Operation and Service Guide
O-940
Dec. 1981

METERING PUMP
SERIES "B" MODELS B71, B72, B73

INSTALLATION

I. UNPACKING

A. Remove tubing, injection check and foot valve from the small cardboard carton included in the pump carton. (Consult Liquid Handling Assembly Parts List) Notify delivery carrier immediately if there are any signs of damage to the metering pump or parts.

II. LOCATION AND MOUNTING

CAUTION: When pumping chemicals make certain that all tubing is securely attached to the fittings. It is recommended that tubing or pipe lines be shielded to prevent possible injury in case of rupture or accidental damage. Always wear protective face shield and clothing when working on or near a chemical metering pump.

A. Locate the pump in an area that is convenient to both chemical injection point and electrical supply. 87 Series metering pumps have corrosion resistant housings, but should not be subjected to continuous high temperature (over 120°F or 49°C). 87 metering pumps are spray resistant and weatherproof.

B. Mount pump on a shelf directly above chemical tank. Secure pump by putting size no. 10(3/16") or 5 mm diameter screws through the four slots at the edge of the pump base.

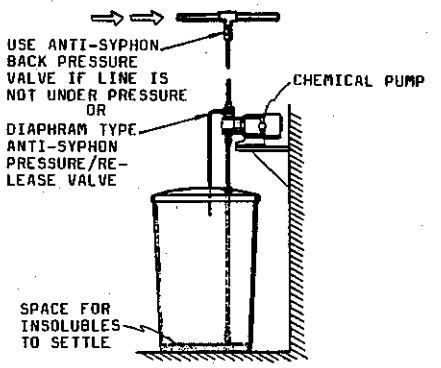
C. Pump may also be mounted on top of molded chemical tank cover provided the cover has a recess for pump mounting to prevent pump from sliding. A molded high rigidity polyethylene cover for this purpose is included with tank and cover assemblies, in 30 and 50 gallon size.

D. Diagrams following show typical chemical pump installation methods. Note location of injection check valve which is most important. Refer to Liquid Handling Assembly instructions Section A below regarding installation of injection check valve.

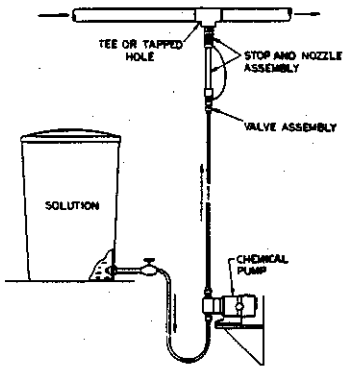
E. BACK PRESSURE REQUIREMENTS: All electronically controlled magnetically driven pumps maintain maximum velocity on the discharge portion of their stroke regardless of the stroke frequency setting. If there is little or no resistance (back pressure) the velocity of the pumped fluid will be so great as to cause over-pumping. Because of this characteristic, back pressure equal to approximately 25 psi must be supplied by an anti-syphon/back pressure valve if the system pressure at the injection point is not high enough to provide the needed back pressure.

CAUTION: Be sure installation does not constitute a cross connection. Check local plumbing code.

