POWERBOSS®

SERVICE MANUAL

DIAGNOSTICS • REPAIR

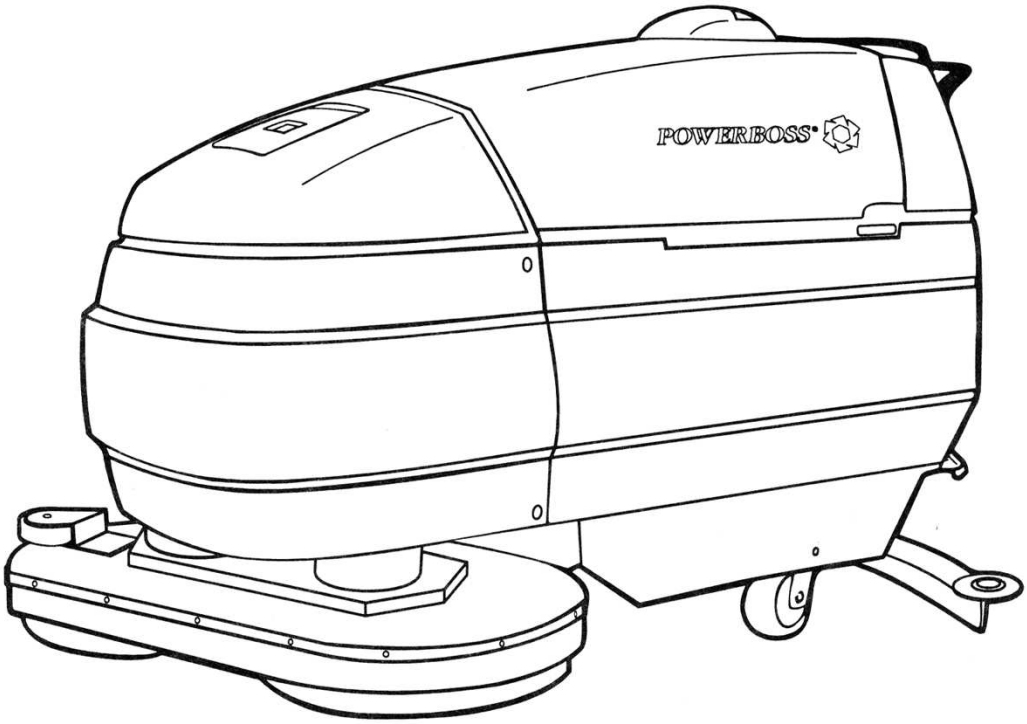
AUTOMATIC SCRUBBERVAC

SB28/70, SB34/85, & SB40/100

330 A/HR 24V

250 A/HR 36V

330 A/HR 36V



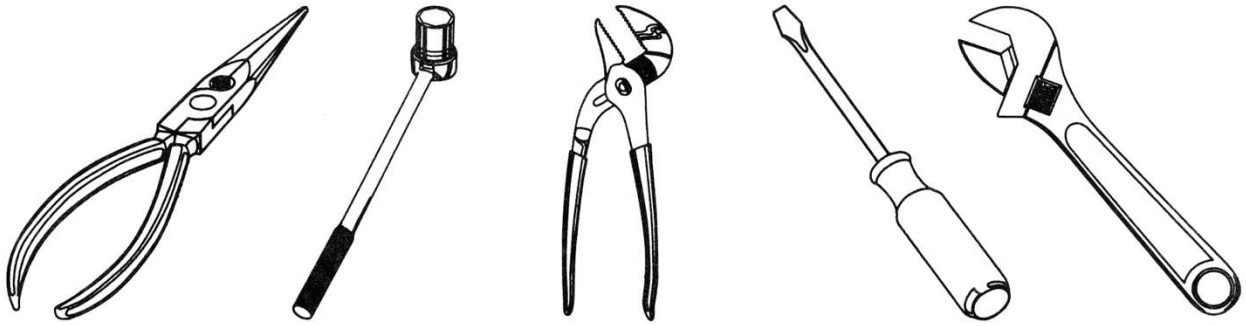


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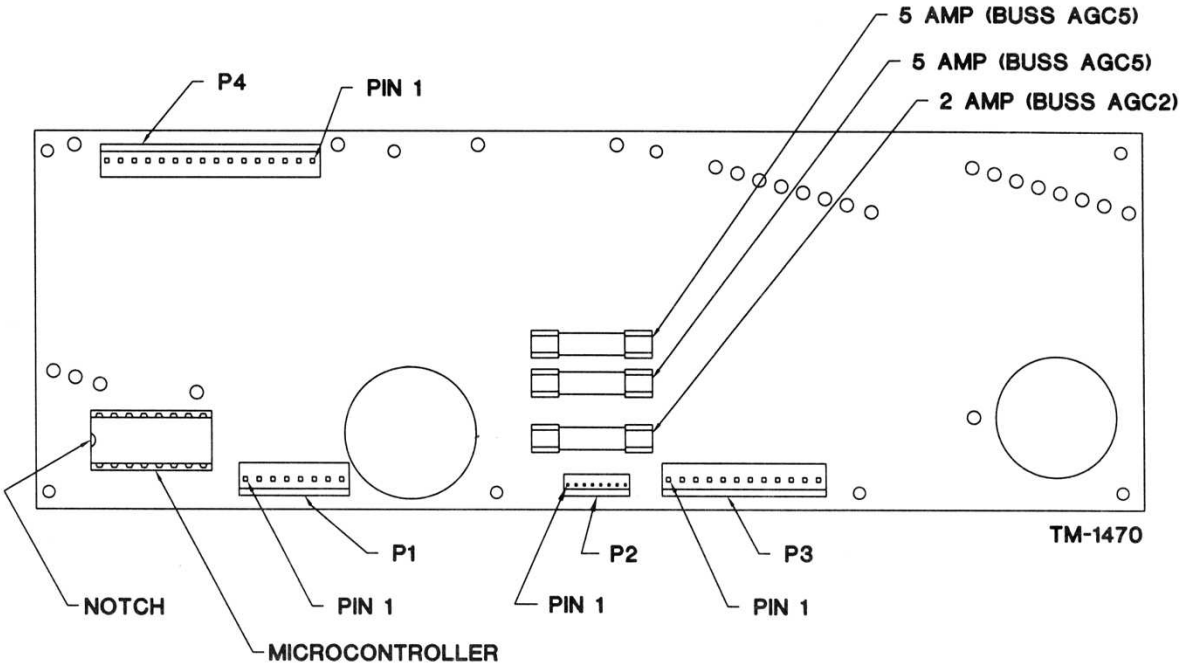
TABLE OF CONTENTS

