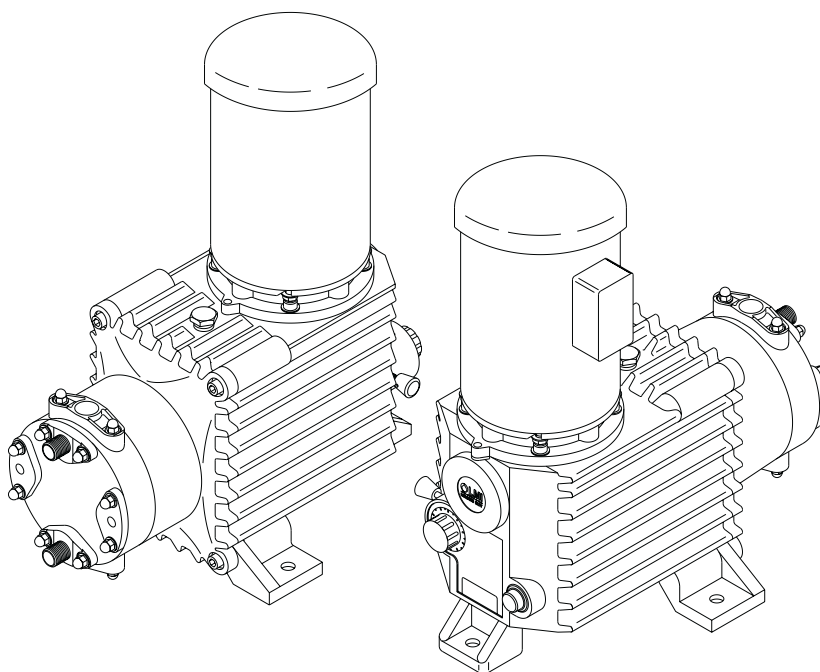


# Instruction **Manual**

**Series L**

## **Motor-Driven Metering Pumps**



For file reference, please record the following data:

Model No: \_\_\_\_\_

Serial No: \_\_\_\_\_

Installation Date: \_\_\_\_\_

Installation Location: \_\_\_\_\_

When ordering replacement parts for your LMI Controller or accessory, please include the complete Model Number and Serial Number of your unit.



8 Post Office Square  
Acton, MA 01720 USA  
TEL: (978) 263-9800  
FAX: (978) 264-9172  
<http://www.lmipumps.com>



Replaces same of Rev. G 5/96  
1230.G 2/98

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### WARNING

**A PRESSURE RELIEF VALVE WITH A RELIEF PRESSURE OF 150 PSI (10.3 BAR) MAXIMUM AND A RELIEF FLOW (BLEED) RATE OF 4 GPM MINIMUM MUST BE INSTALLED IN THE DISCHARGE LINE OF THIS PUMP.**



**Discharge piping should have a minimum burst pressure of 600 psi (41.4 Bar). Failure to provide pressure relief may result in failure modes dangerous to the system, associated piping, the pump itself and operating personnel.**



---

## 1.0 Unpacking

- A. Unbolt pump from plywood skid. Remove optional accessories and inspect everything for shipping damage. Notify delivery carrier immediately if there are any signs of damage to contents.
- B. Series L4 and L8 Current to Frequency Control Unit is shipped complete with 10 ft (3 m) of input cable, stripped ½ in (13 mm) for connection to 4-20 milliamp input signal; 10 ft (3 m) of output cable with mating connector for connection to pump clutch and a 6 ft (1.8 m) power cord with 3-prong plug for connection to 115 VAC electrical source.
- C. LMI's Series L7 Control Unit is packaged complete with 11 ft (3.4 m) of output cable and connector for direct hook up to pump clutch, and 5 ft (1.5 m) of power cord for connection to 115 VAC power source. A clear plastic cover is held to the unit with two (2) thumb screws and protects the controls.

---

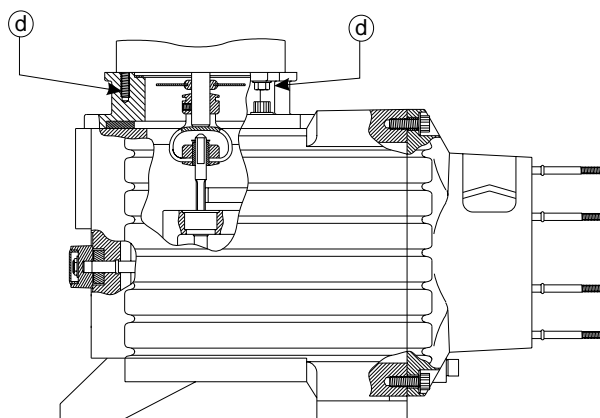
## 2.0 Pump Preparation

### 2.1 Pump Lubrication

Before operating the pump, check oil drain plug for tightness, then fill unit with 2.0 US qts (2.1 l) of SAE/10W (or 10W-40) motor oil. When full, the oil level should be visible at the top of the oil level gauge next to the stroke adjustment knob. Replace filler plug before operating the unit.

### 2.2 Motor Mounting

Series L pumps are available with motors of different voltages, frame styles, enclosure types and number of phases. Regardless of motor type, however, shaft rotation must be counter-clockwise when viewed from the shaft end (or clockwise when viewed from the cooling fan end). If motor rotation is incorrect, please refer to motor data plate or motor manufacturer's instructions for reversing.



**Figure 1**

### 2.3 Motor Removal/Installation

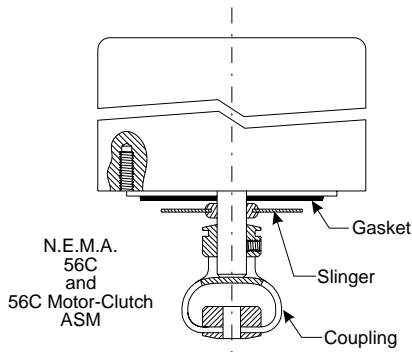
1. Remove four bolts retaining the motor to the motor adapter (3/8-16 bolts for 56C motor, 5/16-18 bolts for frame) (see Figure 1, Part d).
2. Lift off motor assembly.

A motor can be installed using the reverse procedure with the following additions:

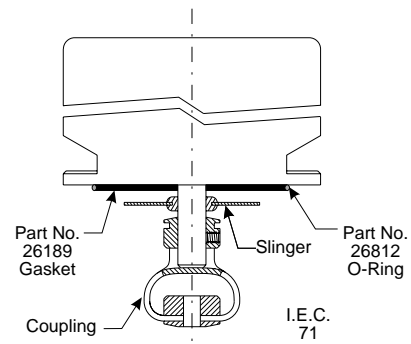
1. Position slinger on motor shaft (see Figures 1A and 1B).



*Slinger is not used on Series L4, L8, or L7 pumps.*

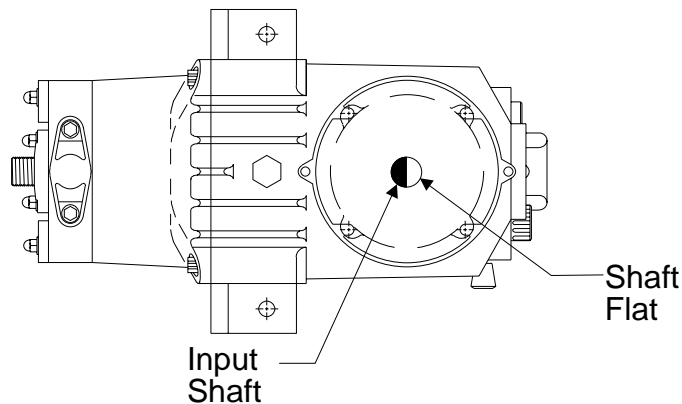


**Figure 1A**



**Figure 1B**

2. Install the coupling on the motor shaft (see Figures 1A and 1B). Tighten coupling setscrew against shaft flat or into shaft keyways.
3. Install LMI Part No. 26189 (Gasket) between the motor and the motor adapter. In addition, Part No. 26182 (O-Ring) must be installed over the motor alignment diameter on the 71 frame motor (see Figure 1B).
4. Before the motor-coupling assembly is mounted on the pump, the input shaft must be rotated by hand until the shaft flat faces the knob-end of the pump (see Figure 2). The motor and coupling is slipped over the input shaft such that the coupling flat is over the shaft flat.



