

INTRODUCTION

GENERAL

NOTE: This section does **NOT** include the EV-100/200 “LX” Series of motor controllers. However, the basic operation and most components are the same. See the section **EV-100/200 LX SERIES DIAGNOSTIC MOTOR CONTROLLER AND HAND SET, 2200 SRM 460** for the “LX” Series controllers.

This section describes the procedures for troubleshooting the EV-100 motor controller. The EV-100 motor controller is used, with modifications, in several series of lift trucks. Other information can be found in the following sections:

EV-100 MOTOR CONTROLLER, REPAIRS AND ADJUSTMENTS, 2200 SRM 288 describes the repairs and adjustments of the EV100 controller and the control switches.

EV-100 MOTOR CONTROLLER, DESCRIPTION AND OPERATION, 2200 SRM 287 describes the circuits and operation of the EV-100 controller.

DIAGRAMS. Circuit diagrams and details for the electrical system. There is a separate **DIAGRAMS** section printed for each series of electric lift truck.

This section is separated into the following parts:

- SRO And PMT Circuits (traction circuit). A short description of the SRO and PMT circuits and the sequence of operation of the controller is used as an introduction to Troubleshooting. The functions and operations of the SRO and PMT circuits must be understood before doing the troubleshooting procedures.
- Troubleshooting (traction circuit without regenerative braking). General procedures and fault analysis.
- Troubleshooting (traction circuit with regenerative braking). General procedures and fault analysis.

- Troubleshooting for lift trucks with an SCR controller for the hydraulic pump motor. General procedures and fault analysis.

Some lift trucks have a second EV-100 controller to control the speed of the hydraulic pump motor. Both controllers are found on the same control panel and use the same principles of operation. The controller for the hydraulic pump motor only controls the motor speed and does not have the other functions necessary for controlling the traction motor. A Troubleshooting guide is included in this section for this controller. Lift trucks that do not have an EV-100 controller for the hydraulic pump motor, have a contactor for motor control.

WHEN YOU NEED HELP. Call a Hyster lift truck dealer if you have correctly followed a fault procedure and have not found the fault. This section describes the most common faults that sometimes occur in the EV-100 controller. Hyster dealers can call Service Engineers who can help you check and repair a fault that is not common.

NOTE: The configuration of the controller was changed during November 1987. The operation of the controller is still the same, but some power connections and the location of some contactors were changed. All of the components are on a base plate mount in the earlier configuration. The later configuration divides the base plate into three groups:

- traction controller group
- contactor group
- controller group for the hydraulic pump.

(If the SCR controller for the hydraulic pump is not used, a single contactor for the hydraulic pump is installed in that position.)

The three groups of components are fastened to the rear plate of the battery compartment. FIGURE 1. shows a typical controller in the newer configuration. FIGURE 2. shows the configuration of the earlier manufacture.

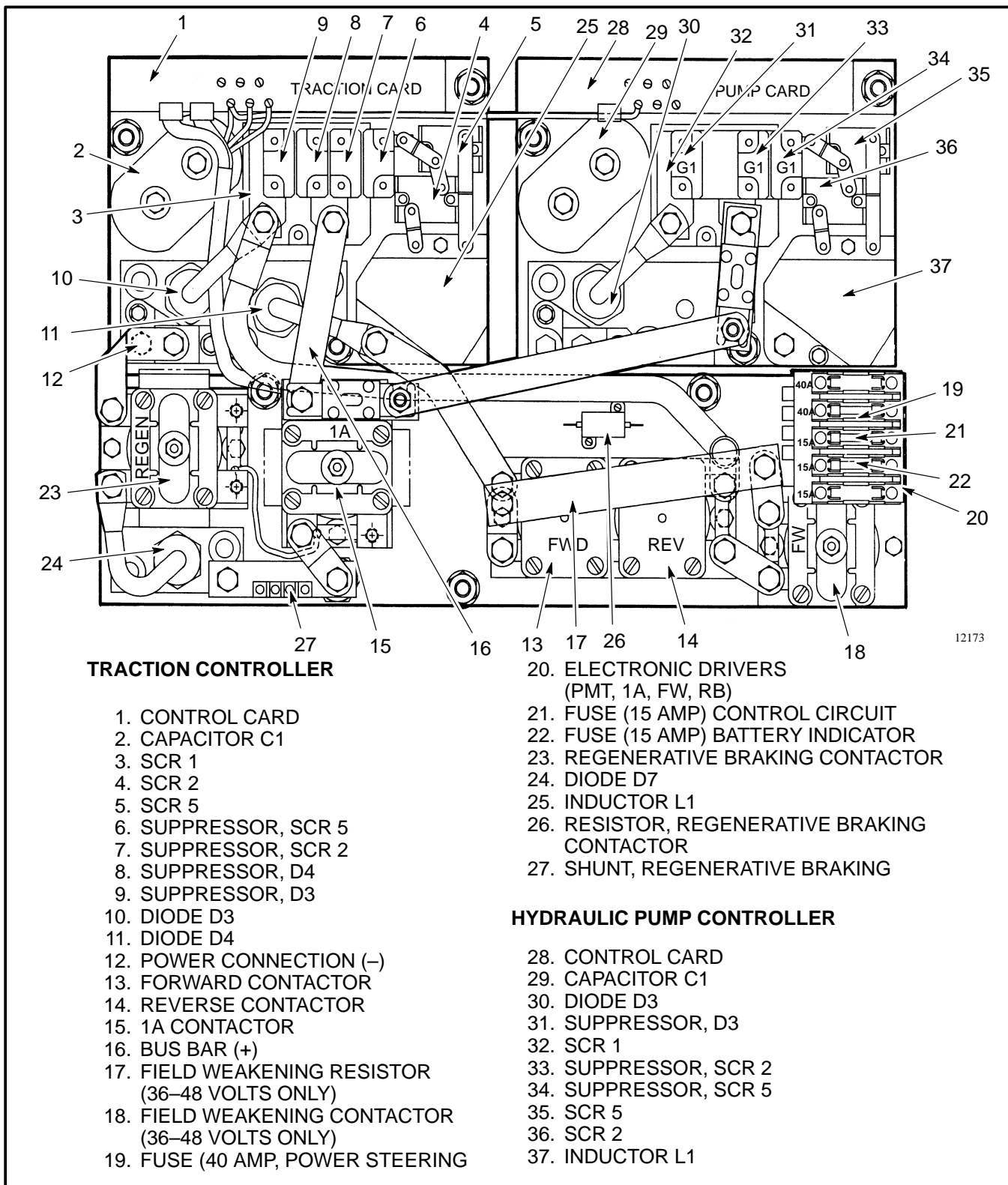
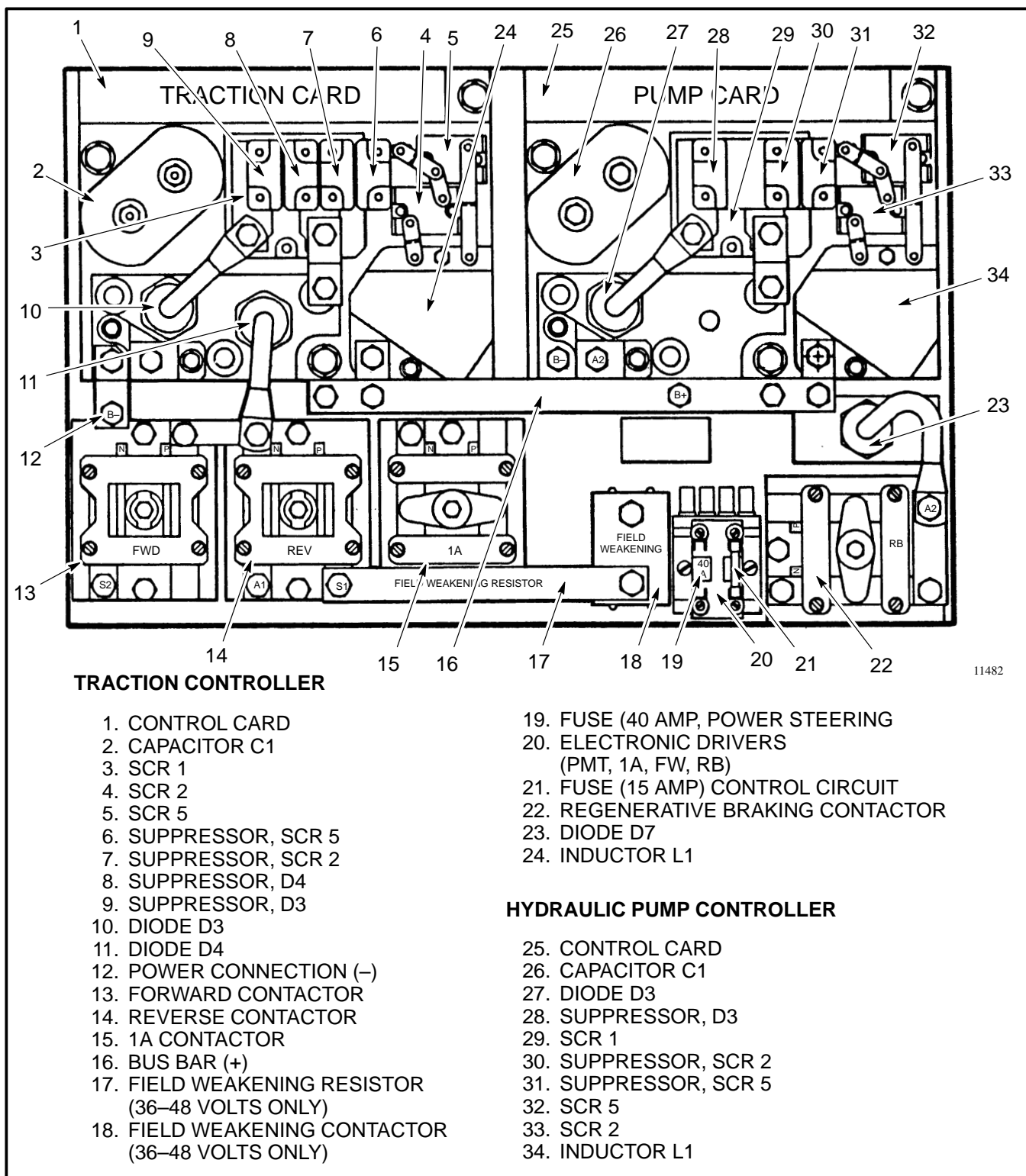


FIGURE 1. EV-100 MOTOR CONTROLLER (AFTER NOVEMBER 1987)



1. CONTROL CARD
2. CAPACITOR C1
3. SCR 1
4. SCR 2
5. SCR 5
6. SUPPRESSOR, SCR 5
7. SUPPRESSOR, SCR 2
8. SUPPRESSOR, D4
9. SUPPRESSOR, D3
10. DIODE D3
11. DIODE D4
12. POWER CONNECTION (-)
13. FORWARD CONTACTOR
14. REVERSE CONTACTOR
15. 1A CONTACTOR
16. BUS BAR (+)
17. FIELD WEAKENING RESISTOR (36-48 VOLTS ONLY)
18. FIELD WEAKENING CONTACTOR (36-48 VOLTS ONLY)

19. FUSE (40 AMP, POWER STEERING)
20. ELECTRONIC DRIVERS (PMT, 1A, FW, RB)
21. FUSE (15 AMP) CONTROL CIRCUIT
22. REGENERATIVE BRAKING CONTACTOR
23. DIODE D7
24. INDUCTOR L1

25. CONTROL CARD
26. CAPACITOR C1
27. DIODE D3
28. SUPPRESSOR, D3
29. SCR 1
30. SUPPRESSOR, SCR 2
31. SUPPRESSOR, SCR 5
32. SCR 5
33. SCR 2
34. INDUCTOR L1

FIGURE 2. EV-100 MOTOR CONTROLLER (BEFORE NOVEMBER 1987)

SRO CIRCUIT AND PMT CIRCUIT (TRACTION CIRCUIT)

STATIC RETURN TO OFF (SRO) CIRCUIT

The “Static Return to OFF” (SRO) circuit prevents the operation of the lift truck if the starting sequence is not correct. The correct sequence is described in the following steps:

- a. Close the seat switch. The operator must be in the seat at the controls.
- b. Turn the key switch to the ON position. The key switch supplies the battery voltage to the control circuits.
- c. Close the direction switch. Move the accelerator (Monotrol) pedal to close the start switch after steps a. and b. are complete. If both direction switches on the Monotrol pedal are closed at the same time, the lift truck will not operate. The brake pedal must be released to energize the traction circuit and permit travel.

If step c. is done before steps a. and b., the lift truck will not start. The seat switch and key switch each send a voltage to a timer circuit. Both input voltages must be sent to the timer circuit before the timer will send a voltage to terminal TB3 on the control card. The timer circuit has a six second delay if the seat switch is opened. This delay permits the operator to change position in the seat without causing the lift truck to stop. The inputs to the SRO circuit are sent to the control card. The SRO circuit is reset when the start switch or a direction switch is momentarily opened.

If there is battery voltage at terminals TB5 or TB6 before there is voltage at terminals TB2 and TB3, the control card will not permit a direction contactor to close. (The voltage must be applied at the control card before the voltage is applied through the start switch and the Forward or Reverse switch.)

PULSE MONITOR TRIP (PMT)

The PMT circuit is part of the control card. After the SRO circuit is complete, the control card senses the battery voltage across SCR 1. If the voltage across SCR 1 stays low, there is a fault across SCR 1. A fault across

SCR 1 can be caused by a short-circuit in SCR 1 or the contacts of the 1A contactor welded closed. If the control card senses a short-circuit across SCR 1 it will not permit the direction contactor to close.

The PMT circuit opens the direction contactors if SCR 1 goes on and stays on. The control card checks the traction circuit for faults during operation of the lift truck. If the SCR 1 stays on for greater than 32 milliseconds, the PMT signal opens the direction contactor. The control card will immediately close the direction contactor again. If the fault continues, the control card will quickly open the direction contactor again. The control card will not close the contactor again until the PMT circuit is reset by turning the key switch to off and then on again.

This rapid double operation of the direction contactor is an important indication when troubleshooting. This double operation normally indicates a fault in the off circuit for the SCR 1. The off circuit for the SCR 1 has the SCR 2, SCR 5, capacitor C1, and the inductor assembly. (A short-circuit across SCR 2 will not often cause a PMT action, but the lift truck will not operate.)

The control card sends a signal to the PMT electronic driver to close a direction contactor when the key switch is turned to ON. The direction contactor does not close because the start switch and a direction switch is not closed. If a fault is detected, the control card deenergizes the signal to the PMT electronic driver. A loss of signal from the control card deenergizes the PMT electronic driver and the direction contactor opens. A PMT fault occurs when the control card senses a malfunction in the operation of SCR 1 and stops sending a signal to the PMT electronic driver.

THE SEQUENCE OF OPERATION (TRACTION CIRCUIT)

The sequence of operation shown in FIGURE 4. describes the beginning conditions and the SCR operation. If your lift truck does not have a regenerative braking function, the references to regenerative braking do not apply.

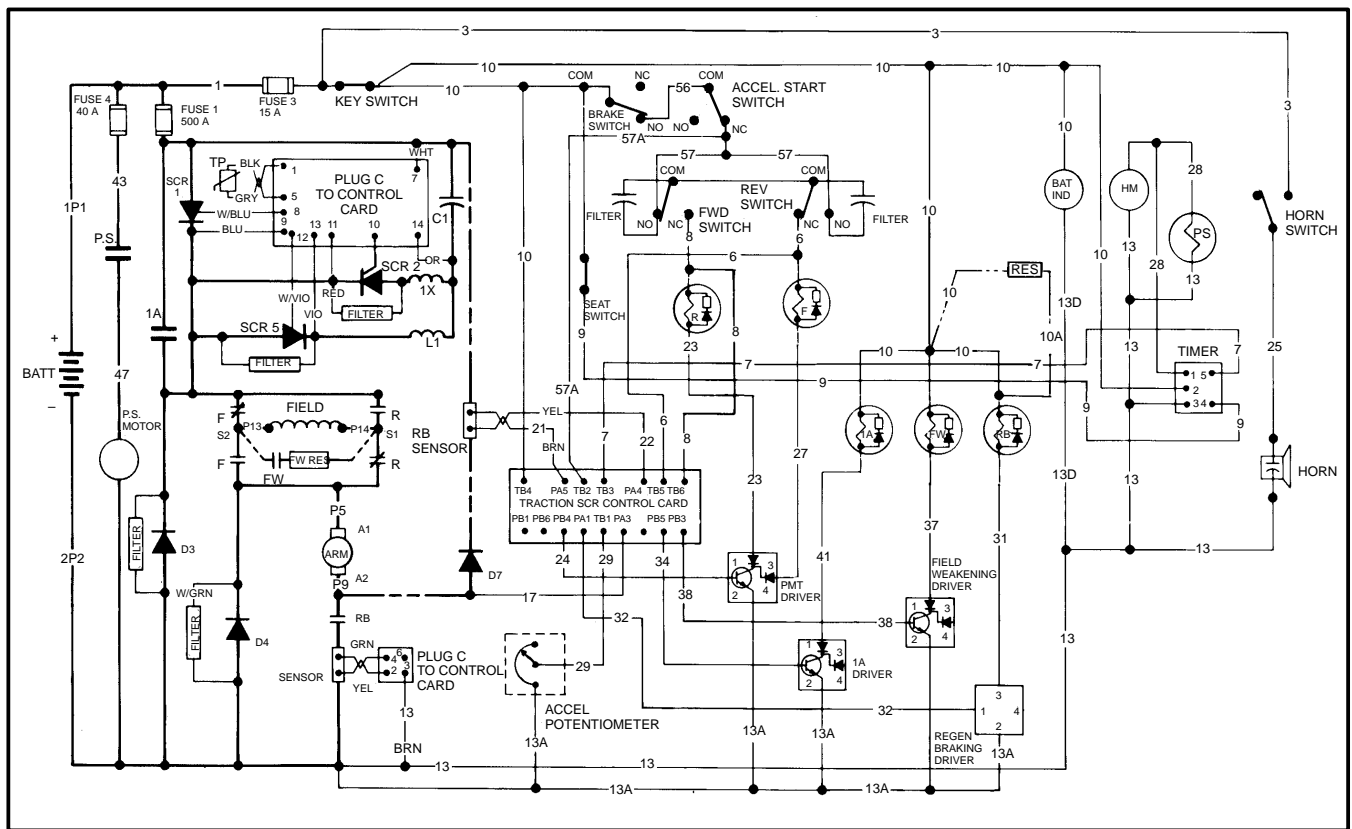


FIGURE 3. SCHEMATIC TO SHOW SRO AND PMT CIRCUITS

CHECKING FOR THE CORRECT OPERATION

A service person must understand the operation of the lift truck with an EV-100 controller. If you understand and have operated a lift truck with normal operation, you will better understand a bad operation. Listen and feel for a normal or bad operation as you operate the lift truck on a level surface.

