IMPORTANT - NEW FEATURE

Series DE, D4, D7 have a power control knob, described on pages 5 and 6. Read these instructions carefully. Power control knob provides for adjustment of pump pressure capability and power consumption to match your particular application.

SERIES DE, D4 & D7 METERING PUMPS

INSTRUCTIONS MAINTENANCE SERVICE

For file reference, please record the following data:

Model No.: _____

Serial No.: _____

Installation Date: _____

Installation Location: _____

_____

When ordering replacement parts for your LMI Metering Pump or accessory, please include complete model number and serial number of your unit.

LIQUID METRONICS INCORPORATED
19 Craig Road, Acton, MA 01720-5495 U.S.A.

Tel: (617) 263-9800
TLX: 95-1781
FAX: (617) 264-9172

Bulletin Sec. 6.0, pg. 1500
Replaces same of 5/86
5A 10/86

INSTALLATION

I. UNPACKING

A. Remove tubing, injection check and foot valve from the small cardboard carton included in the pump carton. 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. LMI DE, D4 & D7 Series metering pumps have corrosion resistant housings, but should not be subjected to continuous high temperature (over 122°F or 50°C).

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 LMI tank and cover assemblies, in 50 gallon size.

D. Diagrams (shown below and on the following page) show typical chemical pump installation methods. Note location of **injection check valve** which is most important. Refer to separate **Liquid Handling Assembly Instructions** Section A regarding installation of injection check valve.

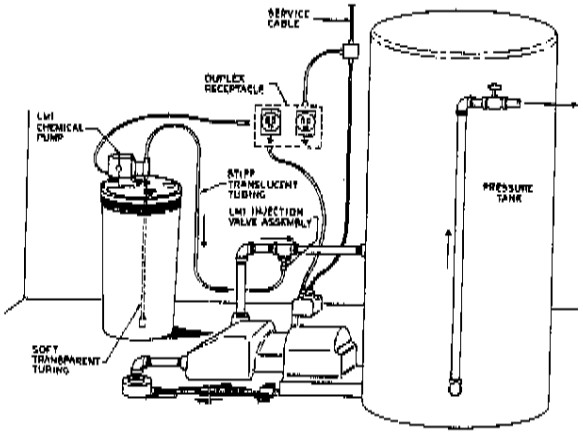
E. BACK PRESSURE REQUIREMENTS—All electronically controlled magnetically driven pumps maintain maximum velocity on the discharge portion of their stroke regardless of the stroke frequency setting. If there is little or no resistance (back pressure) the velocity of the pumped fluid will be so great as 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.

*10 psi for DE3, DE4, D43, D44, D73 & D74 Series.

