

# P0645, P0646, or P0647 Ignition voltage is supplied directly to the A/C compressor clutch relay

## Circuit Description

Ignition voltage is supplied directly to the A/C compressor clutch relay. The engine control module (ECM) controls the relay by grounding the A/C clutch relay control circuit via an internal solid state device called a driver. The primary function of the driver is to supply the ground for the component being controlled. The driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be near 0 volts. When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be near battery voltage. If the fault detection circuit senses a voltage other than what is expected, this DTC will set. The ECM will monitor the control circuit for the following:

- A short to ground
  - A short to voltage
  - An open circuit
  - An open relay coil
  - An internally shorted or excessively low resistance relay coil
- When the ECM detects any of the above malfunctions, this DTC is set and the affected driver is disabled.

## Conditions for Running the DTC

- The ignition voltage is between 9.0–18.0 volts.
- The engine speed is more than 80 RPM.
- The ECM driver transitions from ON to OFF or from OFF to ON.

## Conditions for Setting the DTC

**P0645:** The ECM detects an open on the control circuit of the A/C compressor clutch relay.

**P0646:** The ECM detects a short to ground on the control circuit of the A/C compressor clutch relay.

**P0647:** The ECM detects a short to voltage on the control circuit of the A/C

compressor clutch relay.

## Action Taken When the DTC Sets

- The ECM will not illuminate the malfunction indicator lamp (MIL).
- The ECM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the DTC

- A History DTC clears after forty consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

## Diagnostic Aids

**Important:** Be sure to verify that the ECM engine grounds are secure and clean. If DTC P0645,P0646,P0647 cannot be duplicated, reviewing the Failure Records vehicle millage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition. If the condition is not present, refer to Testing for Intermittent and Poor Connections on page 8-1187 in Wiring Systems.

## Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. Listen for an audible click when the A/C compressor clutch relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Tests for voltage at the coil side of the A/C compressor clutch relay. The 10-amp fuse supplies power to the coil side of the A/C compressor clutch relay.
4. Verifies that the engine control module is providing ground to the A/C compressor clutch relay. If light always on circuit shorted to ground.
8. Tests for a short to voltage or an open.
10. If the A/C fuse is open ensure to test the A/C compressor clutch supply voltage circuit for short to ground.

Step	Action	Yes	No
<b>Schematic Reference: HVAC Schematics Connector End View</b> <b>Reference: HVAC Connector End Views</b>			
1	Did you perform the Vehicle Diagnostic System Check?	Go to Step 2	Go to Diagnostic System Check -HVAC Systems -Automatic
2	<ol style="list-style-type: none"> <li>1. Install a scan tool.</li> <li>2. Turn ON the ignition, with the engine OFF.</li> <li>3. With a scan tool, command the A/C Relay ON and OFF in the ECM Special Functions, Engine Output Controls list.</li> </ol> Does the A/C Relay turn ON and OFF with each command?	Go to Testing for Intermittent and Poor Connections in Wiring Systems	Go to Step 3
3	<ol style="list-style-type: none"> <li>1. Turn OFF the ignition.</li> <li>2. Disconnect the A/C compressor clutch relay.</li> <li>3. Turn ON the ignition, with the engine OFF.</li> <li>4. Probe the battery positive voltage circuit of the A/C compressor clutch relay with a test lamp that is connected to a good ground.</li> </ol> Does the test lamp illuminate?	Go to Step 4	Go to Step 8
4	<ol style="list-style-type: none"> <li>1. Connect a test lamp between the control circuit of the A/C compressor clutch relay and the battery positive voltage circuit of the A/C compressor clutch relay.</li> <li>2. Start the engine.</li> <li>3. With a scan tool, command the A/C Relay ON and OFF.</li> </ol> Does the test lamp turn ON and OFF with each command?	Go to Step 6	Go to Step 5

Step	Action	Yes	No
5	Test the control circuit of the A/C compressor clutch relay for a short to ground, short to voltage or an open. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 7
6	Inspect for poor connections at the A/C compressor clutch relay. Refer to Testing for Intermittent and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 9
7	Inspect for poor connections at the harness connector of the engine control module. Refer to Testing for Intermittent and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to Step 11	Go to Step 10
8	Repair the battery positive voltage circuit of the A/C compressor clutch relay. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	Go to Step 11	—
9	Replace the A/C compressor clutch relay. Did you complete the replacement?	Go to Step 11	—
10	Important: Perform the recalibration procedure for the engine control module (ECM). Replace the ECM. Refer to Engine Control Module (ECM) Replacement in Engine Controls – 3.6L (LY7) or Engine Control Module (ECM) Replacement in Engine Controls – 4.6L (LH2). Did you complete the replacement?	Go to Step 11	—
11	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 2	System OK