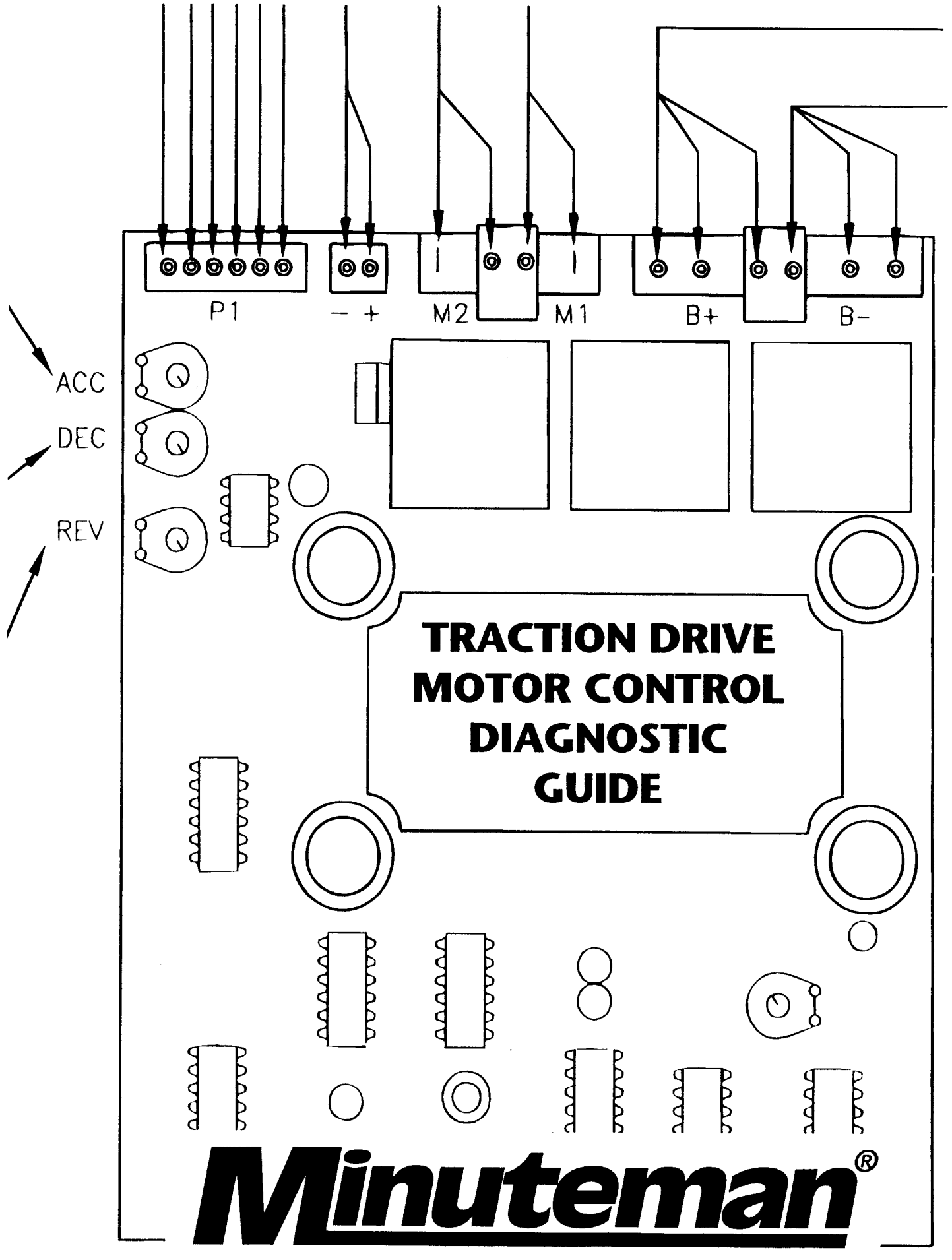

P1
– +
M2
M1
B+
B-
ACC
DEC
REV
TRACTION DRIVE
MOTOR CONTROL
DIAGNOSTIC
GUIDE
Minuteman®

Diagnosing Your Traction Drive Problems: Getting Started

All Minuteman® Automatic Scrubbers use a Curtis® Brand Traction Drive Motor Controller. Doing so allows for similar diagnosis procedures between the various size scrubbers, and makes your job as a Repair Technician that much easier. Understanding how the motor controller functions and what features have been designed into the controller, will also enable you to cut your diagnosis time in half, and allows you to repair a scrubber drive system with confidence the first time out.

