Charging System 812FJ

Student Manual

Charging System

Activity 11

Battery Drain Testing

Performance Objectives:
• Test for and measure battery drain using manufacturer's service procedures.
• Diagnose the cause of abnormal battery drain; determine needed repairs.
• Maintain or restore electronic memory functions.

Tools and Materials*:*
• In-Shop Vehicle with 12V Battery
• Parasitic Drain Test Switch
• Digital Multi-Meter with Amp clamp
• Safety Goggles

References:
• Ford Starting and Charging System Diagnosis Reference Book
• 2003 Chevrolet Impala Service Manual Information

Parasitic Drain:
Parasitic drain is defined as current flow to vehicle components that remain powered up for a period of time after the vehicle is parked and the ignition switch is turned off.

After key-off, current flow to vehicle components from the battery should be minimal. On older vehicles that do not have computers or control modules, parasitic drain measurements will typically range from only a few milliamps to zero. Any vehicle that has an electric clock or a digital radio (which requires constant power to maintain the preset memory) will have a small amount of parasitic drain.

Typical parasitic drain levels by component are as follows:

Component	Typical Parasitic Drain (mA)
Automatic Climate Control Module (ACCM)	1.0 to 3.0
Electronic Brake Control Module (EBCM)	1.0 to 1.5
Generator	2.0
Powertrain Control Module (PCM)	4.0 to 6.0
Radio Memory	4.0 to 7.0

Modern vehicles typically network multiple computers or control modules. For example, the 2003 Chevrolet Impala referenced in this course has a Powertrain Control Module (PCM), an Inflatable Restraint Sensing and Diagnostic Module (SDM), an Electronic Brake Control Module (EBCM), a Body Control Module (BCM), and a Vehicle Communications Interface Module (VCIM, part of OnStar ®). All of these control modules communicate via an interconnecting network.

The network enables these modules to monitor and control multiple vehicle functions. The 2003 Impala BCM, for example, monitors and/or controls these functions:

- Audible warnings
- Interior lighting
- Automatic door locks
- Automatic headlamp control
- Keyless entry
- Passlock and Content theft deterrent systems
- Retained Accessory Power
- Entertainment systems

Control modules typically contain internal timers that enable them to power themselves down either completely or in steps after a key-off event plus a predetermined period of time. This is referred to as “going to sleep”, or “going into standby”. Different modules power down at different times and rates. Some can even be powered back up, or “awakened” by other modules without driver intervention. Each vehicle manufacturer will be different in this regard, and even different vehicle models from the same manufacturer can have different control module power strategies. The total parasitic drain for a given vehicle will vary according to its equipment and option levels.

For example, the following description of the OnStar® Sleep Cycle is from the OnStar® Description and Operation section of the 2003 Chevrolet Impala Service Manual:

The OnStar® system uses a unique sleep cycle to allow the system to receive cellular calls while the ignition is in the OFF position. This cycle enables the VCIM to perform remote functions (such as door unlock) as commanded over the air by the OnStar® Call Center (when requested by the customer) and continue to maintain an acceptable level of battery electrical drain.

The OnStar® system uses three states of readiness:

- *High Power*
- *Low Power*
- *Sleep*

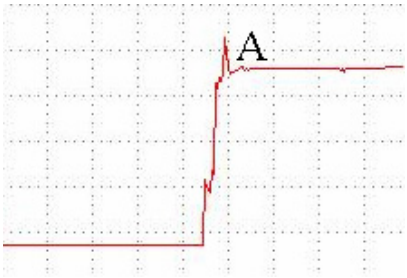
The High power state is in effect whenever the ignition is in the "ON" or "RUN" position, and enables the OnStar® system to send and receive cellular calls and perform all remote functions. The Low power state is entered once the vehicle ignition is placed in the "OFF" position and the retained accessory power (RAP) function has been turned off, or times out. This state will last for one minute and allows incoming cellular calls to be received. After the one minute "window", the OnStar® system moves to the Sleep state. This state will not recognize or receive incoming cellular calls. At a predetermined time recorded within the VCIM (up to nine minutes), the system re-enters the Low power state to listen for a call from the OnStar® Call Center for one minute. After this interval, the system will again return to the Sleep state for nine minutes. After these nine minutes, the system will again enter the Low state of power and listen for any incoming calls that the OnStar® Call Center may be sending. In the event a call is being sent, the OnStar® system will receive the call and immediately go into the High power mode to perform any requested functions. If no call is received during the one-minute interval, the system will go back into the sleep mode for another nine minutes. This process will continue for up to 48 hours, after which, the OnStar® system will permanently enter the Sleep state until the ignition is once again turned to the "ON" or "RUN" position.

