Product: GENERATOR SET
Model: 3456 GENERATOR SET C4G
Configuration: 3456 Generator Set C4G00001-UP

Troubleshooting
3406E and 3456 Generator Set Engines
Media Number -RENR2227-04 **Publication Date -01/07/2004** **Date Updated -19/07/2004**

i02096040

Engine Speed/Timing Sensor Circuit - Test

SMCS - 1912-038

System Operation Description:

The engine is designed to use two speed/timing sensors, the primary speed/timing sensor and the secondary speed/timing sensor. The engine speed/timing sensors provide information to the Electronic Control Module (ECM) by generating pulse signals as the timing reference ring rotates past the magnetic pickups on the sensors. Both sensors are magnetic sensors with an integral connector. The sensors must be serviced as a pair. If one sensor requires replacement, both sensors be replaced.

The secondary engine speed/timing sensor provides continuous operation of the engine if the primary engine speed/timing sensor fails. The loss of signals from both engine speed/timing sensors will prevent the ECM from actuating the injectors. To prevent any unnecessary down time, correct any problems with the speed/timing circuit at the earliest possible convenience.

The engine speed/timing sensors are magnetic sensors that provide a frequency that is directly proportional to engine speed. A unique tooth on the timing reference ring passes by the engine speed/timing sensors. The engine speed/timing sensors produce a duty cycle output. This duty cycle provides the ECM with information on the crankshaft position.

