INSTRUCTIONS

MAINTENANCE AND TROUBLESHOOTING FOR THE EV-10* SCR CONTROL

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GENERAL ELECTRIC

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NOTE
Heavy lines are power circuits;
light lines are control circuits.

Figure 1.5.1
EV-10 ELEMENTARY

Ref. 91TMP.9

1-21

Rev. 00, 1/83
CHAPTER 5
MAINTENANCE AND TROUBLESHOOTING

SECTION 1
GENERAL MAINTENANCE INSTRUCTIONS

The SCR control, like all electrical apparatus, does have some thermal losses. The semiconductor junctions have finite temperature limits above which these devices may be damaged. For these reasons, normal maintenance should guard against any action which exposes the components to excessive heat, such as steam cleaning, or which reduces the heat dissipating ability of the control, such as restricting air flow.

The following DO'S and DON'TS should be observed:

1. Advise the truck manufacturer of any controls that will be used in ambients of 100°F (40°C) or over.

2. Use filters on all external components having inductive coils. Refer to the vehicle manufacturer for specifications.

3. Do not steam-clean the control. In dusty areas, use low pressure air to blow off the control. In oily or greasy areas, use a mild solution of detergent, denatured alcohol, or Freon TF degreaser to wash off the control; then blow it completely dry with low pressure air.

4. Mount the SCR panel against the frame of the truck. The truck frame, acting as an additional heat sink, will give improved truck performance by keeping the SCR control package cooler. Add Silicone Grease (Dow Corning No. 342 or equivalent) between the SCR Control base and the vehicle frame.

5. Keep the terminal boards and other exposed SCR control parts free of dirt and paint which might change the effective resistance between points.

CAUTION

THE TRUCK SHOULD NOT BE PLUGGED IN WHEN IT IS JACKED UP AND THE DRIVE WHEELS ARE IN A FREE-WHEELING POSITION. THIS CAN CREATE EXCESSIVE VOLTAGES THAT CAN BE HARMFUL TO THE CONTROL.

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SECTION 2
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

HOW TO USE THE DIAGNOSTIC DIAGRAM

DIAGRAMS ARRANGED BY FAILURE

The diagrams are arranged by failure modes. These modes are described in oval-shaped boxes at the top of each page.

FIND YOUR SYMPTOM AND FOLLOW THE ARROWS

Find the symptom that describes your vehicle's failure mode and proceed to the next step following the arrow.

FOLLOW THE INSTRUCTIONS

Follow the instruction described in the box and proceed to the next box along the arrow path which coincides with the result of your action.

NOTE

The numbers and letters (i.e., 4A) enclosed in small boxes in the upper right corner of some instruction boxes correspond to a particular segment in Section 4, Checking Components. Please refer to that segment for more detailed instructions.
EXAMPLE

[DIRECTIONAL CONTACTORS CLOSE. VEHICLE ACCELERATES TO FULL SPEED IMMEDIATELY.]

Symptom or failure mode box.

Close the key switch.
Check the voltage at terminal 12 on the control. It should read about 3.5 volts.

4L

3.5V

Replace the control card.

Instruction box.

Path determined by test results.

Near 0 volts

4D

Check the accelerator potentiometer for proper adjustment or shorts to the negative.

Bad

Adjust or repair.

4D

Replace the control card.

4A

Defines reference paragraph for check, replacement, or repair.
ONE DIRECTIONAL CONTACTOR WILL NOT CLOSE.

Check the directional switch to see if it closes.  

Bad  Replace the switch.

OK

After closing the directional switch, check for battery volts on card terminal 13 if the F contactor does not close and terminal 16 if the R contactor does not close.

Yes

Check for positive volts at the coil terminal.

No

Repair the open wire between the F or R switch and the card.

Yes

Jumper terminal 4 or 3 to terminal 2 on the PMTD. Close all switches. Check if the contactor closes.

No

Jumper from the negative side of the coil to terminal 2 on the PMTD. Close all switches. Check if the contactor closes.

Yes

Remove the wire from control terminal 13. Attach a milliamp meter from control terminal 13 to the battery negative. Close all switches; read the milliamps.

0 mA  Replace the control card.

5-10 mA  Replace the PMTD.

No

Repair the wire from the contactor to the PMTD.

Yes

Repair the wire from the negative SCR terminal to the PMTD.

No

Replace the control coil.

WARNING

JACK THE DRIVE WHEELS OFF THE FLOOR TO PREVENT A RUNAWAY VEHICLE.

Figure 5.2.1, Sheet 1
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59

Rev. 00, 1/83
Figure 5.2.1, Sheet 2
TROUBLESHOOTING DIAGNOSTIC DIAGRAM
EV-10 SCR Control
Maintenance and Troubleshooting
Diagnostic Diagram

Greater than 8V

Near 0 volts

4L

Close the keyswitch, the brake start switch, and the F switch. Check for battery volts at card terminal 15.

Yes

No

Check all switches and wiring from the keyswitch to card terminal 15. Repair any open circuits.

Jumper terminal 4 or 3 to terminal 2 on the PMTD. Close all switches. Check if the contactor closes.

Yes

No

Remove the wire from control terminal 13. Attach a milliamp meter from control terminal 13 to the battery negative. Close all switches; read milliams.

0 mA

5-10 mA

Replace the control card.

Replace the PMTD.

Check the 1A contactor for welded tips.

Yes

Repair the tips.

No

1 REC shorted.

Replace 1 REC.

Jumper from the negative side of the coil to terminal 2 on the PMTD. Close all switches. Check if the contactor closes.

Yes

No

Repair the wire from the contactor to the PMTD.

Replace the wire from the negative SCR terminal to the PMTD.

Replace the contactor coil.

Jumper from the negative side of the coil to the negative SCR terminal. Check if the contactor closes.

Yes

No

Figure 5.2.1, Sheet 3
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83

5-6
EV-10 SCR Control
Maintenance and Troubleshooting
Diagnostic Diagram

(CONTACTORS CLOSE. NO POWER WHEN ACCELERATOR IS DEPRESSED.)

Close the F contactor and check the voltage at terminal board point BLU on the control.

Battery volts

Check the voltage at control card terminal 12. The voltage should vary from 3 - 4 volts at creep speed, reducing to 2 volts at full speed.

Yes

Check the accelerator potentiometer for the proper resistance and adjustment.

Yes

Replace the control card.

No

Adjust or replace the accelerator potentiometer.

Check the voltage at card terminal W/BLK. It should read:
- 20.4V or more for 24V truck.
- 30.6V or more for 36V truck.
- 40.8V or more for 48V truck.
- 61.2V or more for 72V truck.

