General Theory

The 7.5 amp fuse is located on the generator control console. A blown fuse will prevent battery power from reaching the circuit board with the same result as setting the controller to OFF. The display and menus will remain active but the unit will not be able to crank or run.

Procedure

Remove and inspect the 7.5 amp fuse (F1). Visually inspect the fuse and fuse element. If the fuse element looks good, or if it cannot be visually inspected, test the fuse for an open with a DMM or Continuity Tester.

Results

1. If the fuse if good, refer back to the Flow Chart.
2. If the fuse is bad, it should be replaced. Use only an identical 7.5 amp replacement fuse.
3. If fuse continues to blow, proceed to **Problem 19** Flow Chart.

Test 45 – Check Battery and Cables

General Theory

Battery power is used to (a) crank the engine and (b) to power the circuit board. Low or no battery voltage can result in failure of the engine to crank, either manually or during automatic operation. The battery charger in the control panel is not designed to recharge a dead battery. As well, if there is a loose connection or corrosion associated with a wire (positive or negative), battery voltage may be present, but because of the high resistance, will not allow current to flow. Electrical voltage drop varies according to current flow. Unless the circuit is operated so current flows through it, voltage drop cannot be measured. To properly measure voltage drop, a crank attempt will need to be performed. This test will determine whether the battery, battery cables, or both are at fault.

Procedure A. Perform Starter Circuit Voltage Drop Test

1. Remove the T1 fuse from the transfer switch.
2. Set a DMM to measure DC voltage.
3. Connect the Red meter test lead to the positive battery post and connect the Black meter test lead to the negative battery post.
   a. If battery voltage is 12.1 VDC or below, or if engine does not crank (turn over), proceed to Procedure C or Procedure D.
   b. If battery voltage is 12.2 VDC or above, proceed to next step. (For this test, battery voltage should be at least 12.2 VDC)
4. Turn off the fuel source and remove Wire 14 from the fuel solenoid to inhibit any possible startup.
5. Refer to battery post and starter connections in ***Figure 4-41*** and ***Figure 4-42*** and perform a voltage drop test as indicated.

NOTE: Single Cylinder units have a bulkhead mounted starter solenoid.

6. Set the controller to MANUAL. Measure and record the voltage.
7. Record readings from test points V1, V2, V3 and V4 as depicted in ***Figure 4-41*** and ***Figure 4-42***. Although resistance-free connections, wires and cables would be ideal, most of them will contain at least some voltage drop. The maximum voltage readings you should see are as follows:
   a. 0.00-0.10 VDC across a connection (V4).
   b. 0.10-0.20 VDC on a ground connection.
   c. 0.20-0.30 VDC across a wire or cable (V1, V2).
   d. 0.20-0.30 VDC across a switch or starter contactor (V3).
   e. 0.40-0.50 VDC across the entire circuit.

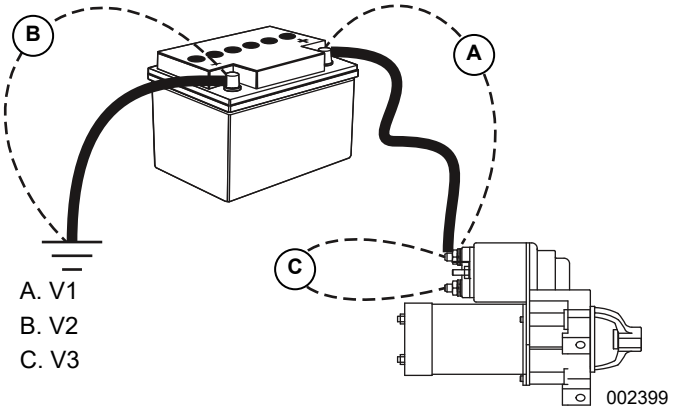


Figure 4-41.

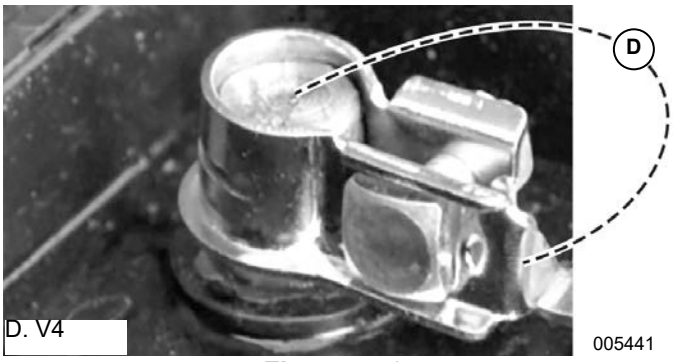


Figure 4-42.

