



WARNING: HAZARDOUS VOLTAGE.

SHOCK OR ELECTROCUTION CAN RESULT.

Use care when performing the troubleshooting tests that are outlined in this manual.

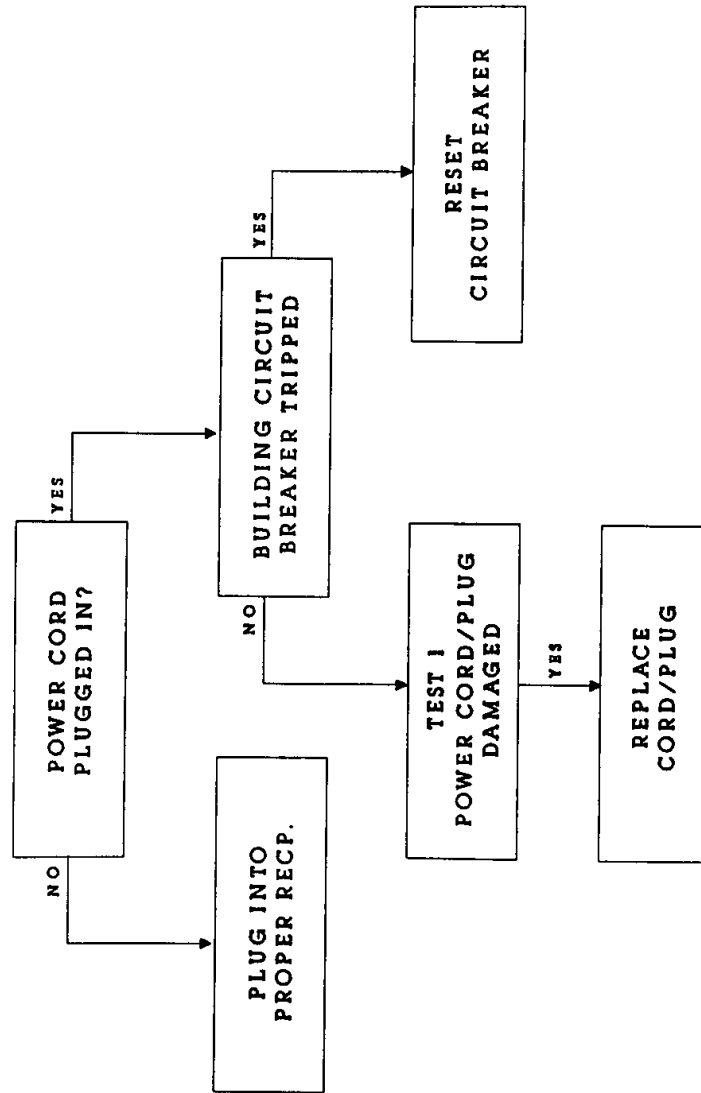
Line voltage represented in this troubleshooting guide was based on 120 VAC, variations will occur based on building line voltage.

1. Troubleshooting	Page No.
Table of Contents - Troubleshooting	1
Troubleshooting Chart	2
A. Machine does not power up - Flow chart	3
1a. Test 1 Line Voltage	4
2a. Test 2 Ground Circuit	5
B. Vacuum motor does not operate - Flow chart	6
1b. Test 1 Vacuum Switch	7
2b. Test 2 Vacuum Motor	8
C. Pump does not run - Flow chart	9-10
1c. Test 1 Wiring & Connections	11
2c. Test 2 Mode Switch	12
3c. Test 3 Pressure Switch	13
D. Brush does not run - Flow chart	14-15
1d. Test 1 Trigger Switch	16
2d. Test 2 Rectifier	17
3d. Test 3 Amp Gauge	18
E. Brush circuit breaker trips - Flow chart	19
F. Brush does not clean floor - Flow chart	20
G. Solution feed will not shut off - Flow chart	21
H. Poor vacuum pick-up or streaking - Flow chart	22-23
I. Foam builds up in cover area - Flow chart	24
2. Parts Removal & Repair	
A. General Instructions	25
B. Electrical Panel - Upper Control Housing	26-28
C. Electrical Panel - Rear Housing 443	28-29
D. Vacuum Fan System	30-32
E. Transport (wheel carriage) System	32-33
F. Motor Frame Group	34
1f. Brush drive and brush motor repairs	34-38
2f. Solution pump repairs/misc.	38-42

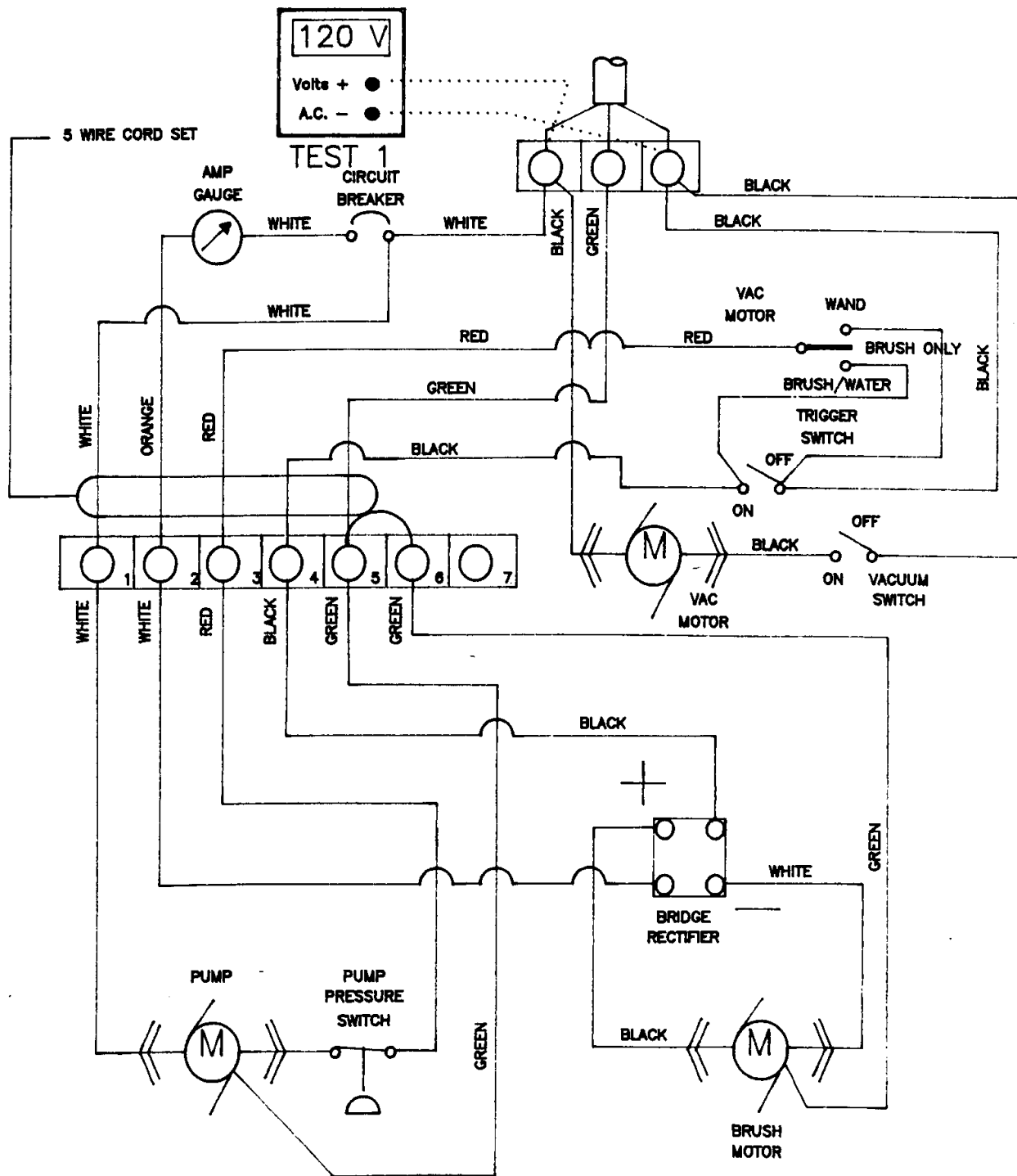
TROUBLESHOOTING 443C

PROBLEM	PROBABLE CAUSE	REMEDY
Machine does not power up	Power cord not plugged in	Plug into proper receptical
	Building circuit breaker tripped	Reset breaker
	Power cord/plug damaged	See Troubleshooting
Vacuum motor does not operate when switch activated.	Worn motor brushes	Replace
	Electrical malfunction	See Troubleshooting
Pump does not run; solution will not dispense to floor.	MODE switch is in wrong position	Move switch to proper position
	Solution tank is empty or low	Fill solution tank
	Quick-disconnect not connected	Connect properly
	Tank filter is plugged	Remove and clean filter
	Solution feed tube is plugged	Remove and clean tube
	Electrical or pump malfunction	See Troubleshooting
Brush does not run	MODE switch is in wrong position	Move switch to proper position
	Circuit breaker is tripped	Reset breaker (reduce brush pressure)
	Drive belt broken	Replace
	Electrical malfunction	See Troubleshooting
Brush circuit breaker trips	Excessive brush pressure	Reduce brush pressure
	Electrical malfunction	See Troubleshooting
Brush does not clean floor	Excessive soil may require several passes to clean	Double scrub area
	Brush worn	Replace brush
	Improper chemical for job	Select proper chemical
Solution feed will not shut off.	MODE switch in improper position	Move switch to proper position
	Pump malfunction	Repair or replace
Poor vacuum pickup or streaking	Squeegee intake slots plugged	Clean
	Improper squeegee adjustment	Adjust
	Poor gasket seal on tank cover	Repair or replace
	Worn or damaged squeegee blades	Replace blades
Foam builds up in cover area and/or foam exits motor louvers	Excessive or improper chemical used	Drain tank and refill with proper dilution
	Solution level too high	Reduce solution level below chain
	Air leak in cover gasket	Repair or replace