Yes

No

WARNING
JACK THE DRIVE WHEELS OFF THE FLOOR TO PREVENT A RUNAWAY VEHICLE.

Check voltage at the load side of the power fuse.

Battery volts

Check the voltage at S1, S2, A2, A1, and A2 terminals on the SCR panel.

Battery volts at all points.

Repair the BLU wire running from A2 to terminal board point BLU on the SCR panel.

0 volts

Replace the power fuse.

No volts

Repair the open circuit.

Figure 5.2.1, Sheet 4
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83
Figure 5.2.1, Sheet 5
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83
[CONTROL SHUTS OFF WHEN THE 1A CONTACTOR DROPS OUT AND THE ACCELERATOR IS RETURNED TO THE SCR RANGE (PMZ TRIP).]

WARNING

JACK THE DRIVE WHEELS OFF THE FLOOR TO PREVENT A RUNAWAY VEHICLE.

Check for slow 1A dropout.
May be caused by:
- A defective coil.
- Foreign matter in the contactor.
- Defective or wrong coil suppression.
- A broken contactor spring.

Figure 5.2.1, Sheet 6
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83
EV-10 SCR Control
Maintenance and Troubleshooting
Diagnostic Diagram

[DIRECTIONAL CONTACTORS CLOSE. VEHICLE ACCELERATES TO FULL SPEED IMMEDIATELY.]

Close the key switch. Check the voltage at terminal 12 on the control. It should read about 3.5 volts.

Near 0 volts

Check the accelerator potentiometer for proper adjustment or shorts to the negative.

3.5V

Check the PMT driver.

OK

Replace the control card.

Bad

Replace the driver.

Bad

Adjust or repair the potentiometer.

4L 4E 4D 4A

Figure 5.2.1, Sheet 7
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.IMP.59
Rev. 00, 1/83 5-10
EV-10 SCR Control
Maintenance and Troubleshooting
Diagnostic Diagram

[DIRECTIONAL CONTACTORS CLOSE THEN REOPEN. PHT TRIP.]

4G
Check 5 REC for any defects. OK
Bad
Replace 5 REC.

4K
Check the transformer for any open circuits. OK
Bad
Replace the transformer.

4G
Check 2 REC for any defects. OK
Bad
Replace 2 REC.

4G
Check for an open Ix. OK
Bad
Replace Ix.

4B
Check the capacitor for any defects. OK
Bad
Replace the capacitor.

4B
Check 3 REC for a short circuit. OK
Bad
Replace 3 REC.

4B
Check 1 REC for any defects. OK
Bad
Replace the control card.

WARNING
JACK THE DRIVE WHEELS OFF THE FLOOR TO PREVENT A RUNAWAY VEHICLE.

Figure 5.2.1, Sheet 8 TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83 5-11
EV-10 SCR Control
Maintenance and Troubleshooting
Diagnostic Diagram

---

[Diagram]

1A CONTACTOR PICKS UP
WHEN THE KEYSWITCH IS CLOSED.

---

WARNING

JACK THE DRIVE WHEELS OFF THE FLOOR
TO PREVENT A RUNAWAY VEHICLE.

---

Remove the wire from 1AD terminal 1.
Close the keyswitch; check if the 1A contactor closes.

---

Yes
Replace 1AD.

---

No

---

4A
Replace the control card.

---

Figure 5.2.1, Sheet 9
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59

Rev. 00, 1/83

5-12
EV-10 SCR Control
Maintenance and Troubleshooting
Diagnostic Diagram

[F AND R CONTACTORS WILL NOT DROP OUT AUTOMATICALLY DURING FULL TORQUE FAULT.]

WARNING

JACK THE DRIVE WHEELS OFF THE FLOOR TO PREVENT A RUNAWAY VEHICLE.

Operate the traction drive. Jumper control card terminal 13 to the negative SCR terminal. Check if the directional contactor opens.

Yes

Replace the control card.

No

Replace the PMTD.

4A

Figure 5.2.1, Sheet 10
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83

5-13
EV-10 SCR Control
Maintenance and Troubleshooting
Diagnostic Diagram

[1A CONTACTOR WILL NOT CLOSE AT TOP SPEED.]

Check the voltage at terminal 12 on the control card with the truck running at top speed.

More than .3V

Check the accelerator potentiometer for proper adjustment.

Misadjusted

Adjust the potentiometer.

.5V or less

DisCONNECT the wire at control card terminal 14. Attach a milliamp meter from terminal 14 to the battery negative. Run the truck up to top speed.

5-10 mA

Replace the control card.

0 mA

Replace the control card.

Reconnect the wire to terminal 14 of the control card. Run the truck up to top speed and check the voltage at terminal 14.

Zero

Check for a wiring short to the negative SCR terminal.

Bad

Repair the wiring.

Approx. 8V

Replace 1AD.

Approx. 1.5V

Check for an open circuit in the wire from terminal 14 to 1AD.

Bad

Repair the wiring.

Close the keyswitch. Check the voltage at terminal 3 of 1AD. (This connects to the 1A contactor coil.)

Battery 0 volts

Check the continuity from terminal 2 on 1AD to the negative SCR terminal. Should read 0 ohms.

OK

OK

Ref. 91.TMP.59
Rev. 00, 1/83

Figure 5.2.1, Sheet 11
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

5-14
Figure 5.2.1, Sheet 12
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83
Figure 5.2.1, Sheet 13
TROUBLESHOOTING DIAGNOSTIC DIAGRAM
BLOWN POWER FUSE

Check the fuse for the proper rating.

Wrong
Replace the fuse with one the correct size.

OK

Check 3 REC for a short circuit.

Bad
Replace 3 REC.

OK

Check for the proper full-load running currents. High current may be caused by a defective drive motor, dragging brakes or drive train problems.

Check 1 REC for possible damage caused by a 3 REC short.