Features designed into the Minuteman motor control by Curtis:

1). Polarity Protection

This feature is designed to prevent any damage to the motor controller, in the event that the batteries for the unit have been installed improperly. The control board will shutdown and no damage will result to the control board. Reverse polarity of the batteries **will damage** the diodes on the relays and contactors of the unit. Replacement of the diodes will be necessary.

2). Low Voltage Shut-Down

This feature protects the electrical components on the scrubber from being run at too low of a voltage, which could cause premature motor, contactor, or switch failure. The speed control board will turn off at a predetermined voltage level. When this happens, the unit will stop propelling itself. The brush and vacuum motors must be turned off to allow the voltage to rise. When the voltage rises past the shut-off point, the traction drive will again function, to allow the operator to return the unit back to the charger. Typically, a 24 volt board will shut down at approximately 16 volts and a 36 volt battery will shut down at approximately 28 volts.

3). Potentiometer Fault Detection

This feature will turnoff the motor controller if a potentiometer wiper is defective or an open occurs in the potentiometer circuit. NOTE: All models use a switch to open and close the potentiometer red wire, which opens and closes the circuit.

4). Thermal Protection

This feature is designed to protect the control board in the event that a drive motor failure occurs. The excessive heat and current draw of a defective motor will cause the motor controller to shut down, if the current draw exceeds a predetermined level. This is a situation most likely to occur on a 260 & 320 Automatic. The 26/32/38B and 200 Automatic incorporates a circuit breaker in the system.

TROUBLESHOOTING THE CONTROL BOARD

When diagnosing the motor controller it is important not to overlook the obvious, or become intimidated by a traverse drive failure. The Curtis Motor Controller used on Minuteman Scrubbers is a highly reliable unit that can last the lifetime of the machine without any maintenance.

Your very first step in diagnosing a failure is to look for the obvious. Ask yourself questions: Is the Traction Drive motor circuit breaker tripped? Look for visible signs of water damage. The control board insulator will be distorted, often wavy after the water dries. The back of the motor controller will have mineral deposits or signs of rust on it. It is not only important to be able to repair a control board failure, it is also important to find out what could have caused the failure and prevent it from reoccurring.

Another situation that can cause control board problems are loose or intermittent wire connections in the drive motor circuit. Loose connections can cause a voltage drop and high heat in the control wiring. A voltage drop could cause the board to turnoff prematurely. High heat at the control board could also cause the thermal protection to shutdown the control board.

One component that must always be inspected and tested after a control board failure are the diodes on each relay and contactor. The diodes are installed on each and every relay and contractor to protect the control board from voltage spikes. Voltage spikes are generated as the relays and contractors turn on and off. If a diode is defective or missing, the new board may soon fall victim because it wasn't protected by a diode. It is necessary to test the diodes with an OHM meter to ensure that they are functional.

