## TROUBLESHOOTING GUIDE 2

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle does not operate</td>
<td>Batteries – Batteries discharged</td>
<td>Charge batteries</td>
</tr>
<tr>
<td></td>
<td>Batteries – Battery connections</td>
<td>Check vehicle wiring. See Wiring Diagrams on page 11-2.</td>
</tr>
<tr>
<td></td>
<td>Battery charger is connected to the vehicle – Solenoid lockout feature has</td>
<td>Disconnect the battery charger from the vehicle</td>
</tr>
<tr>
<td></td>
<td>disabled the vehicle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Onboard computer failure</td>
<td>Test Procedure 2 – Onboard Computer Solenoid Lockout Circuit on page 11-15</td>
</tr>
<tr>
<td></td>
<td>Key switch and MCOR limit switch circuit</td>
<td>Check for loose or disconnected wires at key switch and MCOR</td>
</tr>
<tr>
<td></td>
<td>Failed key switch</td>
<td>Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20</td>
</tr>
<tr>
<td></td>
<td>Failed MCOR</td>
<td>Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20. See</td>
</tr>
<tr>
<td></td>
<td></td>
<td>also Test Procedure 4 – MCOR Voltage on page 11-17.</td>
</tr>
<tr>
<td></td>
<td>Forward/Reverse rocker switch</td>
<td>Test Procedure 15 – Forward/Reverse Rocker Switch on page 11-36</td>
</tr>
<tr>
<td></td>
<td>Solenoid – loose wires</td>
<td>Test Procedure 3 – Solenoid Activating Coil on page 11-16</td>
</tr>
<tr>
<td></td>
<td>Solenoid – failed coil</td>
<td>Test Procedure 3 – Solenoid Activating Coil on page 11-16</td>
</tr>
<tr>
<td></td>
<td>Speed controller thermal cutback</td>
<td>Allow controller to cool and ensure that vehicle is not over-loaded before</td>
</tr>
<tr>
<td></td>
<td></td>
<td>returning to operation</td>
</tr>
<tr>
<td></td>
<td>16-pin connector at speed controller</td>
<td>Check for loose or disconnected wires at the 16-pin connector. See also Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Procedure 9 – 16-Pin Connector on page 11-22.</td>
</tr>
<tr>
<td></td>
<td>High pedal detect</td>
<td>Cycle accelerator pedal</td>
</tr>
<tr>
<td></td>
<td>Motor stall</td>
<td>Cycle accelerator pedal</td>
</tr>
<tr>
<td></td>
<td>Motor Failure</td>
<td>See Section 15a – Motor (Model 5BC59JBS6365).</td>
</tr>
<tr>
<td></td>
<td>Speed controller failure</td>
<td>Replace speed controller. See Speed Controller Removal, Section 12, Page 12-11.</td>
</tr>
</tbody>
</table>

Troubleshooting Guide continued on next page...
## TROUBLESHOOTING GUIDE 2

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle runs slowly</td>
<td>Speed sensor disconnected or failed</td>
<td>Test Procedure 13 – Motor Speed Sensor on page 11-34</td>
</tr>
<tr>
<td></td>
<td>Incorrect speed setting</td>
<td>To change the programmed top speed of the vehicle, an IQDM-P handset must be used</td>
</tr>
<tr>
<td></td>
<td>Wiring – improperly wired</td>
<td>Check vehicle wiring. See Wiring Diagrams on page 11-2.</td>
</tr>
<tr>
<td></td>
<td>Batteries – Batteries discharged</td>
<td>Charge batteries</td>
</tr>
<tr>
<td></td>
<td>MCOR malfunction</td>
<td>Test Procedure 4 – MCOR Voltage on page 11-17</td>
</tr>
<tr>
<td></td>
<td>Motor – loose wires</td>
<td>Inspect and tighten all wire connections at the motor.</td>
</tr>
<tr>
<td></td>
<td>Failed motor</td>
<td>Replace motor. See Motor Removal, Section 15a, Page 15a-3.</td>
</tr>
<tr>
<td></td>
<td>Vehicle is over-loaded</td>
<td>Ensure that vehicle is not over-loaded before returning to operation.</td>
</tr>
<tr>
<td></td>
<td>Speed controller failure</td>
<td>Replace speed controller. See Speed Controller Removal, Section 12, Page 12-11.</td>
</tr>
<tr>
<td></td>
<td>Brakes – improperly adjusted</td>
<td>See Section 6 – Wheel Brake Assemblies.</td>
</tr>
<tr>
<td></td>
<td>Tires – under-inflated or flat tires</td>
<td>See Section 8 – Wheels and Tires.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle operates, but motor braking function does not work</td>
<td>Wiring – improperly wired</td>
<td>Check vehicle wiring. See Wiring Diagrams on page 11-2.</td>
</tr>
<tr>
<td></td>
<td>Speed sensor disconnected or failed</td>
<td>Test Procedure 13 – Motor Speed Sensor on page 11-34</td>
</tr>
<tr>
<td>Vehicle will run in forward, but not in reverse or will run in reverse but not forward</td>
<td>Forward/Reverse rocker switch – improperly wired</td>
<td>Test Procedure 15 – Forward/Reverse Rocker Switch on page 11-36</td>
</tr>
<tr>
<td></td>
<td>Speed controller – improperly wired or failed speed controller FET</td>
<td>Check vehicle wiring. See Wiring Diagrams on page 11-2.</td>
</tr>
<tr>
<td>Vehicle operates, but battery charger does not charge batteries</td>
<td>Onboard computer – gray wire</td>
<td>Test Procedure 11 – Onboard Computer Gray Wire on page 11-33</td>
</tr>
<tr>
<td></td>
<td>Battery charger connections – loose wires at receptacle or batteries</td>
<td>Check wire connections and tighten if necessary.</td>
</tr>
<tr>
<td></td>
<td>Battery charger</td>
<td>Refer to the appropriate battery charger maintenance and service manual.</td>
</tr>
</tbody>
</table>
TEST PROCEDURES

Using the following procedures, the entire IQ electrical system can be tested without major disassembly of the vehicle.

⚠️ WARNING

- If wires are removed or replaced, make sure wiring and wire harness is properly routed and secured. Failure to properly route and secure wiring could result in vehicle malfunction, property damage, personal injury, or death.

For many tests the electronics module cover must be removed to gain access to the various components that are mounted on the component mounting plate. Remove screw (1) and remove cover (2) (Figure 11-6, Page 11-13). See following WARNING.

⚠️ WARNING

- Shorting of battery terminals can cause personal injury or death.
  - Do not place component mounting plate directly on top of batteries when removing or installing plate.
  - Remove plate from vehicle completely.

![Figure 11-6 Electronic Module Cover](image)

After test procedures are completed, be sure to replace the cover. See following CAUTION.

⚠️ CAUTION

- Exposure to water may damage electronic components.
  - Do not operate vehicle without the cover properly installed.
  - Do not direct a water stream in area of the cover.
INDEX OF TEST PROCEDURES

1. Batteries / Voltage Check
2. Onboard Computer Solenoid Lockout Circuit
3. Solenoid Activating Coil
4. MCOR Voltage
5. A1 and A2 Motor Voltage
6. Tow/Run Switch
7. Battery Pack Voltage (Under Load)
8. Key Switch and MCOR Limit Switch Circuit
9. 16-Pin Connector
10. Onboard Computer Silicon-Controlled Rectifier (SCR) Circuit
11. Onboard Computer Gray Wire
12. Voltage at Charger Receptacle Red Wire Socket
13. Motor Speed Sensor
14. Solenoid Continuity
15. Forward/Reverse Rocker Switch
16. Reverse Buzzer
17. Rebooting the Onboard Computer
18. Battery Warning Light

TEST PROCEDURE 1 – BATTERIES / VOLTAGE CHECK

See General Warnings, Section 1, Page 1-1.

NOTE: The batteries must be properly maintained and fully charged in order to perform the following test procedures. Battery maintenance procedures, including watering information and allowable mineral content, can be found in Section 13 of this manual. See Battery Care, Section 13, Page 13-2.

The battery voltage can be displayed with the IQDM handset. If an IQDM handset is not available, proceed to Batteries / Voltage Check without the IQDM Handset on page 11-15.

Batteries / Voltage Check with the IQDM Handset

1. Connect the IQDM to the vehicle as described in the IQDM Owner’s Manual.

2. Access the Test menu and select BATT VOLTAGE by using the SCROLL DISPLAY buttons. The IQDM should indicate at least 48 volts with the batteries fully charged. If not, check for loose battery connections or a battery installed in reverse polarity. Refer to Section 13 – Batteries for further details on battery testing.
**Batteries / Voltage Check without the IQDM Handset**

1. With batteries connected and using a multimeter set to 200 volts DC, place red (+) probe on the positive (+) post of battery no. 1 and the black (–) probe on the negative (–) post of battery no. 4 (Figure 11-7, Page 11-15). The multimeter should indicate at least 48 volts with the batteries fully charged. If not, check for loose battery connections or a battery installed in reverse polarity. Refer to Section 13 – Batteries for further details on battery testing.

![Figure 11-7 Battery Test](image)

**TEST PROCEDURE 2 – ONBOARD COMPUTER SOLENOID LOCKOUT CIRCUIT**

See General Warnings, Section 1, Page 1-1.

The solenoid lockout circuit disables the vehicle when the battery charger is plugged into the vehicle. Use the following procedure to test the solenoid lockout circuit:

1. With batteries connected, place the Tow/Run switch in the RUN position.

2. Using a multimeter set to 200 volts DC, place black (–) probe on battery no. 4 negative post and red (+) probe (with insulation-piercing probe) on the light blue onboard computer wire (at a point between the OBC and the six-pin connector). The reading should be approximately 48-50 volts (full battery voltage). If the reading is not 48-50 volts, proceed to step 3. If the reading is 48-50 volts, proceed to Test Procedure 3 – Solenoid Activating Coil on page 11-16.

3. Place insulation-piercing probe on the light blue 18-gauge wire at a point between OBC six-pin connector and main wire harness. If reading is 48-50 volts, check the wire terminal connectors inside six-pin connector at OBC six-pin connector. Make sure pins are properly aligned inside housing. Make sure wire colors match and are connected to the correct terminals.

4. If reading is zero volts, plug the charger DC cord into the vehicle charger receptacle. If the dash light illuminates for 10 seconds, the OBC is now powered-up. Unplug the DC cord; the reading at the OBC light blue wire should be approximately 48-50 volts. If the vehicle now operates normally, the DC cord has powered up the electrical system. The electrical system should also power-up when the accelerator pedal is pressed. To check the accelerator pedal function, see Test Procedure 4 – MCOR Voltage on page 11-17.

5. If the dash light illuminates for 10 seconds and the vehicle does not operate:
   
   5.1. Using a multimeter set to 200 volts DC, place black (–) probe on battery number 4 and place red (+) probe (with insulation-piercing probe) on light blue 18-gauge wire at OBC six-pin connector.

   5.2. With Tow/Run switch in the RUN position, the voltage reading should be approximately 48 volts.
Test Procedure 2 – Onboard Computer Solenoid Lockout Circuit, Continued:

6. If the dash light does not illuminate and the vehicle does not operate, check the OBC activation circuit.

6.1. Using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the red 18-gauge wire located on the OBC side of the six-pin connector. The reading should be approximately 48 volts. If the reading is incorrect, test the Tow/Run switch and connecting wires. See Test Procedure 6 – Tow/Run Switch on page 11-19.

6.2. Using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the red 18-gauge wire (harness side of six-pin connector). Multimeter should indicate 48 volts. If voltage is correct, check connections in the six-pin connector. If connections are correct, OBC activation circuit has failed. Replace OBC.

TEST PROCEDURE 3 – SOLENOID ACTIVATING COIL

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Remove the two small wire terminals from the solenoid.

3. Place red (+) probe of the multimeter on the positive (+) solenoid terminal. Place the black (–) probe on the other small solenoid terminal. A reading of 180 to 190 ohms should be obtained (Figure 11-8, Page 11-16). If not, replace the solenoid.

![Figure 11-8 Activating Coil Test](image-url)
TEST PROCEDURE 4 – MCOR VOLTAGE

See General Warnings, Section 1, Page 1-1.

The accelerator position, which is proportional to the MCOR voltage, can be displayed with the IQDM handset. If an IQDM handset is not available, proceed to MCOR Voltage Test without the IQDM Handset on page 11-17.

MCOR Voltage Test with the IQDM Handset

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2. See also following WARNING.

⚠️ WARNING
* The key switch should be placed in the OFF position and left in the OFF position for the duration of this test.

2. Connect the IQDM to the vehicle as described in the IQDM Owner’s Manual.
3. Access the Test menu and select THROTTLE % by using the SCROLL DISPLAY buttons.
4. The IQDM should indicate 0 % with the pedal not pressed. While monitoring the IQDM display screen, slowly press the accelerator pedal. As the pedal is pressed, the IQDM should indicate a rise from 0 % (pedal not pressed) to 100 % (pedal fully pressed).
5. If the MCOR does not operate as described in step 4, proceed to MCOR Voltage Test without the IQDM Handset on page 11-17.

MCOR Voltage Test without the IQDM Handset

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2. See also following WARNING.

⚠️ WARNING
* The key switch should be placed in the OFF position and left in the OFF position for the duration of this test.

2. With the batteries connected, place Tow/Run switch in RUN. Using a multimeter set to 200 volts DC, place red (+) probe on battery no. 1 positive post and place black (–) probe (with insulation-piercing probe) on the purple wire at a point close to the three-pin connector at the MCOR. The reading should be approximately 48-50 volts (full battery voltage).
3. If reading is zero volts, check the purple wire continuity from the three-pin connector at the MCOR to the 16-pin connector at the speed controller. Check terminal positions in three-pin connector at the MCOR and the 16-pin connector. If all of the continuity readings are correct and the connectors are wired correctly, replace the speed controller.
4. With multimeter set to 20 volts DC, place the black (–) probe on battery no. 4 negative post and the red (+) probe (with insulation-piercing probe) on the white/black wire at a point close to the three-pin connector at the MCOR. The reading should be approximately 4.65 volts.
5. If reading is zero volts, check the white/black wire continuity from the three-pin connector at the MCOR to the 16-pin connector at the speed controller. Check terminal positions in three-pin connector at the MCOR and the 16-pin connector. If all of the continuity readings are correct and the connectors are wired correctly, replace the speed controller.
MCOR Voltage Test without the IQDM Handset, Continued:

6. With multimeter set to 20 volts DC, place the black (–) probe on battery no. 4 negative post and the red (+) probe (with insulation-piercing probe) on the no. 18 yellow wire at a point close to three-pin connector at the MCOR. The reading should be approximately 0.32 volts with the pedal up. Slowly press the accelerator pedal and note the readings on the multimeter. As the pedal is pressed, the reading should increase until it reaches 4.65 volts when the pedal is fully pressed.

7. If reading does not increase as the pedal is pressed, replace the MCOR.

8. If the reading is not approximately 4.60 volts with the pedal fully pressed, the vehicle will not operate at rated top speed. Check the MCOR resistance.

8.1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

8.2. Disconnect the 16-pin connector at the speed controller.

8.3. Using a multimeter set for 20k ohms, connect the red (+) probe of the multimeter to the yellow wire at the MCOR three-pin connector with an insulation piercing probe. Connect black (–) probe to the purple wire with an insulation-piercing probe.

8.4. With the accelerator pedal fully up (not pressed), the multimeter should read approximately 1k ohms.

8.5. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should rise as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate between 5.67k ohms and 7.43k ohms.

8.6. Using a multimeter set for 20k ohms, connect the red (+) probe of the multimeter to the yellow wire at the MCOR three-pin connector with an insulation piercing probe. Connect black (–) probe to the white/black wire with an insulation-piercing probe.

8.7. With the accelerator pedal fully up (not pressed), the multimeter should indicate between 5.67k ohms and 7.43k ohms.

8.8. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should drop as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate approximately 1k ohms.

8.9. If the MCOR does not operate as described, replace the MCOR.

TEST PROCEDURE 5 – A1 AND A2 MOTOR VOLTAGE

See General Warnings, Section 1, Page 1-1.

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2. See also following WARNING.

⚠️ WARNING

- Keep people and equipment clear from rotating rear wheels. Do not allow persons under the car. Contact with rotating rear wheels could result in serious personal injury.

2. With the batteries connected and using a multimeter set to 200 volts DC, place the black (–) probe on the A2 motor terminal (white wire) and connect the red (+) probe to the A1 (green wire) motor terminal.

3. With Tow/Run switch in the RUN position, place the Forward/Reverse switch in the FORWARD position, turn key switch to the ON position and slowly press accelerator pedal.

4. As the accelerator pedal is pressed, the voltage reading should increase from approximately 5 volts RMS when the MCOR limit switch closes, to approximately 48 volts RMS with the accelerator pedal fully pressed.
4.1. If there is no voltage reading, check the MCOR. See Test Procedure 4 – MCOR Voltage on page 11-17. Also check the continuity of the large posts of the solenoid. See Test Procedure 14 – Solenoid Continuity on page 11-35.

4.2. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

4.3. Check continuity on A1 and A2 motor terminal posts and continuity of the F1 and F2 motor terminal posts. Also, check continuity of all motor wires. See Section 15a – Motor (Model 5BC59JBS6365).

TEST PROCEDURE 6 – TOW/RUN SWITCH
See General Warnings, Section 1, Page 1-1.

Tow/Run Switch Test with the IQDM Handset

1. With the Tow/Run switch in the RUN position, connect the IQDM to the vehicle as described in the IQDM Owner’s Manual.

2. Immediately after the IQDM is connected to the vehicle, the screen should display a copyright notice and the IQDM model number.

3. If the IQDM display screen is blank, drive the vehicle a short distance to activate the onboard computer.

4. If the IQDM display screen begins to work after the vehicle has been driven, turn the key switch to the OFF position and proceed to step 5; otherwise, perform the following procedure, Tow/Run Switch Test without the IQDM Handset.

5. With the IQDM still connected to the vehicle, place the Tow/Run Switch in the TOW position and wait 90 seconds.

6. If the IQDM display screen goes blank after 90 seconds, the Tow/Run switch and connecting wires are operating correctly.

7. If the IQDM display screen is still active after 90 seconds, the switch has failed closed. Replace the Tow/Run switch. See Tow/Run Switch Removal, Section 12, Page 12-6.

Tow/Run Switch Test without the IQDM Handset

1. With the batteries connected and using a multimeter set on 200 volts DC, connect the black (–) probe to the negative post of battery no. 4 and connect red (+) probe (with insulation-piercing probe) on the pink wire close to the connector on the Tow/Run switch.

   **WARNING**

   • The key switch should be placed in the OFF position and left in the OFF position for the duration of this test.

2. With the Tow/Run switch in the RUN position, the reading should be approximately 48-50 volts. With the switch in the TOW position, the reading should be below approximately 5 volts.

3. If the reading is above 5 volts with the switch in the TOW position, replace the switch.

4. If the reading is below 5 volts with switch in the RUN position, check continuity of the blue 18-gauge wire from the large post of the solenoid to the connector at the Tow/Run switch.

5. If the continuity readings are correct, replace the Tow/Run switch.
TEST PROCEDURE 7 – BATTERY PACK VOLTAGE (UNDER LOAD)

See General Warnings, Section 1, Page 1-1.

1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.
2. Connect the tester leads to the positive (+) post of battery no.1 and negative (–) post of battery no. 4 (Figure 11-9, Page 11-20)
3. Turn the discharge machine on and record the voltage reading of battery pack while under load.
4. A fully charged set of batteries in good condition should read between 46-49 volts while under load.
5. A reading of 32-46 volts indicates discharged or failed batteries. Each battery should be checked with a multimeter while under load.
6. A reading of 32 volts or less will not activate discharge machine. If the voltage of the batteries is below 32 volts, the batteries are deeply discharged or have failed.
7. Recording the battery pack voltage reading while under load provides a more accurate diagnosis of the condition of the batteries. When the discharge machine is ON, it places the battery pack under load and many times can help determine if one or more batteries in the set have failed. Testing battery voltage while the batteries are not under load will not always indicate the true condition of the batteries. For more information about the batteries, refer to Section 13 – Batteries.