1. Check the specific gravity of the battery. If the specific gravity is less than 1.260, the battery is not fully charged or is damaged.
2. Connect the battery connector. The horn can now be operated.

⚠ WARNING

The SRO circuit is designed to so that the lift truck will not operate if one of the switches has a failure. When the SRO circuit is checked for operation, the operator must make the checks as if the lift truck will suddenly start to operate.

3. You must be on the operator's seat to close the seat switch. Check the operation of the SRO circuit. Move the accelerator (Monotrol) pedal to the operating range before you turn the key switch to the ON position. Turn the key switch to the ON position. The power steering motor will begin to operate. If the lift truck is equipped with regenerative braking, the regenerative braking contactor will close. (Lift trucks that have a Forward and Reverse lever on a column mount can be checked the same as lift trucks with Monotrol control. Move the lever to the Forward or Reverse position and move the accelerator into the operating range before you turn the key switch to ON.) If the SRO circuit is operating correctly, the controller will not energize the traction circuit.

Release the accelerator to reset the SRO circuit. Changing the controls from Reverse to Forward or Forward to Reverse will also reset the SRO circuit. The lift system can be operated when the key switch is on. The lift truck is ready to move.

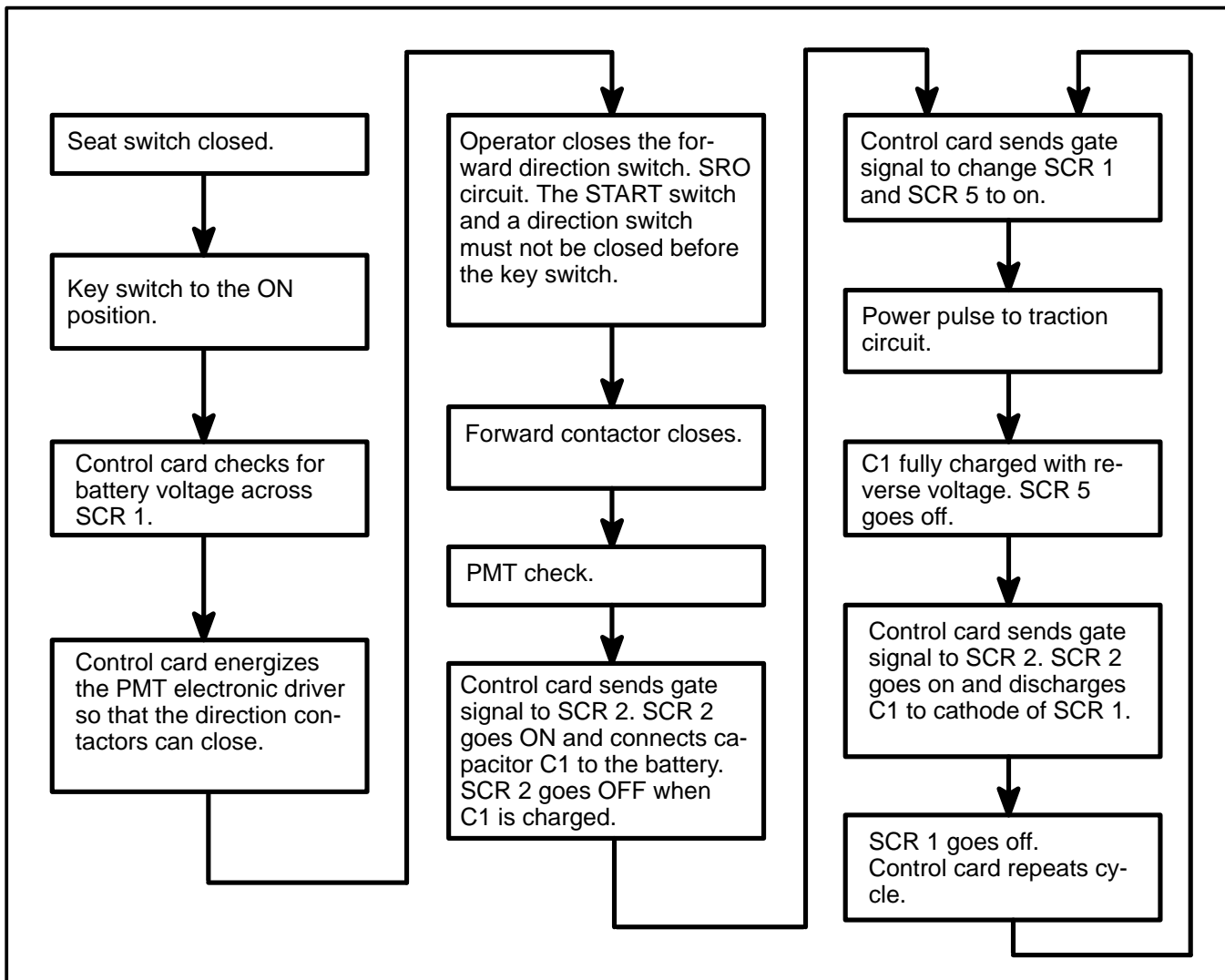


FIGURE 4. SEQUENCE OF OPERATION

4. Slowly move the accelerator a small amount for the reverse direction. Listen for the reverse contactor to close. Listen for a low hum from the controller. The lowest power that can be applied to the traction circuit when the direction contactor is closed is the Creep speed. The Creep speed can be adjusted so that the lift truck will or will not begin to move at the low power setting where the controller just begins to operate.

5. Move the accelerator a small amount so that the lift truck will begin to move slowly.

6. Increased movement of the accelerator causes the lift truck to move faster. The SCR hum becomes louder with a higher frequency sound.

7. Check the plugging or regenerative braking function. When the lift truck is traveling at top speed in the reverse direction, move the control to the Forward top speed position. A correctly adjusted lift truck will stop smoothly and will then move in the forward direction. It will accelerate smoothly to top speed.

TROUBLESHOOTING

You will need the following tools and instruments to make the troubleshooting checks:

- Cir/Kit meter or an ohmmeter and voltmeter. The voltmeter must have a minimum rating of 20 000

ohms per volt. The Cir/Kit meter is also useful for checking the SCRs.

- 20 cm (8 in) insulated probe. A long thin screwdriver with an insulated shaft can be used as an in-

ulated probe when checking the voltages on the electronic drivers and the SCRs. (See FIGURE 5.)

- Tester for checking the operation of SCRs.

⚠ CAUTION

ALWAYS replace all of the contactor contacts of a contactor at the same time. Replace the pump contactor contacts after 1000 hours of operation. Replace other contactor contacts when the thickness of any area of a contact is 30% of the thickness when new or there is any transfer of contact material.

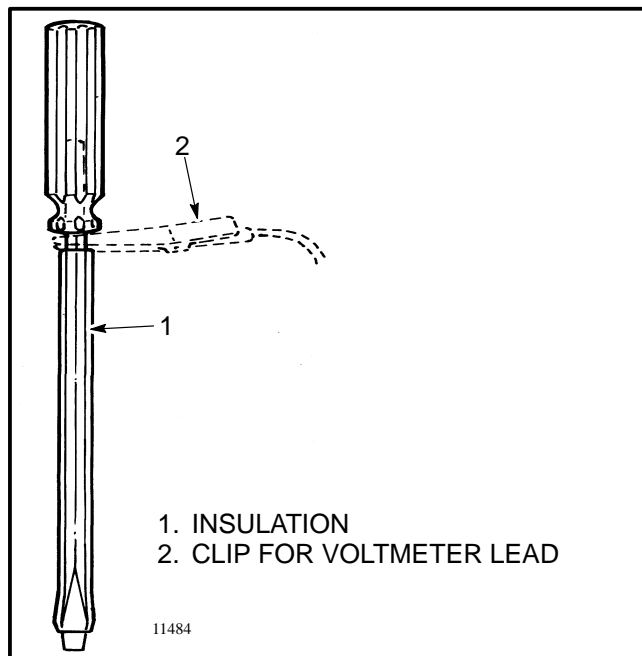


FIGURE 5. INSULATED PROBE

GENERAL PROCEDURES

1. Disconnect the battery and separate the connectors. Check the specific gravity of the battery. If the specific gravity is less than 1.260, the battery is not fully charged or is damaged. A fully charged battery has a specific gravity of 1.270 to 1.290. A discharged battery has a specific gravity of approximately 1.130.

2. The lift truck is a two-wire system. The frame must not be a common electrical path. Check for 50 000 ohms or more between each terminal of the battery connector for the lift truck and a clean connection on the frame. Remove any circuit paths between the controller and the frame of the lift truck. Carbon dust in a motor or other parts can cause a circuit path. Check for additional equipment that is causing a circuit path to the frame.

3. Check for voltage between each terminal of the connector fastened to the battery and a clean connection on the frame. It is normal to measure some voltage between the battery and the frame even if the resistance checks are correct. The leakage voltage is normally less than 30% of the battery voltage. A high leakage voltage can indicate a dirty battery or a battery with a fault. Clean the battery and battery compartment as necessary.

4. Make a visual check for parts or wires that are loose, broken, or damaged.

The instructions for checking the parts and assemblies are described in the section **ELECTRICAL REPAIRS AND ADJUSTMENTS, 2200 SRM 288**. The following **WARNINGS, NOTES** and additional information are given to help during troubleshooting:

⚠ WARNING

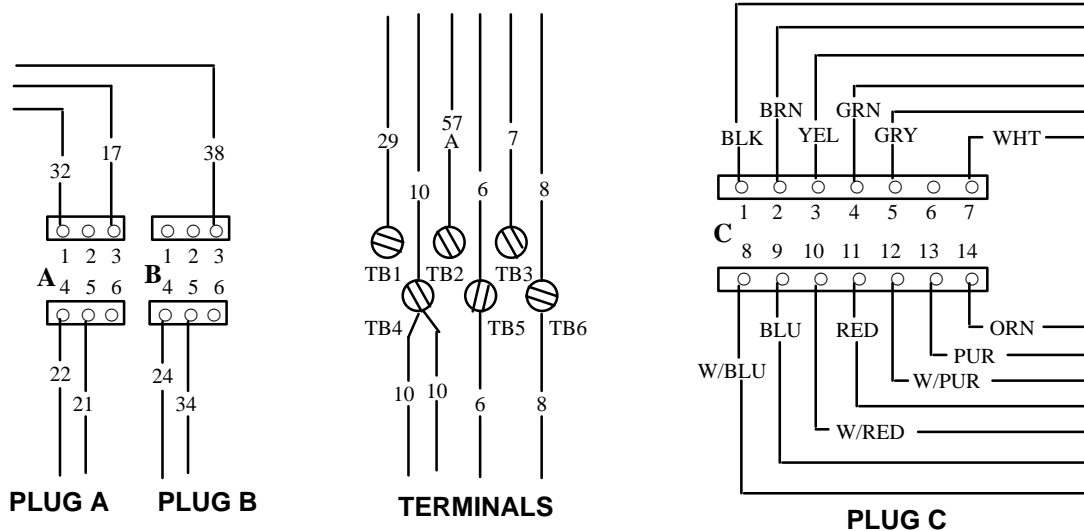
Make sure you disconnect the battery and separate the connector before you disassemble any part of the controller. Make sure you also discharge the capacitor C1 after the battery is disconnected. The high current flow from the battery can cause burns and damage the electrical parts if the tools cause a short-circuit.

⚠ CAUTION

Some checks and adjustments must be made with the battery connected. When the battery is connected, raise both drive wheels from the surface before making checks so that the lift truck does not suddenly move.

NOTE: The correct meter polarity is necessary for the checks. The voltage checks are made between the indicated point in the troubleshooting chart and battery negative. Connect the meter negative to battery negative.

NOTE: Make an identification of any wires before you disconnect them. The wires must be connected again correctly. FIGURE 6. shows the pin arrangements in the card plugs and the function of each pin of the control card plugs. The plugs are not normally disconnected for the troubleshooting steps described in this section. The plugs can be disconnected if a resistance check must be made for a sensor wire. Most of the functions can be checked at the terminals where the wires connect to the part.



NO.	FUNCTION
PA1	Signal to energize the regenerative braking electronic driver (wire 32).
PA2	Not used.
PA3	Voltage check for regenerative braking function (wire 17).
PA4	Signal to the regenerative braking sensor (wire 22).
PA5	Signal to the regenerative braking sensor (wire 21).
PA6	Not used.
PB1	Not used.
PB2	Not used.
PB3	Signal to energize the field weakening electronic driver (wire 38).
PB4	Signal to energize the PMT electronic driver (wire 24).
PB5	Signal to energize the 1A electronic driver (wire 34).
PB6	Not used.
TB1	5 volt supply to accelerator potentiometer (wire 29).
TB2	Signal connection between start switch and control card (wire 57A).
TB3	Voltage input from timer circuit (wire 7).
TB4	Battery voltage supply from key switch (wire 10).
TB5	Voltage input from forward direction switch (wire 6).
TB6	Voltage input from reverse direction switch (wire 8).
PC1	Signal wire from SCR 1 thermal protector (black wire).
PC2	Battery negative (brown wire).
PC3	Signal wire from current sensor (traction circuit) (yellow wire).
PC4	Signal wire from current sensor (traction circuit) (green wire).
PC5	Signal wire from SCR 1 thermal protector (gray wire).
PC6	Not used.
PC7	Battery positive voltage (white wire).
PC8	Signal wire to SCR 1 gate (blue/white wire).
PC9	Signal from SCR 1 cathode (blue wire).
PC10	Signal wire to SCR 2 gate (white/red wire).
PC11	Connection between filter for SCR 2 and control card (red wire).
PC12	Signal wire to SCR 5 gate (white/violet wire).
PC13	Connection between filter for SCR 5 and control card (violet wire).
PC14	Sensor wire for voltage check across capacitor C1 (orange wire).