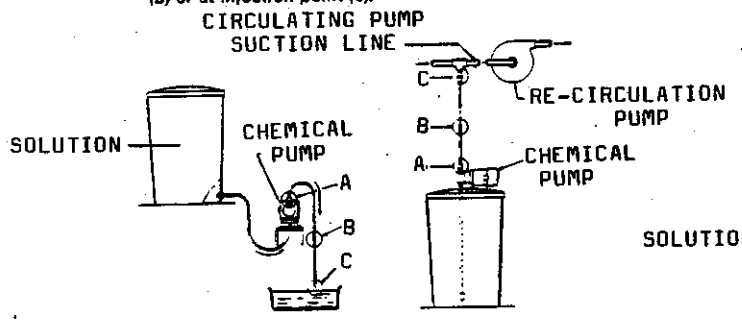
SUCTION LIFT INSTALLATION



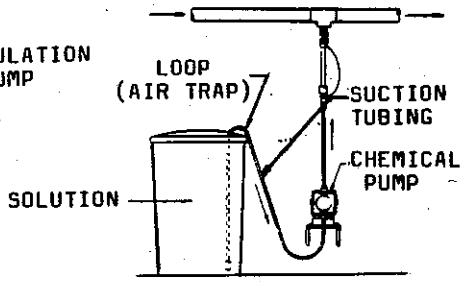
FLOODED SUCTION INSTALLATION
helpful when pumping at very low rates



PREVENT SYPHONING WHEN PUMPING
"Downhill" or into pump suction. Always use anti-syphon/back pressure valve at pump discharge (a) in line (b) or at injection point (c).



AVOID THIS TYPE OF "FALSE" FLOODED SUCTION INSTALLATION
The loop at the top of the tank forms a neat air trap. In time, air and gases can bubble out, accumulate, and cause loss of prime.



LIQUID HANDLING ASSEMBLY INSTRUCTIONS:

A. INSTALLING INJECTION CHECK VALVE

1. The injection check valve should always be installed as close as possible to the point of chemical injection, at the very end of the tubing run.
2. Purpose of injection check valve is to prevent backflow from treated line.
3. A 1/2" NPT female fitting with sufficient depth will accept the injection check valve.
4. In order to insure correct seating of the ball inside the check valve, the injection check valve should be installed upwards, in the direction of flow.

B. CONNECTING DISCHARGE TUBING

NOTE: Cut tubing to length needed for discharge line making sure sufficient amount is left for suction line.

1. Route tubing from injection check valve to chemical metering pump making sure it does not touch hot surfaces, sharp surfaces, or is bent so sharply that it kinks.
2. Slide small end of coupling nut onto tubing.
3. Push tubing over tapered nozzle of pump head so that tubing flares out and reaches the shoulder. (If tubing is stiff from cold, dip end in hot water).
4. Slide down the coupling nut until threads are engaged. Tighten by hand until tubing is held securely in place.

Excessive force will crack or distort fittings. DO NOT USE PIPE WRENCH.

5. Follow the same procedure for connecting tubing to injection valve.

(over)

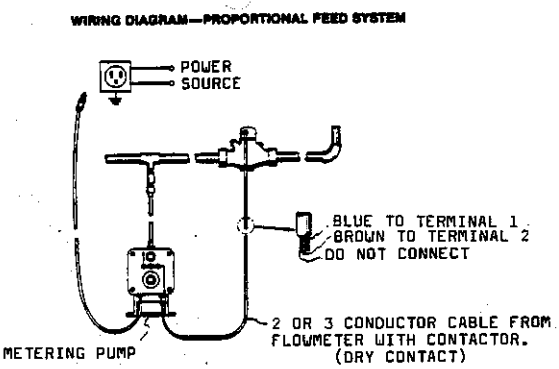
C. CONNECTING SUCTION TUBING
1. Cut suction tubing to length necessary between suction valve of chemical metering pump and foot valve. Foot valve should just sit at the bottom of chemical container. Maximum recommended vertical suction lift is 5 ft. (1.5m).
2. Follow same procedure (see B) in connecting suction tubing to suction valve and foot valve.
3. If a suction tube straightener is desired, one may be fabricated from a 3 ft. (1m) piece of 3/4" Schedule 80 polypropylene pipe.
4. Cut pipe to length and insert suction tubing through pipe.

D. PRIMING
1. Temporarily remove tubing from injection check valve and hold the end of tubing so it is above pump level.
2. Set pump at maximum speed and 100% stroke and start pump.
3. As soon as chemical is visible through translucent discharge tubing just past the discharge valve, stop the pump.
4. Pump is now primed.
5. Reconnect tubing to injection check valve.