Figure 5.2.1, Sheet 14
TROUBLESHOOTING DIAGNOSTIC DIAGRAM

Ref. 91.TMP.59
Rev. 00, 1/83
SECTION 3
DESCRIPTION OF OSCILLATOR CARD INPUTS AND OUTPUTS

INPUTS

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<td>Plugging input</td>
</tr>
<tr>
<td>GRY</td>
<td>Thermal protector input</td>
</tr>
<tr>
<td>ORN</td>
<td>Battery volts reference</td>
</tr>
<tr>
<td>RED</td>
<td>Gate drive for 5 REC</td>
</tr>
<tr>
<td>BRN</td>
<td>Gate loading for 5 REC</td>
</tr>
<tr>
<td>W/BLK</td>
<td>Gate loading for 2 REC &amp; capacitor volts</td>
</tr>
<tr>
<td>W/RED</td>
<td>Gate drive for 2 REC</td>
</tr>
<tr>
<td>BLU</td>
<td>PMT/current limit sense input</td>
</tr>
<tr>
<td>WHT</td>
<td>Gate drive for 1 REC</td>
</tr>
<tr>
<td>VIO</td>
<td>Gate loading for 1 REC</td>
</tr>
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<td>BLK (2)</td>
<td>Negative card input - 1 wire from negative on transformer and 1 wire from thermal protector.</td>
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<td>18</td>
<td>Battery positive input for 36 volt vehicle</td>
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<td>17</td>
<td>Battery positive input for 24 volt vehicle</td>
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<td>16</td>
<td>Reverse directional switch input</td>
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<td>15</td>
<td>Forward directional switch input</td>
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<td>14</td>
<td>Signal for 1A driver</td>
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<tr>
<td>13</td>
<td>Signal for PMTD or F/R driver</td>
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<tr>
<td>12</td>
<td>Accelerator potentiometer input</td>
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Table 5.3.2
OSCILLATOR CARD OUTPUTS
SECTION 4
CHECKING COMPONENTS

This section provides step-by-step instructions for checking the components. These instructions include meter readings from the Volt-Ohm-Meter, with the desired reading indicated at the end of that particular step.

MAIN SCR CONTROL CARD (4A)

The troubleshooting diagnostics check all outside devices and eliminate them as the source of the problem. If that does not resolve the problem, then the card must be faulty.

INSTRUCTIONS FOR REMOVAL OF THE CONTROL CARD

[WARNING]

TO AVOID DAMAGE TO THE CARD, DO NOT REMOVE THE SCR CONTROL CARD FROM ITS METAL TOP AND BOTTOM.
1. Remove all wires from the outside terminal board on the control card.
2. Remove all wires from the inside terminal board on the control card.
3. Remove the 2 screws attaching the control card bottom to the stand-up bracket (near the capacitor).

Figure 5.4.1
SCR CONTROL CARD

Ref. 91.TMP.26

Rev. 00, 1/83
CAPACITOR 1C (4B)

WARNING

TO AVOID ELECTRICAL SHOCK OR A RUNAWAY VEHICLE, DISCONNECT THE BATTERY AND DISCHARGE THE CAPACITOR BEFORE DOING ANY TESTING.

USING A VOLT-OHM-METER (VOM) SET TO THE R X 10,000 SCALE:

1. Remove the wires from one of the terminals of the capacitor.

2. Connect the leads from the VOM across the capacitor terminals. The meter should swing to 0 ohms, then gradually swing to above 100,000 ohms.

3. Reverse the leads of the VOM. The meter should swing to 0 ohms, then gradually swing to above 100,000 ohms.

4. Check the resistance from one of the capacitor terminals to its case. Meter reading: 50,000 ohms or more.

Figure 5.4.2
CAPACITOR CHECK

Ref. 91.TMP.27

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Rev. 00, 1/83
CONTACTORS F, R, IA, and P (4C)

For 150 and 300 amp contactors, refer to GEH-4469 located in Section 7 of this chapter.

For 75 amp contactors, refer to GEH-3099A located in Section 7 of this chapter.
POTENTIOMETER IN ACCELERATOR (4D)

1. Disconnect the battery.

2. Remove the wire from terminal board point 12.

3. Connect a Volt-Ohm-Meter from the wire at terminal board point 12 to the negative on the transformer with the scale set to R X 100.

4. Set the accelerator at creep speed.
   Meter reading: 4800 to 6000 ohms.

5. Move the accelerator to top speed.
   Meter reading: 200 ohms or less.

6. Move the negative VOM lead to the truck frame.
   Meter reading: 1,000,000 ohms or more.

---

Figure 5.4.3
ACCELERATOR POTENTIOMETER CHECK

Ref. 91.TMP.28

Rev. 00, 1/83
DRIVER MODULE (4E)

Resistor = 8200 ohms 2 watts for 72 volts.
= 4700 ohms 2 watts for 24/36/48 volts.

USING A VOM SET TO THE 50V DC SCALE:

(For 24/36/48V, use a VOM set to a 100V dc scale.)

1. Disconnect the leads.
2. Connect the resistor, coil and switch to terminals 1 and 3 as shown.
3. Connect the battery negative to terminal 2 and the battery positive to the junction of the switch and the resistor.
4. Connect the negative lead of the VOM to terminal 2 and the positive lead of the VOM to terminal 3. Read the battery voltage on the VOM.
5. Close the switch. The VOM meter reading should drop to 2V or less.
6. Move the resistor and the positive meter lead from terminal 3 to terminal 4.
7. Repeat the same test.

![Diagram of the driver module check](image)

Figure 5.4.4
DRIVER MODULE CHECK

Ref. 91.TMP.29

Rev. 00, 1/83
HOURMETER MODULE (4F)

USING A VOM SET TO THE R X 1 SCALE:

1. Disconnect the lead from terminal 4.

2. Connect the positive lead of the VOM to terminal 3 and the negative lead of the VOM to terminal 4.
   Meter reading: less than 20 ohms.

3. Move the positive lead to terminal 2.
   Meter reading: less than 20 ohms.

4. Move the positive lead to terminal 1.
   Meter reading: less than 20 ohms.

SWITCH THE VOM TO THE R X 10,000 SCALE:

5. Connect the negative lead of the VOM to terminal 3 and the positive lead to terminal 4.
   Meter reading: 50,000 ohms or more.

6. Move the negative lead to terminal 2.
   Meter reading: 50,000 ohms or more.

7. Move the negative lead to terminal 1.
   Meter reading: 50,000 ohms or more.

---

Figure 5.4.5
HOURMETER MODULE CHECK

Figure 5.4.6
HOURMETER MODULE CHECK

Ref. 91TMP.30
Ref. 91TMP.31

Rev. 00, 1/83
SCR (1 REC, 2 REC, 5 REC) (4G)

WARNING

TO AVOID ELECTRICAL SHOCK OR A RUNAWAY VEHICLE, DISCONNECT THE BATTERY AND DISCHARGE THE CAPACITOR BEFORE DOING ANY TESTING.

