the battery charged. You should have the alternator tested (or bench tested at an auto parts store). If the current output is not up to specifications, replace the alternator.



Charging voltage with engine idling should be 13.5 to 14.5 volts.

After the battery has been recharged, the battery should also be tested to see if it is capable of holding a charge. This can be done with a hand-held [electronic battery tester](#) or a [conventional load tester](#). The tester will tell you if the battery is good or bad. NOTE: Load testers require the battery to be fully charged for accurate test results. By comparison, most electronic testers will give reliable test results even if the battery is not fully charged. If the battery fails a load test, it needs to be replaced. See [BATTERY REPLACEMENT](#) for details on how to change your car battery.

The average service life of a wet cell lead-acid car battery is only about four to five years, and can be as little as three years in really hot climates (like Arizona and Florida). AGM batteries are better and typically last 6 or more years. So if you have a conventional wet cell battery that is more than four or five years old, chances are it has reached the end of its useful service life and needs to be replaced if it is not accepting or holding a charge (and the charging system is working normally).

KEY-OFF CAR BATTERY DRAIN

If your car battery is less than six years old and tests okay, and the charging system is working normally, your battery may be running down because of a key-off current drain (also called "parasitic battery drain").

When you turn the ignition off, switch the lights off and remove the key from the ignition switch (or the smart key fob from the vehicle), the electrical load on the battery should drop to almost nothing. On older cars that do not have computers or other onboard electronic modules, the key-off load on the battery is typically only a few milliamps (if it has a clock or a digital radio), or it may drop to zero (no load at all). However, on late model vehicles with [computers](#) and numerous electronic modules, the key-off drain on

the battery can range from 20 to 50 milliamps, and as much as 300 to 400 milliamps on some applications. On some Fords, the electrical system will continue to pull as much as 850 milliamps (almost 1 amp) for up to 20 minutes or more after the ignition has been turned off.

The key-off current drain is used by the modules to keep their memories alive. The chips that store certain settings and learned information are called the "Keep Alive Memory" (KAM).

Many modules have internal timers that either turn off the module to put it into a "sleep mode," or power down the module to a "standby mode" to reduce the parasitic power drain on the battery after a predetermined length of time when the key is turned off. Some of these modules power down in steps and time out at different rates. It may take up to a half hour before all of these modules reduce their current drain on the battery to minimum levels.

If the battery runs down (or is disconnected), KAM information can be lost. Computers and modules may reset to a "default" setting after the battery is recharged or reconnected, but you may notice some changes in the way your vehicle runs and drives, and you may have to reset the radio channels, clock and other memory presets. Worse yet, on some vehicles the climate control system, power windows or radio may not function at all until they are reset using a special "relearn" procedure or a dealer scan tool. On many BMW, Audi, Acura and VW models, for example, the radio won't work if the battery has been disconnected or run dead until the factory security code has been reentered. [Read This](#) before you disconnect or replace a battery on a late model vehicle.

WARNING: When disconnecting or replacing a car battery on a late model vehicle, you should always maintain voltage to the vehicle's electrical system to preserve learned module settings. This can be done by plugging a backup battery into the cigarette lighter, or attaching a backup battery or battery charger to the car's battery cables BEFORE the cables are disconnected.



Key-Off current drain should be less than 50 mA after 1 hour.

As a rule, the parasitic drain on most late model vehicles should be less than 50 milliamps one hour after the vehicle has been shut off and left undisturbed. But this is a rule of thumb only. Always refer to the vehicle manufacturer's key-off electrical drain specifications if available (some vehicle manufacturers have no published specifications).

Keep in mind, though, that opening a door, the trunk or turning anything on can wake up various modules and start the timer countdown all over again. So if you want to check the parasitic draw on the battery, leave the hood open (or the trunk if the battery is located in the back).

How To Measure Key-Off Battery Current Drain

Any of the following methods can be used to measure key-off current drain on the battery:

Check for Voltage Drop: Use a digital volt meter to measure [voltage drop](#) across individual fuses with the key off. This method does not require removing any fuses or disconnecting the battery. Set the voltmeter to the millivolt (Mv) scale. No current flow through a circuit should show a zero reading on the voltmeter when the probes are connected to both sides of individual fuses. Any reading other than zero (typically a few tenths of a volt) would indicate current flow in a circuit and a potential drain on the battery.

Use an ammeter with an amp probe to measure key-off current flow at the battery: Connect an inductive amp probe to your ammeter or digital multimeter, then clamp the probe around one of the battery cables. Set the meter to read milliamps (mA). If there is a key-off current drain on the battery, the meter should detect the current. Make sure the amp probe you are using is one that is calibrated to detect small milliamp currents, not large multiamp currents.