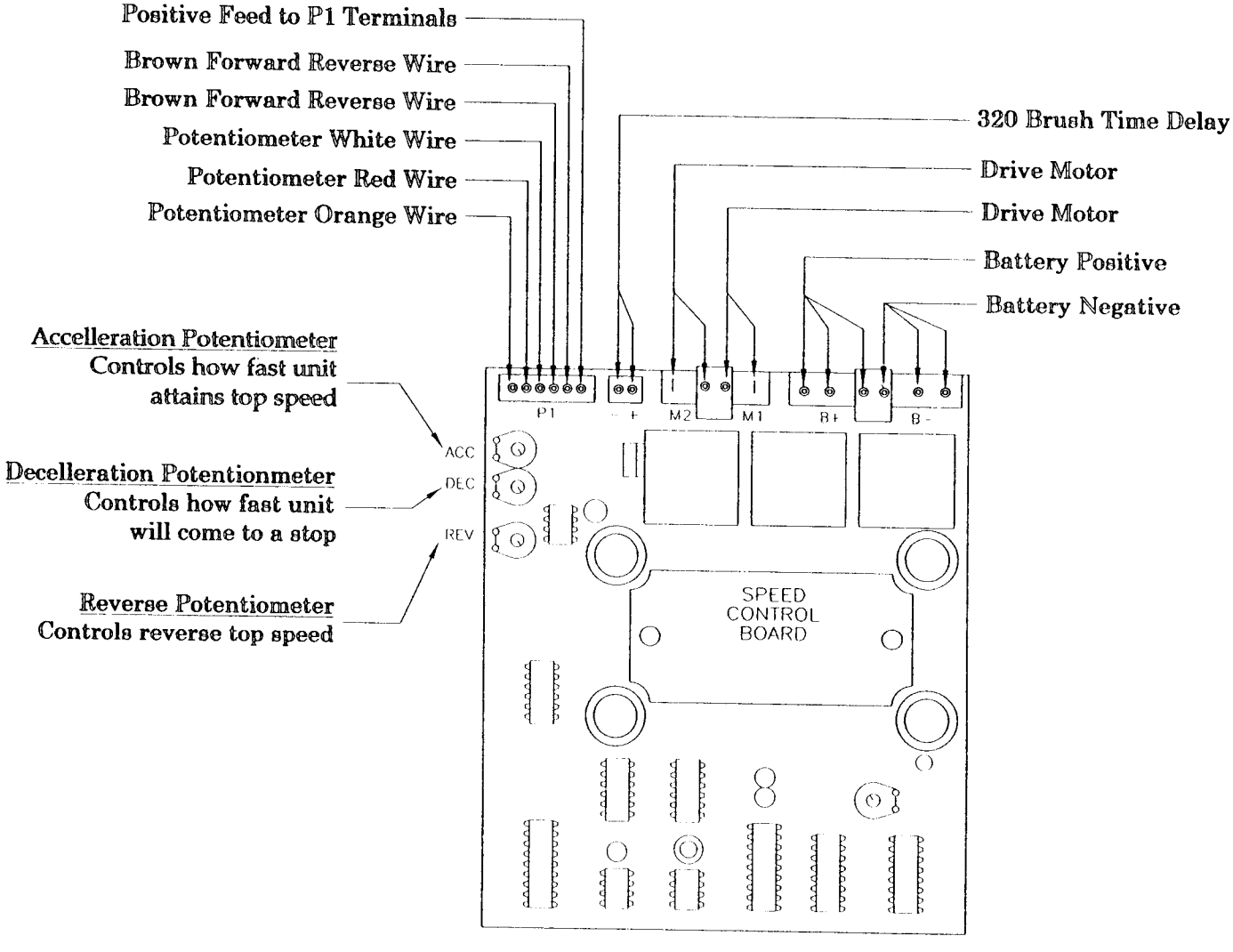
With all of these facts in mind and the following diagnosis charts, troubleshooting the control board should be relatively easy and straight forward.

Good Troubleshooting!!

QUESTIONS:

Call (800) 323-9420 and Ask for the Service Department

Speed Control Board



THE UNIT WILL NOT TRAVERSE IN FORWARD OR REVERSE

Is system voltage present across the B+ & B- terminals on the Controller Board? Example 24 & 36 Volts. Accurate measurements are critical.

Yes

Is voltage present across the M1 & M2 (motor) terminals on the Control Board? Turn rabbit control (potentiometer) to the fast position and activate dead man switch or drive lever, while testing. Voltage will vary.

Yes

Is circuit breaker open?

Yes

Repair the Circuit Breaker if applicable.

NO

Test the drive motor by applying power directly to the motor. (Caution: Jack up one side of the machine so one drive wheel is off the floor, while doing this test)

No

Is system voltage present on the positive feed wire that powers the P1 terminal pin? (See the drawing on page 3)

Yes

Test for voltage on the potentiometer? It should be about 5 volts + on the orange wire. Note some older models the white is 5+ instead of orange. Note measure from battery neg. to this pin.

Yes

Do you have 5 volts positive on the red potentiometer terminal when potentiometer is in full rabbit position?

Yes

Do you have 5 volts + on the P1 connector at the red potentiometer wire when activating the drive switch? Note: Insert a straightened paper clip along side of the wire on the connector while testing.

Yes

Replace the controller.

No

Test for continuity on the red wire between the potentiometer and P1 connector. Test Drive and Brake switch. Repair if needed.

Note: Models that have an extra resister may only have 3 volts.

No

Replace the potentiometer.

No

Check and repair faulty connections between the potentiometer and the control board. Check the P 1 connector, be sure that it is properly plugged on the board and the contacts in the connector are in good condition. Are they OK?