TEST PROCEDURE 8 – KEY SWITCH AND MCOR LIMIT SWITCH CIRCUIT

See General Warnings, Section 1, Page 1-1.

Key Switch and MCOR Limit Switch Circuit Test with the IQDM Handset

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.
2. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
3. Connect the IQDM to the vehicle as described in the IQDM Owner’s Manual.
4. Test the key switch.
4.1. Access the Test menu and select KEY INPUT by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the key switch is in the OFF position.
4.2. While monitoring the IQDM display screen, turn the key switch to the ON position. The IQDM should indicate ON.

4.3. If the IQDM does not indicate that KEY INPUT is ON when the key switch is in the ON position, proceed to the following procedure, Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset. If the key switch functions as described, proceed to the following step. **See following NOTE.**

**NOTE:** The key switch MUST function properly in order to test the MCOR limit switch with the IQDM handset.

5. Test the MCOR limit switch.

5.1. Select FOOT INPUT on the Test menu by using the SCROLL DISPLAY buttons on the IQDM.

5.2. The IQDM should indicate that FOOT INPUT is OFF when the accelerator pedal is not pressed, regardless of the key switch position.

5.3. With the key switch in the ON position, press the accelerator pedal. The IQDM should indicate that FOOT INPUT is ON when the accelerator pedal is pressed.

6. If any reading is obtained that is not described in steps 4 and 5, perform the following steps:

6.1. Check the wiring of the key switch and MCOR. **See Wiring Diagrams on page 11-2.**

6.2. Check the continuity of the key switch wires and the MCOR limit switch wires.

7. If the problem was not found, proceed to the following procedure, Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset on page 11-21.

**Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset**

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**

3. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.

4. Test the key switch.

4.1. Remove the instrument panel. **See step 2 of Key Switch Removal, Section 12, Page 12-1.**

4.2. Using a multimeter set to 200 ohms, place the red (+) probe on the key switch terminal with the blue wire. Place the black (–) probe on the other key switch terminal.

4.3. With the key switch in the OFF position, the multimeter should indicate that continuity is not present.

4.4. With the key switch in the ON position, the multimeter should indicate that continuity is present.

4.5. If any other reading is obtained, replace the key switch. **See Key Switch Removal, Section 12, Page 12-1.**

4.6. If the key switch operates as described in the previous steps, install the instrument panel in the reverse order of removal and proceed to the following step.

5. Test the MCOR limit switch. **See following NOTE.**

**NOTE:** Make sure that the key switch is operating correctly and that the key switch and instrument panel are properly installed before proceeding.

5.1. With batteries connected and using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the green wire close to the two-pin connector on the MCOR.
Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset, Continued:

⚠️ WARNING

- The Forward/Reverse switch must be in the neutral position to avoid personal injury due to contact with rotating wheels.

5.2. With Tow/Run switch in the RUN position, key switch in the ON position, and Forward/Reverse rocker switch in the NEUTRAL position, the voltage reading should be zero volts. When the accelerator pedal is pressed, the voltage reading should be approximately 48 volts (full battery voltage).

5.3. If the voltage reading is 48 volts when the accelerator pedal is not pressed, replace the MCOR. See MCOR Removal, Section 12, Page 12-7.

5.4. If the voltage reading is zero volts when the accelerator pedal is pressed, check the limit switch circuit using the following test procedures.

5.4.1. Using a multimeter set to 200 volts DC, place black (–) probe on battery no. 4 negative post and the place red (+) probe (with insulation-piercing probe) on the blue wire where it connects to the MCOR. With the key switch ON, the reading should be approximately 48 volts (full battery voltage).

5.4.2. If the reading is zero volts, check the continuity of the blue wire that goes from the key switch to the MCOR.

5.4.3. If the reading is approximately 48 volts, proceed to the following step.

5.4.4. Using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the green wire where it connects to the MCOR. With the Tow/Run switch in the RUN position, the key switch ON, the Forward/Reverse rocker switch in NEUTRAL and the accelerator pedal pressed, the reading should be approximately 48 volts (full battery voltage).

5.4.5. If the reading is zero volts, test the continuity of the MCOR limit switch and the green wire. If the limit switch does not pass the continuity test, replace the MCOR. See MCOR Removal, Section 12, Page 12-7.

TEST PROCEDURE 9 – 16-PIN CONNECTOR

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Disconnect the 16-pin connector from the speed controller. Inspect terminal ends inside plug to ensure they are in position and seated in plug housing. If any terminals look like they are not pushed all the way into the connector, gently push the terminals until they are firmly seated in the 16-pin connector. After each terminal has been pushed into the housing, gently pull on the wire to ensure it is locked into place.

3. Check wires in the plug to make sure none are broken at the terminal pin crimp. Repair or replace as required.

4. Check the wire colors of each wire and make sure that the colors for each pin position match the wire colors in the wiring diagram. See Wiring Diagrams on page 11-2.

5. When connecting the 16-pin connector to the controller, push plug into controller receptacle with enough force to lock plug into place. An audible click will be heard when plug is properly seated to the controller.

A procedure is provided for testing each of the wires in the 16-pin connector. Refer to the following chart for the appropriate procedure for each pin in the 16-pin connector.
If the results of any of the referenced procedures are different from those described in the procedure, check the continuity of the wires in the wire harness and test the connected components with the appropriate test procedures. See Index of Test Procedures on page 11-14.

### SPEED CONTROLLER 16-PIN CONNECTOR WIRE TEST PROCEDURE

| Pin 1 – White/Black (18-gauge) | TEST PROCEDURE |
| Pin 2 – Yellow (18-gauge) | Test Procedure 9A – Pins 1, 2, and 3 on page 11-23 |
| Pin 3 – Purple (18-gauge) | |
| Pin 4 – Open (No wire) | |
| Pin 5 – Light Blue (18-gauge) | Test Procedure 9B – Pin 5 on page 11-24 |
| Pin 6 – Green (18-gauge) | Test Procedure 9C – Pin 6 on page 11-25 |
| Pin 7 – Orange/White (18-gauge) | Test Procedure 9D – Pin 7 on page 11-27 |
| Pin 8 – White (18-gauge) | Test Procedure 9E – Pins 8 and 16 on page 11-28 |
| Pin 9 – Gray (18-gauge) | Test Procedure 9F – Pin 9 on page 11-29 |
| Pin 10 – Tan (18-gauge) | Test Procedure 9G – Pin 10 on page 11-30 |
| Pin 11 – Open (no wire) | |
| Pin 12 – Blue/White (18-gauge) | Test Procedure 9H – Pin 12 on page 11-31 |
| Pin 13 – Black/White (18-gauge) | Test continuity of each wire and perform Test Procedure 13 – Motor Speed Sensor on page 11-34 |
| Pin 14 – Light Green (18-gauge) | |
| Pin 15 – Red (18-gauge) | |
| Pin 16 – Blue (18-gauge) | Test Procedure 9E – Pins 8 and 16 on page 11-28 |

**Test Procedure 9A – Pins 1, 2, and 3**

See General Warnings, Section 1, Page 1-1.

Pins 1, 2, and 3 in the 16-pin connector provide a connection point from the MCOR potentiometer to the speed controller.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.
3. Disconnect the 16-pin connector at the speed controller.
4. Using a multimeter set for 20k ohms, insert the red (+) probe of the multimeter into pin 2 (yellow wire) of the 16-pin connector. See following CAUTION. Insert the black (–) probe into pin 3 (purple wire) of the 16-pin connector (Figure 11-10, Page 11-24).

**CAUTION**

- Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.
5. With the accelerator pedal fully up (not pressed), the multimeter should read approximately 1k ohms.
6. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should rise as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate between 5.67k ohms and 7.43k ohms.
Test Procedure 9A – Pins 1, 2, and 3, Continued:

7. Using a multimeter set for 20k ohms, insert the red (+) probe of the multimeter into pin 2 (yellow wire) at the 16-pin connector. Connect the black (−) probe into pin 1 (white/black wire). See previous CAUTION.

8. With the accelerator pedal fully up (not pressed), the multimeter should indicate between 5.67k ohms and 7.43k ohms.

9. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should drop as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate approximately 1k ohms.

10. If any other reading is observed, check the continuity of the wires in the wire harness.

Test Procedure 9B – Pin 5

See General Warnings, Section 1, Page 1-1.

Pin 5 in the 16-pin connector provides a connection point for the solenoid lockout circuit from the onboard computer to the speed controller.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Disconnect the 16-pin connector at the speed controller.

4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 5 (light blue wire) of the 16-pin connector. See following CAUTION. Using an alligator clip, connect the black (−) probe to the B− terminal of the speed controller (Figure 11-11, Page 11-25).

CAUTION

• Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

6. Place the Tow/Run switch in the RUN position.

7. The multimeter should indicate zero volts DC at this time.

8. While monitoring the multimeter, plug the battery charger into the vehicle charger receptacle.

9. After a short delay, the onboard computer should power-up (come out of sleep mode), charger relay should click, and the ammeter on the charger should indicate that the vehicle batteries are being charged.

10. The multimeter should indicate zero volts DC while the charger is connected to the vehicle.

11. While observing the multimeter, disconnect the DC plug from the vehicle charger receptacle.

12. The multimeter should indicate full battery voltage when the charger is not connected to the vehicle.

13. If any other reading is obtained, check the following items:
   • Continuity of the wires in the wire harness
   • Onboard computer for proper operation. See Test Procedure 11 – Onboard Computer Gray Wire on page 11-33.
   • Tow/Run switch for proper operation. See Test Procedure 6 – Tow/Run Switch on page 11-19.

**Test Procedure 9C – Pin 6**

**See General Warnings, Section 1, Page 1-1.**

Pin 6 in the 16-pin connector provides a connection point for the MCOR limit switch to the speed controller.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Disconnect the 16-pin connector at the speed controller.
Test Procedure 9C – Pin 6, Continued:

4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 6 (green wire) of the 16-pin connector. **See following CAUTION.** Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (Figure 11-12, Page 11-26).

⚠ **CAUTION**

- Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.

5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

6. Place the Tow/Run switch in the RUN position, key switch in the ON position, and Forward/Reverse switch in the FORWARD position.

7. The multimeter should indicate zero volts DC at this time.

8. While monitoring the multimeter, slowly press the accelerator pedal and hold the pedal at approximately 20% of full travel.

9. After a short delay, the onboard computer should power-up (come out of sleep mode).

10. The multimeter should indicate full battery voltage (approximately 48 volts) when the accelerator pedal is pressed.

11. While observing the multimeter, release the accelerator pedal.

12. The multimeter should indicate zero volts when the accelerator pedal is not pressed.

13. If any other reading is obtained, check the following items:

- Continuity of the wires in the wire harness
- Onboard computer for proper operation. **See Test Procedure 11 – Onboard Computer Gray Wire on page 11-33.**
- Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**
- Key switch and MCOR limit switch for proper operation. **See Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20.**
Test Procedure 9D – Pin 7

See General Warnings, Section 1, Page 1-1.

Pin 7 in the 16-pin connector provides a connection point for the reverse buzzer to the speed controller.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Disconnect the 16-pin connector at the speed controller.

4. Place a jumper wire with an alligator clip between the B– terminal of the speed controller (use alligator clip for this connection) and pin 7 (orange/white wire) of the 16-pin connector (Figure 11-13, Page 11-27). See following CAUTION.

**CAUTION**

- Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.

5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

6. Place the Tow/Run switch in the RUN position.

7. The reverse buzzer should sound when the Tow/Run switch is in the RUN position.

8. If any other activity is observed, check the following items:

   - Continuity of the wires in the wire harness

![Figure 11-13 Pin 7 Test](image-url)
Test Procedure 9E – Pins 8 and 16

See General Warnings, Section 1, Page 1-1.

Pins 8 and 16 in the 16-pin connector provide a connection point for the Forward/Reverse rocker switch to the speed controller. The switch provides a +48 volt signal to the speed controller through pin 8 when the Forward/Reverse switch is in the FORWARD position and provides a +48 volt signal on pin 16 when the Forward/Reverse switch is in the REVERSE position.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame crossmember between the spring mount and side stringer, just forward of each rear wheel. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Disconnect the 16-pin connector at the speed controller.

4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 8 (white wire) of the 16-pin connector. See following CAUTION. Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (Figure 11-14, Page 11-29).

**CAUTION**

- Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.

5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

6. Place the Tow/Run switch in the RUN position and the Forward/Reverse switch in the NEUTRAL position. The multimeter should indicate zero volts DC at this time.

7. While monitoring the multimeter, place the Forward/Reverse switch in the REVERSE position. The multimeter should still indicate zero volts.

8. Place the Forward/Reverse switch in the FORWARD position. The multimeter should indicate full battery voltage (approximately 48 volts).

9. Insert the red (+) probe of the multimeter into pin 16 (blue wire) of the 16-pin connector. Leave the black (–) probe (alligator clip) connected to the B– terminal of the speed controller. See previous CAUTION.

10. Place the Forward/Reverse switch in the NEUTRAL position. The multimeter should indicate zero volts DC at this time.

11. While monitoring the multimeter, place the Forward/Reverse switch in the FORWARD position. The multimeter should still indicate zero volts.

12. Place the Forward/Reverse switch in the REVERSE position. The multimeter should indicate full battery voltage (approximately 48 volts).

13. If any other reading is obtained, check the following items:

   - Continuity of the wires in the wire harness
Test Procedure 9F – Pin 9

See General Warnings, Section 1, Page 1-1.

Pin 9 in the 16-pin connector provides a connection point for the Tow/Run switch to the speed controller. The switch provides a +48 volt signal to the speed controller through pin 9 when the Tow/Run switch is in the RUN position.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Disconnect the 16-pin connector at the speed controller.

4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 9 (gray wire) of the 16-pin connector. See following CAUTION. Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (Figure 11-15, Page 11-30).

CAUTION

• Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.

5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

6. With the Tow/Run switch in the TOW position, the multimeter should indicate zero volts.

7. Place the Tow/Run switch in the RUN position.
Test Procedure 9F – Pin 9, Continued:

8. With the Tow/Run switch in the RUN position, the multimeter should indicate full battery voltage (approximately 48 volts).

9. If any other reading is obtained, check the following items:
   - Continuity of the wires in the wire harness

Test Procedure 9G – Pin 10

See General Warnings, Section 1, Page 1-1.

Pin 10 in the 16-pin connector provides a connection point for the key switch to the speed controller. The key switch provides a +48 volt signal to the speed controller through pin 10 when the key switch is in the ON position.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Disconnect the 16-pin connector at the speed controller.

4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 10 (tan wire) of the 16-pin connector. See following CAUTION. Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (Figure 11-16, Page 11-31).

**CAUTION**

- Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

6. With the Tow/Run switch in the TOW position, the multimeter should indicate zero volts.

7. Place the Tow/Run switch in the RUN position and the key switch in the ON position.

8. With the key switch in the ON position, the multimeter should indicate full battery voltage (approximately 48 volts). With the key switch in the OFF position, the reading should be zero volts.

9. If any other reading is obtained, check the following items:
   • Continuity of the wires in the wire harness
   • Tow/Run switch for proper operation. See Test Procedure 6 – Tow/Run Switch on page 11-19.
   • Key switch for proper operation. See Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20.

**Test Procedure 9H – Pin 12**

See General Warnings, Section 1, Page 1-1.

Pin 12 in the 16-pin connector provides a connection point for the solenoid coil to the speed controller. The speed controller activates the solenoid coil by providing a ground to the solenoid coil at the appropriate time.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Disconnect the 16-pin connector at the speed controller.

4. Place a jumper wire with an alligator clip between the B– terminal of the speed controller (use alligator clip for this connection) and pin 12 (blue/white wire) of the 16-pin connector (Figure 11-17, Page 11-32). See following CAUTION.

**CAUTION**

- Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.

5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).
Test Procedure 9H – Pin 12, Continued:

6. Place the Tow/Run switch in the RUN position and the key switch in the ON position.
7. The solenoid should click when the key switch is placed in the ON position.
8. If any other activity is observed, check the following items:
   - Continuity of the wires in the wire harness
   - Key switch for proper operation. See Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20.
   - Solenoid for proper operation. See Test Procedure 14 – Solenoid Continuity on page 11-35.

TEST PROCEDURE 10 – ONBOARD COMPUTER SILICON-CONTROLLED RECTIFIER (SCR) CIRCUIT

See General Warnings, Section 1, Page 1-1.

The silicon controlled rectifier (SCR), located inside the onboard computer, acts as a switch on the negative side of the circuit.

This allows the onboard computer (OBC) to control the battery charging current.

Use the following procedure to test the SCR:

1. With batteries connected and using a multimeter set to 200 volts DC, place the red (+) probe on the positive post of battery no. 1 and place the black (–) probe on the charger receptacle socket that has the black 10-gauge wire attached to it. The reading should be approximately 36-42 volts.
2. If the reading is zero volts, check the black 10-gauge wire connection to the OBC connector. Check the continuity of the black 10-gauge wires. If the wires and connections are okay, the SCR has failed. Replace the OBC. If the reading is correct, proceed to the following step.
3. Plug in AC and DC cords. When the battery charger relay clicks on, reading should be approximately 48 volts (full battery voltage). If the reading does not rise from approximately 40 volts to full battery voltage when the DC cord is plugged in and the relay clicks on, check the following items:
   - Black wire terminal socket in the charger receptacle.
• Onboard computer gray wire. See Test Procedure 11 – Onboard Computer Gray Wire on page 11-33.

• Red wire at the charger receptacle. See Test Procedure 12 – Voltage at Charger Receptacle Red Wire Socket on page 11-33.

TEST PROCEDURE 11 – ONBOARD COMPUTER GRAY WIRE

See General Warnings, Section 1, Page 1-1.

1. With batteries connected and the DC cord disconnected, pull back on the boot on the gray wire connection at the OBC (Figure 11-18, Page 11-33). Using a multimeter set to 200 volts DC, connect the red (+) probe to the positive post of battery no. 1 and black (–) probe to gray 16-gauge wire at the OBC connection. Reading should be approximately 48 volts. If reading is zero volts, replace the OBC.

![Figure 11-18 OBC Connections]

2. If the reading in step 1 is 48 volts, plug the DC cord into the vehicle’s charger receptacle. The voltage reading should drop to approximately 4.0 volts before the charger relay clicks on.

3. When the charger relay is activated, the reading should rise to approximately 48 volts.

4. If voltage does not drop to approximately 4.0 volts when the DC cord is plugged in and then rise to approximately 48 volts when the charger relay clicks on, the gray wire circuit in the OBC has failed. Replace the OBC.

TEST PROCEDURE 12 – VOLTAGE AT CHARGER RECEPTACLE RED WIRE SOCKET

See General Warnings, Section 1, Page 1-1.

1. With batteries connected, DC cord disconnected, and using a multimeter set to 200 volts DC, place the black (–) probe on the negative post of battery no. 4 and place the red (+) probe on the charger receptacle socket connected to the red 10-gauge wire. The reading should be 48-50 volts (full battery voltage).

2. If the reading is zero volts, check the continuity of the 10-gauge red wire from the positive post of battery no. 1 to the receptacle socket.
TEST PROCEDURE 13 – MOTOR SPEED SENSOR

See General Warnings, Section 1, Page 1-1.

Motor Speed Sensor Test with the IQDM Handset

⚠️ CAUTION

- Perform the following procedure only on a level surface. To avoid injury or property damage, ensure that the path of the vehicle is clear before pushing vehicle.

1. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
2. Connect the IQDM to the vehicle as described in the IQDM Owner’s Manual.
3. Access the Test menu and select SPEED PULSES by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the vehicle is at rest.
4. While monitoring the IQDM display screen, slowly push the vehicle a short distance (about 3 feet (1 meter)). The IQDM should indicate ON for speed sensor pulses while the wheels are in motion.
5. If the IQDM does not indicate ON while the wheels are in motion, proceed to the following procedure, Motor Speed Sensor Test without the IQDM Handset.