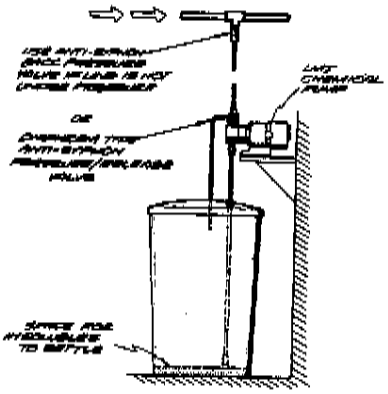
CAUTION

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

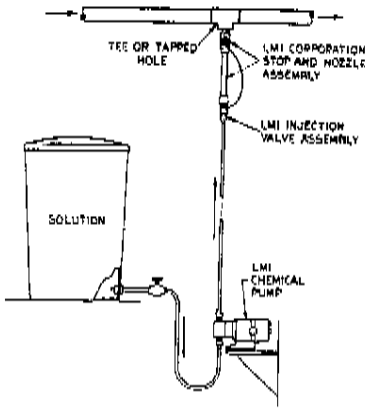
HYDROPNEUMATIC SYSTEMS



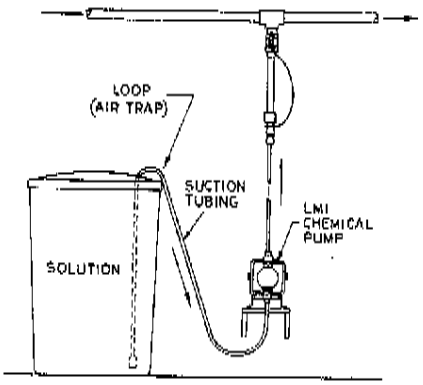
SUCTION LIFT INSTALLATION



FLOODED SUCTION INSTALLATION
helpful when pumping at very low rates

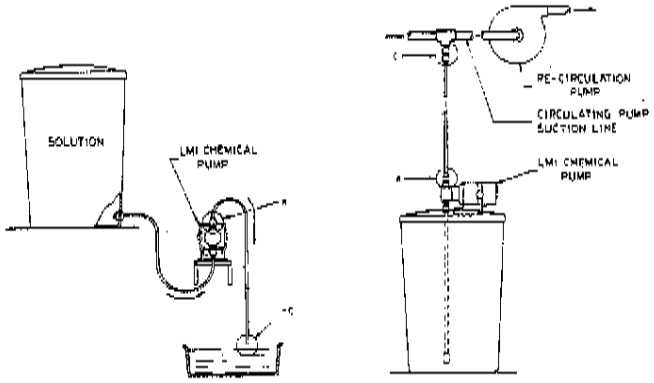


AVOID THIS TYPE OF "FALSE" FLOODED SUCTION INSTALLATION
The loop at the top of the tank forms a neat air trap. In time, air and gases can bubble out, accumulate, and cause loss of prime.



PREVENT SYPHONING WHEN PUMPING

"Downhill" or into pump suction. Always use anti-syphon/ back pressure valve at pump discharge (a) or at injection point (c).



III. 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.

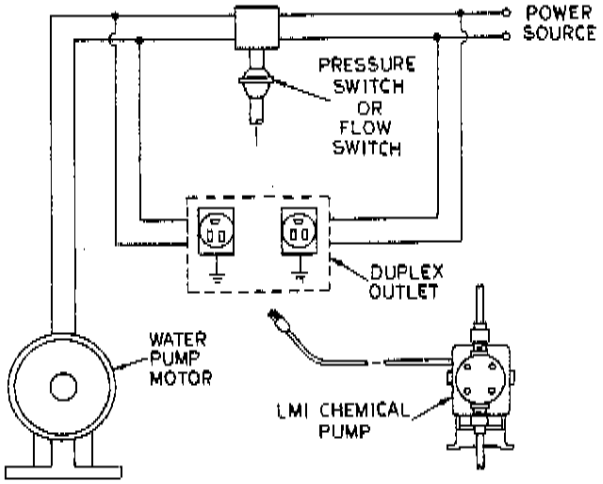
B. It is extremely important that ground prong of the 3-prong plug is connected to a good ground. Do NOT use adapters.

C. **DE** or **D7** Externally Triggered: For external operation with LMI Flowmeter-Pulser or Liquitron™ Current-to-Frequency Converter, the 4-prong connector socket from the Flowmeter-Pulser or Liquitron™ should be inserted into the pump external input jack. Below are examples of wiring schemes commonly used.

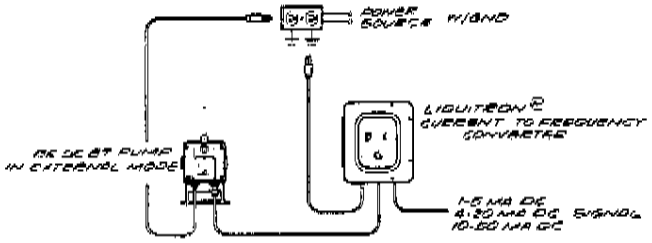
D. **DE, D4** or **D7** Low Level Switch—for operation with Low Level Switch (LMI Part No. 29190) insert the mini-phone plug connector from the Low Level Switch into the phone jack located underneath pump control panel.

