

# ***INSTRUCTION MANUAL***

**M E T E R I N G P U M P S**

LINC85T-11 & 12 Series Chemical Metering Pump  
Pneumatic Bellows



# M E T E R I N G P U M P S

P N E U M A T I C B E L L O W S

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# METERING PUMPS

## P N E U M A T I C B E L L O W S

| General Specifications: 85T Series Pneumatic Bellows Metering Pumps |                     |   |                               |
|---|---------------------|---|-------------------------------|
| <b>Wetted Parts:</b>  |                     | <b>Pneumatic Section:</b>                               |                               |
| Pump Body:  | 303 Stainless Steel | Piston Housing:   | 303 Stainless Steel           |
| Plunger:  | Ceramic             | Timer:  | 303 Stainless Steel           |
| Plunger Seal:   | Lubrithane          | <b>Plunger Sizes:</b>                                   | 1/4" & 1/2" plunger diameters |
| Bellows:  | TFE                 | <b>Pressure:</b>  | To 2,400 psi, maximum         |
| <b>Check Valves :</b>   |                     | <b>Optional Materials:</b> Hastelloy, Monel, & Titanium |                               |
| Body:   | 316 Stainless Steel |   |                               |
| Ball:   | Carbide             |   |                               |
| Spring - Discharge:   | 316 Stainless Steel |   |                               |
| Seat:   | TFE                 |   |                               |

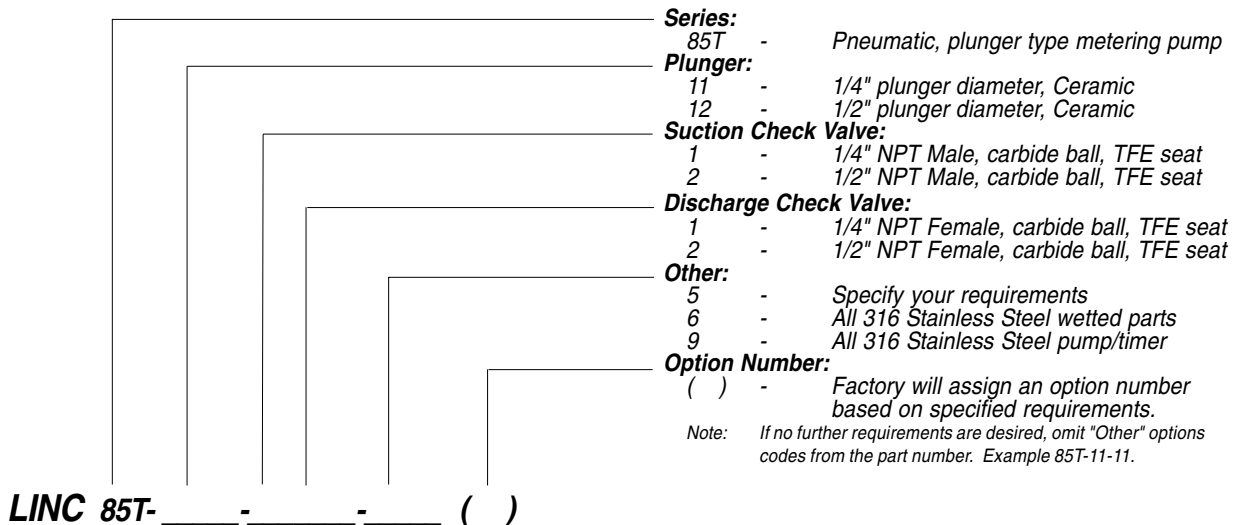
| The LINC 85T Series: Pneumatic, Bellows-Type Metering Pump Selection Chart |                  |                 |                     |                       |                     |                       |                      |                      |                        |                    |                   |               |
|--|------------------|-----------------|---------------------|-----------------------|---------------------|-----------------------|----------------------|----------------------|------------------------|--------------------|-------------------|---------------|
| Model Number   | Plunger Diameter | Piston Diameter | Maximum Rate Gal/Hr | Maximum Rate Liter/Hr | Minimum Rate Gal/Hr | Minimum Rate Liter/Hr | Maximum Pressure psi | Maximum Pressure bar | Theoretical Amp. Ratio | Strokes Per Minute | Volume Per Stroke | Stroke Length |
| 85T-11   | 1/4"             | 2 1/4"          | 0.42                | 1.59                  | 0.006               | 0.023                 | 2,400 <sup>5</sup>   | 165.5                | 81:1                   | 4 - 50             | 0.53 cc           | 1"            |
| 85T-12   | 1/2"             | 3"              | 1.66                | 6.28                  | 0.025               | 0.095                 | 2,400 <sup>5</sup>   | 165.5                | 36:1                   | 4 - 50             | 2.10 cc           | 1"            |