Motor Speed Sensor Test without the IQDM Handset

1. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
2. With batteries connected, disconnect the three-pin connector at the motor speed sensor.
3. Check voltage at black/white wire:
   3.1. Using a multimeter set to 200 volts DC, place the red (+) probe on the battery no. 1 positive post and place the black (−) probe on the black/white wire terminal socket in the three-pin connector. The voltage reading should be 48 to 50 volts (full battery voltage).
   3.2. If the reading is zero volts, check the continuity of the black/white wire from the 16-pin connector at the speed controller to the three-pin connector at the motor speed sensor. If the continuity is correct, replace the speed controller.
4. Check voltage at the red motor speed sensor wire:
   4.1. With Tow/Run switch in the RUN position and using a multimeter set to 20 volts DC, place the black (−) probe on the battery no. 4 negative post and place red (+) probe on red wire terminal socket in three-pin connector. The voltage reading should be approximately 15-16 volts.
   4.2. If the voltage reading is zero volts, check the continuity of the red wire from the 16-pin connector at the speed controller to the three-pin connector at the motor speed sensor. If the wire continuity is correct, replace the speed controller.
   4.3. If the reading is below 14 volts, replace the speed controller.
   4.4. If the voltage reading is correct, proceed to the following step.
5. Check voltage at the light green wire:
   5.1. Using a multimeter set to 20 volts DC, place the black (−) probe on the battery no. 4 negative post and place the red (+) probe on the light green wire female terminal in the three-pin connector at the motor speed sensor. The voltage reading should be from 4.60 to 4.90 volts.
   5.2. If the voltage is zero volts, check the continuity of the light green wire from the 16-pin connector at the speed controller to the three-pin connector at the motor speed sensor. If the continuity is correct, replace the speed controller.
   5.3. If reading is below 3.50 volts, check the continuity of the wires and plug and replace the speed controller if necessary.
6. Reconnect the three-pin connector at the motor speed sensor. Using a multimeter set to 20 volts DC, place the black (-) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the green wire between the three-pin connector and the motor speed sensor.

6.1. Raise one rear wheel off ground. Slowly turn the rear wheel to rotate the motor armature. As the armature rotates, the voltage reading should alternate from zero to approximately 4.85 volts. The voltage reading will fluctuate from zero to 4.85 volts and back to zero four times for each revolution of the motor armature.

**NOTE:** The voltage reading of 4.85 is an approximate reading. The actual reading may vary from 4.50 to 5.00 volts.

6.2. Replace the speed sensor if:

- There is no voltage reading.
- The voltage reading is not above 3.50.
- The voltage reading does not fluctuate as the motor is turned.

**TEST PROCEDURE 14 – SOLENOID CONTINUITY**

See General Warnings, Section 1, Page 1-1.

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

2. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

3. Disconnect the three wires that are crimped together from the forward large post of the solenoid.

4. Using a multimeter set to 200k ohms, place the black (-) probe on one solenoid large post and place the red (+) probe on the other large post. The reading should be no continuity.

5. Connect the three wires crimped together to the forward large solenoid post. Install washer and nut on large solenoid post and tighten to 77 in-lb (8.7 N·m).

6. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

**WARNING**

- Keep people and equipment clear from rotating rear wheels. Do not allow persons under the car. Contact with rotating rear wheels could result in serious personal injury.

7. Place the Tow/Run switch in the RUN position, turn the key switch to the ON position, place the Forward/Reverse rocker switch in the FORWARD position, and press the accelerator pedal. The solenoid should click and the multimeter should indicate continuity. If the reading is no continuity, replace the solenoid.
TEST PROCEDURE 15 – FORWARD/REVERSE ROCKER SWITCH

See General Warnings, Section 1, Page 1-1.

Forward/Reverse Rocker Switch Test with the IQDM Handset

1. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
2. Connect the IQDM to the vehicle as described in the IQDM Owner’s Manual.
3. Test FORWARD INPUT.
   3.1. Access the Test menu and select FORWARD INPUT by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the Forward/Reverse switch is in the NEUTRAL or REVERSE position.
   3.2. Place the Forward/Reverse switch in the FORWARD position. The IQDM should indicate that FORWARD INPUT is ON. If the IQDM indicates any other reading, check vehicle wiring. See Wiring Diagrams on page 11-2. Also check the 16-pin connector at the speed controller. See Test Procedure 9 – 16-Pin Connector on page 11-22.
4. Test REVERSE INPUT.
   4.1. Access the Test menu and select REVERSE INPUT by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the Forward/Reverse switch is in the NEUTRAL or FORWARD position.
   4.2. Place the Forward/Reverse switch in the REVERSE position. The IQDM should indicate that REVERSE INPUT is ON. If the IQDM indicates any other reading, check vehicle wiring. See Wiring Diagrams on page 11-2. Also check the 16-pin connector at the speed controller. See Test Procedure 9 – 16-Pin Connector on page 11-22.
5. If the IQDM displays readings other than those described above and the wiring is found to be correct, proceed to the following procedure, Forward/Reverse Rocker Switch Test without the IQDM Handset.

Forward/Reverse Rocker Switch Test without the IQDM Handset

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.
2. Remove the two screws securing the rocker switch case to the vehicle body.
4. Disconnect the three wires from the rocker switch. Using a multimeter set to 200 ohms, place the black (–) probe on the blue wire terminal 3 position on the rocker switch, and place the red (+) probe on the red wire terminal 2 position. With the switch in NEUTRAL or REVERSE, there should be no continuity. With the switch in FORWARD, there should be continuity. If the readings are incorrect, replace the switch.
5. Place the black (–) probe on the white wire terminal 1 position on the rocker switch and place the red (+) probe on the red wire terminal. With the switch in REVERSE, there should be continuity. If the readings are incorrect, replace the switch.
TEST PROCEDURE 16 – REVERSE BUZZER

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove the instrument panel. See step 2 of Key Switch Removal, Section 12, Page 12-1.

3. Disconnect the orange/white and pink wires from the reverse buzzer.

4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

5. Place the key switch in the OFF position and the Tow/Run switch in the RUN position.

6. Using a multimeter set to 200 volts DC, place the black (–) probe on battery no. 4 negative post and place the red (+) probe on the pink wire terminal end that was disconnected from the reverse buzzer. The reading should be approximately 48 volts (full battery voltage).

6.1. If the voltage reading is correct, proceed to step 7.


6.3. If the continuity readings are not correct, repair or replace the pink wire.

6.4. If the continuity readings are correct, proceed to step 7.

7. Place the Forward/Reverse switch in REVERSE. Using a multimeter set to 200 volts DC, place the black (–) probe on the orange/white wire terminal end (that was disconnected from the reverse buzzer) and place the red (+) probe on battery no. 1 positive post. The reading should be approximately 48 volts (full battery voltage).

7.1. If the voltage reading is correct, replace the reverse buzzer.

7.2. If reading is zero volts, check orange/white wire continuity and connection at Pin 7 in 16-Pin connector.

7.3. If there is no continuity in the orange/white wire, or the Pin 7 terminal in the 16-Pin connector is not properly seated, repair or replace as required.

7.4. If the orange/white wire continuity and 16-Pin connector are correct and there is no voltage at the orange wire, replace the controller.

TEST PROCEDURE 17 – REBOOTING THE ONBOARD COMPUTER

See General Warnings, Section 1, Page 1-1.

It is possible the onboard computer (OBC) can become “locked up”, causing the OBC solenoid lockout circuit to malfunction. If this condition is suspected, restart the computer as follows:

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1. See following NOTE.

   NOTE: Wait at least 90 seconds for the capacitors in the speed controller to discharge. The capacitors in the speed controller must be fully discharged in order to reboot the OBC.

2. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

3. Place Tow/Run switch in the RUN position.

4. Test drive the vehicle. If the vehicle functions normally the problem is corrected. If the problem still exists, refer to Wiring Diagrams on page 11-2.
TEST PROCEDURE 18 – BATTERY WARNING LIGHT

See General Warnings, Section 1, Page 1-1.

1. Reboot the OBC and drive the vehicle a short distance. When vehicle is first driven, the battery warning light should illuminate for 10 seconds. See Test Procedure 17 – Rebooting the Onboard Computer on page 11-37. If the battery warning light does not illuminate when rebooting the OBC, proceed to step 2.

2. Turn key switch OFF, place Tow/Run switch in TOW and place Forward/Reverse rocker switch in NEUTRAL.

3. Disconnect the six-pin connector at the OBC.

4. Remove the wedge lock from the six-pin connector housing that is connected to the vehicle wire harness. Remove the brown/white wire from the connector plug.

5. Using a jumper wire with an alligator clip at each end, connect one alligator clip to the negative post of battery no. 1 and the other alligator clip to the brown/white wire terminal socket that was removed from the six-pin connector plug.

6. Install the wedgelock in the six-pin connector housing and reconnect the six-pin connector plug. Place the Tow/Run switch in the RUN position and the battery light should illuminate. If the light does not illuminate, replace the battery warning light assembly.

COMMUNICATION DISPLAY MODULE (CDM)

The CDM can be used to retrieve from the onboard computer four important items of information that can be useful in troubleshooting the IQ System vehicle. To access one of these items, the item’s corresponding Function Code must be selected on the CDM. This is done by pressing the Function Button until the desired function code is displayed in the window. See Figure 11-19, Page 11-38 for CDM features. Releasing the button when the desired code is displayed will display the data. Function codes and corresponding data are as follows:
• **F1 – Battery voltage:**
  This displays the battery pack’s current state of charge. A reading of less than 48 volts indicates that the batteries need to be charged. If a reading of less than 48 volts is obtained immediately after a charge cycle, there may be a problem in the charge circuit.

• **F2 – Energy units removed since last charge cycle:**
  If the display reads over 75 (the vehicle battery warning light should be illuminated), the vehicle batteries need to be recharged before being used again. This data can be used to make sure all vehicles in a fleet receive equal usage on a short-term basis.

• **F3 – Total accumulated energy units removed since initial vehicle start-up:**
  This information is most useful in making sure that all vehicles in a fleet receive equal usage over long periods of time.

• **F4 – Last charge termination type (1 = incomplete, 2 = DVDT, 4 = normal, 8 = max. timer):**
  A 1, 2, 4, or 8 will be displayed.

  1 – Indicates the last charge cycle was incomplete and the batteries were not fully charged. Batteries should be charged again at the earliest opportunity.

  2 – Indicates a back-up charge program was employed by the OBC to complete the charge cycle. A DVDT charge may be displayed the first few times a new set of batteries is charged, and the first time a set of batteries is charged after the batteries have been disconnected and reconnected. A problem may exist if persistent DVDT readings are obtained.

  4 – Indicates the last charge cycle was normal.

  8 – Indicates the charger ran for sixteen hours and shut itself off without completing the charge cycle. This means there may be a problem in the charge circuit.

The CDM also has a low battery indicator, which illuminates when CDM batteries are weak and need to be replaced. Weak batteries in the CDM may cause the CDM to register inaccurate information or no information.

### USING THE CDM TO RETRIEVE DATA FROM THE ONBOARD COMPUTER

1. Turn the CDM ON.

2. Position CDM on seat bottom so it is aligned directly with the battery warning light. Ensure CDM infrared LED receiver is pointed at battery warning light and there is a clear path between them. **See following NOTE.**

   **NOTE:** If, by positioning CDM on seat bottom, the CDM is unable to collect the data stream from the onboard computer, hold CDM approximately 6 inches (15.2 cm) from battery warning light.

3. Wait approximately 30 seconds for a value to appear in the display window.

4. If a value does not appear in the display window after 30 seconds, try adjusting the aim of the CDM and repeating step 3 until a value appears. If there is still no reading, check for weak batteries in the CDM.

   4.1. Adjust aim of CDM.

   4.2. Drive vehicle a short distance to ensure OBC is not in powerdown mode.

   4.3. Check for weak batteries in CDM.

   4.4. If reading is still not obtained, go to the CDM Troubleshooting Guide on page 11-40.
Using the CDM to Retrieve Data from the Onboard Computer, Continued:

Once a value has been obtained in the display window, the CDM may be removed from its receiving position and the data reviewed. The CDM will hold the values for F1, F2, F3, and F4 until the CDM is turned OFF or it receives another line of data from the same or another onboard computer. Use the following procedure to review the data stored in the CDM:

- The value currently displayed will be F1 (battery voltage).
- To view F2, press and hold the button on the CDM. When “Func 2” appears in the display window, release the button. The value for F2 will then be displayed.
- To view F3, press and hold the button on the CDM until “Func 3” appears in the display window. Release the button. The value for F3 will be displayed.
- To view F4, press and hold the button on the CDM until “Func 4” appears in the display window. Release the button. The value for F4 will be displayed.

**NOTE:** The values of all four functions can be recalled by pressing and releasing the CDM button.

**CDM TROUBLESHOOTING GUIDE**

Use the following chart as a starting point for troubleshooting problems with communication between the CDM and onboard computer. Contact your Club Car representative for more comprehensive information.

![Flow Chart – CDM Troubleshooting Guide](image-url)
SECTION 12 – ELECTRICAL COMPONENTS

⚠️ DANGER

• See General Warnings, Section 1, Page 1-1.

⚠️ WARNING

• See General Warnings, Section 1, Page 1-1.

KEY SWITCH

See General Warnings, Section 1, Page 1-1.

Testing the Key Switch

See Test Procedure 8, Section 11, Page 11-20.

Key Switch Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove the instrument panel (Figure 12-1, Page 12-1).
   2.1. Remove three screws (1) from the instrument panel (2) (Figure 12-1, Page 12-1).
   2.2. Rotate the instrument panel up and away from the dash to disengage the tabs at the top of the panel.
   2.3. Disconnect the electrical connector (3) to the instrument panel.

![Figure 12-1 Instrument Panel Removal](image-url)
Key Switch Removal, Continued:

3. Disconnect the wires from the key switch.

4. From the back of the instrument panel, push down on the retaining tabs surrounding the key switch (4) and remove the key switch cap (8). Hold the key switch and remove the switch retaining nut (6) from the outside of the instrument panel. (Figure 12-2, Page 12-2).

Key Switch Installation

1. Position the key switch and flat washer (9) in the instrument panel, then install and tighten the switch retaining nut (6) to 40 in-lb (4.5 N·m). Install key switch cap (8) in center dash (Figure 12-2, Page 12-2).

2. Connect the blue and green wires to the key switch terminals. Either orientation is correct. See Wiring Diagrams, Section 11, Page 11-2.

3. Install the instrument panel.

3.1. Connect the electrical connector (3) (Figure 12-1, Page 12-1).

3.2. Position the instrument panel (2) on the dash assembly. Make sure tabs on upper edge properly engage with the corresponding slots on the dash assembly. Ensure that there are no wires exposed or pinched during positioning.

3.3. Secure instrument panel to the dash assembly with three screws (1). Tighten screws to 1.8 ft-lb (2.5 N·m).

4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
BATTERY WARNING LIGHT

See General Warnings, Section 1, Page 1-1.

Testing the Battery Warning Light
See Test Procedure 18, Section 11, Page 11-38.

Battery Warning Light Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove instrument panel. See step 2 of Key Switch Removal on page 12-1.

3. Disconnect the wires at the warning light.

4. Press the two retaining tabs (11) and remove the light from the center dash (Figure 12-3, Page 12-3).

Battery Warning Light Installation

1. Install in reverse order of removal.

2. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

FORWARD/REVERSE ROCKER SWITCH

See General Warnings, Section 1, Page 1-1.

Testing the Forward/Reverse Rocker Switch
See Test Procedure 15, Section 11, Page 11-36.

Forward/Reverse Rocker Switch Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.
2. Remove two screws (2) that hold Forward/Reverse rocker switch housing (1) to the vehicle (Figure 12-4, Page 12-4).

3. Remove the three wires from the rocker switch.

4. Press in on the locking tabs on each side of switch (3), and push switch out of housing.

---

**Forward/Reverse Rocker Switch Installation**

1. Route the three wires through bezel. Connect the three wires to the rocker switch (3), exactly as shown in (Figure 12-4, Page 12-4).

2. Orient the rocker switch (3) so the terminals are towards the front of the housing (1). Push rocker switch (3) into housing (1) (Figure 12-4, Page 12-4).

3. Place the housing in position on the body and install the two screws (2). Tighten to 20 in-lb (2.3 N·m).

4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

5. Place the Tow/Run switch in the RUN position.

6. Inspect the vehicle for proper operation.

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⚠️ **WARNING**

- Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.

- Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.

- Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.
ELECTRONICS MODULE COVER

See General Warnings, Section 1, Page 1-1.

The electronics module cover needs to be removed to gain access to the electronics module, the Tow/Run switch, and hour meter.

Electronics Module Cover Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove the screw (1) that holds the cover (2) over the electronics module (Figure 12-5, Page 12-5).

3. Hold battery wire out of way and lift cover (2) off the vehicle.

Electronics Module Cover Installation

1. Hold battery wire out of way and place cover (2) over the electronics module.

2. Install screw (1) to secure cover in place. Tighten screw to 3.4 ft-lb (4.6 N·m).

CAUTION

- Exposure to water may damage electronic components.
  - Do not operate vehicle without this cover properly installed.
  - Do not direct water stream in the area of the cover.

3. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

Figure 12-5  Electronics Module Cover
TOW/RUN SWITCH

See General Warnings, Section 1, Page 1-1.

Testing the Tow/Run Switch

See Test Procedure 6, Section 11, Page 11-19.

Tow/Run Switch Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove the electronics module cover. See Electronics Module Cover Removal on page 12-5.

3. Remove Tow/Run switch boot/hex nut (1) (Figure 12-6, Page 12-6).

4. Remove Tow/Run switch (2) from bracket.

5. Disconnect the two wires (3) and remove switch.

Tow/Run Switch Installation

1. Installation is reverse of removal. Make sure flat on switch is aligned with the flat on bracket. Tighten Tow/Run switch boot/hex nut (1) to 16 in-lb (1.8 N·m) (Figure 12-6, Page 12-6).

2. Install the electronics module cover. See Electronics Module Cover Installation on page 12-5.

3. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

Figure 12-6  Tow/Run Switch
MOTOR CONTROLLER OUTPUT REGULATOR (MCOR)

See General Warnings, Section 1, Page 1-1.

Testing the MCOR

See Section 11, Test Procedure 4, Page 11-17 and Test Procedure 8, Page 11-20.

MCOR Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove pedal group. See Pedal Group Removal, Section 5, Page 5-1.

3. Disconnect the two-pin and three-pin connectors (1) from the MCOR (2) (Figure 12-7, Page 12-7).

4. Remove the hex-head screws (3) connecting the MCOR to the pedal group.

MCOR Installation

1. Secure the MCOR (2) to the pedal group with two hex-head screws (3) (Figure 12-7, Page 12-7). Tighten screws to 23 in-lb (2.6 N·m).

2. Connect the two-pin and three-pin connectors (1) from the wire harness to the MCOR.

3. Install the pedal group. See Pedal Group Installation, Section 5, Page 5-6.

4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

Figure 12-7   Motor Controller Output Regulator
REVERSE BUZZER

See General Warnings, Section 1, Page 1-1.

Testing the Reverse Buzzer

See Test Procedure 16, Section 11, Page 11-37.

Reverse Buzzer Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove instrument panel. See step 2 of Key Switch Removal on page 12-1.

3. Disconnect the 18-gauge pink and orange/white wires from reverse buzzer.

4. Remove the two screws from the reverse buzzer. Remove the reverse buzzer from the dash panel.

Reverse Buzzer Installation

1. Install the reverse buzzer in the reverse order of removal. Pink wire must be connected to the positive terminal. Tighten screws to 4 in-lb (0.45 N·m).

2. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

Figure 12-8  Reverse Buzzer
Figure 12-9  Electronics Module Removal
ELECTRONICS MODULE

See General Warnings, Section 1, Page 1-1.

While it is not necessary to remove the electronics module from the vehicle, access to individual components may be easier with the module removed.

Electronics Module Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.
2. Remove the electronics module cover. See Electronics Module Cover Removal on page 12-5.
3. Remove three power-connection screws on top of the controller (1) and remove the wires from the screw threads (Figure 12-9, Page 12-9).
4. Disconnect the 16-pin connector, 4-pin connector, and the spade connectors from the top of the controller.
5. Remove two nuts on top of the solenoid (2) posts and remove the wires from the posts.
6. Disconnect the spade connectors on the front of the solenoid.
7. On driver side of the electronic module, separate the 6-pin connector and disconnect all leads to the on-board computer (OBC) (3) and two wires to tow switch.
8. Lift the electronics module from the vehicle. See following WARNING.

⚠️ WARNING

- Shorting of battery terminals can cause personal injury or death.
  - Do not place component mounting plate directly on top of batteries when removing or installing plate.
  - Remove plate from vehicle completely.

