

# ELECTRA-MATIC



## INSTRUCTION MANUAL

■ OPERATION

■ CARE

■ SERVICE



**Model EM-21A**



WINDSOR INDUSTRIES, INC 1351 W STANFORD AVE . ENGLEWOOD, CO 80110 • 303/ 762-1800 • TWX 910-931-0565

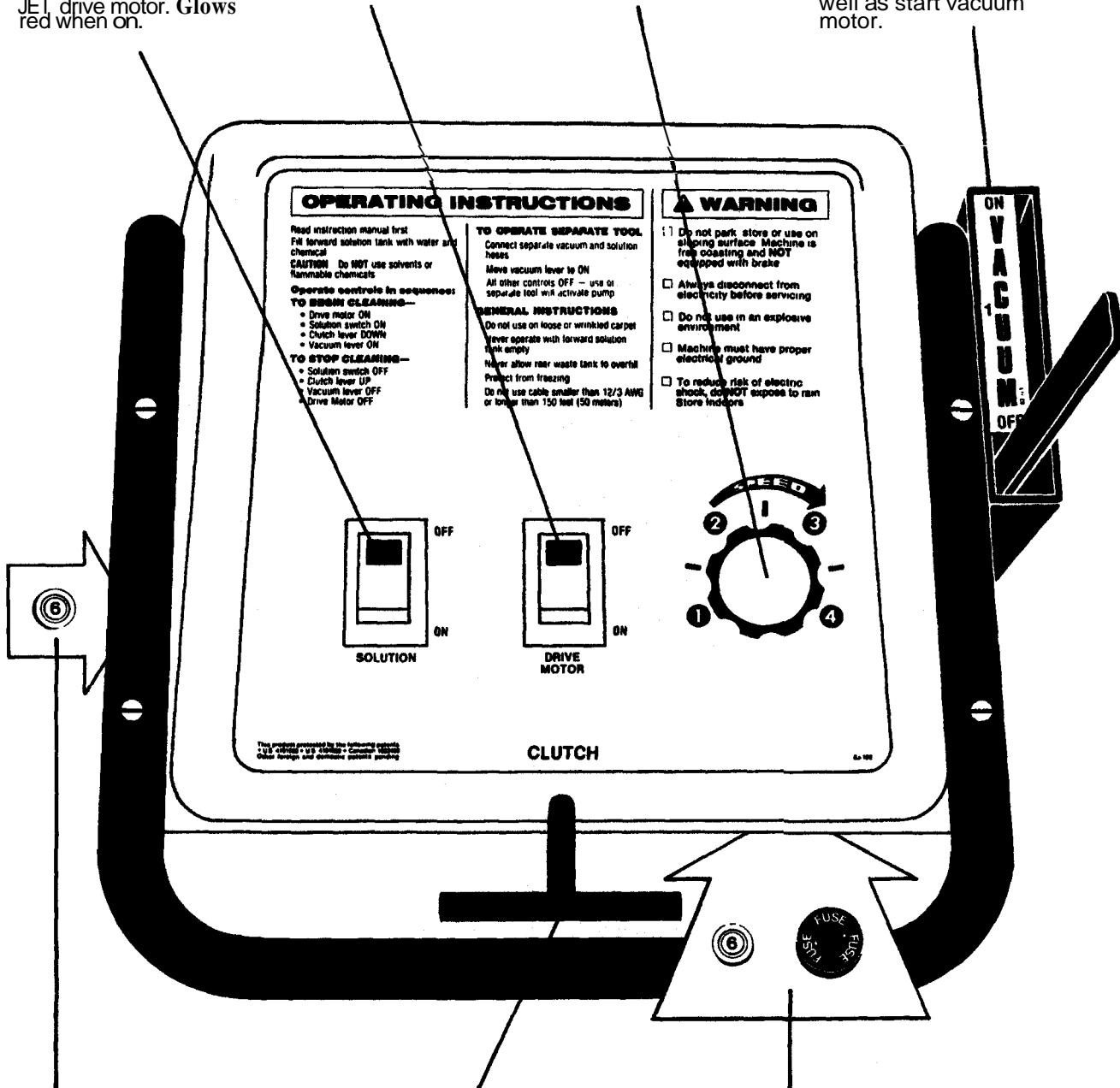


**SOLUTION/THRUSTERJET**  
Turns on solution pump and THRUSTERJET drive motor. Glows red when on.

**DRIVE MOTOR**  
Turns on propelling motor. Glows red when on.

**SPEED**  
Control forward propelling speed from 1 (stop) to 4 (max.).

**VACUUM LEVER**  
Release to forward position to lower pickup assembly to carpet as well as start vacuum motor.



**THRUSTERJET CIRCUIT BREAKER**  
Protects pump/spinner drive motor from burn-out. Push to reset after correcting problem.

**CLUTCH**  
Push down to propel when DRIVE MOTOR is on.

**DRIVE MOTOR LINE FUSE AND CIRCUIT BREAKER**  
Protects drive motor and circuit board. Replace fuse or push to reset breaker after correcting problem.

**PREPARING THE ELECTRA-MATIC**

**FILL SOLUTION TANK** to the desired level according to the marked gauge inside the tank **CAUTION** If a bucket is used to fill the tank, be sure that it is clean

**LIQUID DETERGENTS ARE PREFERRED**, however if a powdered detergent is used, be sure it is fully dissolved **BEFORE** putting it in the solution tank Do this by dissolving it in a bucket containing about 1 gallon of hot water before emptying it into the solution tank

You will find a 1 cup (8 oz.) measure on the bottom of the solution tank lid to assist you in making the proper dilution of cleaning chemical and water

**CAUTION** Do not put defoamer, solvents, spotter or prespray chemicals in the solution tank

**SPLASH APRON ADJUSTMENT** — With machine setting on carpet to be cleaned, adjust each splash apron to touch top of carpet pile



**PLACE RECOVERY DOME** atop recovery tank, being sure that gasket material is undamaged and making a good seal with the recovery tank

**ATTACH ELECTRIC CABLE** to Twist-Lok connection at rear of control panel beneath operating handle

- Note that all switches are in "off" position when attaching Twist-Lok



- Attach cable strain reliever as shown to prevent electrical problems
- Plug into grounded wall outlet

**IMPORTANT!** An extension cable may be used with the ELECTRA-MATIC, however, use nothing less than a 12 gauge, 3-wire of not more than 75 feet in length

**TO BEGIN CLEANING: FOLLOW THE SEQUENCE BELOW. . .**

1. Set forward speed with control knob
2. Press "drive" motor switch to "on" position — red light will glow **CAUTION** Never turn on drive motor with clutch lever down, damage to motor and clutch could result
3. Begin moving by pressing down on clutch lever **CAUTION** Never secure clutch lever in down position, damage to drive motor and clutch could result
4. Press thruster jet switch to "on" position — red light will glow
5. Release vacuum lift lever to forward position to **start vacuum** motor, and lower pkkup **assembly to floor.**

**CLEANING TIPS . . .**

- GO SLOW on very dirty carpet to avoid streaking Be prepared to make two cleanings if carpet is badly soiled **Pre-spraying** may also be necessary
- Narrow bands of streaking can result from a plugged THRUSTERJET nozzle See **service section** for instructions Pay more attention to using a clean bucket when filling solution tank to avoid future problems
- Paths, or wide stripes, over the carpet can occur with certain types of carpets This is due to the "lay" of the carpet fibers It will go away when vacuumed
- Be sure to overlap enough to prevent uncleaned stripe

**WORK AWAY** from the power source if possible Begin cleaning next to wall This will allow you to always make turns away from the cable

**KEEP ELECTRA-MATIC MOVING** when thruster jets are "on" If it becomes necessary to stop to maneuver in a turn or corner, push the thruster jet switch to the "off" position **CAUTION** Over-wetting of the carpet is likely, or damage to the carpet is possible, if the ELECTRA-MATIC is permitted to stand in one position with the thruster jets on

**THE FORWARD SPEED** of the ELECTRA-MATIC is controlled with the knob on the control panel, numbered from 1 to 4

**RESTORATION OR SALVAGE CLEANING** will be best accomplished with the control set from 1 to 2½

**MAINTENANCE CLEANING** can be best accomplished somewhere from 2½ up to

4, depending upon the condition of the carpet being cleaned.

Forward speeds and approximate coverages are

	SPEED FPM	COVERAGE SQUARE FEET PER HOUR (Straightahead cleaning — no allowances)
4	60	5400
3½	43	3800
3	32	2800
2½	25	2250

**TO PULL THE ELECTRA-MATIC IN REVERSE**, or go forward without power, raise the pickup assembly by pulling back on the vacuum motor lever

**CAUTION:** ELECTRA-MATIC is free-wheeling It should not be used on sloping surfaces or ramps Care should be exercised when approaching walls, obstructions or open stairways

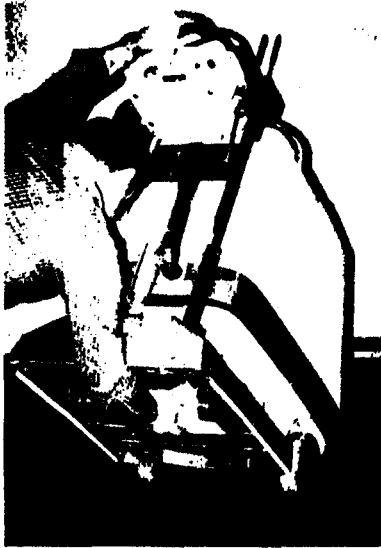
**TO STOP THE ELECTRA-MATIC:**

**FOLLOW THE SEQUENCE BELOW. . .**

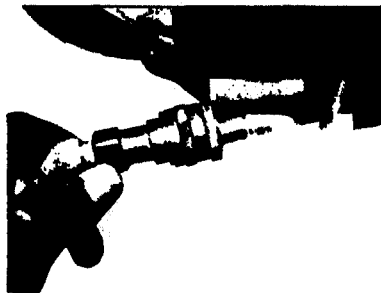
1. Push thruster jet switch to "off" 2 to 3 feet before stopping
2. Release clutch lever to bring ELECTRA-MATIC to complete stop
3. Pull vacuum lever backward to notched "hold" position
4. Do not push drive switch "off" unless you are done working with machine for the day or an extended period It is preferred that the drive motor remain on during brief periods of nonuse.

**SPINNER REMOVAL**

To avoid the possibility of the spinner assembly seizing on the rotary union shaft due to alkaline buildup, remove spinner at the end of each day The jets can be removed for cleaning Wash jets and blow dry Do not use pins or wire to remove obstruction as this could damage jets and change spray pattern To remove spinner, tilt machine forward and remove spinner assembly by turning counter clockwise. (See photo on next page). If spinner is seized on shaft, refer to Photo 13 on page 6



**TO USE FLOOR AND HAND TOOLS** with the ELECTRA-MATIC, attach solution hose to male attachment at lower right rear of machine, and the vacuum hose to the clear plastic recovery dome



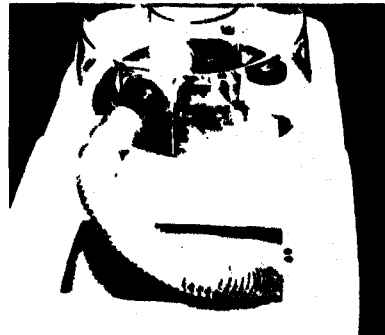
Release the vacuum lever to the forward position to create vacuum. Solution pump turns on when valve at attachment is activated. CAUTION. Switches on ELECTRA-MATIC control panel must remain "off"

**CLEANUP AND STORAGE**

**WARNING:** To avoid electric shock do not expose to rain. Store indoors



**EMPTY RECOVERY TANK** directly into floor drain or into bucket for disposal. Flush inside of recovery tank with clean water. Clean the inside of the recovery dome



**EMPTY SOLUTION TANK** by detaching recovery hose at floor tool and placing into solution tank with vacuum motor running

**CAUTION** Never allow recovered solution to remain in tank when not in use, nor allow unused solution to remain in solution tank when in storage

**WIPE** the entire outside of the ELECTRA-MATIC with a cleaning cloth, using warm water and mild soap



**STORE** ELECTRA-MATIC with recovery shoe in the "up" position. Place recovery dome upside down in recovery tank as shown to permit drying of gasket and the inside of the tank

**INSPECT** screens in solution and recovery tanks. Clean with soft-bristled brush if necessary

**PERIODIC MAINTENANCE**

**EVERY TWO WEEKS:**

**CLEAN SOLUTION SYSTEM** by diluting 2 gallons of clean water with a quart of white vinegar (acetic acid) in ELECTRA-MATIC solution tank. Run solution through the system with the machine parked over a floor drain. This procedure will free the system of harmful buildups which could eventually cause it to plug

**EVERY 500 OPERATING HOURS:**



**OIL FRONT DRIVE WHEEL BEARINGS** by removing hub cap and snap ring on axle. Slide wheel off axle and apply 6 drops of 10W oil to bearings

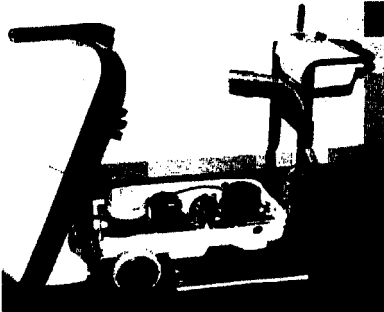
**REMOVE VACUUM MOTOR** to inspect carbon brushes for wear. If worn to 3/8 inch, the brushes should be replaced. See service section for instructions

**WIPE** clean all working components when exposed for vacuum motor inspection



**TO EXPOSE WORKING PARTS FOR INSPECTION** remove inspection plugs, loos-

en screws holding tank support bracket to frame and tip tank assembly forward.



**CAUTION:** Be sure ELECTRA-MATIC IS UNPLUGGED FROM WALL OUTLET AND THAT TANKS ARE EMPTY.



**TO REMOVE TANK ASSEMBLY FROM MACHINE** disconnect internal hoses, pull pins from front hinges and tip off.



This digital recorder keeps track of operating hours. It is wired into the vacuum motor circuit so that all operations using the vacuum are recorded.

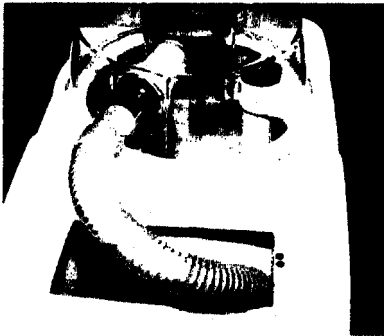
**IF YOU WILL USE AND CARE FOR YOUR ELECTRA-MATIC AS WE HAVE DESCRIBED IN THIS SECTION, IT WILL GIVE YOU YEARS OF TROUBLE-FREE SERVICE.**

## SERVICING THE ELECTRA-MATIC

### DRAIN AND CLEAN TANKS

**SOLUTION TANK** — (To remove unused solution).

1. Plug extension cable from machine into properly grounded outlet.
2. Remove hose from vac shoe and pull through guide on handle



1.

3. Position dome on waste water tank to allow vac hose to be lowered into solution tank.
4. Lower vacuum lever to turn on vac motor. Vacuum solution into waste water tank. Use water hose to rinse inside of tank. Reattach vac hose to shoe when finished.

### WASTE WATER TANK:



2.

1. Remove drain hose from keeper on bottom of control housing and put hose over drain or bucket.
2. Use water hose and detergent to clean inside of tank.

### TANK REMOVAL

1. Empty solution and waste water tanks.

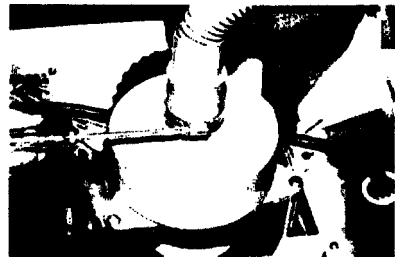


3.