POWERBOSS SYSTEM CIRCUIT BOARD CONNECTIONS



CONNECTOR P1

PIN 1 TANK PROBE 1 (-), NO.57
PIN 2 TANK PROBE 2 (+), NO.58
PIN 3 BRUSH UP SWITCH (-), NO.17
PIN 4 BRUSH UP SWITCH (+), NO.18
PIN 5 BRUSH DOWN SWITCH (-), NO.23
PIN 6 BRUSH DOWN SWITCH (+), NO.22
PIN 7 ON/OFF HANDLE SWITCH (-), NO.55
PIN 8 ON/OFF HANDLE SWITCH (+), NO.56

CONNECTOR P2 (KEYPAD)

PIN 1 KEYPAD ROW 1 (TOP ROW)

PIN 2 KEYPAD ROW 2 (BOTTOM ROW)

PIN 3 KEYPAD COLUMN 1 (FAR LEFT COLUMN)

PIN 4 KEYPAD COLUMN 2 (CENTER LEFT COLUMN)

PIN 5 KEYPAD COLUMN 3 (CENTER RIGHT COLUMN)

PIN 6 KEYPAD COLUMN 4 (FAR RIGHT COLUMN)

PIN 7 STATIC GROUND

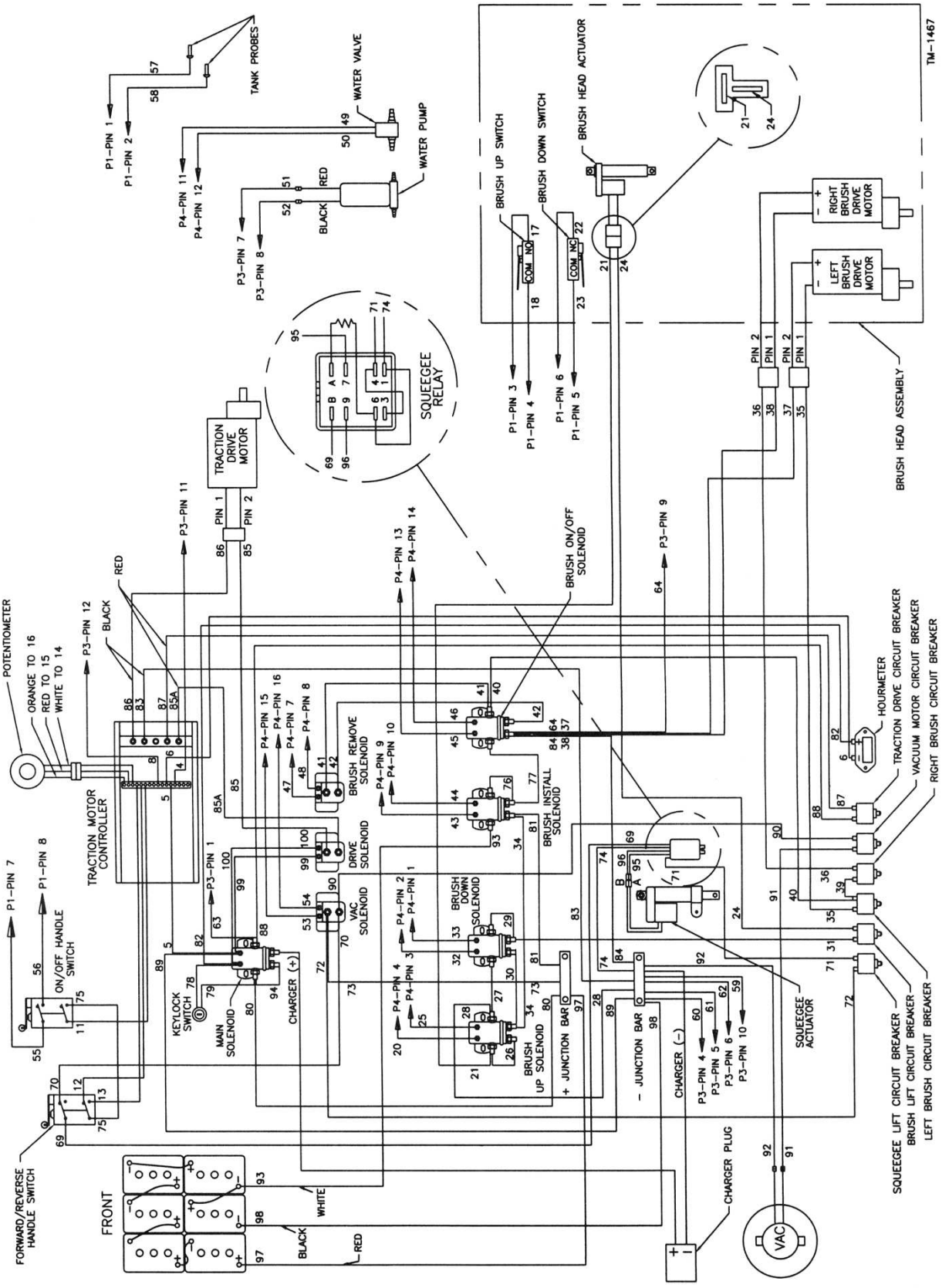
CONNECTOR P3

PIN 1 MAIN SOLENOID, NO.63
PIN 2 NOT USED
PIN 3 NOT USED
PIN 4 (-) JUNCTION BAR, NO.60
PIN 5 (-) JUNCTION BAR, NO.61
PIN 6 (-) JUNCTION BAR, NO.62
PIN 7 WATER PUMP (+), NO.51
PIN 8 WATER PUMP (-), NO.52
PIN 9 LOAD INDICATOR (+), NO.64
PIN 10 LOAD INDICATOR (-), NO.59
PIN 11 BATTERY LOW INDICATOR (+), NO.4
PIN 12 BATTERY LOW INDICATOR (-), NO.8