FIGURE 6. TERMINAL AND PIN ARRANGEMENTS FOR THE CONTROL CARD (TRACTION CARD)

LIFT TRUCKS WITHOUT REGENERATIVE BRAKING

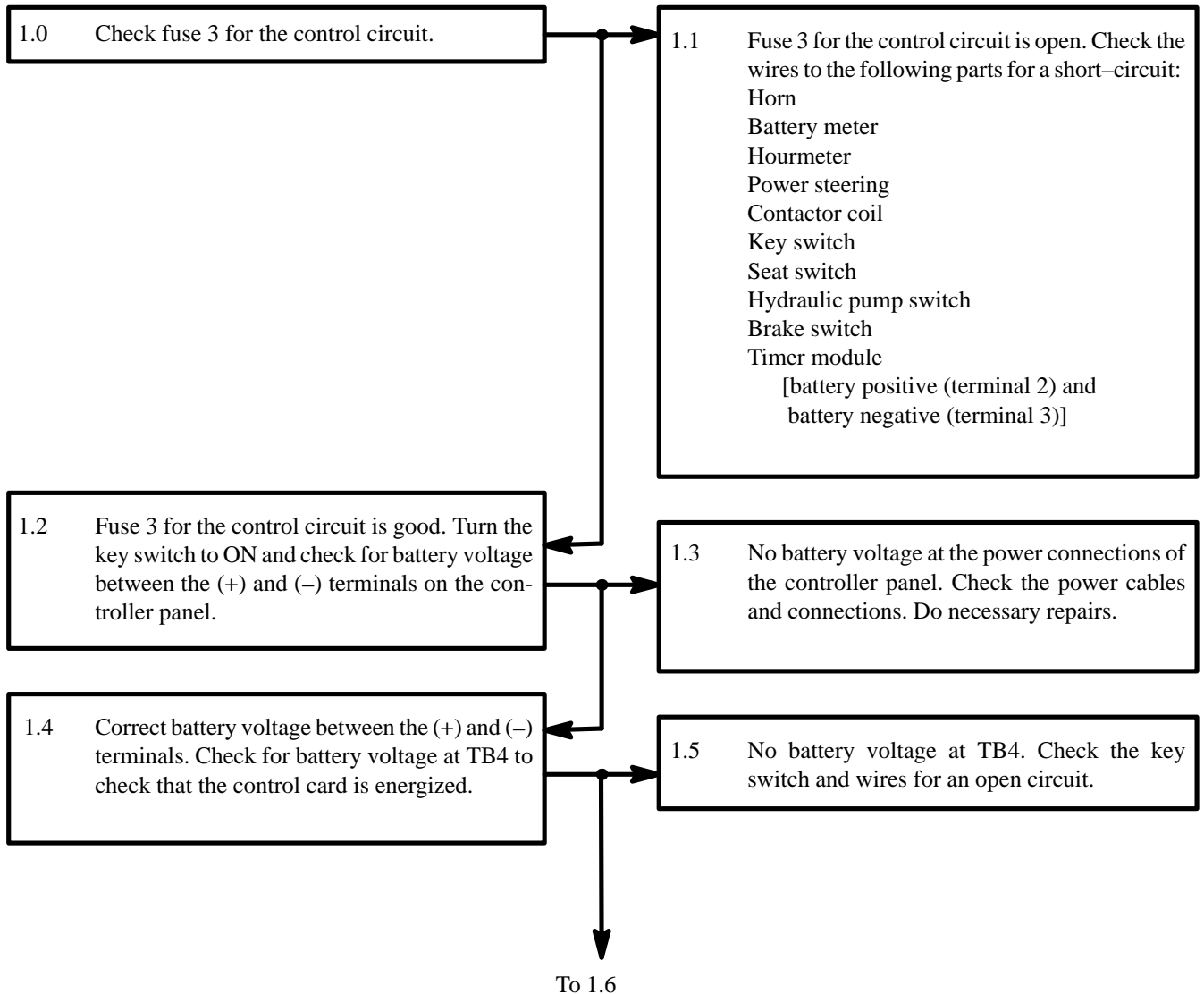


RAISE DRIVE WHEELS

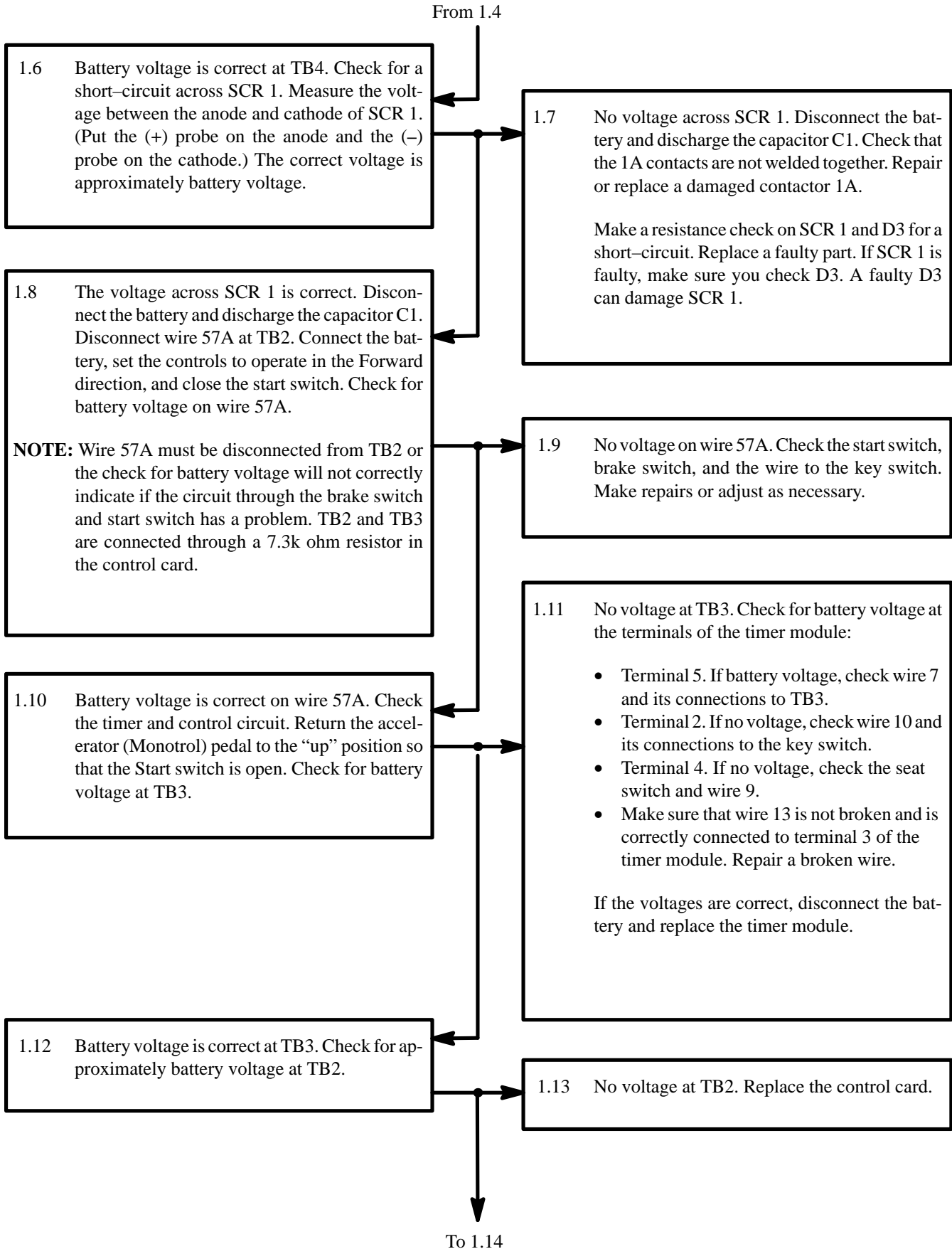
FAULT NUMBER 1. The Direction Contactors Will Not Close For Operation In Either Direction.

Possible Causes:

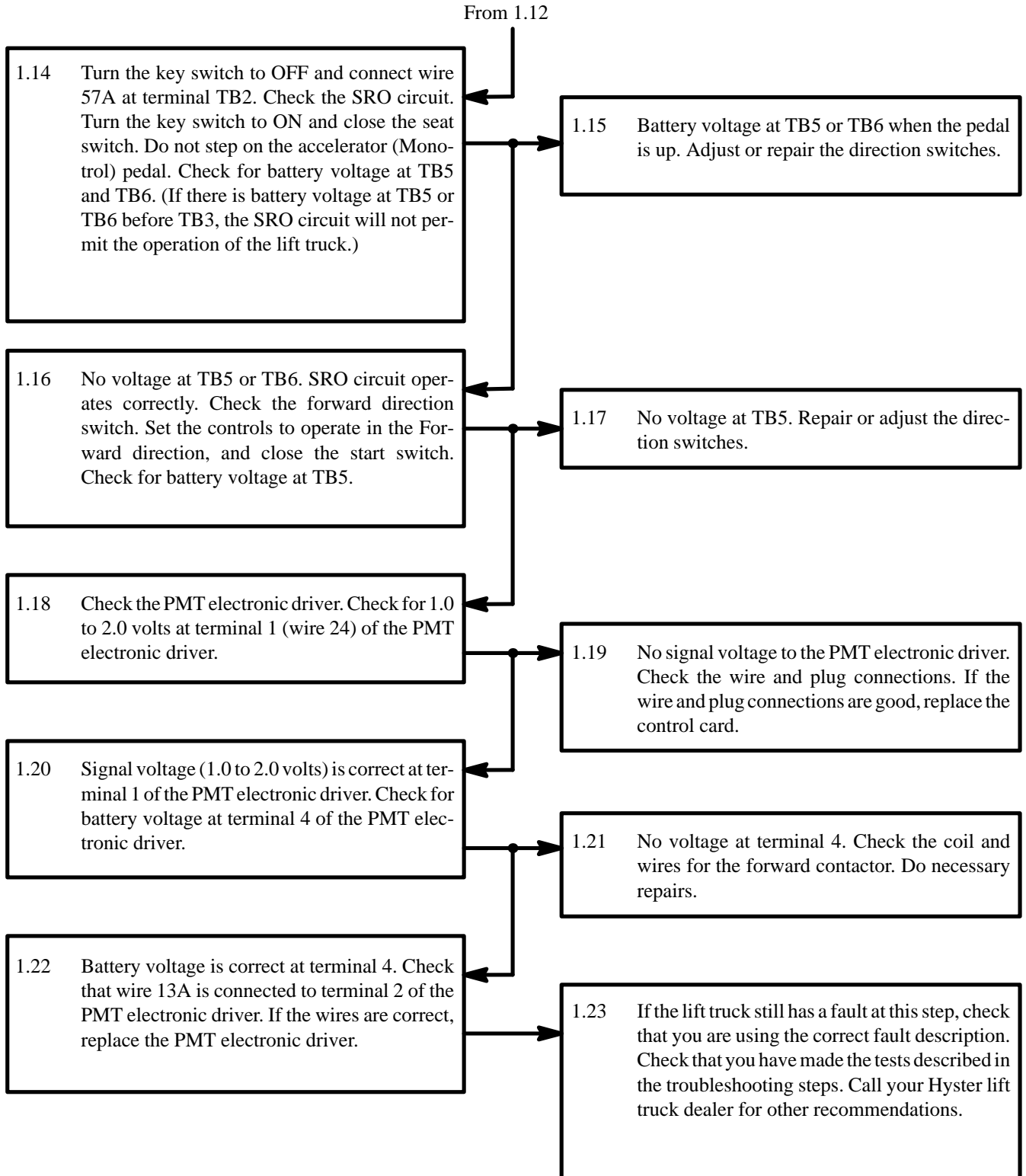
- Short-circuit across SCR 1
- Short-circuit or open circuit in the control circuit
- Faulty switch in the control circuit (possible SRO function)
- Control card is faulty
- Faulty timer module
- 1A contacts welded closed
- PMT electronic driver is faulty
- Brown wire to PC2 is open



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING

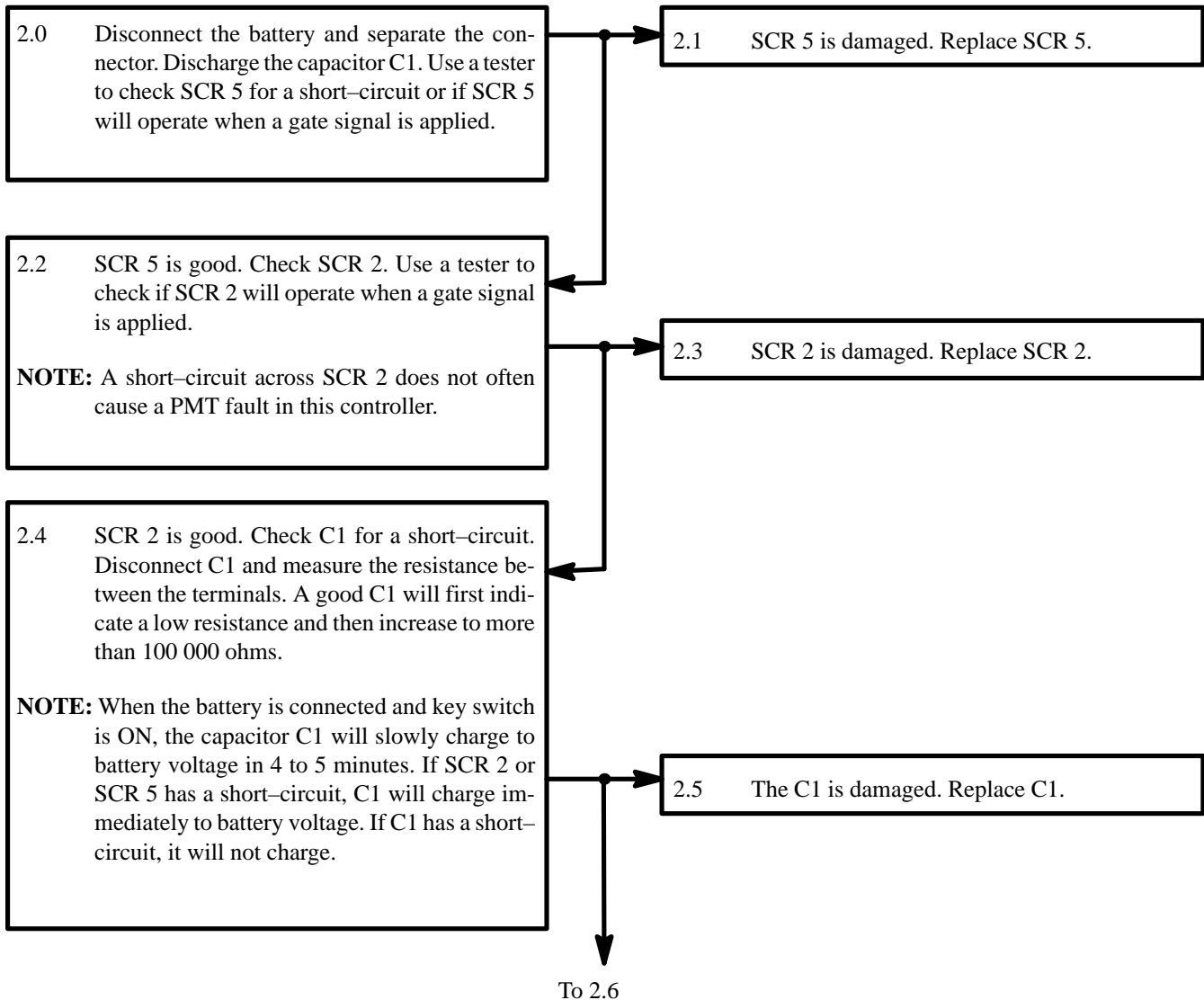


RAISE DRIVE WHEELS

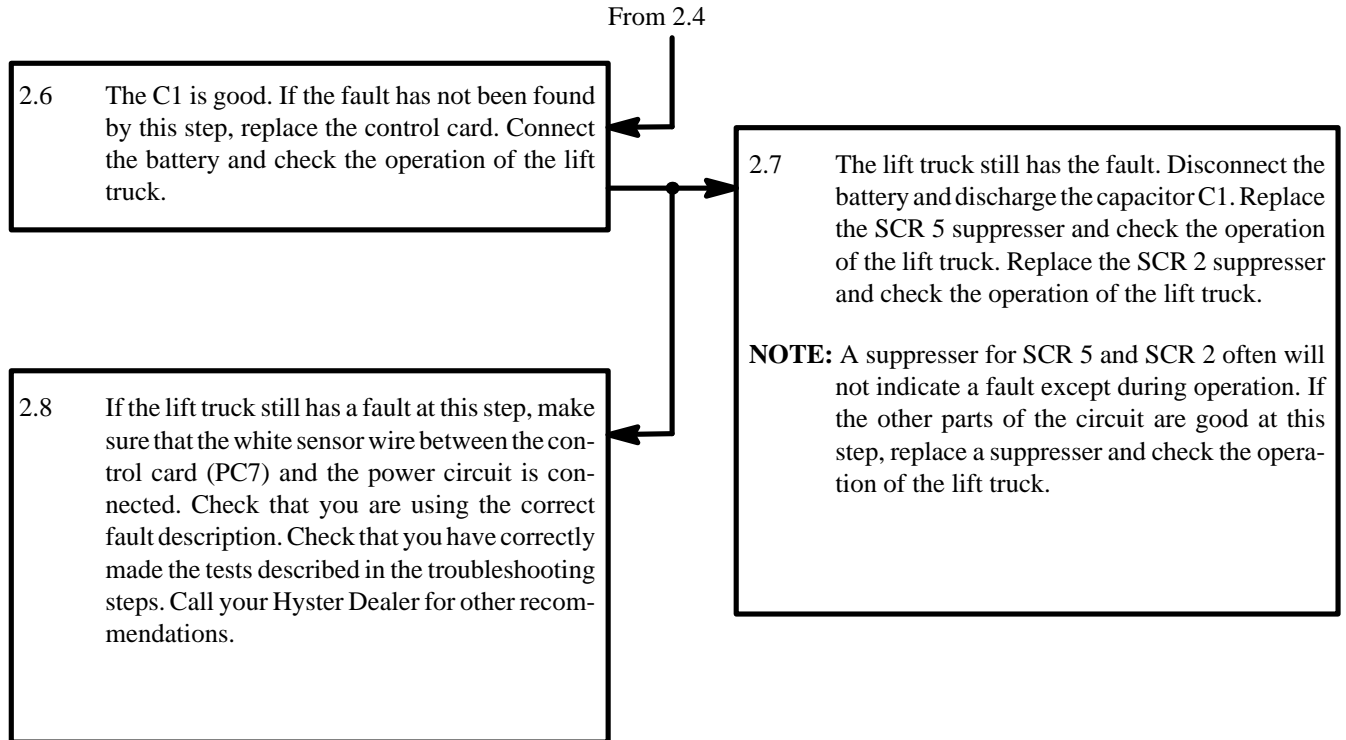
FAULT NUMBER 2. Lift Truck Will Not Move In Either Direction. The Direction Contactors Close And Then Immediately Open (PMT Fault)