2. Remove inspection plugs. Loosen screws holding tank support bracket to frame and tip tank assembly forward.

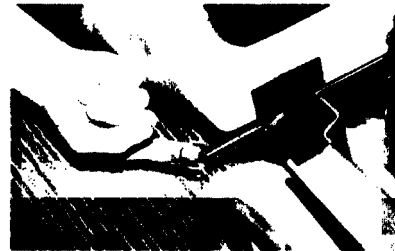


4.



5.

3. Tilt tank forward and disconnect hoses from tank and vac motor.



6.

4. Remove front hinge pins and set tank aside.

**Tank Repair:**

The tanks are made of Polyethylene. Small holes, cracks, etc., can be repaired by using heat. Apply low heat from torch to damaged area until material is softened. Use screw driver blade or other flat metal tool to seal damaged area.

**TO REINSTALL TANKS**

1. Set tank in front of machine and install hinge pins.
2. Connect solution and vac hoses.
3. Lower tank to base...check position of hoses to make sure that they are not pinched.
4. Tighten screws to hold tank support bracket to frame.

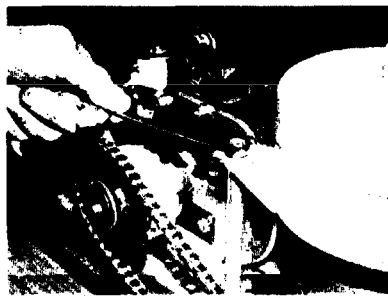
**VACUUM MOTOR REMOVAL**

1. Disconnect machine power cord from electrical source.
2. To access vac motor, refer to "Tank Removal" instructions.



7.

3. Disconnect hose from vac motor exhaust.



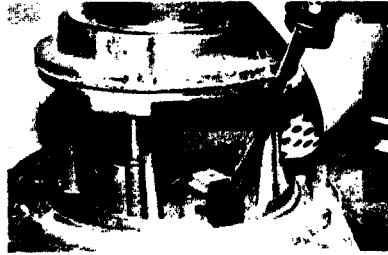
8.

4. Remove 3 screws holding vac motor.



9.

5. Disconnect vac motor leads from terminal block and remove vac motor.



10.

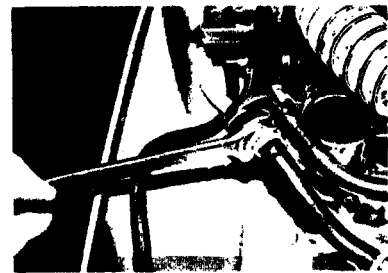
6. To inspect motor brushes, remove metal band around motor and remove brush holder assembly. Brushes should be replaced when worn to 3/8 inch or after about 750 operating hours. After second brush replacement, armature commutator should be checked for pitting and concentricity. Vacuum motors can be repaired but such repairs should be made by a qualified motor repair shop.

**VACUUM MOTOR INSTALLATION**

1. Position vac motor on supports and secure with screws and washers.
2. Attach hoses to motor.
3. Connect motor leads to terminal block (refer to machine wiring diagram as required.)
4. Plug power cord from machine to properly grounded outlet and test vac motor by lowering vacuum control lever.

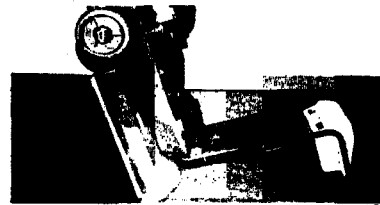
**SOLUTION PUMP REMOVAL**

1. Disconnect machine power cord from electrical source.
2. To access solution pump, refer to "Tank Removal" instructions.



11.

3. Remove hosebarbs from pump fittings. (NOTE: Special hosebarbs allow hose to swivel on barb during removal without damage to hose.)
4. Move machine rearward slightly to position casters in rearward position.



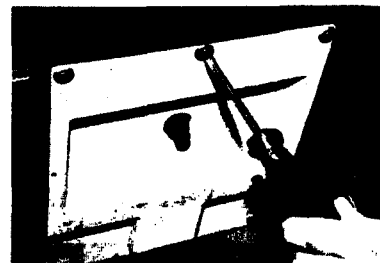
12.

5. Lift front of machine and tilt backwards until it rests on the control handle.



13.

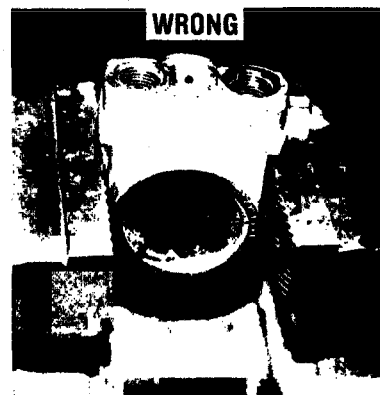
6. Remove spinner assembly using 1/2 inch open end wrench to hold shaft and turn spinner counterclockwise (facing spinner).



14.

7. Remove belt access cover.
8. Loosen 3 nuts and screws that hold pump to base and slide pump rearward to allow belt to be removed from pulley. Remove nuts and screws and pump from base.

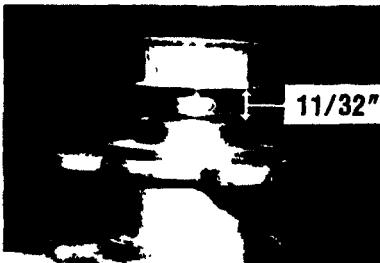
**SOLUTION PUMP INSTALLATION**





1. Remove elbows from old pump and install on new pump using pipe joint sealant

CAUTION — if a vise is used to hold pump, see photo for correct way to clamp pump. Do not overtighten vise as this could cause internal damage to pump. Extra caution should be taken to keep foreign material from entering pump during assembly.

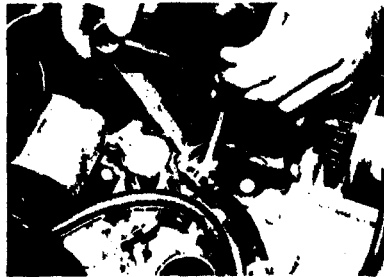


2. Install pulley on pump shaft at dimension shown in Photo W17 (11/32 inch between pump face and pulley flange)
3. Set pump in position on main frame and put belt on pulley. Install screws and nuts that hold pump. Slide pump forward to tighten belt and tighten pump mounting screws
4. Install belt access cover, lower machine to floor and install tank assembly. Reinstall spinner assembly. Put solution in tank and test pump

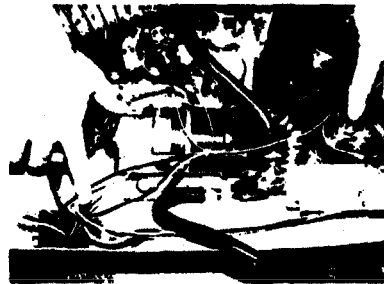
**ROTARY UNION AND/OR SOLENOID VALVE REMOVAL**

**SOLENOID VALVE ONLY:**

1. Disconnect machine power cord from electrical source
2. To access solenoid valve, refer to "Tank Removal" instructions



3. Remove hose barb from solenoid (the special push lock hose barb allows hose to swivel during removal without damage to hose)



4. Disconnect solenoid leads from terminal block and top of capacitor
5. Use wrench to remove solenoid valve from rotary union
6. Clean, inspect or replace as required

**ROTARY UNION AND SOLENOID VALVE ASSEMBLY:**

1. Proceed as outlined in Steps 1 through 4 under "Solenoid Valve"
2. Lift front of machine and tilt backwards until machine rests on control handle (Photo 12)
3. Remove belt access cover (Photo 14)



4. Remove belt from rotary union pulley (roll off being careful not to damage belt)



5. Loosen set screws (2) in pulley and remove pulley from rotary union shaft (use gear puller)
6. Remove 3 screws holding rotary union to main frame and lift out solenoid valve and rotary union assembly
7. Inspect, repair, or replace as required (Refer to rotary union breakdown for replacement parts)

**ROTARY UNION INSTALLATION**

1. Position rotary union on main housing and install mounting screws

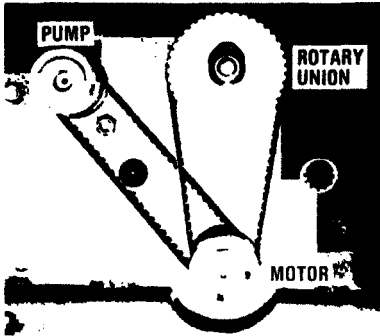


2. Slide pulley on shaft to dimension noted and tighten set screws (11/16 inch between pulley and frame.)
3. Install belt on pulley (roll belt onto pulley as shown in Photo 20). If belt is loose, tighten by adjusting drive motor or refer to "Belt Adjustment" instructions
4. Install belt access cover and spinner assembly
5. Lower machine to floor and install tanks
6. Put solution in tank and test machine

**BELT REPLACEMENT! ADJUSTMENT**

1. Disconnect machine power cord from electrical source
2. To access drive belts, refer to "Tank Removal" instructions
3. Lift front of machine and tilt backwards until machine rests on control handle (Photo 12)
4. Remove belt access cover (Photo 14)
5. Loosen motor mounting screws (4) and slide motor forward, then remove belt(s)

When installing new belts use the following sequence:



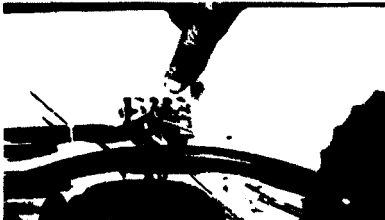
24

**NOTE** Drive motor and pump are movable to allow for belt adjustment. Loosen screws holding pump and motor.

- A. Install pump drive belt then rotary union drive belt. Slide motor rearward until rotary union drive belt is tight. Tighten motor screws.
- B. Slide pump forward until drive belt is tight. Tighten pump screws.

**AUXILIARY PUMP REMOVAL**

- 1. Disconnect machine power cord from electrical source.
- 2. To access auxiliary pump, refer to "Tank Removal" instructions.



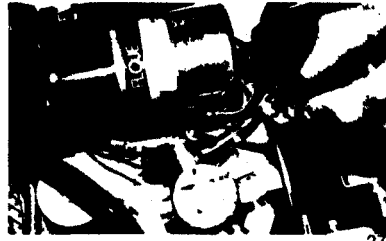
25

- 3. Disconnect pump leads from terminal block.



26

- 4. Remove hose barb at branch tee (special push lock hosebarbs allow hose to swivel without damage to hose during removal and assembly).



27

- 5. Remove 4 screws holding pump to frame and lift out pump.
- 6. Remove outlet hose with hose barb from pump head.
- 7. Lay pump on bench and refer to auxiliary pump breakdown for replacement parts.
- 8. Reinstall pump in reverse of Step 1 through 6 above.

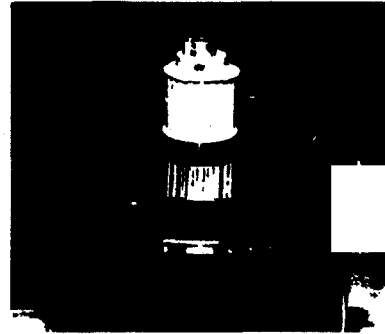
**MOTOR REMOVAL (PUMP/ROTARY UNION DRIVE MOTOR)**

- 1. Disconnect machine power cord from electrical source.
- 2. To access drive motor, refer to "Tank Removal" instructions.
- 3. Disconnect motor leads from terminal block and capacitor (Refer to Photo 25).
- 4. Lift front of machine and tilt backwards until machine rests on control handle (Photo 12).
- 5. Remove belt access cover (Photo 14).
- 6. Loosen 4 screws holding motor to frame, slide motor forward and remove belts from motor pulleys.



28

- 7. Remove screws holding motor and lift motor out.
- 6. Inspect motor, repair or replace as required.



29

- 9. When installing motor pulley, note dimension for spacing (13/8 inches from face of motor to inside edge of outer flange on pulley).
- 10. Install motor in reverse of above steps.
- 11. If required, refer to "Belt Replacement/Adjustment --".

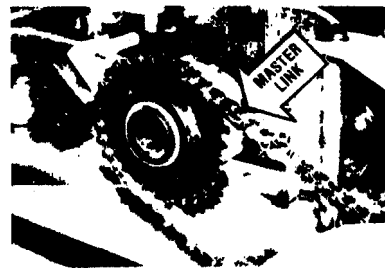
**FRONT AXLE AND WHEEL ASSEMBLY REMOVAL**

- 1. Disconnect machine power cord from electrical source.
- 2. Remove tanks, refer to "Tank Removal" instructions.
- 3. Remove belt access cover (Photo 12).



30

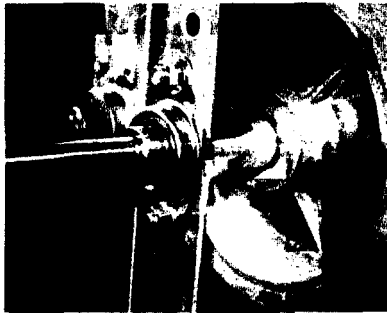
- 4. Remove bottom splash guard.



31

- 5. Remove drive chain from sprocket. **NOTE:** Chain has master link for easy removal.





32.

- Remove nuts and bolts holding flange bearing to frame.

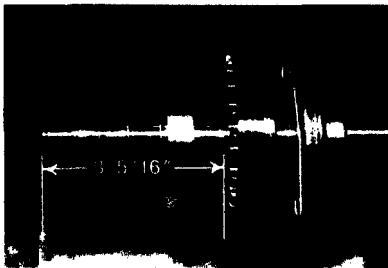


33.

- Remove axle assembly from machine and put on workbench to service.
- Remove snap ring on each end of axle.

**WHEEL AND AXLE SERVICE/INSTALLATION**

- Install flange bearings on axle. Position set screws (in locking collars) over innermost flats on axle and tighten screws. (Slight adjustment of bearings may be necessary when reinstalling assembly to frame.)
- When replacing sprocket on axle note dimension — approx. 3 5/16 from end of axle to face of sprocket. (Photo 34)



34.

- Replacing bearing/clutch bearings in wheels. These are directional bearings and must be installed as follows:



35.

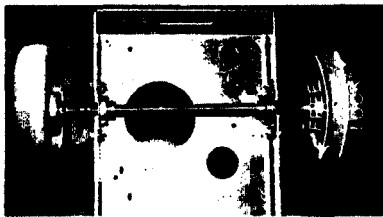
**LEFT WHEEL:** Bearing must be pressed in from inboard side of wheel with knurled end of bearing sleeve on inboard side of wheel.



36.

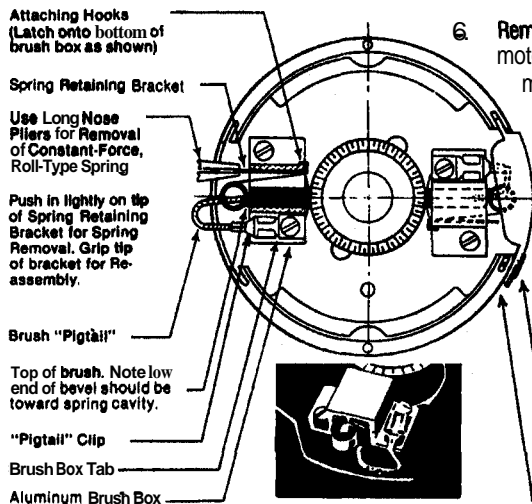
**RIGHT WHEEL:** Bearing must be pressed in from outboard side of wheel with knurled end of bearing sleeve on outboard side of wheel.