**Notes:**

1. Maximum rates are based on 50 strokes per minute.
2. Minimum rates are calculated on: 1/4" and 1/2" pumps are 1/4" stroke length and a minimum of 4 strokes per minute.
3. The timer supply pressure is 15 to 100 psi.\*
4. TFE wetted O-rings are standard.
5. 85T-11 Maximum pressure based on 80 psi supply pressure.\*
6. 85T-12 Maximum pressure based on 100 psi supply pressure.\*

\*Actual pump discharge pressure and stroke frequency will be dependent on the actual timer supply pressure used to stroke the pump.

### Ordering Chart: 85T Series Pneumatic Bellows Plunger Metering Pump



**Example: LINC 85T-12-22-6 Pneumatic, Bellows Metering Pump**

# METERING PUMPS

P N E U M A T I C B E L L O W S

## Scope Of This Manual:

This manual describes the LINC85T Chemical Metering Pump, which is a pneumatically operated bellows type pump. This bellows design isolates the process chemical from the rest of the system.

## Installation:

The LINC85T pump requires a flooded suction and must be installed lower than the chemical supply tank. Vertical installation is required.

1. Connect the suction line to the suction check valve (fig. 1, item 21).
2. Connect the discharge line to the discharge check valve (fig. 1, item 18).

**Note:** Installation of an in-line check valve P/N 25019 at the point of injection is recommended to prevent back flow to the pump during shutdown or servicing.

3. Connect the air or gas supply line to the timer port marked "IN" (fig. 1, item 1).
4. The supply pressure to the timer must be regulated between 15 and 100 psig.\*

\* Actual pump discharge and stroke frequency will be dependant on the actual timer supply pressure used to stroke the pump.

5. Set the regulator output pressure to overcome the discharge pressure. Refer to the paragraph on "Amplification Ratio" at the end of this manual for information on determining the correct supply pressure.
6. To prime the pump, loosen the bleed screw to vent the trapped air allowing the liquid to flow into the pump chamber and out of the bleed plug. Snug tighten the bleed plug (fig. 1, item 22).
7. Start the pump and run for a minimum of 30 seconds. Then, open the bleed plug again to evacuate all remaining air from the pump chamber.

## Maintenance:

Before proceeding with any maintenance procedures, please refer to the sectional drawings in this manual.

## Removing the Pump from

### Service:

1. Rotate the control knob on the timer to the "0" position.
2. Disconnect the supply pressure from the timer.
3. Close the upstream and the downstream valves on the chemical lines.
4. Open the bleed plug to release the pressure.

5. Disconnect the suction and discharge lines from the check valves.

## Timer, Fig. 1, Item 1 & Fig.2

1. Disconnect the supply pressure from the timer.
2. Rotate the timer counter-clockwise on the pipe nipple that connects it to the piston housing until the timer is vertical with the supply pressure port pointing down.
3. Loosen and remove the two screws from the timer (fig. 2, item 1).
4. Separate the three timer sections and discard the seal, diaphragm and the disc (fig. 2, items 4, 6 & 15). Be careful not to lose the small disc spring (fig. 2, item 16). Note the orientation of the diaphragm as it is removed.
5. Loosen the set screw on the knob (fig. 2, item 11). Remove the knob and knob spring (fig. 2, item 9).
6. Unscrew the adjustment screw (fig. 2, item 10) from the front body (fig. 2, item 13). Remove and discard the o-ring (fig. 2, item 12).
7. Reassemble the timer in reverse order of the above steps, using new rubber parts. Lubricate the adjustment screw threads and its o-ring. No other lubrication is required.

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8. After installing the adjustment screw, turn it in by hand without the knob installed until it lightly seats. During this operations do not over-tighten the adjustment screw into its seat. Apply supply pressure to the timer and unscrew the adjustment screw slowly until the pump starts to run. Trial and error will be necessary to determine the proper orientation of the knob on the adjustment screw. Once the proper orientation is determined, reinstall the knob spring and knob.