Possible Causes:

- SCR 5 short-circuit or open circuit
- SCR 2 no gate signal or open circuit
- Control card is faulty
- SCR 5 suppresser is faulty
- Capacitor C1 is faulty
- White sensor wire between the control card (PC7) and the power circuit is disconnected



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING

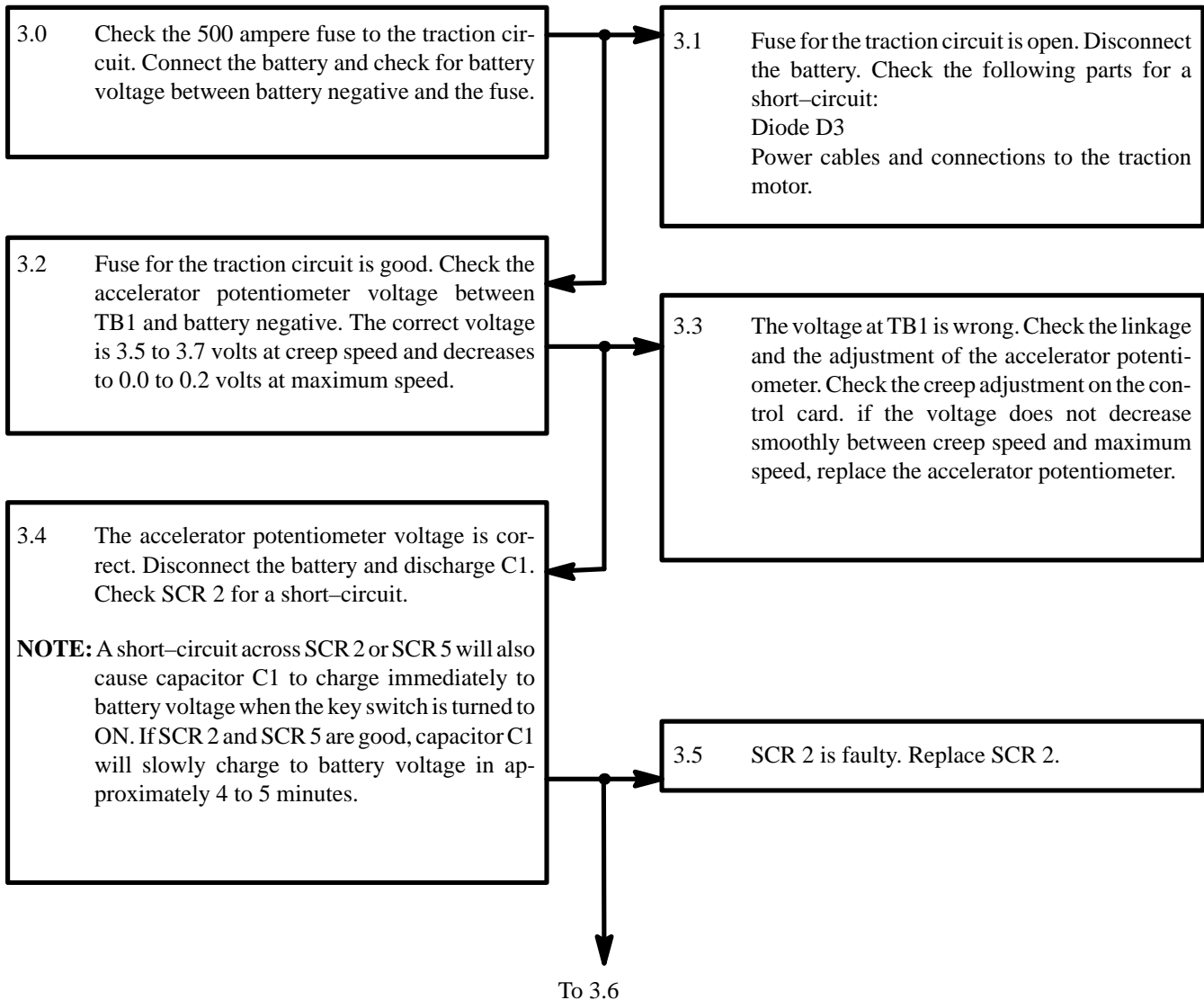


RAISE DRIVE WHEELS

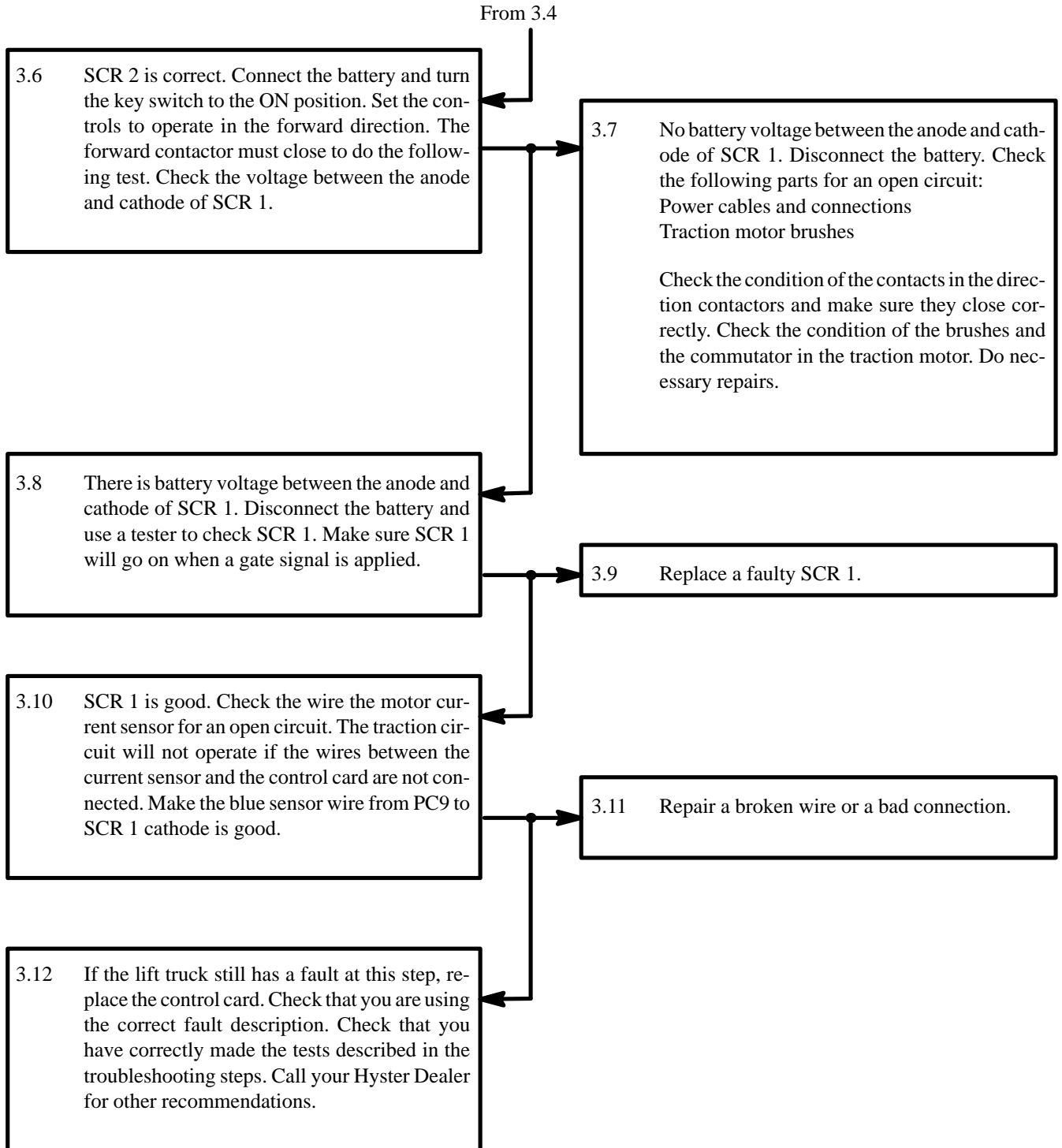
FAULT NUMBER 3. Lift Truck Will Not Move In Either Direction. The Direction Contactors Close Normally (No PMT Fault)

Possible Causes:

- Open circuit in traction circuit
- Accelerator potentiometer is faulty or linkage needs adjustment
- Open power circuit connections
- Traction motor is damaged
- SCR 2 has a short-circuit
- Control card has a fault (no gate signal to SCR 1)
- SCR 1 is damaged
- Wires to motor current sensor have an open circuit
- Blue sensor wire between SCR 1 and the control card (PC9) is disconnected



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING



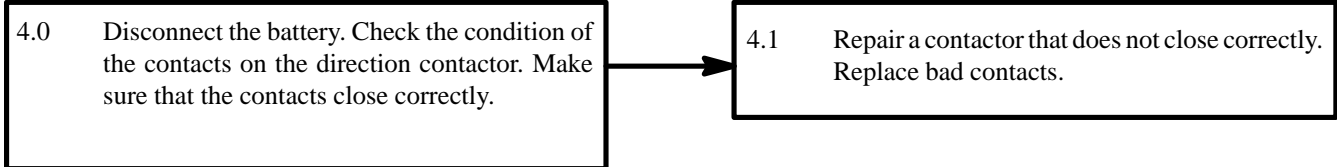
LIFT TRUCKS WITHOUT REGENERATIVE BRAKING



RAISE DRIVE WHEELS

FAULT NUMBER 4. Lift Truck Will Not Move In One Direction. The Direction Contactors Close Normally (No PMT Fault).

Possible Causes: • Bad direction contactor

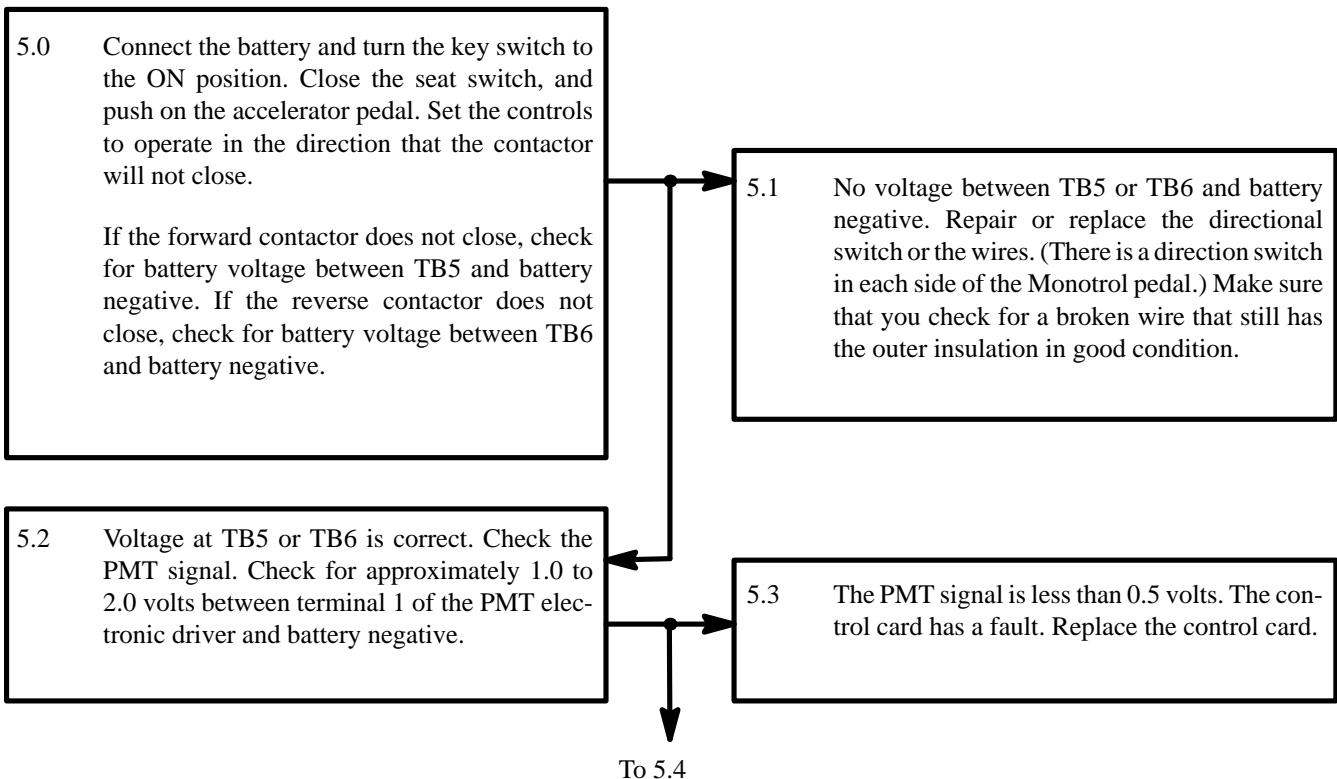


RAISE DRIVE WHEELS

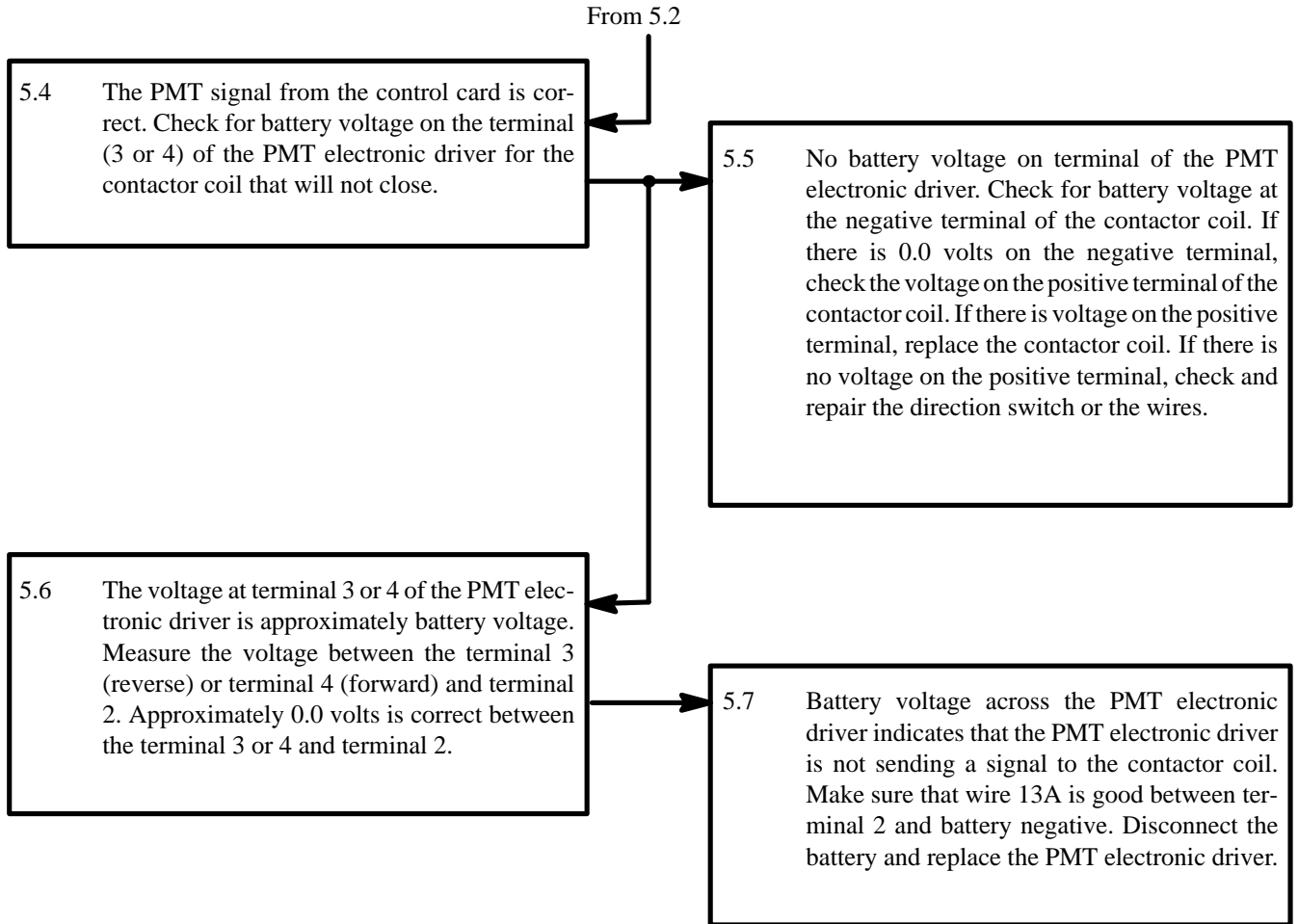
FAULT NUMBER 5. One Direction Contactor Will Not Close. Traction Circuit Operates Normally In Only One Direction.

