

Charging System 812FJ

Student Manual

Charging System

Activity 2

Charging System Description and Operation

Performance Objectives:

- Identify internal generator components.
- Identify charging system circuits.
- Describe charging system operation.
- Perform a No-Load charging system test.

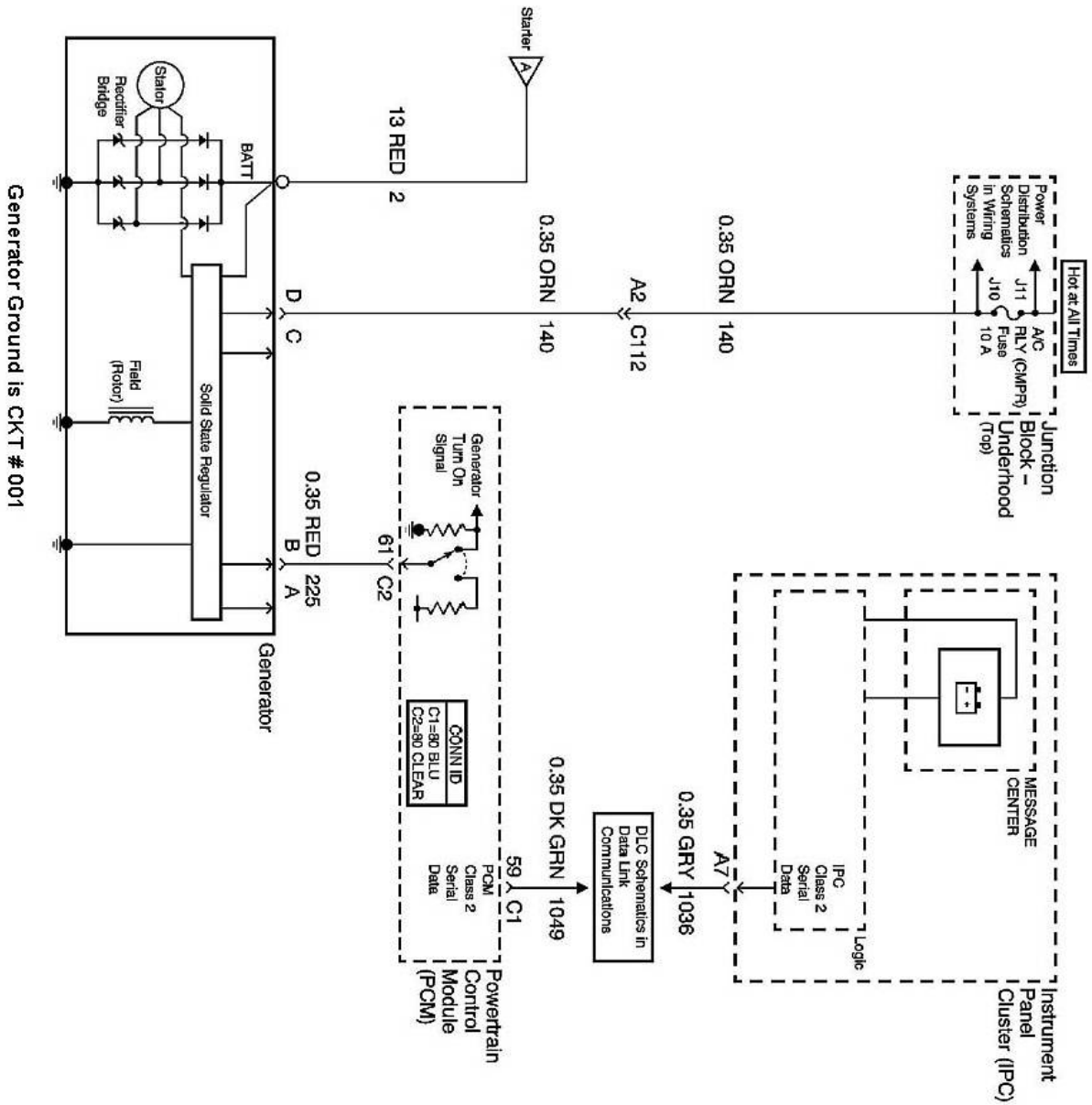
Tools and Materials:

- ATech Model 812FJ Charging System Trainer
- Fully charged 12-Volt Battery
- Jumper Cables (to connect the battery to the trainer)
- Digital Multi-Meter

References:

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

CHARGING SYSTEM SCHEMATIC



Reference Book:

- Read pages 4-1 to 4-8 in the Reference Book.

