

Charging System 812FJ

Student Manual

Charging System

Activity 4

Charging System Diagnosis

Performance Objectives:

- Perform Charging System Test per Service Manual Information.
- Practice charging system fault diagnosis.

Tools and Materials:

- ATech Model 812FJ Charging System Trainer
- Fully charged 12-Volt Battery
- Jumper Cables (to connect the battery to the trainer)
- Starting and Charging Tester with inductive ammeter and carbon-pile load (VAT 40 or equivalent)
- Digital Multi-Meter
- Tech 2 scan tool (optional)

References:

- 2003 Chevrolet Impala Service Manual Information

Service Manual Information:

- Read the first page of the DTC P0620 section on Page 8 of the Service Manual Information.

According to both the Circuit Description and our own observations and measurements, the PCM sends a 5 volt “command” signal to the voltage regulator via the GEN-L circuit to turn the generator on. The PCM’s fault detection circuitry monitors the voltage level of this signal. If the PCM “sees” any voltage less than 5V for more than 30 seconds while it is commanding the generator on, P0620 sets.

This strategy also allows the voltage regulator to “signal” the PCM by pulling this voltage low if it “sees” a charging system problem.

1. Technician A says that on this vehicle the engine must be running for DTC P0620 to set. Technician B says that on this vehicle, DTC P0620 will set with the key on and engine off. 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
2. Technician A says that on this vehicle, DTC P0620 will illuminate the MIL when set. Technician B says that on this vehicle, DTC P0620 will not illuminate the MIL when set. 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

Charging System Testing Review:

Begin diagnosis with a review of the system’s description and operation.

The diagnostic system check comes next. This verifies scan tool communication, checks for DTCs, and helps the technician determine a diagnostic path.

The ATech Model 812FJ Charging System Trainer has a built-in scan tool that will display and control charging system functions. Optionally, a Tech 2 scan tool can be used in system diagnosis if it is available. When using a Tech 2 to diagnose the trainer, functions and options not related to the charging system will not be available.

Note: The ATech Model 812FJ Charging System Trainer does not have network communication functions built in. Network communication diagnosis is beyond the scope of this Charging Systems course.

The next diagnostic step is a visual inspection of the system for add-on devices, obvious damage, or abnormal conditions which could cause a system problem, set a DTC or cause a customer complaint.

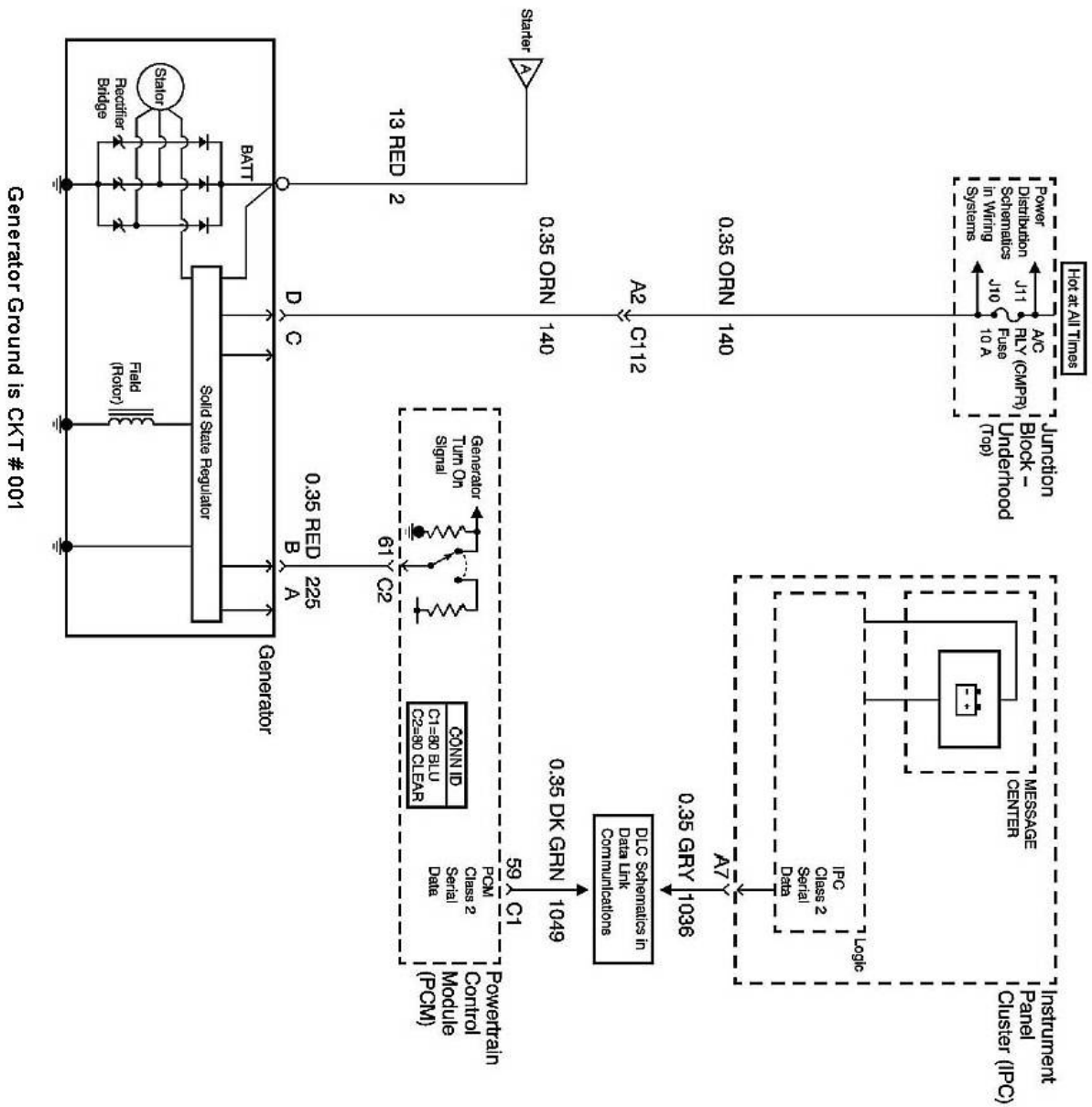
This will be followed by a system test that should guide the technician towards pinpointing the source of the problem.

