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

Troubleshooting

3406E and 3456 Generator Set Engines

Media Number -REN2227-04

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i02093817

Electrical Power Supply Circuit - Test

SMCS - 1401-038

System Operation Description:

The Electronic Control Module (ECM) receives electrical power (battery voltage) through four input signals from the Engine Control Switch (ECS) when the ECS is in AUTO, START, or STOP position.

An input is provided to the ECM that detects the position of the ECS. When the ECM detects battery voltage on this input, the ECM will power up. When the battery voltage is removed from the input the ECM will power down.

The engine ECM requires the ECS to be in the AUTO, START or STOP position in order to maintain communications with the Caterpillar Electronic Technician (ET).

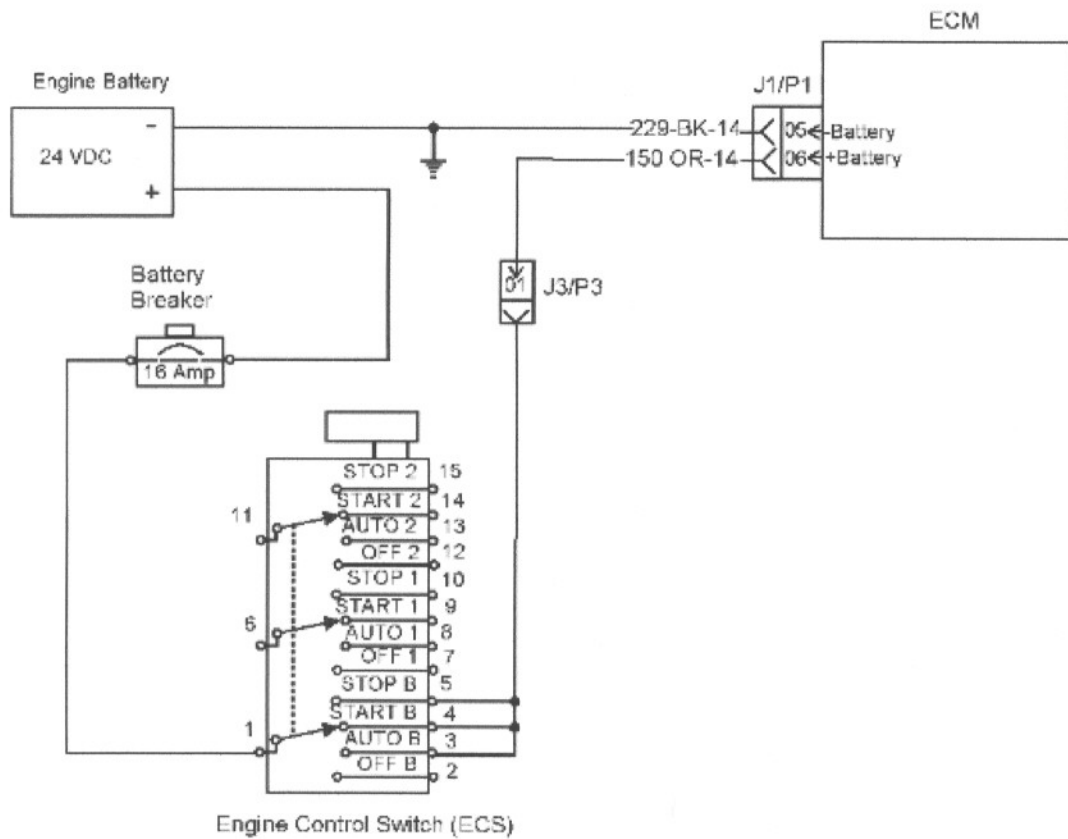


Illustration 1
Schematic

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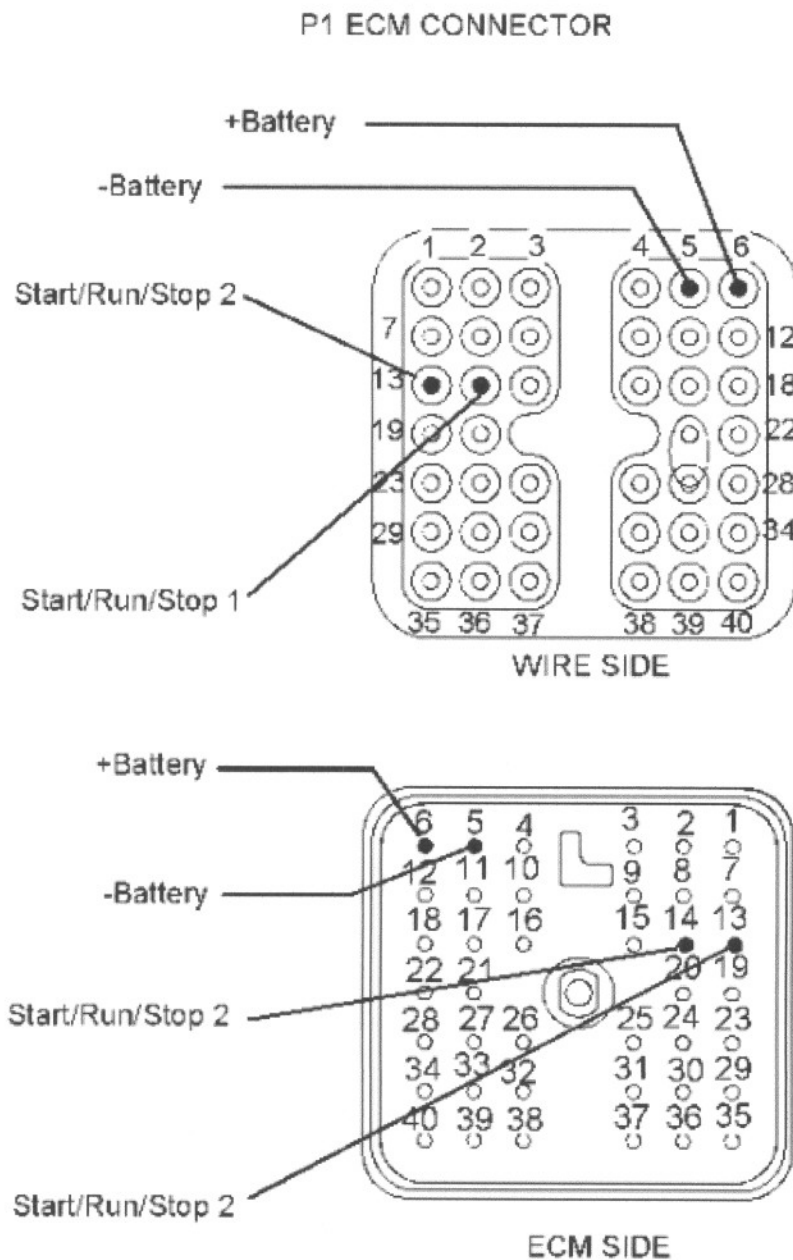


Illustration 2
P1 ECM connector

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Test Step 1. Inspect the Electrical Connectors and the Wiring

- A. Turn the ECS to the OFF/RESET position.
- B. Turn the battery disconnect switch to the OFF position.
- C. Thoroughly inspect J1/P1 and J2/P2 (ECM connectors). Inspect all of the other connectors. Refer

to the diagnostic functional test Troubleshooting, "Electrical Connectors - Inspect" for details.

- D. Perform a 45 N (10 lb) pull test on each of the wires in the ECM connector that are associated with the following connections:
- P1:06 (+Battery)
 - P1:05 (-Battery)
 - P1:14 (Start/run/stop 1)
 - P1:13 (Start/run/stop 2)
- E. Check the ECM connector (allen head screw) for the proper torque of 6.0 N·m (53 lb in).
- F. Check the harness and the wiring for abrasion and for pinch points.

Expected Result:

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