**Figure 2**

5. Tighten motor mounting bolts with washers.
6. To change motor frame type from the type designated or supplied (example 48N to 56C or 71 frame), please consult the factory.

---

## 3.0 Location and Operating Conditions

For best results, ambient temperature must not exceed 130° F (59° C).

### 3.1 LMI's Series L metering pump mounting conditions required for successful operation:

1. Unit must be mounted level.
2. The surface must be able to support the unit's weight which can be approximately 85 lbs (39 kg) (depending on options).
3. For best results, the pump should be secured to the mounting surface using three .500" diameter fasteners.

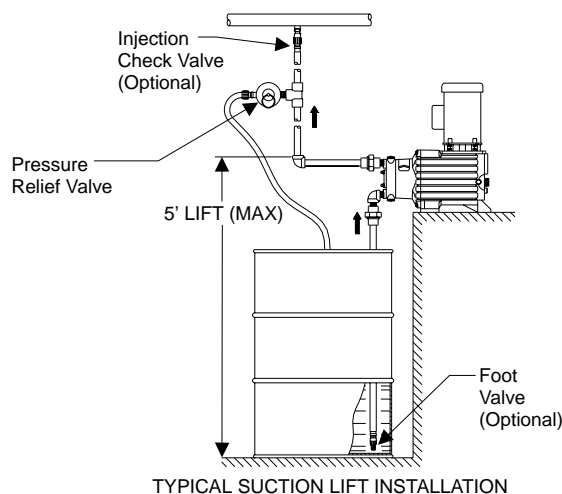
### 3.2 Series L4, L7 and L8

Mount the Liquitron™ L4, L7 or L8 converter on a wall or post at eye level, away from solution tank and in an area that is preferably not more than 10 ft (3 m) away from the pump and convenient to electrical supply and input signal source. If additional distance between pump and converter is required, extension cables may be purchased separately. These converters have corrosion resistant housing but should not be subjected to temperatures over 130° F (59° C), solution spray, very high humidity or weather.

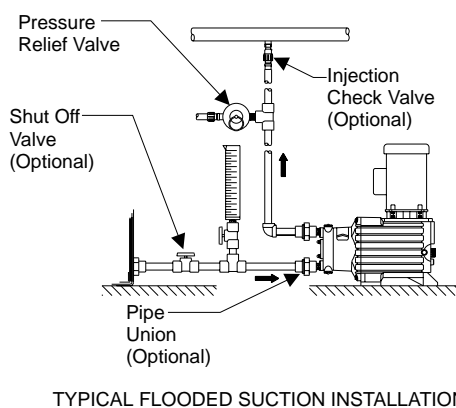
---

## 4.0 Plumbing Configuration

Series L pumps may be configured with either flooded suction or suction lift type configurations (see Figures 3 and 4).



**Figure 3**



**Figure 4**

### 4.1 Fluid Connections

Series L metering pumps are equipped with  $\frac{3}{4}$ " NPT Male connections for both suction and discharge. Schedule 80  $\frac{3}{4}$ " pipe should be used for plumbing and the following precautions should be taken:

1. Pressure test all plumbing before use to guard against leaks.
2. Prevent thread sealant from getting inside the plumbing.
3. Install a shut off valve in the suction side of the flooded suction installations to simplify maintenance.
4. A foot valve should be used in suction lift installations to ensure ease of priming (see Figure 3).
5. A pressure relief valve with a relief pressure of 150 psi (10.3 Bar) maximum and a relief flow (bleed) rate of 4 GPM minimum (see Figures 3 and 4) must be installed in the discharge line of this pump. Discharge piping should have a minimum burst pressure of 600 psi (41.4 Bar). Failure to provide pressure relief may result in failure modes dangerous to the system, associated piping, the pump itself and operating personnel.