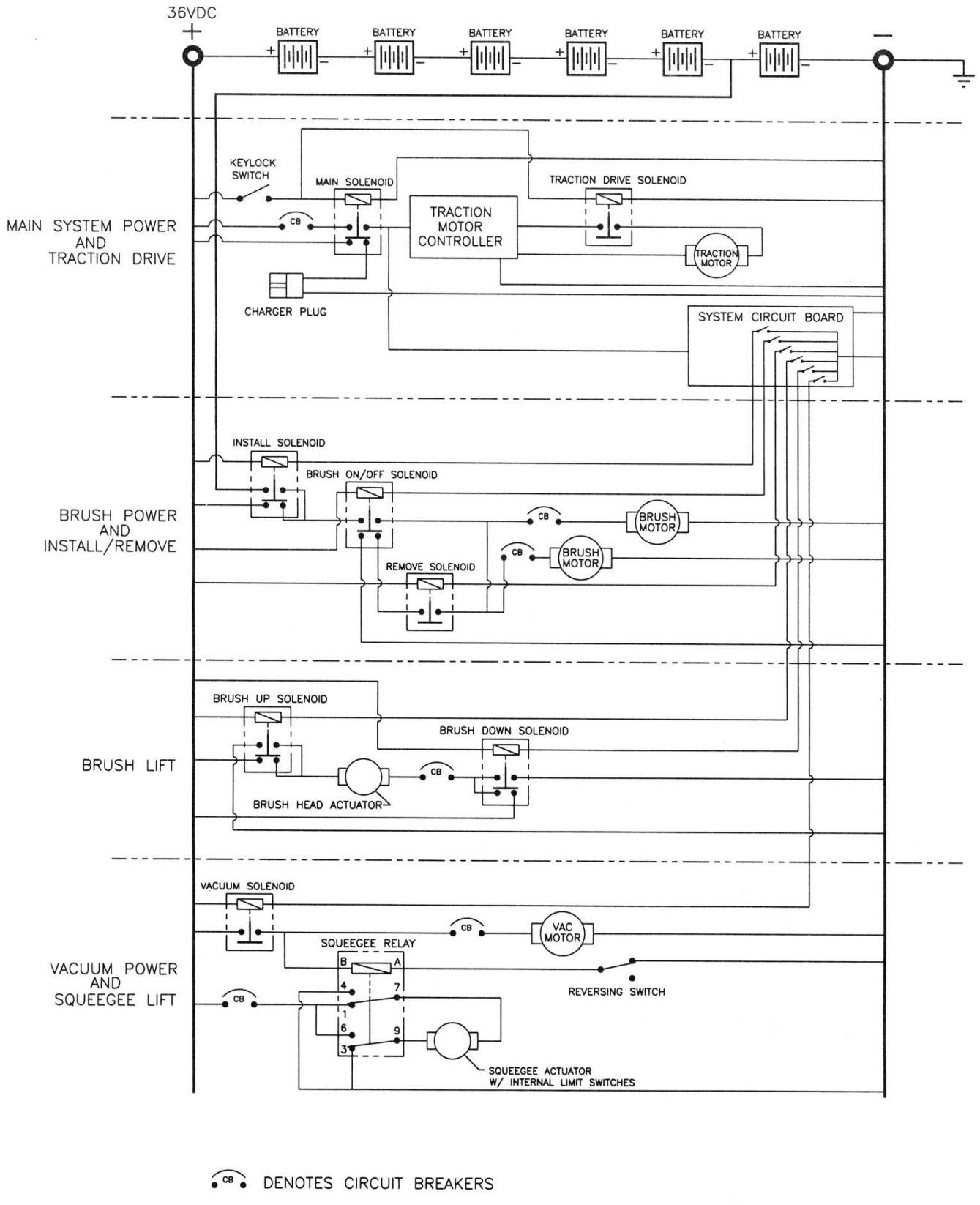
CONNECTOR P4

PIN 1 BRUSH DOWN SOLENOID (+), NO.33
PIN 2 BRUSH DOWN SOLENOID (-), NO.32
PIN 3 BRUSH UP SOLENOID (+), NO.25
PIN 4 BRUSH UP SOLENOID (-), NO.20
PIN 5 NOT USED
PIN 6 NOT USED
PIN 7 REMOVE SOLENOID (+), NO.47
PIN 8 REMOVE SOLENOID (-), NO.48
PIN 9 INSTALL SOLENOID (+), NO.43
PIN 10 INSTALL SOLENOID (-), NO.44
PIN 11 WATER VALVE (+), NO.49
PIN 12 WATER VALVE (-), NO.50
PIN 13 BRUSH ON/OFF SOLENOID (+), NO.45
PIN 14 BRUSH ON/OFF SOLENOID (-), NO.46
PIN 15 VAC SOLENOID (+), NO.53
PIN 16 VAC SOLENOID (-), NO.54

POWERBOSS WIRING DIAGRAM



POWERBOSS POWER CIRCUIT DIAGRAM



STARTING OUT

With the keylock switch off, remove the two instrument panel screws, and flip the instrument panel over onto the recovery tank. Turn the keylock switch on. Use a voltmeter set on DC volts. In each case the black or negative lead of the voltmeter goes to the connector pin that's denoted (-), and the red or positive lead of the voltmeter goes to the connector pin that's denoted (+). See the PowerBoss System Circuit Board Connections diagram on the previous page to help identify the connector pins.

PART 1, UNPREDICTABLE BEHAVIOR

The only known causes for unpredictable behavior are shown below. Unpredictable behavior is a reaction that should not normally happen under any circumstances, such as a change in the water flow rate when the vacuum button is pushed, etc. This does not cover instances where something that should happen does not happen. There could be several reasons why an anticipated reaction does not occur. (See Part 2)

1. Brush Up and Brush Down switches both closed at the same time.

   Easy Test to verify that a brush up or down switch or the wiring is a problem:

   Disconnect the plug from P1 on the circuit board and turn the key switch on. Try to turn on the vacuum motor and change the solution flow levels. These two controls should work normally unless there is a circuit board or a microcontroller problem. (None of the other buttons will function)

   If the vac button and flow level button work O.K., connect the P1 Plug to the circuit board and disconnect the big 12 pin connector at the front of the machine and retry the test. If the vac button and the flow level control button still work O.K., the problem is in the brush head wiring or the brush up or brush down switches themselves. If these functions fail it indicates a problem in the wiring between the P1 harness plug on the circuit board, and the 12 pin harness plug up front. (Note: Machines produced after December 1994 will not have the 12 harness plug.)

   A. Test Voltage across P1-3(grd)&P1-4(+) 0VDC indicates brush up switch is closed. (Should only happen if head is up) 2-5VDC indicates brush up switch is open.

   B. Test Voltage across P1-5(grd)&P1-6(+). 0VDC indicates that brush down switch is closed. (Should only happen if head is down.). 2-5VDC indicates brush down switch is open. (If both readings are 0VDC there is a switch or wiring problem)

2. Key turned off then back on too quickly. (Allow 5 seconds before turning back on.)
3. Faulty Microcontroller Chip #027156.
4. Faulty Circuit Board #027129.
5. Faulty Keypad #027128.