Review Questions:

- Answer the Review Questions on page 4-9. **Do not write in the Reference Book.**
Use a separate piece of paper to record your answers. (Answers are provided on page 4-10).

Service Manual Information:

- Refer to the Charging System Description and Operation on Page 2 of the Service Manual Information and the Charging System Schematic on the preceding page and answer the following questions:

Generator:

1. Technician A says that generator service on the 2003 Chevrolet Impala should only include tightening of mount components or generator replacement. Technician B says that the 2003 Chevrolet Impala generator is field-serviceable, and that internal generator parts can be replaced as necessary. 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

Regulator:

2. The voltage regulator switches the rotor field current on and off at a rate of:
 - a. 10 cycles per second
 - b. 90 cycles per second
 - c. 400 cycles per second
 - d. 1000 cycles per second

Circuit Description:

3. The generator's rotor creates what type of voltage in the stator windings?
 - a. Direct Current (DC)
 - b. Alternating Current (AC)
4. Technician A says that the generated DC voltage is converted to AC by the rectifier bridge. Technician B says that the generated AC voltage is converted to DC by the rectifier bridge. 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: On the actual vehicle, the generator is grounded through the mounting bracket to the engine block. The trainer's generator is grounded through the large black wire and ring terminal which mounts to one of the generator case half bolts. This wire is not shown in the Charging System Schematic because it is not found on the actual vehicle.

5. What is the wire color and circuit number for the generator turn-on signal circuit?
 - a. RED 2
 - b. ORN 140
 - c. RED 225
 - d. GRY 1036

6. What is the wire color and circuit number for the system voltage sense circuit?
 - a. RED 2
 - b. ORN 140
 - c. RED 225
 - d. GRY 1036

7. What is the wire color and circuit number for the generator output circuit?
 - a. RED 2
 - b. ORN 140
 - c. RED 225
 - d. GRY 1036

8. Technician A says that the system voltage sense circuit is used by the PCM as the reference for system voltage control. Technician B says that the system voltage sense circuit is used by the generator's voltage regulator as the reference for system voltage control. 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: In this particular application (2003 Chevrolet Impala 3.4), the system voltage sense circuit is redundant. If the voltage regulator sees less than 8 volts on this circuit, it switches internally to monitor the system voltage via the generator output circuit. This will not illuminate the charge indicator.

Charging System Indicator:

9. Technician A says that the Instrument Panel Cluster (IPC) turns on the charge indicator when the PCM detects that the generator output is less than 11 V or greater than 16 V. Technician B says that the Instrument Panel Cluster (IPC) turns on the charge indicator when it determines that system voltage is less than 11 V or greater than 16 V. 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

Conclusion:

The generator rotor produces a magnetic field which rotates within the stator. This rotating field produces AC voltage in the stator which is converted to DC voltage by the rectifier bridge. The voltage regulator monitors the generator's voltage output and varies the rotor field current to maintain the proper output voltage level. The generator is turned on and off by the PCM, and the charging system indicator is controlled by the IPC.

The 2003 Chevrolet Impala generator circuits are:

- Generator turn-on signal
- System voltage sense
- Generator output

Complete the On-Trainer Worksheet at this time.

On-Trainer Worksheet

Activity 2

Charging System Description and Operation

Tools and Materials:

- ATech Model 812FJ Charging System Trainer
- Digital Multi-Meter (DMM)
- Fully charged 12-Volt Battery

Procedures:

- Set the System Power Switch to the OFF position.
- Set the Ignition Switch to the OFF position.
- Set the Motor Switch (located on the trainer side of the motor) to the OFF (down) position.
- Make sure both of the trainer's Connector switches are in the connected position.
- Make sure the Scan Tool Mode / User Mode switch is in the down (User Mode) position.
- Connect the ATech Charging System Trainer to the 12-Volt Battery.

Be sure to observe the correct polarity!

- Turn the System Power Switch on.
- Turn the Ignition Switch on.

Note: All answers to questions with measured values are approximate. Choose the answer that is the closest to your actual measurement.

- Refer to the Charging System Schematic at the beginning of this activity as needed.