Figure 5.4.7
SCR LOCATIONS

Ref. 91.TMP.32

Rev. 00, 1/83
1 REC

**USING A 6V TEST LIGHT, AS SHOWN:**

1. Disconnect the WHT wire from the card.

2. Connect the negative lead of the test light to terminal board point VI0 (cathode).

3. Connect the positive lead of the test light to terminal board point BLU (anode). If the light comes on, 1 REC has shorted. If the light does not come on, continue testing.

![Diagram of test light connection](image)

**Figure 5.4.8**

1 REC TEST LIGHT CHECK

Ref. 91.TMF.33

Rev. 00, 1/83
1 REC (Continued)

4. Touch the WHT (gate) wire to terminal board point BLU. The light should come on. If it does not, 1 REC is open.
1 REC (Continued)

**USING A VOM SET TO THE RX 1 SCALE:**

1. Disconnect the BLU wire from terminal board point BLU.
2. Disconnect the WHT wire from terminal board point WHT.
3. Connect the negative lead of the VOM to the WHT wire (gate).
4. Connect the positive lead of the VOM to terminal board point VIO (cathode). Replace 1 REC if the reading is either zero or infinity.
5. Reverse the meter leads and check again. Replace 1 REC if the reading is zero or infinity.

---

![Diagram](image)

Figure 5.4.10
1 REC VOM CHECK

Ref. 91/tmp.35

5-30

Rev. 00, 1/83
1 REC (Continued)

SWITCH THE VOM TO THE R X 100 SCALE:

6. Connect the negative lead of the VOM to the BLU wire (anode).

7. Connect the positive lead of the VOM to terminal board point VI0 (cathode). Replace 1 REC if the meter reads zero.

---

Figure 5.4.11
1 REC VOM CHECK

Ref. 91.TMP.36

Rev. 00, 1/83
2 REC

USING A 6V TEST LIGHT, AS SHOWN:

1. Disconnect the W/RED wire from the card.

2. Connect the negative lead of the test light to terminal board point W/BLK (cathode).

3. Connect the positive lead of the test light to terminal board point BLU (anode). If the light comes on, 1 REC has shorted. If the light does not come on, continue testing.

Figure 5.4.12
2 REC TEST LIGHT CHECK

Ref. 91.TMP.37

5-32

Rev. 00, 1/83
2 REC (Continued)

4. Touch the W/RED (gate) wire to terminal board point BLU. The light should come on and stay on when the W/RED wire is removed; if not, 2 REC is open.

Figure 5.4.13
2 REC TEST LIGHT CHECK

Ref. 91.TMP.38

Rev. 00, 1/83
2 REC (Continued)

**USING A VOM SET TO THE RX1 SCALE:**

1. Disconnect the BLU wire from terminal board point BLU.
2. Disconnect the W/RED wire from terminal board point W/RED.
3. Connect the negative lead of the VOM to the W/RED wire (gate).
4. Connect the positive lead of the VOM to terminal board point W/BLK (cathode). Replace 2 REC if the reading is either zero or infinity.
5. Reverse the meter leads and check again. Replace 1 REC if the reading is zero or infinity.

![Diagram](image)

*Figure 5.4.14
2 REC VOM CHECK*

Ref. 91.TMF.39

Rev. 00, 1/83
2 REC (Continued)

SWITCH THE VOM TO THE R X 100 SCALE:

6. Connect the negative lead of the VOM to the BLU wire (anode).

7. Connect the positive lead of the VOM to terminal board point w/BLK (cathode). Replace 2 REC if the meter reads zero.

---

Ref. 91.TMP.40

Rev. 00, 1/83
5 REC

Using a 6V test light, as shown:

1. Disconnect the RED wire from the card.

2. Connect the negative lead of the test light to terminal board point BRN (cathode).

3. Connect the positive lead of the test light to terminal board point W/BLK (anode). If the light comes on, 1 REC has shorted. If the light does not come on, continue testing.

Ref. 91,TMP.41

Rev. 00, 1/83
5 REC (Continued)

4. Touch the RED (gate) wire to terminal board point W/Blk. The light should come on and stay on when the RED wire is removed; if not, 5 REC is open.
5 REC (Continued)

USING A VOM SET TO THE R X 1 SCALE:

1. Disconnect the W/BLK wire from terminal board point W/BLK (anode).
2. Disconnect the BRN wire from terminal board point BRN.
3. Connect the negative lead of the VOM to the BRN wire (cathode).
4. Connect the positive lead of the VOM to terminal board point RED (gate). Replace 5 REC if the reading is either zero or infinity.
5. Reverse the meter leads and check again. Replace 5 REC if the reading is zero or infinity.

Figure 5.4.18
5 REC VOM CHECK

Ref. 91.TMP.43

5-38

Rev. 00, 1/83
5 REC (Continued)

SWITCH THE VOM TO THE R X 100 SCALE:

6. Connect the negative lead of the VOM to the W/BLK wire (anode).

7. Connect the positive lead of the VOM to the BRN wire (cathode). Replace 5 REC if the meter reads zero.

Figure 5.4.19
5 REC VOM CHECK

Ref. 91.TMP.44

5-39

Rev. 00, 1/83
RECTIFIERS (3 AND 4 REC) (4H)

**WARNING**

TO AVOID ELECTRICAL SHOCK OR A RUNAWAY VEHICLE, WHEN CHECKING DIODES, DISCONNECT THE BATTERY AND DISCHARGE THE CAPACITOR IC.

![Diode Diagram]

Figure 5.4.20
DIODE DESCRIPTION

Ref. 91.TMP.45

Rev. 00, 1/83
RECTIFIERS (3 AND 4 REC) (Continued)

USING A CONTINUITY TEST LIGHT:

1. Disconnect the cathode end from the panel wiring.

2. Connect the negative lead of the test light to the anode.

3. Connect the positive lead of the test light to the cathode. If the light comes on, the REC has shorted. If the light does not come on, continue testing.

![Figure 5.4.21](image1)

Figure 5.4.21
3 AND 4 REC TEST LIGHT CHECK

USING A CONTINUITY TEST LIGHT (Continued):

4. Connect the negative lead of the test light to the cathode.

5. Connect the positive lead of the test light to the anode. The light should normally come on. If it comes on, the test is concluded using a continuity light. If it does not come on, the diode is open.