### **Check Valves, Fig. 1, Item 18 & 21**

**Note:** Field repair is not recommended because of potential contamination. These assemblies should be replaced in the field, then serviced in the shop. The check valves feature a two-piece construction for easy repair.

1. Separate the two halves of the check valve (fig. 3 & 4, items 1 & 4).
2. Replace the o-rings, the ball, and spring as required (fig. 3 & 4, items 2, 3, 5, & 6). The Teflon o-ring may be removed, turned around, and reused once, if a new o-ring is not available. During this procedure, extreme care

should be exercised. The ball should be "peened" on to the Teflon seat to ensure proper sealing (fig. 3 & 4, items 5 & 2).

3. Ensure that the proper flow direction, as marked on the check valve body, is observed when installing or replacing the check valves.

### **Piston Plunger Assembly, Fig. 1, Item 7, 8, 9, 13, & 14**

It is recommended that the pump be repaired in a clean environment. If the pump must be serviced in the field, please use extreme care in handling the parts.

1. Secure the bellows housing in a vise to facilitate disassembly of the pump.
2. Open the bleed plug (fig. 1, item 22) to release any of pressure trapped in the pump cavity.
3. Loosen the Stroke Adjustment Lock Nut, and unscrew the Stroke Adjustment Screw, until all spring tension is removed from the adjusting screw. (fig 1, item 5 & 6)
4. Remove the button head screws, (fig. 1, item 12) while holding the piston housing (fig. 1, item 10) down against the pump. The piston return spring (fig. 1, item 9) will exert an upward force on the piston housing. Carefully remove the piston housing.

5. Carefully remove the exposed piston assembly (fig. 1, item 7) by pulling upwards slowly. Use care not to scratch, or damage, the plunger.
6. Inspect the lower section of the plunger for wear. If scoring is present on this area, replace the piston assembly.
7. Inspect the u-cup seal on the piston and replace if necessary (fig. 1, item 8).
8. Remove the spring, the lubricant seal retainer, and lubricant seal (fig. 1, items 9, 13 & 14), from the spring cavity and discard the old lubricant seal.
9. Place a new lubricant seal, lubricant seal retainer, and spring into the center housing (fig. 1, items 14, 13 & 9).
10. Carefully insert the plunger back into the center housing.
11. Inspect and clean the inside of the piston housing (fig. 1, item 10).
12. Apply a generous amount of light weight lubricant (grease) to the piston u-cup seal (fig. 1, item 8), and to the inside of the piston housing (fig. 1, item 10).
13. Replace the piston housing on the pump and secure with the three button head screws (fig. 1, item 12).

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## **Plunger Seals, Figure 1:**

1. Disconnect the air supply from the timer.
2. Open the bleed plug (fig. 1, item 22) to release any pressure trapped in the pump cavity.
3. Remove the four set screws (fig. 1, item 27) from the center section of the pump housing .
4. Remove the top half of the pump by slowly pulling upward. Use care not to damage the exposed end of the plunger.
5. Remove both of the plunger seals (fig. 1, item 24) from the cavity in the lower portion of the pump. Do not use a screw driver or metal tool to remove the seal. Use a paper clip modified to resemble a hook. Insert the hook through the center hole and pull upwards, pulling both seals at the same time.
6. Install one new plunger seal with the u-shaped angle facing down on both seals. Install the first seal at an angle to accommodate installation. Using the upper plunger seal, with the u-shaped angle facing down, position it on top of the first plunger seal and push both seals into position.
7. Both the first and upper plunger seals should fit flush within the packing gland.

8. Check the hydraulic fluid level before continuing. If the fluid level is below the height of the upper seal, then the hydraulic fluid should be refilled. Refer to the "Oil Re-Fill/Top-Off Procedure".
9. Before reassembling the pump, apply a thin coat of silicone grease to the pump plunger.
10. Before installing the center housing (fig. 1, item 28) onto the bellows housing (fig. 1, item 17) the pump must be refilled with oil. Refer to the "Oil Re-Fill/Top-Off Procedure".
11. Reassemble the two pump halves and fasten with the four set screws (fig. 1, item 27).