WIRING DIAGRAM

PRESSURE OR FLOW SWITCH SYSTEM
D7 IN INTERNAL MODE

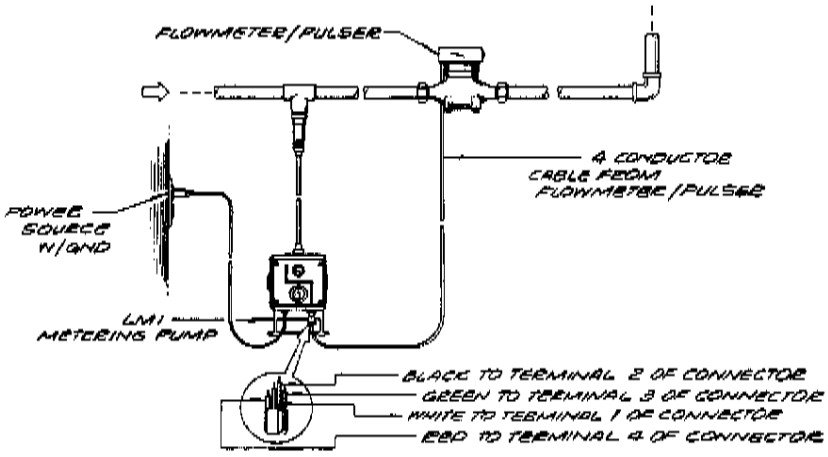


CONNECTOR INSTALLATION—LIQUITRON™
CURRENT-TO-FREQUENCY CONVERTER/PUMP
DE OR D7 IN EXTERNAL MODE



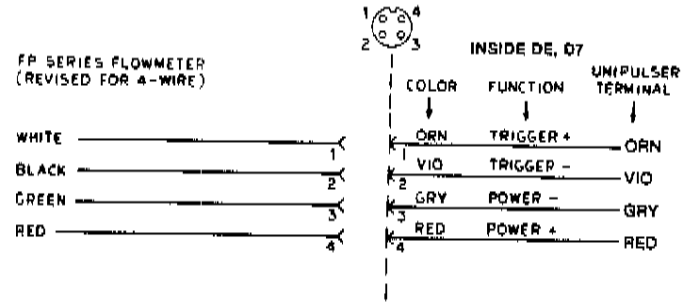
CONNECTOR INSTALLATION

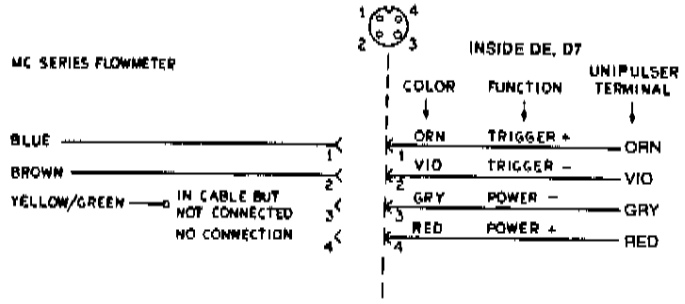
FLOWMETER-PULSER/PUMP
DE OR D7 IN EXTERNAL MODE

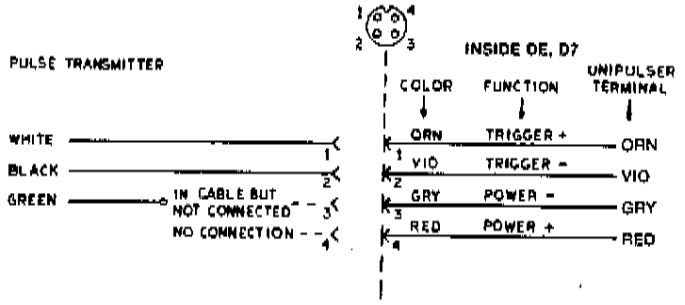


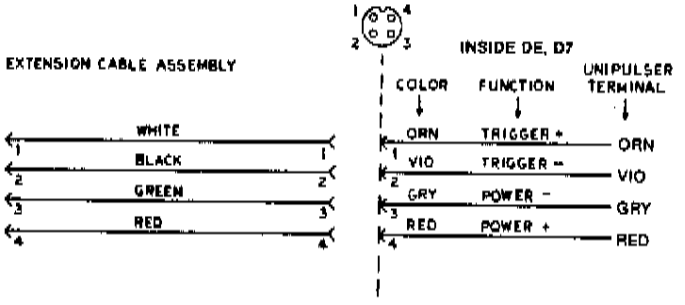
NOTE:
The Flowmeter-Pulser Connector is available from Liquid Metronics Inc. as Part No. 25643. It is also available from your local Radio Shack as Cat. No. 274 001 4-Pin Female Mike Plug with threaded locking ring, or No. T609CB available from Philmore Manufacturing Co., Inc., 49 Inip Drive, Inwood, N.Y. 11696 or 11045 Weddington St., North Hollywood, CA 91601.

