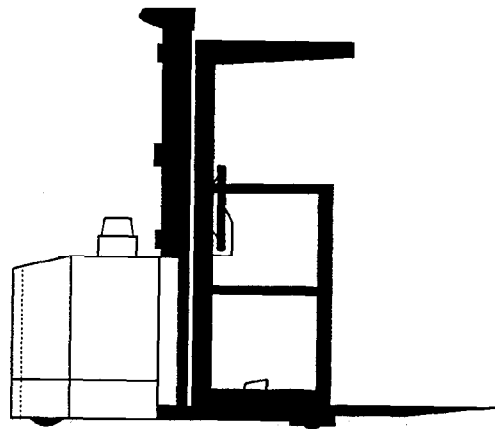


# Service Manual

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SM576  
OP15B

## Main Index

STATUS CODE - 01

### DESCRIPTION

No foot switch input.

### MEMORY RECALL

NO

### CIRCUIT

Traction

### SYMPTOM

Forward or reverse contactor will not pick up.

### POSSIBLE CAUSE

Mis-adjusted or defective foot switch.

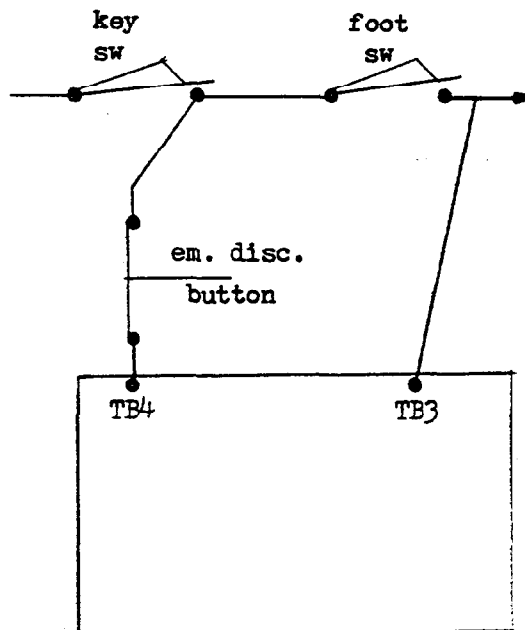
Check seat switch to insure proper switch.

Open circuit between battery positive TB3.

Check for loose connections or broken wire between foot switch and TB3 and between key switch and positive side of the foot switch and key switch to TB4.

### STATUS INDICATION CRITERIA

This status code will be displayed when TB3 is less than 50% battery volts.



## Main Index

STATUS CODE - 02

### DESCRIPTION

Forward directional switch is closed on initial power up.

### MEMORY RECALL

No

### CIRCUIT

Traction

### SYMPTOM

Forward contactor will not pick up static return of off (SRO) lock out.

### POSSIBLE CAUSE

Forward directional switch closed on initial power up. Battery plugged in, key foot gate, chain and brake switches closed.

Return directional switch lever to neutral and then select a direction.

Forward directional switch is welded closed or mis-adjusted to be held closed.

Replace or adjust directional switch to insure that it opens when directional switch is returned to neutral.

Short circuit between TB2 and TB5.

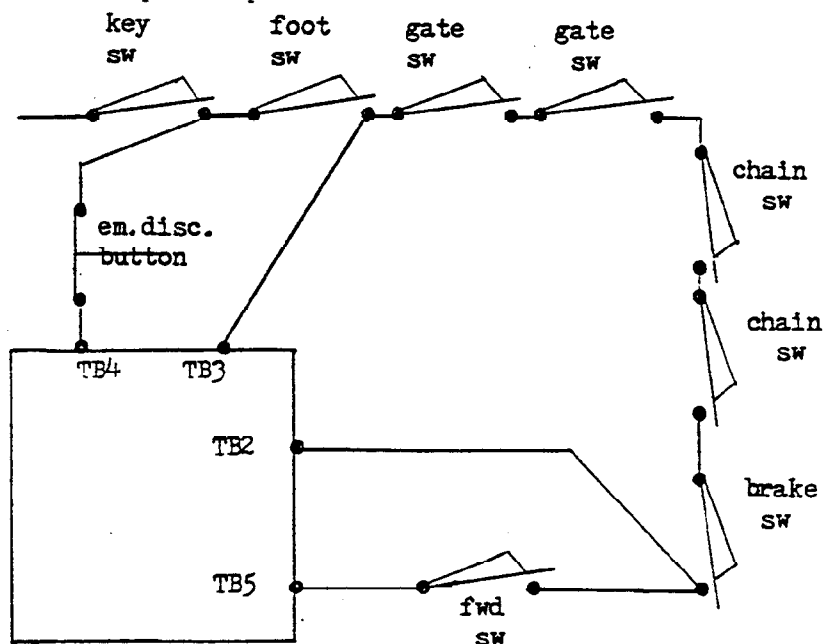
Disconnect wire from TB5 and check for short circuit between TB2 and wire.