Yes

Replace the controller.

No

Repair the connections

No

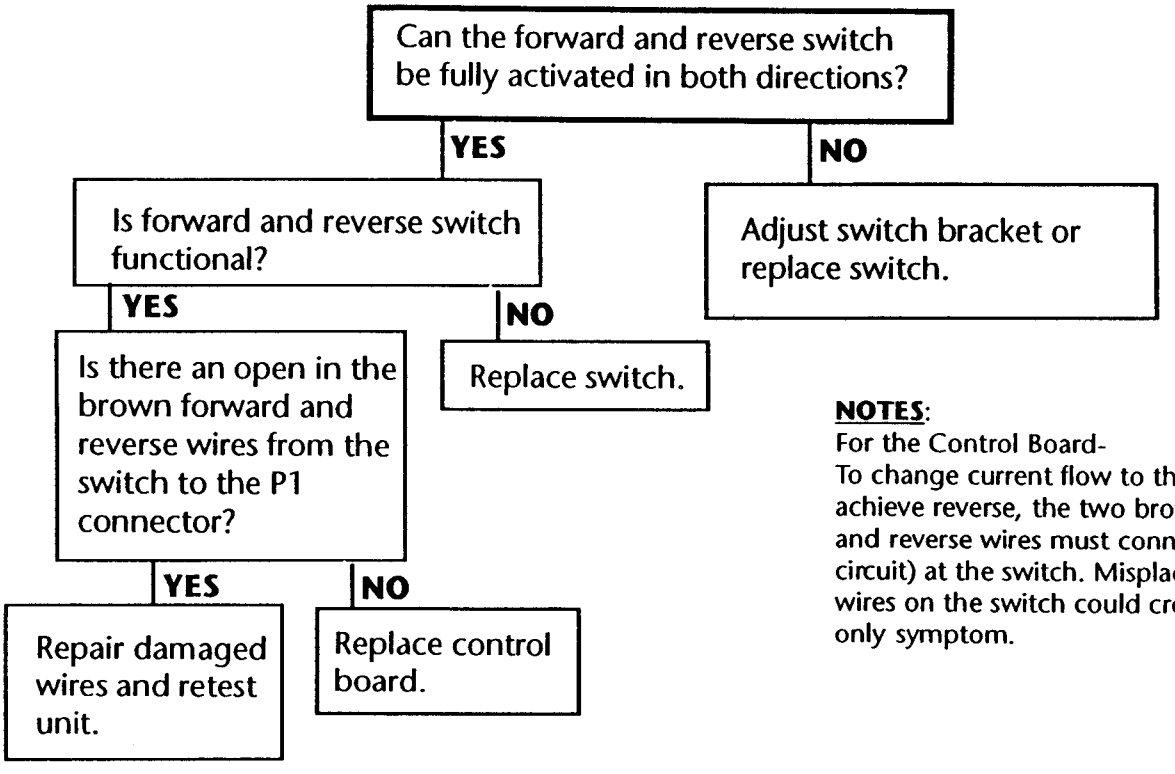
Trace wires out and restore power to the board.

NO

Check the main power switch, if applicable. Repair to allow B+ voltage to flow to P1 connector.