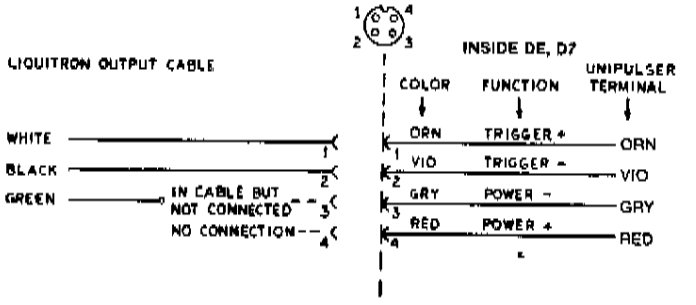
E. The various devices of LMI manufacture that are connectable to **DE** or **D7** pumps and their wiring/termination diagrams are shown below:



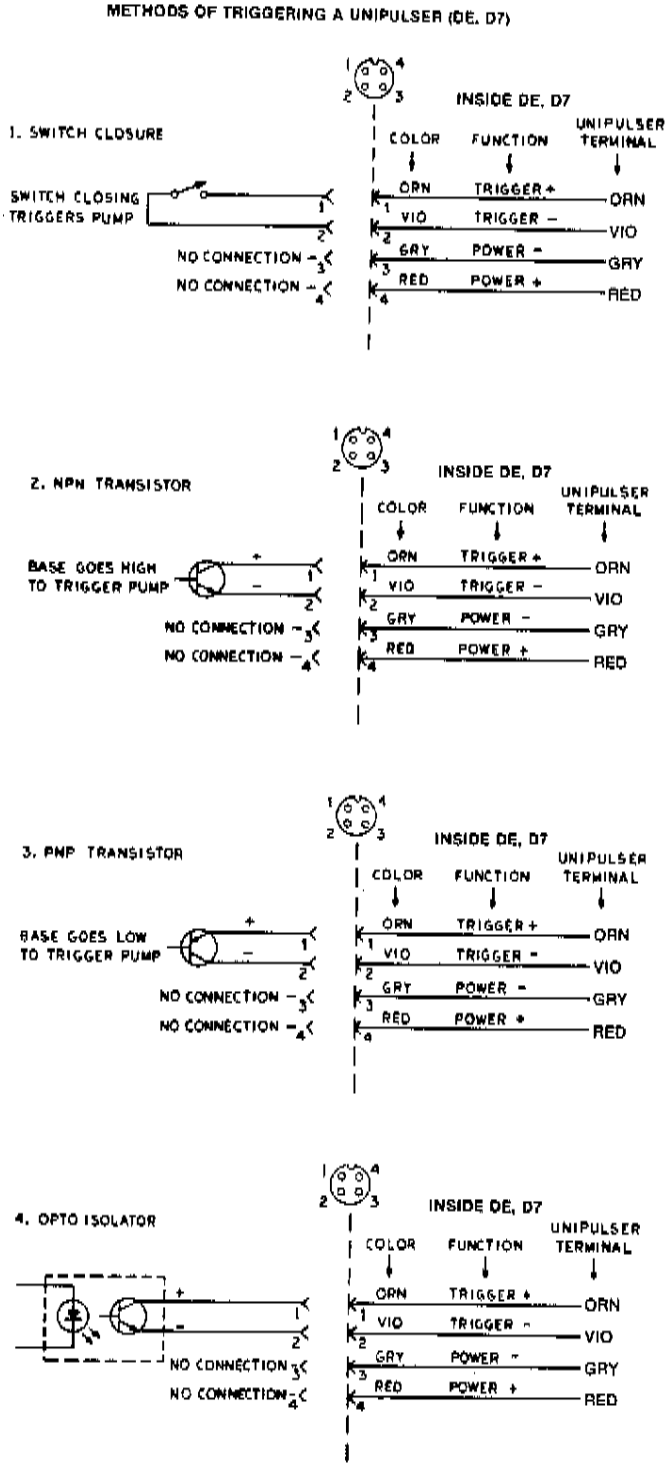








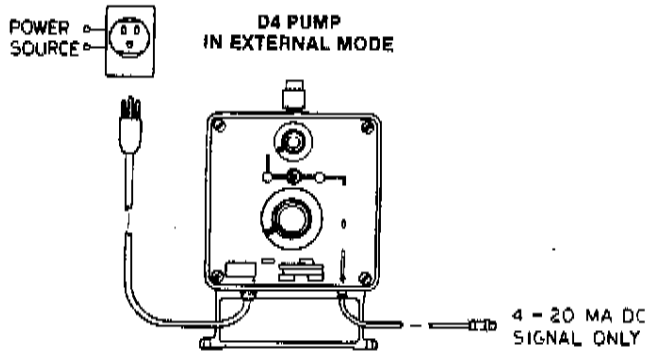
F. Many other methods of externally triggering or pacing **DE** & **D7** pumps may be used. Examples are shown below:



NOTE:
Switch or transistors must be capable of switching 15V DC at 2 milliamperes. Minimum time in low impedance state (on) is 50 milliseconds. Minimum time in high impedance state (off) is 100 milliseconds.