Defective card

Disconnect wire sat TB5; Measure voltage at TB5, should be less than 60% of battery volts.

### STATUS INDICATION CRITERIA

This status code will be displayed when TB5 is greater than 60% battery volts at initial power up.



## Main Index

### STATUS CODE -03

#### DESCRIPTION

Reverse directional switch is closed on initial power up.

#### MEMORY RECALL

No.

#### CIRCUIT

Traction

#### SYMPTOM

Reverse contactor will not pick up static return to off (SRO) lock out.

#### POSSIBLE CAUSE

Reverse directional switch closed on initial power up. Battery plugged in, key, foot gate, chain and brake switches closed.

Return directional switch lever to neutral and then select a direction.

Reverse directional switch is welded closed or misaligned to be held closed.

Replace or adjust directional switch to insure that it opens when directional switch is returned to neutral.

Short circuit between TB2 and TB6.

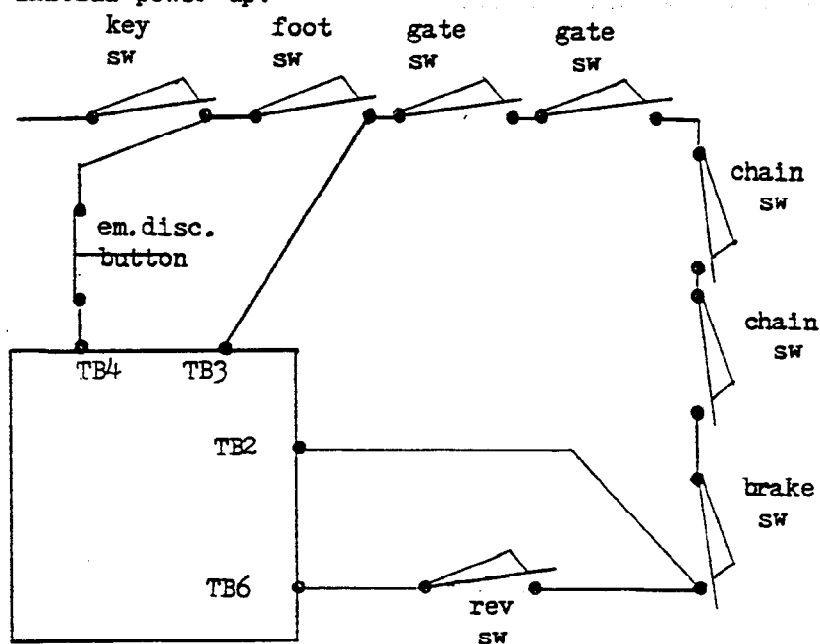
Disconnect wire from TB6 and check for short circuit between TB2 and wire.

Defective card.

Disconnect wire at TB6; Measure voltage at TB6, should be less than 60% of battery volts.

#### STATUS INDICATION CRITERIA

This status code will be displayed when TB6 is greater than 60% battery volts at initial power up.



## Main Index

STATUS CODE - 04

### DESCRIPTION

Switch input low after initial start up.

### MEMORY RECALL

Yes

### CIRCUIT

Traction

### SYMPTOM

Forward or reverse contacor will not pick-up.

### POSSIBLE CAUSE

Forward or reverse directional switch closed on initial start up.

Close key, foot, gate, chain and brake switch. Status code will change to 03 if reverse directional switch or to 02 if forward directional switch is closed. If either of these codes appear, return directional switch to neutral and then select the desired direction.