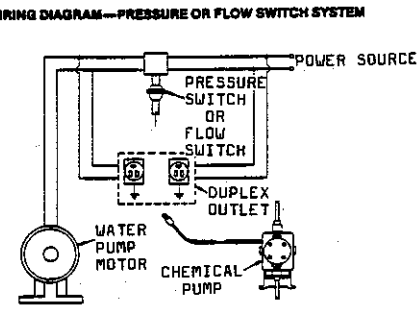
OTE:
(a) Pump is normally self-priming if suction lift is no more than 5 ft. (1.5m), valves in the pump are wet with water (Pump is shipped from factory with water in pump head and therefore valves are wet) and the above steps (D1 through D3) are followed.
(b) If the pump does not self prime, remove discharge valve housing and ball and pour water or chemical slowly into discharge port until it is filled. Follow steps D2 through D5 thereafter.

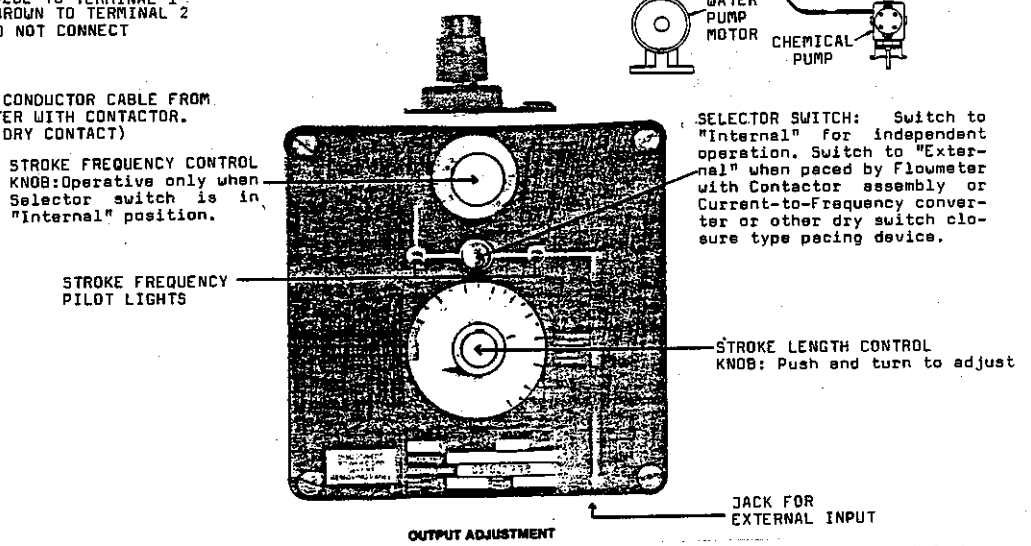
CAUTION: 1. Maximum pump pressure rating is reduced by 25 psi (1.7 bar) with anti-syphon spring installed.
2. Do not remove anti-syphon spring if pressure at injection point is less than 20 psi (1.4 bar).

II. ELECTRICAL
A. Chemical metering pump should be plugged into a 3-prong grounded electrical outlet with ratings conforming to data on the pump control panel.
Note: All wiring must be approved under local electrical code.
B. It is extremely important that ground prong of the 3-prong plug is connected to a good ground. DO NOT use adapters.
C. For external operation with a flowmeter/contactor that provides a dry switch closure, the 4-prong connector socket from the flowmeter should be inserted into the pump external input connector. From any pacing device providing a dry switch closure, wire switch contacts to terminals 1 & 2 Part No. 25-0643 or connector listed below.
D. Diagrams (below) are examples of wiring schemes commonly used.