Possible Causes:

- Direction switch is faulty
- Control card is faulty
- Contactor coil is faulty
- Broken or disconnected wires
- PMT electronic driver is faulty on one output

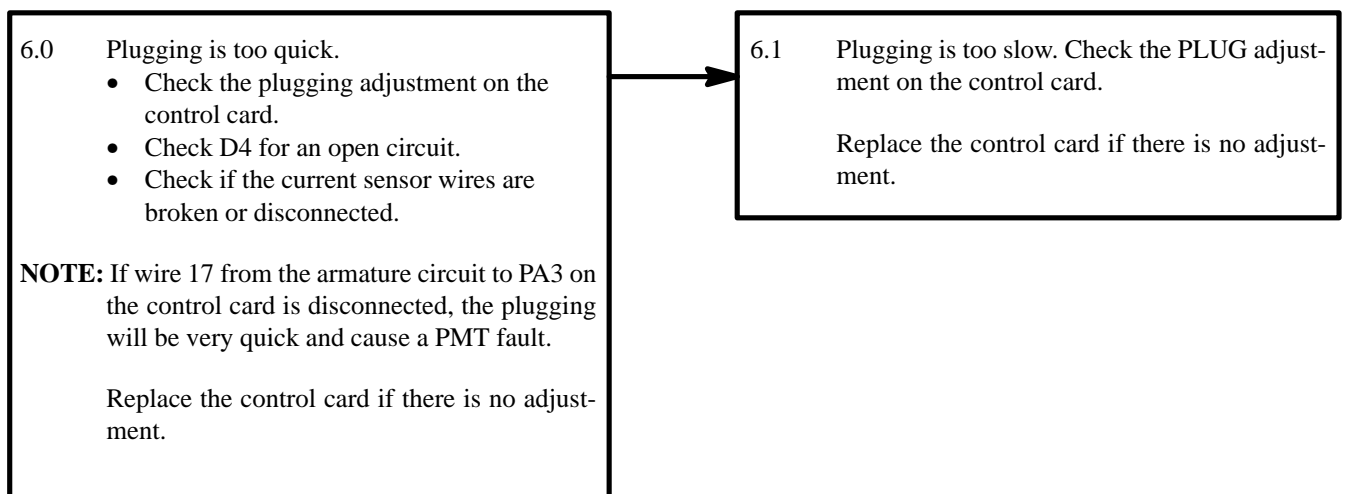


LIFT TRUCKS WITHOUT REGENERATIVE BRAKING



RAISE DRIVE WHEELS

FAULT NUMBER 6. Plugging Problems



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING

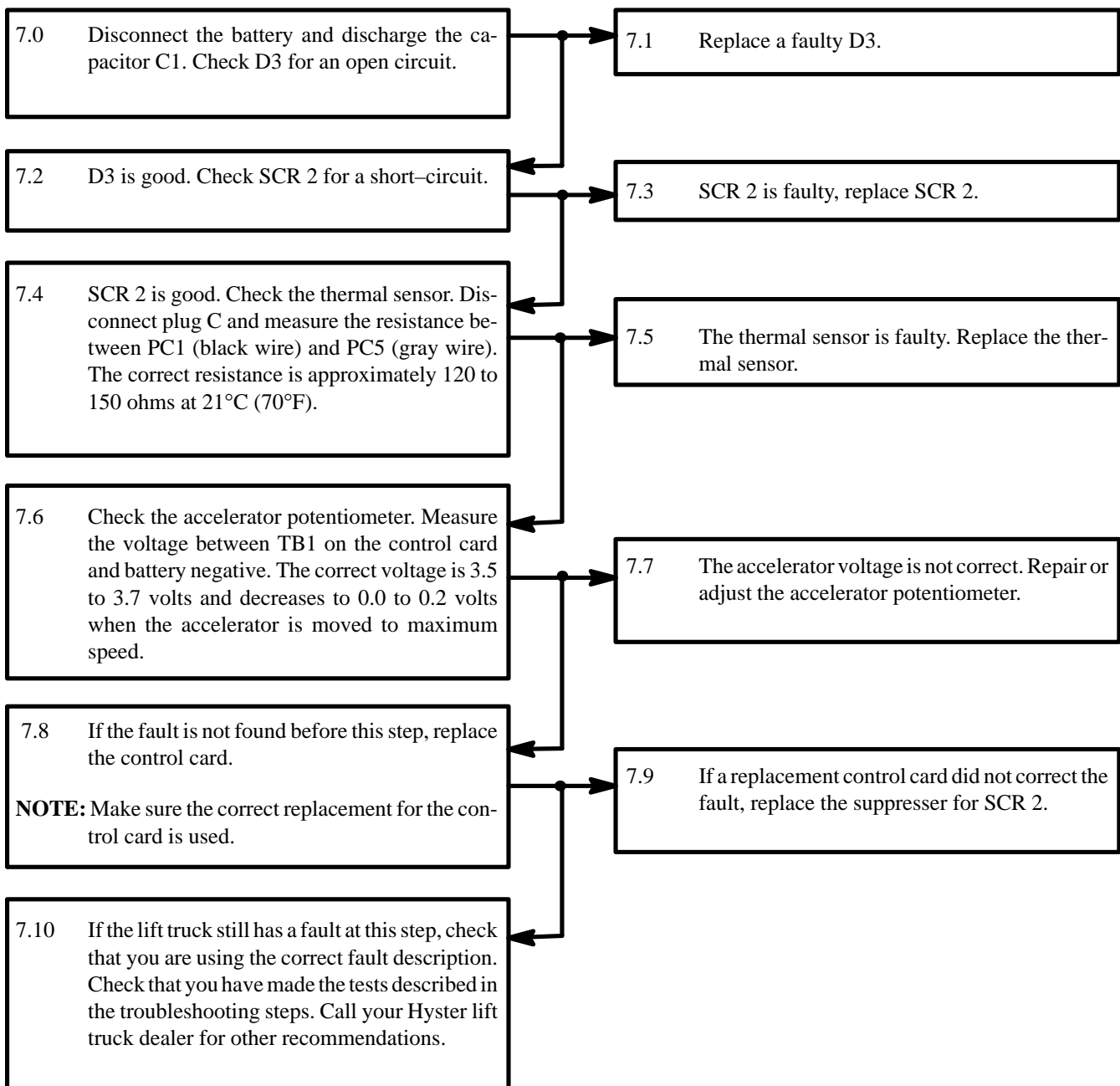


RAISE DRIVE WHEELS

FAULT NUMBER 7. Direction Contactors Close Normally. The Lift Truck Has Only Low Power Or Moves Slowly.

Possible Causes:

- Diode D3 has an open circuit
- Thermal sensor has an open circuit
- Accelerator potentiometer is faulty or needs adjustment
- Control card has a fault
- SCR 2 has a short-circuit
- SCR 2 suppresser is faulty



LIFT TRUCKS WITHOUT REGENERATIVE BRAKING

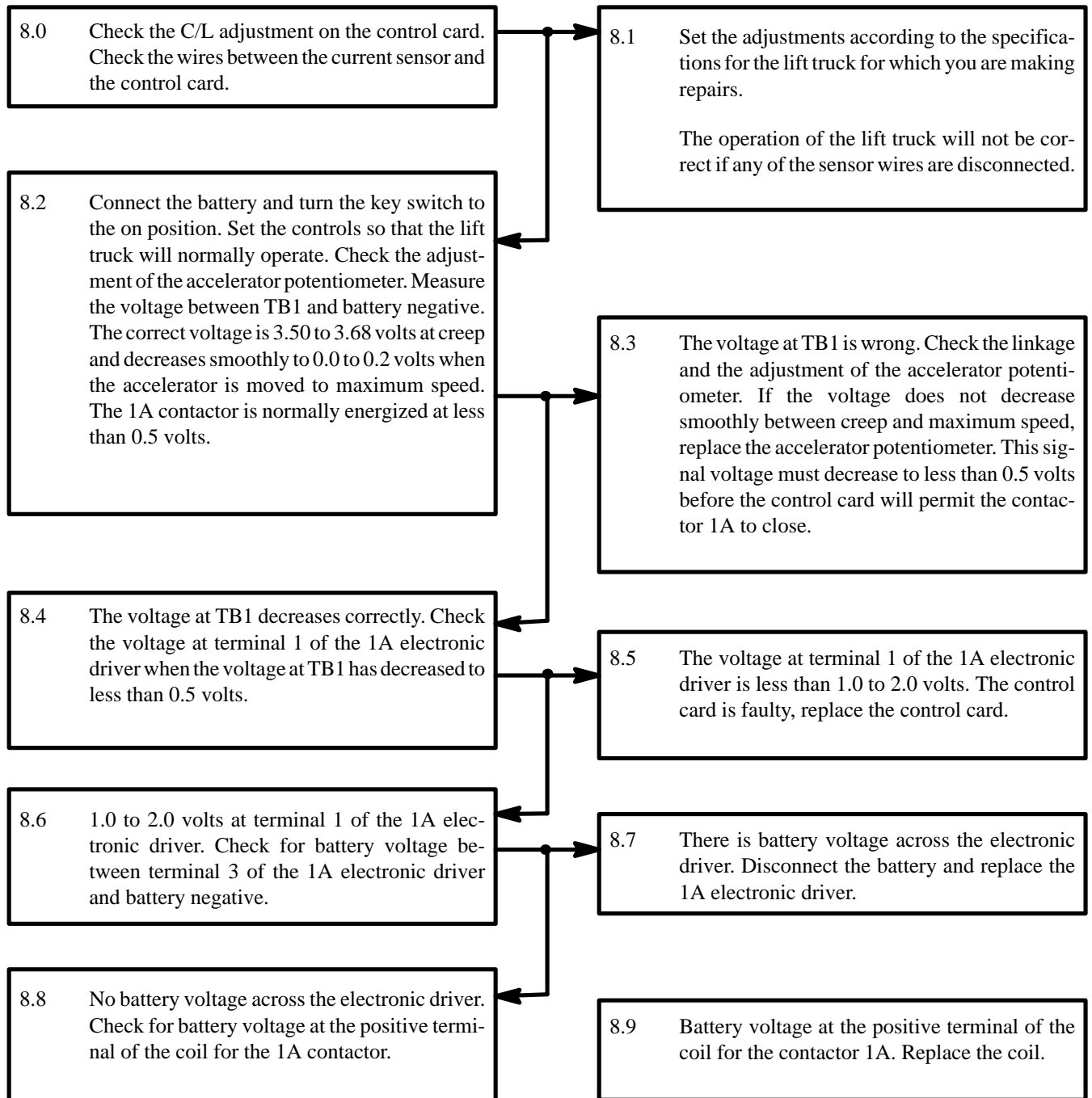


RAISE DRIVE WHEELS

FAULT NUMBER 8. Contactor 1a Will Not Energize. The Other Operations Of The Lift Truck Are Normal.

Possible Causes:

- Control card is faulty or needs adjustment
- Accelerator potentiometer is faulty or needs adjustment
- Contactor 1A is faulty
- 1A electronic driver is faulty



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

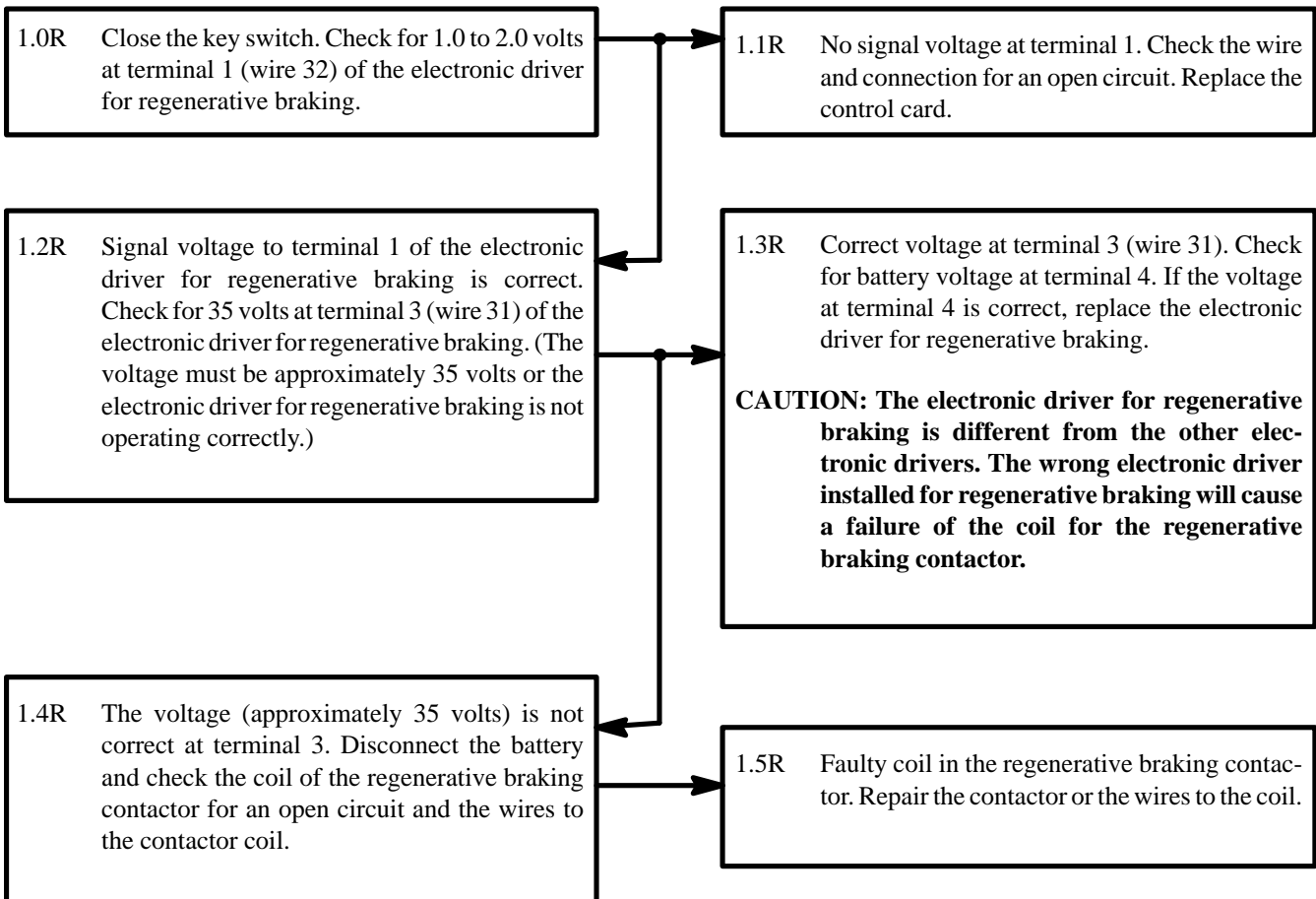


RAISE DRIVE WHEELS

FAULT NUMBER 1R. Regenerative Braking Contactor Does Not Close. The Forward And Reverse Contactors Will Close. The Lift Truck Will Not Operate.