Conclusion:

When troubleshooting the charging system, refer to the manufacturer's procedures and verify system operation to save time and avoid false diagnosis.

Complete the On-Trainer Worksheet at this time.

CHARGING SYSTEM SCHEMATIC



On-Trainer Worksheet

Activity 4

Charging System Diagnosis

Tools and Materials:

- ATech Model 812FJ Charging System Trainer
- Fully charged 12-Volt Battery
- Jumper Cables (to connect the battery to the trainer)
- Starting and Charging Tester with inductive ammeter and carbon-pile load (VAT 40 or equivalent)
- Digital Multi-Meter
- Tech 2 scan tool (optional)

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.
- Ask your instructor to insert Fault #2 into the trainer.
- Turn the Ignition Switch on.

1. Which Indicators come on? (choose all that apply if more than one)
 - a. GEN-L
 - b. BATT
 - c. MIL
 - d. All of these

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

2. Which Indicators come on? (choose all that apply if more than one)
 - a. GEN-L
 - b. BATT
 - c. MIL
 - d. All of these

- Let the motor run for at least one minute.
- Flip the Motor Switch (located on the trainer side of the motor) to the OFF (down) position.

Note: Step and sub-step refer to the Service Manual Information. Question refers to the numbered questions in this activity.

- Following the step-by-step Service Manual Information procedure, perform the Charging System Test on the trainer. Check off each step as you perform it. Use the Charging System Schematic provided at the beginning of this activity as needed.
- Step 1 in this procedure is a DTC check. Either the trainer's scan tool mode or a Tech 2 can be used.

Note: When using a Tech 2 to diagnose the trainer, program the vehicle as a 2003 Chevrolet Impala 3.4 VIN E RPO LA1 engine. Functions and options not related to the charging system will not be available.

3. Are there any charging system-related DTCs set?
 - a. Yes
 - b. No

- Skip Step 2, which is a Battery Test and Inspection. You should be using a known-good, fully-charged battery for this on-trainer exercise.

Note: As per Step 2, when performing the Charging System Test on a live vehicle, a good, fully-charged battery must be installed for the results to be accurate. Battery testing and service procedures are covered in Activities 7 through 11 of this course.

- Step 3 has four sub-steps.
 - For Step 3-1, either the trainer's scan tool mode or a Tech 2 can be used.
 - For Step 3-2, flip the Motor Switch (located on the trainer side of the motor) to the ON (up) position.
 - For Step 3-3, either the trainer's scan tool mode or a Tech 2 can be used.
 - For Step 3-4, either a DMM connected to the trainer's battery tip jacks, the trainer's Battery Voltage display or a Tech 2 can be used to observe voltage.

4. As per Step 3-3, does the voltage change with each command?
 - a. Yes
 - b. No
5. Based upon your answer to Question 4, what step are you directed to next?
 - a. Step 4
 - b. Step 5
 - c. Step 6
 - d. Step 8

Note: The connect/disconnect switches on the trainer are to be used when the diagnostic procedure calls for harness or component disconnection.

6. Based upon your answer to Question 5, does commanding the GEN-L circuit on and off result in the expected voltage readings? (~5V when commanded on, ~0V when commanded off)
 - a. Yes
 - b. No

7. Based upon your answer to Question 6, what step are you directed to next?
 - a. Step 9
 - b. Step 11
 - c. Step 12
 - d. Step 14

8. Which circuit number contains the fault?
 - a. 001
 - b. 002
 - c. 140
 - d. 225
 - e. 1036
 - f. 1049

9. This fault could be further pinpointed by repeating Step 8 of the Charging System Test while measuring the voltage of:
 - a. Circuit 225 at the PCM Harness Connector
 - b. Circuit 140 at the Generator Connector
 - c. Circuit 2 at the back of the Generator
 - d. None of these

10. What type of fault did you find in the circuit?
 - a. An open circuit
 - b. A short to ground
 - c. A short to voltage
 - d. Excessive resistance

- 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.
- Clear the inserted Fault #2, or ask your instructor to clear it.