Electronics Module Installation

1. Insert the electronics module into the vehicle. Ensure the orientation is correct, with the computer toward the front, the controller toward the rear, and both facing the passenger side of the vehicle.
2. Complete connections to the computer, the controller, and the solenoid per the electrical schematics. See Wiring Diagrams, Section 11, Page 11-2.
3. Tighten bolts on the controller to 9 ft-lb (12.2 N·m).
4. Tighten nuts on the solenoid to 6.4 ft-lb (8.7 N·m).
5. Install electronic module cover. See Electronics Module Cover Installation on page 12-5.
6. Inspect the vehicle for proper operation.

⚠️ WARNING

- Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.
- Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.
- Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.
SOLID STATE SPEED CONTROLLER

See General Warnings, Section 1, Page 1-1.

Testing the Solid State Speed Controller

See Test Procedure 5, Section 11, Page 11-18.

Speed Controller Removal

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**

2. Remove electronics module cover. **See Electronics Module Cover Removal on page 12-5.**

3. Remove electronics module assembly from the vehicle. **See Electronics Module Removal on page 12-10.**

4. Remove the three self-tapping screws (1) that hold the controller to the component mounting plate and remove the controller from the vehicle (**Figure 12-10, Page 12-12**).

Speed Controller Installation

1. Install the three self-tapping screws (1) that hold the controller to the component mounting plate and tighten to 5.5 ft-lb (7.5 N·m) (**Figure 12-10, Page 12-12**).

2. Install electronic module assembly in the vehicle. **See Electronics Module Installation on page 12-10.**

3. Install electronics module assembly cover. **See Electronics Module Cover Installation on page 12-5.**

4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

5. Place the Tow/Run switch in the RUN position.

6. Inspect the vehicle for proper operation.

**WARNING**

- Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.

- Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.

- Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.
SOLENOID

See General Warnings, Section 1, Page 1-1.

The solenoid is located on the passenger side of the electrical component mounting plate.

Testing the Solenoid


Solenoid Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.
2. Remove electronics module cover. See Electronics Module Cover Removal on page 12-5.
3. Remove 4 wires from solenoid.
4. Loosen both solenoid mounting screws (2) (Figure 12-10, Page 12-12).
5. Rotate solenoid up in front and slide off of the component mounting plate.

Solenoid Installation

1. Mount solenoid onto component mounting plate with screws (2) (Figure 12-10, Page 12-12).
2. Tighten screws (2) to 5.5 ft-lb (7.5 N·m).
3. Connect yellow (4) and red (5) wires (Figure 12-9, Page 12-9). Tighten to 72 - 84 in-lb (8 - 9.5 N·m).
4. Install electronics module cover. See Electronics Module Cover Installation on page 12-5.
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
ONBOARD COMPUTER (OBC)

See General Warnings, Section 1, Page 1-1.

Testing the Onboard Computer


Onboard Computer Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.
2. Remove electronics module cover. See Electronics Module Cover Removal on page 12-5.
3. Disconnect wires (Figure 12-9, Page 12-9).
4. Loosen, but do not remove, the two self-tapping screws (3) holding OBC to component mounting plate (Figure 12-10, Page 12-12).
5. Slide OBC upwards to align heads of self-tapping screws (3) with the two key holes in the OBC face plate and remove OBC.

Onboard Computer Installation

1. Install the OBC onto the component mounting plate by aligning the two holes on the OBC face plate with two holes on component mounting plate. Slide OBC down and align heads of self-tapping screws (3) with smaller part of two holes in OBC face plate (Figure 12-10, Page 12-12). Tighten screws to 5.5 ft-lb (7.5 N·m).
2. Connect wires (Figure 12-9, Page 12-9). Make sure all connections are fully seated and boot on gray sense lead is properly seated.
3. Install electronics module cover. See Electronics Module Cover Installation on page 12-5.
4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

CHARGER RECEPTACLE

See General Warnings, Section 1, Page 1-1.

The charger cord, plug, and receptacle are wear items and should be inspected daily. Visually inspect them for cracks, loose connections, and frayed wiring; they must be replaced when worn or damaged. If charger plug or receptacle show signs of corrosion or the plug is difficult to insert or remove, the receptacle contacts and plug terminals should be cleaned with a good electrical contact cleaner or lightly sprayed with electrical contact cleaner. The plug should then be inserted and removed several times to ensure ease of insertion, ease of removal, and good electrical contact.

Testing the Charger Receptacle

See Test Procedure 12, Section 11, Page 11-33.

See also the appropriate battery charger maintenance and service manual.

Charger Receptacle Inspection

Inspect the receptacle for cracks, loose connections and frayed wiring.

NOTE: Disassembly of the charger receptacle, for the purpose of removal or installation, is not recommended.
Charger Receptacle Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Remove electronic module cover.

3. Remove kick plate. See Kick Plate and Charger Receptacle Bezel, Section 4, Page 4-7.

4. Remove the 10-gauge red wire from the positive post of battery no. 1 (Figure 12-11, Page 12-14).

5. Disconnect the black wire from its connector.

6. Disconnect the gray wire from the OBC.

7. Remove the three screws (1) that secure the charger receptacle (2) to the bucket.

Charger Receptacle Installation

1. Insert the wires through the hole in the bucket (Figure 12-11, Page 12-14).

2. Insert receptacle (2) into bucket.

3. Install the three screws (1) that secure the receptacle to the bucket. Tighten screws to 16 in-lb (1.8 N·m).

4. Connect gray wire to the OBC. Make sure boot is properly seated.

5. Connect the black wire to the mating connector. Make sure connector is fully seated.

6. Connect the red wire to the positive post of battery no. 1.

7. Install kick plate. See Kick Plate and Charger Receptacle Bezel, Section 4, Page 4-7.

8. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
SECTION 13 – BATTERIES

⚠️ DANGER

- See General Warnings, Section 1, Page 1-1.

⚠️ WARNING

- See General Warnings, Section 1, Page 1-1.

- Battery – Explosive gases! Do not smoke. Keep sparks and flames away from the vehicle and service area. Ventilate when charging or operating vehicle in an enclosed area. Wear a full face shield and rubber gloves when working on or near batteries.

- Battery – Poison! Contains acid! Causes severe burns. Avoid contact with skin, eyes, or clothing. Antidotes:
  - External: Flush with water. Call a physician immediately.
  - Internal: Drink large quantities of milk or water. Follow with milk of magnesia or vegetable oil. Call a physician immediately.
  - Eyes: Flush with water for 15 minutes. Call a physician immediately.
  - Use insulated tools when working near batteries or electrical connections. Use extreme caution to avoid shorting of components or wiring.

GENERAL INFORMATION

The batteries supplied with an electric Club Car vehicle are different from those supplied with an automobile. The outward appearance of these two batteries is similar, but the operating characteristics are very different. The Club Car electric vehicle battery is a deep-cycle battery, and the automotive battery is a “starting, lighting and ignition” (SLI) battery. They should never be substituted for one another.

BATTERY REPLACEMENT

See General Warnings, Section 1, Page 1-1.

⚠️ WARNING

- To prevent electrolyte leakage from the battery vents, batteries must be kept in an upright position. Tipping a battery beyond a 45° angle in any direction can allow a small amount of electrolyte to leak out the vent hole. Do not exceed this 45° angle when lifting, carrying, or installing batteries. Battery acid can cause severe personal injury to skin or eyes, and can damage clothing.

1. Before removing batteries, note the orientation of the batteries and the connecting wires. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1. Remove remaining wires and batteries. See Wiring Diagrams, Section 11, Page 11-2.

2. Visually inspect the new batteries for any damage that may have occurred in transit.
Battery Replacement, Continued:

3. If the battery cables are to be reused, inspect them for broken or frayed wires, damaged terminals, or worn insulation. Remove any corrosion on the connectors. A solution of baking soda and water (1 cup (237 mL) baking soda per 1 gallon (3.8 L) of water) does an excellent job of neutralizing and removing the corrosion. Be careful not to allow the baking soda solution to enter the battery.

4. Check and clean the battery rack and hold-downs. The nuts and bolts on the hold-downs may corrode. It is therefore advised they be cleaned periodically and replaced as necessary.

5. Install batteries in the proper orientation (Figure 13-1, Page 13-2). Install battery hold-downs. The hold-downs should be tight enough so batteries do not move while vehicle is in motion, but not so tight as to crack or buckle battery case. Tighten to 97.4 in-lb (11 N·m), alternating between hold-down bolts.

6. Install wires in proper sequence (Figure 13-1, Page 13-2). Install black wire to negative post of battery no. 4 last. Make sure all connections are tight. Tighten to 110 in-lb (12.4 N·m). Coat all terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize future corrosion.

7. Give the batteries a full charge prior to operation. This ensures all the batteries are fully charged and the cells are equalized prior to use.

**BATTERY CARE**

See General Warnings, Section 1, Page 1-1.

**PREVENTIVE MAINTENANCE**

To keep batteries in sound operating condition, follow these steps on a regular basis.

1. Any corrosion build-up on or around batteries should be removed immediately. Terminal connections should be clean and tight. Any frayed or worn wires should be replaced. After all cables have been connected, coat all terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to help prevent future corrosion.
2. Batteries should be clean and free of corrosion. Wash tops and terminals of batteries with a solution of baking soda and water (1 cup (237 mL) baking soda per 1 gallon (3.8 L) of water). Rinse solution off batteries. Do not allow this solution to enter the batteries. Be sure terminals are tight. Let the terminals dry and then coat them with Battery Terminal Protector Spray (CCI P/N 1014305). See Self-Discharge on page 13-3.


4. Batteries should be properly charged every day they are used. Check the batteries periodically to see that they are in a full state of charge. See Battery Charging on page 13-4.


SELF-DISCHARGE

Contaminants on dirty batteries can provide a path for a small current draw that can slowly discharge batteries, thus wasting valuable energy. To prevent self-discharge, batteries should always be kept clean.

Hot weather also has an effect on a battery’s self-discharge rate. The higher the temperature, the quicker a set of batteries will discharge. In hotter climates, batteries should be checked more often. When storing batteries, keep in a cool place. See Battery Storage on page 13-12.

ELECTROLYTE LEVEL

⚠️ CAUTION

- Do not allow battery acid from battery caps or hydrometer to drip onto the front or rear body of the vehicle. Battery acid will cause permanent damage. Wash immediately.

Add water only after charging unless the electrolyte is below the level of the plates. If the electrolyte level is below the level of the plates, add just enough water to cover the plates and then charge the batteries. After charging, fill with water to the level indicator. Filling a battery to the level indicator before charging will result in overfilling because the electrolyte level will rise during charging and some of the electrolyte may bubble out of the cap. This reduces the battery’s capacity and corrodes the metal parts around it.
Electrolyte Level, Continued:

The electrolyte level should be checked weekly to be sure electrolyte is at its proper level (Figure 13-2, Page 13-3). Never allow the electrolyte level to fall below the tops of the plates because this will cause the exposed part of the plate to become permanently inactive. For best results, use a battery watering gun to add water to batteries. Check the electrolyte level more frequently in hot weather or when batteries are old.

MINERAL CONTENT

For the longest battery life, use distilled water in batteries. However, if tap water is to be used, be sure the mineral contents are below these levels:

<table>
<thead>
<tr>
<th>IMPURITY</th>
<th>ALLOWABLE CONTENT (PARTS PER MILLION)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended matter</td>
<td>Trace</td>
</tr>
<tr>
<td>Total solids</td>
<td>100.0</td>
</tr>
<tr>
<td>Calcium and Magnesium Oxides</td>
<td>40.0</td>
</tr>
<tr>
<td>Iron</td>
<td>5.0</td>
</tr>
<tr>
<td>Ammonia</td>
<td>8.0</td>
</tr>
<tr>
<td>Organic matter</td>
<td>50.0</td>
</tr>
<tr>
<td>Nitrates</td>
<td>10.0</td>
</tr>
<tr>
<td>Nitrites</td>
<td>5.0</td>
</tr>
<tr>
<td>Chloride</td>
<td>5.0</td>
</tr>
</tbody>
</table>

VIBRATION DAMAGE

The battery hold-downs should always be tight enough to keep the battery from bouncing. Battery life may be severely shortened if the battery hold-downs are too loose. Battery hold-downs should be tightened to 97 in-lb (11 N·m). Excessive vibration causes the plates to shed prematurely and shortens the life of the battery. It may also cause acid to leak out of the vent caps and corrosion to build up on surrounding metal parts. The acid which is lost reduces the capacity of the battery and cannot be replaced. Battery hold-downs should NOT be so tight as to crack or buckle the battery case. This may cause leaks which would dry out a cell or cause internal short circuits. See Battery Replacement on page 13-1.

BATTERY CHARGING

See General Warnings, Section 1, Page 1-1.

The charger supplied with the Club Car electric vehicle resolves the most common problems associated with battery charging. Undercharging and overcharging are prevented provided the charger is allowed to shut off by itself. Also, all cells are automatically given an equalization charge at low current, which prolongs battery life. Batteries should never be left in a discharged state, as this too affects the internal components and can reduce the capacity of the battery. The batteries should be charged every day they are used. However, the batteries should not be charged if they have not been used.
**CHARGER SHUTS OFF AFTER 16 HOURS**

This may be due to 1) new batteries, 2) hard use, or 3) cold temperatures. A catch-up charge may be necessary when these conditions are present. On those days when all or some of the vehicles do not get used, check the batteries for state of charge. Any battery with a specific gravity lower than 1.250 will need a catch-up charge. If the problem continues after a catch-up charge has been performed, check the battery charger. See Section 14 – Battery Charger.

**DEEP-DISCHARGE**

Never discharge batteries to the point the vehicle will no longer operate. This will considerably shorten the cycle life of the batteries, and may permanently damage the batteries. It is possible the batteries will not accept a charge if they are completely discharged. The deeper the discharge, the harder it is on the batteries. For this reason, it is recommended that Club Car electric vehicle batteries be charged after each use (provided the charge cycle will not be interrupted and the charger will be allowed to shut off automatically). Placing the batteries on charge after each use reduces the depth of discharge and prolongs battery life.

**EARLY EXCESSIVE DISCHARGING**

When vehicle batteries are new, they do not reach their full capacity until they have been used and recharged 20 to 50 times. If they are excessively discharged early in their life, their effective service life will be shortened. It is advisable to limit the use of any vehicle with new batteries for at least the first four weeks and then gradually increase their range.

**INCOMING AC SERVICE**

Make sure the incoming AC line service is sufficient. If circuit breakers are tripping, fuses blow during the night or the charger does not give the required starting rate when sound batteries are put on charge, an AC line problem exists. The electrical service to the vehicle storage facility should be sufficient to deliver adequate voltage and current to each charger with all the chargers turned on. If not, consult your local power company or electrical contractor. See Section 14 – Battery Charger.

**FLEET ROTATION**

Rotate vehicle usage. It is very hard on batteries if the last vehicles in at night are the first ones out in the morning. Spread the workload evenly, giving all vehicles the same amount of use. This will keep your fleet in balance and will not overwork certain sets of batteries.

**NOTE:** When vehicles are being rotated, the Club Car CDM (Communication Display Module) can be a very helpful service tool. Monitoring the value of function 3 with the CDM simplifies vehicle usage scheduling. See Communication Display Module (CDM), Section 11, Page 11-38.

**NUMBERING VEHICLES AND CHARGERS**

Return the vehicles to the same charger each night if possible. If the vehicles are put in a storage facility at random and a vehicle dies while in use and testing shows the batteries are sound, then the problem is most likely with the charger. However, finding the problem charger may prove to be quite time consuming. Numbering the vehicles and the chargers and returning each vehicle to its designated charger each night can significantly reduce the amount of time spent troubleshooting a problem.
BATTERY TROUBLESHOOTING CHART

Vehicle not operating to expectation.

Fully Charge Batteries.

Battery Charger Test

Reading below 6 amps and on-charge voltage above 56 volts.

On-Charge Voltage Test

Reading of 6 amps or more.

Check electrical system and charger for problems. See Troubleshooting Guide

If problem is not found, go to on-charge voltage test.

Any reading below 9.3 volts and not within 0.7 volts of those batteries above 9.3 volts, replace battery.

All readings above 9.3V and within 0.7V.

Hydrometer Test

All readings below 9.3V but within 0.7V

Possible old batteries. Go to hydrometer testing.

Replace any battery with a variation of more than 50 points of specific gravity between cells or has a cell with no reading at all.

Entire battery set with specific gravity readings below 1.250 is being consistently undercharged. Evaluate charging practices.

Discharge Test

If discharge time is less than 60 minutes, replace all batteries below 6.7 volts.

If discharge time is 60 minutes or more, problem is not with the batteries.

Replace any battery with a variation of more than 50 points of specific gravity between cells or has a cell with no reading at all.
BATTERY TESTING

See General Warnings, Section 1, Page 1-1.

Four tests have been developed to help diagnose problems with batteries that have not performed as expected. Because each test becomes progressively more detailed and time-consuming, begin with the first test and follow through with the other tests until the problem has been identified as outlined in the Battery Troubleshooting Chart (Figure 13-3, Page 13-6).

BATTERY CHARGER TEST

The easiest way to monitor the condition of a vehicle’s batteries is simply to observe the reading on the battery charger ammeter at the end of the charge cycle. After a full charge, disconnect the charger DC plug, wait 20 to 30 seconds and reconnect the charger DC plug. The ammeter needle will jump to 15 amps or more and then taper to below 6 amps within 10 to 20 minutes, indicating sound, fully charged batteries.

Continued poor performance may indicate a problem in the vehicle electrical system, brakes or battery charger. If the problem is not found in the vehicle or charging system, proceed to the on-charge voltage test. Batteries that remain at 8 amps or higher should be tested further using the on-charge voltage test.

ON-CHARGE VOLTAGE TEST

When the batteries are fully charged, disconnect the charger DC plug. Wait 20 to 30 seconds and reconnect the DC plug to restart the charger. After 5 minutes, use a multimeter to check and record the voltage of the battery set as well as the individual batteries. Set the multimeter to 200 volts DC. Place the red (+) probe on the positive (+) post of battery no. 1 and the black (–) probe on the negative (–) post of battery no. 4 (Figure 13-1, Page 13-2). Record reading. Then set multimeter to 20 volts DC and place the red (+) probe on the positive (+) post and the black (–) probe at the negative (–) post of each battery. Record the readings.

The on-charge voltage for the set should be between 56.0 volts and 63.0 volts depending on the age and state of charge of the batteries being tested. If individual batteries read above 14.0 volts and are within 1.0 volts of each other, go to the hydrometer test. If any battery reads below 14.0 volts and not within 1.0 volts of those batteries above 14.0 volts, replace battery. If readings are below 14.0 volts but within 1.0 volts of each other, the batteries are old. Old batteries may have enough capacity left to last several more months. Go to hydrometer test. See Battery Troubleshooting Chart on page 13-6 and the examples on the following pages.

HYDROMETER TEST

A hydrometer measures the specific gravity of the battery’s electrolyte. The higher the specific gravity, the higher the state of charge of the batteries. A fully charged battery should read between 1.250 and 1.280 at 80 °F (26.7 °C). Never add acid to batteries to obtain a higher specific gravity.

Performing the Hydrometer Test

1. Be sure batteries have sufficient electrolyte to cover plates by approximately 1/2 inch (13 mm) and are fully charged prior to beginning test. If water must be added, recharge the batteries before performing the hydrometer test.

2. Remove the vent cap. Using a battery thermometer (CCI P/N 1011767), record electrolyte temperature of the no. 2 cell.

3. Squeeze the rubber bulb of the hydrometer and insert into the cell. Slowly release the bulb, drawing electrolyte up into the glass tube of the hydrometer.

4. When the float rises off the bottom, adjust the electrolyte level so that the float rides free of the bottom but does not strike the top of the glass tube. Remove the hydrometer from the cell and release the pressure from the bulb.
Performing the Hydrometer Test, Continued:

5. Hold the hydrometer vertically, ensuring that the float is not touching the sides of the barrel. Hold the hydrometer at eye level and read the scale at the level of electrolyte (Figure 13-4, Page 13-8).