The Flowmeter Connector is available from your local Radio Shack as Catalog No. 274-001 4 Pin Female Mike Plug with threaded locking ring or Number T609CB from Philmore Manufacturing Co. Inc.,49 Inip Drive,Inwood, N.Y.11696 or 11045 Weddington St.North Hollywood,Ca. 91601





I. INITIAL APPROXIMATION
A. Stroke frequency adjustment knob is the uppermost of the two knobs on the control panel. Speed control dial is graduated in approximate strokes per minute. Turning this knob clockwise increases pumping frequency.
Output Estimate - Total output of pump may be estimated by multiplying stroke frequency (percent of maximum) by stroke length setting (percent of maximum).
For example, if the stroke length knob is set at 100% of maximum and the stroke frequency is 20% of maximum, total pump output will be approximately 20%; if the stroke length knob is set at 30% of maximum and stroke frequency is 20% of maximum, total output will be approximately 6% of the pump's maximum rating. This is, 20% times 30% equals 6%.
B. To determine exact frequency in strokes per minute at any speed knob setting count number of flashes of stroke frequency pilot light for one minute.
C. Stroke length adjustment knob is the lower of two control panel knobs. Adjust by pushing in and rotating to desired setting, while pump is stroking.
D. Setting - Maximum output of the pump is obtained with stroke frequency knob set at maximum and stroke length knob set at maximum.
If pump is to be used at less than maximum output, best volumetric efficiency will be achieved if stroke length knob is left at maximum, and stroke frequency knob rotated counter-clockwise to reduce pump output. If more output reduction is required than can be achieved by reducing stroke frequency, reduce output by turning the stroke length knob counter-clockwise.
E. After installation is complete and an initial approximation setting has been made, the pump should be calibrated and the stroke frequency and/or stroke length settings adjusted.
F. Nominal output and pressure ratings at 100% settings of stroke frequency and stroke length.

	Maximum Pressure Rating		Maximum Output Rating	
	PSI	Bar	gph	lph
B71	150	10.3	1.6	6.0
B72	100	6.9	2.5	9.5
B73	50	3.5	4.5	17.0

(Continued on next page)

II. CALIBRATION PROCEDURE - ON -SITE VOLUMETRIC CALIBRATION

A. With pump primed and discharge tubing connected to the injection point as it would be in normal service, place foot valve and strainer assembly in a graduated container with a volume of 500 ml or more (so that the volume displaced by tubing and foot valve assembly is nominal in relation to volume of the solution in the container.

B. Switch pump on, and pump until air is exhausted from the suction line and pump head.

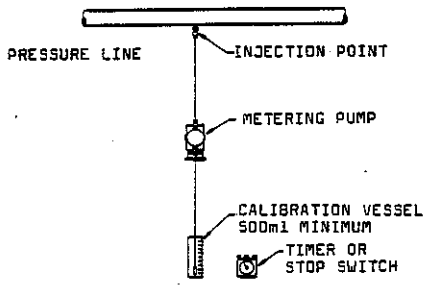
C. Switch pump off, note the solution level in the graduate. Refill graduate if necessary.

D. Switch pump on, and permit it to pump for a measured time. Be sure time is long enough to accumulate an adequate number (minimum 50) pump strokes. In general, the longer the calibration period, the more confidence you can have in accuracy of results.

E. Switch off pump at the end of the calibration period, note volume pumped during the calibration period, and calculate volume of chemical pumped in time unit you choose (minute, hour, day, etc.).

F. Adjust stroke frequency and/or stroke length knobs to your best estimate of required correction, and repeat calibration measurements as a check.

You may elect for safety and convenience to do the first calibration or operating test with water or other non-hazardous solution. If so,make certain the water or test fluid is removed from the Liquid End before pumping chemicals that may react with the test fluid or be exothermic, such as sulfuric acid. The final calibration adjustment should be made with pumping conditions identical to conditions of normal pumping service. This means that factors such as injection pressure, fluid viscosity, suction lift and others will automatically be accounted for in making the final adjustment of the pump.