PART 2, WHEN A DESIRED FUNCTION DOES NOT WORK

WHEN THE BRUSH ON/OFF BUTTON IS PUSHED THERE ARE 3 NORMAL REACTIONS:

1. If brush head is not up and the tank is not full, the following conditions should be true:

   A. Probe contacts should be open. Voltage across P1-1(grd)&P1-2(+) should be about 2VDC. (A reading of 0VDC indicates a full recovery tank or dirty probes)

   B. Brush up switch should be open. Voltage across P1-3(grd)&P1-4(+) should be about 2-4VDC. (A reading of 0VDC indicates a brush up switch or wiring problem)

   C. Brush Up solenoid should activate until brush is completely up. Voltage across P4-3(+) & P4-4(grd) should be about 36VDC. (If the above tests for A&B are as expected, a reading of 0VDC here indicates a faulty microcontroller, circuit board, or keypad)

2. If brush head is up and the tank is not full, following conditions should be true:

   A. Probe contacts should be open. Voltage across P1-1(grd)&P1-2(+) should be about 2VDC. (A reading of 0VDC indicates a full recovery tank or dirty probes)

   B. Brush up switch should be closed. Voltage across P1-3(grd)&P1-4(+) should be 0VDC. A reading of 2-4VDC indicates a brush up switch or wiring problem)

C. Brush down switch should be open. Voltage across P1-5(grd)&P1-6(+) should be 2-4VDC. (A reading of 0VDC indicates a brush down switch or wiring problem).

D. Brush Down Solenoid should activate until brush down switch closes. Voltage across P4-1(+) & P4-2(grd) should be 36VDC. (If the above tests for A,B,&C are as expected, a reading of 0VDC here indicates a faulty Microcontroller chip or circuit board)

E. Solution should come on. Voltage across P4-11(+)& P4-12(grd) should be 36VDC. (If the above tests for A,B,&C are as expected, a reading of 0VDC here indicates a faulty Microcontroller chip or circuit board).

F. **Brush power should come on for at least 2 seconds** after the brush up switch opens. Note: This will not happen if the brush head stays up. Voltage across P4-13(+)& P4-14(grd) should be 36VDC. (If the above tests for A,B,&C are as expected, a reading of 0VDC here indicates a faulty Microcontroller chip or circuit board)

3. If tank is full then there should be no reaction except to turn off the tank full indicator light.

PROCEDURES

REMOVING BACK COVER

1. Disconnect red and black battery leads in the battery compartment.
2. Remove the two screws from back edge of control panel, slide the control panel back slightly, then lift the panel up off the rear plastic cover.
3. Loosen the set screws on back side of actuator handle on both ends. (REAR COVER ASSEMBLY, Page 14, Item 41)
4. Remove the actuator shaft (REAR COVER ASSEMBLY, Page 14, Item 36) from each end of the actuator handle, and set the actuator handle aside.
5. Remove the two rigid handle screws (REAR COVER ASSEMBLY, Page 14, Item 23) and remove the rigid handle (REAR COVER ASSEMBLY, Page 14, Item 35) by pulling the handle up, out of its mounting sockets.
6. Remove the four mounting screws around the rear cover. (REAR COVER ASSEMBLY, Page 14, Item 34)
7. Remove the two screws on each side of the brake knob. (REAR COVER ASSEMBLY, Page 14, Item 12)
8. Remove the two screws on each end of the circuit breaker panel. (REAR COVER ASSEMBLY, Page 14, Item 14)
9. Remove the rear cover and set aside.

REPLACING THE CONTROL PANEL

1. Disconnect red battery lead in the battery compartment.
2. Remove the two screws from back edge of control panel, slide the control panel back slightly, then lift the panel up and forward of the handle and flip upside down.
3. Remove the two wires from the keylock switch.
4. Disconnect speed control potentiometer plug from the machine's wiring harness
5. Disconnect the three harness plugs from control panel circuit board. Set the old control panel aside.
6. Connect the three harness plugs to the new control panel circuit board, taking care to make sure the edges of each plug is even with the edges of the corresponding connector on the circuit board.
7. Connect the speed control potentiometer plug to the machine's wiring harness.
8. Connect the two wires to the keylock switch.

9. Place the control panel in position with the tabs along the front edge under the plastic cover, and install the two screw on the back edge of the control panel.
10. Reconnect the red battery lead in the battery compartment.

REPLACING THE MICROCONTROLLER CHIP

WARNING: CHIP IS STATIC SENSITIVE. DO NOT TOUCH WITHOUT FIRST TOUCHING A GROUNDED OBJECT OR SURFACE. EXAMPLES OF GROUNDED OBJECTS INCLUDE: METAL WATER PIPES, ELECTRICAL CONDUIT, METAL RECEPTICAL PLATES, ETC.

1. Disconnect red battery lead in the battery compartment.
2. Remove the two screws from back edge of control panel, slide the control panel back slightly, then lift the panel up and forward of the handle and flip upside down.
3. Touch an exposed screw on the backpanel of the machine to dissipate any static electricity that could harm the microcontroller chip.
4. Using a small flat blade screw driver, gently pry up each end of the microcontroller chip and pull the chip straight up and off of the system circuit board.
5. Insert the new microcontroller chip with the chip notch (see figure) on the correct end. Make sure that all of the pins are started into the socket before pressing the chip to firmly seat it in place.
6. Place the control panel in position with the tabs along the front edge under the plastic cover, and install the two screw on the back edge of the control panel.
7. Reconnect the red battery lead in the battery compartment.

COMMON PROBLEM SYMPTOMS

1. BRUSH INSTALL AND REMOVE DO NOT FUNCTION.

   REASON- Traction Drive ON/OFF Switch not set properly (Microcontroller thinks machine is moving).

   HOW TO VERIFY- Turn Brush on with control bar released. Brush motors should shut off after about 2-3 seconds.

   FIX- Readjust switches by bending lever or repositioning cams.

2. NO BRUSH RELATED FUNCTIONS WORK (See PowerBoss Service bulletin #311)

   REASON- Brush UP Cut-out switch on brush head is turning actuator off before Brush Up switch is triggered. (Microcontroller thinks head is never up)

   HOW TO VERIFY- With brush head in up position, turn key switch off. Remove front gray cover. Reach around to back side of actuator and see if pressing up on the lever on the right side of the machine (with wires #17 and #18) makes the switch trigger (click). If so, this verifies the problem.

   FIX- Remove wires #19 & #20 from the brush up cut-out switch. Connect these wires together permanently using a wire nut or a wire splice connector. For more detailed information see PowerBoss service bulletin #311. (Note: Machines produduced after December 1994 will not have the brush up cut-out switch or wires #19 & #20.)

3. ALL THE LIGHTS ON THE BRUSH LOAD INDICATOR ARE ON, EVEN IF BRUSH IS "OFF"

   REASON- Bad connection on wire #64 (P3-9) or wire #59 (P3-10).