443C MACHINE DOES NOT POWER UP

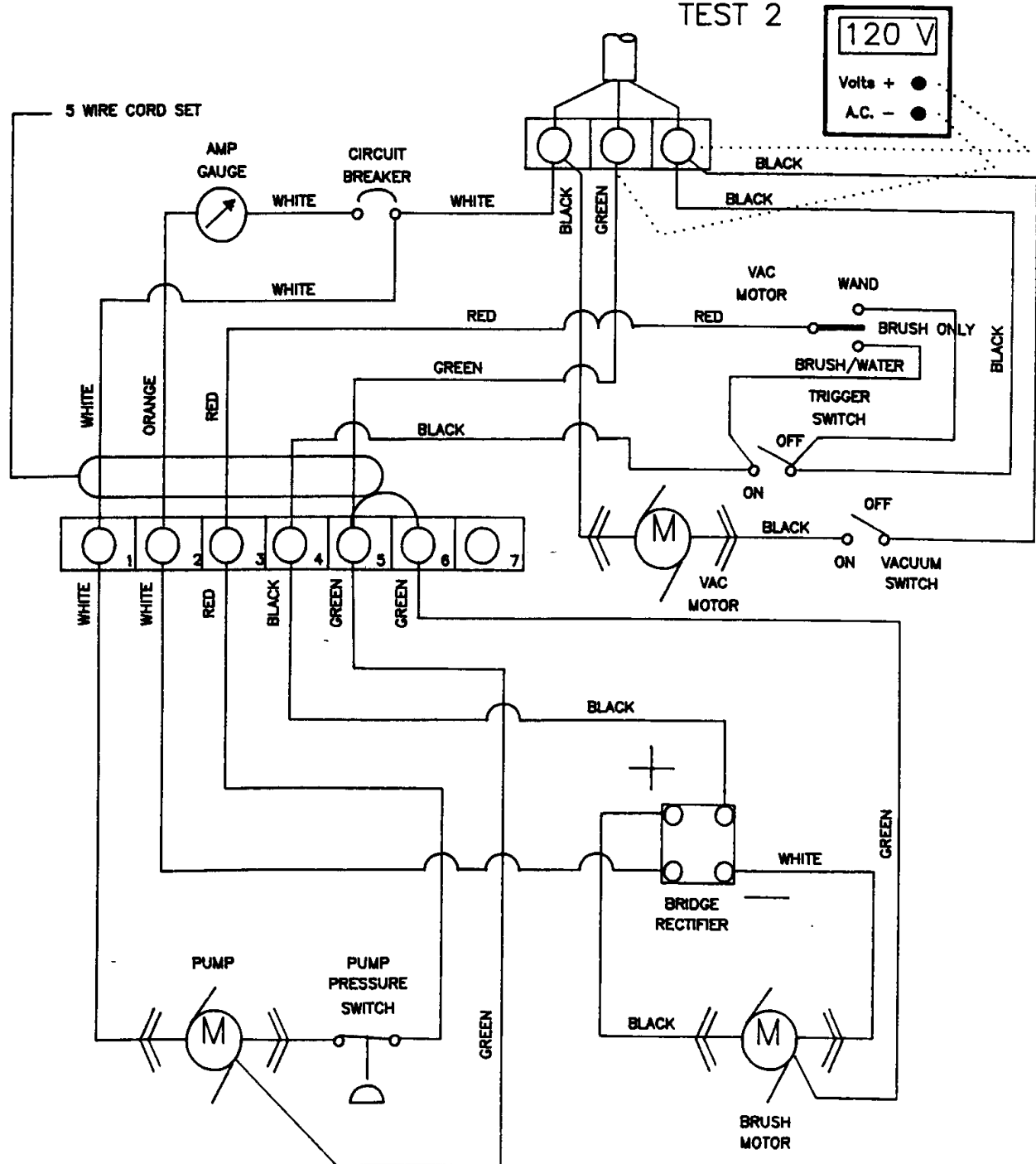


443C
MACHINE DOES NOT POWER UP

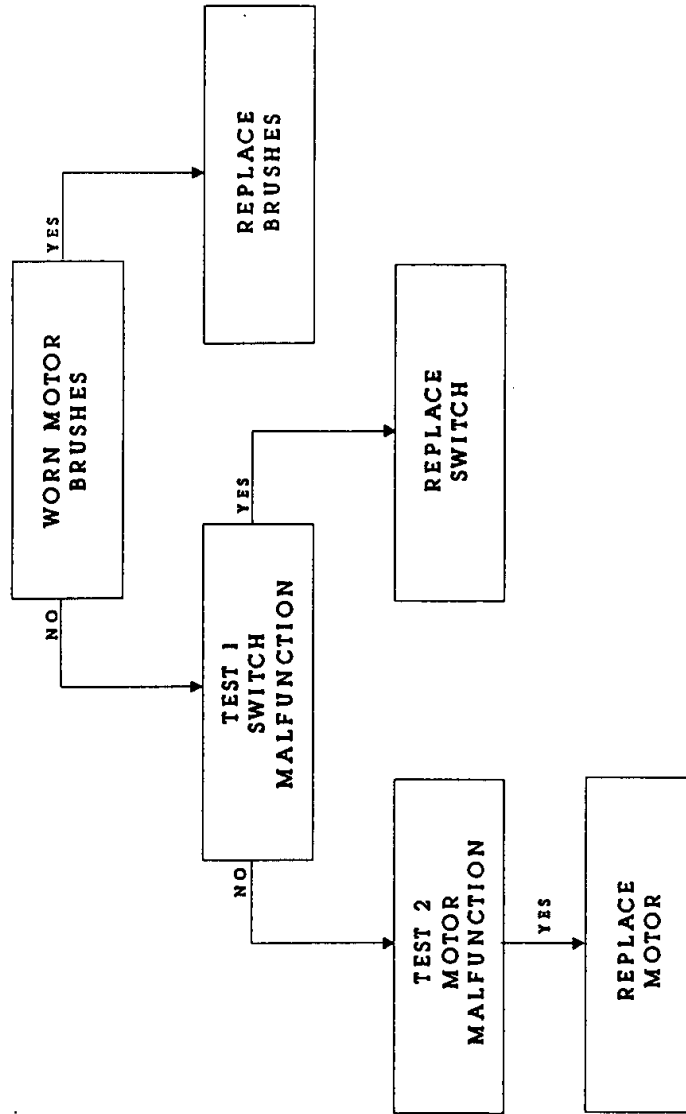


443C
MACHINE DOES NOT POWER UP

GROUND TEST
TEST 2

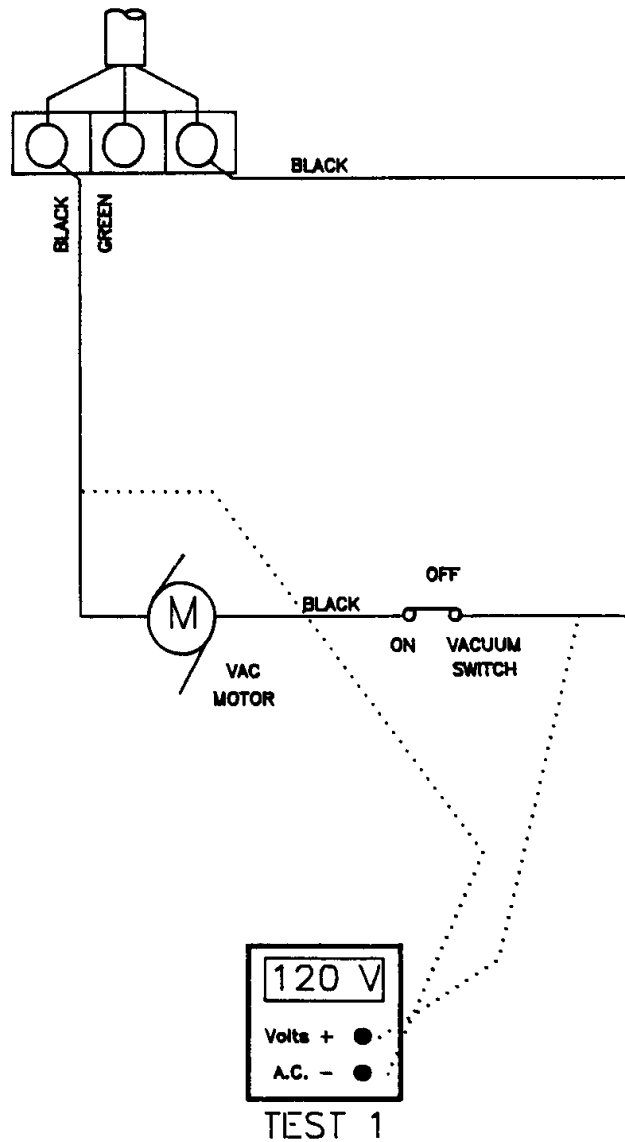


443C VACUUM MOTOR DOES NOT OPERATE WHEN SWITCH IS ACTIVATED

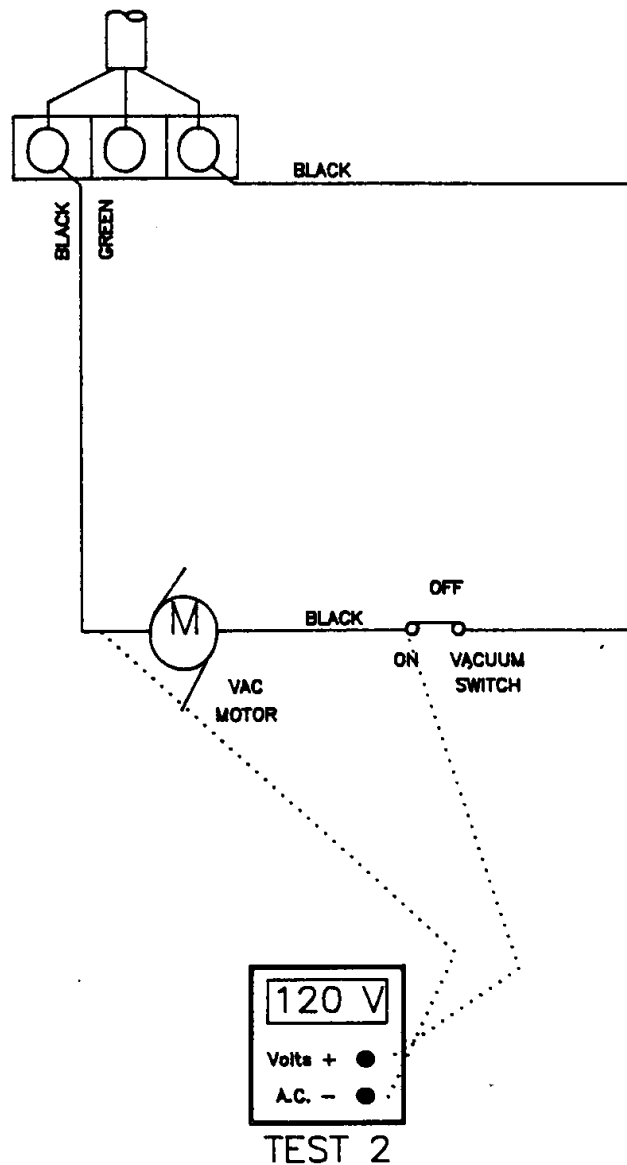


443C