**NOTE:** Both right and left bearing assemblies must be pressed in flush with the **inside** of wheel hubs.



37.

- To check assembly: hold axle — each wheel should rotate forward freely and lock on shaft when rotation is reversed.



**TRAVERSE DRIVE MOTOR AND CLUTCH REMOVAL (Bodine Motor)**

- Disconnect machine power cable from electrical source.
- To access traverse drive motor, refer to "Tank Removal" instructions.

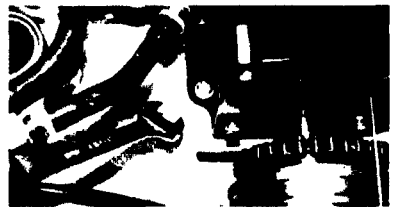


38.



39.

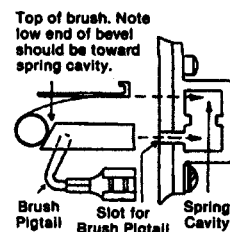
- Disconnect Molex connector from motor and clutch lead connector.
- Remove chain. **NOTE:** Chain has master link for easy removal (Photo 31).
- Remove belt access cover (Photo 12) and bottom splash guard (Photo 30).



40.

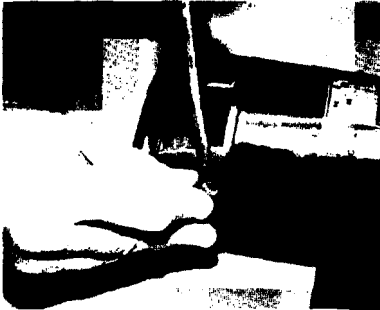
- Remove 4 screws and nuts holding motor and clutch to frame and remove motor. Put on workbench to service.

- To check motor brushes:



Brush caps are held in place with snap-type rivets. Snap brush caps out using largest possible screw driver tip under cap overhang.

**BRUSH REMOVAL  
(Bodine Motor)**



41.

Brush caps are held in place with snap-type rivets. Snap brush caps out using large screwdriver tip under cap overhang. Brushes are retained by constant-force, roll-type springs. To remove springs, press inward on the end of the spring retaining bracket using the tip of a pair of long nose pliers or other appropriate tool. Springs should "pop" out. If they don't, they can be removed by pulling outward on the spring retaining bracket with a pair of long nose pliers. Brushes can now be removed by pulling them out of the brush boxes by their "pigtails." It is not necessary to remove the brush pigtail dip from its connection to the brush box tab for brush inspection.

**BRUSH INSPECTION AND CLEANING  
(Bodine Motor)**

Brushes should be replaced before they are less than 1/4 inch (7 mm.) in length. Carbon dust accumulation should be removed periodically. If the end shield has been removed from the drive, a clean, dry, nonlinting cloth can be used for cleaning. Do not use solvents as they may damage the nonmetallic end shield.

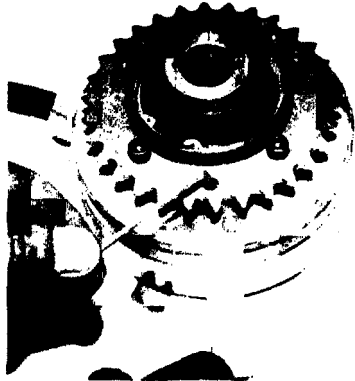
**IMPORTANT** — Make certain that the roll-type springs are positioned directly on the brushes.

- 8. The drive motor is equipped with sealed ball bearings and does not require lubrication.
- 9. The gear box on traction drive motor is grease-lubricated to last for the design life of the gear motor.

**CLUTCH ADJUSTMENT AND SERVICING  
(Electro Magnetic Clutch)**

- 1. Depending on the duty cycle and load, periodic inspections of the wear rate should be made. The air gap is preset at the factory to .005/.010. When this gap increases to

.025 it must be readjusted to factory specs (.005/.010).



42.

- 2. To adjust, use a feeler gauge (of spec. value) and turn the (3) set screws in equally to close air gap. When air gap can no longer be adjusted clutch must be replaced.
- 3. Care should be taken to insure that dust, dirt, oil, grease, soap, water, etc. does not come in contact with the working surfaces (rotor and armature faces) of the unit. If friction faces become dirty, the clutch will slip, causing overheating and a loss of torque.
- 4. If clutch fails to engage, check the following:
  - A. Check air gap: regap as required.
  - B. Check for contamination of the working faces.
  - C. Check electrical connections.
  - D. Check for grounded or open coil.

**Grounded Coil:** Disconnect machine from power source. With ohmmeter connected between clutch lead and housing, there should be no reading on meter (check both clutch leads). If ohm meter shows a reading, the coil is grounded and clutch must be replaced.

**Open Coil:** Use ohmmeter to measure resistance between clutch leads. Reading on ohmmeter should be  $775 \pm 40$  ohm. An open coil indicates near zero reading and clutch must be replaced.

**AVERSE DRIVE MOTOR CLUTCH REMOVAL  
(Von Welse Motor and Marquette Clutch)**

- 1. Disconnect machine power cable from electrical source.

- 2. To access traverse drive motor, refer to "Tank Removal" instructions.
- 3. Disconnect motor lead connector.



43.

- 4. Disconnect leads from clutch arm solenoid.
- 5. Remove chain. **NOTE:** Chain has master link for easy removal. (Photo 31)
- 6. Remove belt access cover (Photo 12) and bottom splash guard (Photo 30).
- 7. Remove (4) screws and nuts holding motor and clutch to main frame. Remove motor and clutch and put on work bench to service.



44.

- 8. Remove brush cap and inspect motor brushes periodically. Brushes should be replaced when they reach 3/8" length or after approximately 750 operating hours. The gear box is sealed and permanently lubricated for the life of motor.

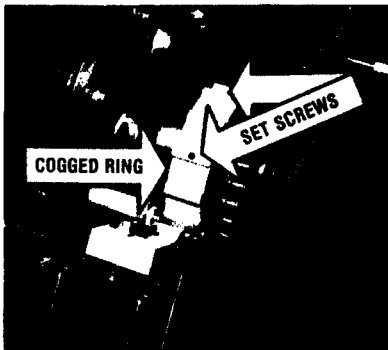


45.

**CLUTCH ADJUSTMENT AND SERVICING  
(Marquette Mechanical Clutch)**

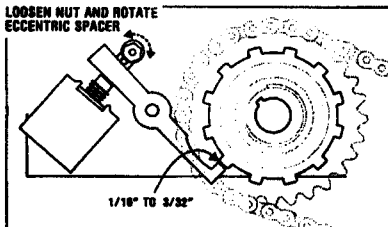
- 1. Depending on the duty cycle of the clutch, periodic inspections should be made.

2. Check (2) set screws located in outer cogged clutch ring. If screws loosen and back out, clutch slippage will occur. To reset cogged ring; remove set screws from ring. Rotate ring to align set screw holes in ring with corresponding hole in metal clutch body. Using allen wrench install the set screws finger tight. **CAUTION: DO NOT overtighten** as this will distort cogged ring and cause it to rotate "out of round."



46.

3. Clutch actuator arm/solenoid adjustment:



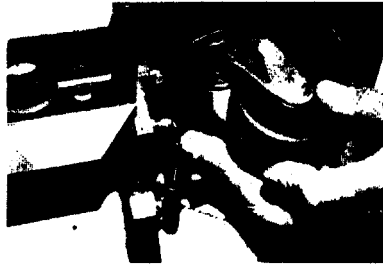
A space of 1/16 to 3/32 must be maintained between the tip of the actuator arm and the cogged ring. To adjust, loosen the nut holding eccentric spacer and rotate spacer until proper adjustment is made. Retighten nut to secure spacer.

**VACUUM SHOE REMOVAL**



47.

1. Remove lift rod from casting (snap spring connector).



48.

2. Remove lower ball joint connectors from vac casting (snap spring connector).
3. Use pliers to remove springs from anchor screws.



49.

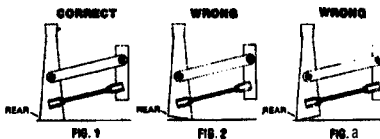
4. Loosen set screws that secure shoulder bolts to frame.



50.

5. Remove shoulder bolts that hold upper link arms to frame and remove vac casting.
6. Repair as required and replace in reverse of above steps.

**VAC SHOE ADJUSTMENT**



With machine on smooth level surface the front and rear shoe of vac casting should be parallel with surface.

1. If front shoe is off floor (Fig. 3), lengthen lower adjusting rods.
2. if rear shoe is off floor (Fig. 2), shorten lower adjusting rods.
3. Retighten lock nuts on adjusting rods after completing vac shoe adjustment.

4. **Vac Shoe Height Adjustment**—Place machine on smooth level surface, lower vac shoe. Lever should have approximately 1" of additional forward travel when properly adjusted. Lengthen or shorten lift rods A & B as required (Fig.4).

**CONTROL BOX REMOVAL AND SERVICE**

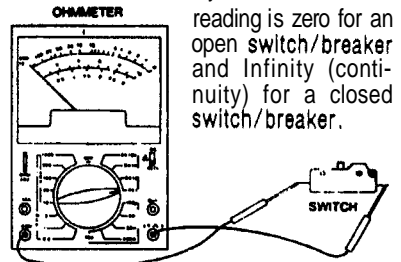
1. Disconnect machine power cord from electrical source.
2. Remove (4) screws and nuts holding control box to handle.
3. Remove (2) screws and nuts holding upper and lower section of control box together.

The following instructions pertain to identification and troubleshooting the repairable components in the control box.

**CAUTION:** Repairs should only be attempted by qualified personnel since damage can be done by persons not experienced in working with printed circuit boards and components. **Testing** can be done with an **AC/DC volt-ohmmeter**.

**TO TEST SWITCHES AND CIRCUIT BREAKERS**

Remove them from machine and use an ohmmeter or continuity tester. The correct



reading is zero for an open switch/breaker and Infinity (continuity) for a closed switch/breaker.

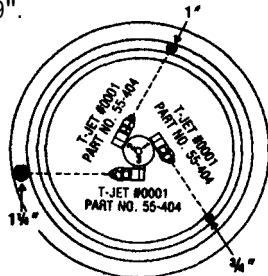
**TROUBLESHOOTING SPINNER MOTOR CIRCUIT BREAKER:**

If it trips, check the following:

- A. Incorrect size extension cable — nothing less than 12 gauge, 3-wire of 1 m ft in length.
- B. Faulty pump drive motor.
- C. Plunger thruster jet(s).
- D. Faulty rotary union or pump.
- E. Faulty capacitor.
- F. Faulty circuit board.

**TO CHECK SPINNER SPRAYPATTERN**

Use a commercial low pile carpet (a dark color is preferable) to test spray pattern. With solution in tank, activate solution switch momentarily to produce a "suds" pattern on carpet. The inside pattern diameter (Jet #1) must be 15 1/4" to 16 1/4". The middle pattern diameter (Jet #2) must be 17" to 18 3/4". The outside pattern diameter (Jet #3) must be 18 1/2" to 19".



**SOLID STATE CLUTCH CONTROL (DC CIRCUIT): (Bodline PC Board)**

This control supplies DC current to clutch. To check solid state control raise front of machine and use wood block to hold front drive wheels off floor. Plug machine power cord into properly grounded outlet. Turn on drive-motor switch and depress clutch switch lever. If clutch does not engage, check voltages on octal socket. Voltage at terminals 2 and 5 should be 115 VAC ± 10% (on 115 volt models) and 230 VAC ± 10% (on 230 volt models). Voltage at terminals 4 and 7 should be 90 to 110 VDC ± 10%. If zero reading at terminals 4 and 7, replace solid state control.

**SOLID STATE CLUTCH CONTROL (DC CIRCUIT): (Dart PC Control)**

This control supplies DC current to the clutch. To check solid state control. raise front of machine and use wood block to hold front drive wheels off floor. Plug machine power cord into properly grounded outlet. Turn on drive-motor switch and depress clutch switch lever. If clutch does not engage, check voltages at control board. Voltage at terminals marked AC should be 115 VAC ± 10% (on 115 volt models) and 230 VAC ± 10% (on 230 volt models). Voltage at terminals F- and F+ should be 85 to 105 VDC ± 10%. If zero reading at terminals F- and F+ replace solid state control.

**SPEED CONTROL/ TRACTION DRIVE MOTOR (DC CIRCUIT): (Bodline Motor and PC Board)**

The magnetic circuit breaker and in-line (ceramic) armature fuse protects circuit board and traction drive gear motor.

If drive motor does not run, check the following:

1. With machine plugged in use AC volt meter to check input voltage at terminals LI-L2 (with drive-motor switch on); reading should be 115 VAC ± 10% (on 115 volt models) and 230 VAC ± 10% (on 230 volt models). The output voltage at terminal A1 and A2 should be 0-130 volts D.C.
2. Check for loose electrical connections (at terminal block, switch, motor P.C. board and receptacle).
3. Open S-2 lead — use ohmmeter to check continuity from speed potentiometer to P.C. control board.
4. Check circuit breaker for continuity (use ohmmeter). If breaker trips after being reset, check for cause — faulty power cord or short in circuit. If this does not correct the problem, the P.C. control board may be faulty.
5. Check in-line armature fuse (2 amp ceramic fuse). If blown, replace with exact same type. If fuse blows after being replaced, the gear motor may be grounded or short circuited.

To test motor for ground or short circuit, first disconnect machine power cord from electrical source then disconnect motor lead Molex connector from motor. Using ohmmeter, check resistance between each motor lead and the motor frame. If readings are Infinity (continuity), the armature is grounded; replace gear motor.

To check for shorted armature, use ohmmeter to measure the resistance between the motor leads. If resistance is 5 ohms or less, the armature is short-circuited; replace gear motor.

6. If motor runs at maximum speed (no speed control), check leads S-1 and S-3 for open circuit between speed potentiometer and the P.C. control board. If no open circuit is found, the control board may be faulty.
7. Erratic starting and stopping of traverse motor could be due to a faulty P.C. board. With power connected to machine and motor switch on,

check D.C. output voltage at terminals A1 and A2. If voltage does not remain constant this is an indication that the P.C. board is shorted or open internally. Replace as required.

**SPEED CONTROL/ TRACTION DRIVE MOTOR (DC CIRCUIT): (Dart PC Control)**

The magnetic circuit breaker and in-line (ceramic) armature fuse protects circuit board and traction drive gear motor.