## **Bellows Assembly Replacement Procedure, Fig. 1, items 19 & 29**

**Note:** It is recommended that the bellows be replaced in a clean environment, if possible.

1. Disconnect the supply pressure from the timer.
2. Close the upstream and downstream valves on the chemical lines.
3. Open the bleed plug to release any pressure trapped in the pump cavity (fig. 1, item 22).
4. Remove the five cap screws and lock washers (fig. 1, items 25 & 26) from the bellows housing.

**NOTE:** The 1/2" Pump 85T-12 has 8 set screw & lock washers.

5. Remove the complete upper section of the pump by pulling upward.
6. Carefully remove the bellows assembly (fig. 1, item 19) from the inside of the housing (fig. 1, item 17). Due to the pressure exerted on the bellows, it may not come out easily. It may be necessary to remove the suction check valve. Push the bellows assembly out from the suction check valve port.
7. Prefill the bellows assembly with oil prior to assembling it into the pump body. 1st fill the bellows with oil, and place it on a level well supported work surface. Place your thumbs on the flanged edge of the bellows, and slightly compress the bellows forcing the trapped air out of the bellows assembly. Refill the bellows with oil and repeat this process until no more bubbles appear in the oil. (This will typically take 2-3 cycles.)

**Note:** The recommended fill fluid for the bellows is 10W-30 or 5W-30 motor oil depending on temperature conditions.

8. Ensure that the bellows

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return spring (fig. 1, item 20) is centered in the housing, the large end of the spring should be down. Assure that the o-ring which is part of the bellows assembly is properly in place in the groove on the lower face of the bellows flange, and that the upper bellow o-ring is in place as well. (fig. 1, item 23 & 29) Replace the new bellows into the housing and gently press until the bellows seats.

9. Replace the upper section of the pump and secure with the cap screws, and washers. (fig. 1, items 25 & 26)
10. Torque the bolts evenly in a cross pattern to 60 in/lb.
11. **Warning:** Do not overtighten the mounting bolts. When properly installed, there will be a gap between the bellows adapter and the bellows housing (fig. 1, items 16 & 17).

## **Oil Re-fill/Top-off Procedure, Figure 1:**

**Note:** The recommended fill fluid for the bellows is 10W-30 or 5W-30 motor oil depending on temperature conditions.

1. Disconnect the supply pressure from the timer.
2. Open the bleed plug to release any pressure trapped in the pump cavity (fig. 1, item 22).
3. Remove the four set screws (fig. 1, item 27) on the center section of the pump and remove the top section of the pump.
4. Slowly fill the bellows cavity by adding oil through the center of the plunger seal. Fill the cavity until the oil is flush with the top of the upper plunger seal (fig. 1, item 24).
5. It is important to remove air bubbles trapped within the bellows cavity. Insert a small wire or similar item into the cavity and gently stir the oil in order to release any trapped air. If necessary, add additional oil until it is flush with the top of the upper plunger seal, and the top of the bellows adapter (fig. 1, item 16). For several days this excess oil will slowly bleed out onto the top of the bellows housing. This is normal and does not require a refill.

## **Seal Lubrication:**

1. Remove the pipe plug from the center housing of the pump (fig. 1, item 15).
2. Add silicone base grease (Dow Corning DC-7, part #10354) to the pump.
3. Replace the plug and tighten sufficiently to prevent loosening during operation.
4. Silicone grease should be added approximately every 4-6 weeks depending upon operating conditions.

**Note:** The use of a grease gun is not recommended due to the high pressure that can develop.

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## **IMPORTANT: How To Determine Supply Pressure:**

*For best results and longer pump life, it is recommended that a pressure regulator be used upstream of the pump in order to properly adjust the supply pressure. The supply pressure to the pump should be a minimum of 15 psig and a maximum of 100 psig.*