6. Record the reading and return the electrolyte to the cell from which it was taken. Replace vent cap.

7. Repeat steps 2 through 6 on all cells.

Hydrometer Calibration

Most hydrometers are calibrated to read correctly at 80 °F (26.7 °C). The readings obtained as described above must be corrected for temperature. For each 10 °F (5.6 °C) above 80 °F (26.7 °C), add 0.004 to the reading. For each 10 °F (5.6 °C) below 80 °F (26.7 °C), subtract 0.004 from the reading.

Interpreting the Results of the Hydrometer Test

The approximate state of charge can be determined from the following table:

<table>
<thead>
<tr>
<th>SPECIFIC GRAVITY (TEMPERATURE CORRECTED)</th>
<th>APPROXIMATE STATE OF CHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.250-1.280</td>
<td>100%</td>
</tr>
<tr>
<td>1.220-1.240</td>
<td>75%</td>
</tr>
<tr>
<td>1.190-1.210</td>
<td>50%</td>
</tr>
<tr>
<td>1.160-1.180</td>
<td>25%</td>
</tr>
</tbody>
</table>

If the difference between the cells is 0.020 or more, the low cell should be suspected. It may require a catch-up charge or it may be a weak cell. When the variations between cells reach 0.050 or more, the battery with the low cell should be replaced.
DISCHARGE TEST

If the previous tests have failed to identify the problem, conduct a discharge test. The discharge test comes closest to simulating actual vehicle operating conditions by continuously drawing current from the batteries until voltage drops to 42.0 volts.

The discharge test is the hardest test on the batteries and the most time-consuming to perform. Use the battery discharge tester (CCI P/N 101831901).

Performing the Discharge Test

1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.

2. Connect the tester leads to the positive (+) post of battery no. 1 and negative (–) post of battery no. 4 (Figure 13-5, Page 13-9).

<table>
<thead>
<tr>
<th>VEHICLE NO.</th>
<th>BATTERY NO.</th>
<th>ELECTROLYTE TEMPERATURE</th>
<th>CORRECTION FACTOR</th>
<th>CORRECTED SPECIFIC GRAVITY</th>
<th>REQUIRED ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1</td>
<td>20 °F (–6.6 °C)</td>
<td>–0.024</td>
<td>1.275 – 0.024 = 1.251</td>
<td>Sound Battery – Fully Charged</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.280 – 0.024 = 1.256</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.280 – 0.024 = 1.256</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.275 – 0.024 = 1.251</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.280 – 0.024 = 1.256</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>3</td>
<td>50 °F (10 °C)</td>
<td>–0.012</td>
<td>1.260 – 0.012 = 1.248</td>
<td>Bad no. 2 Cell</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.200 – 0.012 = 1.188</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.270 – 0.012 = 1.253</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.265 – 0.012 = 1.253</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.270 – 0.012 = 1.253</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>2</td>
<td>100 °F (37.8 °C)</td>
<td>+ .008</td>
<td>1.200 + 0.008 = 1.208</td>
<td>Discharged Battery – Recharge and Recheck</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.180 + 0.008 = 1.188</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.170 + 0.008 = 1.178</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.200 + 0.008 = 1.208</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.180 + 0.008 = 1.188</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>4</td>
<td>80 °F (26.7 °C)</td>
<td>.000</td>
<td>1.240 – 0 = 1.240</td>
<td>no.3 Cell Dead – Replace Battery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.245 – 0 = 1.245</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.250 – 0 = 1.250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.240 – 0 = 1.240</td>
<td></td>
</tr>
</tbody>
</table>

Figure 13-5 Battery Discharge Test
Performing the Discharge Test, Continued:

3. Check and record the electrolyte temperature of the battery packs. Check cell no. 2 (second cell from positive post) in each battery.

4. Reset discharge machine and turn the tester ON.

5. When the batteries have been discharging for approximately 60 minutes, set the discharge machine to function 3 and check battery set voltage. Check voltage every 10 minutes throughout the rest of the test. As soon as the battery set voltage reaches 0.5 volts above the shut-off point (42.0 volts), use a multimeter to measure individual battery voltages. Measure and record the voltage of each battery to the nearest 0.01 volt.

**NOTE:** The tester will shut off automatically when shut-off voltage is reached.

Interpreting Discharge Test Results

1. If discharge time is 60 minutes or higher, the problem is not with the batteries.

2. If discharge times are low (less than 60 minutes), replace batteries below 10.05 volts.

<table>
<thead>
<tr>
<th>BATTERY VOLTAGES</th>
<th>BATTERY CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.50 V</td>
<td>10.50 V</td>
</tr>
<tr>
<td>10.60 V</td>
<td>10.60 V</td>
</tr>
<tr>
<td>10.8 V</td>
<td>10.8 V</td>
</tr>
</tbody>
</table>

3. In general, battery sets that discharge in less than 60 minutes at 78 °F (25.6 °C) on the discharge test will typically not hold a charge for an entire work shift. However, discharge time is dependent on the electrolyte temperature. The table shown gives the discharge times, at various temperatures, of a set of batteries that delivers 62 minutes at 80 °F (26.7 °C).

<table>
<thead>
<tr>
<th>ELECTROLYTE TEMPERATURE</th>
<th>DISCHARGE TIME TO SHUT-OFF POINT</th>
<th>ELECTROLYTE TEMPERATURE</th>
<th>DISCHARGE TIME TO SHUT-OFF POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49 °F (4-9 °C)</td>
<td>40 Minutes</td>
<td>85-89 °F (29-32 °C)</td>
<td>64 Minutes</td>
</tr>
<tr>
<td>50-59 °F (10-15 °C)</td>
<td>45 Minutes</td>
<td>89-99 °F (32-37 °C)</td>
<td>66 Minutes</td>
</tr>
<tr>
<td>60-64 °F (16-18 °C)</td>
<td>50 Minutes</td>
<td>100-109 °F (38-43 °C)</td>
<td>68 Minutes</td>
</tr>
<tr>
<td>65-69 °F (18-21 °C)</td>
<td>54 Minutes</td>
<td>110-119 °F (43-48 °C)</td>
<td>70 Minutes</td>
</tr>
<tr>
<td>70-74 °F (21-23 °C)</td>
<td>57 Minutes</td>
<td>120-129 °F (49-54 °C)</td>
<td>72 Minutes</td>
</tr>
<tr>
<td>75-79 °F (24-26 °C)</td>
<td>60 Minutes</td>
<td>130-150 °F (54-66 °C)</td>
<td>74 Minutes</td>
</tr>
<tr>
<td>80-84 °F (27-29 °C)</td>
<td>62 Minutes</td>
<td>*****</td>
<td>*****</td>
</tr>
</tbody>
</table>
BATTERY TROUBLESHOOTING EXAMPLES

The following information represents a few examples of troubleshooting battery problems.

Example 1

Vehicle no. 68 was suspected of having a bad battery due to its performance. As a result, the battery charger test was performed. After a full charge, the battery charger ammeter read 8.0 amps. Next, the on-charge voltage test was performed and the following results were recorded:

<table>
<thead>
<tr>
<th>BATTERY NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Charge Voltage</td>
<td>15.22 V</td>
<td>15.90 V</td>
<td>14.70* V</td>
<td>15.24 V</td>
</tr>
</tbody>
</table>

*Battery no. 3 appears suspect. Battery nos. 1 and 4 are also suspect. Next, a hydrometer test should be conducted on all batteries.

**Hydrometer test results:**

<table>
<thead>
<tr>
<th>CELL NUMBER</th>
<th>BATTERY NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Cell 1 (Positive Post)</td>
<td>1.200*</td>
</tr>
<tr>
<td>Cell 2</td>
<td>1.285</td>
</tr>
<tr>
<td>Cell 3</td>
<td>1.265</td>
</tr>
<tr>
<td>Cell 4 (Negative Post)</td>
<td>1.275</td>
</tr>
<tr>
<td>Cell 5</td>
<td>1.270</td>
</tr>
<tr>
<td>Cell 6</td>
<td>1.275</td>
</tr>
</tbody>
</table>

*After the hydrometer test, it appears that battery no. 1 is the problem. Next, the discharge test was performed.

**Discharge test results:**

<table>
<thead>
<tr>
<th>BATTERY NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge Voltage</td>
<td>8.16* V</td>
<td>10.99 V</td>
<td>11.60 V</td>
<td>10.72 V</td>
</tr>
</tbody>
</table>

*After a discharge test which lasted 45 minutes, battery no. 1 is clearly shown to be the problem. Battery no. 4 should be watched a little more closely but appears to be okay. Battery no. 1 should be replaced with a battery that has about the same age and usage as the other batteries in the set.

Example 2

Vehicle no. 70 was also suspected of having a bad battery due to its performance. The battery charger test showed 7.0 amps after a full charge. After confirming there were no problems with the electrical system, charger or brakes, the on-charge voltage was recorded as follows:

<table>
<thead>
<tr>
<th>BATTERY NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Charge Voltage</td>
<td>15.72 V</td>
<td>14.66* V</td>
<td>15.80 V</td>
<td>15.85 V</td>
</tr>
</tbody>
</table>

*Battery no. 2 was immediately suspected as the problem. After checking battery no. 2 with a hydrometer, it was discovered that the negative post cell was completely dead. Battery no. 2 should be replaced with a battery that has the same age and usage as the other batteries in the set.
BATTERY STORAGE

See General Warnings, Section 1, Page 1-1.

When storing batteries during the off-season or when maintaining a replacement stock, follow these guidelines:

1. Keep the batteries clean and free of corrosion. See Battery Care on page 13-2.
2. Batteries that are in vehicles for winter storage should be left disconnected in the vehicles if the batteries are not going to be connected to a charger.
3. Fully charge the batteries prior to storage.
4. Store in a cool area. The colder the area in which the batteries are stored, the less the batteries will self-discharge. Batteries stored at 0 °F (−17.8 °C) will discharge very little over a four-month period. Batteries stored at 80 °F (26.7 °C) will have to be recharged every few weeks.
5. 48-volt Club Car electric vehicles and compatible battery chargers are designed to be left connected, with AC power to the charger ON, during off-season storage. The storage charge feature will automatically charge the batteries as needed throughout the storage period.

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

See the appropriate battery charger maintenance and service manual.
SECTION 14 – BATTERY CHARGER

Refer to the appropriate battery charger maintenance and service manual.
DANGER
• See General Warnings, Section 1, Page 1-1.

WARNING
• See General Warnings, Section 1, Page 1-1.

GENERAL INFORMATION

The IQ System vehicle is equipped with a 48-volt DC, shunt-wound, reversible traction motor. The shunt-wound motor is designed for use on the IQ System vehicle only. Club Car recommends that motors requiring major repair be sent to a qualified motor repair shop; however, there are many relatively simple tasks that can be performed by a technician with general knowledge and experience in electric motor repair.

MOTOR IDENTIFICATION

There are two types of motors used in 2005 model year IQ System electric vehicles: Model 5BC59JBS6365 (gray housing), and EJ4-4001 (black housing). Do not attempt to service a motor that has not been properly identified. If the motor cannot be properly identified, contact your local Club Car dealer or distributor.

EXTERNAL MOTOR TESTING

Using a multimeter or continuity tester, the following tests can be performed without disassembling the motor.

NOTE: Tag the motor wires for identification before disconnecting.

TEST PROCEDURE 1 – INTERNAL SHORT CIRCUITS

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Using two wrenches to prevent posts from turning, disconnect wires from terminals on motor.

3. Using a multimeter set to 200 ohms, place black (−) probe on motor housing. Scratch through paint to ensure a good connection. Place red (+) probe on A1, A2, F1, and F2 terminals respectively (Figure 15a-1, Page 15a-2). Multimeter should indicate no continuity. If readings are incorrect, motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal on page 15a-3.

3.1. An incorrect reading from the A1 or A2 terminal indicates three possible problems: a grounded A1 or A2 terminal, a grounded wire in the brush area, or a grounded armature/commutator. An incorrect reading for the F1 or F2 terminal indicates a possible grounded F1 or F2 terminal or field coil.
External Motor Testing, Continued:

![Figure 15a-1 Motor Short Circuit Test](image)

**TEST PROCEDURE 2 – ARMATURE CIRCUIT OPEN**

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Using two wrenches to prevent the posts from turning, disconnect wires from the A1 and A2 terminals on the motor. Using a multimeter set to 200 ohms, place the red (+) probe on the A1 terminal and black (−) probe on the A2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal on page 15a-3.

**TEST PROCEDURE 3 – FIELD CIRCUIT OPEN**

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Using two wrenches to prevent the post from turning, disconnect wires from the F1 and F2 terminals on the motor. Using a multimeter set to 200 ohms, place the red (+) probe on the F1 terminal and the black (−) probe on the F2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open field coil or bad connections at the terminals may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal on page 15a-3.
MOTOR

See General Warnings, Section 1, Page 1-1.

Motor Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.

2. Using two wrenches to prevent posts from turning, disconnect wires from terminals on motor. Label the wires to ensure proper reconnection.

3. Slightly loosen all the lug nuts on both rear wheels.

4. Place floor jack under transaxle and raise rear of vehicle (Figure 15a-2, Page 15a-3) then place jack stands under frame crossmember between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jack stands support the vehicle (Figure 15a-3, Page 15a-3). See following WARNING.

⚠️ WARNING

- Lift only one end of the vehicle at a time. Use a suitable lifting device (chain hoist or hydraulic floor jack) with 1000 lb. (454 kg) minimum lifting capacity. Do not use lifting device to hold vehicle in raised position. Use approved jack stands of proper weight capacity to support the vehicle and chock the wheels that remain on the floor. When not performing a test or service procedure that requires movement of the wheels, lock the brakes.

5. Remove both rear wheels.

6. Remove the nut, cup washer, and bushing from the bottom side of the shock absorber. Compress the shock absorber (pushing upwards) to move it out of the way (Figure 15a-4, Page 15a-4).

7. Remove the nuts and bolts mounting the rear leaf springs to the shackles.
Motor Removal, Continued:

8. To gain easier access to the motor, lower the transaxle as low as it will go. If more room is needed, remove the jack from beneath the transaxle and allow the springs to rest on the floor (Figure 15a-4, Page 15a-4). See following WARNING.

⚠️ WARNING

- Hot! Do not attempt to service hot motor, this could result in severe burns.
- Do not position fingers under motor when sliding motor off of the input shaft in step 10. Fingers may get pinched when motor disengages.

9. Remove the four bolts that mount the motor to the transaxle (Figure 15a-19, Page 15a-15).

10. Carefully slide the motor away from the transaxle until the motor spline disengages the input shaft and remove the motor from the vehicle.

Motor Disassembly

1. Before beginning disassembly, place match marks on the motor end shield and stator shell, then place the motor in a vice with wooden blocks as shown (Figure 15a-5, Page 15a-5).

2. Remove the four bolts (8) securing the end shield (10) to the stator shell (2).

3. Remove the two screws (9) attaching the end shield to the bearing retainer.

4. Lift stator shell (2) off of armature (17).

5. Remove two screws (11) attaching brush rigging (12) to the stator shell (2) (Figure 15a-10, Page 15a-8).

6. Mark the brush terminal posts (A1 and A2) (13) to identify their positions in the stator shell, then remove the nuts (6) and flat washers (5) (Figure 15a-10, Page 15a-8). From the outside, push the posts through the stator shell wall into the interior of the stator shell.

7. Carefully remove the brush rigging and the terminal posts from the stator shell.

8. To remove brush springs (14) from the rigging, lift the spring extensions out and over the brush mounts and then slide the springs off their mounting tabs (Figure 15a-6, Page 15a-5).
MOTOR COMPONENT TESTING AND INSPECTION

See General Warnings, Section 1, Page 1-1.

ARMATURE

Visual Inspection

Disassemble the motor and carefully inspect the armature for the following characteristics:

• Burned, charred or cracked insulation
• Improperly cured varnish
• Thrown solder
• Flared armature windings
• Damaged armature core laminations
• Worn, burned or glazed commutators
• Dirty or oily commutators
• Raised commutator bars
• Worn armature bearing or shaft
Visual Inspection, Continued:

A dirty or oily commutator should be cleaned and wiped dry. Abnormalities identified during the inspection can help determine original cause of failure. Slight roughness of the commutator can be polished smooth with 400 grit or finer sandpaper. See following CAUTION and NOTE.

CAUTION

- Do not use emery cloth to polish the commutator. Particles of emery are conductive and may short-circuit the commutator bars. Do not use oil or lubricants on the commutator or brushes.

NOTE: Oil on the commutator may indicate a faulty transaxle input shaft oil seal.

Armature Ground Test

⚠️ CAUTION

- Do not submerge the armature in solvent.

NOTE: Before testing the armature, wipe it clean with a clean cloth. Remove any carbon dust and metal particles from between the commutator bars.

1. With a multimeter set to 200 ohms, place one probe on the commutator and the other on the armature core. The multimeter should indicate no continuity (Figure 15a-7, Page 15a-6). If the reading is incorrect, replace the armature.

FIELD WINDINGS INSPECTION

Burned or scorched insulation on the field windings indicates the motor has overheated due to overloads or grounded or shorted coil windings. If the insulation on the field windings is scorched, replace the motor or the stator shell assembly.
MOTOR COMPONENTS

1. Inspect the insulators (4 and 7) for cracks or other damage (Figure 15a-10, Page 15a-8).

2. Inspect the brushes (13) for damage or excessive wear. Replace brushes if required. See following NOTE.

3. Inspect the brush springs (14) (Figure 15a-10, Page 15a-8). Replace springs that are discolored from heat (light gold or blue tinted). Replace springs which apply a force of less than 16 oz. (Figure 15a-8, Page 15a-7).

CAUTION

- When checking brush spring tension, do not over-extend the spring. Using excessive force will damage the spring.

NOTE: When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging. Refer to Motor Assembly for brush installation. See Motor Assembly on page 15a-10.

When replacing brushes, replace all four brushes. Never replace only two.

Install the brushes in the same rigging 180° apart from each other.

BEARING INSPECTION

1. Using a clean cloth, wipe the carbon dust off of the bearing. Inspect the bearing by spinning it by hand and checking for both axial (A) and radial (B) play (Figure 15a-9, Page 15a-7).

2. Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearing and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing. Do not remove the bearing from the armature shaft unless it is to be replaced.
BEARING REMOVAL

1. Place the wedge attachment tool (CCI P/N 1012812) between the bearing (15) and the armature (17) (Figure 15a-10, Page 15a-8). Make sure the wedge attachment tool is supporting the inner race of the bearing. If a press is not available, secure a bearing puller (CCI P/N 1012811) to the bearing and pull the bearing off of the end of the armature shaft. Support the shaft so it will not drop when the bearing is removed (Figure 15a-11, Page 15a-11). Discard the bearing and speed sensor magnet. See following NOTE.

NOTE: The speed sensor magnet will be pressed off by the bearing when the bearing is removed.

BEARING INSTALLATION

1. Press a new bearing (15) onto the armature (Figure 15a-10, Page 15a-8). Use an arbor press that exerts pressure on the inner race only. See following NOTE.

NOTE: Make sure the bearing retainer (16) is positioned on the armature shaft before the bearing is pressed onto the armature (Figure 15a-10, Page 15a-8).

An arbor with an outside diameter of less than 5/8 inch (16 mm) should be used to press the bearing onto the armature.


SPEED SENSOR MAGNET INSPECTION

Inspect the speed sensor magnet (18) for rust, wear, and cracks (Figure 15a-10, Page 15a-8). Replace the magnet if necessary.

SPEED SENSOR MAGNET REMOVAL

1. To remove the speed sensor magnet (18), remove the motor bearing (Figure 15a-10, Page 15a-8). See Bearing Removal on page 15a-9.

SPEED SENSOR MAGNET INSTALLATION

1. Using a solid bearing driver with a diameter of no less than 1 inch (2.54 cm), press the motor speed sensor magnet (18) onto the shaft until the magnet hub is flush with the armature shaft.

RECONDITIONING THE MOTOR

See General Warnings, Section 1, Page 1-1.