![Figure 5.4.22](image2)

Figure 5.4.22
3 AND 4 REC TEST LIGHT CHECK

Ref. 91.TMP.46
Ref. 91.TMP.47

Rev. 00, 1/83
RECTIFIERS (3 AND 4 REC) (Continued)

USING A VOLT-OHM-METER (VOM) SET TO THE R X 10,000 SCALE:

1. Disconnect the VOM.

2. Connect the positive lead of the VOM to the cathode.

3. Connect the negative lead of the VOM to the anode.
   Meter reading: 50,000 ohms or more.

![Diagram of a VOM with RX 10,000 setting]

Figure 5.4.23
3 AND 4 REC VOM CHECK

USING A VOLT-OHM-METER (VOM) SET TO THE R X 10,000 SCALE (Continued):

SWITCH THE VOM TO THE R X 1 SCALE:

4. Connect the positive lead of the VOM to the anode.

5. Connect the negative lead of the VOM to the cathode.
   Meter reading: 7 to 12 ohms.

![Diagram of a VOM with RX 1 setting]

Figure 5.4.24
3 AND 4 REC VOM CHECK

Ref. 91.TMP.48
Ref. 91.TMP.49

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Rev. 00, 1/83
THERMAL PROTECTOR (TP) (4J)

USING A VOM-OM-HMETER (VOM) SET TO THE k X 100 SCALE:

1. Disconnect the GRY wire from terminal board point GRY.

2. Connect the leads of the VOM to the GRY wire and to terminal board point BJK as shown in Figure 5.4.25. The resistance should be less than 200 ohms when at normal temperature.

Figure 5.4.25
THERMAL PROTECTOR CHECK

Ref. 91.TMP.50

Rev. 00, 1/83
TRANSFORMER (4K)

USING A VOM SET TO THE RX 1 SCALE:

1. Connect the leads of the VOM to the negative (transformer) and IC.
   Meter reading: less than 2 ohms.

   ![Diagram 1]

   Figure 5.4.26
   TRANSFORMER CHECK

2. Connect the leads of the VOM to A2 (transformer) and terminal board point BRN.
   Meter reading: less than 2 ohms.

   ![Diagram 2]

   Figure 5.4.27
   TRANSFORMER CHECK

Ref. 91.TMP.51
Ref. 91.TMP.52

Rev. 00, 1/83
VOLTAGE CHECK (4L)

USING A VOM SET TO THE DC VOLTAGE SCALE:

1. Set the VOM equal to or greater than the anticipated voltage.
2. Connect the black negative head of the VOM to the SCR negative.
3. Connect the red positive lead of the VOM to the point described in the Troubleshooting Diagnostic Diagram.
4. Read the voltage.

MILLIAMPS CHECK (4M)

USING A VOM SET TO THE 10 MA SCALE:

1. Connect the black negative lead of the VOM to the SCR negative.
2. Disconnect the wire from the point described in the Troubleshooting Diagnostic Diagram.
3. Connect the red positive lead to the point indicated.
4. Read the milliamps.
SECTION 5
REPLACEMENT OF COMPONENTS

NOTE
The use of a heat transfer grease such as GE Versilube G-350-M or its equivalent is recommended.

REPLACEMENT OF THE 1 REC MODULE

1. Remove the 1 REC gate wire (WHT) from the inside card terminal board.
2. Remove the wires from the outside card terminal board.
3. Remove the two card mounting screws and rotate the card over the capacitor and the transformer.
4. Unplug the two thermal protector wires.
5. Disconnect the T2-strap from the top heat sink.
6. Remove the spring assembly by first removing its mounting bolts.
7. Clean both heat sinks with a clean rag and isopropyl alcohol.
8. Apply a light coat of heat transfer grease to both ends of the 1 REC Press-Pak.
9. Install and torque the heat sink/spring assembly according to the torquing instructions that follow.
10. Reconnect the thermal protector, strap (T2), card, and card wires.
TORQUING INSTRUCTIONS

MOUNTING PROCEDURE

1. Apply Silicon Grease (Dow No. 44) to both sides of the SCR.
2. Locate the SCR in place with the pin on the large heat sink.
3. With the anode down, place the upper heat sink on top with the clamp in position. (See Figure 5.5.1.)

![Figure 5.5.1](image)

4. Tighten the bolts evenly until they are finger tight. Then tighten each bolt 1/4 turn using a 7/16 socket wrench on the bolt heads.
5. Place the force indicator gauge firmly against the springs, as shown on the outline drawing, so that both ends and the middle are in solid contact with the springs. The edges of the gauge will then indicate the spring deflection or force. Correct mounting force is indicated when the proper edges coincide.

Ref. 91.TMP.53

Rev. 00, 1/83
6. If the mounting force indicated is less than rated force, tighten the bolts alternately 1/4 turn at a time until the points coincide. (See Figure 5.5.3.)

7. If excessive force is indicated, loosen the bolts and start over. Never try to adjust spring force by backing off the bolts. Spring friction will produce false readings.
CALIBRATE THE FORCE GAUGE

If you suspect the force gauge is out of calibration due to wear or damage, check it on a flat surface, as indicated in Figure 5.5.5.

NOTE

If the edges are not flush within ±.010, calibrate the gauge by filing the bottom contact points.

Figure 5.5.5
FORCE GAUGE

Ref. 91.TMP.57

Rev. 00, 1/83
REPLACEMENT OF THE CAPACITOR

1. Remove the nuts from the capacitor connections and remove the wires.
2. Remove the two mounting screws and bracket.
3. Reverse this procedure to install a new capacitor.

REPLACEMENT OF THE TRANSFORMER/CHOKE

1. Disconnect all transformer leads.
2. Remove the two mounting screws and lift the transformer free.
3. Reverse this procedure to reassemble.

REPLACEMENT OF THE CONTROL CARD

1. The panels are factory-adjusted for a particular motor and truck and should not need adjustment when used with this motor and truck.

NOTE

If the panels are used to control motors or trucks for which they were not factory-adjusted, the settings may be out of optimum adjustment to the extent that they do interact.

2. Clockwise (CW) rotation increases the function being adjusted.

3. Connect the shunt, the millivoltmeter, and the voltmeter to measure the battery current and motor voltage.
   a. Connect the shunt and the millivoltmeter between battery negative and 1 REC (or between the truck receptacle and the battery plug).
   b. Connect the voltmeter between battery positive and T2 on the SCR panel.

4. Jack up the truck so that the drive wheels are free to rotate. If a brake interlock is used, jumper it out so that power and the brakes can be applied at the same time.

5-50

Rev. 00, 1/83
5. Equipment required:
   a. 50 millivolt dc shunt.

**NOTE**

The shunt rating must be greater than the current to be measured. Best results are obtained when the reading is between half and full scale on the meter. If a shunt of too high a rating is used (i.e., a 500 amp rating to read 100 amps), the meter will be hard to read and the accuracy of the reading will be poor.