CALIBRATION TEST

TROUBLE SHOOTING- LIQUID END

I. LOW PUMP OUTPUT

A. Low pump output can be caused by many things. Some of the more common ones are:
Very low stroke setting, i. e. red zone setting of knob
Trapped air in pump head (trapped air in discharge tubing has on effect)
Air leak through valve seal rings
Ruptured pumping diaphragm
Clogged Liquid End, or injection point connection
Injection into pressure within 25 psi of pump's maximum pressure rating with anti-syphon spring in place
Injection into pressure in excess of pump rating

Pressure Ratings:	PSI	bar
B71	150	10.3
B72	100	6.9
B73	50	3.5

B. Very low stroke setting - check position of stroke length knob (lower knob) by rotating it counter-clockwise until diaphragm stops moving with the pump operating. The pumping diaphragm should not stop reciprocating (moving or clicking) until the knob points to zero. If it stops before zero, reset knob by loosening two set screws, set the knob to point to zero and retighten set screws. Rotate knob clockwise and operate unit above the red zone.

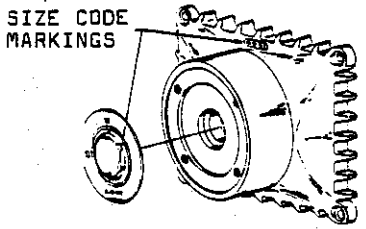
C. Trapped air in pump head - May be caused by leaks in the suction line, where the suction line joins the suction fitting, or at the seal ring between suction fitting and pump head. It may also be caused by air or gases coming out of the solution. Trapped air or bubbles in the discharge line have no effect on the pump's operation. They may be ignored.
To remove trapped air from the pump head, operate the pump with the selector switch set on "internal" and both stroke frequency knob and stroke length knob set a 100.
If your pump does not have an anti-syphon/relief valve it may be necessary to disconnect the discharge tubing from the injection point temporarily in order to relieve the pressure on the pump discharge. Operate the pump for a few minutes to purge the head and valves of air or gas.

D. Air leak through valve seal rings - usually caused by worn or damaged seal rings or loose fittings. Tighten fittings by hand until they are very snug. If there is no improvement, replace both seal rings in pump head. See Liquid Handling Assembly.

E. Ruptured pumping diaphragm - if rupture is severe, and pump is injecting into pressure, chemical leak will be obvious through the 3/16" (5mm) diameter hole at the bottom of the spacer directly behind the pump head. Replace pumping diaphragm.
If rupture is a small pin hole, there may be oozing of solution through the 3/16" (5mm) diameter hole described above. Replacement of pumping diaphragm will be necessary.
Clogged Liquid End - will cause low pump output. Disassemble Liquid End. Clean individual parts with water and detergent or appropriate cleaning solution.

II. CHANGING PUMPING DIAPHRAGM:

A. Make sure size code markings (0.9 S.I.or 1.8 S.I.) on spacer and diaphragm are the same. Diaphragm and spacer size code must match in order for the pump to function.



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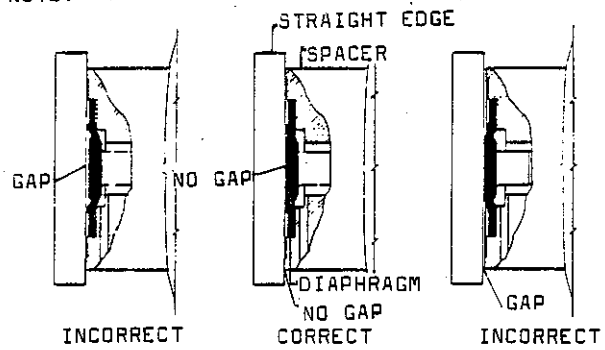
B. Depressurize discharge line by temporarily disconnecting tubing, slowly, from injection check valve. Lift foot valve from chemical and let pump run pumping air for a few minutes. Then remove pump head.
C. Set stroke length knob (lower knob) to zero by pushing and rotating it counter-clockwise with the pump switched on, then stop the pump by turning selector switch to "off".
D. Lift edge of diaphragm and rotate it counter-clockwise to unscrew the diaphragm.
E. Before installing new pumping diaphragm, switch pump on and rotate stroke length control knob (lower knob) to 90. With pump stroking, screw on new pumping diaphragm until the center part begins to buckle inwards during the latter half of the stroke. Switch pump off and check diaphragm position with a straight edge according to the illustration below. If diaphragm setting is not correct, restart pump then screw in or out the pumping diaphragm. Always stop pump electrically when checking diaphragm setting. Repeat procedure if necessary. Then switch off pump.
F. Reinstall pump head and tighten head mounting screws in criss-cross pattern.