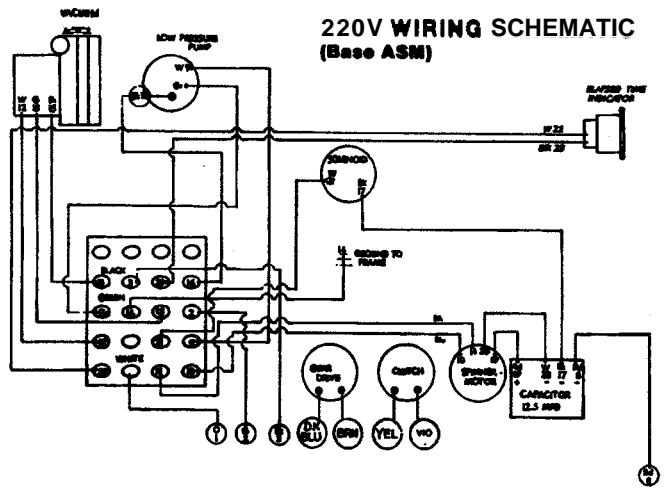
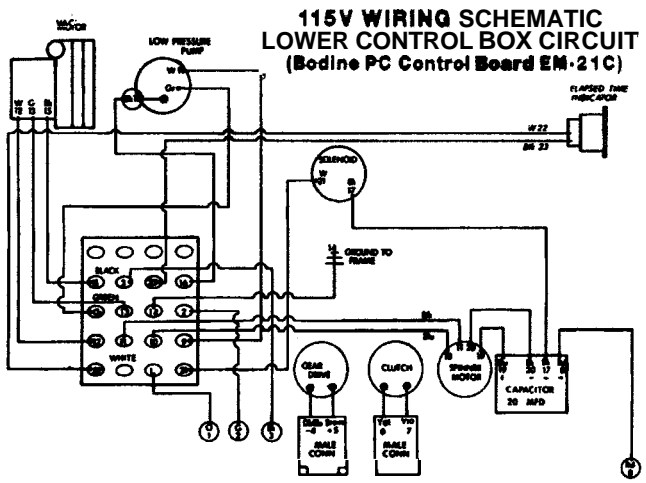
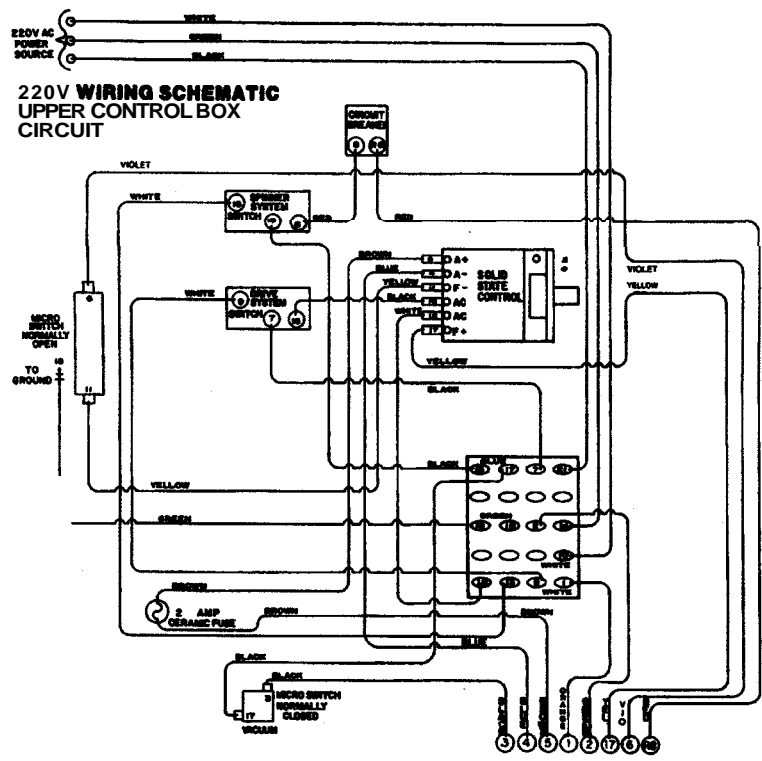
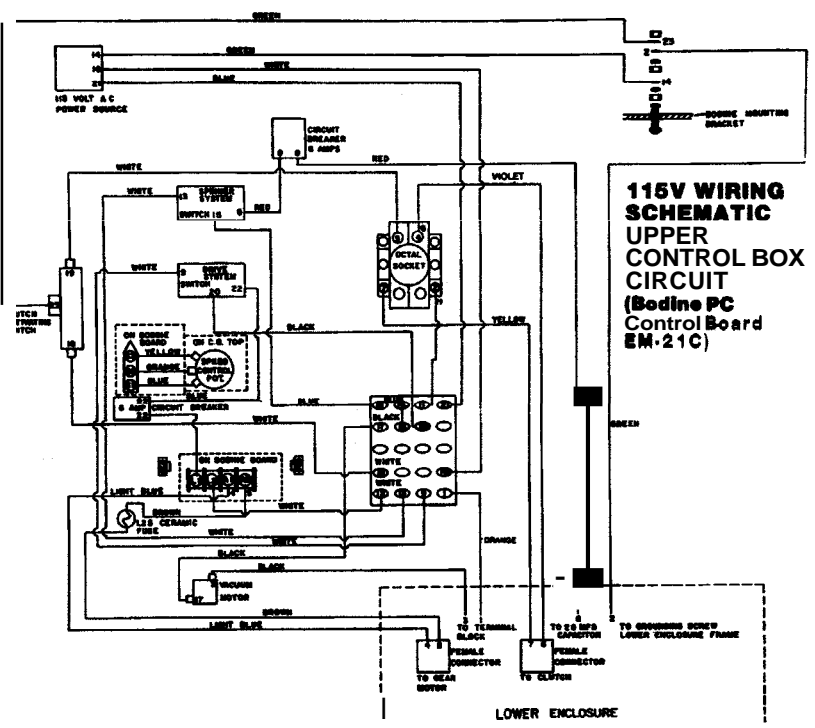
If drive motor does not run, check the following:

1. With machine plugged in use AC voltmeter to check input voltage at terminals AC. AC (with drive motor switch on), reading should be 115 VAC ± 10% (on 115 volt models) and 230 VAC ± 10% (on 230 volt models). The output voltage at terminals A+ and A- should be 0-105 volts DC.
2. Check for loose electrical connections (at terminal block, switch, and P.C. board).
3. Check circuit breaker for continuity (use ohmmeter). If breaker trips after being reset, check for cause — faulty power cord or short in circuit. If this does not correct the problem, the P.C. board may be faulty.
4. Check in-line armature (2 amp ceramic fuser). If blown, replace with exact same type. If fuse blows after being replaced, the gear motor may be grounded or short circuited.

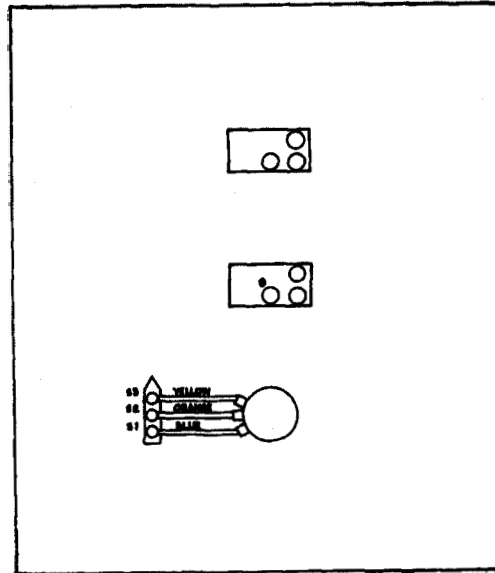
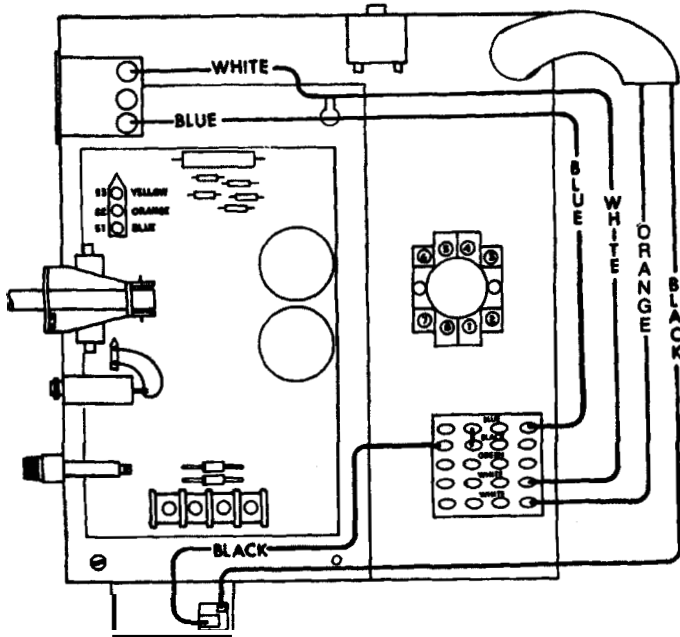
To test for ground or short circuit first disconnect machine power cord from electrical source then disconnect motor lead Molex connector from motor. Using ohmmeter, check resistance between each motor lead and the motor frame. If readings are not infinity (continuity), the armature is grounded, replace gear motor.

To check for shorted armature, use ohmmeter to measure the resistance between the motor leads. If resistance is 5 ohms or less, the armature is short circuited; replace gear motor.

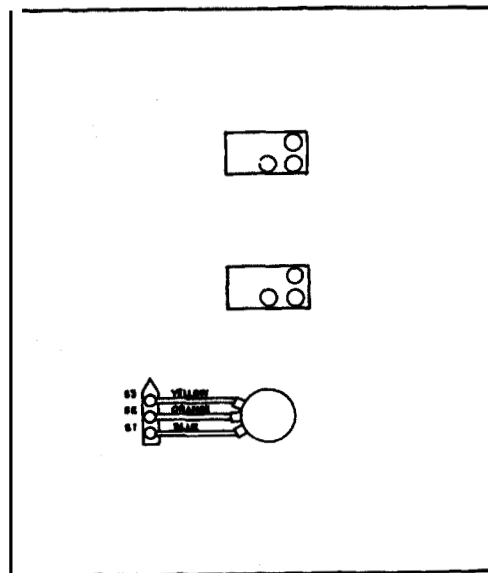
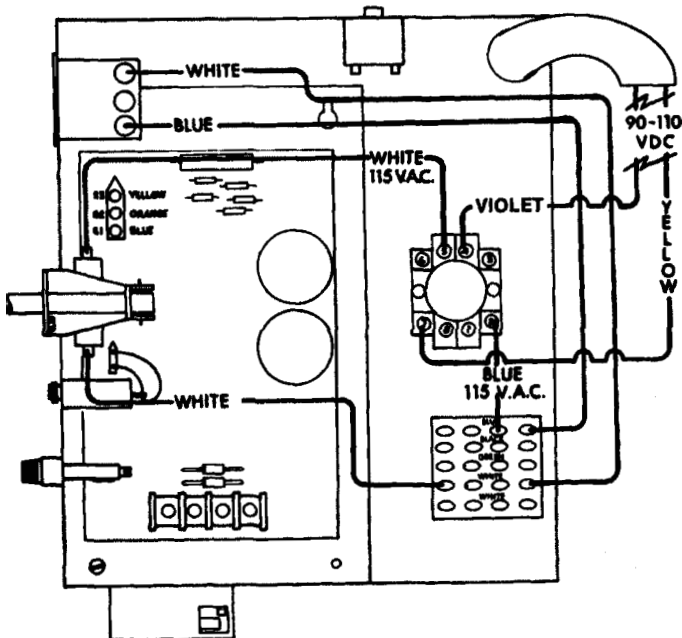
5. Erratic starting and stopping of traverse motor could be due to a faulty P.C. board. With power connected to machine and motor switch on, check DC output voltage at terminals A+ and A-. If voltage does not remain constant this is an indication that the P.C. board is shorted or open internally. Replace as required.