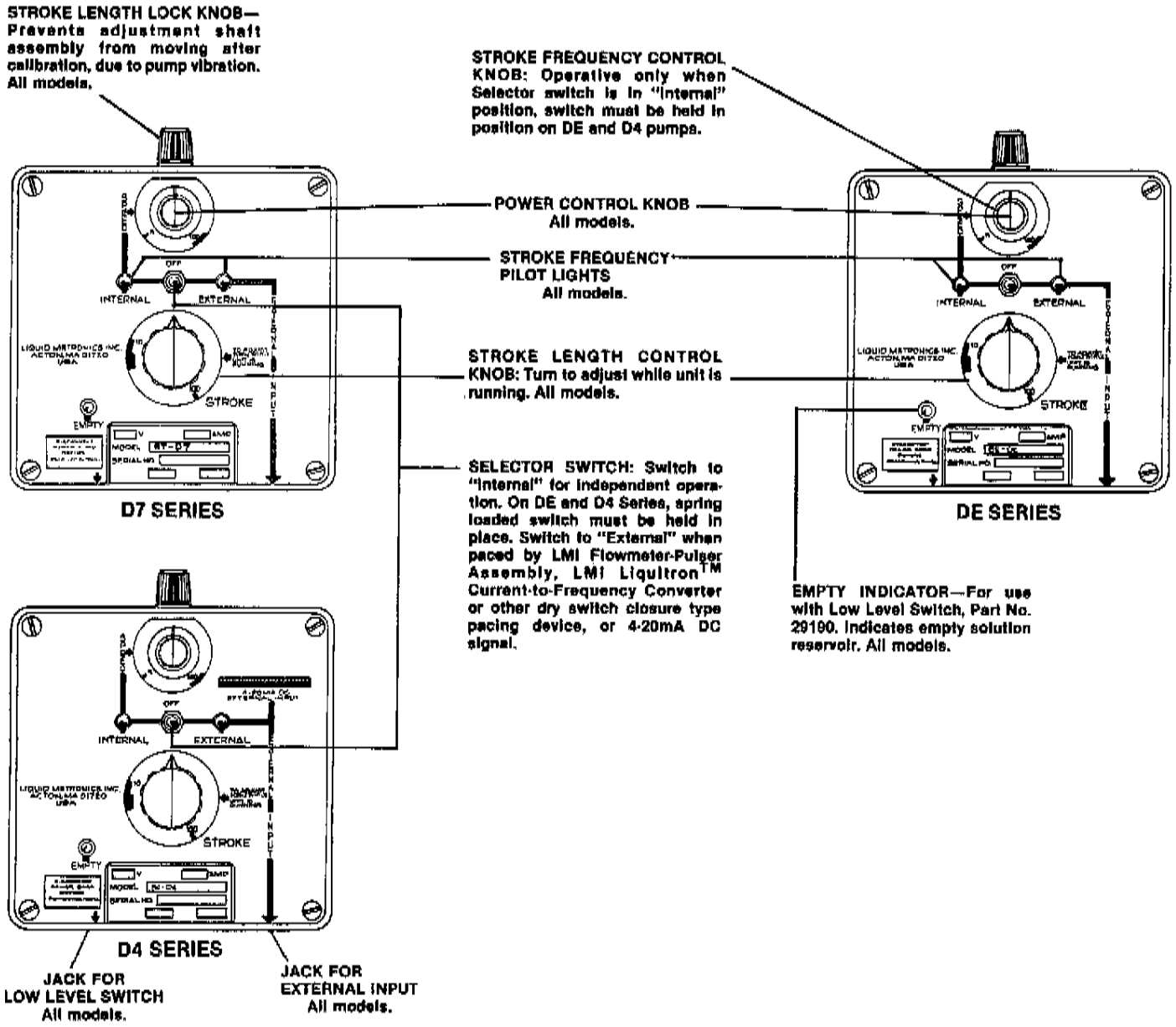
G. D4 Milliampere Input Pump. Most common wiring scheme is shown below:

D4 Pump Connected to 4-20 mA DC Signal Source



For operation from 4-20mA DC signal source only. Pump is supplied with 10 ft. (3m) of 3 conductor cable wired to a 4-prong connector socket. Insert this socket into the pump external input jack. Connect other end of signal input cable to current signal source of 4-20 mA DC. Polarity is as follows: Red + Black – .