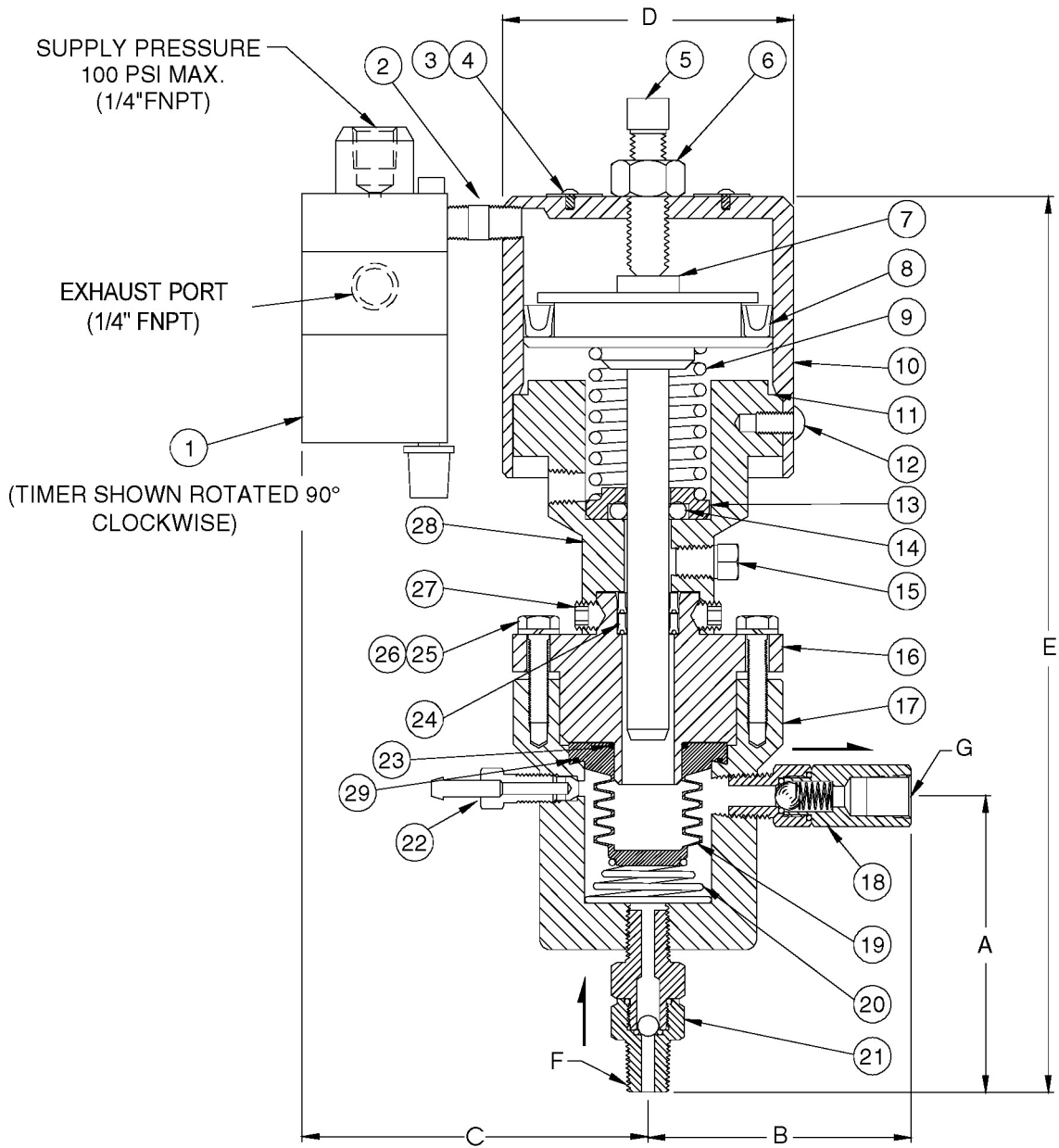
*The "theoretical" amplification ratio of the 85T-11 bellows pump is 81:1. The "theoretical" amplification ratio of the 85T-12 bellows pump is 36:1; however in actual application many factors (ie: Stroke Rate, Fluid Viscosity, Gas Quality, Temperature, etc.) will affect the specific supply pressure required to achieve the desired discharge requirements. Proper balancing of air or gas supply pressure against the discharge requirements will provide longer pump life and reduce maintenance; therefore we recommend that you perform test at your specific conditions to determine what supply pressure will be required to provide the chemical injection rate and pressure, that you desire. Set the supply pressure only marginally (5 psi) above the actual required pressure to obtain the pump performance desired.*

**Note: The discharge pressure of the 85T-11 and the 85T-12 should never exceed 2,400 psig.**

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Figure 1, LINC85T-11 & 12 Metering Pump



MODEL 85T-12-11

| Model             | 85T-11-11 | 85T-12-11 |
|-------------------|-----------|-----------|
| A .....           | 3 1/2"    | 3 5/8"    |
| B .....           | 3 1/8"    | 3 5/16"   |
| C .....           | 3 7/8"    | 4 1/4"    |
| D .....           | 2 3/4"    | 3 1/2"    |
| E .....           | 10 3/4"   | 11"       |
| F Suction .....   | 1/4" NPTM | 1/4" NPTM |
| G Discharge ..... | 1/4" NPTF | 1/4" NPTF |