Use an ammeter to measure key-off current flow at the battery: This method requires disconnecting one of the battery cables and connecting the ammeter in series between the battery and cable so any current flow will pass through the meter. Make sure you provide backup power to the electrical system before disconnecting the battery. As before, use the milliamp scale.

CAUSES OF EXCESSIVE KEY OFF CURRENT DRAIN

Causes of excessive current drain from a car battery include things like lights that remain on (trunk and hood lights, interior lights, brake lights, etc.) and also [relays](#) that may be stuck on, or modules that are not going to sleep or powering down. Keyless entry systems and anti-theft systems can often be the source of a significant key-off current drain on the battery.

A fuel pump relay that sticks on may keep the fuel pump running after the engine is shut off. A switch or relay that powers a rear window defogger can stick on, pulling current from the battery after the ignition is off. An electronic suspension module, [ABS module](#) or keyless entry module may remain active long after it should have powered down.

An accessory such as a DVD player, game console or cell phone charger left plugged into a rear seat power receptacle may be pulling power from the battery. So before you spend a lot of time trying to figure out where the amps are disappearing, check all of the vehicle's power receptacles to see if something is plugged in that may be using power.

FINDING THE CAUSE OF A KEY OFF CURRENT DRAIN

If the key-off current reading is above specifications (typically, more than 50 mA one hour after the vehicle has been shut off), the current drain is too high. It's time to start pulling fuses and relays to find the fault.



Remove fuses and relays one at a time to find circuit that is draining the battery. Or, use a voltmeter to check for a voltage drop across each fuse. A voltage drop reading would indicate current flow in the circuit.

Refer to your vehicle owner's manual or a wiring diagram to identify the fuses and relays. Then pull the fuses and relays one at a time until the current reading drops. Avoid pulling the fuses for the PCM or other KAM-sensitive modules until you have checked all of the other circuits.

Once you've found the circuit that is causing the excessive current drain, check the relay, switch, module or other components in the circuit and replace as needed.

Sometimes a bad alternator diode can cause a car battery to run down. A good diode should only pass current in one direction. If it leaks current in the opposite direction, it may keep the charging circuit on when the engine is not running, causing the battery to run down. This kind of problem can be diagnosed several ways. If your voltmeter has an AC (alternating current) scale, switch to that scale and observe the charging voltage with the engine running. If the meter shows any AC voltage, one or more diodes are leaking and the alternator needs to be replaced. The alternator's output can also be observed as a waveform on a digital storage oscilloscope (DSO) or an alternator tester

that measures ripple voltage to detect this kind of problem. Or, just disconnect the alternator overnight and see if the battery stills run down. If the battery drain stops, you have found the problem. Replace the alternator.

Battery Related Recalls

GM recalled 2013 Chevy Malibu Ecos and 2012 to 2013 Buick LaCrosse and Regal models with eAssist for a charging system fault that can allow the battery to run down and/or cause a fire in the trunk. The "Generator Control Module" in the trunk may malfunction, causing gradual loss of battery charge and a charging indicator warning light to come on. Continuing to drive the vehicle may cause the engine to stall and not start. In addition, there may be a burning or melting odor, smoke, and possibly a fire in the trunk. The battery drain affects the vehicle's conventional 12-volt battery and not the lithium-ion battery that is part of the hybrid system

BMW recalled 2004 to 2010 BMW 5 Series and 6 Series cars for a faulty battery-cable connection in the trunk. A bolt that connects the battery cables in the trunk may come loose, creating increased electric resistance and an overheated cable connection. This may cause the battery to run down due to reduced charging input into the battery as well as electrical malfunctions due to low voltage. In some situations, the cable may overheat resulting in melted insulation, smoke under the trunk mat and a possible fire.



More Car Battery Related Articles:

[Car Battery Safety & Jump Starting \(Read First!!!\)](#)

[Battery FAQs](#)

[Battery Testing](#)

[Car Battery Disconnect Problems](#) (Read This BEFORE Disconnecting or Replacing Your Battery)

[Battery Replacement](#)

[Hybrid Safety Hazards](#)

[Troubleshoot electrical problems](#)

[Electrical Loads for Automotive Systems, Lighting and Accessories](#)

[Voltage Drop Testing](#)

[Power Centers: Relays & Fuses](#)

[Starting & Charging System Troubleshooting](#)

[Starter Diagnosis](#)

[Charging System Checks \(alternator testing\)](#)

[High Output Alternators \(Why You May Need One\)](#)

[What You Should Know About Rebuilt Alternators, Starters & Other Parts](#)

[Diagnosing An Engine that Won't Crank or Start](#)

Car Battery Resources:

[Battery Council](#) (manufacturer info on batteries)

[BatteryFAQ.org](#) (Extensive battery info resource)

[Battery Manufacturers](#) (list of worldwide manufacturers)



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