VACUUM MOTOR DOES NOT OPERATE WHEN SWITCH IS ACTIVATED

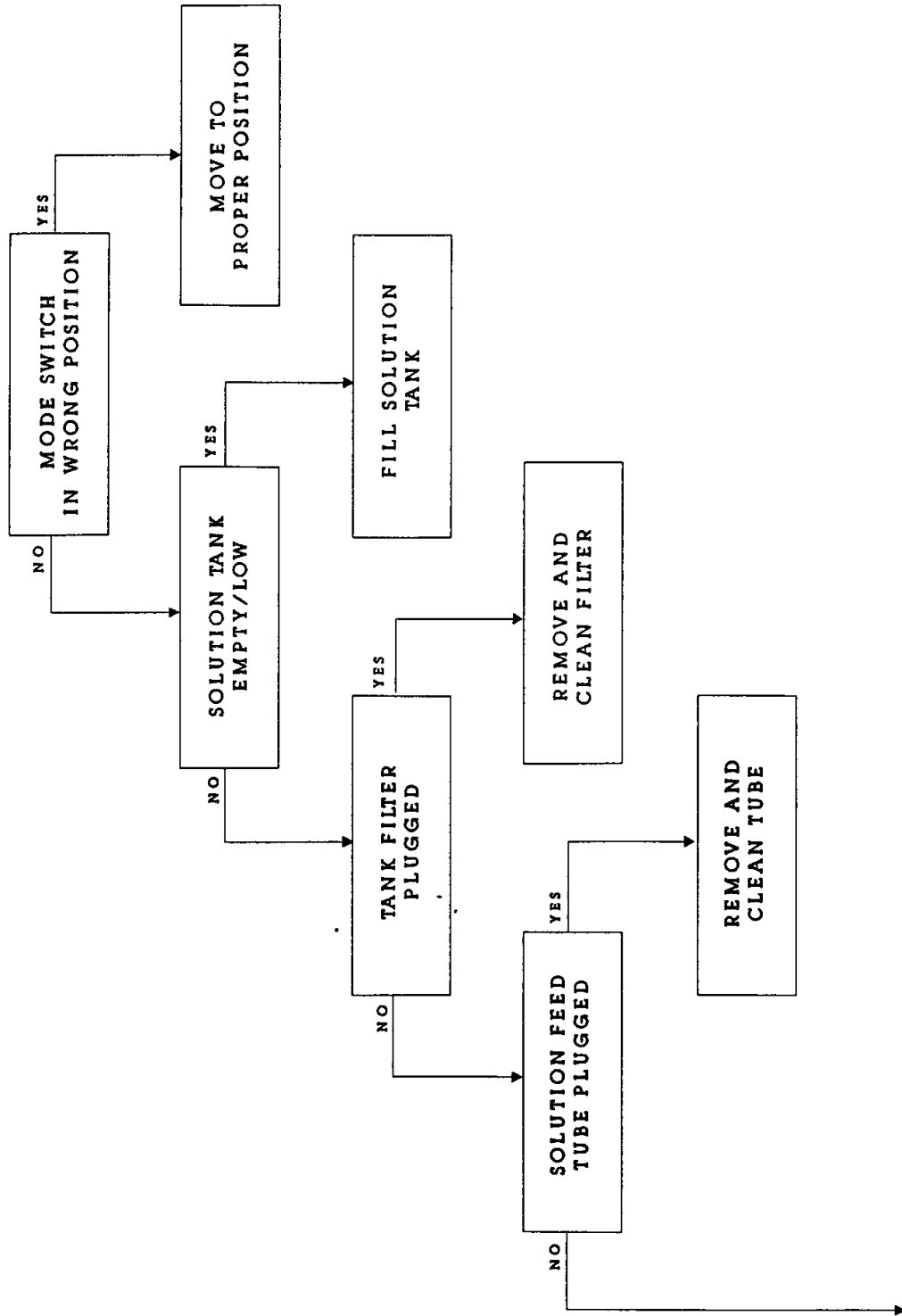


443C VACUUM MOTOR DOES NOT OPERATE WHEN SWITCH IS ACTIVATED

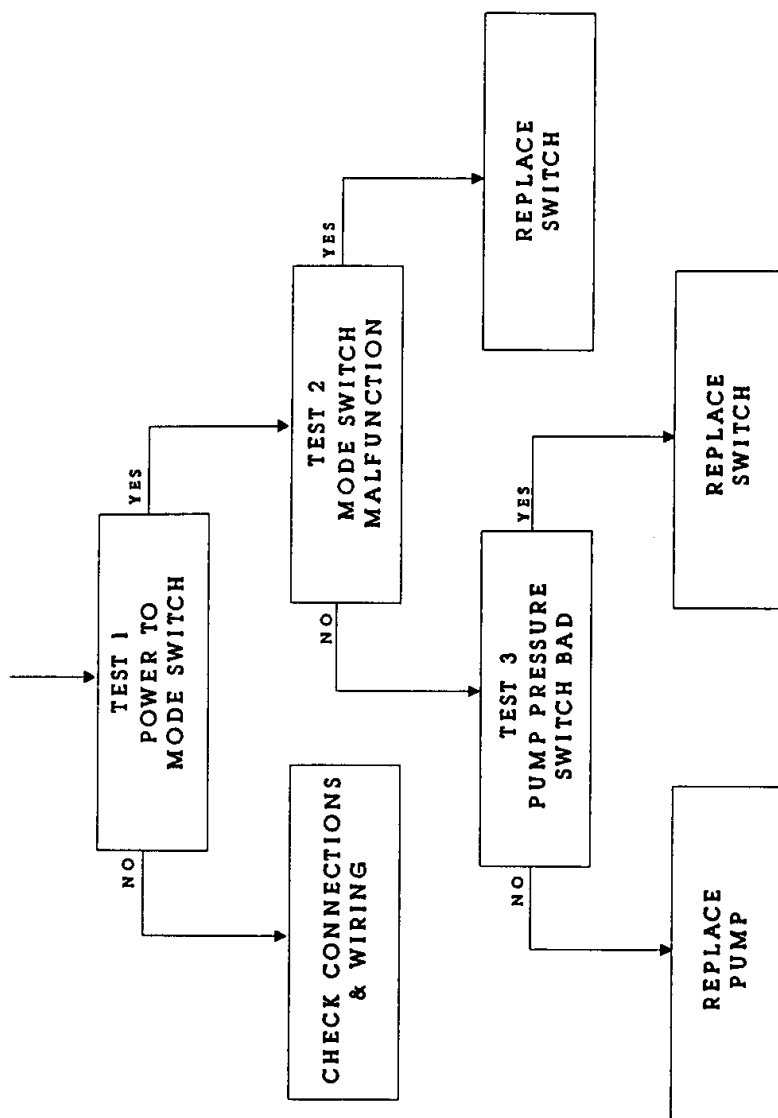


443C

PUMP DOES NOT RUN;
SOLUTION WILL NOT DISPENSE TO FLOOR

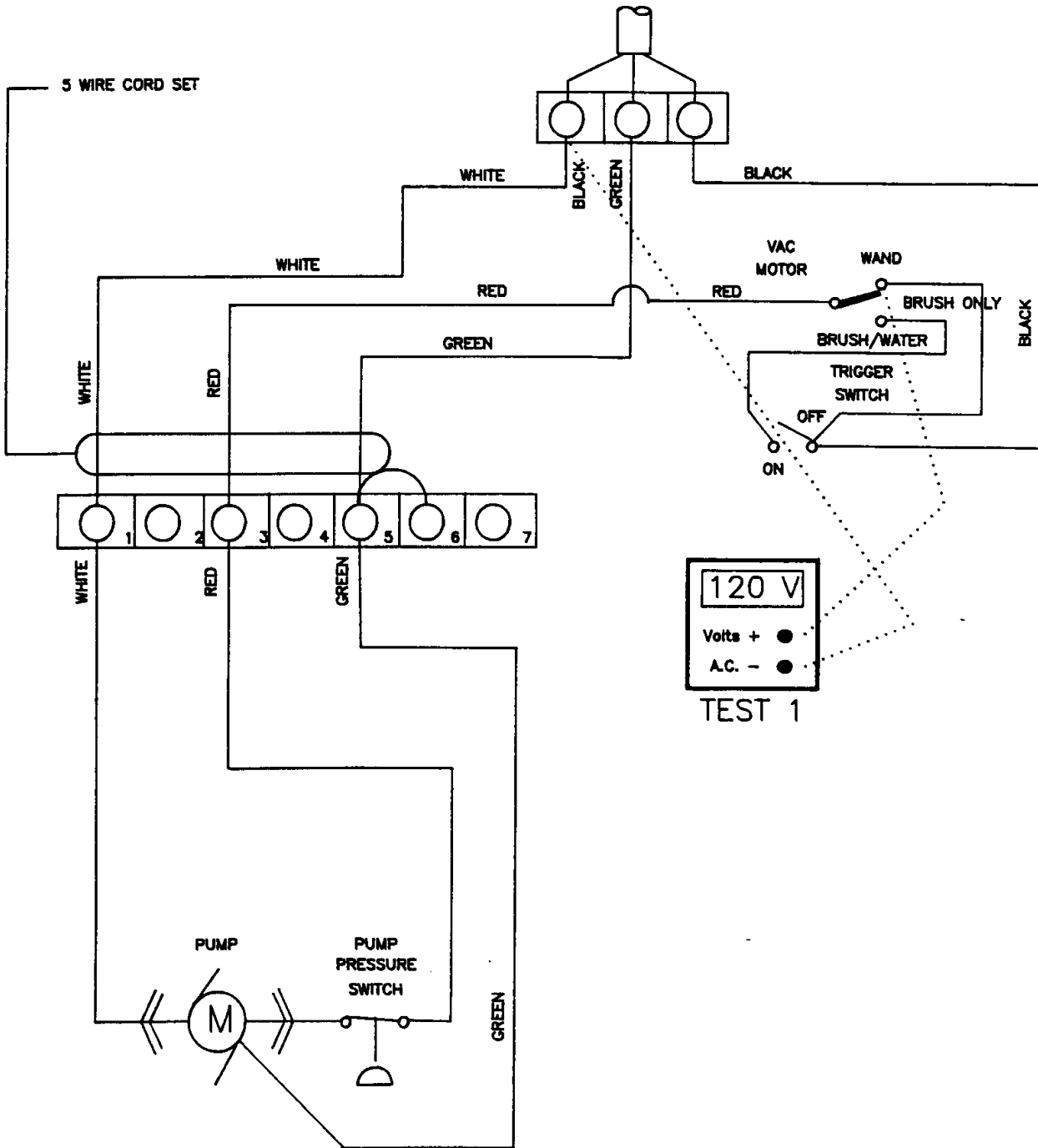


443C PUMP DOES NOT RUN; SOLUTION WILL NOT DISPENSE TO FLOOR