Possible Causes:

- Electronic driver for regenerative braking is faulty
- Regenerative braking contactor is damaged
- Control card is faulty



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

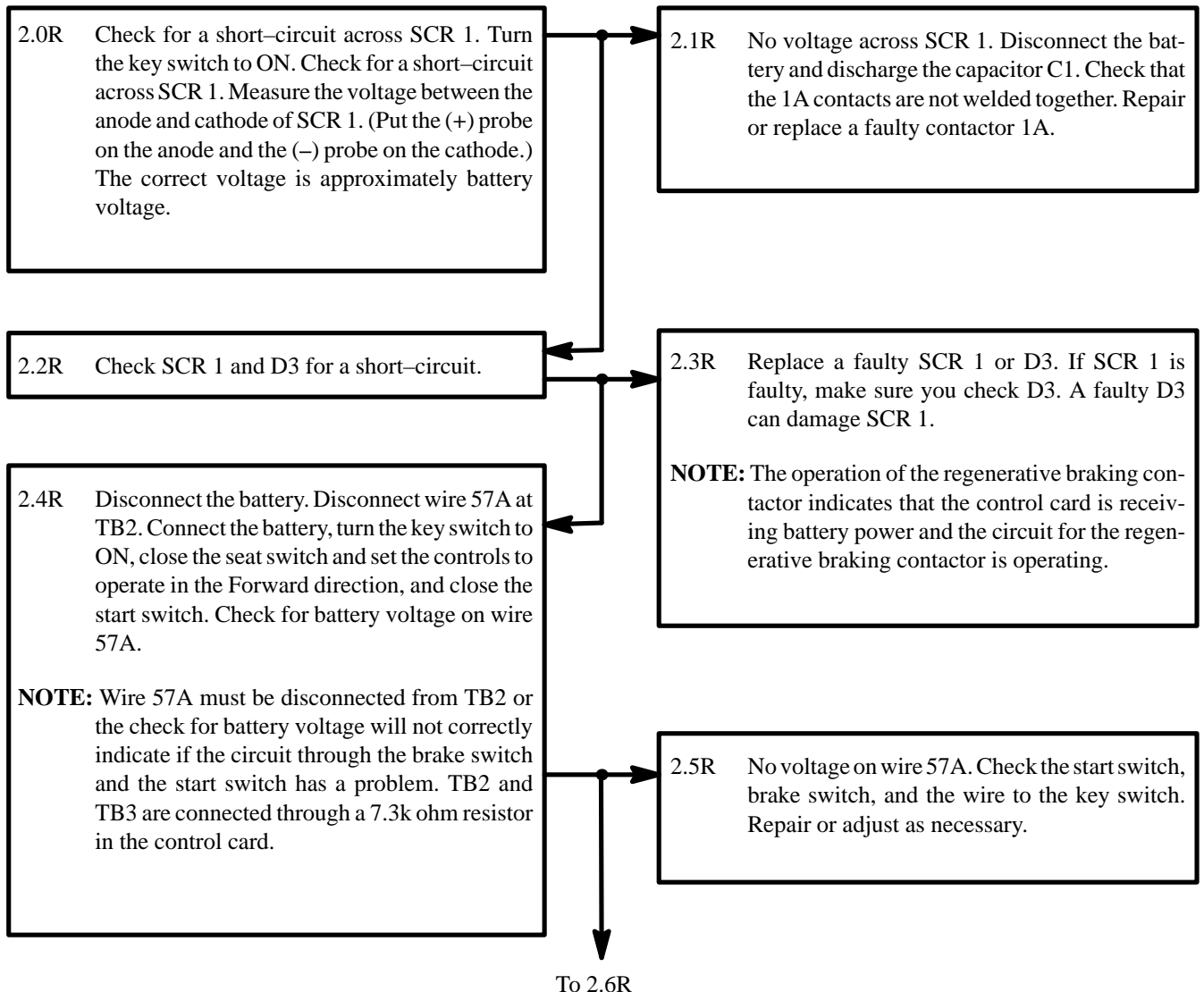


RAISE DRIVE WHEELS

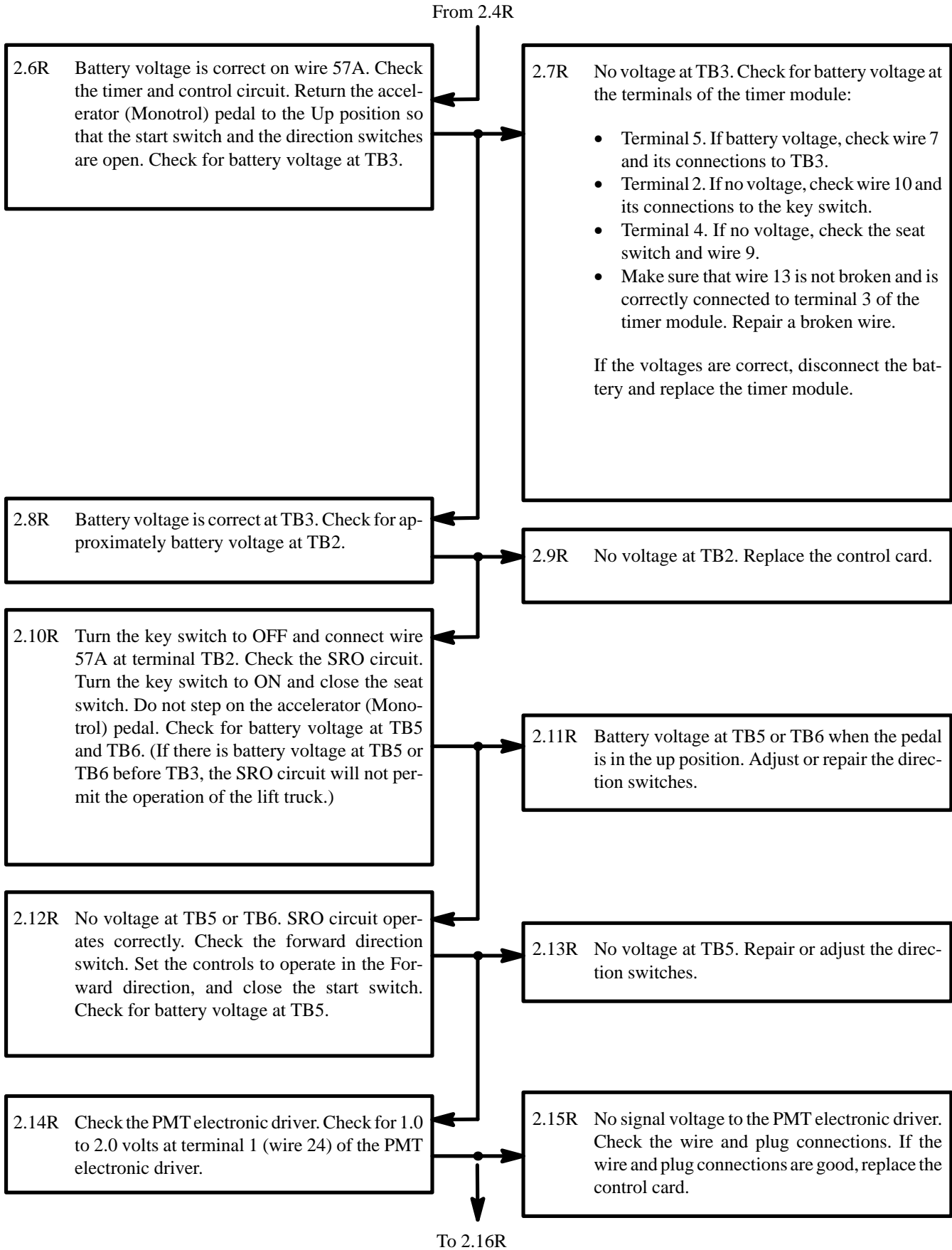
FAULT NUMBER 2R. Lift Truck Will Not Move In Either Direction. The Direction Contactors Never Close. The Regenerative Braking Contactor Closes.

Possible Causes:

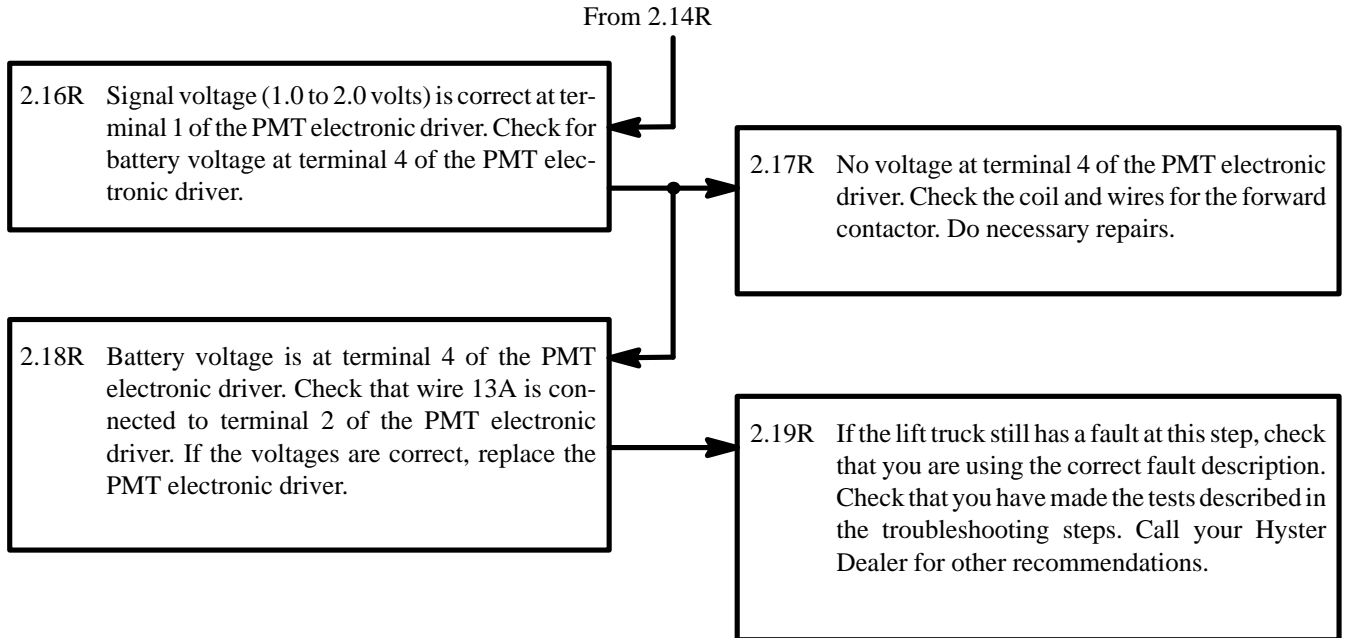
- Short-circuit across SCR 1
- Short-circuit or open circuit in the control circuit
- Faulty switch in the control circuit (possible SRO function)
- Control card is faulty
- Faulty timer module
- 1A contacts welded closed
- PMT electronic driver is faulty
- Brown wire to PC2 is open



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

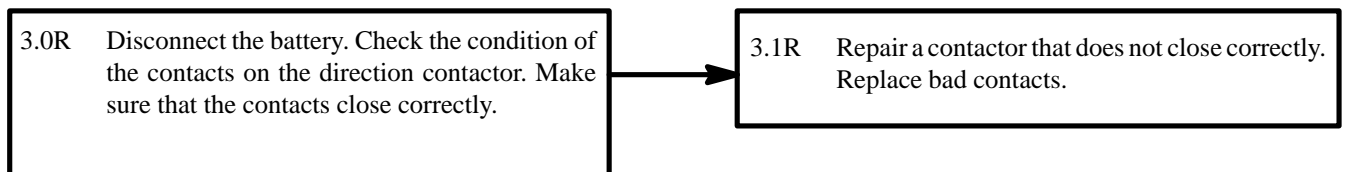


RAISE DRIVE WHEELS

FAULT NUMBER 3R. Lift Truck Will Not Move In One Direction. The Regenerative Braking Contactor Closes Normally. Direction Contactors Close Normally (No PMT Fault).

Possible Causes:

- Bad direction contactor



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

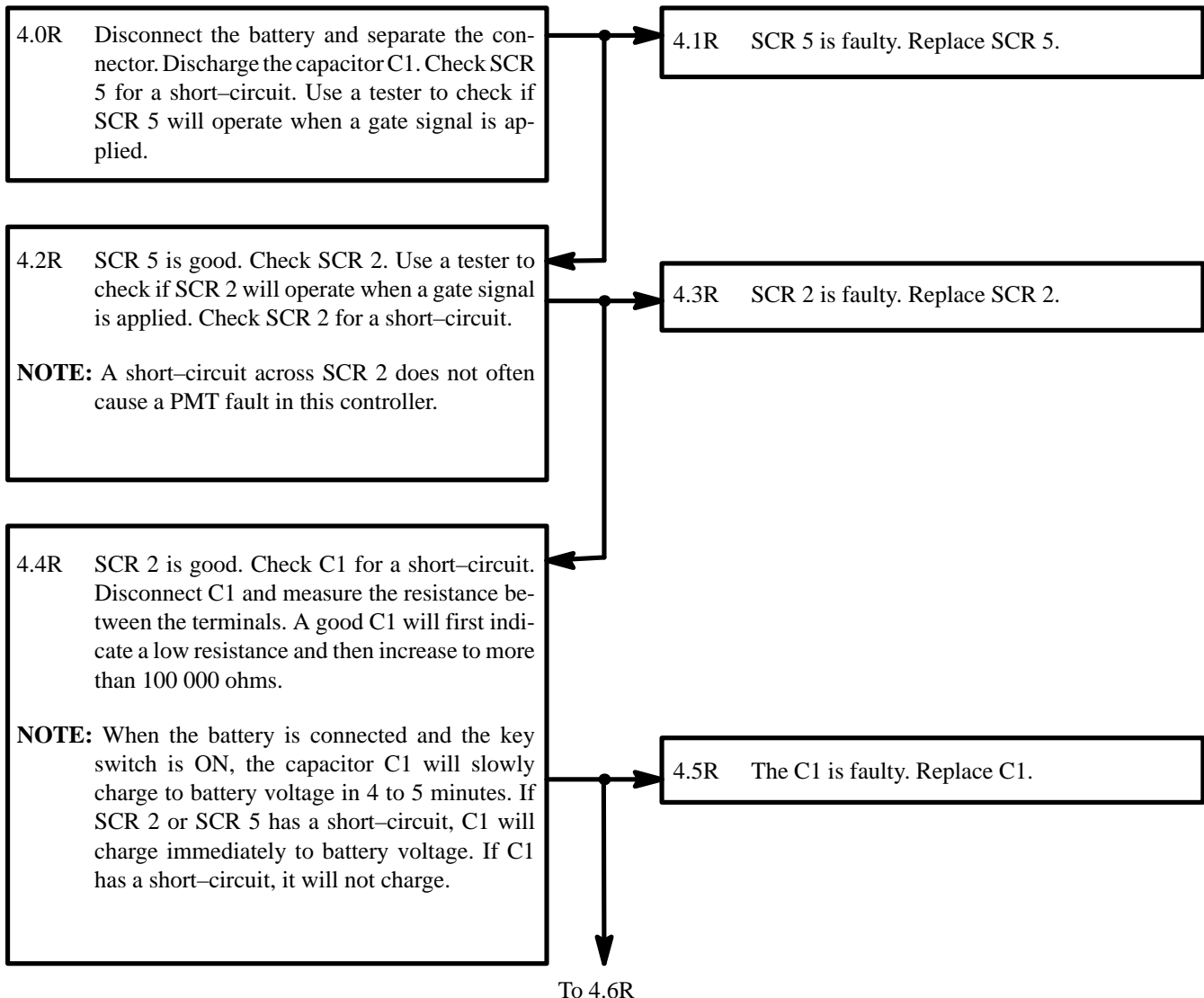


RAISE DRIVE WHEELS

FAULT NUMBER 4R. Lift Truck Will Not Move In Either Direction. The Regenerative Braking Contactor Closes. A Direction Contactor Closes And Then Immediately Opens [PMT (Double) Fault].

Possible Causes:

- SCR 5 short-circuit or open circuit
- SCR 2 open circuit or no gate signal
- SCR 5 suppresser is faulty
- Capacitor C1 is faulty
- Control card is faulty
- White sensor wire between the control card (PC7) and the power circuit is disconnected



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

From 4.4R

4.6R The C1 is good. If the fault has not been found by this step, replace the control card. Connect the battery and check the operation of the lift truck.

4.8R If the lift truck still has a fault at this step, make sure that the white sensor wire between the control card (PC7) and the power circuit is connected. Check that you are using the correct fault description. Check that you have made the tests described in the troubleshooting steps. Call your Hyster Dealer for other recommendations.

4.7R The lift truck still has the fault. Disconnect the battery and discharge the capacitor C1. Replace the SCR 5 suppresser and check the operation of the lift truck. Replace the SCR 2 suppresser and check the operation of the lift truck.

NOTE: A suppresser for SCR 5 and SCR 2 often will not indicate a fault except during operation. If the other parts of the circuit are good at this step, replace a suppresser and check the operation of the lift truck.

LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

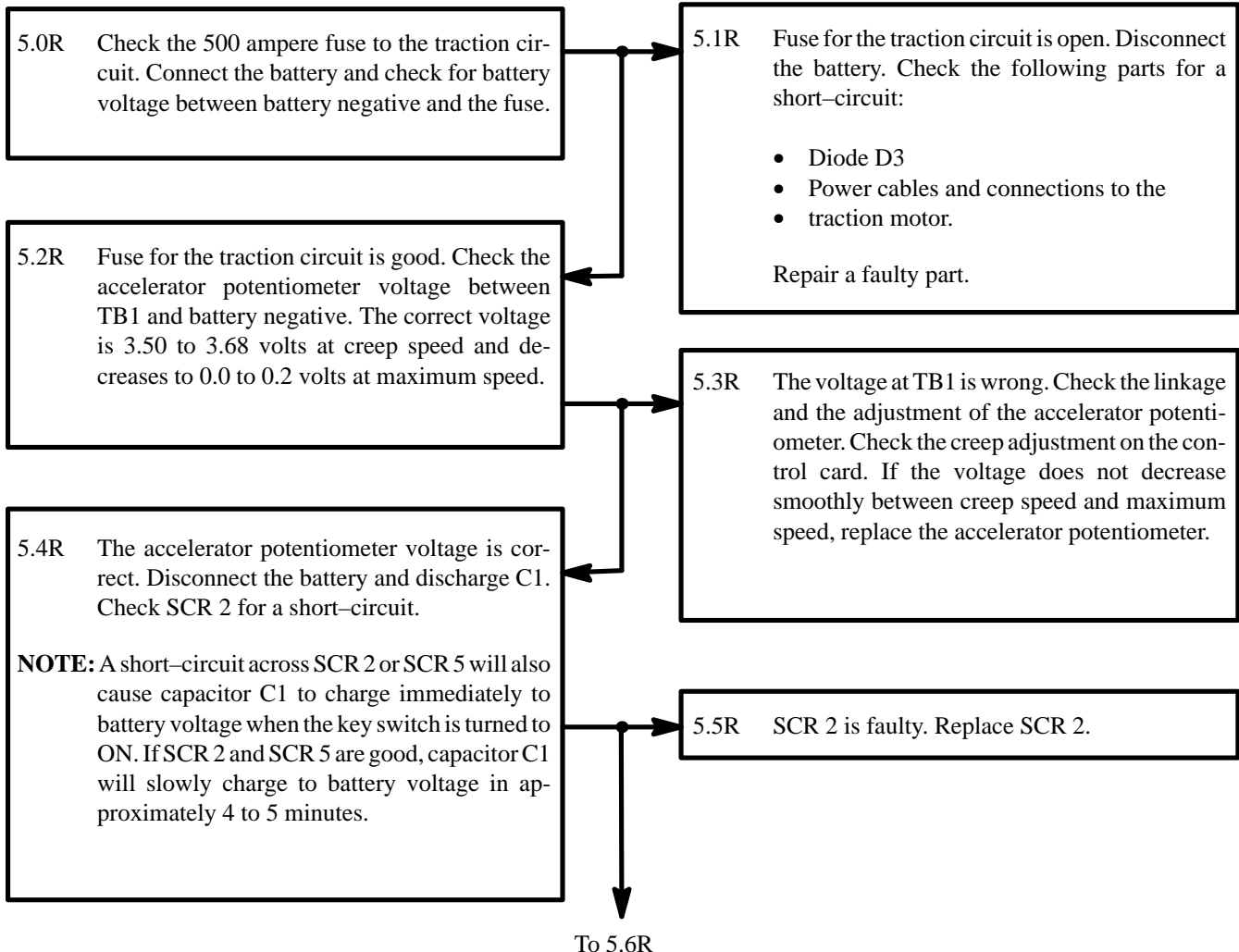


RAISE DRIVE WHEELS

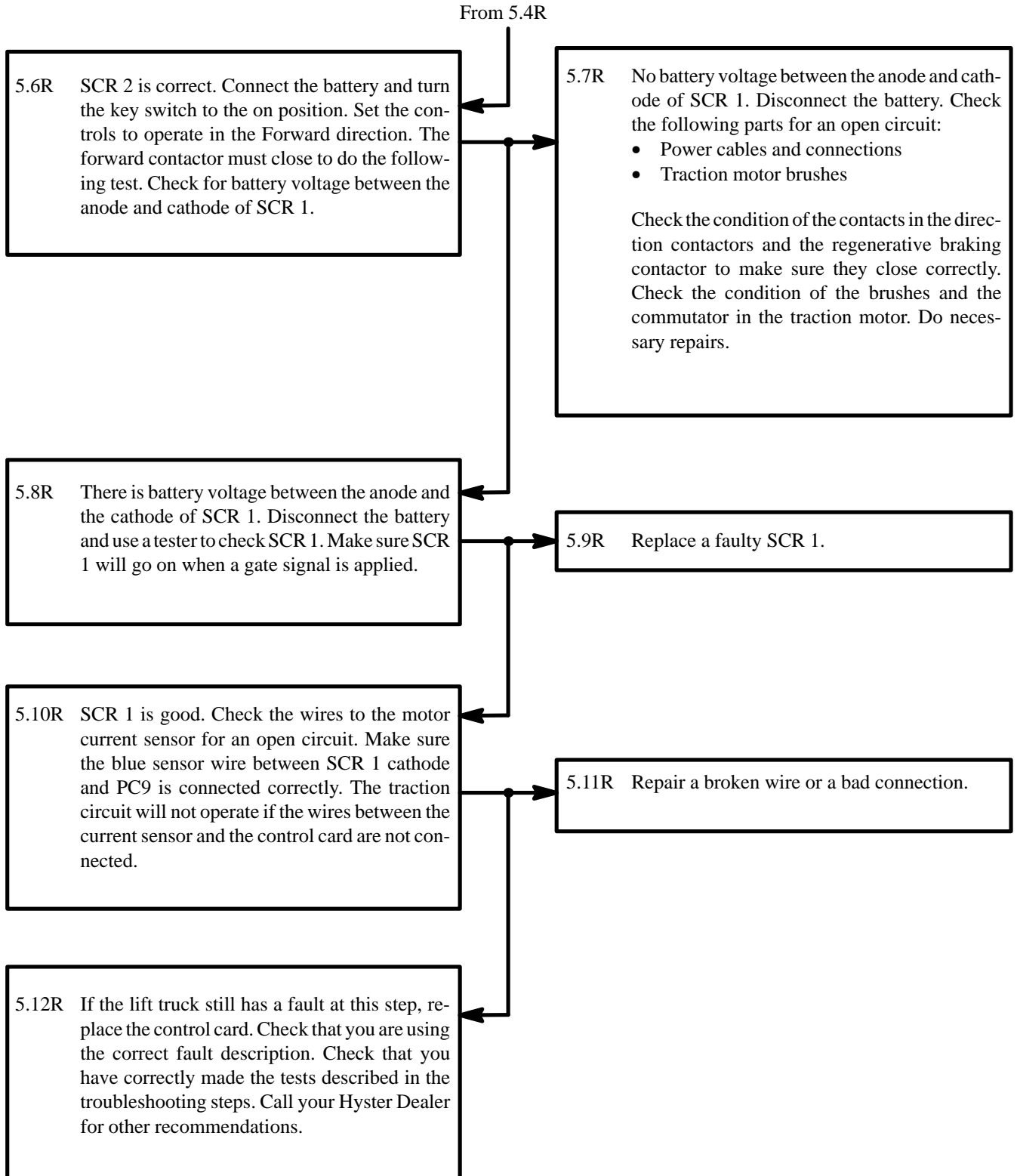
FAULT NUMBER 5R. Lift Truck Will Not Move In Either Direction. The Regenerative Braking Contactor Closes. The Direction Contactors Close Normally (No PMT Fault)

Possible Causes:

- Open power fuse (short-circuit in traction circuit)
- Accelerator potentiometer is faulty or linkage needs adjustment
- Open circuit power connections
- Traction motor is damaged
- SCR 2 has a short-circuit
- Control card has fault (no gate signal to SCR 1)
- SCR 1 has a fault
- Wires to motor current sensor have an open circuit
- Blue sensor wire between SCR 1 and the control card (PC9) is disconnected



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

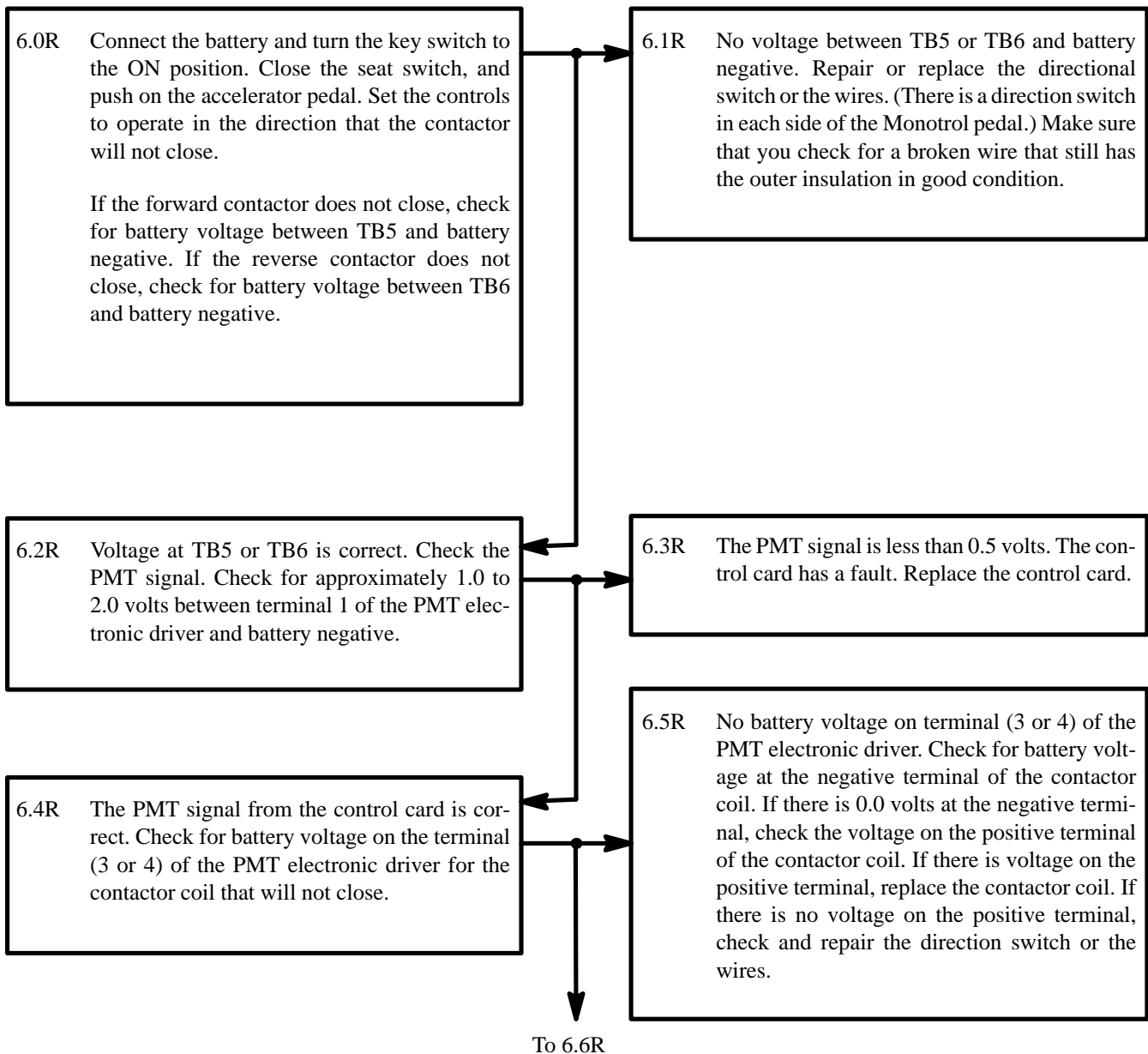


RAISE DRIVE WHEELS

FAULT NUMBER 6R. One Direction Contactor Will Not Close. The Regenerative Braking Contactor Closes Normally. The Traction Circuit Operates Normally In One Direction.

Possible Causes:

- Direction switch is faulty
- Control card is faulty
- Contactor coil is faulty
- Broken or disconnected wires
- PMT electronic driver is faulty on one output



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

From 6.4R

6.6R The voltage at terminal 3 or 4 of the PMT electronic driver is approximately battery voltage. Measure the voltage between terminal 3 (reverse) or terminal 4 (forward) and terminal 2. Approximately 0.0 volts is correct between the terminal 3 or 4 and terminal 2.

6.7R Battery voltage across the PMT electronic driver indicates that the PMT electronic driver is not sending a signal to the contactor coil. Make sure that wire 13A is good between terminal 2 and battery negative. Disconnect the battery and replace the PMT electronic driver.

LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

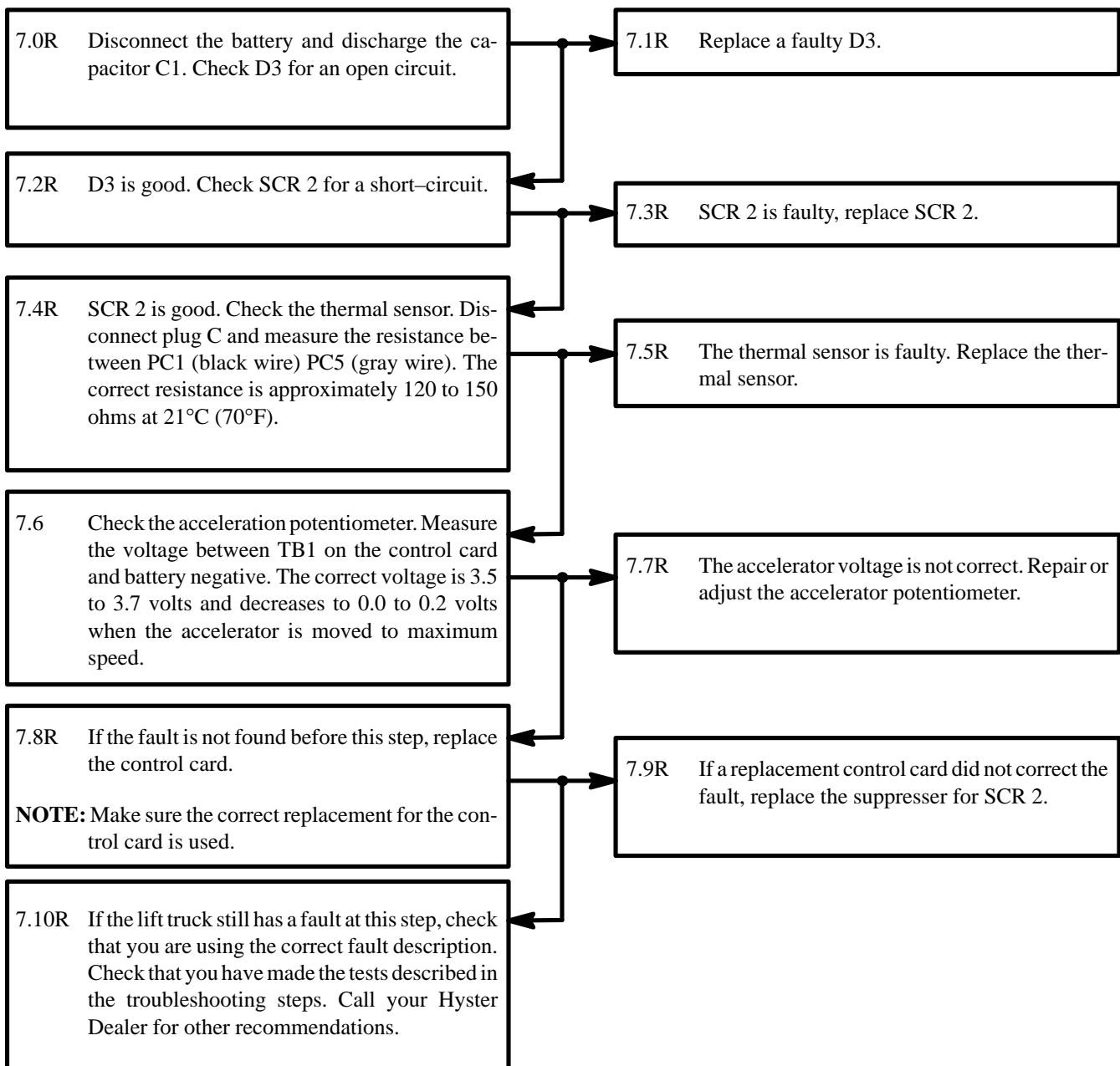


RAISE DRIVE WHEELS

FAULT NUMBER 7R. Direction Contactors Close Normally. The Lift Truck Has Only Low Power Or Moves Slowly. The Regenerative Braking Contactor Closes Normally.