## 4.2 Electrical

### 4.2.1 Series L4 & L8 (See Wiring Diagrams below and on page 7)

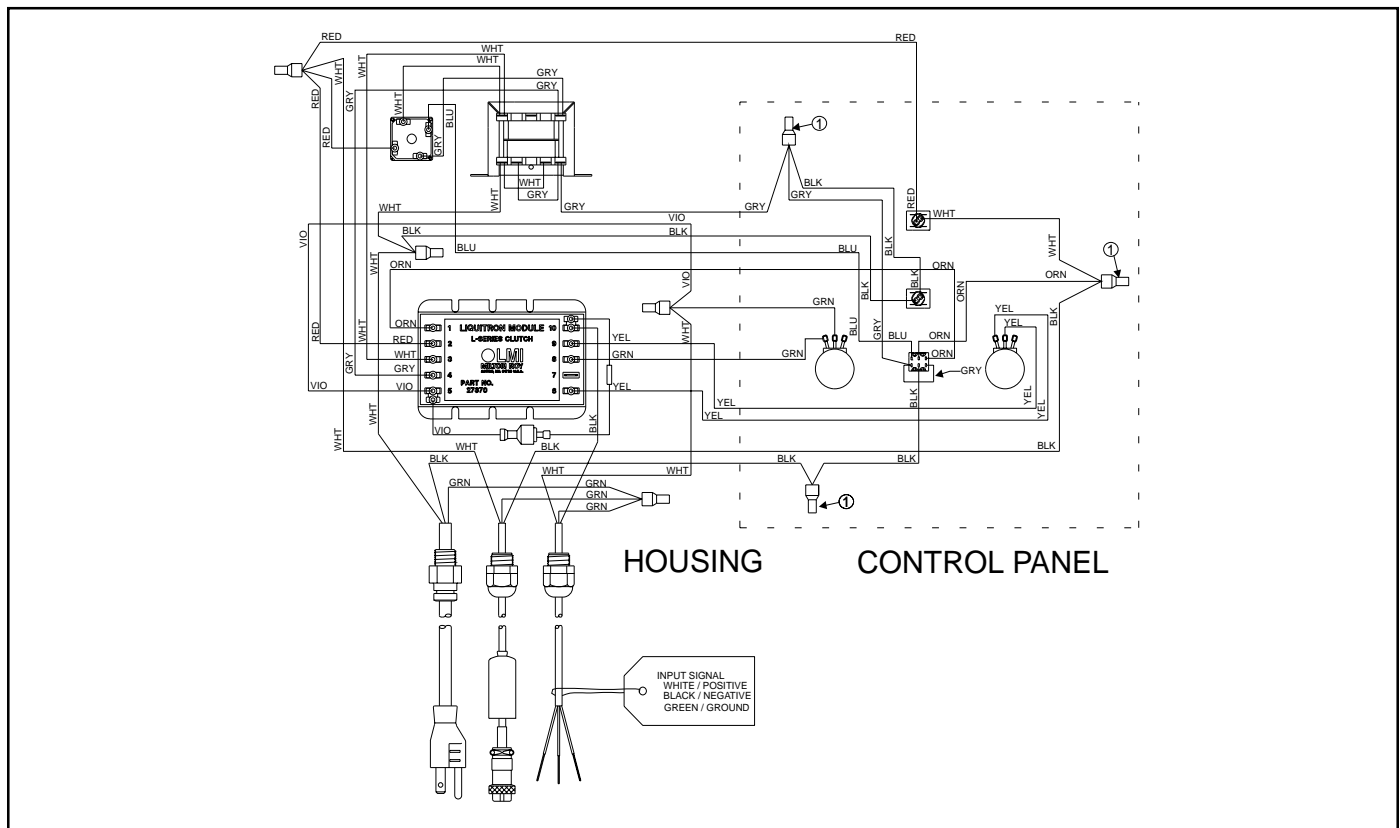


*Be sure the converter power switch is in the “OFF” position before proceeding.*

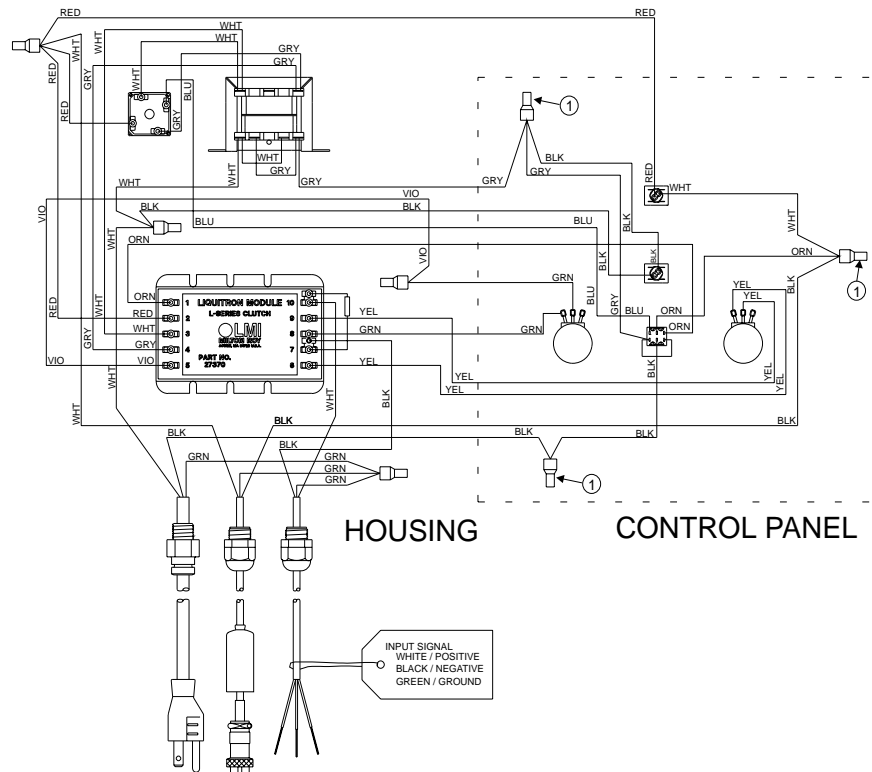
1. The power cord of the converter must be plugged into a 3-prong grounded 115VAC electrical outlet.
2. Connect input cable to current signal source of 4-20 mA DC. Polarity is as follows:  
white lead +  
black lead –
3. Output cable is equipped with mating connector for connection to pump clutch. Push connectors from output cable and clutch together and tighten.

### 4.2.2 Series L7 (See Wiring Diagram on page 7)

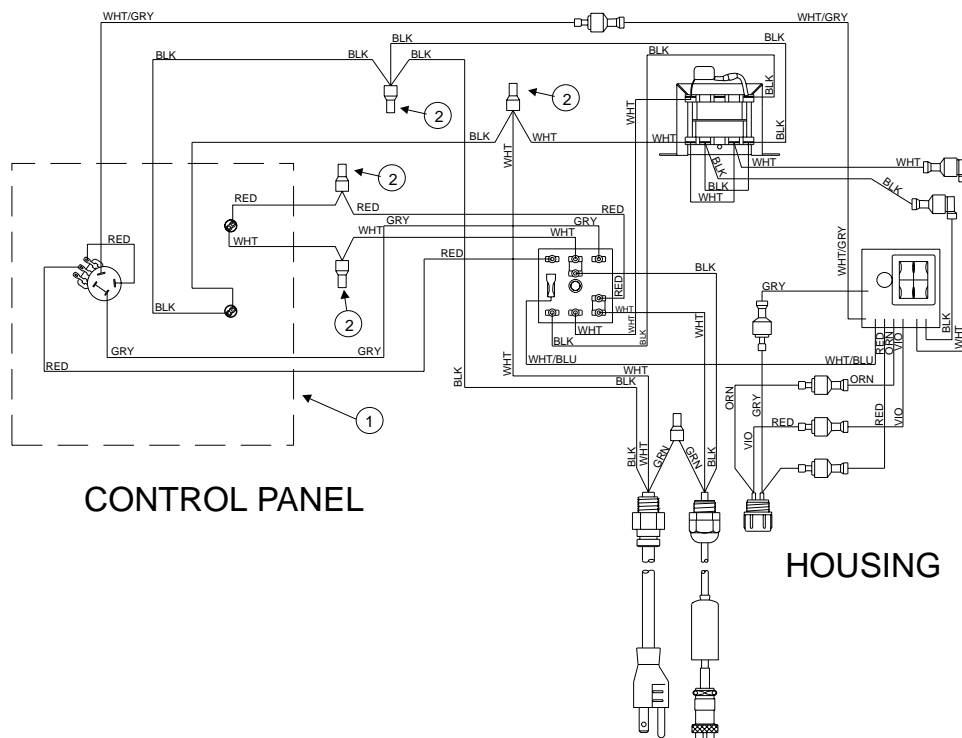
1. The power cord of the control unit should be plugged into a 3-prong grounded 115 VAC electrical outlet.
2. Insert 4-prong connector socket from the flowmeter cable into the external input jack of the control unit and tighten the coupling nut.
3. In the same manner, connect the cable of the control unit to the Series L7 clutch.



**L4 Wiring Diagram No. 28756 Direct**



**L8 Wiring Diagram No. 28767 Inverse**



**L7 Wiring Diagram No. 28771**

## 5.0 Pump Operation for Series L1 and L2

### 5.1 Priming

Series L pumps are shipped from the factory with water in the pump head to assist priming. Priming can be done only against atmospheric pressure when using a suction lift configuration. Flooded suction installations will allow the unit to prime itself under pressure. Set pump stroke knob to 100% output to prime.

In all cases, priming will be assisted by releasing or reducing pressure on the pump discharge.

### 5.2 Output Adjustment

Pump output is adjusted using the stroke knob located at the rear of the pump. After stroke knob adjustment, the lock knob holds the shaft to prevent setting change. Before adjusting the pump, the lock knob should be loosened and the pump should be running. The dial under the knob represents “% of total output” and provides accurate output adjustment above the 10% setting. The maximum output position is reached by turning the knob 360° clockwise from this point with the unit running.

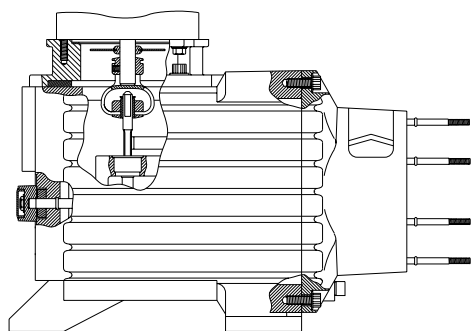
### 5.3 Calibration

1. The pump is best calibrated after installation is complete (including injection pressure, fluid viscosity and suction lift).
2. Set initial stroke output adjustment.
3. Using a graduated container of sufficient volume, measure the displacement of fluid over time, counting the number of pump strokes.
4. Note the time elapsed in relationship to the volume displaced.
5. Calculate the amount displaced in volume per stroke.