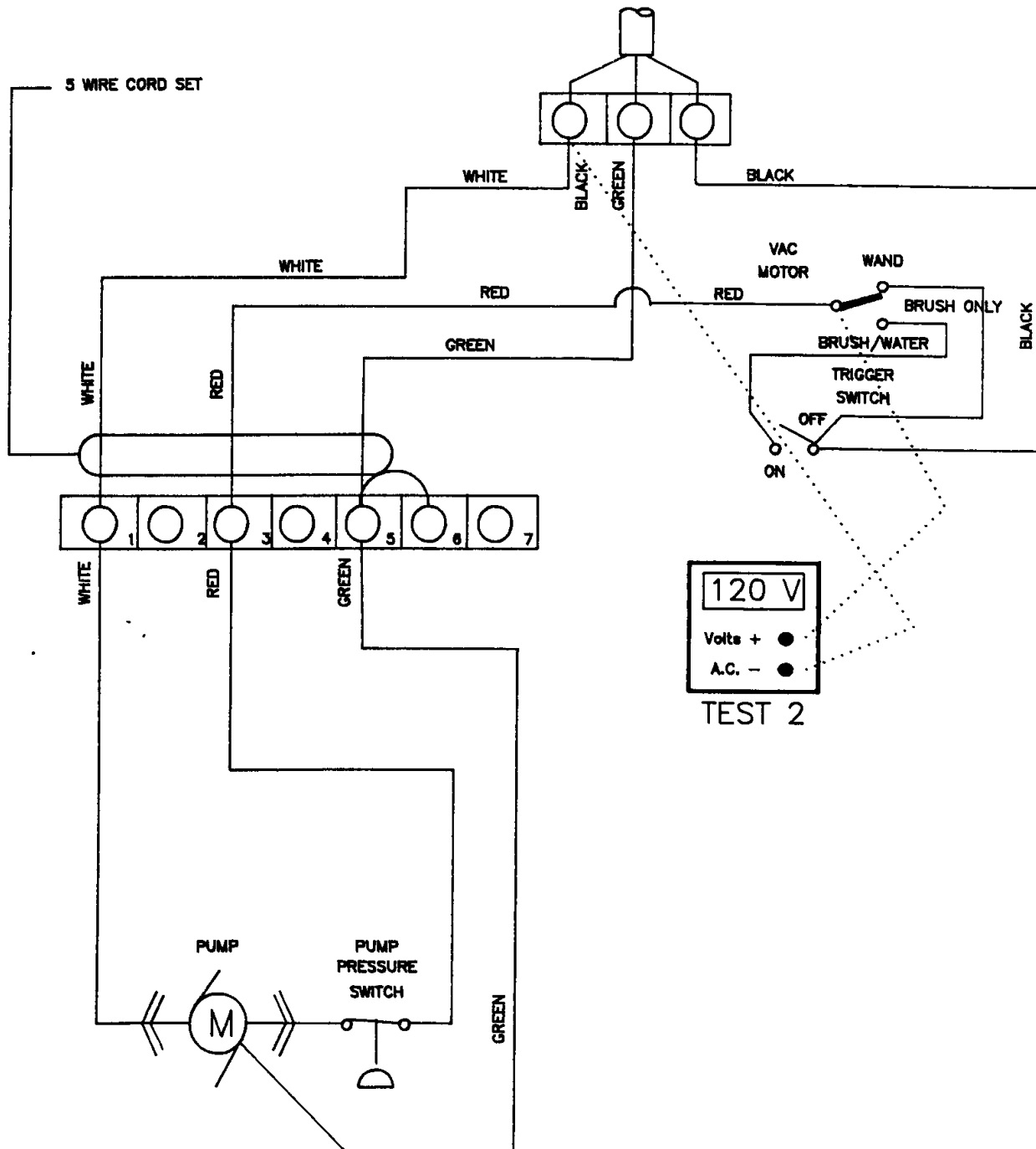


443C

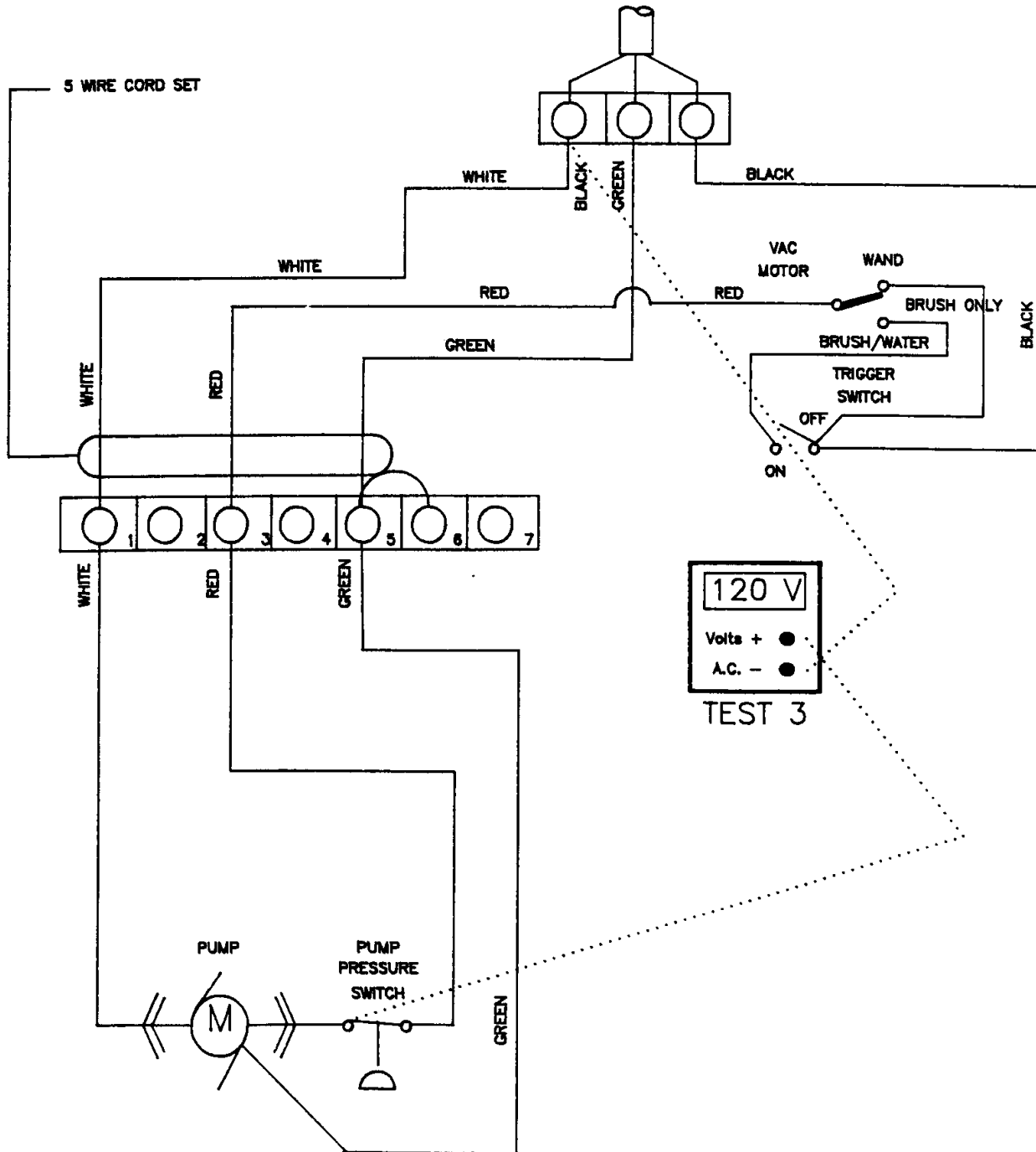
PUMP DOES NOT RUN; SOLUTION
WILL NOT DISPENSE TO FLOOR



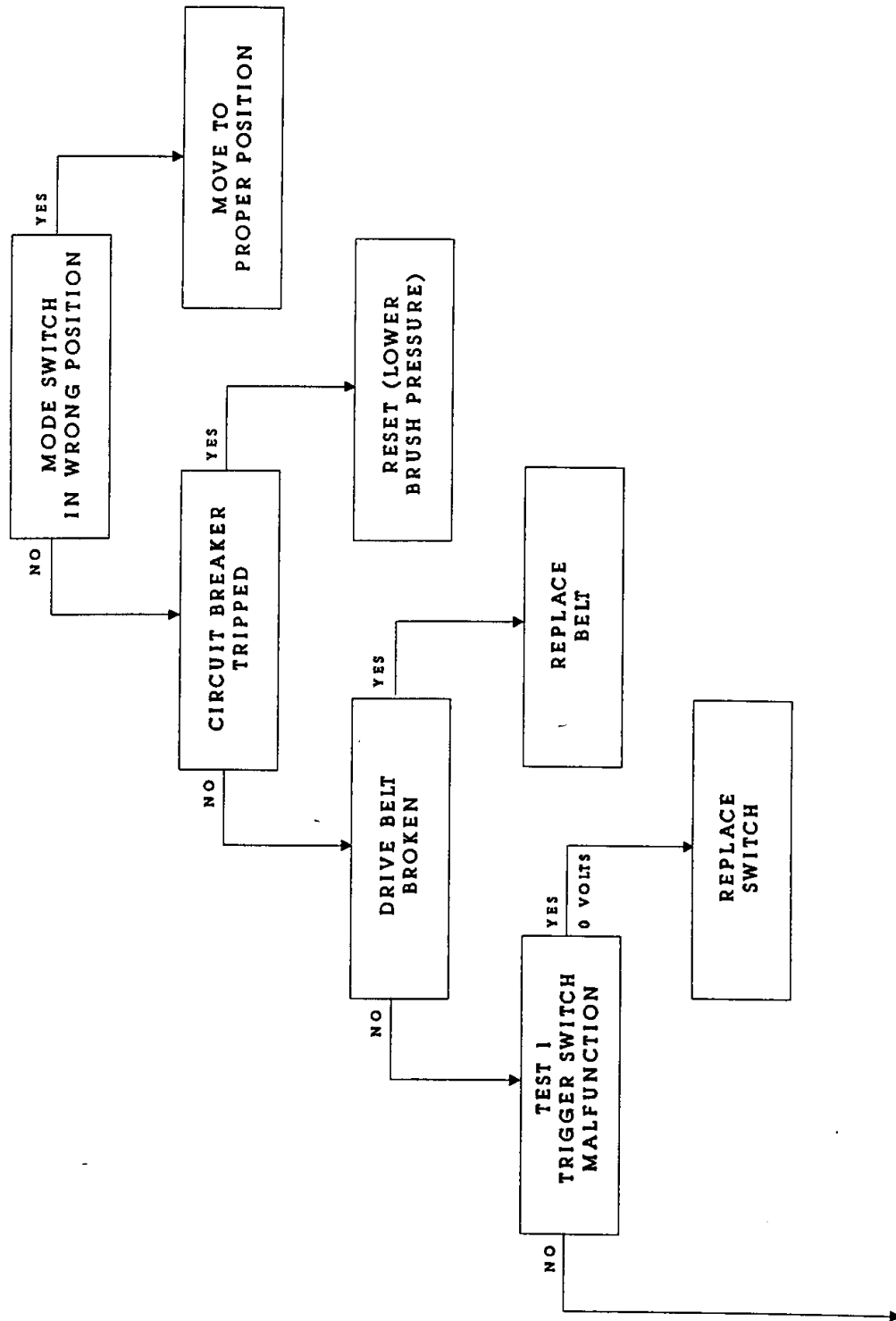
443C
PUMP DOES NOT RUN; SOLUTION
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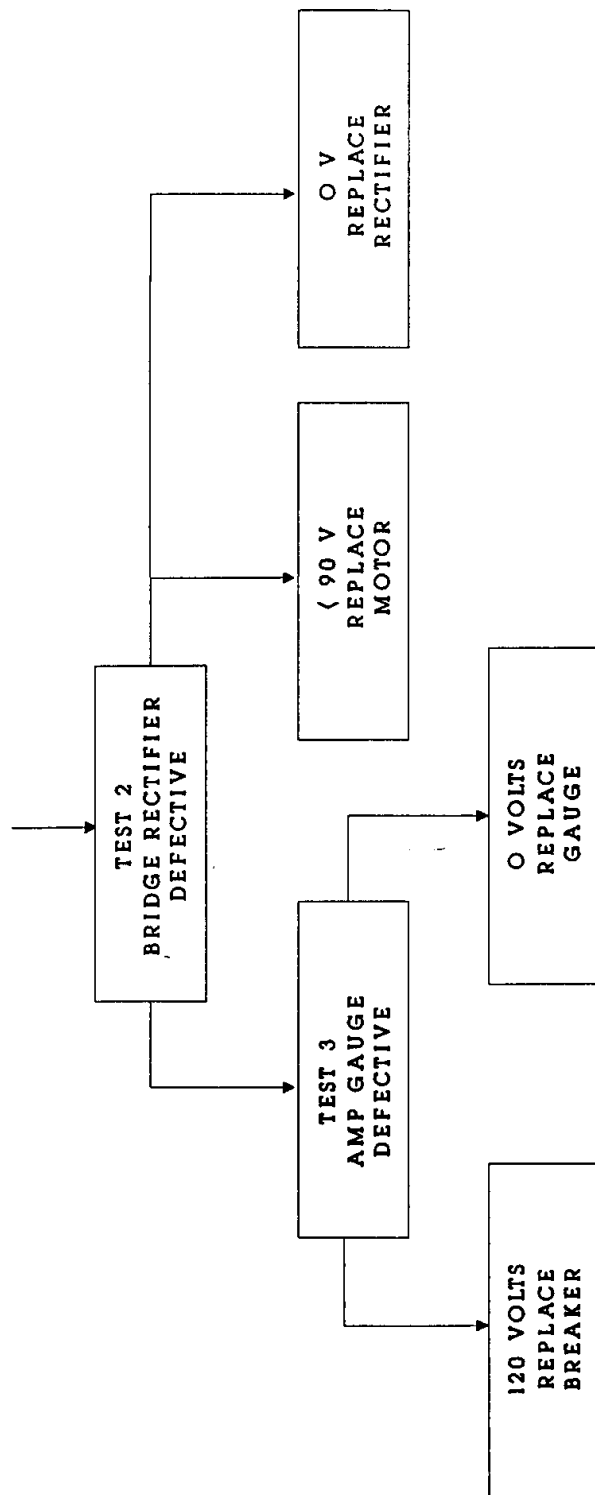
443C PUMP DOES NOT RUN; SOLUTION WILL NOT DISPENSE TO FLOOR