Results:

- **OK** - The connectors and wiring are okay. Proceed to Test Step 2.
- **Not OK** - The connectors and/or wiring are not okay.

Repair: Repair the connectors and/or wiring or replace the connectors and/or wiring.

Stop.

Test Step 2. Check the Voltage to the ECM

- A. Remove J1/P1 (ECM connector).
- B. Turn the circuit breaker for the battery to the ON position.
- C. Turn the ECS to the STOP position.
- D. Measure the voltage between P1:06 (+Battery) and P1:05 (-Battery).
- E. Turn the ECS to the OFF/RESET position.
- F. Turn the circuit breaker for the battery to the OFF position.
- G. Reconnect J1/P1 (ECM connector).

Expected Result:

The voltage is 25 ± 2 VDC.

Results:

- **OK** - The ECM is receiving the correct voltage. Proceed to Test Step 6.
- **Not OK** - The voltage is incorrect. The battery or the alternator may be causing the problem.

Repair: Repair the wiring or replace the wiring between the ECM and the battery. Verify that the repair has eliminated the problem.

If the problem has not been eliminated, proceed to Test Step 3.

Test Step 3. Check the Battery Voltage

- A. Turn the circuit breaker for the battery to the OFF position.
- B. Turn the ECS to the OFF/RESET position.
- C. Measure the no-load battery voltage at the battery terminals.
- D. Load test the batteries. Use the **4C-4911** Battery Load Tester. Refer to the Operating Manual, SEHS9249. Refer to Special Instruction, SEHS7633.

Expected Result:

The no-load voltage at the batteries is at least 23.5 VDC, and the batteries pass the load test.

Results:

- **OK** - The batteries are not the problem. Proceed to Test Step 4.
- **Not OK** - The battery voltage is incorrect and/or the battery fails the load test.

Repair: The batteries or the alternator are causing the problem. Recharge the batteries or replace the batteries. Verify that the original condition is resolved.

If the problem has not been eliminated, proceed to Test Step 4.