Motor reconditioning must be performed by a qualified motor repair technician. The use of proper tools and procedures is absolutely essential for successful motor reconditioning.
Motor Specifications

Any rework must be performed by a qualified technician. Motor service specifications are listed in the following table.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SERVICE LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commutator diameter (minimum)</td>
<td>2.265 in. (66.675 mm)</td>
</tr>
<tr>
<td>Commutator concentric with armature shaft within</td>
<td>0.001 in. (0.0254 mm)</td>
</tr>
<tr>
<td>Limit depth of cut when machining commutator</td>
<td>0.005 in. (0.127 mm)</td>
</tr>
<tr>
<td>Bar to bar runout should not exceed</td>
<td>0.002 in. (0.00508 mm)</td>
</tr>
<tr>
<td>If undercut of segment insulator is less than 0.016 inch (0.406 mm), it should be undercut to</td>
<td>0.031 in. (0.8 mm)</td>
</tr>
<tr>
<td>Machined face of commutator</td>
<td>8-16 microinches (203.2-406.4 nm)</td>
</tr>
<tr>
<td>Field coil resistance (IQ System, 3.20 hp)</td>
<td>1.61 ohms</td>
</tr>
</tbody>
</table>

MOTOR ASSEMBLY

See General Warnings, Section 1, Page 1-1.

1. If the bearing has been removed, replace the bearing. See Bearing Installation on page 15a-9.

2. Install the brushes. See following NOTE.

NOTE: When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging. Refer to Motor Assembly for brush installation. See Motor Assembly on page 15a-10.

When replacing brushes, replace all four brushes. Never replace only two.

Install the brushes in the same rigging 180° apart from each other.

2.1. With brush rigging facing down and held slightly above stator shell, insert the two terminal posts through insulators in stator shell wall at the A1 and A2 positions. Insert brush holder screws through the holes in the brush rigging and into the threaded holes in the mounting bracket (Figure 15a-12, Page 15a-12). Tighten the screws to 20 in-lb (2.3 N-m).

2.2. One at a time, push brush spring extensions back from brushes and slide the brushes back until they are completely retracted into their mounting slots. Then position the brush springs against the sides of the brushes so that spring pressure will hold them in the retracted position (Figure 15a-6, Page 15a-5).
2.3. Slide the armature, bearing end first, into the stator shell. Make sure the brushes are held back while positioning the armature for proper commutator/brush contact. Release the brushes and place the springs outside the brushes so the brushes are being held against the commutator. See following CAUTION.

**CAUTION**

- If the motor is being assembled with the armature standing on end as the commutator is positioned, make sure the brushes are held back. Do not allow the brushes to support the weight of the stator shell. The brushes can be easily damaged by this weight.

3. Install the end shield onto the stator shell.

3.1. Attach the end shield (10) to bearing retainer (16) by aligning the two holes in the bearing retainer with the two mating holes in the end shield and installing the screws (9) (Figure 15a-10, Page 15a-8). Tighten the screws to 17 in-lb (1.9 N·m). See following NOTE.

**NOTE:** Use a long screw with the same thread specifications as the mounting screws to maintain hole alignment while starting the first mounting screw (Figure 15a-13, Page 15a-12).

3.2. Align the match marks on the end shield and the stator shell, then install the four screws (8) (Figure 15a-10, Page 15a-8). Tighten the screws to 90 in-lb (10 N·m).

**NOTE:** Make sure the motor speed sensor wires located on the end shield are aligned between the terminals on the motor housing.

4. Make sure the armature turns freely. If it does not turn freely, disassemble the motor to find the problem. Make sure the bearing is properly seated in the end shield when assembling the motor.
Motor Assembly, Continued:

![Diagram of Motor Components]

**MOTOR INSTALLATION**

**See General Warnings, Section 1, Page 1-1.**

1. Clean the transaxle input shaft.
   1.1. Spray the input shaft thoroughly with CRC® Brakleen™ or equivalent brake cleaner degreaser.
   1.2. Wipe input shaft with a clean cloth.
   1.3. Inspect the grooves of the input shaft and remove any remaining debris.
   1.4. Repeat steps 1.1 through 1.3 until input shaft is clean.

2. Lubricate the transaxle input shaft.
   2.1. Squeeze approximately 1/2 inch (1.3 cm) of moly-teflon lubricant (CCI P/N 102265201) from tube onto a putty knife as shown (Figure 15a-14, Page 15a-13).
   2.2. Rotate wheels to rotate input shaft.
   2.3. Apply motor coupling grease evenly to the rotating input shaft starting at approximately 1/8 inch (3.1 mm) from the end of the shaft and working back toward the transaxle (away from the end of the shaft) (Figure 15a-15, Page 15a-13).
   2.4. The grease should be evenly distributed in the grooves to a width of approximately 3/8 inch (9.5 mm).
   2.5. Using a flat screwdriver, clean the grease out of one of the grooves to allow air to escape when the motor is pushed onto the input shaft.
2.6. Check the chamfer and end of the input shaft to ensure these areas are completely clean of grease as shown (Figure 15a-16, Page 15a-13).

3. Install the molded bumper.
   3.1. With the flat side toward the bottom of the coupling, install the molded bumper (30) into the motor coupling (Figure 15a-10, Page 15a-8). See following NOTE.

**NOTE:** The motor coupling and the new molded bumper must be free of grease and debris.

3.2. Ensure that the installed bumper is seated at the bottom of the coupling.

4. Install motor on transaxle.
   4.1. Slide the motor coupling onto the transaxle input shaft. See following NOTE.

**NOTE:** The coupling will push any excess grease on the input shaft along the shaft toward the transaxle. When the motor is pushed onto the input shaft, the motor adapter ring (1) will not bottom out against the transaxle housing (Figure 15a-10, Page 15a-8). There will be approximately 1/16 inch (1.6 mm) gap between the motor adapter ring and transaxle housing as shown (Figure 15a-17, Page 15a-13).

![Figure 15a-14 Grease on Putty Knife](image1)

![Figure 15a-15 Application of grease to Input Shaft Grooves](image2)

![Figure 15a-16 Clean Chamfer and Input Shaft End](image3)

![Figure 15a-17 Gap at Motor and Transaxle](image4)
Motor Installation, Continued:

4.2. Loosely install four motor bolts and washers that secure the motor to the transaxle. Do not tighten.

4.3. Begin finger tightening the bolts (1 and 2) in the sequence indicated (Figure 15a-19, Page 15a-15). Continue tightening by hand until the motor is seated in the transaxle housing. See following CAUTION and NOTE.

**CAUTION**

- Make sure the motor is properly seated in the transaxle housing.

**NOTE:** Failure to install and tighten the motor mounting bolts in the proper sequence and to the proper tightness may result in motor noise during operation.

4.4. Tighten the right bolt (1) to 65 in-lb (7.3 N·m).

4.5. Tighten the left bolt (2) to 65 in-lb (7.3 N·m).

4.6. Tighten the center bolt (3) to 65 in-lb (7.3 N·m) (Figure 15a-19, Page 15a-15).

4.7. Tighten the bolt (24) inserted through the tab to 155 in-lb (17.5 N·m) (Figure 15a-18, Page 15a-15).

4.8. Install the motor wires, making sure they are connected to the correct motor terminals and that the terminal orientation is correct. See Wiring Diagrams, Section 11, Page 11-2. Using two wrenches to prevent the posts from turning, tighten the terminal retaining nuts to 65 in-lb (7.3 N·m).

4.9. Secure the white, orange, green, and blue wires with a wire tie so that none of the motor wires will scrub the motor or transaxle when the vehicle is in operation.

4.10. Connect the three-pin speed sensor wire to the vehicle wire harness.

5. If using a chain hoist, lower the vehicle and guide the leaf springs into the shackles. If using a floor jack, raise the transaxle until the leaf springs can be guided into the shackles.

6. Insert the mounting bolts through the spring shackles and the bushings in the leaf spring eyes and install lock nuts. Tighten the bolts to 23 ft-lb (31 N·m). See Section 9 – Rear Suspension in the appropriate maintenance and service manual.

7. Install the shock absorbers. Tighten nut until rubber bushing expands to the diameter of the cup washer.

8. If removed, install wheels and finger tighten the lug nuts.

9. Lift vehicle and remove jack stands. Lower vehicle to the floor and tighten lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).

10. Place the Tow/Run switch in the TOW position and connect the batteries, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

11. Place the Tow/Run switch in the RUN position.

12. Inspect the vehicle for proper operation. See following WARNING.

**WARNING**

- Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.

- Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.

- Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.
MOTOR SPEED SENSOR

See General Warnings, Section 1, Page 1-1.

Testing the Motor Speed Sensor

See Test Procedure 13, Section 11, Page 11-34.

Motor Speed Sensor Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Disconnect the three-pin connector (22) from the vehicle wire harness (Figure 15a-20, Page 15a-16).

3. Using a screwdriver, gently pry the motor speed sensor (21) from recessed area on the motor end shield.

Motor Speed Sensor Installation

1. Position the motor speed sensor (21) as shown and firmly press the speed sensor into the motor end shield. Sensor should fit flush against the motor (Figure 15a-20, Page 15a-16).

2. Connect the three-pin connector (22) to the vehicle wire harness.

3. Place the Tow/Run switch in the TOW position and connect the batteries, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
Motor Speed Sensor Installation, Continued:

Figure 15a-20  IQ Motor Speed Sensor
GENERAL INFORMATION

The IQ System vehicle is equipped with a 48-volt DC, shunt-wound, reversible traction motor. The shunt-wound motor is designed for use on IQ System vehicles only. Club Car recommends that motors requiring major repair be sent to a qualified motor repair shop; however, there are many relatively simple tasks that can be performed by a technician with general knowledge and experience in electric motor repair.

MOTOR IDENTIFICATION

There are two types of motors used in 2005 model year IQ System electric vehicles: Model 5BC59JBS6365 (gray housing), and EJ4-4001 (black housing). Do not attempt to service a motor that has not been properly identified. If the motor cannot be properly identified, contact your local Club Car dealer or distributor.

EXTERNAL MOTOR TESTING

The following tests can be performed without disassembling the motor using a multimeter or continuity tester.

NOTE: Tag the motor wires for identification before disconnecting.

TEST PROCEDURE 1 – INTERNAL SHORT CIRCUITS

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Disconnect wires from terminals on motor using two wrenches to prevent posts from turning.

3. With a multimeter set to 200 ohms, place black (–) probe on motor housing. Scratch through paint to ensure a good connection. Place red (+) probe on A1, A2, S1, and S2 terminals respectively. Multimeter should indicate no continuity between the motor housing and all individual terminals. If readings are incorrect, motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal on page 15b-2.

3.1. An incorrect reading from the A1 or A2 terminal indicates three possible problems: a grounded A1 or A2 terminal, a grounded wire in the brush area, or a grounded armature/commutator. An incorrect reading for the S1 or S2 terminal indicates a possible grounded S1 or S2 terminal or field coil.
TEST PROCEDURE 2 – ARMATURE CIRCUIT OPEN

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Disconnect wires from the A1 and A2 terminals on the motor using two wrenches to prevent posts from turning. Set a multimeter to 200 ohms and place the red (+) probe on the A1 terminal and black (–) probe on the A2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal on page 15b-2.

TEST PROCEDURE 3 – FIELD CIRCUIT OPEN

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Disconnect wires from the S1 and S2 terminals on the motor using two wrenches to prevent posts from turning. Set a multimeter to 200 ohms and place the red (+) probe on the S1 terminal and the black (–) probe on the S2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open field coil or bad connections at the terminals may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal on page 15b-2.

MOTOR REMOVAL

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Disconnect wires from the terminals on the motor using two wrenches to prevent posts from turning. Label the wires to ensure proper reconnection.

3. Slightly loosen all the lug nuts on both rear wheels.

4. Place floor jack under transaxle and raise rear of vehicle (Figure 15b-1, Page 15b-3) then place jack stands under frame crossmember between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jack stands support the vehicle (Figure 15b-2, Page 15b-3). See following WARNING.

⚠️ WARNING

- Lift only one end of the vehicle at a time. Use a suitable lifting device (chain hoist or hydraulic floor jack) with 1000 lb. (454 kg) minimum lifting capacity. Do not use lifting device to hold vehicle in raised position. Use approved jack stands of proper weight capacity to support the vehicle and chock the wheels that remain on the floor. When not performing a test or service procedure that requires movement of the wheels, lock the brakes.
5. Remove both rear wheels.

6. Remove the nut, cup washer, and bushing from the bottom side of the shock absorber. Compress the shock absorber (pushing upwards) to move it out of the way (Figure 15b-3, Page 15b-3).

7. Remove the nuts and bolts mounting the rear leaf springs to the shackles.

8. To gain easier access to the motor, lower the transaxle as low as it will go. If more room is needed, remove the jack from beneath the transaxle and allow the springs to rest on the floor (Figure 15b-3, Page 15b-3).

9. Remove the four bolts that mount the motor to the transaxle (Figure 15b-24, Page 15b-15). See following CAUTION.

⚠️ CAUTION ⚠️

- Do not position fingers under motor when sliding motor off of the input shaft in step 9. Fingers may get pinched when motor disengages.

10. Carefully slide the motor away from the transaxle until the motor spline disengages the input shaft and remove the motor from the vehicle.
MOTOR DISASSEMBLY

1. Before beginning disassembly, place match marks on the motor end cap and motor frame.

2. Remove speed sensor and magnet.
   2.1. Remove the two screws (25) that secure the speed sensor (10) to the end cap (11) (Figure 15b-15, Page 15b-10).
   2.2. Remove the screw securing the magnet to the armature shaft (Figure 15b-4, Page 15b-4).
   2.3. Inspect the speed sensor magnet. See Speed Sensor Magnet Inspection on page 15b-9.

3. Loosen, but do not remove, the two screws securing the end cap to the motor frame (Figure 15b-5, Page 15b-4).

4. Orient the motor so that the splined end of the armature is facing down.

5. Inspect the area where the end cap mates with the motor frame. If the end cap appears to be loose where it connects to the motor frame, proceed to step 6; otherwise, disengage the end cap from the motor frame using the following procedure:
   5.1. With the end cap bolts loose (about 1/4 inch between the end cap and the head of the bolt), place a socket on the head of the bolt. See following CAUTION.
CAUTION

- Ensure that there is sufficient thread engagement of the end cap bolts before proceeding. Performing the procedure without having adequate thread engagement could damage the motor frame, end cap, or end cap bolts.

5.2. Gently tap each bolt, alternating between blows, until the end cap and motor frame become disengaged (Figure 15b-6, Page 15b-4).

6. Remove the two end cap bolts.

7. Remove the end cap and armature from the motor frame (Figure 15b-7, Page 15b-4).

8. Inspect the brush springs for proper tension. See Motor Brush, Spring, and Terminal Insulator Inspection on page 15b-8.

9. Remove the armature from the end cap bearing. See following CAUTION and NOTE.

⚠️ CAUTION

- Removing the armature from the end cap requires two people: one to operate the press, and another to hold the armature. Failure to heed this CAUTION could result in personal injury and/or damage to the armature resulting from an unsupported armature falling after it becomes disengaged from the end cap bearing.

NOTE: Replacement of the end cap bearing is recommended if the armature is removed.

9.1. Place the end cap in a press with the armature facing down.

9.2. Place a bearing press tool with an outer diameter smaller than that of the armature shaft between the press ram and the armature shaft (Figure 15b-8, Page 15b-6).

9.3. Have an assistant support the armature while the press is activated.

10. Inspect the armature for wear and damage. See Armature Inspection and Testing on page 15b-6.

11. Inspect the motor frame and field windings. See Motor Frame and Field Windings Inspection on page 15b-8.

12. Remove the brush rigging.

12.1. Mark the brush terminal posts (A1 and A2).

12.2. Remove the two nuts securing the brush terminals (A1 and A2) to the end cap (Figure 15b-9, Page 15b-6).

12.3. Remove the two screws and the brush rigging to the end cap (Figure 15b-10, Page 15b-6).


14. Remove the bearing from the end cap.

14.1. Remove the retaining ring that secures the bearing in the end cap (Figure 15b-11, Page 15b-6).

14.2. Use an arbor press to remove the bearing from the end cap.

15. Inspect the bearing for wear and damage. See Bearing Inspection on page 15b-9.
MOTOR COMPONENT TESTING AND INSPECTION

See General Warnings, Section 1, Page 1-1.

ARMATURE INSPECTION AND TESTING

1. Remove the motor from the vehicle. See Motor Removal on page 15b-2.

2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.

Visual Inspection

• Burned, charred or cracked insulation
• Improperly cured varnish
• Thrown solder
• Flared armature windings
• Damaged armature core laminations
• Worn, burned or glazed commutators
• Dirty or oily commutators
• Raised commutator bars
• Worn armature bearing or shaft

A dirty or oily commutator should be cleaned and wiped dry. Abnormalities identified during the inspection can help determine original cause of failure. Slight roughness of the commutator can be polished smooth with 400 grit or finer sandpaper. See following CAUTION and NOTE.

**CAUTION**

• Do not use emery cloth to polish the commutator. Particles of emery are conductive and may short-circuit the commutator bars. Do not use oil or lubricants on the commutator or brushes.

**NOTE:** Oil on the commutator may indicate a faulty transaxle input shaft oil seal.

**Armature Ground Test**

**CAUTION**

• Do not submerge the armature in solvent.

**NOTE:** Before testing the armature, wipe it clean with a clean cloth. Remove any carbon dust and metal particles from between the commutator bars.

1. With a multimeter set to 200 ohms, place one probe on the commutator and the other on the armature core. The multimeter should indicate no continuity (Figure 15b-12, Page 15b-7). If the reading is incorrect, replace the armature.
MOTOR FRAME AND FIELD WINDINGS INSPECTION

1. Remove the motor from the vehicle. See Motor Removal on page 15b-2.

2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.

3. Burned or scorched insulation on the field windings indicates the motor has overheated due to overloads or grounded or shorted coil windings. If the insulation on the field windings is scorched, replace the motor or the stator shell assembly.

MOTOR BRUSH, SPRING, AND TERMINAL INSULATOR INSPECTION

Brush Spring Tension Test

1. Remove the motor from the vehicle. See Motor Removal on page 15b-2.

2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.

3. Inspect the brush springs (14) (Figure 15b-15, Page 15b-10). Replace springs that are discolored from heat (light gold or blue tinted).

4. Test the brush springs for proper tension.
   4.1. Place a C-shaped steel plate on a scale.
   4.2. Place the end of the C-shaped plate so that it is between the spring and the brush as shown (Figure 15b-13, Page 15b-9).
   4.3. Gently pull the scale to obtain the spring tension reading. See following CAUTION.

CAUTION

- When checking brush spring tension, do not over-ex tend the spring. Using excessive force will damage the spring.

4.4. Replace springs which require a force of less than 35 oz. (990 grams) (Figure 15b-13, Page 15b-9). See following NOTE.

NOTE: When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging. Refer to Motor Assembly for brush installation. See Motor Assembly on page 15b-11.

When replacing brushes, replace all four brushes. Never replace only two.

Install the brushes in the same rigging 180° apart from each other.

Brush Inspection

1. Remove the motor from the vehicle. See Motor Removal on page 15b-2.

2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.

3. Inspect the brushes (13) for damage or excessive wear (Figure 15b-15, Page 15b-10). Replace brushes if required. See preceding NOTE.

4. Use dial calipers or a micrometer to measure the brush length. The minimum-allowable brush length is 0.62 inches (16 mm). Replace the set of brushes as required. See preceding NOTE.
Terminal Insulator Inspection

1. Remove the motor from the vehicle. See Motor Removal on page 15b-2.
2. Remove the terminal insulators by performing steps 1 through 12 of Motor Disassembly on page 15b-4.
3. Inspect the insulators (4 and 6) for cracks or other damage (Figure 15b-15, Page 15b-10). Replace insulators as required.

Bearing Inspection

**NOTE:** Replacement of the end cap bearing is highly-recommended if the end cap is removed from the motor. The following procedure is provided as a guideline for determining general bearing failure.

1. Remove the motor from the vehicle. See Motor Removal on page 15b-2.
2. Remove the bearing by performing steps 1 through 14 of Motor Disassembly on page 15b-4.
3. Use a clean cloth to wipe the carbon dust off of the bearing. Inspect the bearing by spinning it by hand and checking for both axial (A) and radial (B) play (Figure 15b-14, Page 15b-9).
4. Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearing and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing.