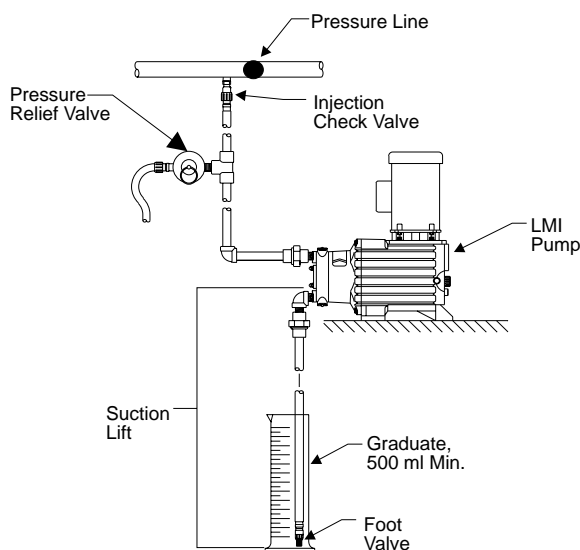


*1/4 HP motors will have a maximum of 72 strokes per minute. 1/2 HP motors will have a maximum of 144 strokes per minute. In all cases, output per stroke is adjustable between 3 to 30 ml per stroke.*

6. After calibration results, adjust stroke knob setting to increase or decrease output.



**Figure 5**



**Figure 6**



---

## 6.0 Pump Operation for Series L4 and L8

### 6.1 General

---

Series L4 and L8 pumps provide manual stroke length adjustment and 4-20 mA frequency adjustment. These two (2) methods achieve desired output.

1. **STROKE:** The stroke knob allows manual adjustment from 10% to 100% of the pump's rated output (see Section 5.2).
2. **FREQUENCY:** The Liquitron™ current-to-frequency converter provides linear response to a 4-20 mA signal based on fixed span and zero adjustments. Frequency is controlled by the amount of time the motor clutch is engaged. Decreasing the time the clutch is engaged decreases output. Increasing the time the clutch is engaged increases output.

**L4:** Provides direct response; output increases as milliamp response increases.

**L8:** Provides inverse response; output increases as milliamp response decreases.

**MAN-OFF-AUTO:** The manual-off-automatic switch provides mode selection of pump operation.

**MAN:** This mode powers the converter to operate the pump at maximum stroke frequency, regardless of input 4-20 mA signal (MAN mode should be used when priming).

**OFF:** This mode interrupts electrical power to the Liquitron™ CTF converter.

**AUTO:** This mode powers the converter to operate the pump based on the incoming 4-20 mA signal.

**ZERO ADJUSTMENT (Point 1):** The zero knob adjusts the milliamp signal level at which the converter begins to operate. This is Point 1.

**SPAN ADJUSTMENT:** Once the zero point has been set, the span knob adjusts the second point (2) to provide desired pump output at a desired milliamp signal level. Pump output increases and decrease based on an increase or decrease of the milliamp input signal along a line determined by these two (2) points.

---

### 6.2 System Adjustment for L4 and L8

#### 1. Stroke Setting:

Determine desired maximum pump output in gallons per hour (GPH), then divide by rated maximum pump output.

**Example:**

Required maximum output = 27 GPH

Rated maximum pump output = 35 GPH

$$\frac{27 \text{ GPH}}{35 \text{ GPH}} = 77\% \text{ Stroke Setting}$$

This would be the maximum percent output at the maximum frequency.



*60% is a recommended minimum initial stroke length setting for applications requiring less than 50% of the rated pump output. 60% allows flexibility in later adjustments. Therefore, set stroke length to 60% if required output is less than 60% and correct with frequency adjustment.*

## 2. % Zero Setting:

Set zero point (1) by selecting the % knob setting in relationship to the required milliamp input. Use converter setting chart to determine % knob setting or by the following:

$$\frac{\text{mA Value}}{4} \text{ For L4}$$

$$\frac{\text{mA Value}}{20} \text{ For L8}$$

For L4 to have zero output at 4 m A, the zero% should be set to 100%.

### Example:

$$\frac{4 \text{ mA}}{4 \text{ mA}} = 1.00 \text{ or } 100\%$$

For L8 to have zero output at 20 mA, the zero % should be set to 100%.

### Example:

$$\frac{20 \text{ mA}}{20 \text{ mA}} = 1.00 \text{ or } 100\%$$

## 3. % Span Settings

Set span point (2) by selecting the % knob setting in relationship to the required output over a milliamp range from point (1). Pump response is determined by a line between these points. Use the converter setting chart to determine % knob setting.

### Example:

For L412-40

Required Zero Setting: 4 mA

Required Span Setting: 20 mA

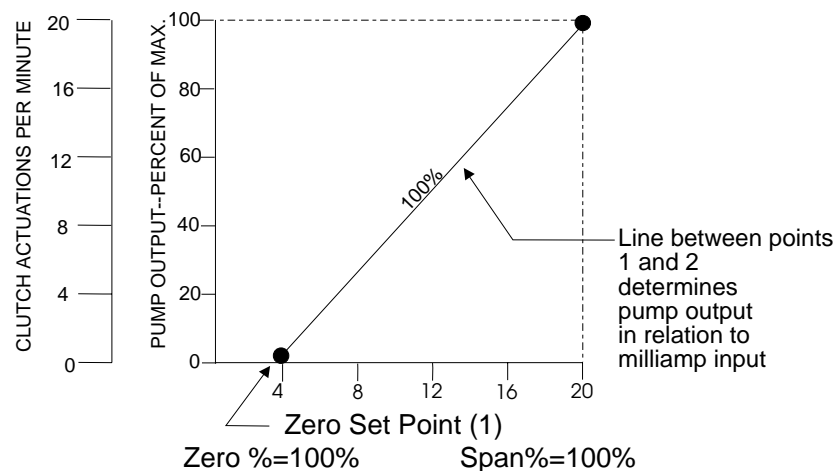
Use the converter setting chart to determine % knob setting.

### Example:

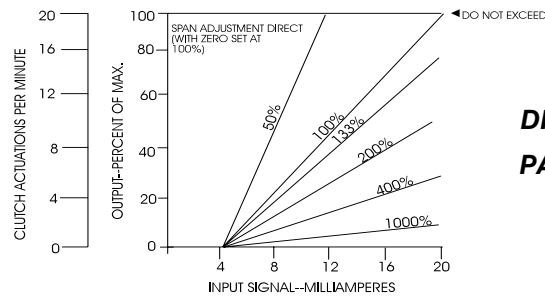
For L412-40

Required Zero Setting: 4 mA

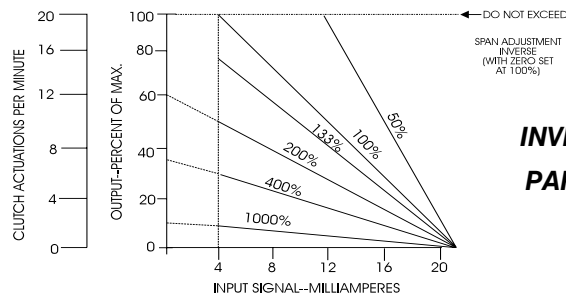
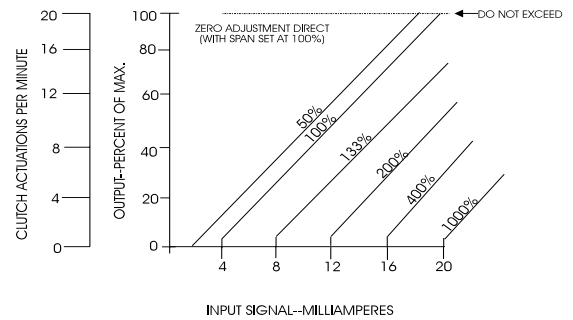
Required Span Setting: 20 mA



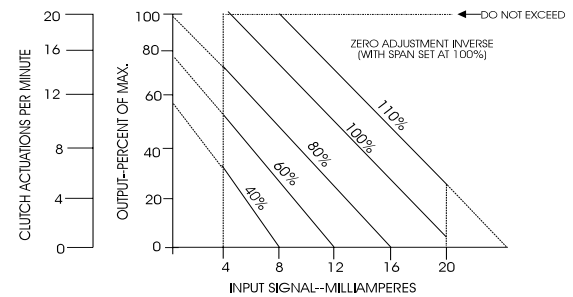
## CURRENT TO FREQUENCY CONVERTER SETTINGS



**DIRECT ACTION  
PART NO. 28756**



**INVERSE ACTION  
PART NO. 28767**



### 6.3 System Adjustment Examples

Certain systems require emphasizing pump output per cycle or pump output frequency. However, a general starting method could be as follows for both the Series L4 and L8.