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## LINC85T Metering Pump Parts List

### 85T Pump Assembly

| Model        | 85T-11-11 | 85T-12-11 |
|--------------|-----------|-----------|
| Plunger Size | 1/4"      | 1/2"      |
| Piston Size  | 2 1/4"    | 3"        |

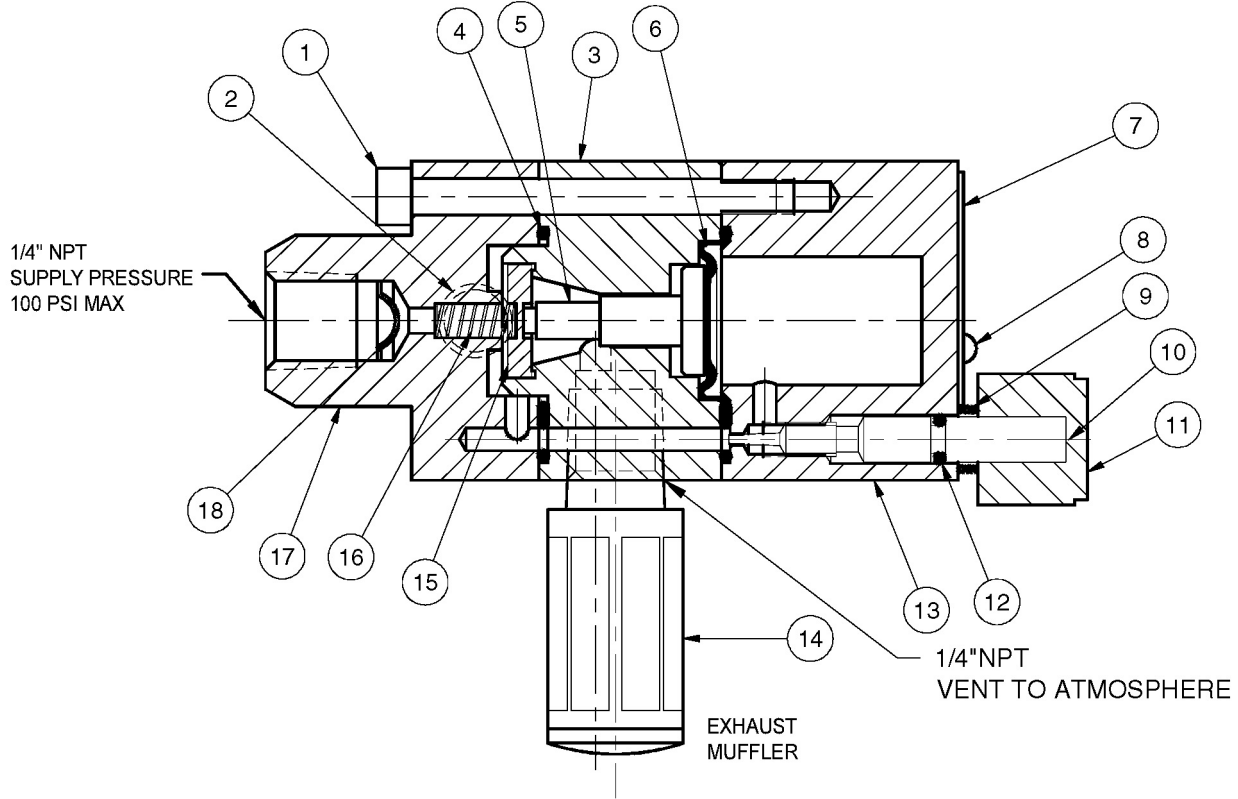
| Item | Part# | Part# | Description                           | Material     | Qty                  |
|------|-------|-------|---------------------------------------|--------------|----------------------|
| 1    | 31668 | 31668 | Pneumatic Timer                       | See Parts    | 1                    |
| 2    | 25130 | 25130 | Nipple                                | 303 ss       | 1                    |
| 3    | 11243 | 11243 | Name Plate                            | 18-8 ss      | 1                    |
| 4    | 10324 | 10324 | Drive Screw                           | 18-8 ss      | 2                    |
| 5    | 11843 | 11843 | Stroke Adjustment Screw               | 18-8 ss      | 1                    |
| 6    | 20985 | 20985 | Lock Nut                              | 303 ss       | 1                    |
| 7    | 24647 | 24670 | Piston Assembly                       | Ceramic      | 1                    |
| 8    | 10019 | 11146 | Piston U-Cup                          | Nitrile      | 1                    |
| 9    | 10448 | 12992 | Piston Return Spring                  | 17-7 ss      | 1                    |
| 10   | 20457 | 30744 | Piston Housing                        | 303 ss       | 1                    |
| 11   | 12371 |       | Piston Housing Seal                   | Nitrile      | 1                    |
| 12   | 11753 | 11753 | Piston Housing Screw                  | 18-8 ss      | 3                    |
| 13   | 24658 |       | Lubricant Seal Back-Up                | Acetal       | 1                    |
| 13   |       | 24713 | Lubricant Seal Back-Up                | 303 ss       | 1                    |
| 14   | 12947 |       | Lubricant Seal                        | Lubrithane   | 1                    |
| 14   |       | 12991 | Lubricant Seal                        | Fluorocarbon | 1                    |
| 15   | 10278 | 10278 | Pipe Plug                             | 304 ss       | 1                    |
| 16   | 31808 | 31810 | Bellows Adapter                       | 303 ss       | 1                    |
| 17   | 31807 | 31809 | Bellows Housing                       | 303 ss       | 1                    |
| 18   | 24751 | 24751 | Discharge Check Valve Assembly        | 316 ss       | See Parts (figure 3) |
| 19   | 25347 | 25348 | Teflon Bellows Assembly               | Teflon       | 1                    |
| 20   | 11541 | 11542 | Bellows Return Spring                 | 302 ss       | 1                    |
| 21   | 22879 | 22879 | Suction Check Valve Assembly          | 316 ss       | See Parts (figure 4) |
| 22   | 20460 | 20460 | Bleed Screw w/Hose Barb               | 316 ss       | 1                    |
| 23   | 10996 | 11546 | Bellows O-Ring                        | Fluorocarbon | 1                    |
| 24   | 12948 | 12960 | Plunger Seal                          | Lubrithane   | 2                    |
| 25   | 13275 |       | Bellows Assembly Cap Screws           | 18.8 ss      | 5                    |
| 25   |       | 13275 | Bellows Assembly Cap Screws           | 18.8 ss      | 8                    |
| 26   | 12300 |       | Bellows Assembly Lock Washer          | 18.8 ss      | 5                    |
| 26   |       | 12300 | Bellows Assembly Lock Washer          | 18.8 ss      | 8                    |
| 27   | 11390 | 11390 | Upper Section Set Screw               | 18-8 ss      | 4                    |
| 28   | 43738 | 44818 | Center Housing                        | 303 ss       | 1                    |
| 29   | 13353 | 13354 | O-Ring (Included in Assembly Item#19) | TFE Encap.   | 1                    |