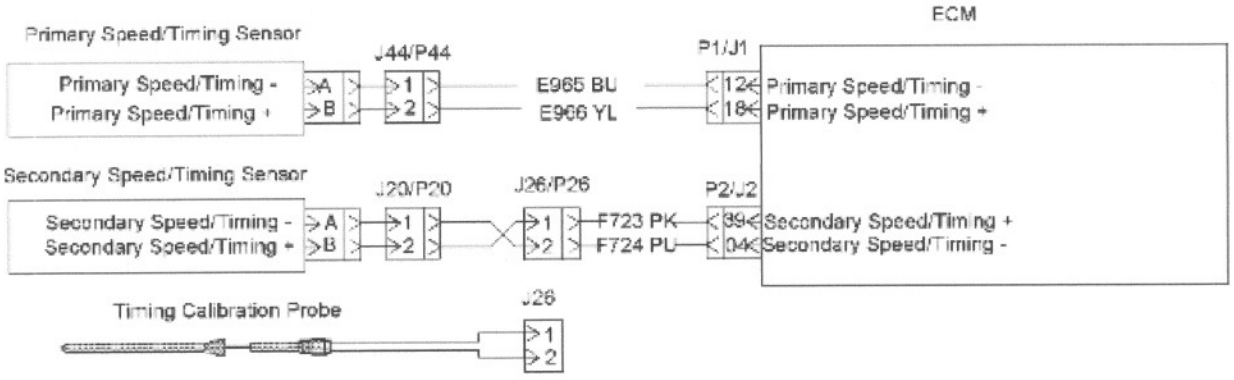

Illustration 1 g01068574
Schematic

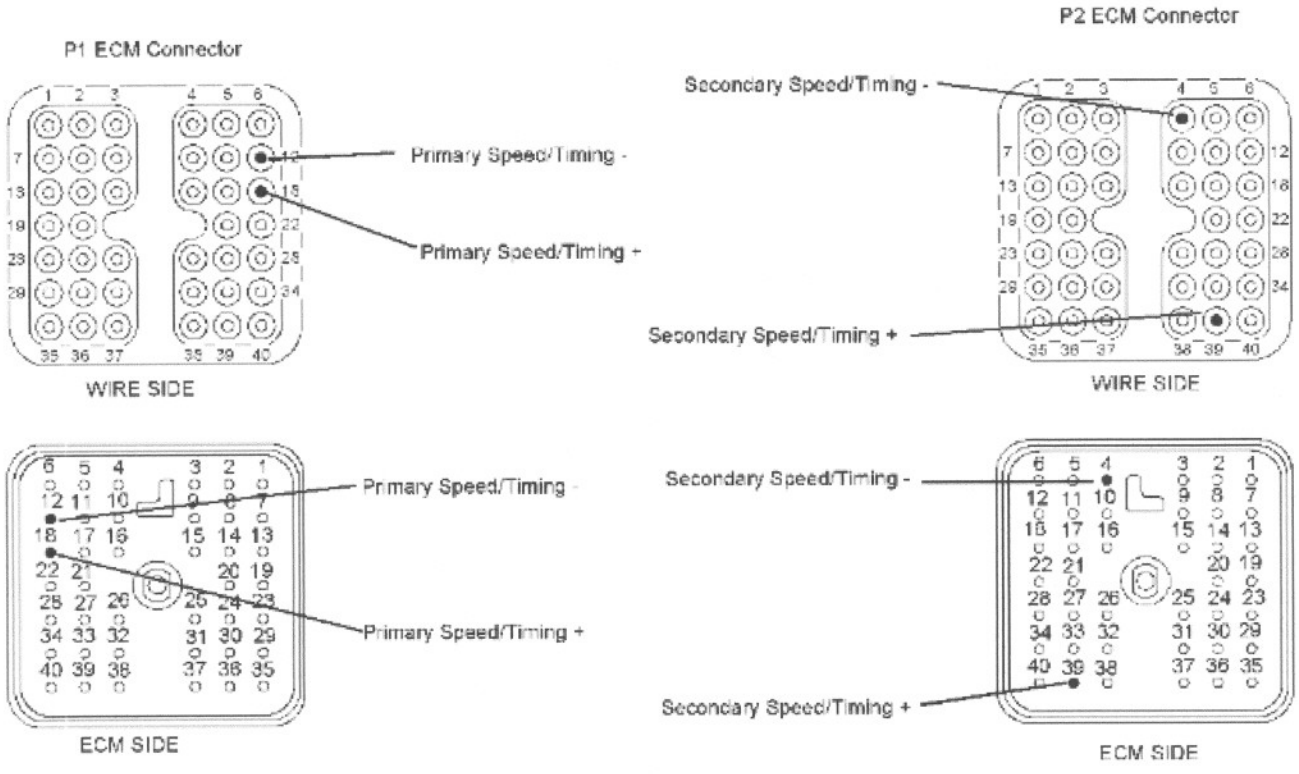

Illustration 2 g01068612
P1 and P2 ECM connectors

Test Step 1. Inspect Electrical Connectors and Wiring

A. Turn the Engine Control Switch (ECS) to the OFF/RESET position.

B. Thoroughly inspect all electrical connectors that may be suspect to the ECM. Refer to Troubleshooting, "Electrical Connectors - Inspect" for details.

C. Check the harness and wiring for abrasion and for pinch points from the engine speed/timing sensors to the ECM.

Expected Result:

All connectors, pins, and sockets are completely inserted and coupled. The harness and wiring are free of corrosion, of abrasion, and of pinch points.

Results:

- **OK -** Proceed to Test Step 2.
- **Not OK -**

  Repair: Repair the circuit. Verify that the repair eliminates the problem.

  Stop.

Test Step 2. Check for Diagnostic Codes

A. Connect the Caterpillar Electronic Technician (ET) to the service tool connector.

B. Turn the ECS to the ON position.

C. Look for the following diagnostic codes on Cat ET:

- 190-02
- 190-08
- 342-02
- 342-08

Expected Result:

None of the above diagnostic codes are active or recently logged.

Results:

- **OK -** The problem seems to be resolved.

  Repair: If you are troubleshooting an intermittent problem, refer to Troubleshooting, "Electrical Connectors - Inspect".

  Stop.

- **Not OK -** One of the above diagnostic codes is active or recently logged. Proceed to Test Step 3.

Test Step 3. Check the Engine Speed/Timing Sensor

A. Turn the circuit breaker for the battery to the OFF position.

B. Turn the ECS to the OFF/RESET position.

C. Disconnect the suspect sensor.

D. Inspect the bracket in order to ensure that the flange of the sensor is flush.

   Verify that the bracket is not bent.

   Note: The bracket cannot be replaced separately.

E. Remove the suspect sensor.

F. Ensure that the O-ring is installed on the sensor, and ensure that the O-ring is free of damage.

G. Measure the resistance between terminals 1 and 2 of the suspect sensor.

Expected Result:

The flange of the sensor is flush. The sensor mounting bracket is not bent. The O-ring is in place. The resistance of the primary sensor is between 75.0 to 230.0 Ohms and the resistance of the secondary sensor is between 600 to 1800 Ohms.

Results:

- **OK -** Install the sensor. Verify that the engine speed/timing sensor is seated properly and verify that the bracket is not bent. Do not reconnect the sensor to the engine harness. Proceed to Test Step 4.

- **Not OK -** The engine speed/timing sensor is not seated properly or the bracket is bent. The sensor resistance is out of the acceptable range.