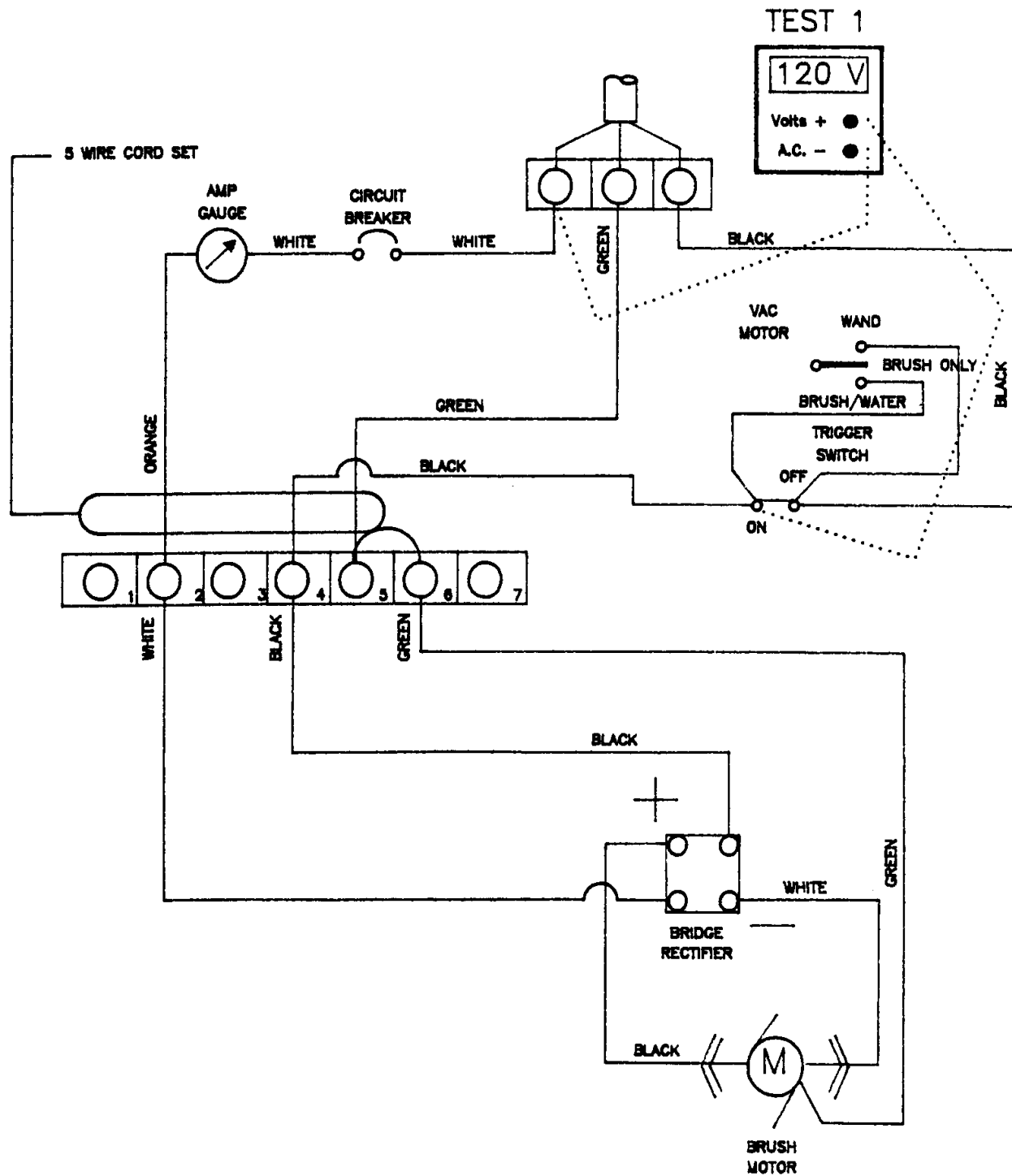
443C BRUSH DOES NOT RUN



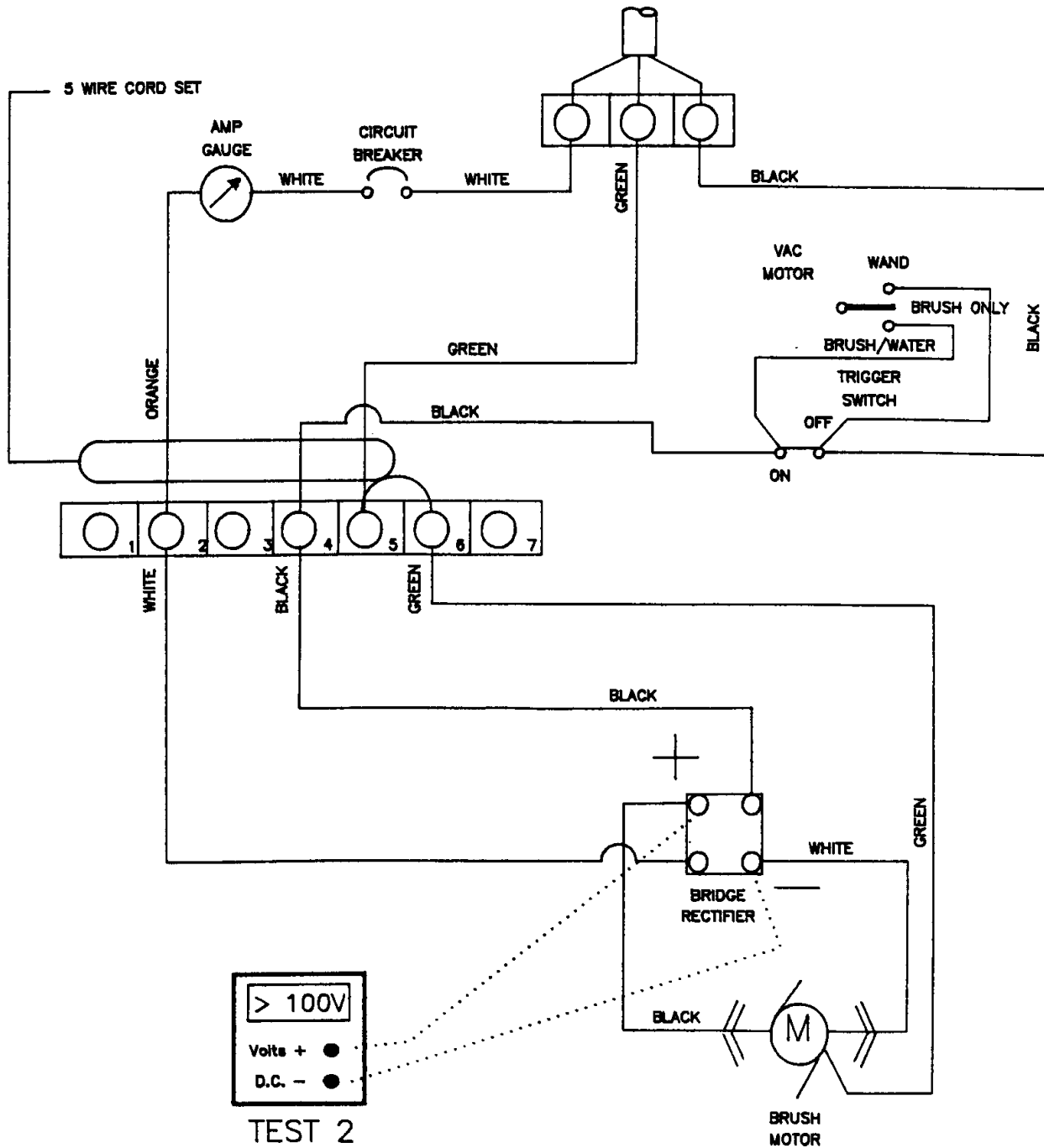
443C BRUSH DOES NOT RUN



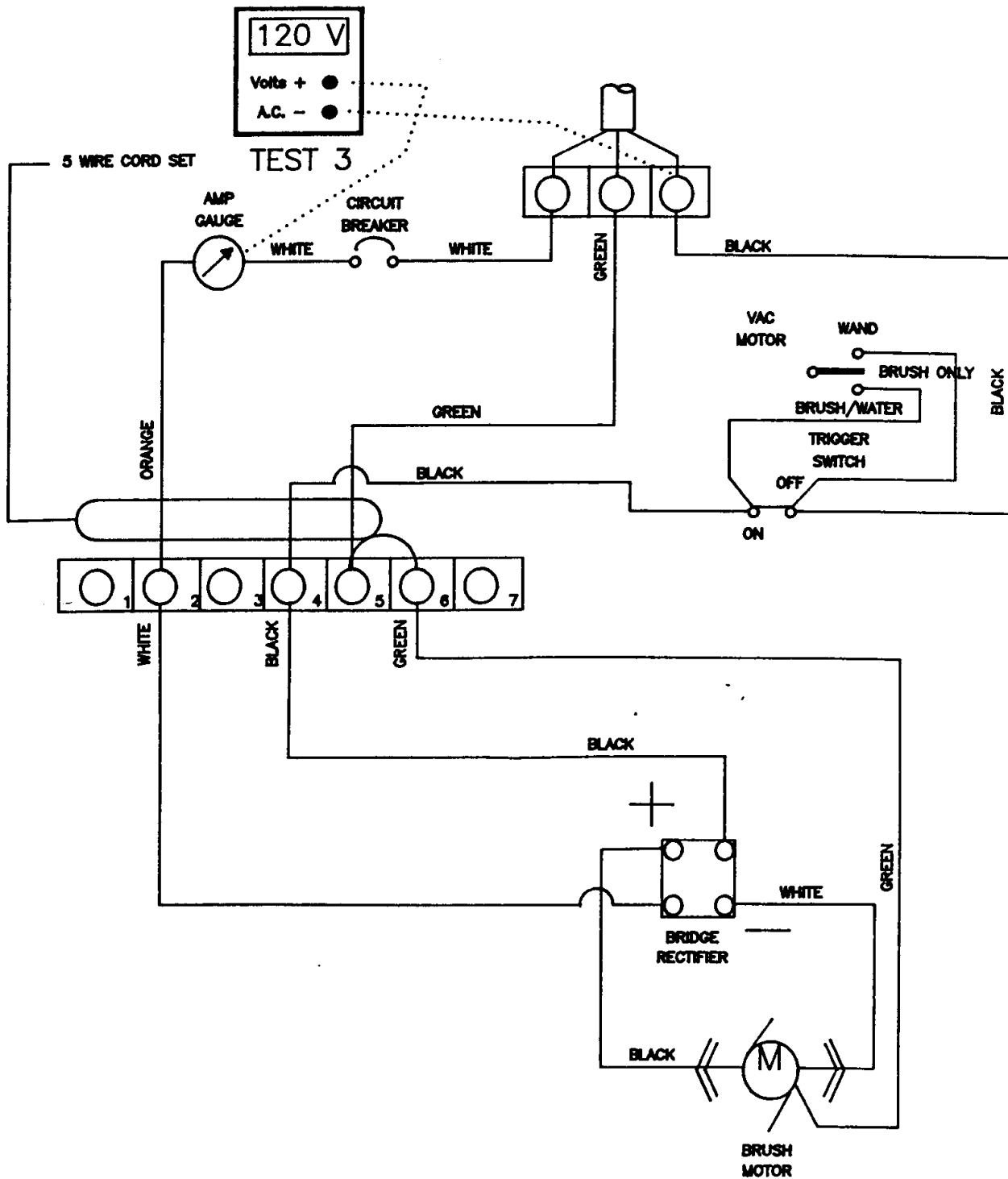
443C BRUSH DOES NOT RUN



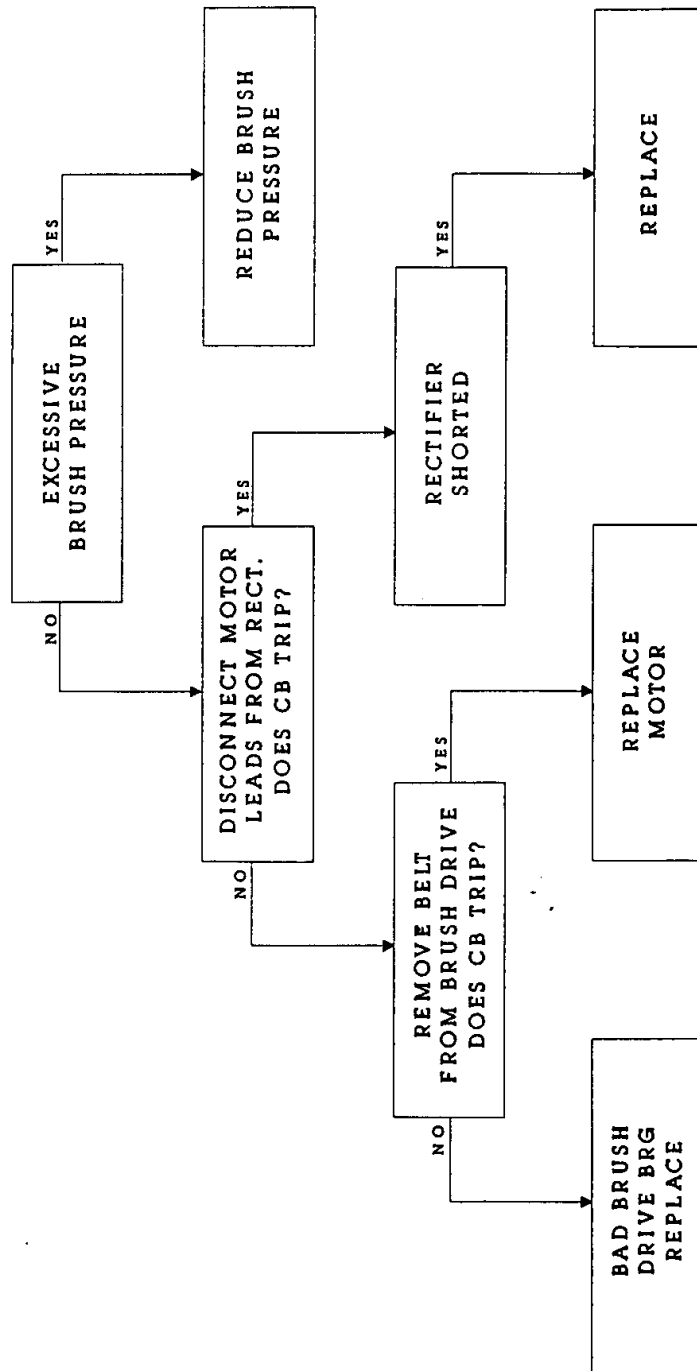
443C
BRUSH DOES NOT RUN



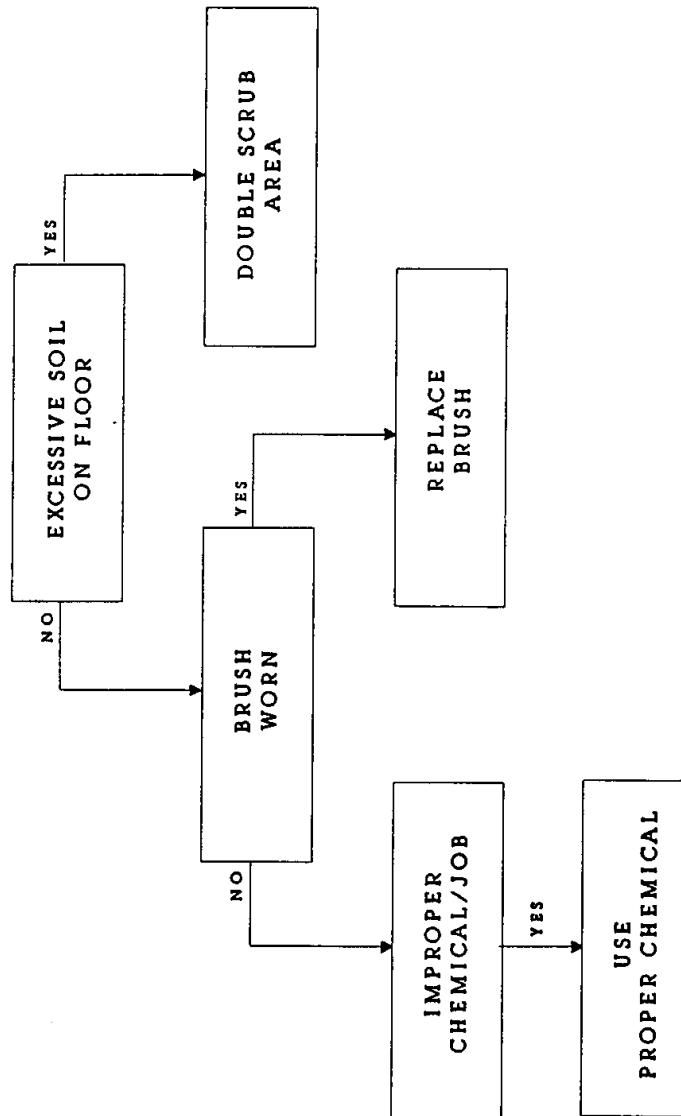
443C BRUSH DOES NOT RUN



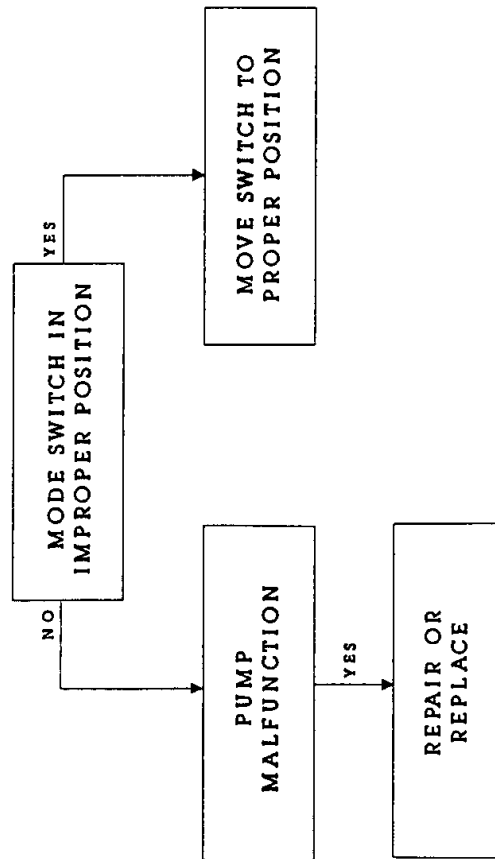
443C BRUSH CB TRIPS



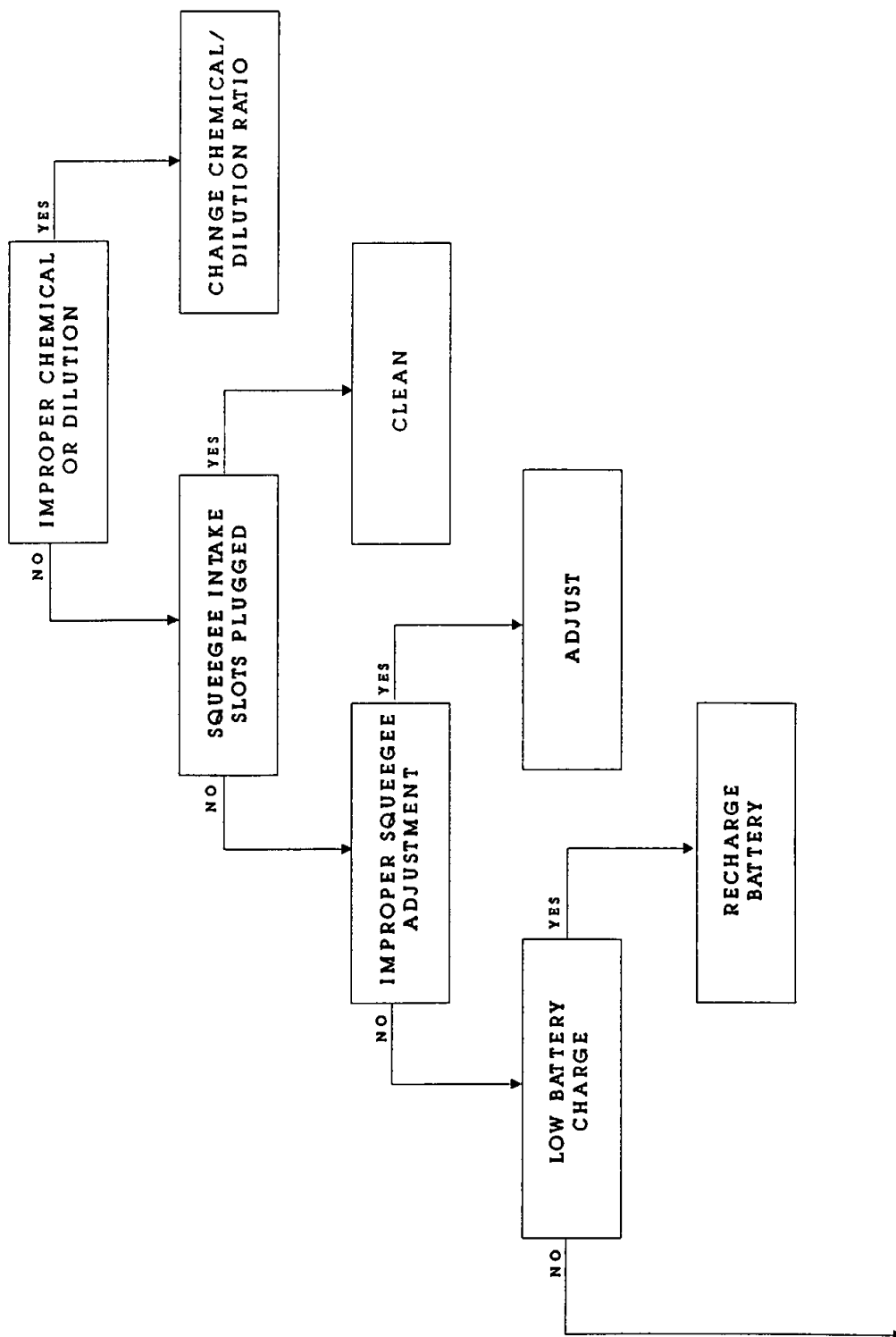