1. Determine required maximum flow from the Series L pump in GPH, then divide by rated maximum pump output.
2. Set Stroke Length Control to proper percent.
3. Determine where the zero point and span point should be adjusted for the particular system.
4. Set Current-To-Frequency Control Unit (ZERO and SPAN).



The method described above suggests adjusting the stroke length to achieve **desired maximum** pump output (assuming maximum frequency range requirement). If the result from above is less than 50%, for optimal performance and flexibility the stroke length should be set to 60%, and % maximum frequency reduced proportionally.

#### Example:

L412-40 rated maximum output = 35 GPH  
 Required output (max) = 14 GPH  
 Required ZERO Point = 7 mA  
 Required maximum mA signal = 20 mA

1. Stroke length setting  $\frac{14 \text{ GPH}}{35 \text{ GPH}} = 40\%$



However, 60% is a recommended minimum initial stroke length setting for applications requiring less than 50% of rated output. 60% setting allows flexibility in later adjustments. Therefore, set the stroke length to 60% (not 40% as calculated), and correct with maximum frequency adjustment.

$$\% \text{ of maximum frequency} = \frac{14 \text{ GPH}}{(0.6)(35 \text{ GPH})} = 67\%$$

\*Point 1  
(required mA  
starting point)

2. Set ZERO adj:  $\frac{\text{Point 1}}{4 \text{ mA}} = \% \text{ (percent) zero setting}$

3. Set SPAN adj:  $\frac{20 \text{ mA} - \text{Point 1}}{16 \text{ mA}} = \boxed{\phantom{000}} \div .667 = \% \text{ (percent) span setting}$

**Example:**

Set ZERO adj:  $\frac{*7 \text{ mA (point 1)}}{4 \text{ mA}} = 175\%$

Set SPAN adj:  $\frac{20 \text{ mA} - *7 \text{ mA (point 1)}}{16 \text{ mA}} = \boxed{.8125} \div .667 = 122\%$

## 7.0 Pump Operations Series L7

### 7.1 Controls

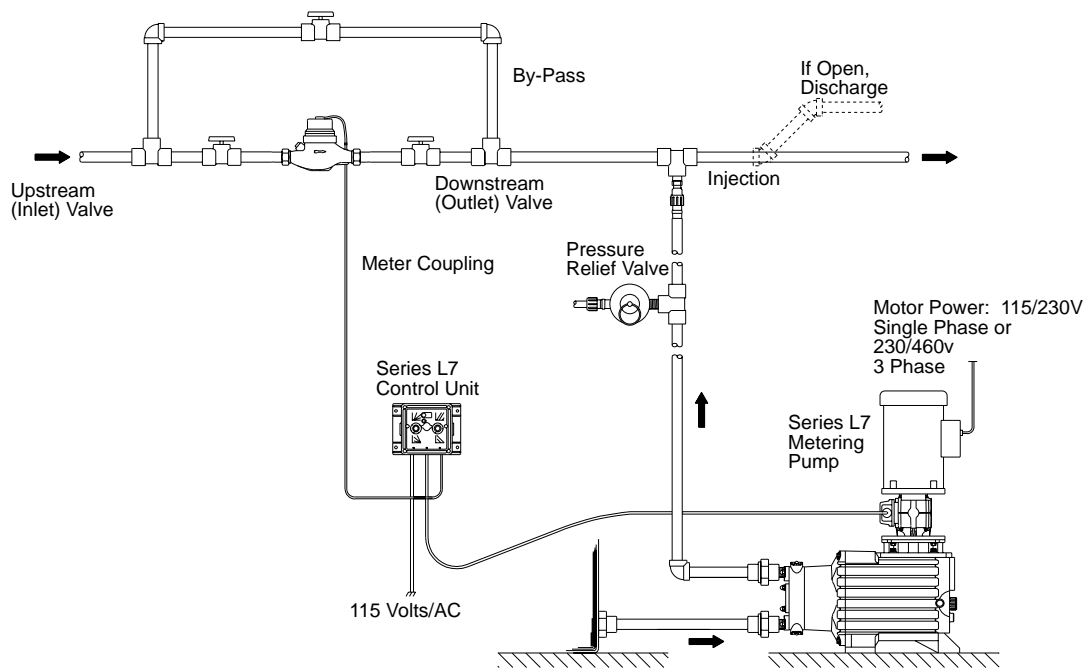
The panel of the Control unit has a stroke light which flashes on each time the pump strokes, both in INTERNAL mode and in EXTERNAL mode, and acts as a visual aid. The POWER light indicates a power on or power off condition. The dial knob controls pump speed when in INTERNAL mode and allows you to switch to EXTERNAL mode when turned counter-clockwise to the six o'clock position.

### 7.2 Operation in Internal Mode

The Internal control knob is graduated in percent of maximum pump speed, from 5% to 100%. Setting the knob within this range allows the pump to operate independently of the flowmeter signal. Total pump output may be estimated by multiplying the speed setting (percent of maximum) by the stroke length setting (percent of maximum). Stroke length is controlled by a large knob at the rear of the pump itself, also graduated in percent of maximum. For example, if speed knob is set at 20% of maximum, and stroke length (at pump) is set at 60% of maximum, total pump output will be 12% of the pump's rated maximum. That is, 20% times 60% equals 12%. Series L7 equipped with 1/4 HP (1725 RPM) motors have a maximum speed of 72 strokes per minute. Those equipped with 1/2 HP (3450 RPM) motors have a maximum speed of 144 strokes per minute. Series L71 pumps exhibit 3.6 strokes per clutch actuation with a range of 3 to 30 cc's per stroke. Series L72 pumps exhibit 7.2 strokes per clutch actuation with a range of 3 to 30 cc's per stroke.



Prime your Series L7 pump while in the internal mode.



**Figure 7**

### 7.3 Operation in External Mode

For operation in EXTERNAL mode, turn the speed knob on the Control Unit counter-clockwise until it clicks into the six o'clock position. The pump will now respond directly and proportionally to the incoming flowmeter signal. Pump output adjustment can be made at the pump by using the stroke length knob at the rear of the pump. While the frequency with which the pump strokes is now determined by flow rate, output per stroke can be varied from 3 to 30 cc's per stroke using the control knob at the pump. For purposes of setting the divider number on the flowmeter, set the knob at the pump to 60%, since instructions in the following section are based on 60% stroke length for start up estimating.

## 8.0 Maintenance

Should output be reduced or leaks develop, the valves, seal rings and seals may need to be replaced. Spare parts kits are available from your distributor. The following steps describe the proper procedures for depressurizing and disassembling for spare parts replacement.