OUTPUT ADJUSTMENT



OUTPUT ADJUSTMENT

I. INITIAL APPROXIMATION

The uppermost set of knobs on the control panel serve a dual purpose. The smallest of these knobs (the inner knob of this concentric knob) is the power control knob. The larger knob directly underneath this is the stroke frequency (or speed adjustment knob). Graduation markings for the small power control knob are etched in yellow on the stroke frequency knob itself. Graduations for the stroke frequency knob appear directly on the face of the control panel.

A. For initial approximation and all calibration procedures be certain the power control knob is turned fully clockwise ↻ .

B. Speed control dial is graduated in approximate strokes per minute. Turning this knob clockwise increases pumping frequency. **Hold selector switch in Internal position on DE and D4 pumps.**

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 .2 x .3 = .06 or 6%.

C. 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.

D. Stroke length adjustment knob is the lower of the control panel knobs. Adjust by rotating to desired setting, while pump is stroking.

E. 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. ↻

F. 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.

G. Nominal output and pressure ratings at 100% settings of stroke frequency and stroke length.

Series	Max. Pressure Rating		Max. Output Rating	
	PSI	Bar	gph	lph
DE0, D40, D70	300	20.7	1.3	4.9
DE1, D41, D71	150	10.3	2.5	9.5
DE2, D42, D72	100	6.9	4.0	15.2
DE3, D43, D73	60	4.1	8.0	30.3
DE4, D44, D74	20	1.4	20.0	76.0

II. CALIBRATION PROCEDURE—ON-SITE VOLUMETRIC CALIBRATION FOR D7 IN INTERNAL MODE

A. Make certain power control knob is turned fully clockwise ↻ .

B. 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 minimal in relation to volume of the solution in the container).

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

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

E. 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.

F. 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.).

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

H. After all output adjustments have been made, you may set power control knob. While unit is running turn power control knob slowly counter-clockwise ↻ until unit just begins to stall. From this stall point, now turn power control knob clockwise ↻ from 1 to1½ graduation marks. This is the optimum power control setting for your application.

III. CALIBRATION PROCEDURE—ON-SITE VOLUMETRIC CALIBRATION FOR DE, D4 OR D7 IN EXTERNAL MODE

A. Since pump output is governed by an external device such as Flowmeter-Pulser, Liquitron™ Current-to-Frequency Converter or 4-20 mA DC signal from an instrument, only the **output per stroke** may be calibrated.

B. 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 (same as II. B. above).

C. Switch pump to **Internal** mode with speed knob set at 100 and hold switch in Internal position on DE and D4 pumps until air is exhausted from suction line and pump head.

D. Switch pump off (D7) or release switch (DE and D4) and note solution level in graduated container. Refill graduate if necessary.

E. Switch pump on (D7) or hold switch in Internal position (DE and D4) and **count the number of strokes** for exactly one minute. Then switch pump off (D7) or release switch (DE and D4).

F. Note volume pumped during the calibration period of one minute. Divide into this the number of strokes to determine the volume of chemical pumped per stroke.

Example: 150 ml ÷ 75 spm = 2.0 ml per stroke.

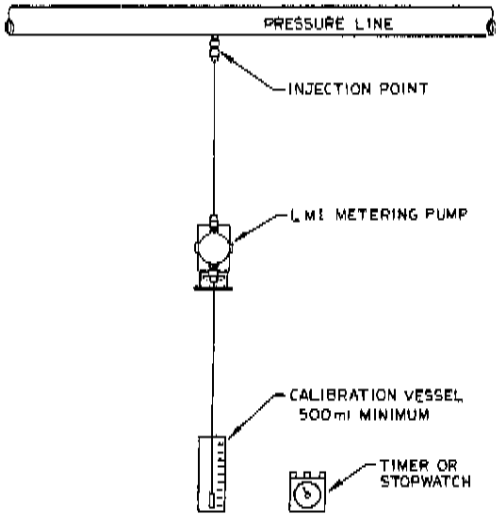
Multiply this by your expected stroke rate per minute, per hour or per day and compare with desired output requirements.

G. Adjust stroke length knob (lower knob) to your best estimate of required correction and repeat calibration procedure.

H. After all output adjustments have been made you may set the power control knob. While unit is running turn power control knob slowly counter-clockwise ↻ until unit just begins to stall. From this stall point, now turn power control knob clockwise ↻ from 1 to 1½ graduation marks. This is the optimum power control setting for your application.