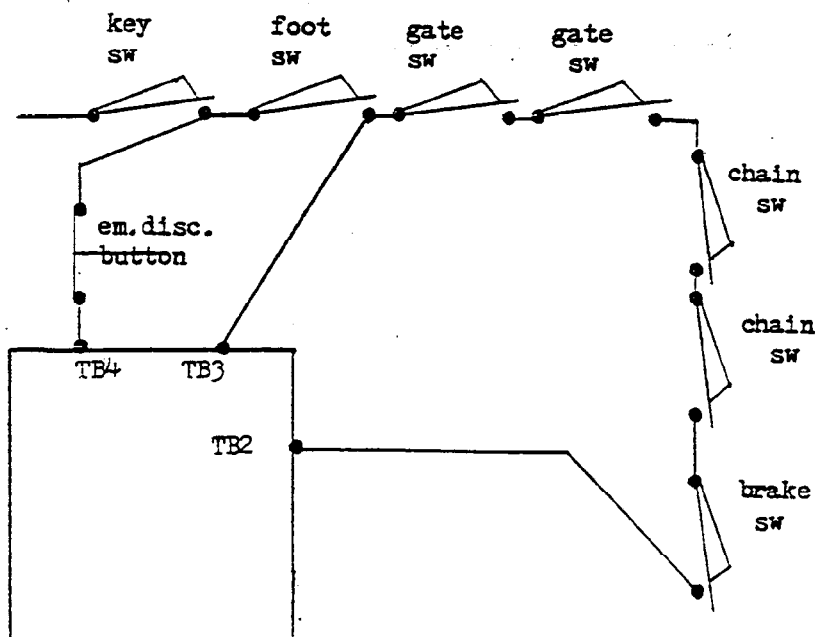
Excessive leakage from TB2 to battery negative.

Check voltage at TB2 with key, foot, gate, chain and brake switches closed and directional switch in neutral. Voltage should be greater than 60% of battery voltage.

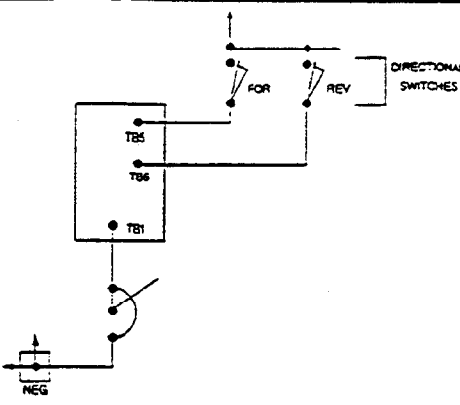
If less than 60% battery voltage. Remove wire and measure resistance from wire to SCR negative. Value should be less than 22K ohms.

### STATUS INDICATION CRITERIA

This status code is displayed when TB2 voltage is less than 60% of battery volts at initial start-up (seat switch closure).



STATUS CODE  <b>-06</b>	DESCRIPTION	MEMORY RECALL	No
	Accelerator depressed with no direction selected.	CIRCUIT	Traction

<p><b>SYMPTOM</b></p> <p>Forward or reverse contactor will not pick up.</p> <p><b>POSSIBLE CAUSE</b></p> <p>Accelerator pedal is depressed before closing forward or reverse directional switch.</p> <ul style="list-style-type: none"><li>• Status code will disappear when directional switch is closed or when accelerator pedal is released.</li></ul> <p>Defective directional switch</p> <ul style="list-style-type: none"><li>• Check forward or reverse switch to insure closure when direction is selected.</li></ul> <p>Open circuit between directional switch(s) and battery positive or between directional switch(s) and TB5 or TB6.</p> <ul style="list-style-type: none"><li>• Check all control wires and connections shown in Figure 1.</li></ul>	 <p>Figure 1.</p>
<p><b>STATUS INDICATION CRITERIA</b></p> <p>This status code will be displayed when TB5 and TB6 are less than 60% of the battery volts, and TB1 is less than 2.5 volts.</p>	

<b>STATUS CODE</b> <b>-07</b>	<b>DESCRIPTION</b> Accelerator input voltage too high.	<b>MEMORY RECALL</b>	No
		<b>CIRCUIT</b>	Traction

**SYMPTOM**

Forward or reverse contactor picks up but control will not operate when accelerator pedal is depressed or status code -07 is displayed then disappears when the vehicle starts to accelerate.

**POSSIBLE CAUSE**

Accelerator input mis-adjusted or defective.

- Input voltage at TB1 should be less than 3.7 volts. Adjust or replace accelerator unit to insure that the voltage at TB1 will vary from 3.5 volts to less than .5 volts when the pedal is depressed.

Open circuit between battery negative and TB1 in accelerator input circuit.

- Check for broken wires or loose connections or open potentiometer / voltage supply in the circuit shown in Figure 1.

Short circuit from battery positive to wiring in accelerator input circuit.

- Disconnect wire from TB1 and measure voltage at wire to negative. Should be zero volts for potentiometer type and less than 3.7 volts for solid state type accelerator input.