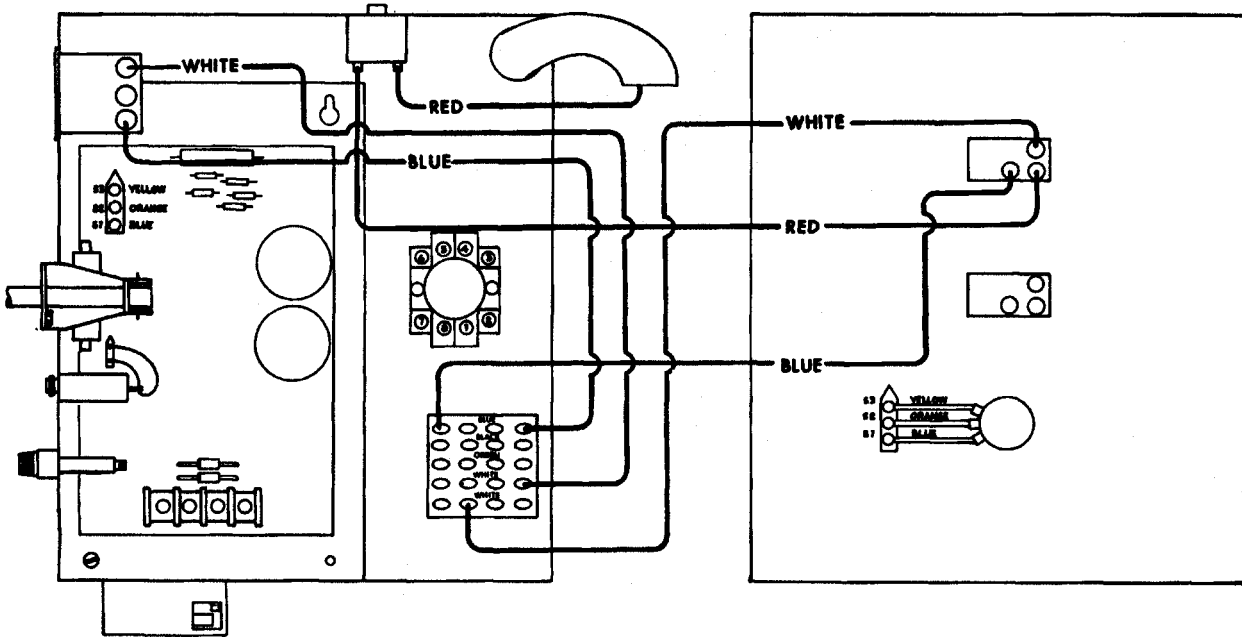
**ELECTRICAL CIR  
(Bodine Motor and**



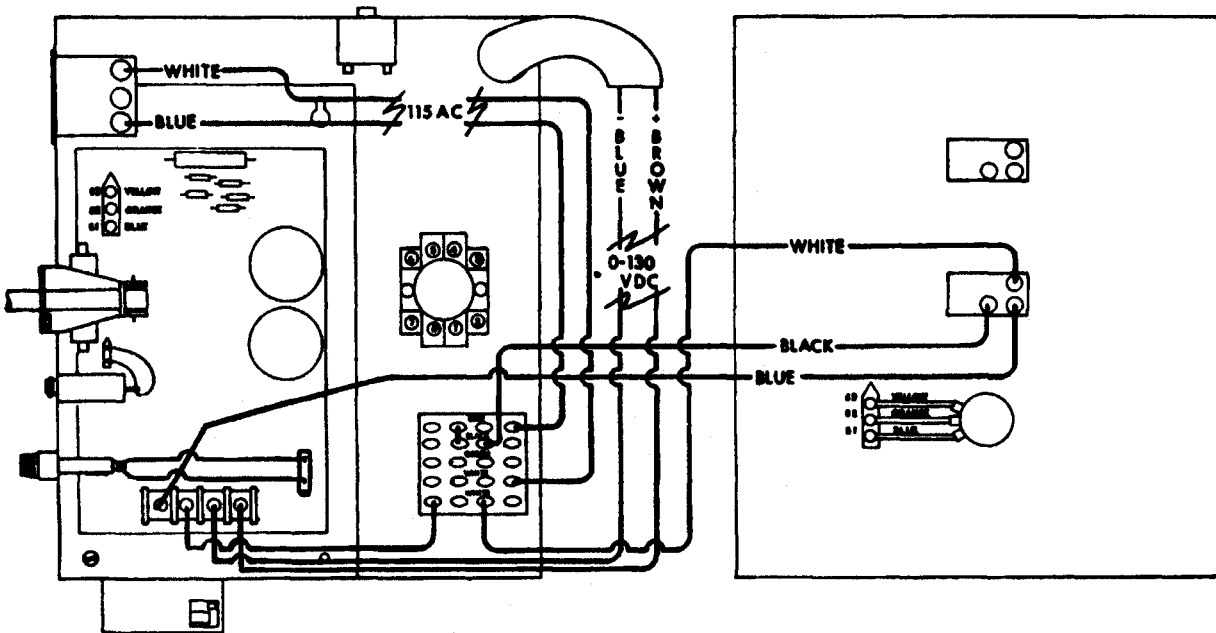
**VACUUM CIRCUIT**



**CLUTCH CIRCUIT**

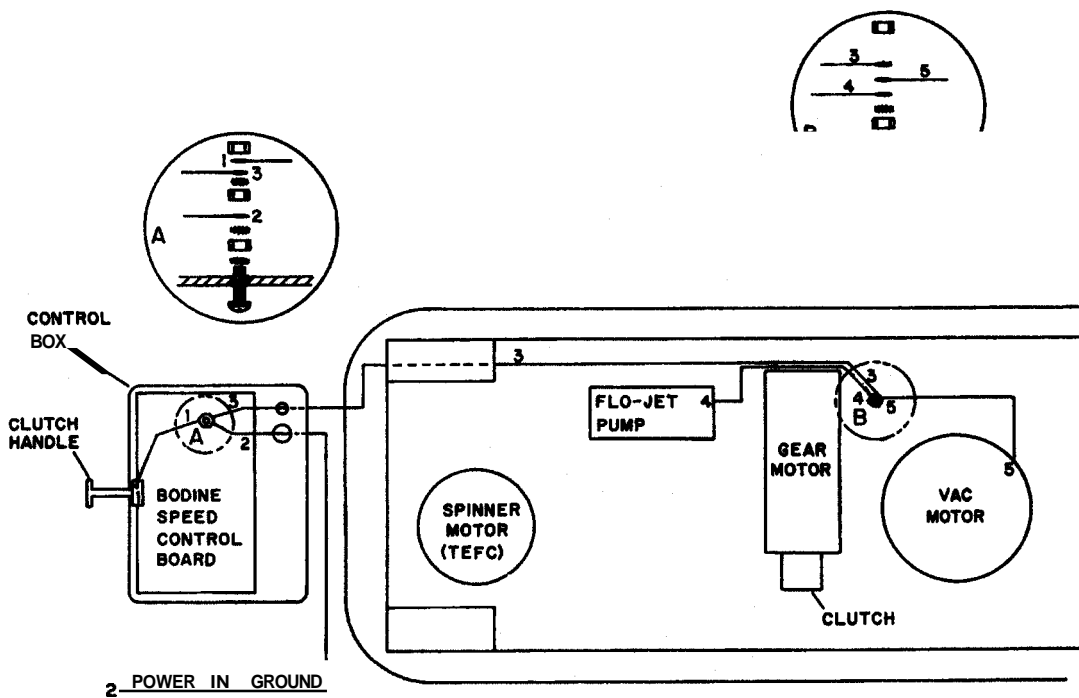
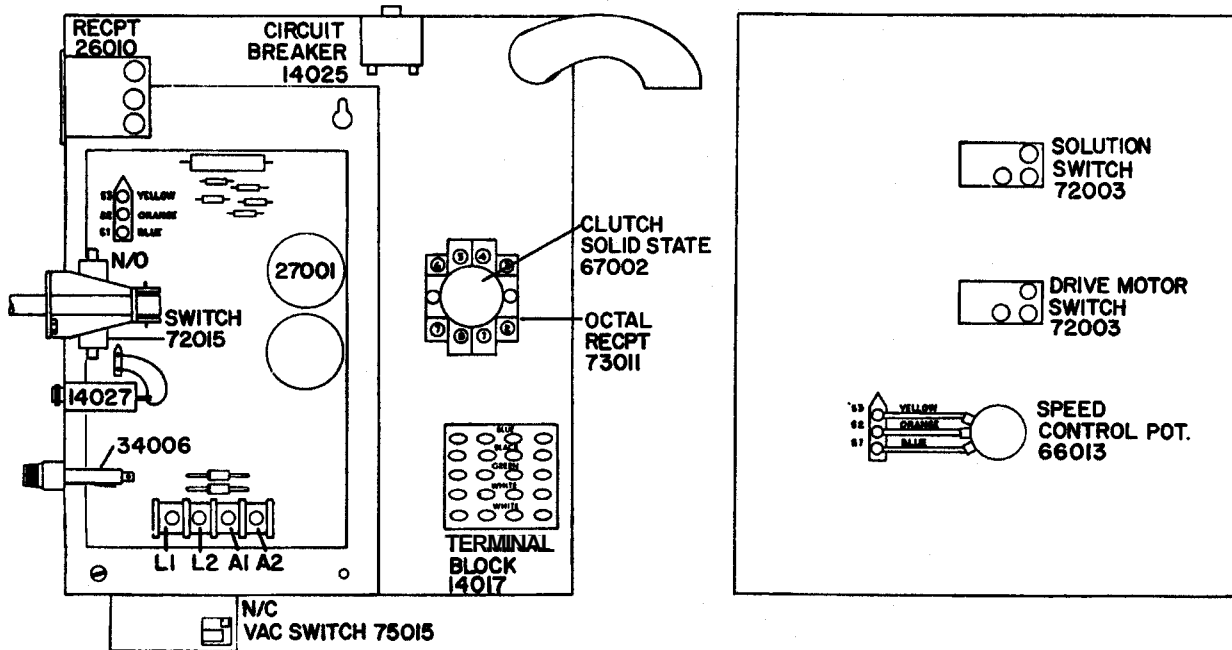


THRUSTER CIRCUIT



DRIVE SYSTEM CIRCUIT

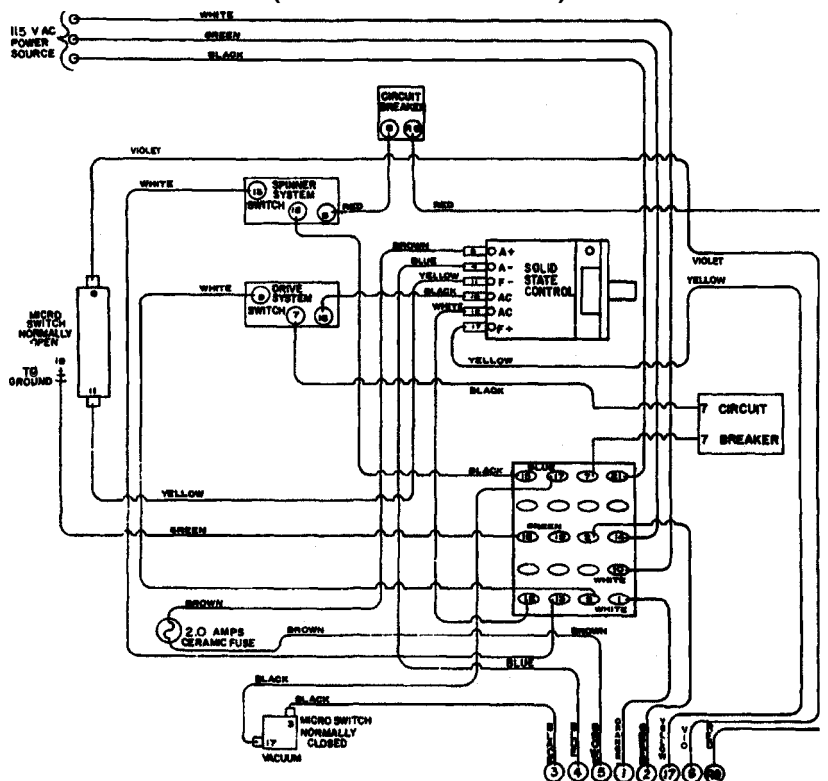
**ELECTRICAL CIRCUIT IDENTIFICATION**  
**(Bodine Motor and PC Control Board EM-21C)**



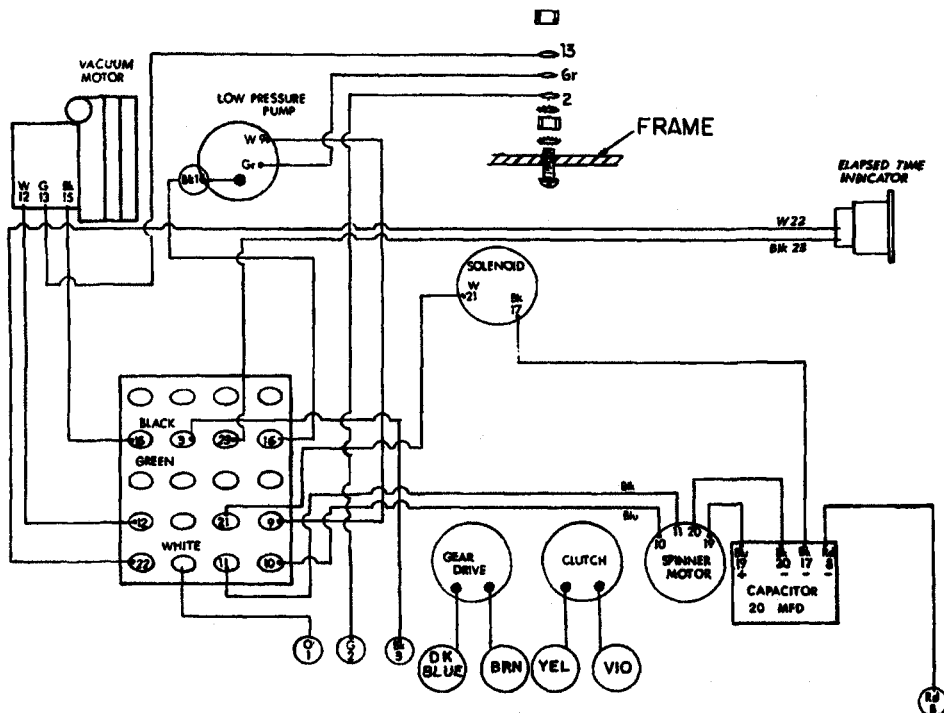
**GROUNDING CIRCUITS EM-21C**



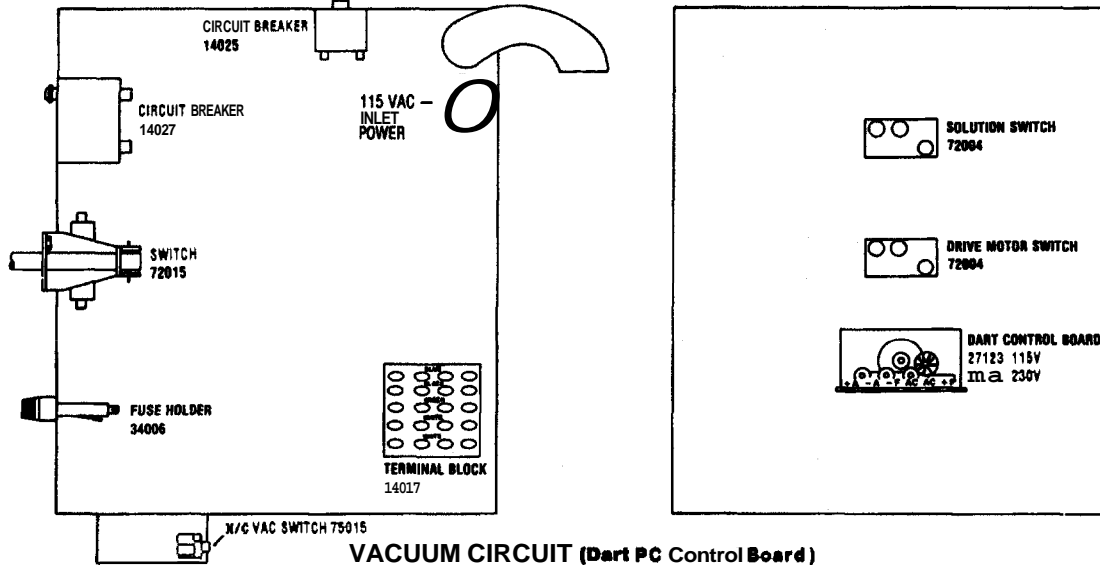
**115V WIRING SCHEMATIC UPPER CONTROL BOX CIRCUIT**  
(Dart PC Control Board)



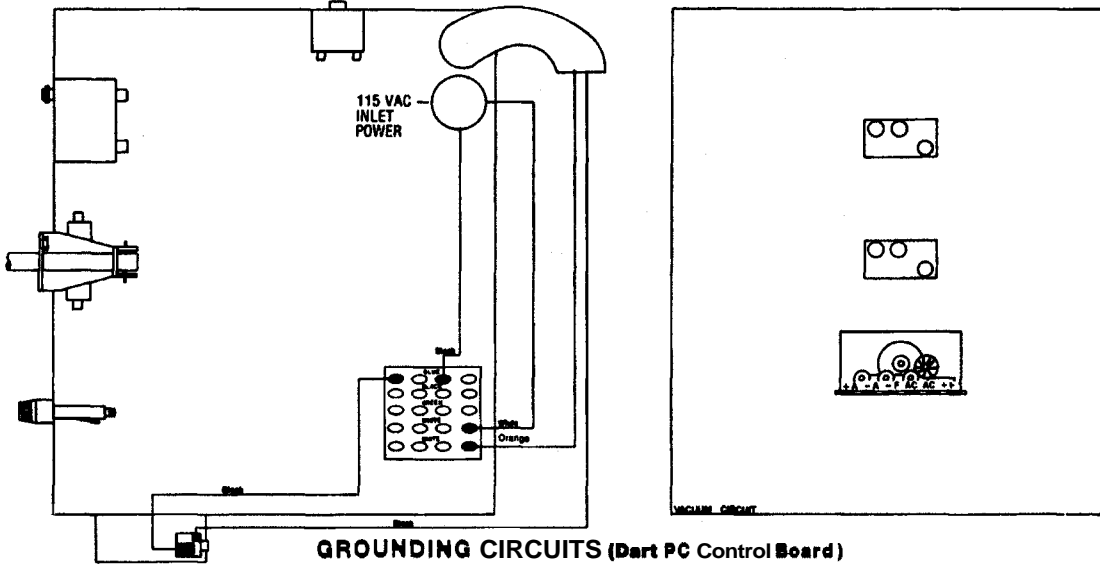
**115V WIRING SCHEMATIC BASE ASSEMBLY**  
(Dart PC Control Board)



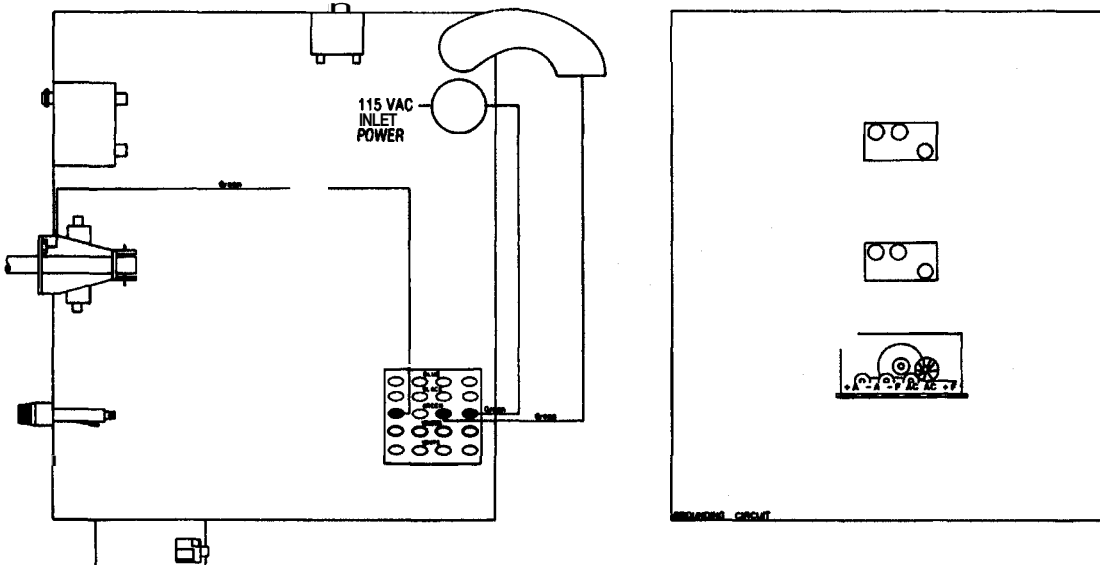
**ELECTRICAL PARTS IDENTIFICATION (Dart PC Control Board)**



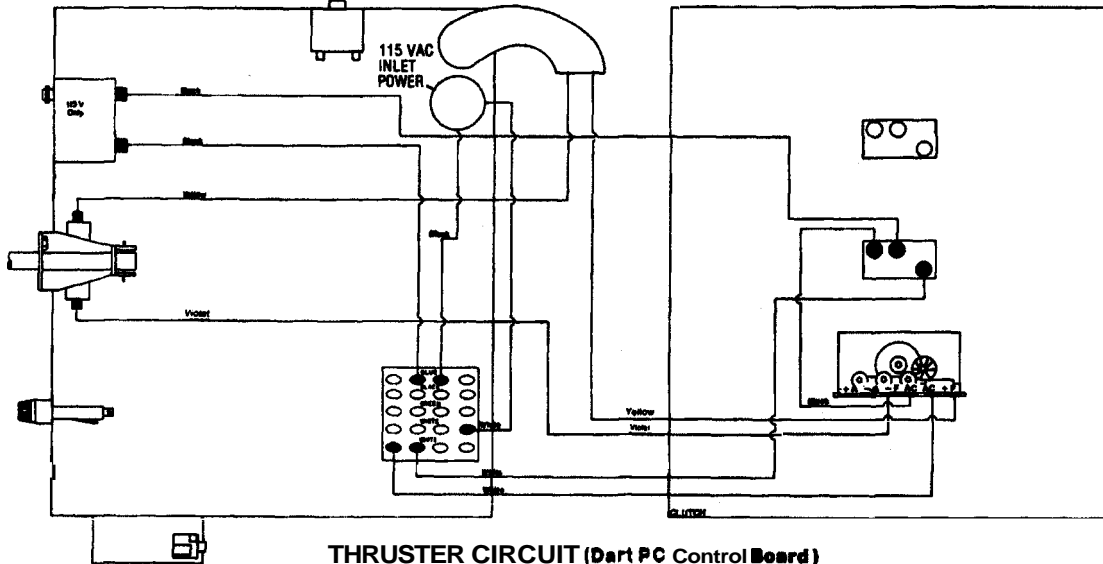
**VACUUM CIRCUIT (Dart PC Control Board)**



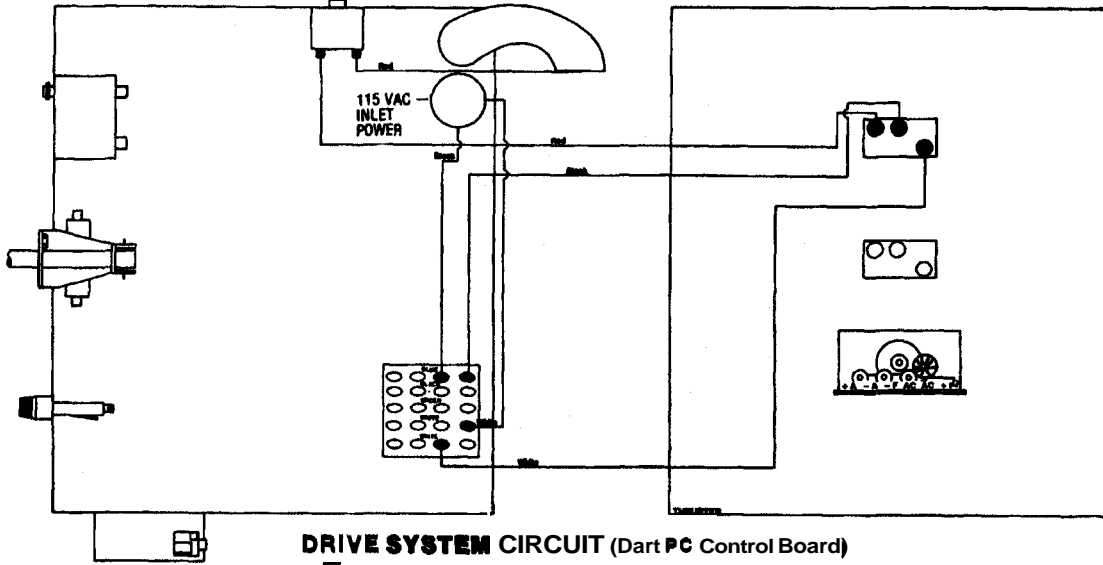
**GROUNDING CIRCUITS (Dart PC Control Board)**



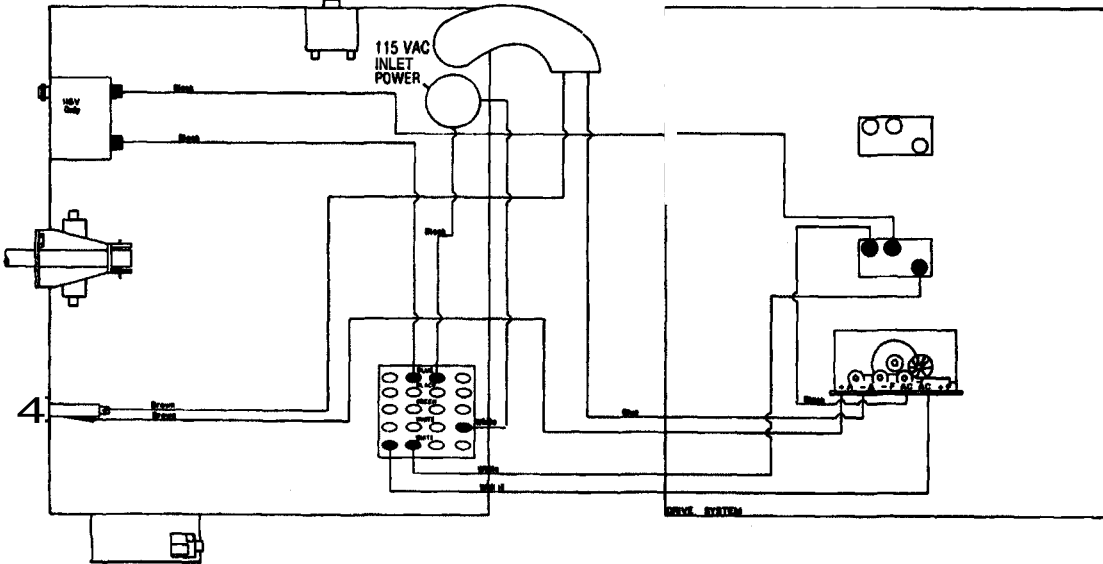
**CLUTCH CIRCUIT (Dart PC Control Board)**

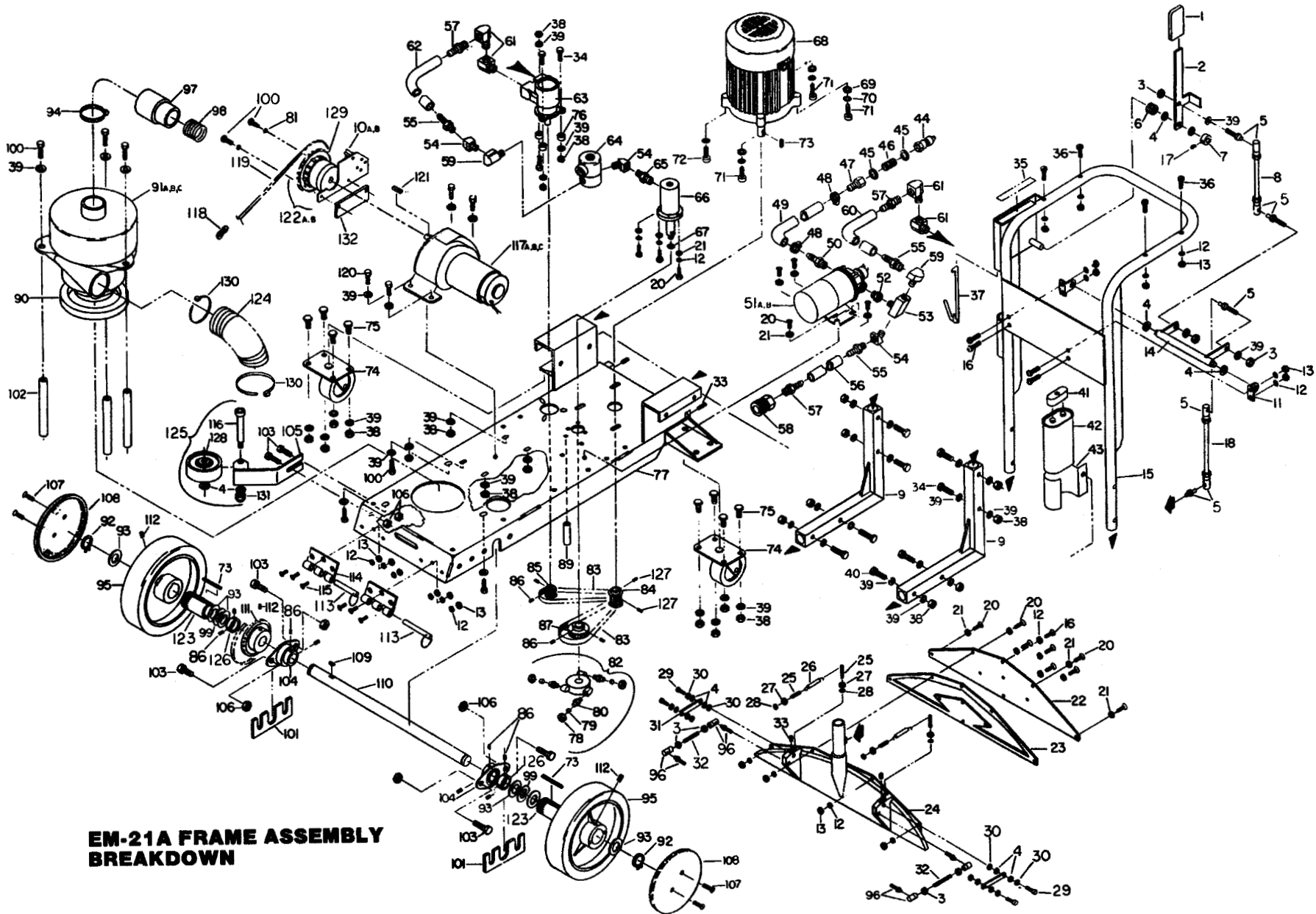


**THRUSTER CIRCUIT (Dart PC Control Board)**



**DRIVE SYSTEM CIRCUIT (Dart PC Control Board)**



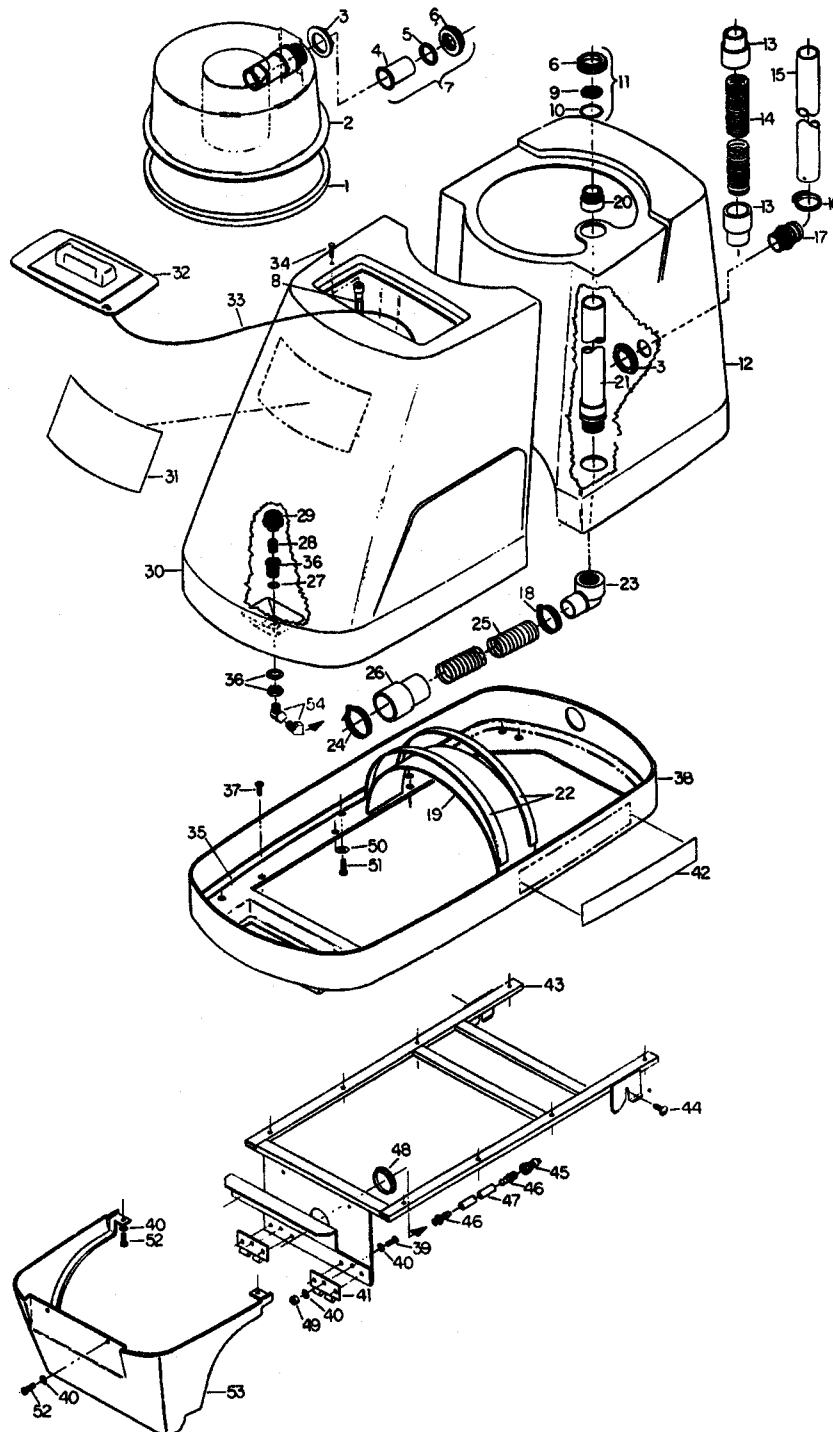


**EM-21A FRAME ASSEMBLY  
BREAKDOWN**

KEY	PART NO.	DESCRIPTION	KEY	PART NO.	DESCRIPTION	KEY	PART NO.	DESCRIPTION
1	36004	Grip, Vinyl Handle	47	40012	Hosebarb, 1/4" FPT x 1/4" HB	91B	53004	Motor, 230V 3-stage Vac w/tube
2	38019	Handle, Vac Shoe Lift	48	20016	Clamp, 1/2" Dia. Hose	91C	53111	Motor, 115V 5.7 Tang H-Perf. (EM-21C)
3	57029	Nut, 1/4-28 Hex	49	39056	Hose, 1/4" x 13"	92	67010	Ring, 5/8" Snap
4	87030	Washer, Teflon	50	40008	Hosebarb, 3/8" MPT x 1/4" HB	93	67012	Race, Thrust
5	14052	Ball Joint	51A	65018	Pump & Motor, 115V Flojet 2000-032	94	20019	Clamp, 1 7/8" Dia. Hose
6	73043	Spring, Compression	51B	65010	Pump & Motor, 230V Flojet	95	89019	Wheel, EM-21 Drive
7	27063	Collar, 3/8 Shaft	52	14076	Bushing, 3/8" MPT x 1/4" FPT Hex Brass	96	14029	Ball Joint, Heavy Duty Vac Shoe
8	51020	Linkage Asm., EM-21 Upper	53	78024	Tee, 1/4" Branch	97	04006	Adapter, 1.5" Hose
9	14090	Bracket Asm., Handle Support	54	31021	Elbow, 1/4" MPT x 1/4" FPT 45 Deg.	98	39020	Hose, EM-21 Vac Intake 19.5"
10A	05010	Actuator Asm., Marq. Clutch 115V	55	40006	Hosebarb, 1/4" MPT x 3/8" Push-on	99	87038	Washer, Wave Spring
10B	05017	Actuator Asm., Marq. Clutch 230V	56	39054	Hose, 3/8" x 13"	100	70011	Scr., 1/4-20 x 5/8" HHMS
11	14062	Bracket, EM-21 Lift Arm	57	40005	Hosebarb, 3/8" MPT x 3/8" Push-on	101	62041	Place, EM-21 Bearing
12	87016	Washer, #10 Ext. Tooth Lock	58	22012	Coupler, 3/8" Quick Disc.	102	73001	Spacer, EM-21A Vac Motor
13	57014	Nut, 10-32 Hex	59	31016	Elbow, 1/4" MPT x 1/4" FPT	103	70102	Scr., 3/8-16 x 3/4" Lock
14	05005	Arm Asm., EM-21 Vac Shoe Lift	60	39057	Hose, 3/8" x 10" Push-Lock	104	09005	Bearing, 5/8" Flange
15	38056	Handle, EM-21A Main	61	31026	Elbow, 3/8" St.	105	14087	Bracket, R. H. Guide
16	70088	Scr., 10-32 x 1/2" PHMS	62	39055	Hose, 3/8" x 4.75" Push-Lock	106	57032	Nut, 3/8" Flange Lock
17	70033	Scr., 1/4-20 x 3/16" Set	63	65012	Pump, Flange Mount Pro-Con	107	70003	Scr., 10-24 x 5/8" FHST
18	51021	Linkage Asm., EM-21 Lower	64A	84003	Valve, 115V LP 2-Way Solenoid	108	41017	Hub Cap, 6" Dia.
20	70066	Scr., 10-32 x 3/4" PHMS	64B	84024	Valve, 230V LP 2-Way Solenoid	109	48006	Key, #9 Woodruff
21	87018	Washer, 3/16" Flat	65	04012	Adapter, 1/4" MPT x 3/8" MPT Brass	110	03012	Axle, EM-21 Drive Wheel
22	62043	Plate, Vac Shoe Access	66	82001	Rotary Union	111	73045	Sprocket, 5/8" Bore
23	35020	Gasket, EM-21 Vac Shoe	67	59005	"O" Ring	112	70119	Scr., 1/4-20 x 3/8" Set
24	85002	Vac Shoe Asm., Welded	68A	53044	Motor, 115V 1/3 HP TEFC	113	34009	Fast Pin, 1/4" x 3"
25	05009	Anchor, 8-32 x .875" Spring	68B	53003	Motor, 230V 1/3 HP TEFC	114	41072	Hinge, 3" x 3" Butt
26	73044	Spring, Extension	69	87003	Washer, 5/16" Flat	115	70068	Scr., 10-32 x 3/4" FHMS
27	57008	Nut, 8-32 Hex	70	87024	Washer, 3/8" Lock	116	70002	Scr., 5/16-18 x 2" Soc Hd Shldr
28	87007	Washer, #8 Ext. Tooth Lock	71	70096	Scr., 3/8-16 x 1" Soc. Hd.	117A	53043	Motor, 115V 1/8 HP Gear (Bodine, EM-21C)
29	70078	Scr., 5/16-18 x 3/8" Soc Hd	72	70104	Scr., 3/8-16 x 3/4" BHMS	117B	53002	Motor, 230V 1/8 HP Gear (Bodine)
30	87029	Washer, 5/16" Flat	73	48008	Key, EM-21 Spinner	117C	53080	Motor, 115V VW Drive (EM-21A)
31	05002	Arm., EM-21 Upper Vac Control	74	18011	Caster, 3" Dia. Swivel	118	51010	Link, #35 Chain Connector
32	05003	Arm., EM-21 Lower Vac Control	75	70015	Scr., 1/4-20 x 3/4" HHMS	119	27064	Chain, Drive
33	70118	Scr., 8-32 x 5/16" Set	76	73049	Spacer, EM-21 Pump	120	70015	Scr., 1/4-20 x 3/4" HHMS
34	70010	Scr., 1/4-20 x 1.5" HHMS	77	34042	Frame, EM-21 Welded	121	48007	Key, Von Wiese Motor
35	50138	Label, EM-21 Vacuum	78	27074	Cap, Nozzle	122A	27150	Clutch Asm. Marq. 115V
36	70092	Scr., 10-32 x 1.5" PHMS	79	44021	Jet, 0001 SS Tee	122B	27238	Clutch Asm. Marq. 230V
37	41024	Hanger, ESW (Optional)	80	44010	Jet Body, 1/4" MPT	123	09011	Bearing Asm., EM-21A Wheel
38	57047	Nut, 1/4-20 Lock	81	87025	Washer, 1/4" Ext. Tooth Lock	124	39024	Hose, EM-21 Vac Motor Exhaust
39	87013	Washer, 1/4 Flat	82	41050	Hub Asm., EM-21 Spinner	125A	89001	Wheel Asm., R. H. Guide
40	70105	Scr., 1/4-20 x 1.75" HHMS	83	11004	Belt, Spinner Drive	125B	89023	Wheel Asm., L. H. Guide (Optional)
41	14026	Boot, Rubber Capacitor	84	64014	Pulley, EM-21 Spinner Motor 1"	126	27122	Collar, EM-21A Wheel Shaft
42A	27055	Capacitor, 20 MFD 115V	85	64012	Pulley, 20XL037 w/7/16" Bore	127	70074	Scr., 10-32 x 1/4" Set
42B	27006	Capacitor, 12.5 MFD 230V	86	70126	Scr., 1/4-28 x 1/4" Nyloc Cup Knurl, Set	128	89017	Wheel, 3" Dia. Gray
43	14066	Bracket, EM-21 Capacitor	87	64005	Pulley, 40XL037 w/.75" Bore	129	27181	Clutch, Marq.
44	56012	Nipple, 1/4" FPT Quick Disc.	89	73048	Spacer, Deflector	130	27049	Cable Tie, 7"
45	87015	Washer, 9/16" Flat	90	35033	Gasket, EM-21 Muffler	131	57023	Nut, 5/16-18 Lock
46	56014	Nipple, 1/4" Close	91A	53018	Motor, 115V 3-stage Vac w/tube	132	62100	Plate, VW Motor & Clutch Mtg.

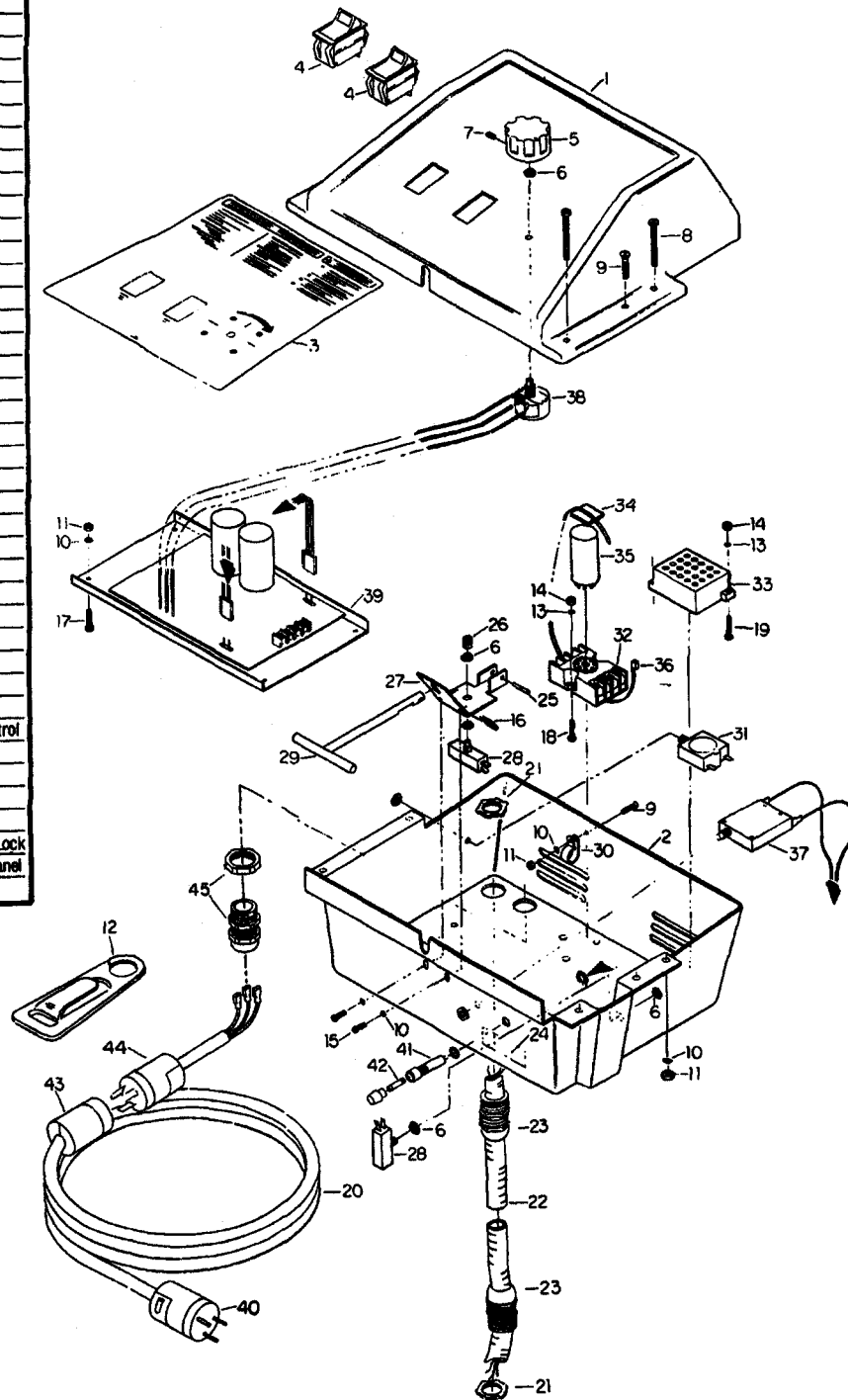
EM-21A SOLUTION /RECOVERY TANK

KEY	PART NO.	DESCRIPTION
1	35016	Gasket, Dome
2	28014	Dome Asm., w/o Gasket (Inc#2,3,&7)
3	57039	Nut, 1.5" Flange
4	78034	Tube, 1.5" Hose Adapter
5	35002	Gasket, Hose Adapter
6	57033	Nut, Intake Adapter
7	28006	Dome Swivel Assembly
8	73094	Scale, EM-21 Sol. Tank PVC
9	73085	Screen, Alum. Bucket Intake
10	59004	"O" Ring
11	34013	Filter Assembly
12	75086	Tank, EM-21A Recovery
13	27073	Cuff, 1.5" ID Hose
14	39022	Hose, EM-21 Rcvy Tank/Vac Shoe
15	39037	Hose, EM-21 Drain
16	20002	Clamp, 2" Hose
17	40001	Hosebarb, 1.5" PVC
18	20041	Clamp, 1.5"- 2.0" Dia. Hose
19	36023	Guard, EM-21A Tank Drip
20	04032	Adapter, 1.5" MPT x 1.5" Soc. PVC
21	78054	Tube Asm., EM-21A Vac Stack
22	35037	Gasket, Sol/Recovery Seal
23	04035	Adapter, 1.5" FPT x 1.5" HB 90° PVC
24	20019	Clamp, 1 7/8" Dia. Hose
25	39020	Hose, EM-21 Vac Intake 19.5"
26	04006	Adapter, 1.5" x 2" Hose Cuff
28	56010	Nipple, 3/8" Close Brass
29	73088	Strainer, 3/8" FPT 80 Mesh
30	75001	Tank, EM-21A Solution
31	50019	Label, EM-21 Main
32	51022	Lid, Solution Tank
33	27007	Cord, Solution Tank Lid
34	70114	Scr., #10 x 3/4" Polyfast
35	35038	Gasket, Sol/Recovery Tank
36	14007	Bushing w/nut, 3/8" FPT x 1" MP
37	70003	Scr., 10-24 x 5/8" FHST
38	66071	Pan, Sol. & Recovery Tank
39	70066	Scr., 10-32 x 3/4" PHMS
40	87018	Washer, 3/16" Flat
41	41072	Hinge, 3" x 3" Butt
42	50023	Label, EM-21A Logo.
43	34001	Frame, EM-21A Tank Support
44	70103	Scr., 1/4-20 x 1" THMS
45	56008	Nipple, 3/8" FPT Quick Disc St. Thru
46	40005	Hosebarb, 3/8" MPT x 3/8" Push-on
47	39004	Hose, Solution Tank 3/8" x 11"
48	14042	Bushing, 2" Nylon Snap
49	57030	Nut, 10-32 Lock
50	87008	Washer, 1/4" Flat
51	70015	Scr., 1/4-20 x 3/4" HHMS
52	70111	Scr., 10-32 x 1/2" Thrd. Cut
53	73030	Skirt, Front
54	31025	Elbow, 3/8" 45° St.



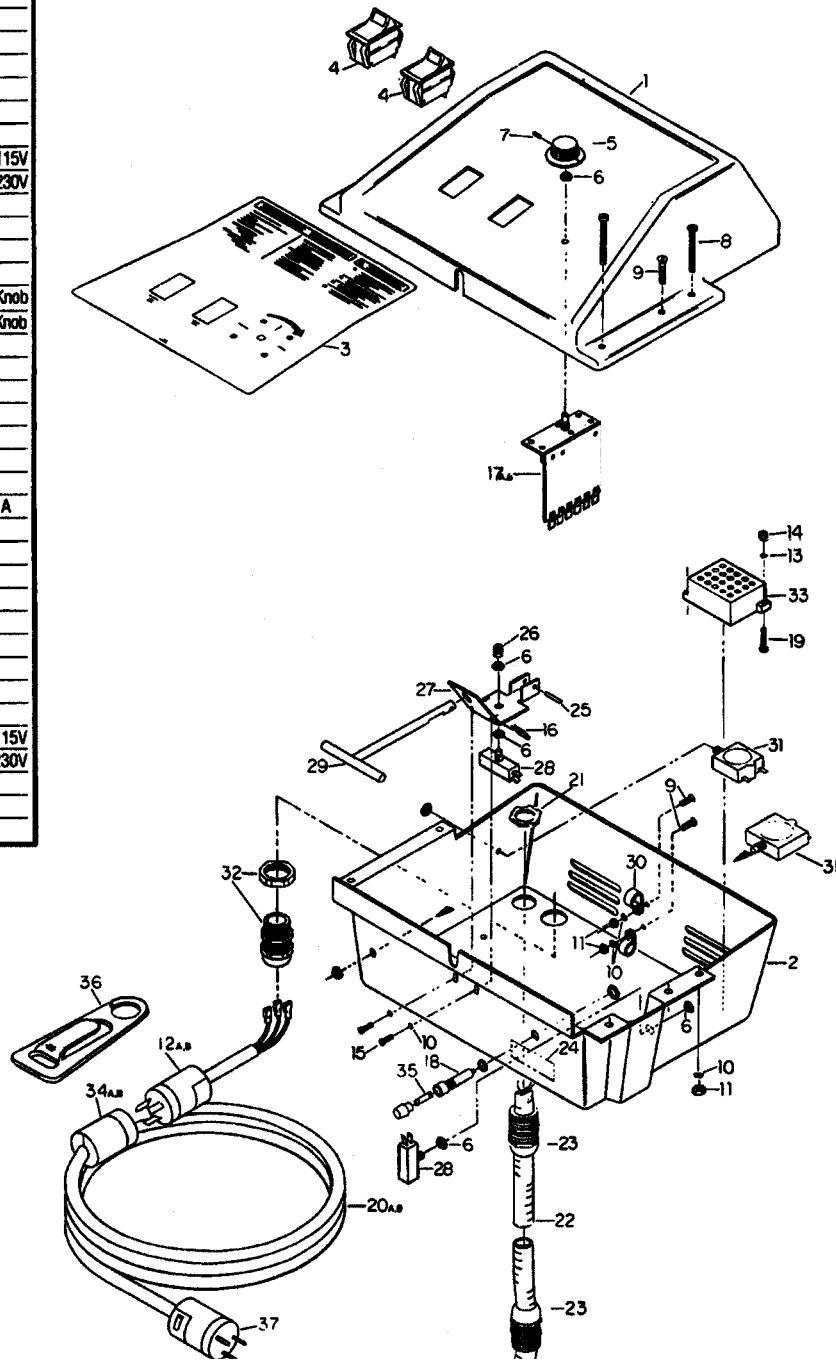
KEY	PART NO.	DESCRIPTION
1	61003	Panel, EM-21 Top Control
2	61002	Panel, EM-21 Bottom Control
3	50136	Label, EM-21 Instruction
4	72004	Switch, Lighted Rocker
5	48003	Knob, Speed Control
6	57020	Nut, 3/8-32 Hex
7	70118	Scr., 8-32 x 5/16" Set
8	70092	Scr., 10-32 x 1 1/2" PHMS
9	70043	Scr., 10-32 x 5/8" FHMS
10	87016	Washer, #10 Ext. Tooth Lock
11	57014	Nut, 10-32 Hex
12	73169	Strain Relief, Shuttle
13	87007	Washer, #8 Ext. Tooth Lock
14	57008	Nut, 8-32 Hex
15	70086	Scr., 10-24 x 1/2" RHMS
16	57028	Nut, 10-24 Tinnerman
17	70088	Scr., 10-32 x 1/2" PHMS
18	70013	Scr., 8-32 x 3/4" PHMS
19	70045	Scr., 8-32 x 1" PHMS
20	23065	Cord Asm., EM-21A 115V
21	57087	Nut, 3/4" NPT
22	23103	Cord Asm., 14/8 EM-21 Panel
23	73196	Strain Relief, 3/4" NPT
24	50143	Label, Replacement Fuse EM-21
25	66031	Pin, .125" Roll
26	73042	Spring, Compression
27	14011	Bracket, EM-21 'T' Handle
28	72015	Switch, 20 A
29	38003	Handle, EM-21 'T'
30	20015	Clamp, 9/16" Plastic
31	14025	Breaker, 115V 6A Circuit
32	73011	Socket, 10A Octal Relay
33	14017	Block, 115V Terminal
34	99814	Gasket, 1 1/8" 1 Side Adh.
35	67002	Rectifier, 115V C-500
36	27050	Cable Tie, 3.5"
37	14027	Breaker, 6A Magnetic
38	66013	Potentiometer, EM-21 Speed Control
39	27001	Control Board, EM-21 115V
40	26006	Cord End, 115V 3-wire
41	34006	Fuse Holder
42	34007	Fuse, 2A Slo/Blow
43	26010	Cord Receptacle, 115A 115V Twist Lock
44	23064	Cord Adm., 115V EM-21 Control Panel
45	73125	Strain Relief, 12/3 with Nut

### EM-21C CONTROL PANEL BREAKDOWN (Bodine PC Control Board)



KEY	PART NO.	DESCRIPTION
1	61003	Panel, EM-21A Top Control
2	61002	Panel, EM-21A Bottom Control
3	50136	Label, EM-21A Instruction
4	72004	Switch, Illuminated Rocker
5	48003	Knob, Speed Control
6	57020	Nut, 3/8-32 Hex
7	70118	Scr., 18-32 x 5/16" Set
8	70092	Scr., 10-32 x 1 1/2" PHMS
9	70043	Scr., 10-32 x 5/8" FHMS
10	87016	Washer, #10 Ext. Tooth Lock
11	57014	Nut, 10-32 Hex
12A	23064	Cord Asm., EM-21A Control Panel 115V
12B	23094	Cord Asm., EM-21A Control Panel 230V
13	87007	Washer, #8 Ext. Tooth Lock
14	57008	Nut, 8-32 Hex
15	70086	Scr., 10-24 x 1/2" RHMS
16	57028	Nut, 10-24 Tinnerman
17A	27123	Control, EM-21A 115V Speed w/Knob
17B	27126	Control, EM-21A 230V Speed w/Knob
18	34006	Fuse Holder (4 Parts)
19	70045	Scr., 8-32 x 1" PHMS
20A	23065	Cord Asm., EM-21A 115V
20B	23092	Cord Asm., Em-21A 230V
21	57087	Nut, 3/4" NPT
22	23103	Cord Asm., 14/8 EM-21A Panel
23	73196	Strain Relief, 3/4" NPT
24	50143	Label, Replacement Fuse EM-21A
25	66031	Pin, .125" Roll
26	73042	Spring, Compression
27	14011	Bracket, EM-21A 'T' Handle
28	72015	Switch, 20 A Toggle
29	38003	Handle, EM-21A 'T'
30	20015	Clamp, 9/16" Plastic
31	14025	Breaker, 115V 6A. Circuit
32	73125	Strain Relief, 12/3 with Nut
33	14017	Block, 115V Terminal
34A	26009	Cord End Reptcl, Twist Lock 15A 115V
34B	26012	Cord End Reptcl, Twist Lock 15A 230V
35	34007	Fuse, 2A. Slo/Blow
36	73189	Strain Relief, Shulte
37	26006	Cord End, 115V 3 Wire

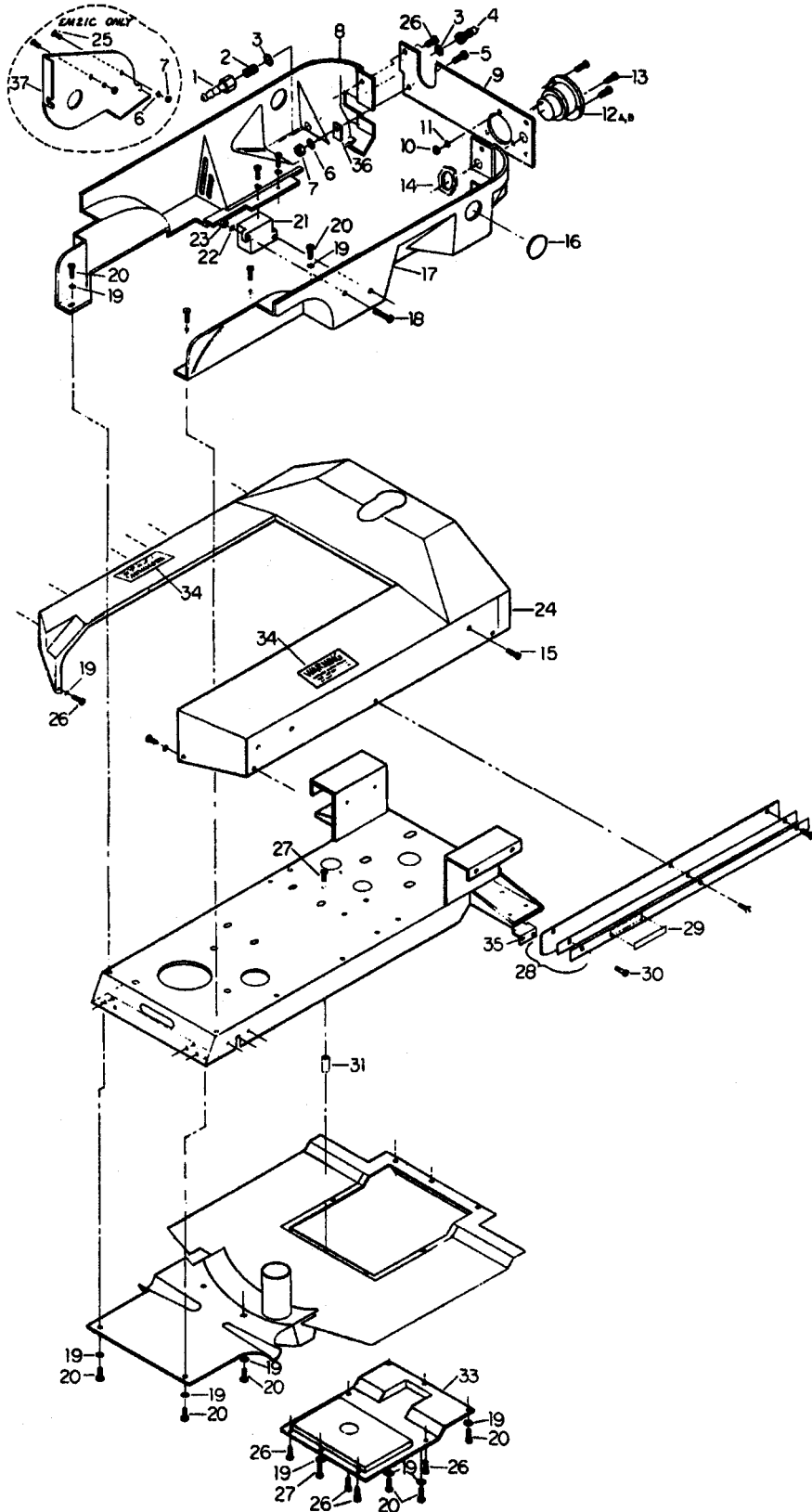
**CONTROL PANEL BREAKDOWN  
(Dart PC Control)**



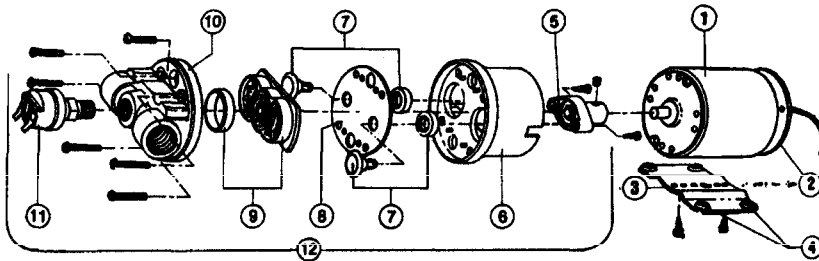


EM-21A LOWER SHROUDS

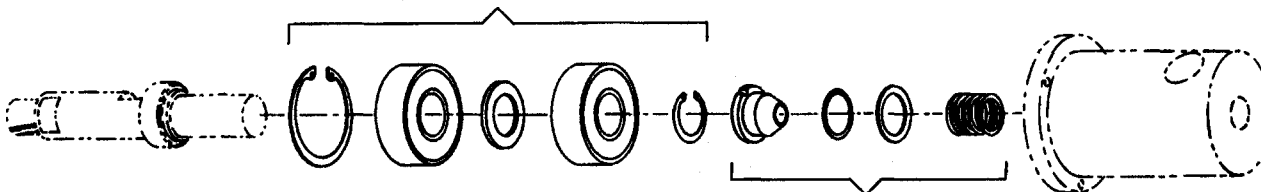
KEY	PART NO.	DESCRIPTION
1	40002	Hosebarb, 1/4" FPT x 1/4" HB
2	56014	Nipple, 1/4" Close
3	87015	Washer, 9/16" Flat
4	56012	Nipple, Quick Disc.
5	70025	Scr., 10-32 x 3/4" HHMS
6	87016	Washer, #10 Ext. Tooth Lock
7	57014	Nut, 10-32 Hex
8	73028	Skirt, R. H.
9	73184	Skirt, Rear
10	57012	Nut, 6-32 Hex
11	87026	Washer, #6 Ext. Tooth Lock
12A	54012	Meter, 115V Hour
12B	54011	Meter, 230V Hour
13	70056	Scr., 6-32 x 1/2" RHMS
14	57087	Nut, 3/4" NPT
15	70003	Scr., 10-24 x 5/8" FHST
16	66020	Plug, 1.5" Dia. Wht. Hole
17	73027	Skirt, L. H.
18	70045	Scr., 8-32 x 1" PHMS
19	87018	Washer, 3/16" Flat
20	70111	Scr., 10-32 x 1/2" Thrd Cut
21	14017	Block, 115V Terminal
22	87007	Washer, #8 Ext. Tooth Lock
23	57008	Nut, 8-32 Hex
24	73005	Skirt, Lower Machined EM-21
25	70068	Scr., 10-32 x 3/4" FHMS
26	70114	Scr., #10 x 3/4" Polyfast
27	70088	Scr., 10-32 x 1/2" PHMS
28	36021	Guard Asm., EM-21 Splash
29	50018	Label, EM-21 Skirt Adj.
30	70103	Scr., 1/4-20 x 1" THMS
31	73048	Spacer, EM-21 Deflector
32	29009	Deflector, EM-21 Machined
33	62016	Plate, EM-21 Access
34	50137	Label, EM-21 Warning
35	14106	Bracket, Lower Skirt Mtg.
36	27061	Clip, SFW Manifold
37	36049	Guard, Chain (EM-21C only)



PUMP PARTS LIST		
KEY	PART NO.	DESCRIPTION
	65018	Pump and Motor Asm., 110V
	65010	Pump and Motor Asm., 230V
1	53016	Motor, 115V
1A	53017	Motor, 230V
2	67066	Rectifier/End Bell Asm.
3	62023	Plate, Motor Mounting
4	36006	Grommet (set of 4)
5-7-8-9	47015	Kit, Pump Repair
6	27057	Bearing Cover
10	41010	Pump Housing
11	72017	Pressure Switch
12	65016	Pump Complete



47023 KIT, ROTARY UNION BEARING



47026 KIT, ROTARY UNION SEAL

TROUBLE-SHOOTING GUIDE		
PROBLEM	CAUSE	SOLUTION
No electrical power.	Dead electrical circuit. Faulty main power switch on machine. Faulty power cord. Fuse blown or circuit breaker tripped (on machine).	Check building circuit breaker or fuse box. Replace switch. Repair or replace power cord. Replace fuse or reset breaker after correcting problem.
Loss of vacuum/ solution recovery.	Vacuum lever in "off" position. Faulty vac motor switch. Worn vac motor brushes or faulty vac motor. Crack in recovery dome Obstruction or damage in vac shoe linkage or vac hose. Incorrectly installed or adjusted vac shoe.	Put lever in "on" position. Replace switch. Replace motor brushes or motor. Repair or replace. Remove obstruction, repair or replace vac casting. Adjust vac shoe.
No forward movement of machine.	Loose wires at switch or connections. Faulty drive motor switch. Worn carbon brushes in gear drive motor or faulty motor. Fuse blown or circuit breaker tripped (on machine). Faulty speed control potentiometer.	Repair as required. Replace switch. Repair or replace motor
No solution flow.	Replace hose or reset breaker after correcting problem. Faulty pump drive motor. Faulty pump. Broken pump drive belt Faulty switch. "Clogged" or faulty solenoid. Obstruction in thrusterjets.	Replace control. Repair or replace motor Replace pump. Replace belt. Replace switch. Remove obstruction or replace. Remove spinner assembly and clean jets.
Solution will not shut off.	Faulty thruster control switch. Dirt in solenoid valve or faulty valve.	Replace switch. Remove obstruction or replace valve.
Uneven cleaning.	One or more thrusterjets plugged. Broken rotary union drive belt.	Remove spinner assembly and clean jets. Replace belt.