6. Check that the ohms in the accelerator potentiometer are less than 200 ohms in the top SCR range.

7. Check the card settings:
   a. Check the current limit by first moving the accelerator until either the F or R contactor operates. Do not move the accelerator to the point where 1A picks up. Apply the brakes until the wheels come to a standstill (the wheels must not be turning) and read the current to see if it falls below the maximum rating of 170 amps and within the rating specified by the truck manufacturer.

**WARNING**

Do not stall the motor for more than 30 seconds at a time. Allow time for the motor to cool between stalls. To avoid personal injury or a runaway vehicle, do not operate the motor at high speeds or plug the motor with the wheels jacked up.

   b. With the truck on the ground, plug the truck from top speed. If the stopping distance is not as desired, adjust the plugging trimpot.
8. Tuneup Procedure.

a. Turn the plugging trimpot fully clockwise to prevent any interaction when setting the current limit trimpot.

b. Turn the current limit trimpot fully counterclockwise.

c. Check to be sure the plugging trimpot is turned fully clockwise.

d. Depress the accelerator until F or R operate, but not the IA contactor.

e. Apply the brakes until the wheels come to a standstill and remain at a standstill.

f. Slowly turn the current limit trimpot in a clockwise direction until the current reaches 170 amps, or as specified by the truck manufacturer.

NOTE

Since these controls are used on a variety of types and sizes of trucks for various applications, it is common for the truck manufacturer to set the current limit at some value below this maximum. For this reason, it is recommended that you obtain the actual current limit setting for your particular truck from the truck manufacturer.
Do not stall the motor for more than 30 seconds at a time. Allow time for the motor to cool between stalls. To avoid personal injury or a runaway vehicle, do not operate the motor at high speeds or plug the motor with the wheels jacked up.

8. To adjust the static plugging, the truck should be in its normal running condition and on the ground. Turn the plugging trimpot fully counterclockwise. This will give the longest distance for stopping.

h. Turn the trimpot clockwise to increase the stopping distance. If the stopping distance is too short or too long, continue to adjust the trimpot until the desired stopping distance is obtained.
PLACEMENT OF THE COMPONENTS

Figure 5.5.6
PLACEMENT OF COMPONENTS

Ref. 91.TMP.58

Rev. 00, 1/83
EV-10 SCR PANEL

OLD

HEAT SINK 44A717441-001
2REC 259A9209PYD
2REC 259A9209PXM (24-48V)
259A9210PXC (72-80V)

NEW

HEAT SINK 44A723546-001
2REC/5REC 44A717074-001

OLDNEW 12/12/85
NOTE: ALL TERMINALS (EXCEPT A2) TO BE MARKED ON BODY NEAR EACH TERMINAL.

FIGURE 2-CONNECTIONS AND TERMINALS
INSTRUCTIONS

150- AND 300-AMPERE
ELECTRIC-VEHICLE CONTROL CONTACTORS
IC4482-CTR A700, A800 SERIES

Before any adjustments, servicing, parts replacement or any other act is performed requiring physical contact with the electrical working components or wiring of this equipment, DISCONNECT THE BATTERY, DISCHARGE CAPACITOR(S), AND JACK WHEELS OFF FLOOR.

DESCRIPTION

GENERAL

These d-c contactors are designed for low-voltage, intermittent-duty operation such as found in battery truck service.

PURPOSE OF INSTRUCTIONS

The purpose of these instructions is to instruct the user on proper care and maintenance to obtain satisfactory service from these devices. The manufacturer of the electric vehicle has tested and applied these contactors according to the requirements of his vehicle. No modifications or changes should be made in the layout, physical arrangement or electrical connections without his permission.

MOUNTING

These contactors are designed to mount on a vertical surface or on a horizontal surface.

DISASSEMBLY AND ASSEMBLY

Two main categories of these contactors are available. The single-pole normally open types, and the single-pole double-throw types which have one normally open and one normally closed contact (Fig. 1). The assembly and disassembly of these devices will be covered individually.

Single-pole, Double-throw Type
(One Normally Open and One Normally Closed Contact)

DISASSEMBLY

(Refer to Fig. 2, page 2 for exploded view and parts index).

1. Remove all electrical connections and remove the contactor from the vehicle for easier servicing.

2. Loosen the four long bolts in each corner, remove the top contact retainer, and the long bolts.

3. Remove the two top stationary normally closed contacts.

4. Remove the two contact spacers.

5. Remove the two bottom stationary contacts.

6. Remove armature and movable-contact assembly.

7. Remove magnet frame and coil from base.

8. Loosen and remove the 10–32 nut from the armature and movable-contact assembly using a 3/8-inch socket or nut driver. Note the order in which the parts are removed from the stud.

The information contained herein is intended to assist truck users and dealers in the servicing of control furnished by the General Electric Company. It does not purport to cover all details or variations in equipment or provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the truck manufacturer through his normal service channels, not directly to General Electric Company.
PARTS INDEX

1. Long bolt with #8 lock washer  
2. Top contact retainer  
3. Top stationary contact  
4. Contact spacer  
5. Bottom stationary contact  
6. Armature and movable-contact assembly  
   a. 10-32 nut  
   b. No. 10 lock washer  
   c. No. 10 flat washer  
   d. Movable-contact carrier  
   e. Shim  
   f. Movable contact  
   g. Spring cup (snaps into 6f)  
   h. Contact spring  
   i. Bottom stationary-contact support  
   j. Armature  
   k. Spiral return spring  
7. Magnet frame  
8. Coil  
9. Base  
10. Bus connector

Fig. 2. Assembly of single-pole, double-throw type

PARTS INDEX

1. Long bolt with #8 lock washer  
2. Contact retainer  
3. Stationary contacts  
4. Armature and movable-contact assembly  
   a. 10-32 nut  
   b. No. 10 lock washer  
   c. No. 10 flat washer  
   d. Contact spring retainer  
   e. Contact spring  
   f. Movable contact  
   g. Shim  
   h. Movable-contact carrier  
   i. Stationary-contact support  
   j. Armature  
   k. Spiral return spring  
5. Magnet frame  
6. Coil  
7. Base

Fig. 3. Assembly of single-pole, single-throw type
ASSEMBLY

(Refer to Fig. 2, page 2 for exploded view and parts index).

Before assembly, all parts should be cleaned, inspected for wear and replaced if required. Assembly is performed in reverse order from disassembly with the following precautions required:

1. Force the small end of the spiral spring over the small diameter on the armature assembly. See Fig. 4, page 3.

2. Reassemble the armature parts 6a to 6k and tighten the 10-32 nut to 14 to 18 inch-pounds torque (1.6 to 2.0 Newton meters).