8. If voltage drop is greater than the above, based on the circuit or component, proceed to Procedure B. If voltage drop is within the above, based on the circuit or component, proceed to Procedure C or D.

Procedure B. Inspect Battery Cables, Terminals and Connections

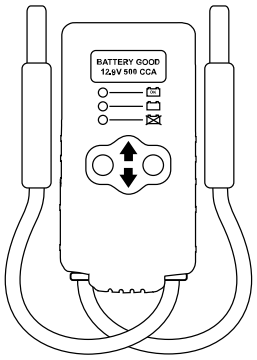
1. Inspect battery cables and battery posts.
2. If cable clamps or terminals are corroded, clean away all corrosion.

NOTE: If corrosion cannot be cleaned or eliminated, replace the component in question.

3. Verify all cable clamps are tight. The Red battery cable from the starter contactor (SC) must be securely attached to the positive (+) battery post. The Black cable from the frame ground stud must be tightly attached to the negative (-) battery post.

Procedure C. Perform a Conductance Test with a Conductance Type Battery Tester

1. Remove 7.5 amp fuse from the controller.
2. Remove the T-1 fuse from the Transfer Switch to disable the battery charger.
3. Connect the test leads to the positive and negative posts of the battery being tested, and follow the battery tester manufacturer's instructions. Battery Test results should not indicate anything lower than 60% of the battery's rated CCA.



003391

Figure 4-43. A Typical Conductance Type Battery Tester

Procedure D. Perform a load test on the Battery (All Lead-Acid Type Batteries)

1. Remove 7.5 amp fuse from the controller.
2. Remove the T-1 fuse from the transfer switch.
3. Disconnect both negative and positive cables.

NOTE: Disconnect negative cable first.

4. Test the load capability of the battery using a lead acid battery load tester.

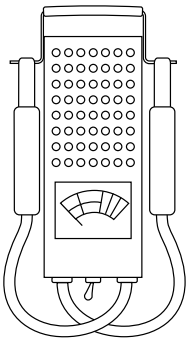

002409

Figure 4-44. A Typical Battery Load Tester

IMPORTANT NOTE: To properly load test a battery, the battery must be fully charged and the load applied must be 1/2 of the battery's CCA Rating. (i.e. 540/2=270A)

5. Follow the load tester's manufacturer's instructions carefully.
6. Connect both positive and negative cables.

NOTE: Connect positive cable first.

Procedure E.Test Battery State of Charge (Non-Maintenance Free Battery Only)

1. Use an automotive type battery hydrometer to test battery state of charge.
2. Follow the hydrometer manufacturer's instructions carefully. Read the specific gravity of the electrolyte fluid in all battery cells.
3. If cells are low, distilled water can be added to refill cell compartment.
4. If the hydrometer does not have a "percentage of charge" scale, compare the reading obtained to the following:
   a. An average reading of 1.260 indicates the battery is 100% charged.
   b. An average reading of 1.230 means the battery is 75% charged.
   c. An average reading of 1.200 means the battery is 50% charged.
   d. An average reading of 1.170 indicates the battery is 25% charged.

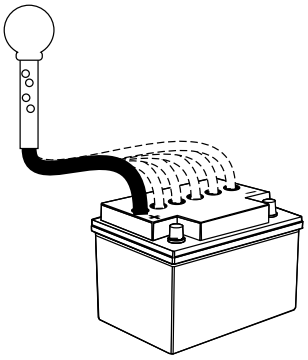
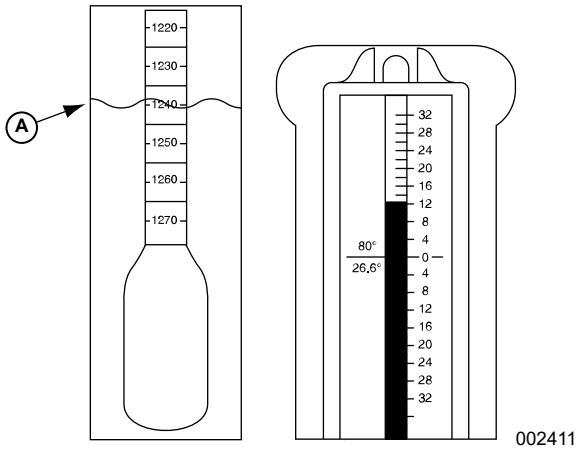

002410

Figure 4-45. Using a Battery Hydrometer

5. Test Battery Condition:
   a. If the difference between the highest and lowest reading cells is greater than 0.050 (50 points), battery condition has deteriorated and the battery should be replaced.
   b. If the highest reading cell has a specific gravity of less than 1.230, the test for condition is questionable. Recharge the battery to a 100 percent state of charge, then repeat the test for condition.