NOTE: This illustration for all pumps.



III. EXCESSIVE PUMP OUTPUT
A. Syphoning - The injection check valve assembly has a chemically resistant anti-syphon spring. Disassemble the injection check valve and check to be sure this spring is in place and undamaged. Replace if necessary. Note that the anti-syphon spring must be removed if injection is into a pressure within 25 psi of pump's maximum pressure rating.
B. Incorrect knob settings - check stroke length knob (lower knob) by rotating it counter-clockwise to zero position. The diaphragm should stop reciprocating. If it does not, reset knob and continue counter-clockwise rotation until motion stops. Loosen knob set screws and reset knob pointing to zero. Speed control knob (upper knob) should be checked also. Rotate clockwise until resistance is felt. Knob should point to 100. Loosen knob set screw and reset if necessary.

TROUBLE SHOOTING ELECTRICAL - 87 SERIES

Note: All tests should be conducted with the pump head and diaphragm installed. If pump head is removed the diaphragm shaft may hang forward and not strike completely.

I. Plug power cord into appropriate outlet.
A. Set speed knob (upper knob) to 100.
B. Set stroke knob (lower knob) to 100.
C. Set mode switch to "internal".
II. Listen for stroking action.
A. If pump strokes and pilot light blinks OFF 95 to 110 times per minute, the electronic pulser is working correctly in "internal" mode.
B. If pilot light does not light up go to step III.
C. If pilot light stays on and does not blink off go to step IV.
D. If pump strokes faster than 110 times per minute, electronic pulser module is defective and should be replaced. Remove all fuses from control panel, check fuses for continuity and save them.
E. If pump strokes slower than 95 times per minute, go to step VI.
III. Unplug power cord and remove control panel from housing. Control panel is secured by a #10 screw in each corner. In addition the stroke knob (lower knob) must be removed by loosening two set screws with a 1/16" (1.5mm) Allen (hex key) wrench.
A. Check for short circuits - Common cause of pilot lights not lighting up is short circuit on the auxiliary power supply. These are the terminals labeled GRY and RED.
1. Disconnect the leads to terminals labeled GRY and RED. Connect electronic pulser power cord to electrical power. If either pilot light lights up, there is a short circuit in the external connector. Unplug power cord.
2. Check to be sure terminals 3 (GRY) and 4 (RED) of the external connector are open circuit and not shorted together.
3. Check into terminals 1 and 2 and 3 and 4. They all should be open circuit.
If terminal 1 (ORN) is shorted to terminal 3 (GRY) unit will not operate on external mode.
If terminal 1 (ORN) is shorted to terminal 4 (RED) the external mode pilot light will blink off together with the internal mode pilot light.
4. Varistor or MOV (red disk connected to power input terminals) should be checked for breaks and shorts. Unplug it and check resistance across MOV. It should be infinity.

IV. A. If pilot light does not blink off in "internal" mode, the potentiometer circuit may be open. Using an ohmmeter and with speed setting at 100% check resistance across the two potentiometer terminals connected to the red wire. Readings should be essentially zero or at most 30 Ohms. If reading is infinity, potentiometer is defective. unsolder the two red leads from the two upper terminals and replace potentiometer.
B. If pilot light does not blink off in "External" mode, there may be a short circuit in the external connector or a break in the external connector leads from the connector to the blades labeled ORN V10.
1. Disconnect terminals from blades labeled ORN and V10. Temporarily short blades ORN to V10 by the tip of a screwdriver. There is only 15 volts DC in this circuit.