Speed Sensor Magnet Inspection

Inspect the speed sensor magnet (24) for rust, wear, and cracks (Figure 15b-15, Page 15b-10). Replace the magnet if necessary.
Figure 15b-15 Motor
RECONDITIONING THE MOTOR

See General Warnings, Section 1, Page 1-1.

Motor reconditioning must be performed by a qualified motor repair technician. The use of proper tools and procedures is absolutely essential for successful motor reconditioning.

Motor Specifications

Any rework must be performed by a qualified technician. Motor service specifications are listed in the following table.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SERVICE LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commutator diameter (minimum)</td>
<td>2.80 in. (71.10 mm)</td>
</tr>
<tr>
<td>Commutator concentric with armature shaft within</td>
<td>0.003 in. (0.08 mm)</td>
</tr>
<tr>
<td>Bar to bar runout should not exceed</td>
<td>0.005 in. (0.013 mm)</td>
</tr>
<tr>
<td>Undercut of segment insulator after machining commutator</td>
<td>0.040 in. (1.0 mm)</td>
</tr>
<tr>
<td>Armature resistance at 75 °F (24 °C)</td>
<td>0.012 ohms between bar 1 and bar 15</td>
</tr>
<tr>
<td>Field coil resistance at 75 °F (24 °C)</td>
<td>1.75 ohms</td>
</tr>
</tbody>
</table>

MOTOR ASSEMBLY

See General Warnings, Section 1, Page 1-1.

1. Replace the bearing.
   1.1. Use an arbor press to install a new bearing into the end cap. To help avoid damaging the bearing, apply pressure only to the outer race when installing the bearing.
   1.2. Install the retaining ring to secure the bearing (Figure 15b-11, Page 15b-6).
2. Install the brushes and brush rigging. See following NOTE.

   NOTE: When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging.

   When replacing brushes, replace all four brushes. Never replace only two.

   Install the brushes in the same rigging 180° apart from each other.

2.1. Insert the brushes into the brush rigging as shown (Figure 15b-16, Page 15b-12).
2.2. Insert the two terminal posts through insulators (4) in the end cap (11) wall at the A1 and A2 positions (Figure 15b-15, Page 15b-10).
2.3. Place external insulators (5) and washers (6) on each terminal post, and secure terminal with nuts (7). Tighten nuts (7) to 100 in-lb (11.3 N·m). Ensure that the terminal posts do not rotate when tightening the nuts (Figure 15b-15, Page 15b-10).
2.4. Secure the brush rigging to the end cap with two screws. Tighten the screws to 25 in-lb (2.8 N·m) (Figure 15b-10, Page 15b-6).
2.5. One at a time, push the brushes back until they are completely retracted into their mounting slots and the spring pressure holds them in the retracted position as shown (Figure 15b-17, Page 15b-12).

3. With the brushes retracted, use an arbor press to press the armature shaft into the end cap bearing (Figure 15b-18, Page 15b-12). See following CAUTION.

**CAUTION**

- Make sure the brushes are held back. Do not allow the brushes to support the weight of the commutator. The brushes can be easily damaged by this weight.

4. Gently press each brush with a small screwdriver until the spring rests on the end of each brush as shown (Figure 15b-19, Page 15b-12).

5. Align the match marks on the end cap and the motor frame (1) and secure with two bolts (16) (Figure 15b-15, Page 15b-10). Tighten bolts to 130 in-lb (14.7 N·m).

6. Install the speed sensor magnet (24) with screw (23). Tighten to 65 in-lb (7.3 N·m).

7. Install the speed sensor (10) with screws (25). Tighten to 25 in-lb (2.8 N·m).

8. Make sure the armature turns freely. If it does not turn freely, disassemble the motor to find the problem.
MOTOR INSTALLATION

See General Warnings, Section 1, Page 1-1.

1. Clean the transaxle input shaft.
   1.1. Spray the input shaft thoroughly with CRC® Brakleen™ or equivalent brake cleaner degreaser.
   1.2. Wipe input shaft with a clean cloth.
   1.3. Inspect the grooves of the input shaft and remove any remaining debris.
   1.4. Repeat steps 1.1 through 1.3 until input shaft is clean.

2. Lubricate the transaxle input shaft.
   2.1. Squeeze approximately 1/2 inch (1.3 cm) of moly-teflon lubricant (CCI P/N 102243403) from tube onto a putty knife as shown (Figure 15b-20, Page 15b-13).
   2.2. Rotate wheels to rotate input shaft.
   2.3. Apply motor coupling grease evenly to the rotating input shaft starting at approximately 1/8 inch (3.1 mm) from the end of the shaft and working back toward the transaxle (away from the end of the shaft) (Figure 15b-21, Page 15b-13).
   2.4. The grease should be evenly distributed in the grooves to a width of approximately 3/8 inch (9.5 mm).
   2.5. Use a flat screwdriver to clean the grease out of one of the grooves and allow air to escape when the motor is pushed onto the input shaft.

2.6. Check the chamfer and end of the input shaft to ensure these areas are completely clean of grease as shown (Figure 15b-22, Page 15b-14).

3. Install the molded bumper.
   3.1. With the flat side toward the bottom of the coupling, install the molded bumper (30) into the motor coupling (Figure 15b-15, Page 15b-10). See following NOTE.

**NOTE:** The motor coupling and the new molded bumper must be free of grease and debris.

3.2. Ensure that the installed bumper is seated at the bottom of the coupling.
Motor Installation, Continued:

4. Install motor on transaxle.

   4.1. Slide the motor coupling onto the transaxle input shaft. See following NOTE.

   **NOTE:** The coupling will push any excess grease on the input shaft along the shaft toward the transaxle. When the motor is pushed onto the input shaft, the motor housing will not bottom out against the transaxle housing (Figure 15b-15, Page 15b-10). There will be approximately 1/16 inch (1.6 mm) gap between the motor adapter ring and transaxle housing as shown (Figure 15b-23, Page 15b-14).

4.2. Loosely install the four bolts that secure the motor to the transaxle. Do not tighten.

4.3. Begin finger-tightening the bolts (1 and 2) in the sequence indicated (Figure 15b-24, Page 15b-15). Continue tightening by hand until the motor is seated in the transaxle housing. See following CAUTION and NOTE.

**CAUTION**

- Make sure the motor is properly seated in the transaxle housing.

**NOTE:** Failure to install and tighten the motor mounting bolts in the proper sequence and to the proper tightness may result in motor noise during operation.

4.4. Tighten the right bolt (1) to 65 in-lb (7.3 N·m).

4.5. Tighten the left bolt (2) to 65 in-lb (7.3 N·m).

4.6. Tighten the center bolt (3) to 65 in-lb (7.3 N·m) (Figure 15b-24, Page 15b-15).

4.7. Tighten the bolt (4) inserted through the L-bracket to 155 in-lb (17.5 N·m) (Figure 15b-24, Page 15b-15).

4.8. Install the motor wires, making sure they are connected to the correct motor terminals and that the terminal orientation is correct. See Wiring Diagrams, Section 11, Page 11-2. Tighten the terminal retaining nuts to 65 in-lb (7.3 N·m).

4.9. Secure the white, orange, green, and blue wires with a wire tie so that none of the motor wires will scrub the motor or transaxle when the vehicle is in operation.

4.10. Connect the three-pin speed sensor wire to the vehicle wire harness.
5. If using a chain hoist, lower the vehicle and guide the leaf springs into the shackles. If using a floor jack, raise the transaxle until the leaf springs can be guided into the shackles.

6. Insert the mounting bolts through the spring shackles and the bushings in the leaf spring eyes and install lock nuts. Tighten the bolts to 23 ft-lb (31 N·m). See Section 9 – Rear Suspension in the appropriate maintenance and service manual.

7. Install the shock absorbers. Tighten nut until rubber bushing expands to the diameter of the cup washer.

8. If removed, install wheels and finger tighten the lug nuts.

9. Lift vehicle and remove jack stands. Lower vehicle to the floor and tighten lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).

10. Place the Tow/Run switch in the TOW position and connect the batteries, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

11. Place the Tow/Run switch in the RUN position.

12. Inspect the vehicle for proper operation. See following WARNING.

⚠️ WARNING

- Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.

- Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.

- Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.

![Motor Mount Diagram](image-url)
SECTION 16 – TRANSAXLE (TYPE G)

⚠️ DANGER

- See General Warnings, Section 1, Page 1-1.

⚠️ WARNING

- See General Warnings, Section 1, Page 1-1.

LUBRICATION

See General Warnings, Section 1, Page 1-1.

There are two plugs located on the lower half of the transaxle housing. The upper plug (21) (as viewed when the vehicle is on a level surface) is used as a lubricant level indicator (Figure 16-5, Page 16-3). When the vehicle is parked on a level surface, the lubricant level should be even with the bottom of the hole. The lower plug (22) is for draining the lubricant. When draining the lubricant, the upper plug should be removed so the lubricant will drain faster. Be sure the drain plug is installed before filling. See following NOTE.

**NOTE:** Recycle or dispose of used oil or lubricant in accordance with local, state, and federal regulations.

AXLE BEARING AND SHAFT

See General Warnings, Section 1, Page 1-1.

AXLE SHAFT

Axle Shaft and Oil Seal Removal

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Place chocks at the front wheels. Loosen lug nuts on rear wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jack stands under the axle tubes to support the vehicle. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Remove the rear wheel and brake drum. See Section 6 – Wheel Brake Assemblies and Section 8 – Wheels and Tires.

4. Use 90° internal snap ring pliers to remove the internal retaining ring (6) from the axle tube (Figure 16-5, Page 16-3). See also Figure 16-1, Page 16-2.

5. Remove the axle, retaining ring, and bearing assembly by pulling the axle straight out of the housing.

6. If necessary, remove the axle oil seal and adapter ring.

   6.1. Use a bearing puller (CCI P/N 1016417) to remove the axle seal and adapter ring from the axle tube (Figure 16-2, Page 16-2). See following CAUTION and NOTE.

**CAUTION**

- Do not scar or damage the inside surfaces of the tube when removing the oil seal and adapter ring. A damaged tube might have to be replaced.
Axle Shaft and Oil Seal Removal, Continued:

**NOTE:** Do not discard the adapter ring. If the adapter ring is lost or damaged, the axle tube will have to be replaced.

6.2. Use a press to separate the axle oil seal (15) from the adapter ring (39) (**Figure 16-3, Page 16-2**). Retain the adapter ring and discard the oil seal.

7. Inspect the axle shaft assembly to be sure the bearing and collar have not slipped and are still seated against the shoulder on the axle shaft.

8. Inspect bearing (5) (**Figure 16-5, Page 16-3**). If the bearing in a Type G transaxle is worn or damaged, the entire axle shaft assembly (1 or 2) must be replaced.

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**Figure 16-1** Axle Tube

**Figure 16-2** Axle Seal and Adapter Ring Removal

**Figure 16-3** Axle Seal and Adapter Ring

**Figure 16-4** Axle Seal and Adapter Ring Installation
Figure 16-5  Transaxle – Type G
Axle Shaft and Oil Seal Installation

1. If previously removed, install a new oil seal.
   1.1. Clean seal seat in the adapter ring (39) (Figure 16-3, Page 16-2).
   1.2. Place a new seal (15) in the adapter ring with the seal lip facing toward the adapter ring lip (Figure 16-3, Page 16-2). Use an axle seal tool (CCI P/N 1014162) and mallet to tap it in until it seats firmly in position (Figure 16-3, Page 16-2). A hydraulic press may also be used with the axle seal tool.
   1.3. Clean adapter ring seat(s) in the axle tube (14 or 35) (Figure 16-5, Page 16-3).
   1.4. Apply Loctite® 603 to the outer diameter of the adapter ring.
   1.5. Place the oil seal and adapter ring assembly into the axle tube with the seal lip facing away from the bearing (Figure 16-4, Page 16-2). Use an axle seal tool (CCI P/N 1014162) and mallet to tap it in until it seats firmly in position. See following CAUTION.

CAUTION

• Clean any residual oil from the exposed end of the axle shaft and from the oil seal area prior to installing the axle shaft to prevent oil from coming in contact with brakes.

2. Install the rear axle into the transaxle. See following NOTE.
   2.1. Insert the shaft, splined end first, through the seal and into the axle tube. Be careful not to damage the seal on the inside of the axle tube hub. Advance the shaft through to the bearing on the shaft, then rotate it to align the shaft splines with the splined bore of the differential side gear (27) (Figure 16-5, Page 16-3). Continue advancing the shaft until the bearing on the axle is firmly seated within the axle tube hub seat.
   2.2. Use a pair of snap ring pliers to install the retaining ring (6) inside axle tube hub so that it seats against the axle bearing assembly and into the machined slot in the inside wall of the axle tube hub (Figure 16-5, Page 16-3).

NOTE: If the retaining ring (6), axle bearing (5), or sleeve (4) must be replaced, the entire axle shaft assembly (1 or 2) must be replaced (Figure 16-5, Page 16-3).

2.3. Place a 1/4 to 3/8-inch (6 to 10 mm) diameter rod against the retaining ring and tap lightly at four to five locations around the retaining ring to ensure it is properly seated. See following WARNING.

WARNING

• Be sure the retaining ring is properly seated in its groove. If the ring is not properly installed, the axle assembly will separate from the transaxle and damage the axle assembly and other components. Loss of vehicle control could result, causing severe personal injury or death.

3. If a new oil seal was installed, allow 24 hours before operating the vehicle to allow the Loctite 603 to fully cure.

AXLE BEARING

Do not remove the axle bearing (5) from a Type G transaxle. If bearing is worn or damaged, the entire axle assembly (1 or 2) must be replaced (Figure 16-5, Page 16-3).
TRANSAXLE

See General Warnings, Section 1, Page 1-1.

TRANSAXLE REMOVAL

1. Disconnect the battery cables as instructed. See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.

2. Place chocks at the front wheels and slightly loosen lug nuts on both rear wheels. See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.

3. Place a floor jack under the transaxle and raise the rear of the vehicle. Position jack stands under the aluminum frame rails forward of the spring mount. Lower the vehicle to let the jack stands support the vehicle (Figure 16-6, Page 16-5). See WARNING “Lift only one end of the vehicle...” in General Warnings, Section 1, Page 1-1.

4. Remove the rear wheels, then thread one lug nut onto a stud on each rear hub. This will keep the brake drums on the hubs.

5. Remove the bow tie pins (1) and brake cable clevis pins (3). Use tool (CCI P/N 102555501) to compress tangs on cable end and remove cable end from bracket (4) (Figure 16-7, Page 16-5).

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Figure 16-6  Vehicle Supported on Jack Stands
Figure 16-7  Brake Cable
Figure 16-8  Disconnect Shocks
Figure 16-9  Shackles
Transaxle Removal, Continued:

6. Disconnect the shock absorbers from their lower mounts *(Figure 16-8, Page 16-5)*.

7. Disconnect the four motor wires. Use two wrenches to prevent the post from turning.

8. With a floor jack supporting the transaxle, remove lower spring shackle nuts and bolts. Position shackles so they are clear of springs *(Figure 16-9, Page 16-5)*.

9. If a chain hoist was used to raise the vehicle, lift the vehicle high enough to permit easy access and clearance for removal of the motor. If a floor jack was used to raise the vehicle, lower the transaxle enough to permit easy access and clearance for removal of the motor.

10. Remove the three motor mounting bolts *(Figure 16-11, Page 16-6)* and the motor positioning bolt *(Figure 16-12, Page 16-7)*, mounting the motor to the transaxle. *See following CAUTION.*

⚠️ **CAUTION**

- Do not position fingers under motor when sliding motor off of the input shaft. Fingers may get pinched when motor disengages.

11. Carefully remove the motor from the transaxle. Slide the motor away from the transaxle until the motor spline becomes disengaged from the input shaft, then lift motor out. *See preceding WARNING.*

12. If a floor jack was used, pull floor jack from beneath the transaxle and allow the springs to rest on the floor.

13. Remove the U-bolts attaching the transaxle to the leaf springs *(Figure 16-10, Page 16-6)*.

14. Carefully lift each end of the transaxle off its positioning pin (on the leaf spring) and slide the transaxle to the rear and out of the vehicle.

15. Drain the lubricant from the transaxle and remove the axle shafts. *See Axle Shaft and Oil Seal Removal on page 16-1. See following NOTE.*

**NOTE:** Recycle or dispose of used oil or lubricant in accordance with local, state, and federal regulations.

16. Remove the brake assemblies if required. *See Brake Cluster Removal, Section 6, Page 6-9.*
TRANSAXLE DISASSEMBLY, INSPECTION, AND ASSEMBLY

See General Warnings, Section 1, Page 1-1.

TRANSAXLE DISASSEMBLY AND INSPECTION

1. To detach axle tubes (14 and 35) from the transaxle housing, remove the bolts (8) (Figure 16-5, Page 16-3).
2. Remove 11 bolts (24) that hold housing together.
3. Pull the halves of the housing (11 and 20) apart. If necessary, tap lightly on the spline of the input pinion (17). See following CAUTION.

CAUTION

• To prevent damage to the housing mating seal surfaces, use caution when separating halves.

4. Remove input pinion gear (17) by pulling gear out while rocking intermediate gear assembly (19). Lift intermediate gear assembly and differential gear case unit out simultaneously (Figure 16-5, Page 16-3). See following CAUTION.

CAUTION

• Do not damage gears. Use extreme care when handling them.

5. Use a bearing puller or arbor press to remove bearings (16) from the input pinion gear. If the oil seal (10) is damaged, replace it (Figure 16-5, Page 16-3). See also Figure 16-13, Page 16-8. See following CAUTION.

CAUTION

• Do not reuse bearings after removing them. Replace bearings with new ones.

6. To disassemble the intermediate gear assembly, press off together the bearing (16) and the gear (19) (Figure 16-5, Page 16-3). See also Figure 16-13, Page 16-8.
Transaxle Disassembly and Inspection, Section 16, Page 16-8

7. Press the bearing (18) off the intermediate gear assembly (Figure 16-5, Page 16-3).

8. Disassemble the differential gear case:
   8.1. Remove the hex bolts (33) and the ring gear (32) from the differential case (Figure 16-5, Page 16-3).
   8.2. Remove the ring gear.
   8.3. Separate the differential gear case housing. If necessary, install two of the hex bolts (removed previously in step 8.1.) into the differential gear unit and, while holding the unit slightly above the work area, lightly tap the bolt heads (Figure 16-14, Page 16-8). Remove the two bolts.
   8.4. Remove the differential pin (31) by pushing pin through differential gear case from one side (Figure 16-5, Page 16-3). See also Figure 16-15, Page 16-9.
   8.5. Remove the idler gears and thrust plates (1 and 2) (Figure 16-16, Page 16-9).
8.6. Remove the differential gears and thrust plates (3 and 4).
8.7. Inspect the bearings (13) of the differential case (26) and replace them if they are damaged (Figure 16-5, Page 16-3). To remove them, press them off. See following CAUTION.

**CAUTION**
- Do not reuse bearings after removing them. Replace bearings with new ones.

9. Inspect parts for wear or damage. Any worn or damaged parts should be replaced. See following NOTE.

**NOTE:** Damaged or worn gears should be replaced as sets.

**TRANSAXLE ASSEMBLY**

**CAUTION**
- Do not press against the bearing outer race.
- The housing and all parts must be wiped clean and dry before reassembly.

1. If bearings (13) were removed during disassembly, install new bearings using an arbor press (Figure 16-5, Page 16-3).

2. Assemble the differential gear case.
   2.1. Install the pin (31) (Figure 16-5, Page 16-3). Apply a small amount of oil to all thrust plates and to both ends of the pin.
   2.2. Install the hex bolts (33) and output gear (32). Tighten bolts to 58 ft-lb (78.6 N·m).

3. Press a new bearing (18) onto the intermediate gear assembly (Figure 16-5, Page 16-3).

4. Press new bearing (16) onto input pinion gear (17).

5. Apply grease to the lip of the new oil seal (10) and install the seal using a transaxle pinion seal tool (CCI P/N 1014161). The lip of the oil seal should face the inside of the transaxle housing. Make sure the seal is firmly seated.