   HOW TO VERIFY- With the brush head in the up position, turn the key switch on. With a voltmeter, check the voltage between P3-9 (+) and P3-10 (-). A reading other than 0 volts indicates a wiring problem.

   FIX- Check and fix connection problem. Problems generally would occur on the P3 plug end of the wires. Note: To allow the machine to be used, a jumper wire can be connected from P3-9 to P3-10. This will disable the lights on the panel.

4. WHEN THE BRUSHES ARE TURNED ON, THE BRUSH HEAD GOES ALL THE WAY DOWN, LIFTING THE MACHINE OFF THE FLOOR.

   REASON- If there is not enough slack in the wires going to the brush head switches, wires can be pulled loose as the brush head goes to the floor, disabling the brush down switch. (A faulty brush down switch can cause this same problem)

   HOW TO VERIFY- Remove the front gray cover, and examine wires #17 & #18 on the switch on the front side of the brush head actuator and at the plug where the harness passes through the frame at the front of the machine. If everything seems to look O.K., turn the key switch on, and press the brush ON/ OFF button. When the head starts to put pressure on the floor, turn the keylock switch off. Now using an ohmmeter, check the resistance across wires #17 and #18 on the brush down switch. A resistance of more than 10 ohms indicates a bad switch. If the switch is O.K., disconnect the harness plug, if equipped with one, and check the resistance between wires #17 and #18 on the plug pins. A resistance of more than 10 ohms indicates a bad connection to the brush head switch. If this is less than 10 ohms, reconnect the plug and try measuring the resistance across wires #17 and #18 on the back side of the plug from the machine. A resistance of more than 10 ohms indicates a bad plug connection.

   FIX- Repair the faulty connection. If there is not enough slack in the wires leading to the brush head switches, clip the wire ties and re-tie the wires with adequate slack.

DEBUGGING THE TRACTION DRIVE CIRCUIT

The traction drive system is independent of the system circuit board on the back of the instrument panel. The entire traction drive circuit is shown on the following page. Each component can be tested individually.

TESTING THE POTENTIOMETER

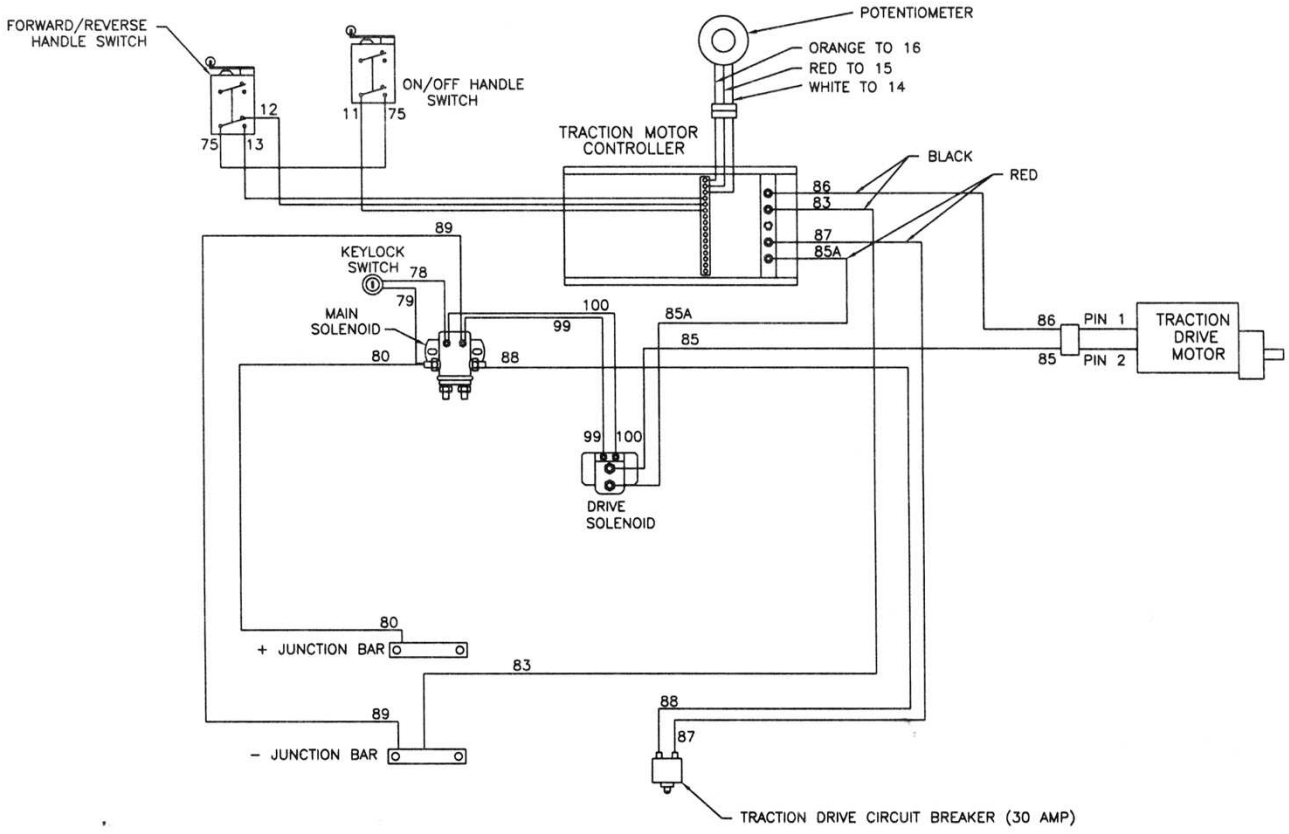
To test the potentiometer requires the use of an ohmmeter. Unplug the potentiometer from the machine.

TEST 1- Place one ohmmeter lead on the red center potentiometer wire. Place the other ohmmeter lead on the white potentiometer wire. With the potentiometer turned as far as possible counterclockwise, there should be a reading of 4000-5200 ohms. As the knob is turned clockwise, the reading should decline smoothly. With the knob in the full clockwise position, there should be a reading of less than 50 ohms.

