

Charging System 812FJ

Student Manual

Charging System

Activity 9

Battery Charging/Jump Starting

Performance Objectives:

- Perform a slow battery charge.
- Perform a fast battery charge.
- Jump start a vehicle using jumper cables and a booster battery.

Tools and Materials:

- Vehicle with dead battery (if available)
- Slow Battery Charger (3-5 Amps)
- Fast Battery Charger (Capable of 30 Amps)
- Safety Goggles

References:

- Ford Starting and Charging System Diagnosis Reference Book
- 2003 Chevrolet Impala Service Manual Information

Reference Book:

- Refer to Pages 3-11 through 3-13 in the Ford Starting and Charging System Diagnosis Reference Book to answer the following questions:

Battery Charging:

1. According to Page 3-11 of the Reference Book, the amount of charge a battery requires depends on the battery's state of charge and:
 - a. The battery's age
 - b. The battery brand
 - c. The battery's reserve capacity
 - d. The battery's post configuration
2. According to Page 3-11 of the Reference Book, frozen and cold batteries should be warmed up to what temperature before charging?
 - a. 30°F (-1°C)
 - b. 40°F (4°C)
 - c. 50°F (10°C)
 - d. 60°F (15°C)

Slow Charging:

3. According to Page 3-11 of the Reference Book, the slow charging rate should equal what percentage of the battery's CCA rating?
 - a. 1%
 - b. 2%
 - c. 5%
 - d. 10%
4. According to Page 3-11 of the Reference Book, what is the average charge time for slow charging?
 - a. 4 to 8 hours
 - b. 8 to 12 hours
 - c. 12 to 16 hours
 - d. 16 to 20 hours

Fast Charging:

5. According to Page 3-12 of the Reference Book, the most common fast charging method for a 12-Volt Battery is a "boost" charge at:
 - a. 60 amps for 30 minutes
 - b. 30 amps for 30 minutes
 - c. 30 amps for 60 minutes
 - d. 60 amps for 60 minutes
6. According to Page 3-12 of the Reference Book, fast charging increases the risk of damage to the battery if it is done longer than:
 - a. 4 hours
 - b. 3 hours
 - c. 2 hours
 - d. 1 hour

Service Manual Information:

- Read Battery Charging on Page 24 of the Service Manual Information to answer the following questions:

Battery Charging:

7. According to the Battery Charging document in the 2003 Chevrolet Impala Service Manual Information, an automatic taper-rate battery charger that is capable of producing 16V will give the best results.
 - a. True
 - b. False

Charging Time Required:

8. According to the Battery Charging document in the 2003 Chevrolet Impala Service Manual Information, all of these factors affect battery charging time **except**:
 - a. The battery charger capacity
 - b. The battery's age
 - c. The battery's state of charge
 - d. The battery's temperature

Jump Starting:

- Review the Jump Starting in Case of Emergency procedure on Page 26 of the Service Manual Information. In what order should the following connections be made?

9. Connect the black negative (-) jumper cable to a heavy, unpainted metal engine part at least 46 cm (18 in) away from the discharged battery.
 - a. First
 - b. Second
 - c. Third
 - d. Fourth
10. Connect the red positive (+) jumper cable to the positive (+) terminal of the booster battery. Use a remote positive (+) terminal if the vehicle has one.
 - a. First
 - b. Second
 - c. Third
 - d. Fourth
11. Connect the black negative (-) jumper cable to the negative (-) terminal of the booster battery.
 - a. First
 - b. Second
 - c. Third
 - d. Fourth

12. Connect the red positive (+) jumper cable to the battery positive (+) terminal (2) of the vehicle with the discharged battery. Use a remote positive (+) terminal if the vehicle has one.
 - a. First
 - b. Second
 - c. Third
 - d. Fourth

Conclusion:

The safest way to recharge a discharged battery is to slow charge it at a rate of 3 to 5 amps for 12 to 16 hours. If the battery must be recharged sooner, a fast charger can be used. The most common “boost” charge is 30 Amps for 30 minutes. The charge rate-time should not exceed the Amp-Hour rating of the battery. Never fast charge a battery over 2 hours or damage could result. Also, be sure to follow the charger manufacturer’s recommendations when using battery chargers.

To avoid injury when jump starting a vehicle, be sure to make the last connection to a heavy, unpainted metal engine part at least 46 cm (18 in) away from the dead battery, **not to the negative (-) battery terminal**. This keeps sparks away from the battery.

Complete the In-Shop Worksheets at this time.

In-Shop Worksheet

Activity 9

Battery Charging/Jump Starting

Tools and Materials:

- Vehicle with dead battery (if available)
- Slow Battery Charger (3-5 Amps)
- Fast Battery Charger (Capable of 30 Amps)
- Jumper Cables
- 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:

- Review the Battery Disconnect Caution on Page 28 of the Service Manual Information.

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.

Important: Always consult and follow the vehicle manufacturer's service procedures whenever disconnecting a battery.

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.

Important: If you aren't sure of how to do this, or if it needs to be done, consult with your instructor before proceeding.

- Disconnect the negative battery cable from the battery.

Slow Charging:

- With your instructor, connect the Slow Charger to the battery.

Be sure to observe the correct polarity!

- Set the charger for a 3-5 Amp charging rate.
 1. How long should the battery be kept on a slow charge?
 - a. 4 to 8 hours
 - b. 8 to 12 hours
 - c. 12 to 16 hours
 - d. 16 to 20 hours
- Turn the charger off and disconnect it once charging is complete.
- Reconnect the negative battery cable.

Fast Charging:

- Note the Amp-Hour rating of the battery (if labeled). _____

Note: If Amp-Hour rating is not given, use a typical value of 60.

- With your instructor, connect the Fast Charger to the battery.

Be sure to observe the correct polarity!
- Set the charger for a 30 Amp charging rate.
 2. How long should the battery be fast charged at this 30 Amp rate? (Hint – the charging time is calculated by dividing the Amp-Hour Rating by the charge rate.)
 - a. 4 hours
 - b. 3 hours
 - c. 2 hours
 - d. 1 hour
 3. Fast charging increases the risk of damage to the battery if it is done longer than:
 - a. 4 hours
 - b. 3 hours
 - c. 2 hours
 - d. 1 hour
- Monitor the battery during the charging process. If the electrolyte begins to spew or if the battery begins to feel excessively hot (over 125°F or 52°C) turn the charger off and allow the battery to cool. Resume charging at a lower rate after the battery has cooled down.
- Turn the charger off and disconnect it once charging is complete.
- Reconnect the negative battery cable.

Jump Starting (requires vehicle):

Important: Wear safety goggles.

- Follow the step-by-step Jump Starting in Case of Emergency procedure on Page X of the Service Manual Information **under the direction of your instructor** to jump start the live vehicle. Check off each step as you perform it.

4. Did you successfully complete the Jump Starting in Case of Emergency procedure?
 - a. Yes
 - b. No

Conclusion:

A charge rate of 3-5 amps can be used to slow charge a discharged battery. Although this method takes about 12-16 hours, the chance of overcharge damage is minimal. Fast charging is designed to bring a battery back up to a level where it can crank an engine within a short period of time. Never fast charge a battery for more than two hours or it may be damaged.

To avoid injury when jump starting a vehicle, be sure to make the last connection to a heavy, unpainted metal engine part at least 46 cm (18 in) away from the dead battery, **not to the negative (-) battery terminal**. This keeps sparks away from the battery.