443C BRUSH DOES NOT CLEAN FLOOR



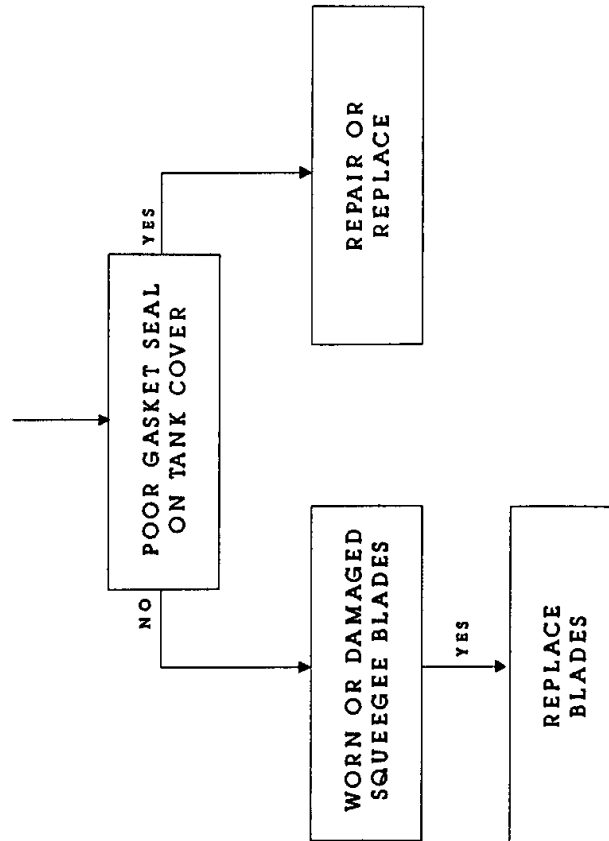
443C SOLUTION FEED WILL NOT SHUT OFF



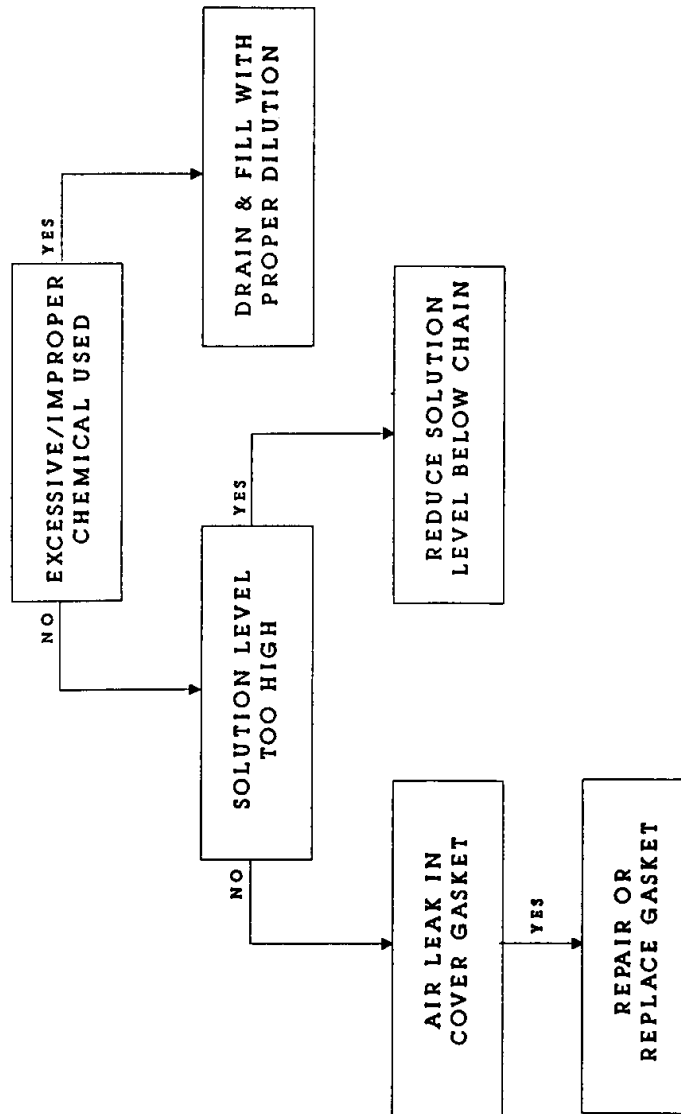
443C POOR VACUUM PICKUP OR STREAKING



443C POOR VACUUM PICKUP OR STREAKING



443C FOAM BUILDS UP IN COVER AREA AND/OR FOAM EXITS MOTOR LOUVERS



1. GENERAL INSTRUCTIONS

ATTENTION! READ THIS SECTION OF THE MANUAL BEFORE PERFORMING ANY MAINTENANCE, SERVICE, OR REPAIR TO THESE PRODUCTS.