Unit Will Only Travel Forward

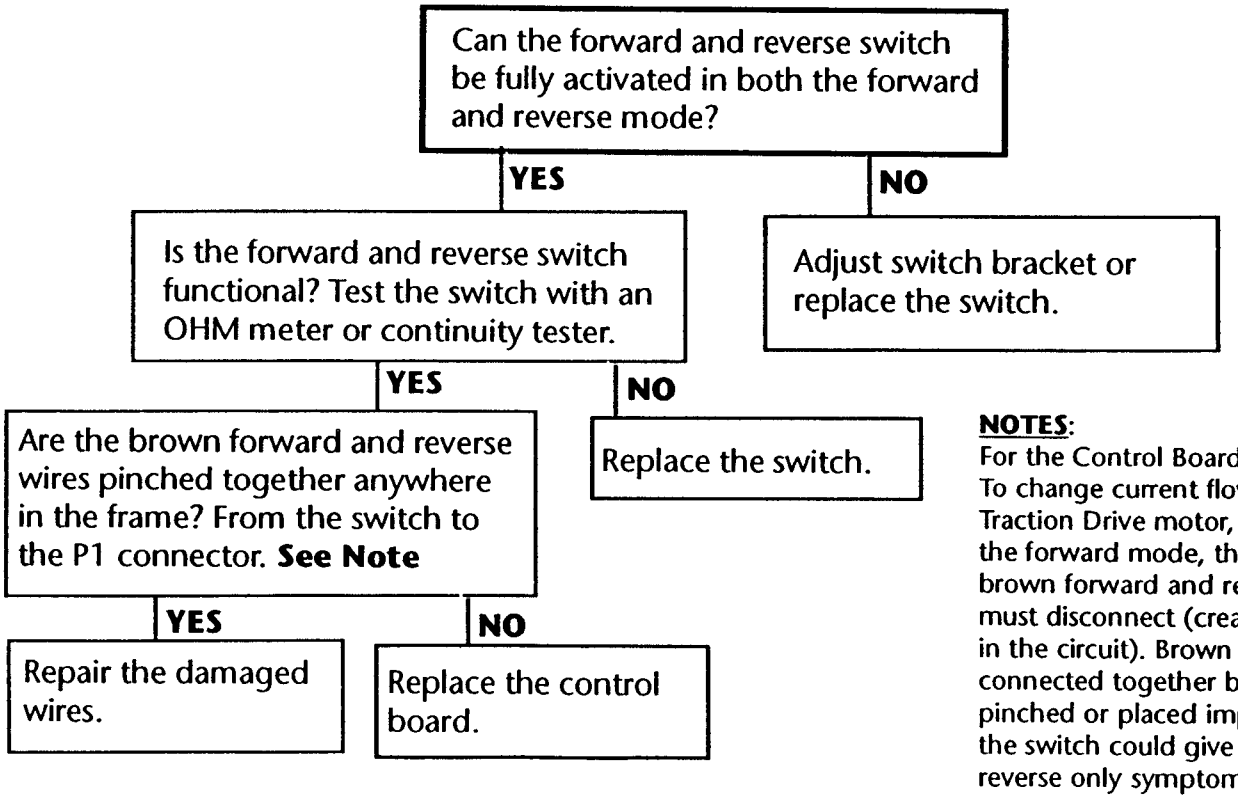
(Has Variable Speed in Forward)



NOTES:
For the Control Board-
To change current flow to the motor, to achieve reverse, the two brown forward and reverse wires must connect (close circuit) at the switch. Misplacement of the wires on the switch could create a forward only symptom.

Unit Will Only Travel In Reverse

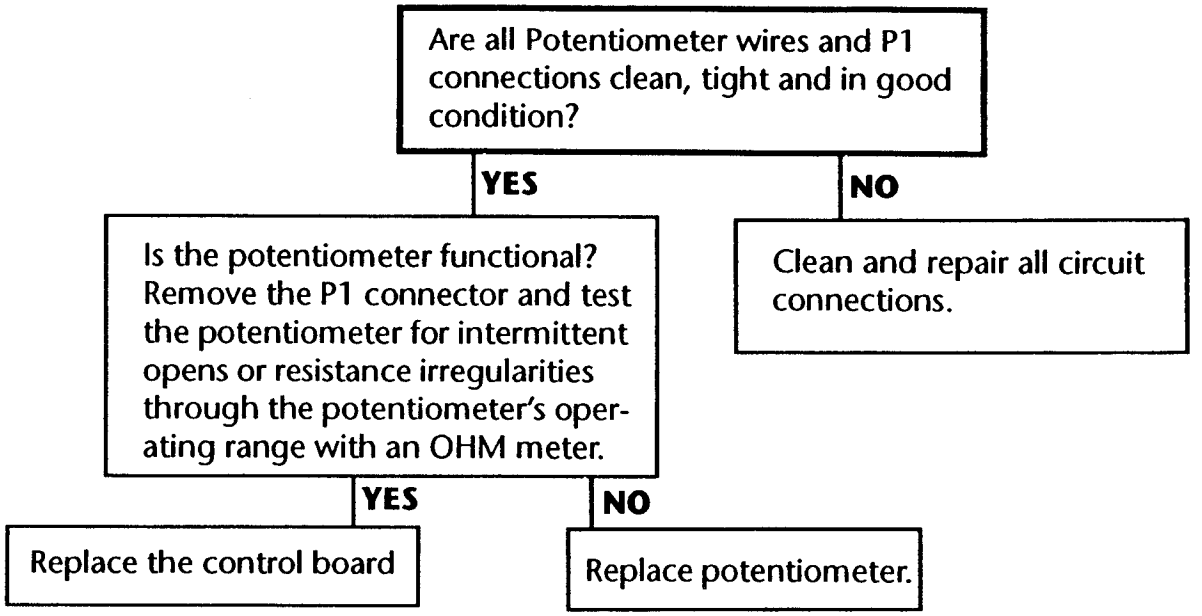
(Has Variable Speed in Reverse)