3. Locate the projections on the magnet frame in the indentations on top of the coil with frame oriented as in Fig. 2.

4. Add the armature and movable-contact assembly.

5. Properly seat the stationary contacts in the slots of the molded stationary contact support and add the two contact spacers.

6. Add the two top stationary contacts and top contact retainer. Insert bus connector before proceeding to Step 7.

7. Tighten the four long bolts in a uniform manner using a diagonal tightening sequence. Tighten the bolts with 14 to 18 inch-pounds torque (1.6 to 2.0 Newton meters).

DISASSEMBLY AND ASSEMBLY

Single-pole, Single-throw Type
(One Normally Open Contact)

DISASSEMBLY

(Refer to Fig. 3, page 2 for exploded view and parts index).

1. Remove all electrical connections and remove the contactor from the vehicle for easier servicing.

2. Loosen the four long bolts in each corner and remove the two contact spacers.

3. Remove the two stationary contacts.

4. Remove armature and movable-contact assembly.

5. Remove magnet frame and coil from the base.

6. Loosen and remove the 10-32 nut from the armature and movable contact assembly using a 3/8-inch socket or nut driver. Note the order in which the parts are removed from the stud. See Fig. 3, page 2.

ASSEMBLY

(Refer to Fig. 3, page 2 for exploded view and parts index).

Before assembly all parts should be cleaned and inspected for wear and replaced if required. The assembly is performed in the reverse order from the disassembly with the following precautions required:

1. Force the small end of the spiral spring over the small diameter on the armature assembly. See Fig. 4, page 3.

2. Reassemble the armature parts 4a to 4k and tighten the 10-32 nut to 14 to 18 inch-pounds torque (1.6 to 2.0 Newton meters).

3. Locate the projections on the magnet frame in the indentations on top of the coil with frame oriented as in Fig. 3.

4. Add the armature and movable-contact assembly.

5. Properly seat the stationary contacts in the slots of the molded stationary-contact support and add the two contact spacers.

6. Tighten the four long bolts with 14 to 18 inch-pounds torque (1.6 to 2.0 Newton meters).

Fig. 4. Spiral spring attached to small diameter on cone head
AUXILIARY CONTACTS

Auxiliary contacts or electrical interlocks are available for the contactors as shown mounted on the contactor in Fig. 5. The auxiliary contact block is operated by de-energizing the contactor. Figures 6 and 7, page 4, illustrate the operations.

To obtain proper operation of the contact block, the gap between the auxiliary contact operator and the button on the contact block should be as shown in Fig. 7. This gap can be obtained by loosening the adjustment screws and moving the interlock support. The slots in the support permit this adjustment. The screws should be retightened to 14 to 18 inch-pounds torque (1.6 to 2.0 Newton meters).

Fig. 5. Contactor with an auxiliary contact

Fig. 6. Auxiliary contact shown in the operated position by the de-energized contactor

Fig. 7. Auxiliary contact shown in the normal position by the energized contactor
GEH-4469, 150- and 300-Ampere Electric-vehicle Control Contactors

Maintenance And Inspection Of Parts

CONTACTS

Contacts must be replaced before they have worn through contact button to the base copper material.

SPIRAL RETURN SPRING

The free length should be between the limits shown in the table and should be replaced if it shows signs of corrosion.

<table>
<thead>
<tr>
<th>Contactor</th>
<th>Free Length &quot;A&quot; In inches (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>700, 710</td>
<td>0.73 to 0.79 (18.5 to 20.1)</td>
</tr>
<tr>
<td>701, 711,</td>
<td>0.67 to 0.73 (17.3 to 18.5)</td>
</tr>
<tr>
<td>712, 801,</td>
<td></td>
</tr>
<tr>
<td>702, 802,</td>
<td></td>
</tr>
<tr>
<td>811, 812</td>
<td></td>
</tr>
<tr>
<td>800, 810</td>
<td>0.80 to 1.00 (20.3 to 25.5)</td>
</tr>
</tbody>
</table>

COILS

**CAUTION:** The coils have voltage suppression cast integral with the coil. If a test voltage is applied in the wrong direction or if the coil is connected backwards, permanent damage may result. Observe the polarity mark on the coil during maintenance.

If the contactor fails to operate, measure the voltage being applied to the coil terminals. The coils on the contactor have been designed to actuate the contactor on reduced battery voltage and with approximately three volts drop in the electronic circuit so that all contactors should operate at or below 65 percent of rated battery voltage. Replace the coil if the contactor does not operate to the full stroke on 65-percent voltage or if the coil shows signs of being overheated.

RENEWAL PARTS

Only factory specified parts should be used. These parts should be obtained from the truck manufacturer through his normal service channels.
INSTRUCTIONS

EV-1* SCR CONTROL
ACCELERATOR SWITCH
IC4485ACC1

Before any adjustments, servicing, parts replacement or any other act is performed requiring physical contact with the electrical working components or wiring of this equipment, JACK WHEELS OFF FLOOR, DISCONNECT THE BATTERY AND DISCHARGE CAPACITOR(S).

DESCRIPTION

The IC4485ACC1 is a family of accelerator master switches that may be either foot-operated through a pedal and linkage system or hand-operated by a suitable handle arrangement. This master switch offers a wide variety of options so that it may be customized to fit the user requirements. The master switch contains a switchette which closes at the beginning of travel to energize the control circuit, a switchette at the end of travel to bypass the control for maximum speed and torque, and a unique unidirectional potentiometer to vary the speed in between. The potentiometer is controlled by mechanical linkage to turn in only one direction so that it is independent of handle movement. This feature simplifies the setting of the potentiometer to provide consistent performance in both directions.

A single molded cam is used for the foot-operated CW and CCW forms. Direction of rotation can be changed in the field by changing the position of the start switchette and relocating the OFF-position stop.

A different molded cam is used for the hand-operated forms.

INSTALLATION

A conduit plate can be located on either side. The four mounting holes are symmetrical relative to the shaft; only three need be used.

When an external linkage is used, a separate external return spring is required. Any external linkage that can be operated forcibly should also have an external mechanical stop.