ATTENTION! ANY PERSON ATTEMPTING REPAIRS ON THESE PRODUCTS MUST FIRST THOROUGHLY READ AND UNDERSTAND THE OPERATING INSTRUCTIONS MANUALS PRIOR TO STARTING. ONLY AUTHORIZED, TRAINED PERSONNEL SHOULD ATTEMPT REPAIRS.

ATTENTION! OBSERVE THE SAFETY PRECAUTIONS AND WARNINGS SHOWN IN THE OPERATOR'S MANUAL DURING ALL REPAIR OR MAINTENANCE PROCEDURES.

The following repairs, adjustments, or procedures are covered in the Operating Instruction Manual, and will not be repeated here:

- A. Scrub (squeegee) head removal
- B. Scrub brush rotation/replacement
- C. Squeegee blade replacement
- D. Feed tube removal/cleaning
- E. Solution filter removal/cleaning
- F. Vac filter removal/cleaning
- G. Proper use and attachment of accessories
- H. Proper use and dilution of chemicals
- I. Routine maintenance schedules and procedures

All possible repairs to this equipment are not covered in this manual. Simple and obvious repairs, such as changing a caster, are not included.

The parts lists are referenced frequently to assist the repair person in locating and identifying parts. When using this manual as a repair guide, it is recommended that the specific parts list be removed from the binder for easier reference.

2. ELECTRICAL PANEL - CONTROL CONSOLE HOUSING 443C & 443

This section should be referred to for repairs or replacement of the following items. Refer to the Parts List for either model under section ELECTRICAL PANEL (443C) or CONSOLE COVER (443) for part descriptions and part numbers.

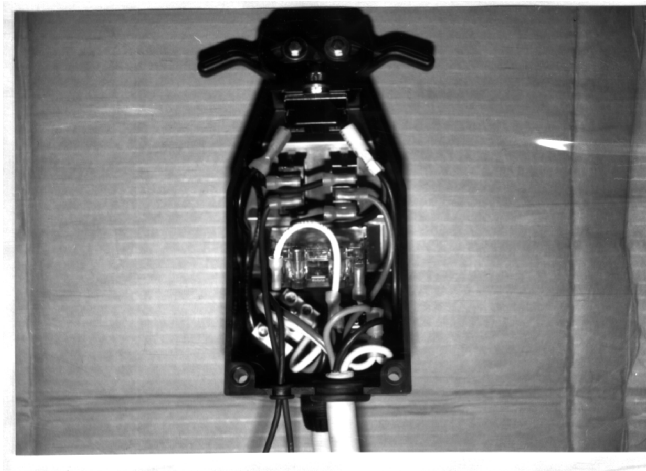
443C, Electrical Panel Group

Cover, Console
Switch, Pushbutton, SPNO
Switch, Rocker, SPST
Switch, Rocker, SPDT
Gauge, Brush Pressure
Circuit Breaker, 3AMP
Cord set, 14/3SJT, Yellow, 40' Lg

443, Console Cover Group

Cover, Console
Switch, Pushbutton, SPNO
Switch, Rocker, SPST(Vac)
Switch, Rocker, SPST(Power)
Gauge, Brush Pressure
Circuit Breaker, 14AMP

- a. All repairs require removal of the console cover first. DO NOT ATTEMPT TO PRY COMPONENTS OUT OF THE COVER FROM THE OUTSIDE OR BREAKAGE CAN OCCUR.
 1. Remove the 3 Phillips screws holding the cover to the tank. Tip the cover toward you from the top, or remove the electrical panel for better access.
 2. When replacing the cover, DO NOT USE A POWER OR AIR- DRIVEN SCREW-DRIVER to tighten the screws, or damage to the female inserts could occur.



b. To replace the PUSHBUTTON SWITCH (trigger activated):

1. Remove both triggers for access. Loosen the hex nut on the button column with a 14mm hex wrench and slide the switch from the slot.
2. Grasp the 2 wire tabs (not the wires) and pull from the switch terminals.
3. To replace, reverse this procedure, making sure the tabs face the original direction and do not interfere with the trigger operation.

c. To replace either the MODE (443C), POWER (443) or the VAC switches:

1. Grasp the 2 wire tabs (not the wires) and pull from the switch terminals.
2. Squeeze the retainer clips on either side of the switch toward the switch body, and slide the switch through the front side of the housing.
3. To replace, reverse this procedure. Make sure the new switch is oriented properly (right-side-up) and that the wiring does not interfere with other components in the housing.

d. To replace the BRUSH PRESSURE METER:

1. Grasp the 2 wire tabs (not the wires) and pull from the switch terminals.
2. With a needle-nose pliers or a straight blade screwdriver, pry the “claws” on the metal retainer away from the meter body and remove the retainer.
3. Slide the meter from the front side of the housing.
4. To replace, reverse this procedure. First straighten the “claws” on the retainer so they will grasp the new meter properly. Once installed, push the “claws” back into the sides of the meter.

e. To replace the CIRCUIT BREAKER:

1. Remove the hex nut on the outside of the cover, and push the breaker inside.
2. Grasp the 2 wire tabs (not the wires) and pull from the breaker terminals.
3. To replace, reverse this procedure.

f. To replace the STRAIN RELIEF and/or POWERCORD:

1. Using a jewelers screwdriver, loosen the screws in the terminal block holding the black, white, and green wires from the powercord. (If access is difficult, remove the terminal block first). Pull the wires from the block and then unscrew the strain relief from the housing.
2. The strain relief removes from the cord by unscrewing the 2 threaded parts.
3. To replace, reverse this procedure. MAKE SURE THAT THE WIRES ARE PROPERLY TERMINATED IN THE BLOCK SO THAT GREEN WIRE IS MATCHED TO THE GREEN IN THE BLOCK, BLACK MATCHES BLACK, ETC.

3. ELECTRICAL PANEL - REAR HOUSING 443 MODELS

This section should be referred to for repair or replacement of the following items. Refer to parts list section TANK GROUP for item and part number reference.

443, Tank Group

Panel, Weldt, Rear

Switch, Rocker, SPDT

Contactor, 24VDC, 100A, SPNO

Fuseholder, Bayonette

Stand off, Terminal

WARNING: HAZARDOUS VOLTAGE. SHOCK OR ELECTROCUTION CAN OCCUR. DISCONNECT BATTERY CABLES FROM BATTERIES BEFORE REMOVING REAR PANEL.

a. All repairs require removal of the REAR PANEL WELDMENT.

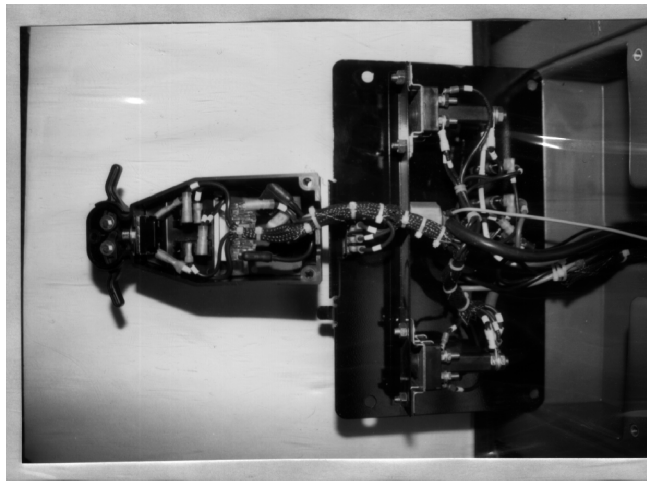
1. Remove the 4 Phillips head screws holding the panel in place. Tip the panel out from the machine.
2. To replace, reverse this procedure. DO NOT USE A POWER OR AIR DRIVEN SCREWDRIVER TO TIGHTEN THE SCREWS or damage to the female inserts could occur.

b. To replace the MODE SWITCH:

1. Grasp the 2 wire tabs (not the wires) and pull from the switch terminals.
2. Squeeze the clips on the ends of the switch. Push the switch through the panel.

c. To replace either SOLENOID CONTACTOR:

1. Using a wrench, remove the wire leads from the terminals.
2. Using a wrench, remove the 2 bolts holding the contactor to the panel.



d. To replace any FUSE HOLDER:

1. First remove the fuse from the holder.
2. Disconnect the wire leads to the holder.
3. Remove the hex nut holding the holder in place, and push the holder through the panel.

4. VACUUM FAN SYSTEM

This section should be referred to for replacement of the following items. Refer to the parts list sections TANK GROUP or VACUUM VAN for item and page reference.

443C, Tank Group

Motor, Vac

Clip, Drain Hose

443C, Vacuum Fan Assembly

Brush, Vac Fan Motor(set of 2)

443, Tank Group

Motor, Vacuum Assy

443, Vacuum Fan Assembly

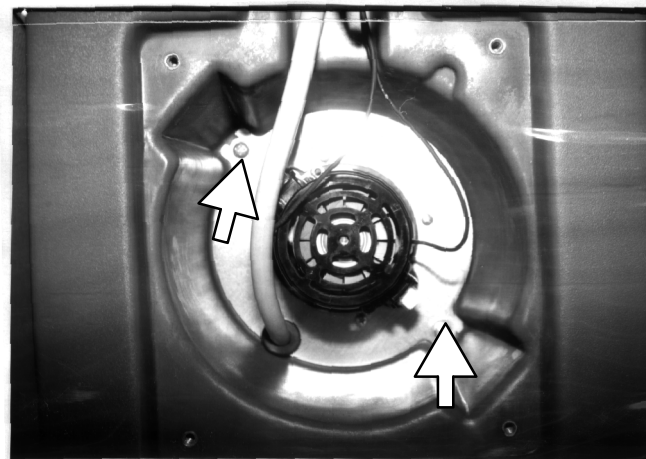
Brush, Vac Fan Motor(set of 2)

a. MODEL 443C vacuum fan ACCESS:

1. Remove the 4 Phillips screws holding the plastic vac motor cover in place.
2. Tip the cover forward. Grasp the plastic transition ring between the cover and motor top to prevent it from falling.
3. To replace, apply Vaseline to the transition ring to hold it in place, and install the cover.

b. To remove the VACUUM FAN from the 443C:

1. Remove the two Phillips head screws holding the motor bracket in place. Slide the motor and bracket from the cavity at the same time.



c. MODEL 443 vacuum fan ACCESS:

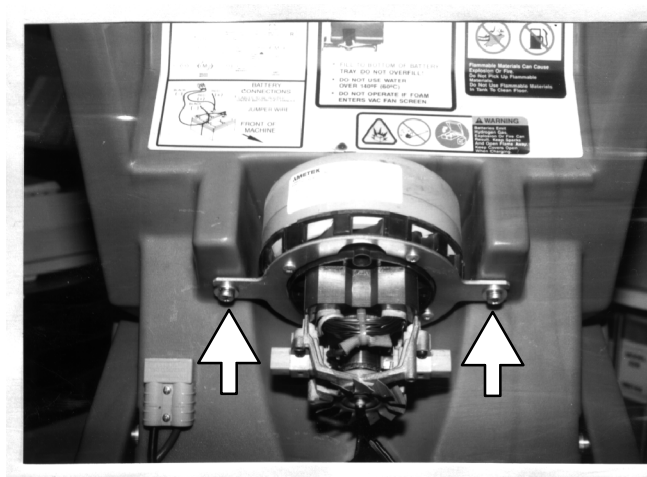
1. Lift the hood cover and tip over center.

Note: Motor brush replacement can be accomplished without removing the motor from it's mount.

d. To remove the VACUUM FAN from the 443:

ATTENTION! IT IS RECOMMENDED THAT THE BATTERIES BE COVERED WITH A NON-CONDUCTIVE SHIELD, SUCH AS A BOARD, WHEN PERFORMING THIS REPAIR.