In the event the OnStar® system loses, or is temporarily removed from battery power, the system will remain in the Sleep state while the key in the OFF position. It will not begin to cycle until the vehicle passes into an open outside area with the ignition ON, where a GPS signal can be acquired, providing a reference for time. The OnStar® Call Center is able to maintain a record of exactly what time each vehicle will enter the one-minute Low power state by synchronizing their clocks with those of the vehicle, based on GPS signals.

1. Technician A says that the OnStar® system "goes to sleep" following the vehicle's ignition being turned off one minute after the Retained Accessory Power function turns off. Technician B says that, under certain conditions, the OnStar® system can wake up automatically for one minute every nine minutes for a period of up to 48 hours. Which Technician is correct?
   a. Technician A only
   b. Technician B only
   c. Both Technician A and Technician B are correct
   d. Neither Technician A nor Technician B is correct

Control Module Power-Up and Power-Down:

Control modules require specific amounts of current to power up. The following graphic was taken from our 2003 Chevrolet Impala using an oscilloscope. An inductive amp clamp was connected around the positive battery cable and a capture of the control module power-up current was recorded while the previously disconnected negative battery cable was reconnected.



Capturing current flow measurements in this manner shows how the parasitic draw changes over a period of time. The flat line on the left side is zero amps. No current is flowing. The rise in the center is current flow starting as the battery cable was connected. Point A shows that after the battery cable was reconnected the vehicle's control modules were drawing approximately two amps. From left to right, start to finish, a nine second period of time is shown.

The next graphic shows a key on and key off event measured over a 27 second period of time:

The rise between points A and B is where the ignition key was turned on. Current flow peaked at twelve amps at point B. Current flow dropped to seven amps at point C, and to just over six amps at point D, where the ignition key was turned off. After a quick dip, current flow decreased over time as modules and components powered down to just over two amps at point E. This amount of current could flow for as long as 20 to 30 minutes or even longer (depending on the vehicle) until all vehicle control modules "went to sleep".

These examples show why it was stated in Activity 3 that the ***Battery Drain Test With Volt-Ohmmeter, To Test Vehicles With Major Key-Off Loads, and To Check for Electronic Drains*** tests listed on pages 3-8 through 3-10 and the Test Lamp test referenced on Page 3-3 of the Ford Starting and Charging System Diagnosis Reference Book **will not give accurate results on modern vehicles**. Manufacturer's specific published test procedures should be followed to insure accurate results when measuring parasitic drain and when diagnosing an abnormal drain condition.

Service Manual Information:

• Refer to the Battery Electrical Drain/Parasitic Load Test on page 29, and the Battery Disconnect Caution on Page 28 of the Service Manual Information and answer the following questions:

2. If a tool or equipment could easily come in contact with a live exposed electrical terminal:
   a. Disconnect the positive battery cable
   b. Disconnect the negative battery cable
   c. Disconnect both battery cables
   d. Don't disconnect either battery cable

The Parasitic Draw Test Switch is essentially a device that will allow a technician to use a DMM in Ammeter mode to measure parasitic drain without breaking or interrupting the negative battery cable connection.