Figure 1.

**STATUS INDICATION CRITERIA**

This status code will be displayed when the accelerator input voltage at TB1 is higher than 3.7 volts, and a directional contactor is picked up.

# Main Index

STATUS CODE <b>-08</b>	DESCRIPTION Accelerator input voltage too low on power up after initial key switch closure.	MEMORY RECALL	No
		CIRCUIT	Traction

**SYMPTOM**

Forward or reverse contactor does not pick up.

**POSSIBLE CAUSE**

Accelerator input mis-adjusted or defective.

- Input voltage at TB1 should be more than 3.0 volts. Adjust or replace accelerator unit to insure that the voltage at TB1 is more than 3.0 volts before depressing pedal.

Short circuit between battery negative and TB1 in accelerator input circuit.

- Disconnect wire from TB1. Check for short circuit from wire to battery negative. Resistance should be greater than 4.7K ohms.

Defective Card

- Disconnect wire from TB1. Measure voltage from TB1 to negative. Voltage should be greater than 4.5 volts, if not, replace card.

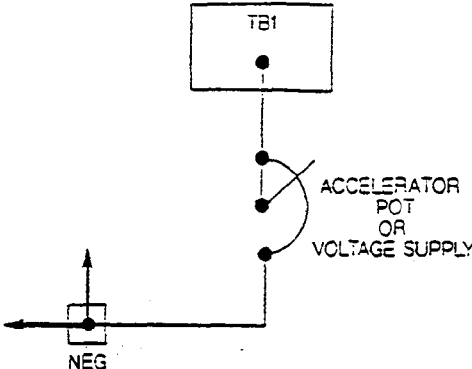
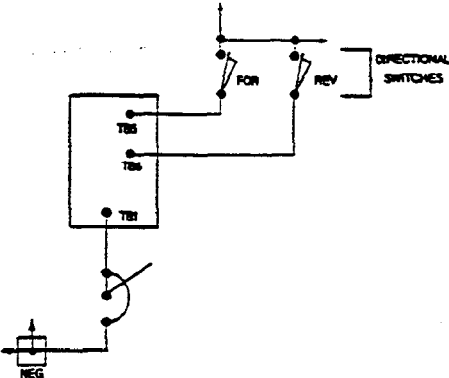


Figure 1

**STATUS INDICATION CRITERIA**

This status code will be displayed when the accelerator input voltage at TB1 is less than 3.0 volts, and any of the following connections are opened and closed, battery plug or seat switch or key switch.

STATUS CODE  <b>-09</b>	DESCRIPTION	MEMORY RECALL	No
	Both forward and reverse directional switches are closed at the same time.	CIRCUIT	Traction

<p><b>SYMPTOM</b></p> <p>Forward or reverse contactor will not pick up.</p> <p><b>POSSIBLE CAUSE</b></p> <p>Forward or reverse directional switch welded closed or mis-adjusted to be held closed.</p> <ul style="list-style-type: none"><li>Replace or adjust directional switches to insure that they open when directional switch is returned to neutral.</li></ul> <p>Short circuit between battery positive and TB5 and/or TB6.</p> <ul style="list-style-type: none"><li>Disconnect wires from TB5 and TB6 and check wires for short circuit to positive side of directional switch.</li></ul> <p>Defective card</p> <ul style="list-style-type: none"><li>Disconnect wires and measure voltage at TB5 and TB6. Voltage should be less than 60% of battery volts.</li></ul>	 <p>The diagram shows a rectangular terminal block with three terminals labeled TB5, TB6, and TB7. TB5 and TB6 are connected to the 'FOR' and 'REV' directional switches respectively. TB7 is connected to a common point that leads to a battery negative terminal labeled 'NEG'. The directional switches are shown in a closed position.</p>
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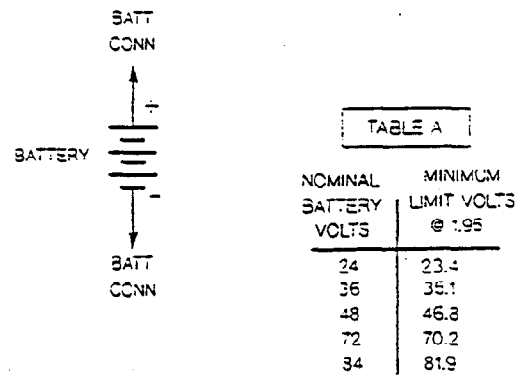
**Figure 1.**

STATUS INDICATION CRITERIA
This status code will be displayed when TB5 and TB6 are greater than 60% of battery volts at the same time.