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:

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 no effect)
- Air leak through valve seal rings
- Ruptured pumping Liquiframᵀᴹ (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 (if so supplied)
- Injection into pressure in excess of pump rating —see chart on page 6

A. Very low stroke setting—check position of stroke length knob (lower knob) by rotating it counter-clockwise until Liquiframᵀᴹ (diaphragm) stops moving with the pump operating. The pumping Liquiframᵀᴹ should not stop reciprocating (moving or clicking) until the knob points to zero. If it stops before zero, reset knob by removing yellow cap, loosen hex nut with 8mm (or 5/16") nut driver enough to turn knob without turning adjustment shaft. Then turn knob to point to zero, retighten nut and replace yellow cap.

B. 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 power control knob, stroke frequency knob and stroke length knob set at 100.

It may be necessary to disconnect the discharge tubing from the injection point temporarily in order to relieve the pressure on the pump discharge or pull on both knobs of "Anti-Syphon/Pressure Release Assembly" if so equipped. Follow "Priming" instructions in the Liquid Handling Assembly sheet inserted in this instruction book and operate the pump for a few minutes to purge the head and valves of air or gas.

C. 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 enclosed Liquid Handling Assembly sheet.

D. Ruptured pumping diaphragm—If rupture is severe, and pump is injecting into pressure, chemical leak will be obvious through the 3/16" (5 mm) diameter hole at the bottom of the spacer directly behind the pump head. Replace pumping Liquiframᵀᴹ (diaphragm).

If rupture is a small pin hole, there may be oozing of solution through the 3/16" (5 mm) diameter hole described above. Replacement of pumping Liquiframᵀᴹ (diaphragm) will be necessary.

E. Clogged Liquid End—will cause low pump output. Disassemble Liquid End. Clean individual parts with water and detergent or appropriate cleaning solution.

F. Injection into excessive pressure—If discharge pressure is within 25 psi* of maximum pump rating, remove **spring** in injection check valve, if so supplied.

*10 psi on DE3, DE4, D43, D44, D73 & D74 Series.

II. EXCESSIVE PUMP OUTPUT:

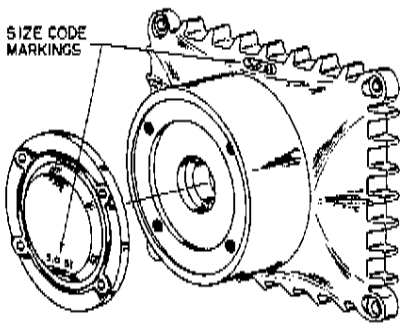
A. Syphoning—If your D Series pump has a Liquid End other than LE 20 HV, LE 29, LE 76, or LE 79, its injection check valve assembly has a chemically resistant anti-syphon spring. Disassemble the injection check valve and check to be sure this spring is in place and undamaged. Replace if necessary. Note that the anti-syphon spring must be removed if injection is into a pressure within 25 psi* of pump's maximum pressure rating. Liquid Ends with a suffix "S" have, in addition, a diaphragm type anti-syphon valve, which prevents syphoning and over pumping.

B. Incorrect knob settings—check stroke length knob (lower knob) by rotating it counter-clockwise to zero position. The Liquiframᵀᴹ (pumping diaphragm) should stop reciprocating. If it does not, reset knob and continue counter-clockwise rotation until motion stops. Remove yellow cap and loosen hex nut with 8mm (or 5/16") nut driver, reset knob by setting knob to point to zero, and retightening hex nut.

III. CHANGING PUMPING LIQUIFRAMᵀᴹ (DIAPHRAGM):

A. Make sure size code markings (1.8 S.I. or 3.0 S.I.) on spacer and Liquiframᵀᴹ (diaphragm) are the same. Liquiframᵀᴹ and spacer size code must match in order for the pump to function. On DE4, D44, and D74, Liquiframᵀᴹ is size code 6.0 S.I., (spacer is 3.0 S.I., but there is a large black spacer adapter).

Always wear protective clothing, gloves and face shield when working on or near chemical metering pumps.



B. Depressurize discharge line following steps G1 thru G4 and H1 thru H7 of supplement "Liquid Handling Assembly" for pumps with Liquid Ends 21 or 22. Follow steps E1 thru E4 of supplement "Liquid Handling Assembly" for pumps with Liquid Ends 71FS, 71S, 72S and 75S. 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 Liquiframᵀᴹ and rotate it counter-clockwise to unscrew the Liquiframᵀᴹ.

E. Before installing new pumping Liquiframᵀᴹ switch pump on and rotate stroke length control knob (lower knob) to the proper setting per the table following.