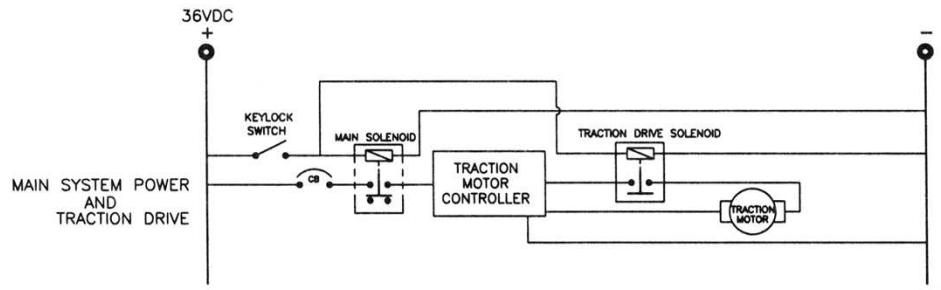
TEST 2- Next place one ohmmeter lead on the red center potentiometer wire. Place the other ohmmeter lead on the orange potentiometer wire. With the potentiometer turned as far as possible clockwise, there should be a reading of 4000-5200 ohms. As the knob is turned counterclockwise, the reading should decline smoothly. With the knob in the full counterclockwise position, there should be a reading of less than 50 ohms.

Test 3- Place one ohmmeter lead on the white potentiometer wire, and the other ohmmeter lead on the orange potentiometer wire. There should be a reading of 4000-5200 ohms regardless of the knob position.

TRACTION DRIVE CIRCUIT DIAGRAM



POWER CIRCUIT SHOWN BELOW



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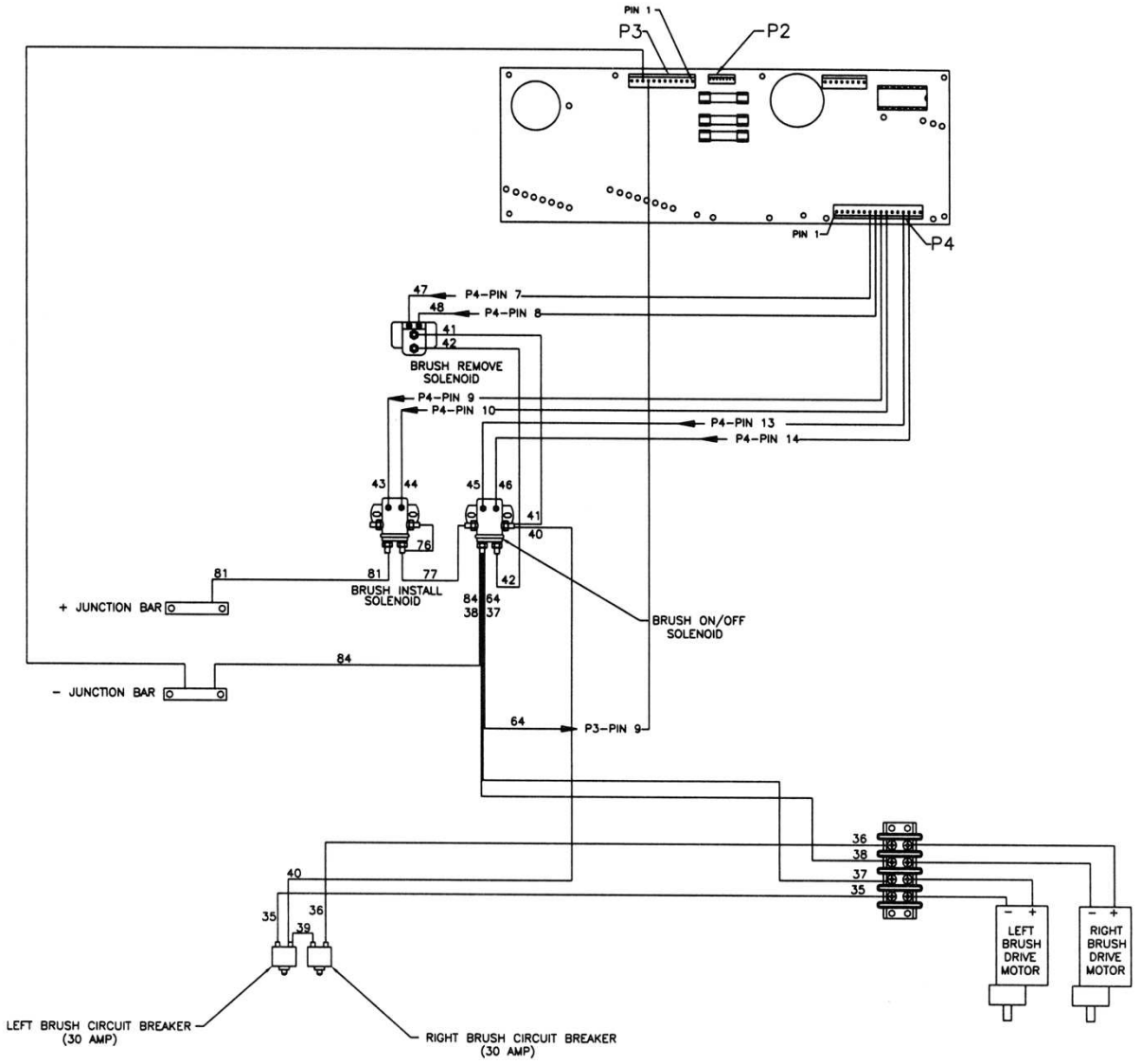
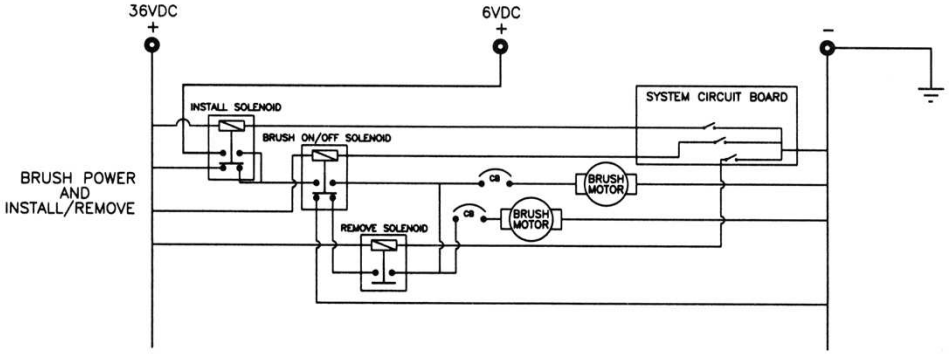
BRUSH DRIVE POWER CIRCUIT DIAGRAM