Results from Procedure C, Procedure D, or Procedure E

1. If battery CCA is 60% or less in Procedure C, replace battery with new.
2. If the DMM indicated less than 10.5 VDC in Procedure D, remove the battery and recharge with an automotive battery charger.
3. If battery fails tests in Procedure E, replace with new battery.
4. If battery condition is good, refer back to flow chart.



A. Liquid Level

Cell #	Specific Gravity
1	1.255
2	1.260
3	1.235
4	1.250
5	1.240
6	1.225

HIGH READING
⇧
35 POINTS DIFFERENCE
⇩
LOW READING

Figure 4-46. Reading a Battery Hydrometer

Test 46 – Check Wire 56 Voltage

General Theory

During an automatic start or when starting manually, an internal crank relay energizes. Each time the crank relay energizes, the controller should deliver 12 VDC to a starter contactor relay (SCR), or starter contactor (SC) and the engine should crank. This test will verify (a) that the crank relay on the controller is energizing, and (b) that the controller is delivering 12 VDC to the SCR relay or the SC.

NOTE: If the unit does not crank the Alarm Log will display, “Stopped-Alarm RPM Sense Loss.”

Procedure

1. Set the DMM to measure DC voltage.
2. Locate and disconnect Wire 56 from the SCR on V-Twin units and the SC on single cylinder units.
3. Connect one meter test lead to Wire 56 and the other meter test lead to the battery negative terminal.
4. Set the controller to MANUAL. Observe the meter. The DMM should indicate battery voltage. If battery voltage was measured, stop testing and refer back to the flow chart. If voltage was NOT measured, proceed to Step 5.

NOTE: If controller is in an Alarm State, digital output will not change. Clear the fault prior to performing Step 5.

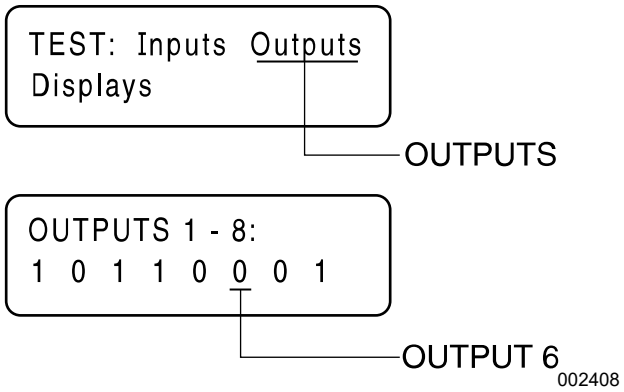


Figure 4-47. The Output Screens

5. Navigate to the Digital Output Screen using the menu system for the controller being worked on.
   a. See ***Figure 4-47***. Digital Output 6 is Wire 56 output from the board.
6. Set the controller to MANUAL and observe digital output Number 6. If the controller is working correctly output Number 6 will change from a “0” to a “1”. Observe and record the change in state.
   a. Press MANUAL button to view change of state.
   b. If the controller indicated a “1” then proceed to the next step.
7. Set a DMM to measure DC volts. Use one meter lead to back probe Wire 56 at the controller connector, leaving the connector connected to the controller. Connect the other meter lead to ground. Set the controller to MANUAL and measure the voltage.
   a. If battery voltage is measured go step 8.
   b. If no voltage is measured replace the controller.
8. Set a DMM to measure resistance.
9. Remove 7.5 amp fuse.
10. Disconnect the harness connector from the controller.
11. Remove Wire 56 from the starter contactor relay (V-twin units) or from the starter contactor (single cylinder units).
12. Connect one meter test lead to disconnected Wire 56 and connect the other meter test lead to the controller side of the harness (Wire 56), measure and record the resistance.

Results

1. If the DMM indicated battery voltage in Step 4, refer back to the flow chart.
2. If the Digital Output in Step 5 did not change, replace the controller.
3. If the DMM did NOT indicate CONTINUITY in Step 12, repair or replace Wire 56 between the controller side of the harness and the relay or contactor.
4. If wire did have continuity and the controller indicated “1” in step 6 then replace controller.