TABLE 1
CURRENT RATING OF SWITCHETTES

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Current-Ampere Make and Break</th>
<th>Current-Ampere Carry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10.0</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>6.0</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>4.0</td>
<td>10</td>
</tr>
<tr>
<td>24</td>
<td>3.5</td>
<td>10</td>
</tr>
<tr>
<td>30</td>
<td>3.0</td>
<td>10</td>
</tr>
<tr>
<td>36</td>
<td>2.5</td>
<td>10</td>
</tr>
<tr>
<td>48</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td>72</td>
<td>1.0</td>
<td>10</td>
</tr>
</tbody>
</table>

The ratings in Table 1 are for single circuits (i.e., normally open contact only). Voltages above 72 require capacitor-type filters, in accordance with factory recommendations.

MAINTENANCE

Oil-less bearings are used on both ends of the main operating shaft and thus eliminate the need for any lubrication of the switch.

* Trademark of General Electric Company

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.
SWITCHETTE ADJUSTMENT

Fig. 2. Switchette adjustment, view from shaft end

Unlock locknut (see Fig. 2) and turn screw CW to make the normally open switchette close at less travel. The start switch should close at 5 to 8 degrees and reset at a minimum of 1-degree travel from the OFF position. The 1A switch should close at 26 to 29 degrees and reset at a minimum of 22 degrees travel from the OFF position. Total travel is 30 degrees.

POTENTIOMETER ADJUSTMENT

Fig. 3. Potentiometer and clamps

To remove the potentiometer, remove the wires from the terminal board, loosen the clamps on the flexible coupling with duck-bill pliers, and move both clamps to the left (see Fig. 3). Remove the potentiometer and its support by removing the two "fine-adjustment" screws. Retain the potentiometer support.

To replace, mount the new potentiometer on the support, locating the tab in the hole of the support, and secure with the lockwasher and nut. With an ohmmeter on the potentiometer terminals (R x 100 scale), turn the shaft clockwise until the point where the resistance starts to reduce below the level (4800- to 6000-ohm) portion of the curve (see Fig. 4). This corresponds to the START position. Rotate the potentiometer shaft CCW 14 degrees to the OFF position.

The width of the potentiometer locating tab is equivalent to 14 degrees. This may be used as a guide when rotating the potentiometer shaft from the START to the OFF position.

Fig. 4. Potentiometer resistance curve

With the potentiometer clamp moved to the left and the master switch in the OFF position, line up the potentiometer shaft with the flexible coupling and center the fine-adjustment slots with the fine-adjustment tapped holes. Push the potentiometer until the support is against the frame. Assemble, but do not tighten, the fine-adjustment screws. Release the coupling clamp with duck-bill pliers and slide the clamp into position.

Rotate the master switch shaft until the START switchette operates (a slight click at about 7 degrees). The ohmmeter should be 4800 to 6000 ohms. Continue rotating the shaft until the 1A switchette operates (a slight click at about 23 degrees). The ohmmeter should be less than 200 ohms and remain above 1 ohm, when the shaft is rotated fully.

If the ohms are too low when the start switch closes, loosen the fine-adjustment screws and rotate the potentiometer support CCW.

If the ohms are too high when the 1A switch closes, loosen the fine-adjustment screws and rotate the potentiometer support CW.

If the fine adjustment is not enough to bring the resistance values within limits, return the master switch to the OFF position, release the potentiometer clamp with duck-bill pliers, and turn the potentiometer shaft with needle-nose pliers a slight amount. (Clockwise from shaft end of potentiometer to reduce ohms.) Recheck resistances at START and 1A and use fine adjustment as described previously if necessary.

Check that coupling clamps are in position and the fine-adjustment screws are tight.

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2
FIELD MODIFICATION OF FOOT-OPERATED SWITCH

If the direction of rotation of a foot-operated switch needs to be changed, the location of the OFF-position stop and the location of the switchette must be changed. (See Figs. 5 and 6 and the Table 2.)

Fig. 5. OFF-position stop

+ POSITION 2 USED ON HAND-OPERATED SWITCHES

Fig. 6. Switchette position

TABLE 2
OFF-POSITION STOP AND SWITCHETTE POSITION

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* Trademark of General Electric Company
EVC
ELECTRIC VEHICLE CONTROL

RENEWAL PARTS BREAKDOWN

IC3645WB

EV-10 AND EV-10 PLUS SCR CONTROLS
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**EV10/10+ RENEWAL PARTS LIST**

**IC364SW09**

**PARTS LIST**

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**CABLE/TUBING NOTE:**

ITEM 15 "A3 OPTION" TUBING AS SHOWN.
FOR "A5 OPTION": CABLE IS CONNECTED
FROM POINT "A" TO POINT "B".
CATALOG NUMBER STRUCTURE

BASIC NUMBER IC3645WB2
VOLTAGE RANGE A3
REVISION LEVEL AA

*Trademark of General Electric Co.

When ordering renewal parts, give quantity, catalog number, description of each item required, and complete nameplate reading.

GENERAL ELECTRIC

Data subject to change without notice.
IC3645WB2/EV-10 SCR CONTROL

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DESCRIPTION

EV-10 Control Card
Heat Sink (#1—#5 Rect.)
Heat Sink (#1—#5 Rect.)
Base
Co-Therm Insulation
#1 Rectifier
Heat Sink Top, (#1 Rect.)
Spring Asml., (#1 Rect.)
Thermal Protector
#2 Rectifier
#5 Rectifier
#4 Rectifier
#4 Rectifier
#3 Rectifier
#3 Rectifier
Transformer
Bus A2 to Heat Sink
Capacitor Bracket
Capacitor
Choke
Bracket, Control Card
Wire Harness
Torque Gauge for #1 Rect.

Screw/10-32, 3-1/2 in. Pan HD
Lock Washer/for No. 10 Screw
Flat Washer/for No. 10 Screw
Bolt/6x1, 14mm, Hex HD
Lock Washer/for M6 Bolt
Flat Washer/for M6 Bolt
Screw/10-32, 3 in. Pan HD
Lock Washer/for No. 10 Screw
Flat Washer/for No. 10 Screw
Bolt/1/4-20, 5/8 In. Hex HD
Lock Washer/for 1/4 in. Bolt
Flat Washer/for 1/4 in. Bolt
Screw/10-32, 7/8 In. Pan HD
Lock Washer/for No. 10 Screw
Flat Washer/for No. 10 Screw
Screw/8-32, 3/8 In. Pan HD
Keps Unit/for No. 8 Screw
Screw/6-32, 5/16 In. Pan HD
Keps Unit/No. 6 Screw
Screw/10-32, 1/2 In. Pan HD
Screw/8-32, 3/8 In. Pan HD
Lock Washer/for No. 8 Screw
Screw/6-32, 1/4 In. Pan HD
Lock Washer/for No. 6 Screw