# Main Index

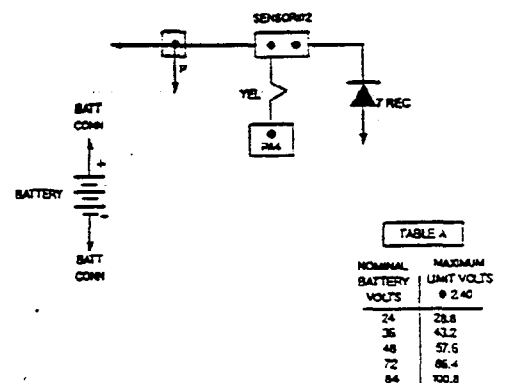
STATUS CODE	DESCRIPTION	MEMORY RECALL	No
<b>-15</b>	Battery volts too low.	CIRCUIT	Traction

<p><b>SYMPTOM</b></p> <p>Forward or reverse contactor will not pick up.</p> <p><b>POSSIBLE CAUSE</b></p> <p>Discharged battery</p> <ul style="list-style-type: none"> <li>Check battery for proper open circuit voltage as outlined in figure 1 and charge battery if required.</li> </ul> <p>Defective battery</p> <ul style="list-style-type: none"> <li>Check each battery cell for proper voltage (greater than 1.95 volts at cell). Replace or repair battery.</li> </ul> <p>Incorrect control card adjustment.</p> <ul style="list-style-type: none"> <li>Check function 15 for proper adjustment for battery being used. See handset instruction sheet for details. Adjust to proper settings.</li> </ul>	 <p><b>TABLE A</b></p> <table> <tr> <th>NOMINAL BATTERY VOLTS</th><th>MINIMUM LIMIT VOLTS @ 1.95</th></tr> <tr> <td>24</td><td>23.4</td></tr> <tr> <td>36</td><td>35.1</td></tr> <tr> <td>48</td><td>46.8</td></tr> <tr> <td>72</td><td>70.2</td></tr> <tr> <td>84</td><td>81.9</td></tr> </table> <p>Figure 1.</p> <p><b>STATUS INDICATION CRITERIA</b></p> <p>This status code is displayed when the battery volts are less than 1.95 volts per cell at initial start up. (See table in figure 1).</p>	NOMINAL BATTERY VOLTS	MINIMUM LIMIT VOLTS @ 1.95	24	23.4	36	35.1	48	46.8	72	70.2	84	81.9
NOMINAL BATTERY VOLTS	MINIMUM LIMIT VOLTS @ 1.95												
24	23.4												
36	35.1												
48	46.8												
72	70.2												
84	81.9												

STATUS CODE	DESCRIPTION	MEMORY RECALL	No
<b>-16</b>	Battery volts too high.	CIRCUIT	Traction

<p><b>SYMPTOM</b></p> <p>Forward and reverse contactor will not pick up.</p> <p><b>POSSIBLE CAUSE</b></p> <p>Incorrect control card adjustment</p> <ul style="list-style-type: none"> <li>Check function 15 for proper adjustment for battery being used. See handset instructions for details. Adjust to proper setting.</li> </ul> <p>Open circuit in regen sensor-circuit</p> <ul style="list-style-type: none"> <li>Check yellow wire from sensor #2 to PA4 for broken wire, loose connections or broken weld at sensor. Check PA4 for loose plug or pin connection.</li> </ul> <p>Battery over charged or incorrect battery used.</p> <ul style="list-style-type: none"> <li>Check battery for proper open circuit voltage per table in figure 1. If voltage excessive-check battery charger for proper output voltage.</li> </ul>	 <p><b>TABLE A</b></p> <table> <tr> <th>NOMINAL BATTERY VOLTS</th><th>MAXIMUM LIMIT VOLTS @ 2.40</th></tr> <tr> <td>24</td><td>28.8</td></tr> <tr> <td>36</td><td>43.2</td></tr> <tr> <td>48</td><td>57.6</td></tr> <tr> <td>72</td><td>86.4</td></tr> <tr> <td>84</td><td>100.8</td></tr> </table> <p>Figure 1.</p> <p><b>STATUS INDICATION CRITERIA</b></p> <p>This status code is displayed when the battery volts are greater than 2.40 volts per cell at initial start up. (see table in figure).</p>	NOMINAL BATTERY VOLTS	MAXIMUM LIMIT VOLTS @ 2.40	24	28.8	36	43.2	48	57.6	72	86.4	84	100.8
NOMINAL BATTERY VOLTS	MAXIMUM LIMIT VOLTS @ 2.40												
24	28.8												
36	43.2												
48	57.6												
72	86.4												
84	100.8												