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Figure 2, "T" Series Timer

Reference fig. 1, item1



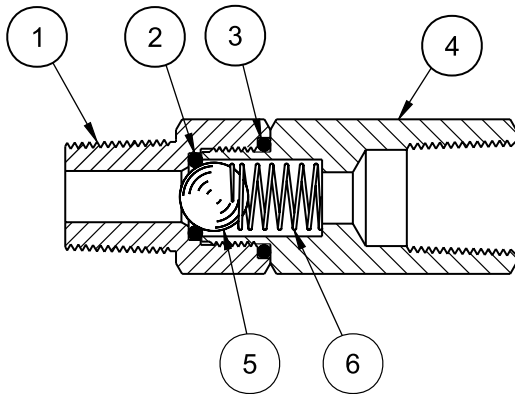
| Assembly Item | Part # | Description      | Material         | Qty |
|---------------|--------|------------------|------------------|-----|
| 1             | 13223  | Screw            | 18-8 ss          | 2   |
| 2             | 25130  | Hex Nipple       | 303 ss           | 1   |
| 3             | 31664  | Center Body      | 303 ss           | 1   |
| 4             | 13227  | Seal             | Nitrile          | 1   |
| 5             | 13247  | Disc Actuator    | Delrin           | 1   |
| 6 *           | 13226  | Diaphragm        | