**SOLUTION/THRUSTERJET**
Turns on solution pump and THRUSTER-JET 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.

**OPERATING INSTRUCTIONS**

**WARNING**

1. Do not run or use on flammable surfaces. Machine is for cleaning and not equipped with brake.
2. Always disconnect from electricity before servicing.
3. Do not use in an explosive environment.
4. Must be used in a dry area.
5. To reduce risk of electrocution, do not expose to rain.

**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 pouring it into 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 vacuum lift lever to “on” position — red light will glow.

5. Release vacuum lift lever to forward position to start vacuum motor, and lower pickup 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-spray may also be necessary.

- Narrow bands of streaking can result from a plugged THRUSTER JET 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 “off.” 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 covers are:

<table>
<thead>
<tr>
<th>SPEED FPM</th>
<th>COVERAGE (SQ. FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>3½</td>
<td>43</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>2½</td>
<td>25</td>
</tr>
</tbody>
</table>

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 lets 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

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:

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.
2. Remove inspection plugs. Loosen screws holding tank support bracket to frame and tip tank assembly forward.
3. Tilt tank forward and disconnect hoses from tank and vac motor.
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 screwdriver 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.
3. Disconnect hose from vac motor exhaust.
4. Remove 3 screws holding vac motor.
5. Disconnect vac motor leads from terminal block and remove vac motor.
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.
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.
5. Lift front of machine and tilt backwards until it rests on the control handle.
6. Remove spinner assembly using 1/2 inch open end wrench to hold shaft and turn spinner counterclockwise (facing spinner).
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 hosebarb from solenoid (the special push lock hosebarb 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 (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:

**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.
3. Disconnect pump leads from terminal block.
4. Remove hosebarb at branch tee (special push lock hosebarbs allow hose to swivel without damage to hose during removal and assembly).

---

**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.
7. Remove screws holding motor and lift motor out.
8. Inspect motor, repair or replace as required.
9. When installing motor pulley, note dimension for spacing (1 3/8 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).
4. Remove bottom splash guard.
5. Remove drive chain from sprocket (special push lock hosebarbs allow hose to swivel without damage to hose during removal and assembly).

---
32. 6. Remove nuts and bolts holding flange bearing to frame.

33. 7. Remove axle assembly from machine and put on workbench to service.

34. 8. Remove snap ring on each end of axle.

### WHEEL AND AXLE SERVICE/INSTALLATION

1. 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.)

2. When replacing sprocket on axle note dimension — approx. 3 5/16 from end of axle to face of sprocket. (Photo 34)

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

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

#### 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.

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

36. 3. Disconnect Molex connector from motor and clutch lead connector.

4. Remove chain. NOTE: Chain has master link for easy removal (Photo 31).

5. Remove belt access cover (Photo 12) and bottom splash guard (Photo 30).

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

7. To check motor brushes:
BRUSH REMOVAL
(Bodine Motor)

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).

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 ohmmeter 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 ± 40 ohm. An open coil indicates near zero reading and clutch must be replaced.

AVERRGE DRIVE MOTOR CLUTCH REMOVAL
(Von Weise 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.

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.

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.

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."

![Cogged Ring](image)

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.

![Actuator Arm](image)

**VACUUM SHOE REMOVAL**

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).

![Vacuum Shoe](image)

**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 (continuity) for a closed switch/breaker.

**THRUNSMET/SPINNER MOTOR CIRCUIT BREAKER:**

If circuit breaker trips after being reset, check following:

A. Incorrect size extension cable—nothing less 14 gauge, 3-wire or 1 m ft. 17 feet in length.
B. Faulty drive motor.
C. Plugged thruster(s).
D. Faulty rotary union or pump.
E. Faulty capacitor.
F. Faulty jet 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% to 16 1/2". The middle pattern diameter (Jet #2) must be 17% to 18 1/4". The outside pattern diameter (Jet #3) must be 18 1/2" to 19".

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**SOLID STATE CLUTCH CONTROL (DC CIRCUIT):**

**(Bodine 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):**

**(Bodine PC Board)**

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):**

**(Bodine Motor and PC Board)**

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

1. If drive motor does not run, check the following:
   - 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.
   - Check for loose electrical connections (at terminal block, switch, motor P.C. board and receptacle).
   - Open S-2 lead - use ohmmeter to check continuity from speed potentiometer to P.C. control board.
   - 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.
   - 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.
   - 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.
   - 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.
   - 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 A+ and A-.

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

**(Bodine Motor and PC Board)**

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

1. With machine plugged in use AC volt meter 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 D.C.
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 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.
5. To test for around 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.
6. 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.
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 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.
THRUSTERVER CIRCUIT

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

GROUNDING CIRCUITS EM-21C
ELECTRICAL PARTS IDENTIFICATION (Dart PC Control Board)

115 VAC INLET POWER

CIRCUIT BREAKER 14017

FUSE HOLDER 34006

TERMINAL BLOCK 14017

VACUUM CIRCUIT (Dart PC Control Board)

GROUNDING CIRCUITS (Dart PC Control Board)
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<tr>
<th>KEY</th>
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<th>DESCRIPTION</th>
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<td>Nut, 10-32 Hex</td>
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<td>14</td>
<td>05005</td>
<td>Arm Assy., EM-21 Vac Shoe Lift</td>
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<td>15</td>
<td>38556</td>
<td>Handle, EM-21A Main</td>
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<tr>
<td>16</td>
<td>70068</td>
<td>Scr., 10-32 x 3/16&quot; PHMS</td>
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<td>17</td>
<td>70033</td>
<td>Scr., 1/4-20 x 3/16&quot; Set</td>
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<td>18</td>
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<td>Linkage Assy., EM-21 Lower</td>
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<td>Scr., 10-32 x 3/4&quot; PHMS</td>
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<td>67010</td>
<td>Washer, 3/16&quot; Flat</td>
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<td>22</td>
<td>62943</td>
<td>Plate, Vac Shoe Access</td>
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<td>23</td>
<td>35020</td>
<td>Gasket, EM-21 Vac Shoe</td>
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<td>Vac Shoe Assy., Welded</td>
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<td>Anchor, 8-32 x .875&quot; Spring</td>
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<td>Scr., 5/16-18 x 3/8&quot; Soc Hd</td>
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<td>80292</td>
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<td>50002</td>
<td>Arm, EM-21 Upper Vac Control</td>
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<tr>
<td>32</td>
<td>50003</td>
<td>Arm, EM-21 Lower Vac Control</td>
</tr>
<tr>
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<td>Scr., 8-32 x 5/16&quot; Set</td>
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<td>34</td>
<td>70010</td>
<td>Scr., 10-20 x 1.5&quot; PHMS</td>
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<td>35</td>
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<td>70092</td>
<td>Scr., 10-32 x 1.5&quot; PHMS</td>
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<td>37</td>
<td>41024</td>
<td>Hanger, ESW (Optional)</td>
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<td>59047</td>
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<td>87013</td>
<td>Washer, 1/4&quot; Flat</td>
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<td>70105</td>
<td>Scr., 1/4-20 x 1.75&quot; PHMS</td>
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<td>41</td>
<td>14029</td>
<td>Bushing, 1/4-20 x 1/8&quot; STEM</td>
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<td>42A</td>
<td>27055</td>
<td>Capacitor, 20 MFD 115V</td>
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<td>42B</td>
<td>27006</td>
<td>Capacitor, 12.5 MFD 230V</td>
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<td>43</td>
<td>14066</td>
<td>Bracket, EM-21 CapaCtor</td>
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<td>44</td>
<td>56012</td>
<td>Nipple, 1/4&quot; FTP Quick Disc.</td>
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<td>45</td>
<td>87015</td>
<td>Washer, 9/16&quot; Flat</td>
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<td>46</td>
<td>56014</td>
<td>Nipple, 1/4&quot; Close</td>
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<tr>
<td>91A</td>
<td>53018</td>
<td>Motor, 115V 3-stage Vac w/tube</td>
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</table>
EM-21A SOLUTION / RECOVERY TANK

KEY PART NO. DESCRIPTION
1 35016 Gasket, Dome
2 28014 Dome Amn., w/o Gasket (incl#3,3,67)
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 Guit, 1.5" ID Hose
14 39022 Hose, EM-21 Rvry 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. PVI
21 78054 Tube Amn., EM-21A Vac Stack
22 35037 Gasket, Soln/Recovery Seal
23 04035 Adapter, 1.5" FPT x 1.5" HB 90° PVC
24 20019 Clamp, 1" 7/8" Dia. Hose
25 38020 Hose, EM-21 Vac Intake 19.5"
26 04006 Adapter, 1.5" x 2" Hose Guit
27 56010 Nipple, 3/8" Close Brass
28 73088 Strainer, 3/8" FPT 80 Mesh
29 75001 Tank, EM-21A Solution
30 50019 Label, EM-21 Main
31 51022 Lid, Solution Tank
32 27007 Cord, Solution Tank Lid
33 70114 Scr., #10 x 3/4" Polyfast
35 35038 Gasket, Soln/Recovery Tank
36 14007 Bushing w/nut, 3/8" FPT x 1" MP
37 70003 Scr., 10-24 x 3/8" FHST
38 60071 Pan, Soln. & 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 ´Swift´ Trund
54 31025 Elbow, 3/8" 45° St.
EM-21C CONTROL PANEL BREAKDOWN
(Bodine PC Control Board)
CONTROL PANEL BREAKDOWN
(Dart PC Control)

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<tr>
<th>REF.</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>1</td>
<td>61002</td>
<td>Panel, EM-21A Top Control</td>
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<td>2</td>
<td>61002</td>
<td>Panel, EM-21A Bottom Control</td>
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<td>3</td>
<td>50136</td>
<td>Label, EM-21A Instruction</td>
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<td>4</td>
<td>72004</td>
<td>Switch, Illuminated Rocker</td>
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<td>5</td>
<td>48003</td>
<td>Knob, Speed Control</td>
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<td>57002</td>
<td>Nut, 3/8-32 Hex</td>
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<td>7</td>
<td>79111</td>
<td>Scr., 18-32 x 5/16&quot; Set</td>
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<td>Scr., 10-32 x 1 1/2&quot; PHMS</td>
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<td>70043</td>
<td>Srs., 10-32 x 5/8&quot; FHMS</td>
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<td>57014</td>
<td>Nut, 10-32 Hex</td>
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<td>12A</td>
<td>23064</td>
<td>Cord Assy., EM-21A Control Panel 115V</td>
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<tr>
<td>12B</td>
<td>23064</td>
<td>Cord Assy., EM-21A Control Panel 230V</td>
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<tr>
<td>13</td>
<td>87007</td>
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<td>57008</td>
<td>Nut, 8-32 Hex</td>
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<td>15</td>
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<td>Scr., 10-24 x 1 1/2&quot; RHMS</td>
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<tr>
<td>16</td>
<td>57028</td>
<td>Nut, 10-24 Timmerman</td>
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<tr>
<td>17A</td>
<td>27123</td>
<td>Control, EM-21A 115V Speed w/Knob</td>
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<tr>
<td>17B</td>
<td>27126</td>
<td>Control, EM-21A 230V Speed w/Knob</td>
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<td>Fuse Holder (4 Parts)</td>
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<td>Scr., 8-32 x 1&quot; PHMS</td>
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<td>23065</td>
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<td>Switch, 20 A Toggle</td>
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<td>Clamp, 3/16&quot; Plastic</td>
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<td>Breaker, 115V 6A Circuit</td>
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<td>73125</td>
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<td>34B</td>
<td>29012</td>
<td>Cord End Recept, Twist Lock 15A 230V</td>
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<td>26006</td>
<td>Cord End, 115V 3 Wire</td>
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8 — 21
PUMP PARTS LIST

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<tr>
<td>1A</td>
<td>53016</td>
<td>Motor, 115V</td>
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<td>2</td>
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<td>Motor, 230V</td>
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<td>Rectifier/End Bell Asm.</td>
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<td>4</td>
<td>62023</td>
<td>Plate, Motor Mounting</td>
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<td>38006</td>
<td>Grommet (set of 4)</td>
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<td>7-8-9</td>
<td>47015</td>
<td>Kit, Pump Repair</td>
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<td>10</td>
<td>41010</td>
<td>Pump Housing</td>
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<td>11</td>
<td>72017</td>
<td>Pressure Switch</td>
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<td>12</td>
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<td>Pump Complete</td>
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47023 KIT, ROTARY UNION BEARING

47026 KIT, ROTARY UNION SEAL

TROUBLE-SHOOTING GUIDE

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
<th>SOLUTION</th>
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<tbody>
<tr>
<td>No electrical power.</td>
<td>Dead electrical circuit.</td>
<td>Check building circuit breaker or fuse box.</td>
</tr>
<tr>
<td></td>
<td>Faulty main power switch on machine.</td>
<td>Replace switch.</td>
</tr>
<tr>
<td></td>
<td>Faulty power cord.</td>
<td>Replace or replace power cord.</td>
</tr>
<tr>
<td>Loss of vacuum/</td>
<td>Fuse blown or circuit breaker tripped (on</td>
<td>Repair or replace power cord after correcting</td>
</tr>
<tr>
<td></td>
<td>Vacuum lever in &quot;off&quot; position.</td>
<td>Put lever in &quot;on&quot; position.</td>
</tr>
<tr>
<td></td>
<td>Faulty vac motor switch.</td>
<td>Replace switch.</td>
</tr>
<tr>
<td></td>
<td>Worn vac motor brushes or faulty vac motor.</td>
<td>Replace motor brushes or motor.</td>
</tr>
<tr>
<td></td>
<td>Crack in recovery dome.</td>
<td>Repair or replace.</td>
</tr>
<tr>
<td></td>
<td>Obstruction or damage in vac shoe linkage</td>
<td>Repair or replace.</td>
</tr>
<tr>
<td></td>
<td>or vac hose.</td>
<td>Repair as required.</td>
</tr>
<tr>
<td></td>
<td>Incorrectly installed or adjusted vac shoe.</td>
<td>Replace switch.</td>
</tr>
<tr>
<td></td>
<td>Lose wires at switch or connections.</td>
<td>Replace motor.</td>
</tr>
<tr>
<td>No forward movement</td>
<td>Faulty drive motor switch.</td>
<td>Repair or replace motor.</td>
</tr>
<tr>
<td>of machine.</td>
<td>Worn carbon brushes in gear drive motor</td>
<td>Replace pump.</td>
</tr>
<tr>
<td></td>
<td>or faulty motor.</td>
<td>Faulty pump drive motor.</td>
</tr>
<tr>
<td></td>
<td>Fuse blown or circuit breaker tripped (on</td>
<td>Broken pump drive belt.</td>
</tr>
<tr>
<td></td>
<td>machine).</td>
<td>Faulty switch.</td>
</tr>
<tr>
<td></td>
<td>Faulty speed control potentiometer.</td>
<td>&quot;Clogged&quot; or faulty solenoid.</td>
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<tr>
<td></td>
<td>Faulty pump.</td>
<td>Faulty thruster control switch.</td>
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<tr>
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<td>Broken pump drive belt</td>
<td>Dirt in solenoid valve or faulty valve.</td>
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<tr>
<td>Solution will not</td>
<td>Faulty switch.</td>
<td>One or more thrusterjets plugged.</td>
</tr>
<tr>
<td>shut off.</td>
<td>&quot;Clogged&quot; or faulty solenoid.</td>
<td>Broken rotary union drive belt.</td>
</tr>
<tr>
<td></td>
<td>Faulty thruster control switch.</td>
<td>Remove obstruction or replace.</td>
</tr>
<tr>
<td></td>
<td>Dirt in solenoid valve or faulty valve.</td>
<td>Remove obstruction or replace valve.</td>
</tr>
<tr>
<td></td>
<td>Obstruction in thrusterjets.</td>
<td>Remove spinner assembly and clean jets.</td>
</tr>
<tr>
<td></td>
<td>One or more thrusterjets plugged.</td>
<td>Replace switch.</td>
</tr>
<tr>
<td></td>
<td>Broken rotary union drive belt.</td>
<td>Remove obstruction or replace valve.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remove spinner assembly and clean jets.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace belt.</td>
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