### Instructions for Spare Parts Kits SP-40/44/45

#### 8.1 Depressurizing the Discharge Line



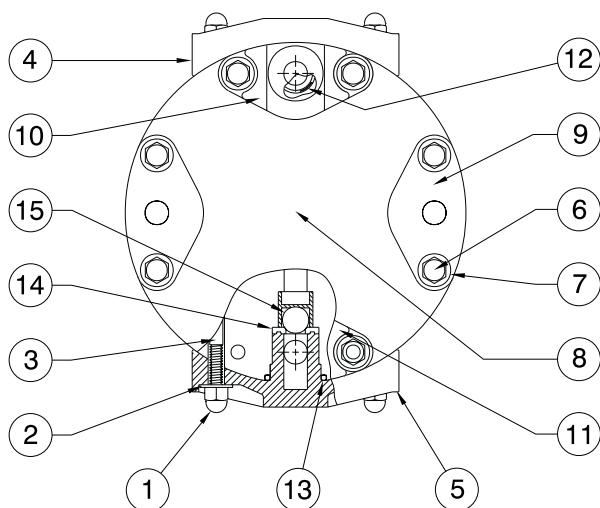
*Before disassembling the pump, place a container below the suction line and pump head as a catch basin for the solution retained in the pump head.*

1. With the pump running, turn the output (stroke) knob fully counter-clockwise to zero, then turn off the pump.
2. If shut off valves have been installed on the pump suction and discharge line, they should be turned to the off position.
3. Carefully release pressure in the discharge line, noting that the pumping solution may be under pressure. Disconnect and drain the suction line into the catch basin.



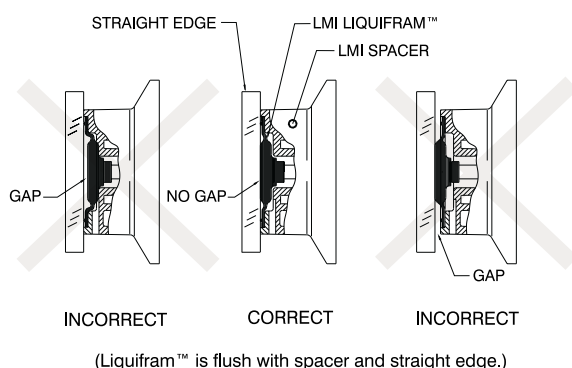
*Head will still retain some solution.*

## 8.2 Liquifram™ (Diaphragm) Replacement



**Figure 8**

1. Carefully remove the two valve cap nuts (1), washers (2) and the two retaining studs (3). Remove the valve caps (4) and (5) and drain remaining solution from the pump head.
2. Remove the eight cap nuts (6) and washers (7) and the pump head (8), along with the two clamp plates (9) and both the suction and discharge valves (10) and (11).
3. **IMPORTANT:** Remove the eight existing O-Ring seals (not shown) located behind the pump head on each head stud and replace with the new O-Ring seals included with the spare parts kit.
4. Disassemble head and clean all components, checking for residual build-up.
5. Turn pump on and adjust the output (stroke) knob to 85%, then turn pump off.
6. Screw on new Liquifram™ and adjust so that the Liquifram™ face is flush with the outside of the spacer (see Figure 9).



**Figure 9**

7. Replace seal rings, balls and O-Rings at (12), (13), (14) and (15), located on both the suction and discharge side of the head.



*Failure to install these O-Ring seals could result in severe spraying of solution outside the pump head. Be sure all seals are in place before starting the pump.*

8. Re-assemble pump head components (1), (2), (3), (4) and (5), tighten the cap nuts evenly. Final torque should be 10 ft lbs.
9. Re-install pump head (8) along with other components (6), (7), (9), (10) and (11). Tighten head cap screws in a criss-cross pattern. Final torque should be 10 ft lbs.

## 8.3 Lubricant Change

For best results, lubricant should be changed once per year. With the pump stopped, the unit should be refilled to the top of the sight glass using 10W or 10W-40 motor oil. Filling to this level requires 1.5 qts (1.4 l) of oil.

## 8.4 Reset Output Adjustment Knob

If the knob line doesn't line up with 100% on the dial **when turned counter-clockwise** until it stops, the knob position on the shaft must be adjusted. Adjustment is achieved using the following procedure with the shaft set at the maximum counter-clockwise position.

1. Pry off yellow knob cover.
2. Loosen knob retention nut while making certain knob-shaft assembly doesn't move.
3. Position the knob line in line with the 100% line on the label.
4. Tighten knob while holding knob steady.
5. Recheck setting and replace knob cover.

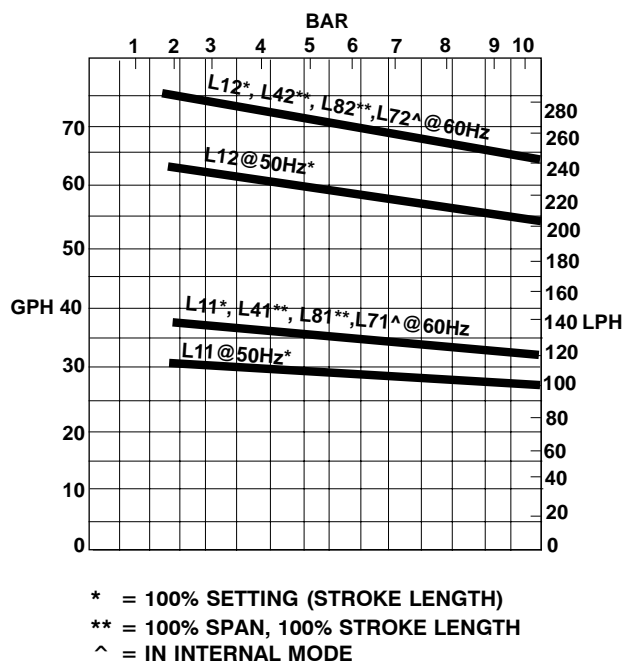
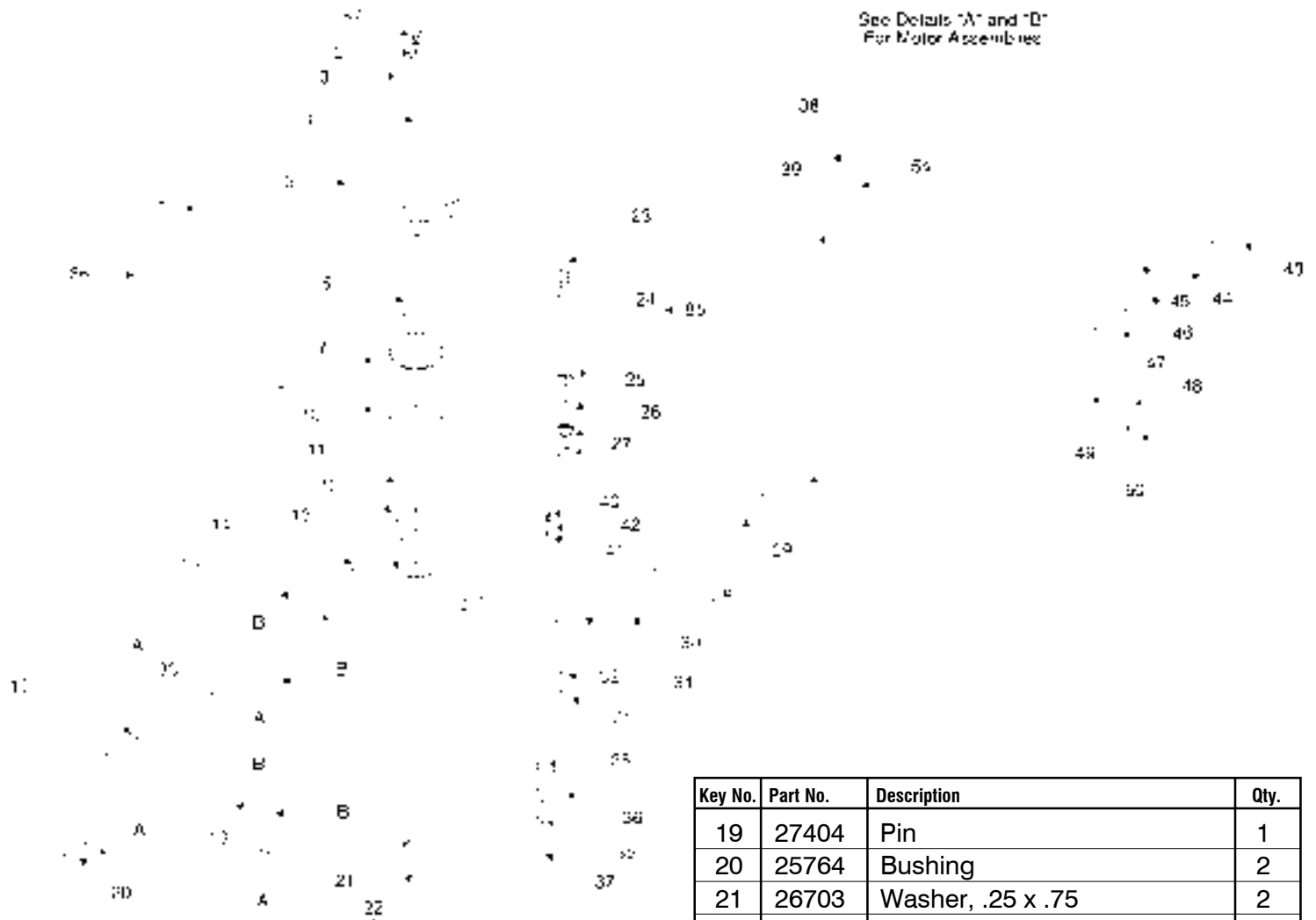