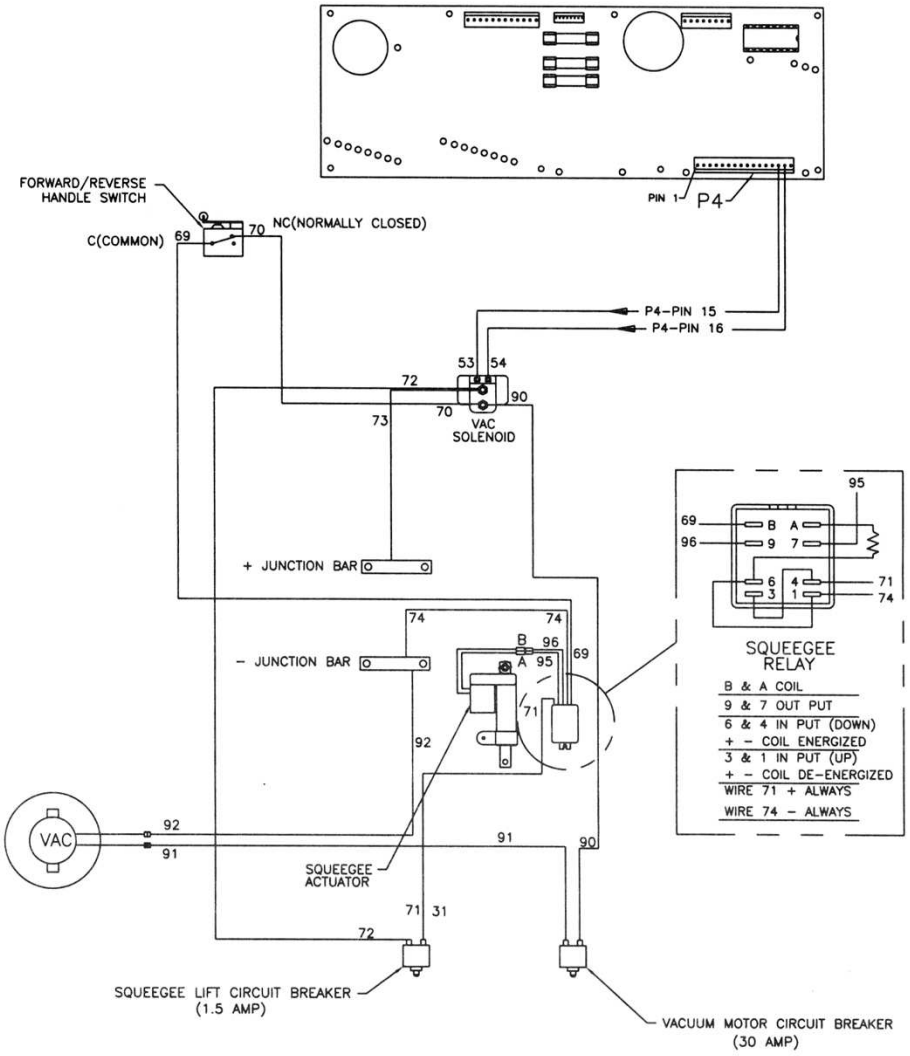


POWER CIRCUIT CONNECTIONS SHOWN BELOW



TM-1510

VACUUM AND SQUEEGEE LIFT CIRCUIT DIAGRAM



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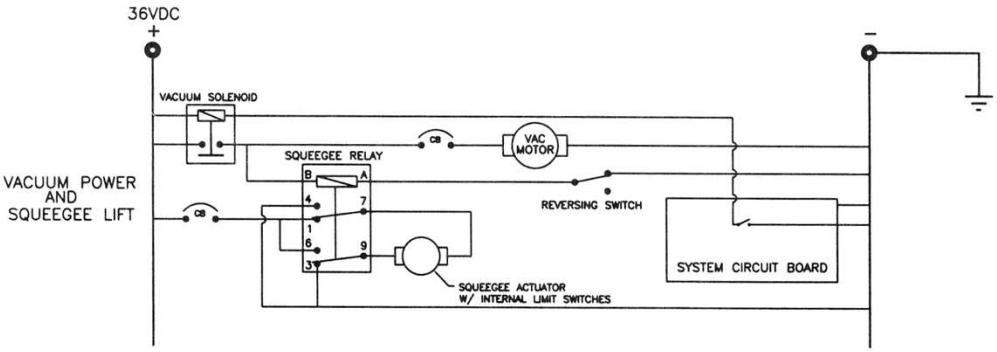
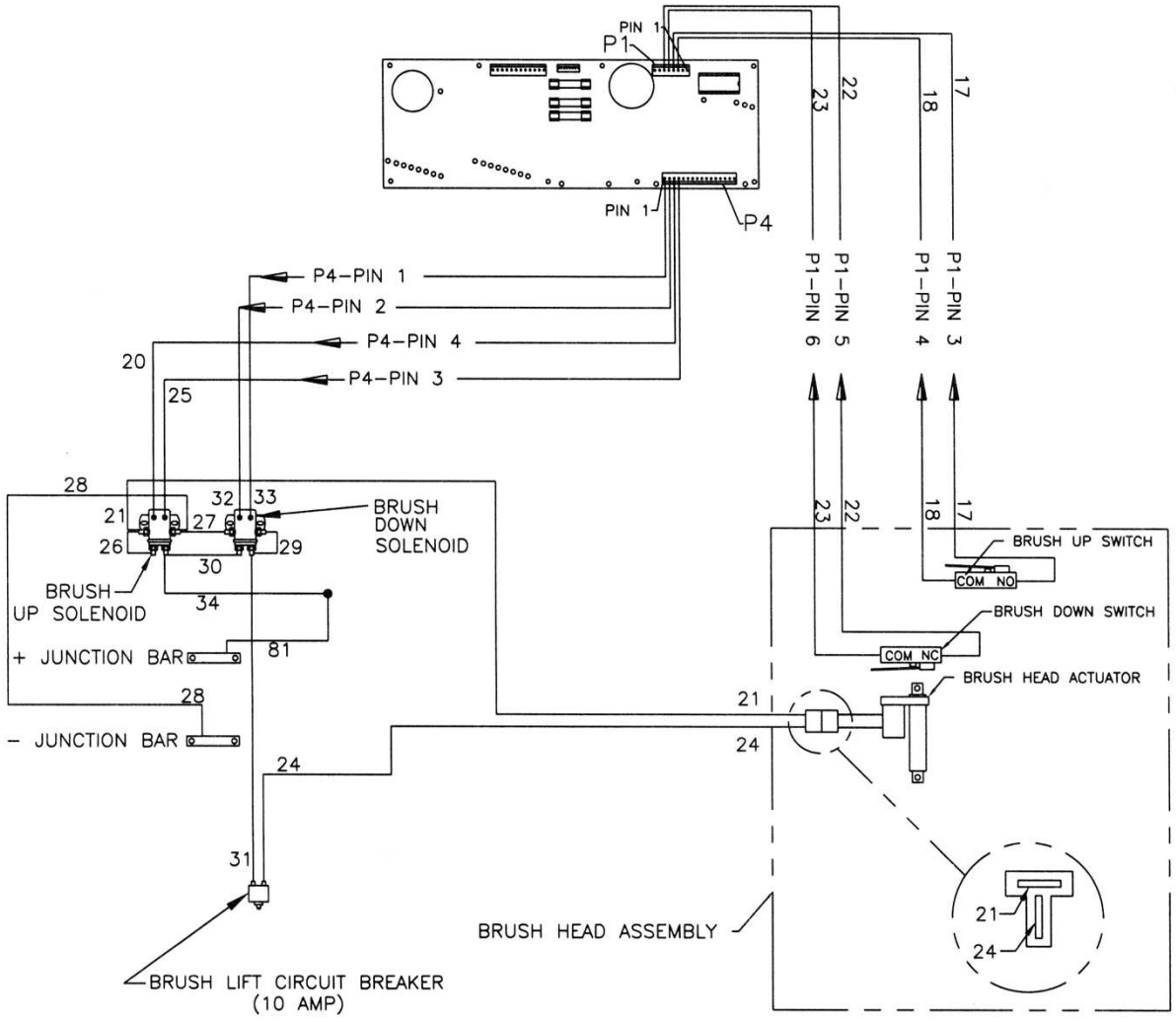


TM-1596

BRUSH LIFT POWER CIRCUIT DIAGRAM



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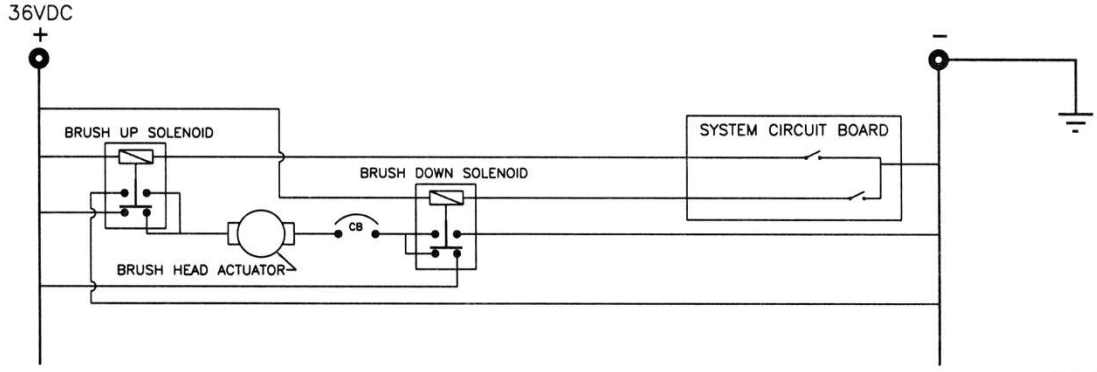

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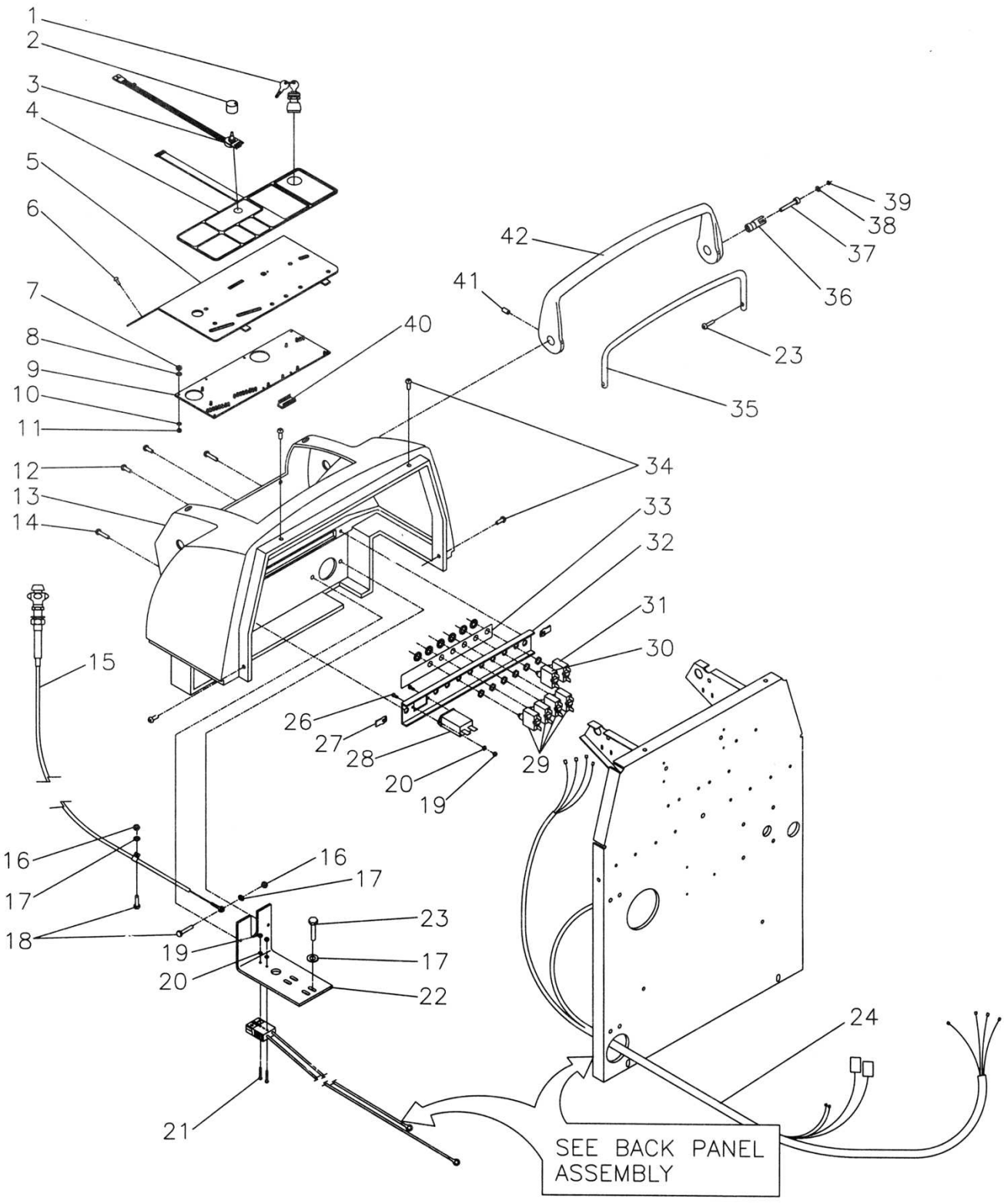
REAR COVER ASSEMBLY



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