3. When using a DMM in Ammeter mode to measure current, the DMM is connected to the circuit:
   a. In series, making the meter a part of the circuit so that all circuit current flows through it
   b. In parallel, making the current measurement across the circuit similar to a voltage measurement

4. The Battery Electrical Drain/Parasitic Load Test procedure calls for the vehicle to be road tested and for all accessories to be activated after the Parasitic Draw Test Switch is installed and closed. Why?
   a. To make sure the vehicle battery is fully charged before the parasitic drain measurement is made.
   b. To make sure the engine is at operating temperature before the parasitic drain measurement is made.
   c. To make sure the Parasitic Draw Test Switch and battery cables are secure.
   d. To make sure all control modules are "awake" and functioning.

5. Steps 8, 9, and 10 of the Electrical Drain/Parasitic Load Test procedure call for a 10A fused jumper wire to be connected across the test switch tool terminals. Step 10 says that if the fuse blows, an inductive ammeter or amp clamp should be used to diagnose the draw. Why?
   a. The blown fuse indicates that circuit current draw is lower than a DMM can safely measure.
   b. The blown fuse indicates that circuit current draw is higher than a DMM can safely measure.
   c. The blown fuse indicates that one of the control modules is shorted to ground.
   d. The blown fuse indicates that one of the control modules is shorted to power.

6. Step 15 of the Electrical Drain/Parasitic Load Test procedure calls for a minimum wait of 20 minutes. Why?
   a. To give the technician time to calculate the maximum allowable parasitic drain as noted in step 18.
   b. To give any accumulated battery surface charge time to dissipate.
   c. To give all control modules enough time to power down and "go to sleep".
   d. To make sure all control modules are "awake" and functioning.

7. Technician A says that the vehicle's charging system should be tested if the parasitic drain measurement is acceptable. Technician B says that pulling fuses one at a time can isolate the circuit or component causing excessive parasitic drain. Which Technician is correct?
   a. Technician A only
   b. Technician B only
   c. Both Technician A and Technician B are correct
   d. Neither Technician A nor Technician B is correct

Note: There is a GM Technical Service Bulletin (TSB) that provides parasitic drain diagnostic tips. It is called Platform Battery Drain Diagnosis Process, and it can be found on Page 32 of the Service Manual Information. This is recommended reading.

Vehicle Battery Disconnect:

Learned control module values and module memory settings are erased whenever the battery is disconnected. Some control modules may require a reset with a factory scan tool or a memory relearn procedure following a battery disconnect or they may not work. For example, in some vehicles the radio won't work until the factory security code has been reentered if the battery has been disconnected.

In the interest of customer satisfaction, saving learned values and memory settings may be faster and easier than recording and relearning them in some cases. This can be done by connecting a suitable auxiliary battery or alternate power source to the vehicle before disconnecting the vehicle's battery. Care must be taken to connect this auxiliary battery or alternate power source in a safe, secure manner. There should be no chance of injury or component damage from the alternate power source grounding or arcing.

Inductive Amp Clamp:
Some manufacturers may specify using an inductive amp clamp connected to a DMM to make parasitic drain measurements. This measurement method has the advantage of being able to measure current flow without disconnecting the battery or disrupting control module power.

The inductive amp clamp used needs to be capable of accurate measurements at very low current flow levels. Optionally, an oscilloscope or graphing multimeter and inductive amp clamp may be a useful diagnostic tool for monitoring or recording parasitic draw over time.

Follow the instructions that came with your particular inductive amp clamp to calibrate and use it. Just as in the GM procedure discussed previously, the vehicle should be driven and all accessories should be activated. Afterwards, wait for the manufacturer's specified time to allow all control modules to power down and "go to sleep" before making parasitic drain measurements.

Conclusion:

Follow manufacturer's procedures for battery disconnection, parasitic drain measurement, and for the diagnosis of abnormal parasitic drain. Research control module operation strategy and be sure that all control modules have sufficient time to power down and "go to sleep" before making parasitic drain measurements.

Complete the In-Shop Worksheets at this time.