Service Manual Information:

- Review the first page of the DTC P0620 section on Page 8 of the Service Manual Information.

11. Technician A says that this fault met the conditions to set DTC P0620 and that the DTC should have set. Technician B says that this fault did not meet the conditions to set DTC P0620. 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

The open circuit did not cause the GEN-L signal voltage to be pulled low as seen by the PCM. Since the conditions to set DTC P0620 were not met, the DTC did not set. If this fault (GEN-L circuit open) occurred on an actual vehicle, the Charge Indicator would illuminate once the PCM saw the system voltage drop below a specific level for a specific length of time. A low system voltage DTC could also set.

Procedures:

- Ask your instructor to insert Fault #4 into the trainer.
- Turn the Ignition Switch on.
- Flip the Motor Switch (located on the trainer side of the motor) to the ON (up) position.
- Let the motor run for at least one minute.
- Flip the Motor Switch (located on the trainer side of the motor) to the OFF (down) position.
- Following the step-by-step Service Manual Information procedure, perform the Charging System Test on the trainer. Check off each step as you perform it. Use the Charging System Schematic provided at the beginning of this activity as needed.
- Step 1 in this procedure is a DTC check. Either the trainer's scan tool mode or a Tech 2 can be used.

12. Did this fault set a DTC P0620?

- a. Yes
- b. No

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

Service Manual Information:

- Begin your diagnostics at Step 3 of the DTC P0620 diagnostic chart on Page 9 of the Service Manual Information. As before, either the trainer's scan tool mode or a Tech 2 can be used.

Note: The connect/disconnect switches on the trainer are to be used when the diagnostic procedure calls for harness or component disconnection.

13. As per Step 3, does the voltage (either on the scan tool or on a DMM connected to the trainer's battery tip jacks) change with each command?

- a. Yes
- b. No

14. As per Step 4, is the PCM sending out the 5V turn-on signal?

- a. Yes
- b. No

- Step 4 directed you to command the generator on with the key on and engine off while measuring the GEN-L signal voltage on the harness side of the **disconnected** generator connector. Close the generator harness disconnect switch, (connect the harness) and then make this same measurement again (ignition on, motor off, command generator on).

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

15. What is the GEN-L signal voltage with the ignition on, motor off, harness connected, and generator commanded on?

- a. Five (5) Volts
- b. Two and a half (2.5) Volts
- c. One (1) Volt
- d. Zero (0) Volts

This is an example of the voltage regulator signaling the PCM by pulling the GEN-L signal low when it “sees” a charging system problem.

- Command the generator off, but leave the ignition on.

16. Based upon your answer to Question 4, what step are you directed to next?

- Step 5
- Step 7
- Step 8
- Step 11

17. This step directs you to check:

- The GEN-L circuit for a short or open
- The voltage sense circuit for high resistance or an open
- The generator harness connector for poor connections
- The PCM harness connector for poor connections

18. Measure and record the voltage between the trainer’s Generator GND tip jack and the voltage sense circuit (pin D) harness connector tip jack. What is the voltage?

- Fourteen (14) Volts
- Twelve (12) Volts
- Five (5) Volts
- Zero (0) Volts

- The generator harness includes the generator output circuit.

19. Measure the voltage between the trainer’s Generator BATT and GND tip jacks. What is the voltage?

- Fourteen (14) Volts
- Twelve (12) Volts
- Five (5) Volts
- Zero (0) Volts

20. Refer to the Charging System Schematic provided at the beginning of this activity. What should this voltage be?

- Fourteen (14) Volts
- Twelve (12) Volts
- Five (5) Volts
- Zero (0) Volts

The voltage regulator failed to “see” battery voltage on the Generator output circuit, so it pulled the GEN-L circuit voltage down to signal the PCM.

21. Which circuit number contains the fault?

- 001
- 2
- 140
- 225

22. What type of fault did you find in the circuit?

- a. An open circuit
- b. A short to ground
- c. A short to voltage
- d. Excessive resistance

- Set both of the trainer's Connector switches to the connected position.
- Set the Ignition Switch to the OFF position.
- Clear the inserted Fault #4, or ask your instructor to clear it.
- Set the System Power Switch to the OFF position.
- Disconnect the ATech Charging System Trainer from the 12-Volt Battery.

Optional Activity: Insert Fault #4 again with the ignition on and the motor running, and while observing the voltage measurement between the trainer's Generator BATT and GND tip jacks. This simulates this fault occurring while driving. Then, while the fault is still in place, turn the motor and ignition off and back on again.

Conclusion:

Charging system diagnostics should be performed following manufacturer's procedures. They will not always pinpoint every problem, but will provide diagnostic direction and verification of what is and isn't working properly within a system.