1. Remove the 2 Phillips screws holding the motor bracket in place.



IMPORTANT! HOLD THE MOTOR TO PREVENT IT FROM FALLING.

e. To replace CARBON MOTOR BRUSHES (443C & 443):

1. Remove the plastic top motor cover by prying the 2 metal retaining clips away and lifting off the cover.
2. Remove the 2 Phillips head screws holding each brush holder bracket in place, and remove the bracket.
3. With a straight-blade screwdriver, pry the brush lead spade (wire attached) from under the brush holder, and remove the brush/brush holder from the motor.
4. Inspect the carbon brushes. If one is worn to less than 3/8", replace both brushes. If the brushes still have some life but one is worn more than the other, reverse the brushes when installing back into the motor.
5. If the brushes require replacement, also inspect the commutator on the armature. If it is scored or dirty, clean with the appropriate abrasive commutator stick.

5. TRANSPORT (WHEEL CARRIAGE) SYSTEM

This section should be referred to for replacement of components found in the parts list under TRANSPORT GROUP. The purpose of this system is to provide a transport position (foot lever locked down) and an adjustable brush pressure mechanism (foot lever in UP position).

- a. The entire front wheel carriage, lift, and adjustment mechanism is held in place with rods and clevis pins, and can be removed from the machine without tools to allow bench repair.

To ACCESS the assembly:

1. Completely drain solution tank.
2. MODEL 443: Disconnect and remove batteries.
 - a. Tape hood in closed position.
3. Remove the brush and squeegee head (per operating instructions)
4. Tip machine on back, side, or front.

b. To remove individual parts:

1. Identify the part and refer to parts list for sequence.

c. To remove entire assembly from machine:

1. Remove the 2 Phillips head screws holding the pump motor cover in place, and remove the cover.
2. Disconnect the extension spring from the bolt.
3. Remove clevis pins and rods, and remove the assembly from the machine.
4. If the adjustable yokes must be removed or replaced, mark the proper stop position on the threads on the transport rod.

d. Before installing components back in machine, lubricate all pivot points with light oil.

6. MOTOR FRAME GROUP

This section should be referred to for repairs or replacement of parts found in the parts list under MOTOR FRAME GROUP. The repairs covered for both 443C and 443 models are:

Belt, Poly-V, Length 381MM

Plug, Brush, Driver

Bearing, Ball (idler & drive)

Motor, Brush Drive

Carbon Brushes, Motor

Pump, 115VAC (solution)

Rectifier, Full Wave (443C - Electrical Panel Group)

Resistor, 6.0 OHM, 40 Watts (443 - Console Cover Group)

a. To replace the BRUSH DRIVE BELT:

NOTE: DO NOT LOOSEN OR REMOVE MOTOR BOLTS FOR THIS REPAIR, OR RETENTIONING PROCEDURES WILL BE REQUIRED.

1. Remove the 3 Phillips head screws holding the brush cover plate in place, and remove the plate.
2. Remove the broken belt, or roll a worn belt off of the motor pulley. Wipe belt dust or debris from housing.
3. Install a new belt by positioning first on the motor pulley, and then roll it onto the brush pulley until it is in the proper position.
4. If the belt is not tensioned properly (slips/squeals or is over-tight, it can be retensioned by loosening the 4 motor mounting bolts. Slide the motor in the mounts and tighten the bolts. The belt should flex about 1/4" when pressure is applied to the belt between the pulleys.

b. To replace the BRUSH PLUG and/or IDLER BEARING in the removable brush arm:

1. Remove the brush arm from the machine.
2. Pry the plastic dust seal out of the cavity.
3. Hold the brush plug and remove the hex bolt and washer.
4. Push the plug out of the bearing.
5. Before installing the new plug, apply Vaseline to the portion that goes inside the bearing.
6. Press the plug into the bearing, and install the bolt and washer. Do not overtighten.

NOTE: DO NOT DAMAGE THE PLASTIC PLUG OR IT WILL NOT HOLD THE BRUSH PROPERLY.

7. To replace the bearing, follow previous steps 1-4.
8. With an inside snap ring pliers, remove the snap ring from the bearing housing.
9. Use a bearing press to press the bearing out of the housing.
10. To install a new bearing, reverse the procedure.

c. To replace the BRUSH PLUG in the drive side:

1. Remove drive belt per previous instructions.
2. Remove hex bolt and washer from the center of the drive pulley, and remove the plug.
3. Before installing the new plug, apply Vaseline to the portion that goes inside the bearing.
4. Press the plug into the bearing and install the bolt and washer. Do not overtighten.

d. To replace the BRUSH DRIVE BEARING:

1. Remove the scrub head assembly, brush, brush drive belt per previous instructions.
2. Remove the 4 Phillips head screws and nuts that hold the plastic bearing mount in place, and remove the mount from the machine. DO NOT LOSE OR DAMAGE THE LARGE O-RING (12)
3. Remove the hex bolt and washer inside the drive pulley, and remove the pulley and plug. DO NOT LOSE THE SQUARE KEY.
4. Press the bearing and seal from the housing.
5. To install new bearing, coat inside and outside races with Vaseline to make installation easier.
6. Press the seal (first) and bearing into bearing mount. Press on the outer bearing race only.
7. Reinstall the parts, making sure the square key is in the plug/pulley and that the large O-ring is positioned against the bearing.



- e. TO ACCESS the brush drive motor for motor brush inspection, brush replacement, or motor brush replacement:
1. Completely drain solution tank.
 2. MODEL 443:
 - a. Disconnect and remove batteries.
 - b. Tape hood in closed position.
 3. Remove the brush and squeegee head (per operating instructions)
 4. Tip machine on back or side.
- f. To inspect the CARBON MOTOR BRUSHES:
- Only one brush holder can be accessed with the motor in the machine. Inspecting one brush can give you an indication of wear on both, but is not always reliable. If in question, the motor should be removed and both brushes checked/replaced.
1. With a large screwdriver or coin, remove the carbon brush cover. The brush is spring loaded to the cover.
 2. Slide the carbon brush from the holder and inspect. If the brush is worn to 3/8" or less, or is burnt, remove the motor per the following procedures and replace both brushes.
- g. To remove the BRUSH MOTOR:
1. To access, either remove the transport carriage assembly or disconnect arms and tip back.
 2. Remove the 2 Phillips screws holding the pump cover in place, and remove the cover.
 3. Grasp the 2 wire tabs (not the wires) connected to the diode bridge and pull off of the bridge terminals. Note the correct position of the wires to the bridge for installation later. NOTE: 443 model has no diode bridge; wires are connected directly to terminal block – remove.

Using a jewelers screwdriver, loosen the set screw in the terminal block holding the green ground wire from the motor, and pull the wire from the block.

4. With a pliers, pinch the plastic strain relief holding the motor cord and pull the strain relief and cord from the hole. Cut wire ties.
5. Remove the 3 Phillips screws holding the belt cover in place and remove the cover. Roll the belt off of the pulleys, and remove the motor pulley using a hex key wrench.
6. With a sharp tool or pencil, scribe around the washers behind the 4 motor mounting bolts. This will provide an alignment guide when reinstalling the motor.
7. Remove the 4 hex bolts holding the motor to the frame. Support the motor with your hand when removing the last bolt, and remove the motor from the housing.
8. To reinstall, reverse the procedure. Make sure you orient the motor in the proper position, and align the 4 washers with the scribed marks before tightening. Install new wire ties.

h. To ACCESS the SOLUTION PUMP:

1. Follow procedures to access brush drive motor.
2. Disconnect the wheel transport return spring from the screw, and lift the wheel assembly past the clear solution hose. Pull the control arms off of the squeegee head.
3. Remove the 2 Phillips screws holding the pump cover in place, and remove the cover.

SCRUBBER

i. To POSITION PUMP FOR REPAIRS to the pump head, it is not necessary to remove the pump completely from the housing:

1. Remove the 2 Phillips screws holding the wiring terminal block to the frame. Hold the lock nuts with a needle-nose pliers. Move the terminal block out of the way.
2. Using a 7mm socket or nut driver, remove the 3 nuts that hold the pump mounting plate in place. Apply Vaseline to the socket to prevent the nuts from dropping into the housing.
3. Remove diode bridge from frame using a 8mm socket driver so pump will clear.
4. Pull pump up and out of frame and place upright in the housing so you can access the head for further repairs.



j. To replace the complete PUMP:

1. Follow instruction above under "i, 1-3".
2. Remove airplane clamps from both solution hoses, and remove hoses from barbed fittings.

NOTE: Hoses may have to be split to remove. There should be enough hose length to cut 3/8" off and reinstall. However, it is recommended that the repair person have new hoses available to replace if necessary.

3. Using a jewelers screwdriver, loosen the terminal block screws that hold the pump wiring, and pull the wiring from the block.
4. Remove the pump from the housing.

k. To REINSTALL PUMP in housing:

1. Reverse above procedure.
2. Make sure pump hoses are not caught or pinched under pump.
3. When installing nuts on pump mount, tighten until the grommets compress so about 1/8" of screw thread is showing.
4. Make sure transport arm bracket clears the clear solution hose and that the tension spring is reattached.

l. Pump HEAD REPAIRS:

1. The following kits are available from Tennant Co. for pump head repairs. Each kit contains instructions for replacement. For reference, refer to the parts list under PUMP MOTOR.

A. Pressure switch kit # 578812

B. Upper housing kit # 578813

C. Diaphragm kit # 578810

D. By-pass valve kit # 578811

E. Lower housing/drive kit # 578809

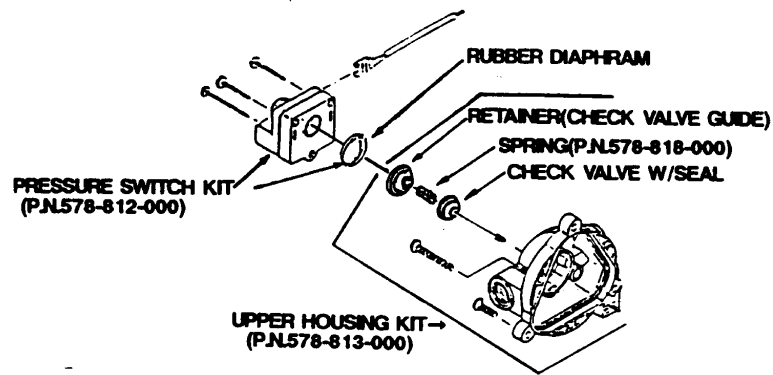
NOTE: The carbon motor brushes are not replaceable on this pump.

2. To replace the CHECK VALVE and SPRING:

The stainless check valve holds pressure in the system to assist priming and prevent cycling of the pressure switch when the power is on but the pump is off.

SCRUBBER

At the time of printing of the parts list, these parts are shown but not called out with key numbers. refer to the following diagram and part numbers for location and order reference.



- a. Remove the 3 Phillips head self-tapping screws from the pressure switch.
Note the location of the long screw.
- b. Remove the pressure switch and diaphragm.
- c. Pull out the black plastic check valve guide.

NOTE: Valve spring is behind guide and may pop out when guide is removed.

- d. Replace check valve and spring if required.

NOTE: If valve leaks, also check valve seat for wear. Replace housing if worn.

m. To replace the diode bridge RECTIFIER on the 443C:

The brush drive motor in the 443C is actually a DC (direct current) motor. In order for it to run on AC, a rectifier is installed which converts alternating current to direct current that the motor can run on. The pump motor works the same way, and has a rectifier built-in to the motor leads.

1. Follow previous instructions to access the pump housing.
2. Disconnect the 4 wire leads to the rectifier. Note or tag proper lead locations for reassembly.
3. Remove the Phillips screw and nut holding the rectifier to the motor housing, and remove the rectifier.
4. To reinstall, make sure the rectifier is in the proper position and that the motor leads are reattached properly.

n. To replace the pump RESISTOR on the 443:

IMPORTANT! RESISTOR MAY BE HOT. ALLOW TO COOL BEFORE ATTEMPTING REPAIRS.

This resistor is required on the 443 model to slow the pump down and therefore reduce the solution flow to the proper amount.

1. Follow previous instructions to access the pump housing.
2. Disconnect the 2 wire leads to the resistor.
3. Remove the two Phillips screws and nuts holding the resistor to the housing.