NOTES:
For the Control Board-
To change current flow to the Traction Drive motor, to achieve the forward mode, the two brown forward and reverse wires must disconnect (create an open in the circuit). Brown wires connected together by being pinched or placed improperly on the switch could give you a reverse only symptom.

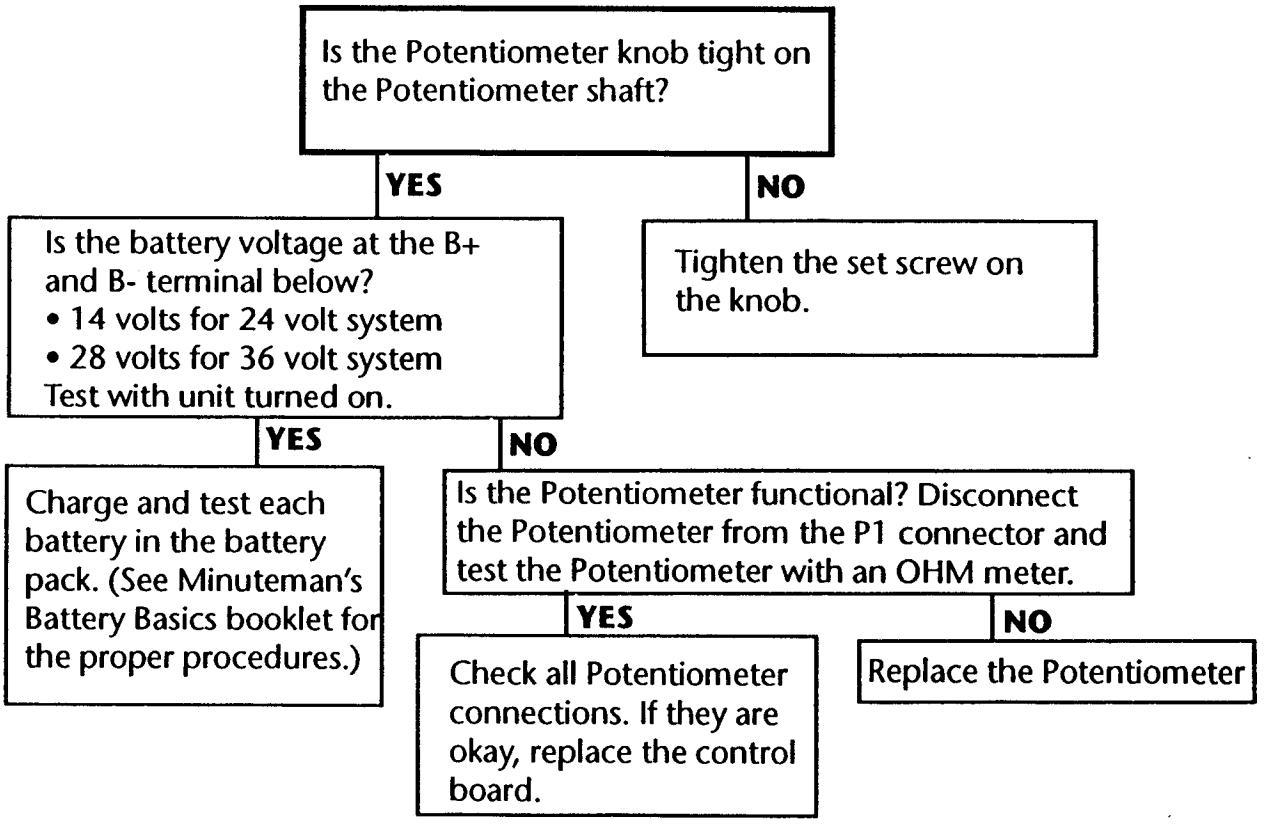
Machine's Travel Speed is Erratic

(With Potentiometer in a Fixed Position)