(Continued on next page)

CAUTION: The input terminals and fused output terminals are high voltage and should not be touched while unit is plugged into electrical power.
If pilot light blinks off when blades ORN and V10 are shorted there is a short circuit in the external connector. By the use of an ohmmeter, check resistance between external connector terminals 1 and 2.

2. If after terminals have been replaced onto blades ORN and V10 the pilot light does not blink off when terminals 1 and 2 of external connector are shorted, there is probably a bad connection between terminals of the external connector and blades ORN and V10 of electronic pulser.

V. FUSE BLOWING

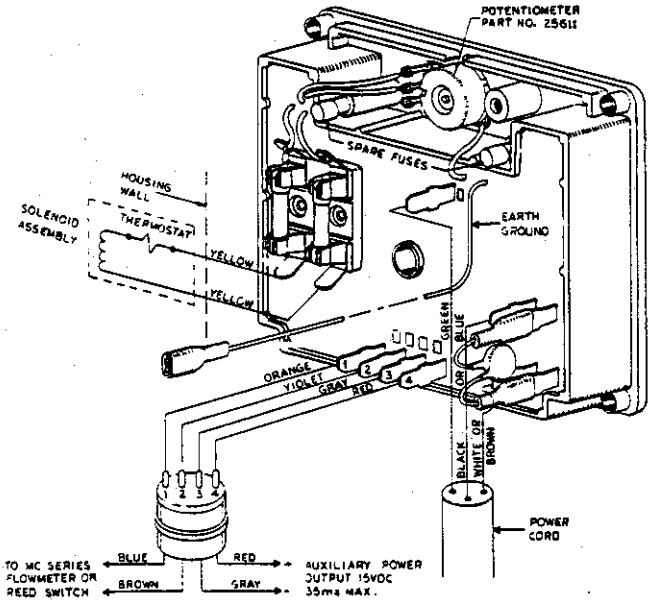
A. Fuse blowing is normally a result of an overload due to a shorted or partially shorted solenoid coil. Disconnect yellow solenoid wires from electronic pulser terminal labeled YEL YEL and the green ground (earth) lead.

B. Measure resistance across solenoid wires. Resistance reading should be:

	Solenoid Resistance
115 Volt Models	43 to 59 Ohms
220-240 Volt Models	170 to 230 Ohms

C. Measure resistance across each solenoid wire to the green ground (earth) terminal or solenoid case. It should be infinity.

D. Coil resistance other than those above indicate that solenoid is defective and should be replaced. Too low a resistance indicates a partial short and while pump may operate for awhile, either thermostat will open or fuse/fuses will blow.



VI. SLOW PULSING

A. Rotate speed knob (upper knob) all the way clockwise. Resistance should be zero Ohms. If it is not, temporarily short the two red wires together with a jumper wire and clip.

B. Plug electronic pulser control panel to appropriate electrical power and count pulse rate (blinks off per minute). If it is now 95 per minute or faster, the potentiometer is damaged and should be replaced.

C. If after step B above pulse rate is still less than 95 per minute and such pulse rate is insufficient for the particular pump application, then the electronic pulser control panel should be replaced.

VII. BLOWN VARISTOR (MOV)

A. A short circuited Varistor (MOV) will trip electrical supply circuit breaker where pump is installed. A blown Varistor is commonly caused by the pump being subjected to higher than normal voltage such as connecting a 115 volt pump to 230 volts or a 220-240 volt pump to 380 volts. A short application of high voltage will not damage the electronic pulser but only the Varistor (MOV) which should then be replaced. Otherwise there will no longer be a voltage surge protector or lightning protector for the electronic pulser.

B. A blown Varistor (MOV) may be open circuit but is noticeable by the fact that there are black marks or breaks on the circular surface. The Veristor (MOV) should be replaced by a new one so it may protect the electronic pulser from voltage surges and/or lightning.

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