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STATUS CODE <b>-17</b>	DESCRIPTION	MEMORY RECALL	No
	Invalid card type selection.	CIRCUIT	Traction
<p><b>SYMPTOM</b></p> <p>Forward or reverse contactors will not close.</p> <p><b>POSSIBLE CAUSE</b></p> <p>Invalid card type selection.</p> <ul style="list-style-type: none"> <li>Review function 17 in the Handset Instruction sheets.</li> <li>Adjust and set card type value as instructed by OEM service manual.</li> </ul>			
<p><b>STATUS INDICATION CRITERIA</b></p> <p>This status code is displayed when the card type selection value is set to an invalid number.</p>			

Figure 1.

STATUS CODE <b>-23</b>	DESCRIPTION	MEMORY RECALL	No
	Forward or reverse contactor coil current low.	CIRCUIT	Traction
<p><b>SYMPTOM</b></p> <p>Forward or reverse contactor will not pick up. Status code may alternate between code 23 and code 24. Complete check for code 23, if the problem is not found, perform check for code 24.</p> <p><b>POSSIBLE CAUSE</b></p> <p>Defective F and R contactor coil circuit.</p> <ul style="list-style-type: none"> <li>Check for open circuit or loose connection between PB4 and positive side of F contactor coil and between PB5 and positive side of R contactor coil.</li> <li>Remove plug B. Check ohmic value from PB4 to positive side of F coil. Value should be 10-14 ohms. Make same check for R coil.</li> </ul> <p>Defective 1A, RB, SP, or FW contactor coil.</p> <ul style="list-style-type: none"> <li>Remove plug B. Check ohmic value from positive side of each coil to its respective plug connection. Value should be 10-14 ohms.</li> </ul>			
<p><b>STATUS INDICATION CRITERIA</b></p> <p>This status code is displayed when the current draw in the forward or reverse contactor coil circuit is less than 100 ma.</p>			

Figure 1.

STATUS CODE <b>-24</b>	DESCRIPTION	MEMORY RECALL	No
	T2 voltage too high. (Greater than 12% of battery volts).	CIRCUIT	Traction

**SYMPTOM**

SCR control does not operate. Status code may alternate between code 23 and code 24. Complete checks for 24, if the problem is not found, perform code 23 check.

**POSSIBLE CAUSE**

Defective F or R contactor.

- F or R power tips fail to close because:
  - 1) Welded normally closed power tips.
  - 2) Binding contactor tip assembly.
  - 3) Defective F or R contactor coil.
 ( See status code 23)

Defective RB contactor.

- Check RB contactor power tips for closure and proper pick up.
- Check for open circuit or loose connections between positive side of RB contactor coil and PB2.

Open motor circuit

- Check for open circuit or loose connection in motor circuit from the A1 connection to the A2 connection on the SCR control panel.

Defective 1A, RB, SP or FW contactor

- Perform checks as outlined in status 23.

Figure 1.

**STATUS INDICATION CRITERIA**

This status code is displayed when T2 volts is greater than 12% of battery volts and the F and R driver is energized.

<b>STATUS CODE</b> <b>-25</b>	<b>DESCRIPTION</b> 1A contactor does not drop out or drops out slowly.	<b>MEMORY RECALL</b>	Yes
		<b>CIRCUIT</b>	Traction

**SYMPTOM**

Short tip life on F and R or 1A contactor. Status code 46 displayed and no fault found.

**POSSIBLE CAUSE**

Note: This status code can only be found by using the handset and looking at function 1. This status code is furnished as a troubleshooting aid for status code 46.

Defective 1A contactor

- Check 1A contactor for binding or slow operation when dropping out.

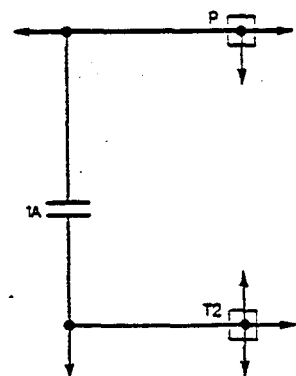


Figure 1.

**STATUS INDICATION CRITERIA**

This status code is displayed when 1A contactor drop out time exceeds .060 seconds.