  Repair: Install a new speed/timing sensor:

  1. Ensure that the O-ring is installed and free of damage.

  2. Ensure that the sensor is properly oriented and that the harness is secured in the proper

location.

3. Seat the sensor and tighten the bolt.

4. Verify that the repair eliminates the problem.

Stop.

Test Step 4. Check for a Short Circuit in the Wiring Harness

Note: If you are troubleshooting the primary speed/timing sensor disconnect the J1/P1 ECM connector. If you are troubleshooting the secondary speed/timing sensor disconnect the J2/P2 ECM connector.

Note: As you measure the resistance pull and/or shake on the wiring harness in order to check for an intermittent short.

A. Turn the circuit breaker for the battery to the OFF position.

B. Turn the ECS to the OFF/RESET position.

C. Measure the following resistances at the P1 or P2 connector:

Primary speed/timing circuit

- Measure the resistance between P1:18 and each individual socket on the J2 connector. Then measure the resistance between P1:18 and the engine ground.

- Measure the resistance between P1:12 (Primary engine speed/timing sensor -) and each individual socket on the J1 connector. Then measure the resistance between P1:12 and the engine ground .

Secondary speed/timing circuit

- Measure the resistance between P2:39 (Secondary engine speed/timing +) and each individual socket on the J1 connector. Then measure the resistance between P2:39 and the engine ground.

- Measure the resistance between P2:04 (Secondary engine speed timing -) and each individual socket on the J1 connector. Then measure the resistance between P2:04 and the engine ground.

Expected Result:

The resistance is greater than 20,000 Ohms for each measurement.

Results:

- **OK -** The circuit for the suspect sensor is not shorted in the harness. Proceed to Test Step 6.

- **Not OK -** There is a short circuit in the harness.

Repair: Repair the circuit.Verify that the repair eliminates the problem.

Stop.

Test Step 5. Check for an Open Circuit in the Harness

A. Fabricate a jumper wire with pins at both ends.

B. Install the jumper wire into the appropriate ECM connector and then measure the resistance of the circuit.

Primary speed/timing circuit

- Install the jumper wire to short P1:12 (Primary speed/timing -) and P1:18 (Primary speed/timing +) together.
- Measure the resistance between P20:1 (Primary speed/timing -) and P20:2 (Primary speed/timing +).

Secondary speed/timing circuit

- Install the jumper wire to short P2:04 (Secondary speed/timing -) and P2:39 (Secondary speed/timing +) together.
- Measure the resistance between P44:1 (Secondary speed/timing -) and P44:2 (Secondary speed/timing +).

C. Remove the jumper wire.

Expected Result:

The resistance is less than 10 Ohms when the jumper wire is installed.

Results:

- **OK -** The circuit for the suspect sensor is not open in the harness. The sensor appears to be OK. However, it is possible that there is still a problem with the sensor. Proceed to Test Step 6.
- **Not OK -** There is an open circuit or excessive resistance in the harness or connectors.

  Repair: Repair the circuit.Verify that the repair eliminates the problem.

  Stop.

Test Step 6. Test the Operation

A. Reconnect the sensor to the harness and reconnect the harness to the ECM.

B. Start the engine. Run the engine at normal operating temperature.

Expected Result:

The engine operates normally.

Results:

- **OK -** The engine operates normally. There are no active diagnostic codes for the speed/timing sensor. The initial diagnostic code was probably caused by a poor electrical connection in one of the harness connectors. **Stop.**
- **Not OK -** The engine did not operate normally. A diagnostic code was activated for the speed/timing sensor. There may be a problem with the speed/timing sensor or with the ECM. Proceed to Test Step 7.

Test Step 7. Replace the Sensor

A. Turn the circuit breaker for the battery to the OFF position.

B. Turn the ECS to the OFF/RESET position.

C. Remove the original speed/timing sensor. Install an engine speed/timing sensor that is known to be good.

D. Turn the ECS to the ON position.

Expected Result:

The problem seems to be resolved. There are no active diagnostic codes for the speed/timing sensor.

Results:

- **OK -** Replacing the sensor resolved the problem. There are no active diagnostic codes. Resume normal operation. **Stop.**
- **Not OK -** The problem was not resolved by switching the sensors. A diagnostic code was activated. The wiring and the sensor are apparently OK. There may be a problem with the ECM.

  Repair: Exit this procedure and perform this procedure again. If the condition is not resolved, install a new ECM according to Troubleshooting, "Replacing the ECM".Verify that the problem is resolved.

  Stop.