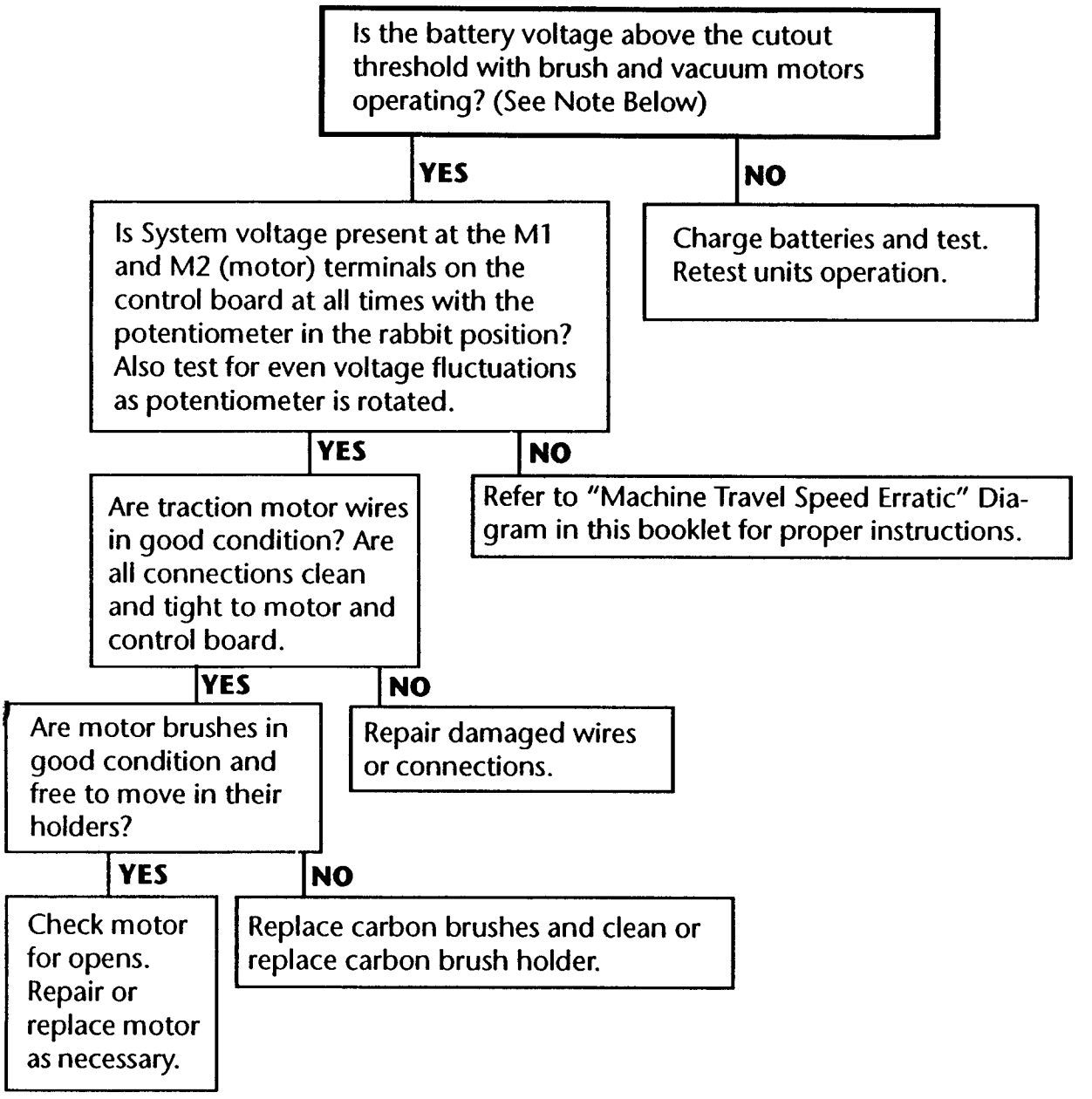


Machine Travels at One Speed Only

(Whether in Forward or Reverse)