Figure 10

## 9.0 L Series Drive Assembly Parts List



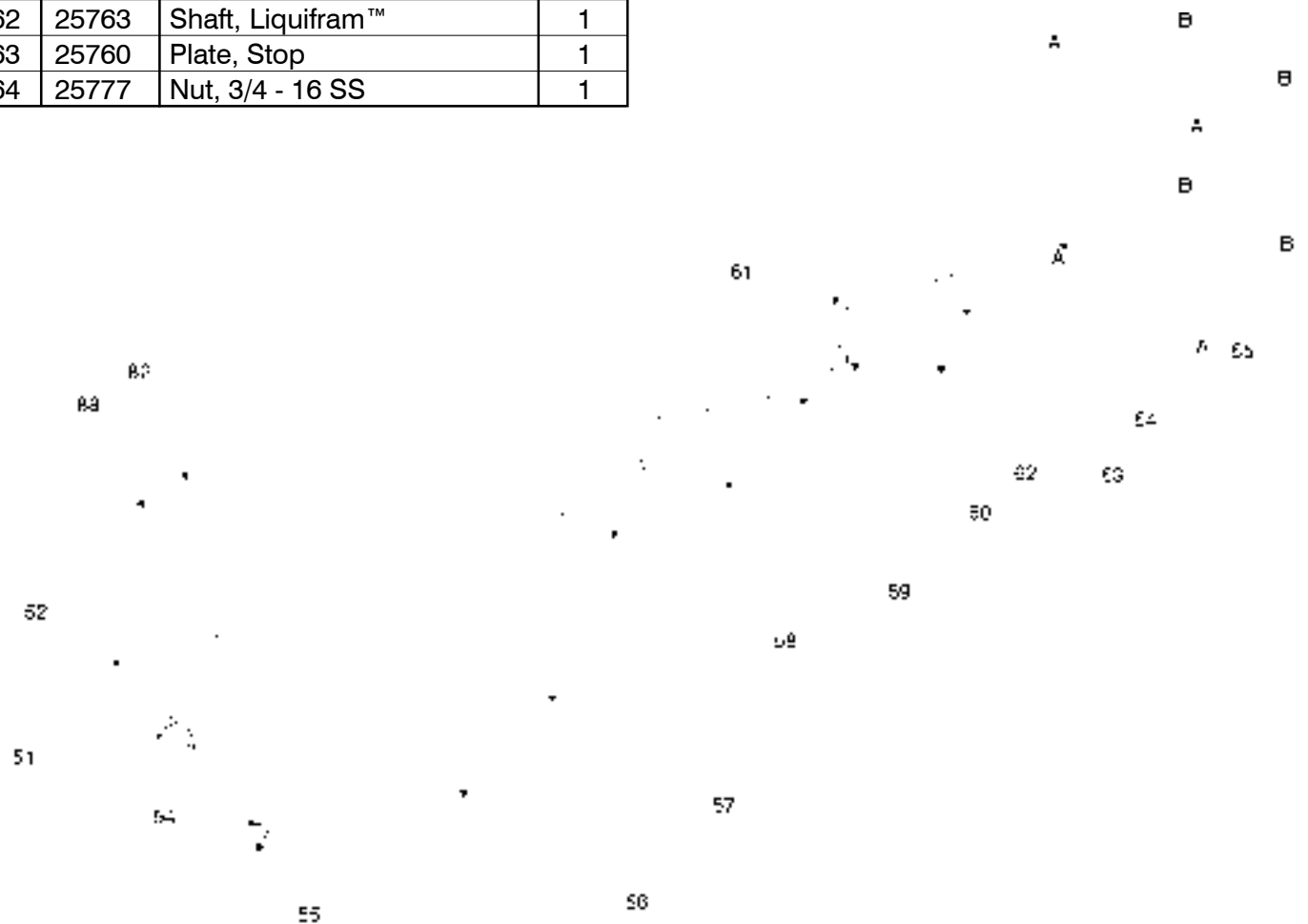
Key No.	Part No.	Description	Qty.
1	27929	Camshaft Assembly	1
2	27938	Washer (Camshaft)	1
3	29133	Washer	1
4	26458-1	Key	1
5	25853	Gear	1
6	28914	Camshaft	1
7	25768	Ball Bearing, 1.38 x 3.15	1
9	30066	Cam Bearing	1
10	25780	Wide Cam Spacer	1
11	25765	Ball Bearing, .98 x 2.4	1
12	25787	Snap Ring	1
13	26128	Nut, 10 mm x 1.5	4
14	27060	Gear Plate	1
15	26592	Alignment Pin	2
16	27244	Head Stud	8
18	25996	Second Stroke Adjustment Shaft	1

Key No.	Part No.	Description	Qty.
19	27404	Pin	1
20	25764	Bushing	2
21	26703	Washer, .25 x .75	2
22	25788	Screw, 1/4 - 20 x 1.0 L	1
23	25852	Input Pinion	1
24	26168	Ball Bearing, .50 x 1.2	1
25	26170	Snap Ring	1
26	25776	Ball Bearing, .375 x .87	1
27	26130	Snap Ring	1
28	26097	Adjustment Shaft	1
29	10487	O-Ring	1
30	26105	Pin	1
31	25995	Adjustment Shaft End	1
32	25902	Nut, 1/4 - 20	1
33	25796	Pin, .25 x 1.5 L	1
35	26149	Washer, .26 x .50	2
36	26208	Oil Splasher	1
37	26171	Screw, 1/4 - 20 x .50 L	1
38	26229	Oil Fill Plug, 1/4 NPT	1
39	27067-1	Housing	1
40	27121	Screw, 10 - 32 x .375 L	1
41	27183	Washer, #10 Flat	1