Possible Causes:

- Diode D3 has an open circuit
- Thermal sensor has an open circuit
- Accelerator potentiometer is faulty or needs adjustment
- Control card has a fault
- SCR 2 has a short-circuit
- SCR 2 suppresser is faulty



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

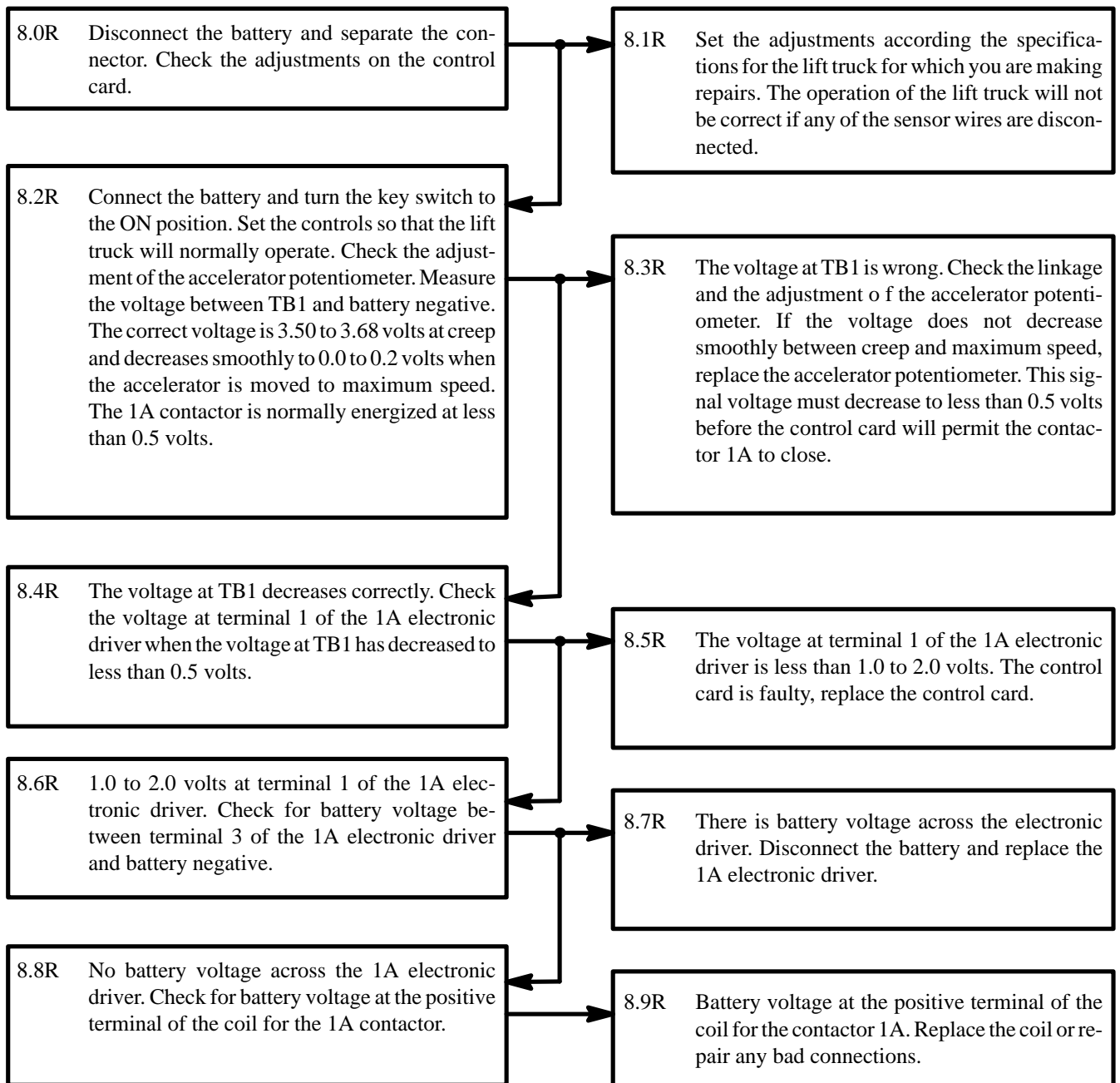


RAISE DRIVE WHEELS

FAULT NUMBER 8R. Contactor 1a Will Not Energize. The Other Operations Of The Lift Truck Are Normal.

Possible Causes:

- Control card is faulty or needs adjustment
- Contactor 1A is faulty
- 1A electronic driver is faulty
- Accelerator potentiometer is faulty or needs adjustment



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

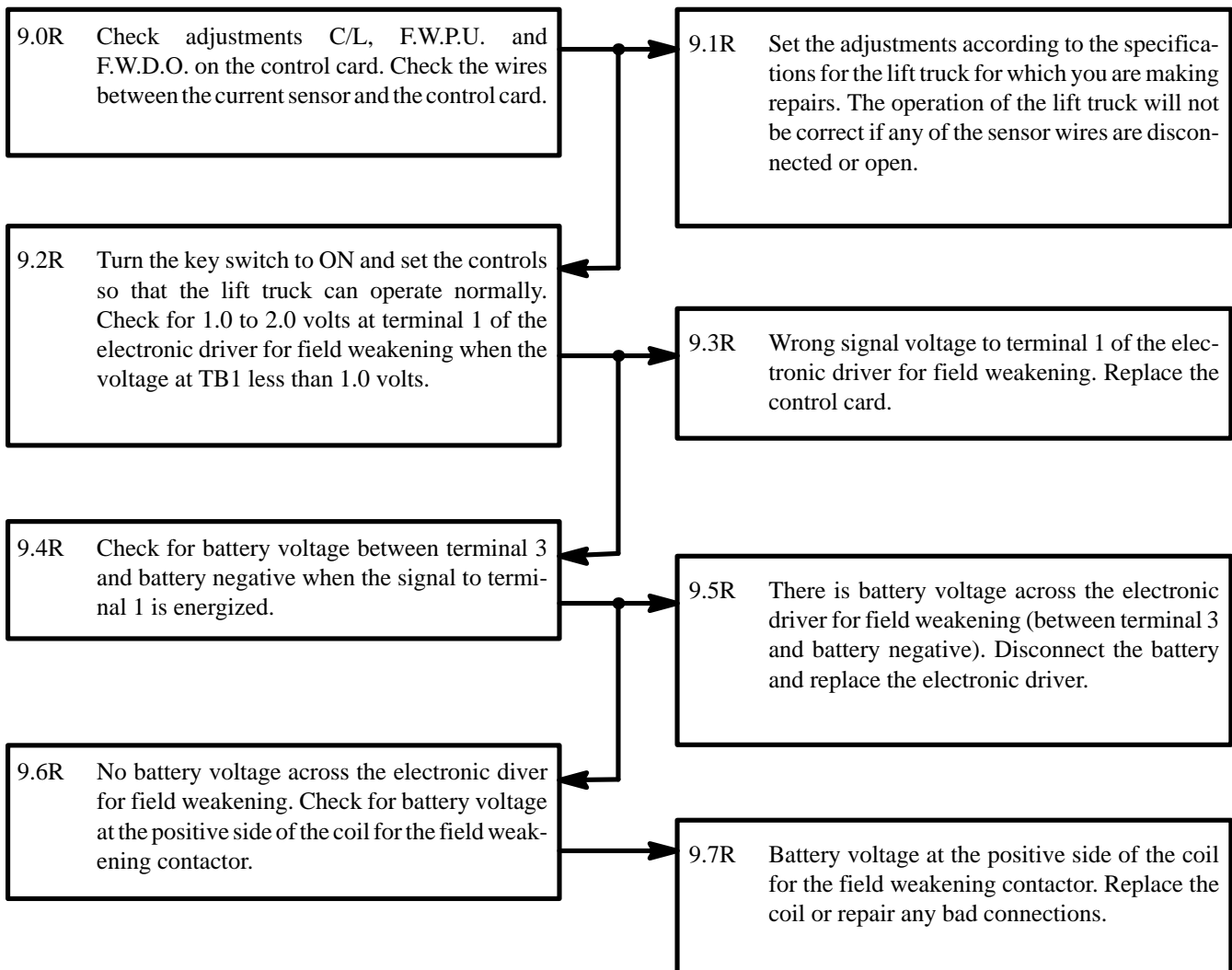


RAISE DRIVE WHEELS

FAULT NUMBER 9R. The Field Weakening Contactor Will Not Energize (36–48 Volt Lift Trucks Only). The Other Operations Of The Lift Truck Are Normal.

Possible Causes:

- Control card is faulty or needs adjustment
- Field weakening contactor is faulty
- Electronic driver for field weakening is faulty



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING



RAISE DRIVE WHEELS

FAULT NUMBER 10R. Regenerative Braking And Plugging Problems

- 10.0R Regenerative braking is too quick and often causes a PMT. Check for the following causes:
- Open yellow sensor wire from current sensor to PC3
 - Open brown wire 21 from regenerative braking sensor to PA5.
 - Open wire 17 from diode D7 to PA3.
 - Regenerative braking sensor. Check that the sensor is correctly connected to the bus bar.
 - Diode D4 is open
 - Control card has a fault. Replace the control card after the other checks have been made.

NOTE: If sensor wires 21 and 22 are not connected correctly, the lift truck will normally operate in one direction. When the plugging or regenerative braking is actuated, the regenerative braking contactor opens and the controller stops operating. The controller will operate again when the accelerator pedal is raised and permits the controller to reset.

- 10.1R Regenerative braking contactor opens, but no regenerative braking action occurs. Check for the following causes:
- Open yellow wire 22 from regenerative braking sensor to PA4
 - Electronic driver for regenerative braking is bad
 - Control card has a fault.
 - Replace the control card after the other checks have been made.

NOTE: If diode D7 is open, the plugging function will still operate and there will not be an indication that the regenerative braking function is not operating. If the traction motor brushes wear faster than normal, check D7 for an open circuit.

- 10.2R If the regenerative braking contactor does not close, the lift truck will not travel in either direction. Check the following parts for a fault:
- Coil for the regenerative braking contactor
 - Electronic driver for regenerative braking
 - Control card. Replace the control card after the other checks have been made.

LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

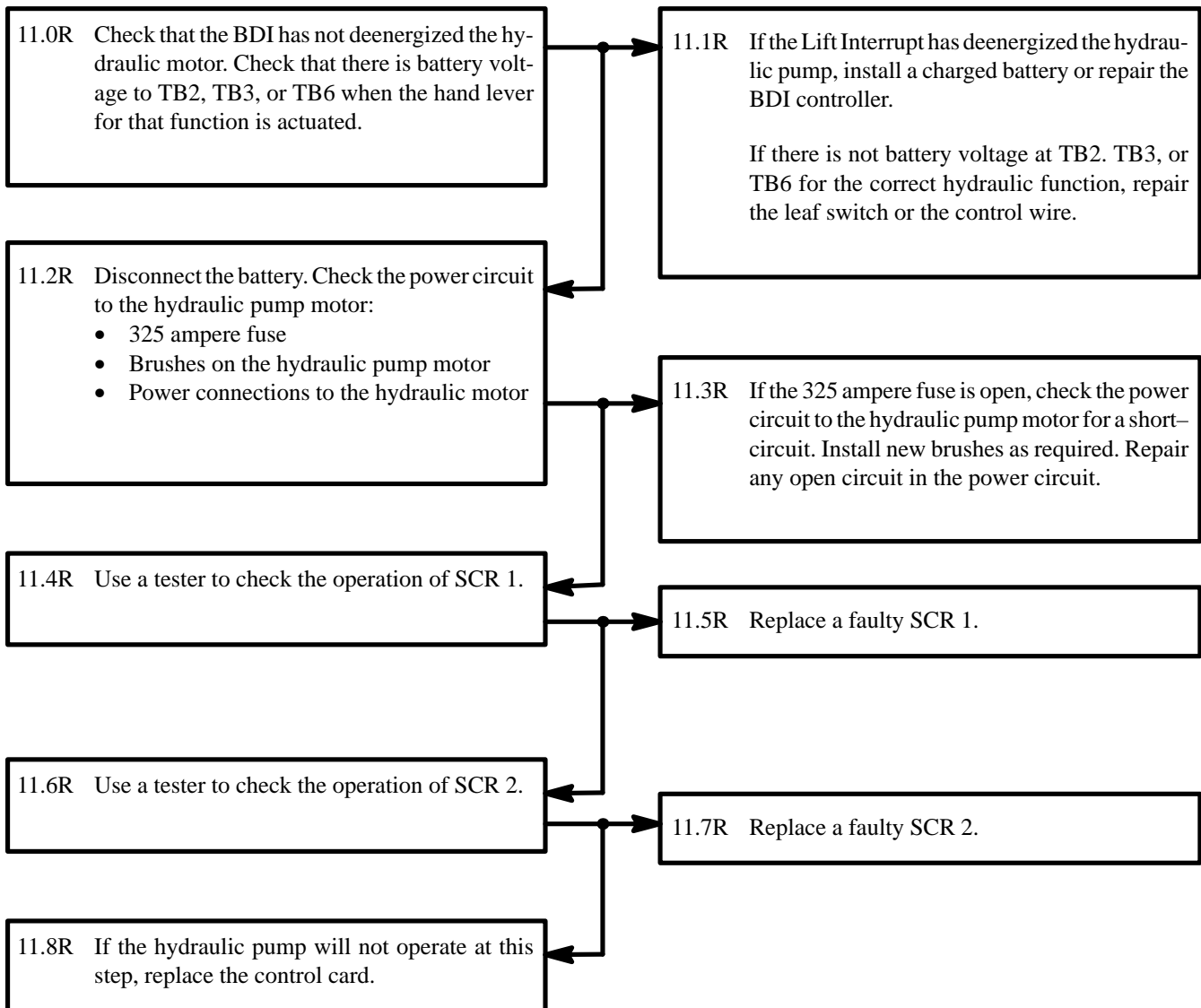


RAISE DRIVE WHEELS

FAULT NUMBER 11R. The Hydraulic Pump Will Not Operate When Any Hydraulic Hand Lever Is Moved From The Neutral Position.

Possible Causes:

- Low battery charge (BDI Lift Interrupt)
- Bad leaf switch or a broken control wire
- Bad power fuse
- Hydraulic pump motor is damaged
- SCR 1 is faulty
- SCR 2 has a short-circuit
- Control card is faulty



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING

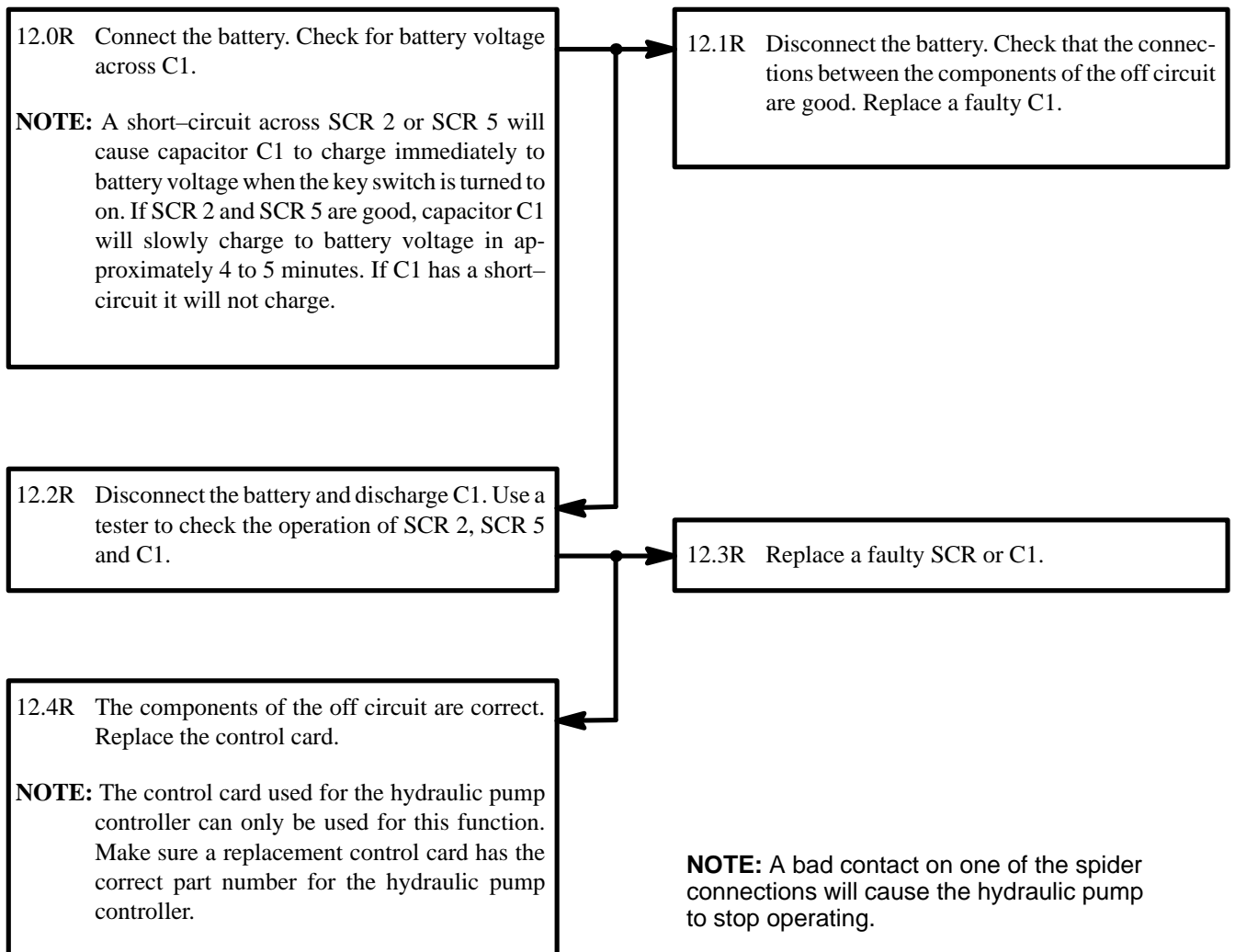


RAISE DRIVE WHEELS

FAULT NUMBER 12R. The Hydraulic Pump Will Not Stop Operating When The Hydraulic Hand Levers Are Returned To The Neutral Position.

Possible Causes:

When the hydraulic pump will not stop operation, the SCR 1 is continuously on. The off circuit (SCR 2, SCR 5, C1, and L1) is not operating.



LIFT TRUCKS EQUIPPED WITH REGENERATIVE BRAKING



RAISE DRIVE WHEELS

FAULT NUMBER 13R. The Hydraulic Pump Will Not Operate When Only One Hydraulic Hand Lever Is Moved From The Neutral Position. The Operation Is Normal For The Other Hydraulic Hand Levers.

Possible Causes:

- Electric leaf switches on a hydraulic hand lever need repair or adjustment
- Hand lever linkage needs adjustment

13.0R Remove the cover from the linkage for hydraulic hand levers. Operate the hand lever for the function that has the fault and check the operation of the contacts.

13.1R Repair or adjust a bad electric leaf switch. Adjust the linkage as required.