Power Check:

1. Using a DMM, measure and record the voltage between the trainer's Generator BATT and GND tip jacks. What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

2. Using a DMM, measure and record the voltage between the trainer's Generator GND tip jack and the generator output connection on the back of the generator case. What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

3. Using a DMM, measure and record the voltage between the trainer's Generator GND tip jack and the positive battery tip jack. What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

Ground Check:

4. Using a DMM, measure and record the voltage between the trainer's Generator BATT tip jack and the generator case. What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts
5. Using a DMM, measure and record the voltage between the trainer's Generator BATT tip jack and the negative battery tip jack. What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

PCM Ground Check:

6. Using a DMM, measure and record the voltage between the trainer's Generator BATT tip jack and the PCM GND harness connector. What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

Voltage Sense Circuit Check:

7. At which generator connector terminal does the system voltage sense circuit connect?
 - a. A
 - b. B
 - c. C
 - d. D
8. Using a DMM, measure and record the voltage between the trainer's Generator GND tip jack and the voltage sense circuit harness connector tip jack (your answer to the previous question). What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

Turn-On Signal Circuit Check:

9. Using a DMM, measure and record the voltage between the trainer's Generator GND tip jack and the C2-61 harness connector tip jack. What is the voltage?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

10. Refer to the Charging System Schematic. What signal is provided by the PCM at the C2-61 harness connector?
 - a. PCM Class 2 Serial Data
 - b. IPC Class 2 Serial Data
 - c. Generator Turn On Signal
 - d. Generator Output Voltage

11. At which generator connector terminal does the generator turn on signal circuit connect?
 - a. A
 - b. B
 - c. C
 - d. D

- Turn the Motor Switch (located on the trainer side of the motor) to the ON (up) position.

12. With the motor running, the GEN-L indicator is:
 - a. On
 - b. Off

13. With the motor running, what is the voltage measurement between the trainer's Generator GND tip jack and the C2-61 harness connector tip jack?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

14. With the motor running, what is the voltage measurement between the trainer's Generator BATT and GND tip jacks?
 - a. Fourteen (14) Volts
 - b. Twelve (12) Volts
 - c. Five (5) Volts
 - d. Zero (0) Volts

Note: This measurement of system voltage with the charging system operational and no extra load applied is called a No-Load test. It is referenced in some manufacturers' service information.

15. Technician A says that an increase in measured system voltage with the engine running indicates that the generator is charging. Technician B says that further testing may be necessary to determine if the charging system is operating properly. Which Technician is correct?
- Technician A only
 - Technician B only
 - Both Technician A and Technician B are correct
 - Neither Technician A nor Technician B is correct
- Open the trainer's PCM harness connector switch.
16. With the motor running and the PCM harness connector switch open, the GEN-L indicator is:
- On
 - Off
- Wait 30 seconds after opening the PCM harness connector switch before making the next measurement.
17. With the motor running and the PCM harness connector switch open, what is the voltage measurement between the trainer's Generator BATT and GND tip jacks?
- Fourteen (14) Volts
 - Twelve (12) Volts
 - Five (5) Volts
 - Zero (0) Volts
- Close the trainer's PCM harness connector switch.
 - Open the trainer's generator harness connector switch.
18. With the motor running and the generator harness connector switch open, the GEN-L indicator is:
- On
 - Off
- Wait 30 seconds after opening the generator harness connector switch before making the next measurement.
19. With the motor running and the PCM harness connector switch open, what is the voltage measurement between the trainer's Generator BATT and GND tip jacks?
- Fourteen (14) Volts
 - Twelve (12) Volts
 - Five (5) Volts
 - Zero (0) Volts

20. Does the generator appear to be capable of charging without a turn on signal??

- a. Yes
- b. No

- Set both of the trainer's Connector switches to the connected position.
- Set the Motor Switch (located on the trainer side of the motor) to the OFF (down) position.
- Set the Ignition Switch to the OFF position.
- Set the System Power Switch to the OFF position.
- Disconnect the ATech Charging System Trainer from the 12-Volt Battery.

Conclusion:

When the engine is running, the PCM sends a turn-on signal to the generator. The system voltage sense circuit receives battery positive voltage, and is used by the generator's voltage regulator as the reference for system voltage control. A No-Load test can indicate whether the generator is charging, but it is not a complete charging system test.