Test Step 4. Check the Voltage at the Engine Control Switch (ECS)

- A. Reconnect J1/P1 (ECM connector).
- B. Turn the ECS to the STOP position. Measure the voltage between wire 229-BK-14 (ECM ground connection) and the following terminals of the ECS:
 - Terminal 1
 - Terminal 3

- Terminal 4
 - Terminal 5
- C. Perform the same test with the ECS in the START, and in the AUTO and in OFF/RESET positions.

Expected Result:

The voltage is 25 ± 2 VDC when the ECS is in the STOP position.

The voltage is 25 ± 2 VDC when the ECS is in the START position.

The voltage is 25 ± 2 VDC when the ECS is in the AUTO position.

There is no voltage when the ECS is set to OFF/RESET position.

Results:

- **OK** - The ECS has the correct voltage on all terminals, terminal 1, terminal 3, terminal 4, and terminal 5. When the ECS is set to OFF/RESET, the ECS has no voltage on terminal 3, no voltage on terminal 4, and no voltage on terminal 5. Proceed to Test Step 5.
- **Not OK** - The ECS does not have the proper voltage. The ECS is suspect.

Repair: Temporarily replace the ECS. If the new ECS eliminates the problem, reinstall the suspect ECS. If the problem returns with the suspect ECS replace the ECS.

If the problem has not been resolved, proceed to Test Step 5.

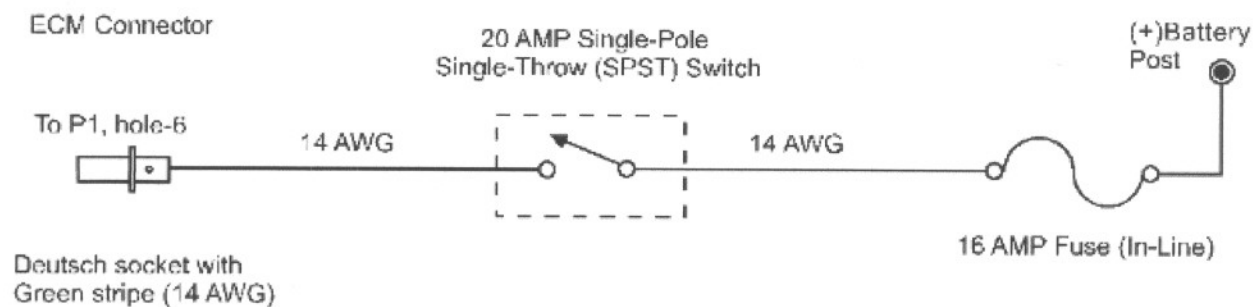
Test Step 5. Bypass the Engine Wiring

Illustration 3

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Note: The bypass is only for this test procedure. The bypass may be left on the engine temporarily in order to test for intermittent problems due to interruptions in battery power to the ECM. The ECS must

be placed in the START or in the STOP position and the bypass switch must be activated for normal engine operation.

Note: Deactivate the bypass switch before performing the following procedures.

- A. Build a bypass circuit. Refer to 3.
- B. Connect the battery end of the bypass directly to the +Battery terminal.
- C. Remove P1:6 (+Battery).
- D. Crimp a Deutsch socket pin (green stripe) to the other end of the bypass. Insert the crimped end into the connection for P1:6.

Note: Use electrical tape on all temporary connections. Wrap the connections tightly in order to keep the connections clean. Securing the connection tightly will also prevent the connections from shorting out. Also, wrapping the connections securely will prevent the connections from becoming loose during engine operation.

- E. Reconnect all connections and restore all wiring to the original condition.

Expected Result:

There is no problem with the operation of the engine.

Results:

- **OK** - The symptoms disappear when the bypass is installed. The symptoms return when the bypass is removed.

Repair: The problem appears to be in the engine wiring that supplies power to the ECM. Repair the engine wiring or replace the engine wiring. Verify that the repairs have eliminated the problem.

If the problem has not been eliminated, proceed to Test Step 6.

- **Not OK** - The symptoms continue when the bypass is installed.

Repair: The problem is not in the electrical system. There may be a mechanical problem. Refer to the appropriate section in Troubleshooting, "Troubleshooting Without a Diagnostic Code".

Stop.

Test Step 6. Check the Voltage at the Sensor Power Supplies.

- A. Turn the ECS to the STOP position.
- B. Measure the voltage between P1:36 (Analog supply) and P1:30 (Analog return).
- C. Measure the voltage between P1:35 (Digital supply) and P1:29 (Digital return).

Expected Result:

The voltage is 5.0 ± 0.2 VDC between P1:36 (Analog supply) and P1:30 (Analog return).

The voltage is 8.0 ± 0.2 VDC between P1:35 (Digital supply) and P1:29 (Digital return).

Results:

- **OK** - The sensor power supply is functioning properly. The ECM is powered up. The problem is not in the electrical system. **Stop.**
- **Not OK** - If the ECM is getting the correct voltage at the +Battery terminal, but the ECM does not supply the correct voltages to the sensors, replace the ECM.

Repair: Refer to the diagnostic procedure Troubleshooting, "Replacing the ECM".

Stop.