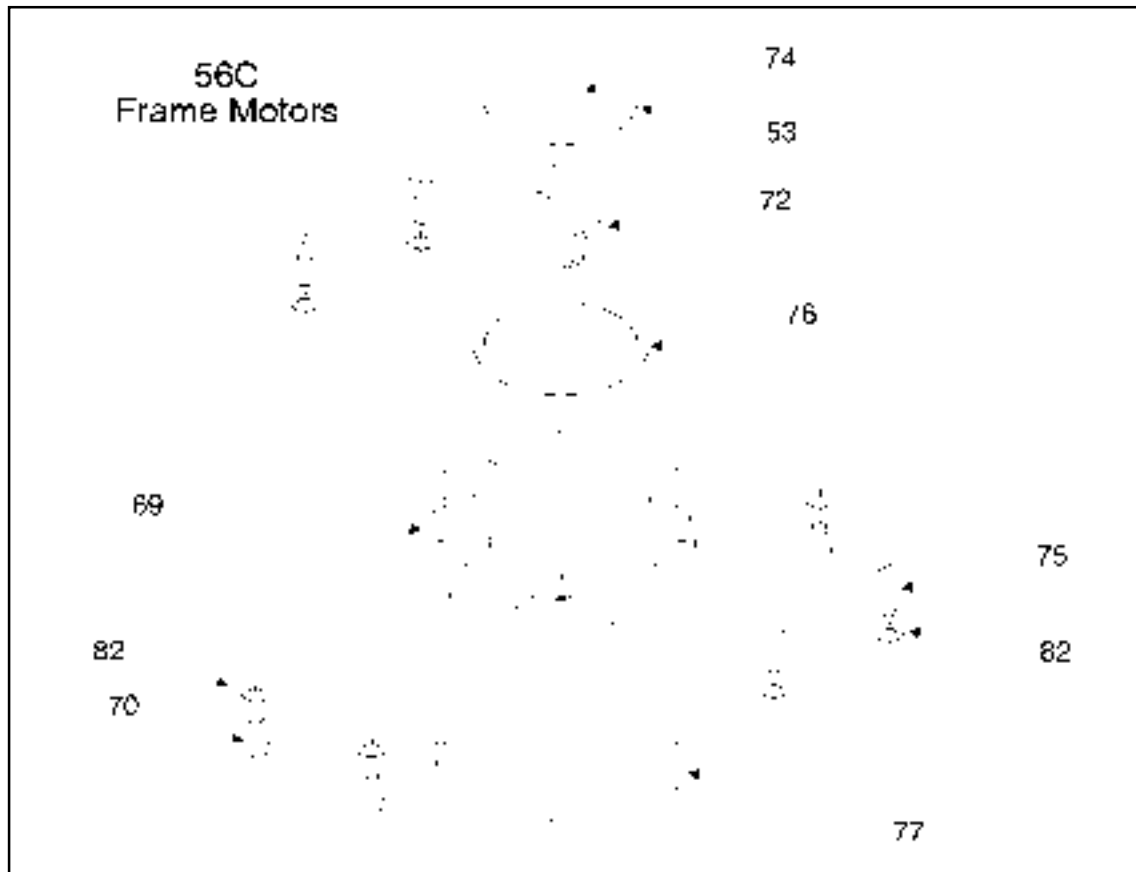


Key No.	Part No.	Description	Qty.
42	30848	Washer	1
43	26608	Knob Assembly	1
44	26607	Adjustment Stop Mechanism	1
45	26152	Sight Glass	1
46	25454	Pin	1
47	28310	Nameplate	1
48	10842	O-Ring	1
49	26100	Shaft Lock Screw	1
50	26043	Lock Knob	1
51	25755	Oil Seal	1
52	26140	O-Ring	8
53	26205	Oil Slinger	1
54	Cust. Supplied Teflon® Tape		A/R
55	26456	Oil Drain plug	1
56	27058-1	Spacer, 12.0 SI	1
57	28154	O-Ring	1
58	25756	Small Return Spring	1
59	25782	Large Return Spring	1
60	25753	Bushing, .87 X 1.0	1
61	26603	Bushing, .375 x .50	1
62	25763	Shaft, Liquifram™	1
63	25760	Plate, Stop	1
64	25777	Nut, 3/4 - 16 SS	1

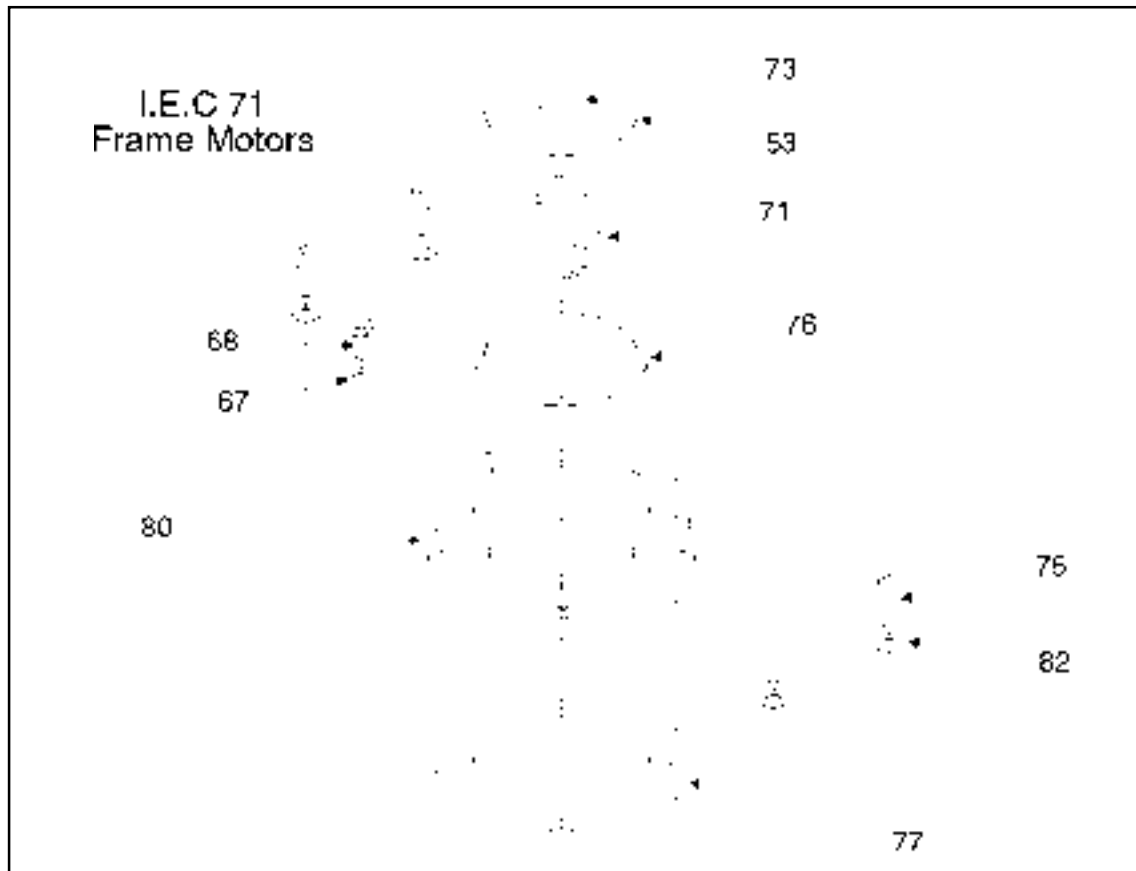
Key No.	Part No.	Description	Qty.
65	25762	Pin, .5 x 4.0 L	1
67	26148	Washer	4
68	27372	Screw	4
69	30624	Motor Adapter	1
70	26107	Screw, 3/8 - 16 x 3/4	4
71	26373	Motor Coupling Asm. (L1XM)	1
72	26371	Motor Coupling Assy	1
73	26180	Grommet	1
74	26181	Grommet	1
75	26108	Screw, 3/8 - 16 x 1	8
76	26189	Gasket	1
77	26190	Gasket	1
80	26985	Motor Adapter	1
82	26150	Washer, .41 x .74	8
85	27930	Input Pinion Asm.	1
86	29141	Camshaft Asm. w/Gear	1
87	29464	Screw 5/16 - 18	1
88	30925	Screw 3/8 - 16 x 1.5	4
---	26670	Oil, 10W-40 (Not Shown)	2



**Detail A**



**Detail B**







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