In-Shop Worksheet

Activity 11

Battery Drain Testing

***Tools and Materials**:*
• Live Vehicle with 12V Battery
• Service Information - for your live vehicle, locate the procedures for:
    • Battery Disconnection (where applicable)
    • Battery (Parasitic) Drain Testing
• Parasitic Drain Test Switch
• Digital Multi-Meter with Amp clamp
• Safety Goggles

Important: Because of the materials used in the manufacture of automotive lead-acid batteries, dealers and service shops that handle them are subject to regulations issued by OSHA, EPA, DOT, and various state or local agencies. Other regulations may also apply in other locations. Always know and follow these regulations when servicing or handling batteries.

Important: Wear safety goggles.

Note: Always use caution when handling a battery since battery gases (hydrogen) are EXPLOSIVE and the acid can cause severe burns.

Procedures:
• Follow the step-by-step service information procedure **under the direction of your instructor** to perform a parasitic drain test on the live vehicle. Check off each step as you perform it.

1. Did you successfully perform the parasitic drain test?
    a. Yes
    b. No

Conclusion:

Follow manufacturer's procedures for battery disconnection, parasitic drain measurement, and for the diagnosis of abnormal parasitic drain. Research control module operation strategy and be sure that all control modules have sufficient time to power down and "go to sleep" before making parasitic drain measurements.

In-Shop Worksheet

Activity 11

Maintain or Restore Electronic Memory Functions

***Tools and Materials**:*
• Live Vehicle with electronic memory functions
• Service Information - for your live vehicle, locate the procedures for:
    • Battery Disconnection (where applicable)
• Required Hand Tools
• An Auxiliary Battery or Alternate 12V Power Source

Important: Because of the materials used in the manufacture of automotive lead-acid batteries, dealers and service shops that handle them are subject to regulations issued by OSHA, EPA, DOT, and various state or local agencies. Other regulations may also apply in other locations. Always know and follow these regulations when servicing or handling batteries.

Important: Wear safety goggles.

Note: Always use caution when handling a battery since battery gases (hydrogen) are EXPLOSIVE and the acid can cause severe burns.

Procedures:
• Consult the Service Information for the vehicle you are working on under the categories of Electrical Systems or Computerized controls to determine if there are any specific instructions concerning maintaining or restoring electronic memory functions. **Under the direction of your instructor, perform the following shop tasks:**

1. Make note of the radio, seat, mirror, climate control or other memorized settings of the accessories on the vehicle you are working on:

    Radio Station Presets _____

    Drivers Seat Position _____

    Passenger Seat Position _____

    Rear View Mirror(s) _____

    Climate Control Settings _____

    Other _____

2. Make note of any diagnostic trouble codes that are present.

Engine _____

Trans _____

Body _____

ABS _____

SRS _____

Other _____

Maintaining Electronic Memory:

• Connect the auxiliary battery or alternate power source to the vehicle.

CAUTION - ***Care must be taken to connect this auxiliary battery or alternate power source in a safe, secure manner. There should be no chance of injury or component damage from the alternate power source grounding or arcing.***

• Disconnect the negative battery cable from the vehicle. Leave the cable unhooked for approximately three to five minutes unless otherwise specified in the Service Information.

• Reconnect the negative battery cable and remove the auxiliary battery or alternate power source.

• Check the accessory system memory function(s) you made note of in Step 1 to ensure that they were maintained while the battery was disconnected.

3. Were the accessory system memory functions and settings maintained?
   a. Yes
   b. No

• Check the DTCs you noted in Step 2 to ensure that they were maintained while the battery was disconnected.

4. Were the DTCs maintained?
   a. Yes
   b. No

Loss of Electronic Memory:

• Disconnect the negative battery cable for three to five minutes, but do not connect the auxiliary battery or alternate power source

• Reconnect the negative battery cable. Recheck the electronic memory functions and DTCs.

5. Were the accessory system memory functions and settings and DTCs maintained?
   a. Yes

b. No

- Reset or reprogram all settings to the values noted in Step 1. If necessary, refer to the vehicle owner's manual.

Conclusion:

Without a constant supply of electrical power most vehicle modules will not maintain memory.