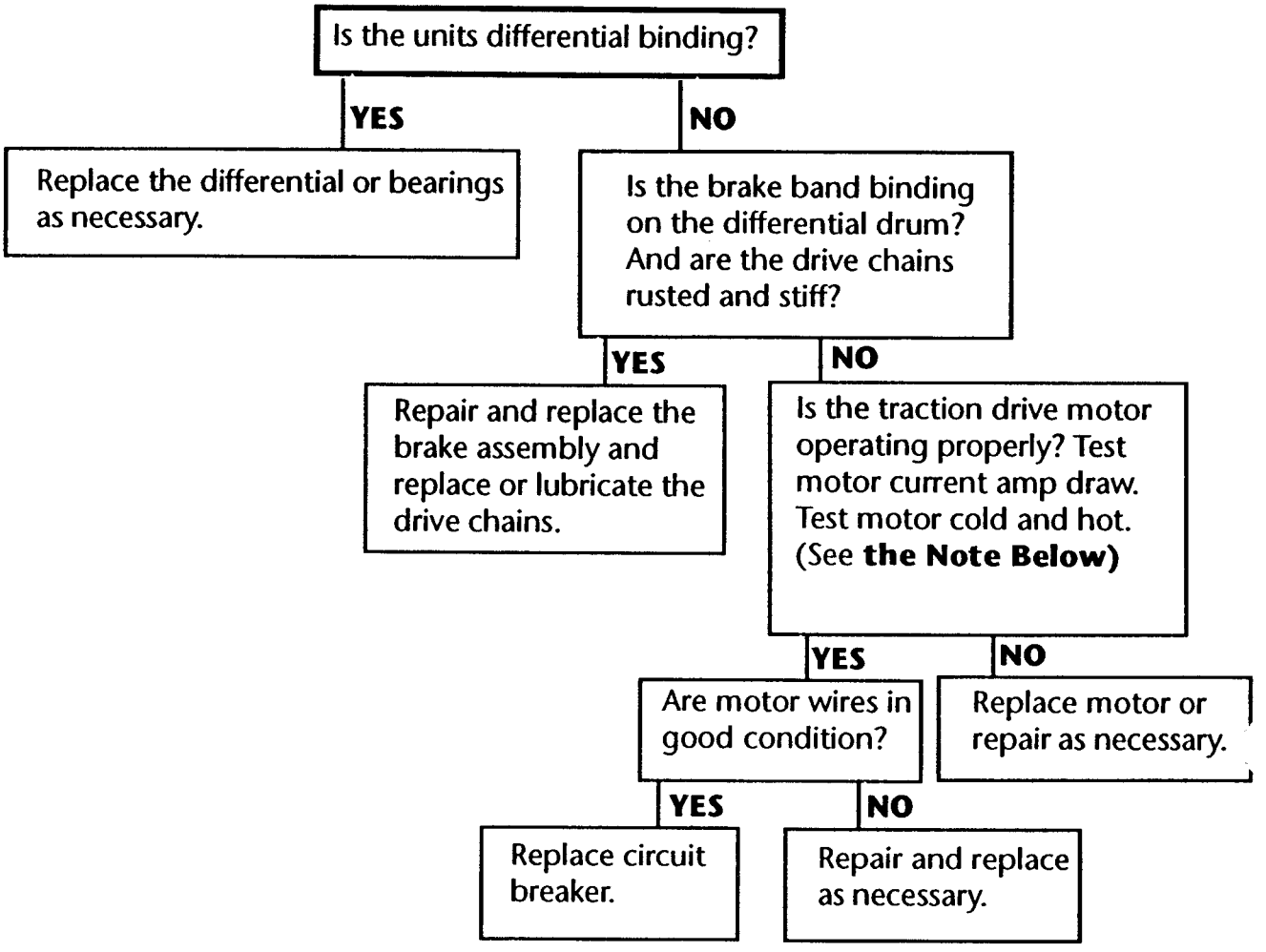


Machine Will Run for Short Periods & Stop



NOTES:
14 volts for a 24 volt system.
28 volts for a 36-volt system.

Machine Runs for Short Period of Time and then Blows the Traction Drive Circuit



NOTES:

Traction Drive Amperage Draws
200 Series Scrubbers - 11 to 16 amps
260 Series Scrubbers - 5 to 11 amps
320 Series Scrubbers - 5 to 11 amps
26/32/38B Scrubbers - 5 to 11 amps

The above amp draw readings were taken on a level concrete and tile floor.

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