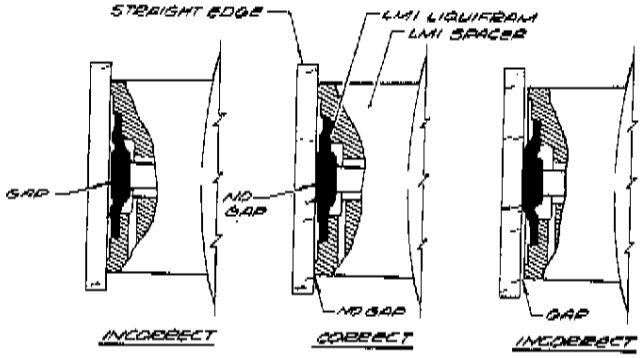
Model	Stroke Setting Length
DE0, DE1, DE2, D40, D41, D42, D70, D71, D72	90%
DE3, D43, D73	70%
DE4, D44, D74	50%

With pump stroking, screw on new pumping Liquiframᵀᴹ until the center part begins to buckle inwards during the latter half of the stroke. Switch pump off and check Liquiframᵀᴹ position with a straight edge according to the illustration.

If Liquiframᵀᴹ setting is not correct, restart pump then screw in or out the pumping Liquiframᵀᴹ. Always stop pump electrically when checking Liquiframᵀᴹ setting. Repeat procedure if necessary.

After Liquiframᵀᴹ is set properly turn stroke knob to 100%.

F. Reinstall pump head and tighten head mounting screw in criss-cross pattern.



TROUBLE SHOOTING ELECTRICAL—DE & D7 SERIES

NOTE: All tests should be conducted with the pump head and Liquiframᵀᴹ (diaphragm) installed. If pump head is removed the Liquiframᵀᴹ shaft may hang forward and not stroke completely.

I. Plug power cord into appropriate outlet.

A. Set power control knob (smaller, upper knob) fully clockwise ↻.

B. Set speed knob (larger, upper knob) to 100.

C. Set stroke knob (lower knob) to 100.

D. Set mode switch to "Internal".

E. On DE and D4 Series, hold switch in Internal.

II. Listen for stroking action.

A. If pump strokes and pilot light blinks OFF 71 to 82 times per minute, the Unipulser 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 82 times per minute, Unipulser module is defective and should be replaced. Remove all fuses from clips in pump housing, check fuses for continuity and replace or reinstall as required.

E. If pump strokes slower than 71 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 hex nut on knob. Check for blown fuses. Fuses are located in clips in pump housing. Replace or reinstall as required.

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 Unipulser 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.

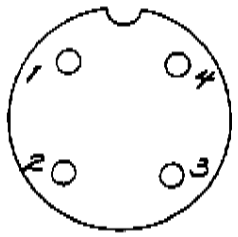
3. Check into terminals 1 and 2 and 3 and 4. They all should be open circuit.

If terminal 1 (ORN) is shorted to terminal 3 (GRY) unit will not operate on external mode.

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. Check liquid level light on control panel. If light is on when jack is not in use check jack for possible short. If this is OK, proceed to B.

B. If pilot light **does not blink off** in "External" mode, first determine if problem is in pump or in external triggering device. Using a small screwdriver blade or paperclip, short terminals 1 and 2 of external connector located on underside of pump housing, control panel side. (See diagram below.)



Pump should respond with one stroke and pilot light should blink off once every time terminals 1 and 2 are shorted. If pump responds properly, problem is with external triggering device. If pump does not stroke and pilot light does not blink off when shorting these terminals proceed to C.

C. 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. VIO.

1. Disconnect terminals from blades labeled ORN and VIO. Temporarily short blades ORN to VIO by the tip of a screwdriver. There is only 15 volts DC in this circuit.

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 VIO are shorted there is a short circuit in the external connector. By the use of an ohmeter, check resistance between external connector terminals 1 and 2.

2. If after terminals have been replaced onto blades ORN and VIO 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 VIO of Unipulser.

V. A. Check EPU for possible overload due to a shorted or partially shorted EPU* coil. Disconnect yellow EPU wires from Unipulser terminal labeled YEL YEL, and the green ground (earth) lead.

B. Measure resistance across EPU wires. Cold coil (18°C-22°C or 64°F-72°F) resistance reading should be:

	EPU Resistance
115 Volt Models	25 to 30 Ohms
220-250 Volt Models	97 to 113 Ohms

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

D. Coil resistance other than those above indicate that EPU 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.

*EPU = Electromagnetic Power Unit

DE OR D7 SERIES CONTROL PANEL