6. Install the differential assembly, the intermediate gear assembly, and the input pinion gear simultaneously. Be sure all bearings are seated properly in the housing. Rotate the input shaft to check for smooth gear operation (Figure 16-11, Page 16-6).
Transaxle Assembly, Continued:

7. Install both dowel pins (25) in the transaxle housing (20) (Figure 16-5, Page 16-3).

8. Install left half of transaxle housing:
   8.1. Place a 1/8-inch (3 mm) bead of Three Bond liquid gasket on mating surface of housing.
   8.2. Install left half of transaxle housing (20) (Figure 16-5, Page 16-3).
   8.3. Install eleven bolts (24) in the case housing and tighten to 19 ft-lb (25.7 N·m). Type G transaxles have no shims or gasket.
   8.4. Install axle tube (14 and 35) with bolts (8) (Figure 16-5, Page 16-3). Tighten the bolts to 37 ft-lb (50.2 N·m).

9. Install the brake assemblies as instructed. See Brake Cluster Installation, Section 6, Page 6-10.

10. Apply a small amount of grease to the lip of the oil seal (15) (Figure 16-5, Page 16-3). See following CAUTION.

⚠️ CAUTION

- Clean any residual oil from the exposed end of the axle shaft and from the oil seal area prior to installing the axle shaft to prevent oil from coming in contact with brakes.

11. Install the rear axle onto the transaxle.
   11.1. Insert the splined end of the axle shaft into the axle tube. Be careful not to damage the seal on the inside of the axle tube hub. Advance the shaft through to the bearing on the shaft, and rotate it to align the shaft splines with the splined bore of the differential gear. Continue advancing the shaft until the bearing on the axle is firmly seated within the axle tube hub seat.
   11.2. Using 90° internal snap ring pliers (0.090 tip) (CCI P/N 1012560), attach the internal retaining ring into the axle tube hub so that it seats against the axle bearing assembly and into the machined slot in the inside wall of the axle tube hub (Figure 16-5, Page 16-3).
   11.3. Place a 1/4 to 3/8-inch (6 to 10 mm) diameter rod against the retaining ring and tap lightly at four or five locations to ensure it is properly seated. See following WARNING.

⚠️ WARNING

- Be sure retaining ring is properly seated in its groove. If ring is not properly installed, the axle assembly will separate from the transaxle and damage the axle assembly and other components. Loss of vehicle control could result in severe personal injury or death.

12. Make sure the drain plug (22) is installed in the transaxle and tightened to 23 ft-lb (31 N·m). Fill the transaxle, through the level indicator hole, with 22 ounces of SAE 30 API Class SE, SF, or SG oil (a higher grade may also be used). Install and tighten the level indicator plug (21) to 23 ft-lb (31 N·m).

TRANAXLE INSTALLATION

See General Warnings, Section 1, Page 1-1.

1. If using a chain hoist, raise the vehicle and place transaxle in position on the jack stands. If using a floor jack, lower the jack stands to their lowest settings and place the transaxle in position on the jack stands.

2. Align the center hole in the saddle of the transaxle with the pilot bolt in the leaf spring assembly.
3. Install the two U-bolts, jounce bumper mount (if required), and spacers, lock washers, and nuts. Tighten the nuts to 25 ft-lb (34 N·m). Tighten the U-bolt nuts so an equal amount of thread is visible on each leg of the bolt.

4. Install the motor. See Motor Installation, Section 15a, Page 15a-12, or Motor Installation, Section 15b, Page 15b-13.

5. If using a chain hoist, lower the vehicle while guiding the leaf springs into the rear spring shackles. If using a floor jack, raise the differential while guiding the leaf springs into the rear spring shackles. Then raise the jack stands to support the transaxle.

6. Connect the four motor wires. Tighten the retaining nuts to 65 in-lb (7.3 N·m). Use two wrenches to prevent the posts from turning. See following NOTE.

**NOTE:** If the motor wires were not tagged when disconnected, refer to the wiring diagram for proper connection. See Wiring Diagrams, Section 11, Page 11-2.

7. Insert bolts through the spring shackles and bushings in the leaf spring eyes. Secure bolts with lock nuts. Tighten to 15 ft-lb (20.3 N·m).

8. Connect the brake cables using new bow tie pins (1) (Figure 16-7, Page 16-5).

9. Install the shock absorbers. Tighten shock absorber retaining nuts until the rubber bushings expand to the same size as the cup washers.

10. Install the rear wheels and finger-tighten the lug nuts.

11. Lift the vehicle and remove the jack stands.

12. Lower vehicle and tighten the lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).

13. Inspect the vehicle to check for proper operation. See following WARNING.

⚠️ **WARNING**

- Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.
- Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.
- Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.
INDEX

A
accelerator return spring .................................. 5-4
access panel .............................................. 4-12, 4-16
armature, motor
   see motor, armature

B
backrest ................................................. 4-10
backrest and structural accessory module ...... 4-10
bag rack
   installation ......................................... 4-10
   removal ............................................ 4-10
basket, sweater ........................................ 4-10
batteries ............................................... 13-1
   see also battery charger
care .................................................... 13-2
charging .............................................. 13-4
deep discharge ....................................... 13-5
electrolyte
   adding water (mineral content) .............. 13-4
   level .............................................. 13-3
excessive early discharging ....................... 13-5
fleet rotation ....................................... 13-5
hydrometer calibration ............................. 13-8
maintenance, preventive ............................. 13-2
   see also batteries, electrolyte
replacement .......................................... 13-1
self-discharge ....................................... 13-3
storage .............................................. 13-12
testing .............................................. 13-7
discharge test ....................................... 13-9
   interpreting test results ...................... 13-10
   hydrometer test ................................ 13-7
   interpreting results ............................ 13-8
on-charge voltage test ........................... 13-7
voltage test ........................................ 11-14
voltage test (under load) ......................... 11-20
troubleshooting examples ....................... 13-11
vibration damage .................................. 13-4
battery charger
   16 hour shut-off .................................. 13-5
   AC service, incoming ......................... 13-5
   numbering vehicles and chargers ........ 13-5
   testing .......................................... 13-7
   on-charge voltage test ....................... 13-7
battery warning light
   installation ....................................... 12-3
   removal .......................................... 12-3
   testing .......................................... 11-38
bearing, axle
   see transaxle, type g, axle bearing
bearing, motor
   see motor, bearing
body, front ........................................... 4-4, 4-8
   see also repair, front and rear body
   installation ....................................... 4-4
   removal .......................................... 4-4
body, rear
   see also repair, front and rear body
   removal .......................................... 4-8
brake return spring ................................ 5-3
brakes
   adjustment ........................................ 6-9
cable
   installation ....................................... 6-12
   removal .......................................... 6-11
cleaning assembly .................................... 6-5
cluster
   installation ....................................... 6-10
   removal .......................................... 6-9
shoe
   installation ....................................... 6-6
   removal .......................................... 6-1
braking, motor
   see regenerative braking
braking, regenerative
   see regenerative braking
bumper, front ........................................ 4-4
C
canopy, four-passenger
   installation ....................................... 4-20
   removal .......................................... 4-20
canopy, two-passenger
   installation ....................................... 4-18
   removal .......................................... 4-16
CAUTION
   definition of ...................................... 1-1
charger bezel ....................................... 4-7
charger receptacle
   fuse link ......................................... 12-14
   installation ....................................... 12-14
   removal .......................................... 12-14
   testing .......................................... 11-33
charger receptacle bezel
   installation ....................................... 4-7
   removal .......................................... 4-7
cleaning
   brake assembly .................................... 6-5
INDEX

seat .................................................................4-1
vehicle body ....................................................4-1
column, steering
see steering column
communication display module (CDM)
function codes ....................................................11-38
retrieving data from ..........................................11-39
troubleshooting ..................................................11-40
connector, 16-pin
see test procedures

D
DANGER
definition of ....................................................1-1
debri shields .....................................................5-3
diode, solenoid
testing ..............................................................11-16
drive motor
see motor

E
electric motor
see motor
electrical system ..............................................11-1
testing circuits ..................................................11-13

F
floor mat and retainers .........................................4-6
floor mat retainer
installation ..........................................................4-7
removal .............................................................4-7
foot deck (four-passenger)
installation ..........................................................4-14
removal .............................................................4-14
Forward/Reverse switch
installation ..........................................................12-4
removal .............................................................12-3
testing .............................................................11-36
front body
see body, front
front bumper .....................................................4-4
fuse, sense lead ..................................................11-33

H
high pedal detect ................................................11-7

I
inspection
front wheel free play ...........................................7-17
motor
armature ground test ......................................15a-6, 15b-7
armature inspection ...........................................15a-5, 15b-6
bearing .............................................................15a-7, 15b-9
brush ...............................................................15b-8
brush spring ......................................................15b-8
field windings .....................................................15a-6, 15b-8
motor components ............................................15a-7
speed sensor magnet ........................................15a-9, 15b-9
shock absorber ..................................................9-1
transaxle, type g ................................................16-7
instrument panel
installation ..........................................................4-6
removal .............................................................4-4

K
key switch
installation ..........................................................12-2
removal .............................................................12-1
testing .............................................................11-20
kick plate ............................................................4-7
installation ..........................................................4-7
removal .............................................................4-7

L
leaf spring
see suspension, front and suspension, rear
lubrication
front suspension .................................................7-10
periodic lubrication schedule ................................10-3
transaxle, type g ..................................................16-1

M
magnet, motor speed sensor
see motor, speed sensor magnet
maintenance
batteries .............................................................13-2
periodic lubrication schedule ................................10-3
periodic service schedule .....................................10-1
MCOR ............................................................5-3
motor ..............................................................11-1, 15a-1, 15b-1
armature
ground test ........................................15a-6, 15b-7
inspection .......................................................15a-5, 15b-6
assembly .........................................................15a-10, 15b-11
bearing
inspection .......................................................15a-7, 15b-9
installation .......................................................15a-9
removal ...........................................................15a-9
braking
  pedal down motor braking .................................. 11-1
  pedal up motor braking .................................... 11-7
brush
  inspection .................................................. 15b-8
brush spring
  inspection .................................................. 15b-8
component
  inspection .................................................. 15a-7
disassembly .................................................. 15a-4, 15b-4
features ........................................................ 11-1
field winding inspection .................................... 15a-6, 15b-8
identification .................................................. 15a-1, 15b-1
installation .................................................... 15a-12, 15b-13
motor braking .................................................. 11-1
protection circuit ............................................ 11-7
reconditioning .................................................. 15a-9, 15b-11
removal ........................................................ 15a-3, 15b-2
service specifications ....................................... 15a-3, 15b-2
speed sensor ................................................... 15a-10, 15b-11
speed sensor magnet
  inspection ................................................... 15a-9, 15b-9
  installation ................................................... 15a-9
  removal ....................................................... 15a-9
  testing ....................................................... 11-18
  see test procedures, motor
zero speed detect ............................................ 11-1
motor braking
  see regenerative braking
motor controller output regulator (MCOR)
  installation .................................................... 12-7
  removal ....................................................... 12-7
  testing ....................................................... 11-17, 11-20
O
onboard computer (OBC) ....................................... 11-7
  installation .................................................... 12-13
  rebooting .................................................... 11-37
  removal ....................................................... 12-13
  retrieving data from ....................................... 11-39
  testing ....................................................... 11-15, 11-32, 11-33
P
pawl assembly .................................................... 5-4
pedal group
  installation .................................................... 5-6
  removal ....................................................... 5-1
periodic lubrication schedule ............................... 10-3
periodic service schedule .................................... 10-1
R
rack and pinion ................................................ 7-4
  assembly ...................................................... 7-8
  disassembly .................................................. 7-5, 7-7
  installation .................................................... 7-9
  removal ....................................................... 7-4
rear beauty panel
  installation .................................................... 4-12, 4-16
  removal ....................................................... 4-10, 4-15
rear body
  see body, rear
rear body, four-passenger .................................... 4-12
rear body, two-passenger ..................................... 4-8
rear suspension
  see suspension, rear
rear underbody
  installation .................................................... 4-12, 4-16
  removal ....................................................... 4-10, 4-16
receptacle
  see charger receptacle
regenerative braking .......................................... 11-7
repair
  front and rear body
    gouges, punctures, tears .................................. 4-2
    minor impact damage/deformations ..................... 4-2
    minor scratches and surface blemishes .............. 4-2
    stress lines or streaks .................................. 4-2
    tire .......................................................... 8-2
reverse buzzer
  installation .................................................... 12-8
  removal ....................................................... 12-8
  testing ....................................................... 11-37
S
safety .......................................................... 1-1, 2-1
  safety committee ............................................ 3-2
SAM
  installation .................................................... 4-10
  removal ....................................................... 4-10
seat back (four-passenger)
  installation .................................................... 4-13
  removal ....................................................... 4-12
seat support (four-passenger)
  installation .................................................... 4-13
  removal ....................................................... 4-13
<table>
<thead>
<tr>
<th>Component</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>serial number, vehicle</td>
<td>3-1</td>
</tr>
<tr>
<td>service schedule</td>
<td></td>
</tr>
<tr>
<td>see periodic service schedule</td>
<td></td>
</tr>
<tr>
<td>see also periodic lubrication schedule</td>
<td></td>
</tr>
<tr>
<td>shock absorber</td>
<td></td>
</tr>
<tr>
<td>see suspension, front and suspension, rear</td>
<td></td>
</tr>
<tr>
<td>solenoid</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>12-12</td>
</tr>
<tr>
<td>removal</td>
<td>12-12</td>
</tr>
<tr>
<td>testing</td>
<td>11-35</td>
</tr>
<tr>
<td>solenoid activating coil</td>
<td></td>
</tr>
<tr>
<td>testing</td>
<td>11-16</td>
</tr>
<tr>
<td>speed controller</td>
<td></td>
</tr>
<tr>
<td>connector, 16-pin</td>
<td></td>
</tr>
<tr>
<td>see test procedures</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>12-11</td>
</tr>
<tr>
<td>removal</td>
<td>12-11</td>
</tr>
<tr>
<td>speed sensor</td>
<td></td>
</tr>
<tr>
<td>see motor, speed sensor</td>
<td></td>
</tr>
<tr>
<td>steering</td>
<td></td>
</tr>
<tr>
<td>rack and pinion</td>
<td></td>
</tr>
<tr>
<td>assembly</td>
<td>7-8</td>
</tr>
<tr>
<td>disassembly</td>
<td>7-7</td>
</tr>
<tr>
<td>installation</td>
<td>7-9</td>
</tr>
<tr>
<td>removal</td>
<td>7-4</td>
</tr>
<tr>
<td>steering column</td>
<td>7-2</td>
</tr>
<tr>
<td>disassembly</td>
<td>7-4</td>
</tr>
<tr>
<td>installation</td>
<td>7-4</td>
</tr>
<tr>
<td>removal</td>
<td>7-2</td>
</tr>
<tr>
<td>steering wheel</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>7-2</td>
</tr>
<tr>
<td>removal</td>
<td>7-1</td>
</tr>
<tr>
<td>storage</td>
<td></td>
</tr>
<tr>
<td>electric vehicle</td>
<td>3-2</td>
</tr>
<tr>
<td>stress lines</td>
<td></td>
</tr>
<tr>
<td>see repair, front and rear body</td>
<td></td>
</tr>
<tr>
<td>suspension, front</td>
<td></td>
</tr>
<tr>
<td>camber adjustment</td>
<td>7-10</td>
</tr>
<tr>
<td>components</td>
<td></td>
</tr>
<tr>
<td>control arm</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>7-14</td>
</tr>
<tr>
<td>removal</td>
<td>7-14</td>
</tr>
<tr>
<td>kingpin and steering spindle</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>7-13</td>
</tr>
<tr>
<td>removal</td>
<td>7-13</td>
</tr>
<tr>
<td>leaf spring</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>7-13</td>
</tr>
<tr>
<td>leaf spring removal</td>
<td>7-13</td>
</tr>
<tr>
<td>shock absorber</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>7-14</td>
</tr>
<tr>
<td>removal</td>
<td>7-14</td>
</tr>
<tr>
<td>tie rod</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>7-12</td>
</tr>
<tr>
<td>tie rod end</td>
<td></td>
</tr>
<tr>
<td>removal</td>
<td>7-12</td>
</tr>
<tr>
<td>wheel bearings and hub</td>
<td></td>
</tr>
<tr>
<td>inspection</td>
<td>7-17</td>
</tr>
<tr>
<td>installation</td>
<td>7-17</td>
</tr>
<tr>
<td>removal</td>
<td>7-17</td>
</tr>
<tr>
<td>lubrication</td>
<td>7-10</td>
</tr>
<tr>
<td>toe-in adjustment</td>
<td>7-11</td>
</tr>
<tr>
<td>wheel alignment</td>
<td>7-10</td>
</tr>
<tr>
<td>suspension, rear</td>
<td></td>
</tr>
<tr>
<td>shock absorber</td>
<td></td>
</tr>
<tr>
<td>inspection and removal</td>
<td>9-1</td>
</tr>
<tr>
<td>installation</td>
<td>9-1</td>
</tr>
<tr>
<td>suspension, rear (four-passenger)</td>
<td></td>
</tr>
<tr>
<td>leaf spring</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>9-6</td>
</tr>
<tr>
<td>removal</td>
<td>9-4</td>
</tr>
<tr>
<td>suspension, rear (two-passenger)</td>
<td></td>
</tr>
<tr>
<td>leaf spring</td>
<td></td>
</tr>
<tr>
<td>installation</td>
<td>9-4</td>
</tr>
<tr>
<td>removal</td>
<td>9-1</td>
</tr>
<tr>
<td>sweater basket</td>
<td>4-10</td>
</tr>
</tbody>
</table>

T

test procedures

1 – batteries/voltage check .......... 11-14
2 – onboard computer solenoid lockout circuit 11-15
3 – solenoid activating coil .......... 11-16
3 – solenoid diode ..................... 11-16
4 – MCOR .................................. 11-17
5 – motor, A1 and A2 voltage .......... 11-18
6 – Tow/Run switch ................... 11-19
7 – battery pack voltage (under load) 11-20
8 – key switch ......................... 11-20
8 – MCOR limit switch ................ 11-20
9 – 16-pin connector .................. 11-22
<table>
<thead>
<tr>
<th>Index</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>onboard computer SCR</td>
<td>11-32</td>
</tr>
<tr>
<td>OBC gray wire and fuse</td>
<td>11-33</td>
</tr>
<tr>
<td>charger receptacle</td>
<td>11-33</td>
</tr>
<tr>
<td>speed sensor, motor</td>
<td>11-34</td>
</tr>
<tr>
<td>solenoid</td>
<td>11-35</td>
</tr>
<tr>
<td>Forward/Reverse rocker switch</td>
<td>11-36</td>
</tr>
<tr>
<td>reverse buzzer</td>
<td>11-37</td>
</tr>
<tr>
<td>OBC, rebooting</td>
<td>11-37</td>
</tr>
<tr>
<td>battery warning light</td>
<td>11-38</td>
</tr>
</tbody>
</table>

**test procedures, motor**

1. internal short circuits | 15a-1, 15b-1
2. armature circuit open | 15a-2, 15b-2
3. field circuit open | 15a-2, 15b-2
armature ground test | 15a-6, 15b-7

**tie rod and drag link**

installation | 7-12
removal | 7-10

**tire**

installation | 8-3
removal | 8-2
repair | 8-2

**Tow/Run switch** | 11-7
installation | 12-6
removal | 12-6
testing | 11-19

**transaxle, type g**

assembly | 16-9
axle bearing | 16-4
axle shaft
installation | 16-2
removal | 16-1
disassembly | 16-7
inspection | 16-7
installation | 16-10
lubrication | 16-1
oil seal
installation | 16-2
removal | 16-1
removal | 16-5

**troubleshooting** | 11-2
battery troubleshooting examples | 13-11
communication display module (CDM) | 11-40
troubleshooting guide 1 | 11-8
troubleshooting guide 2 | 11-11

**U**
universal accessory mounting | 4-8

**W**

andering definition of | 1-1
water level
see batteries, electrolyte level

wheel
installation | 8-1
removal | 8-1
see also tire

wheel liner
installation | 4-12
removal | 4-12

wheel, steering
see steering wheel

**Z**
zero speed detect | 11-1
Your Comments Are Appreciated

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<table>
<thead>
<tr>
<th>Category</th>
<th>Poor</th>
<th>Fair</th>
<th>Average</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ease of Understanding</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. Ease of Finding Information</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. Clarity of Illustrations</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Index Usability</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. Troubleshooting Chart Usability</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

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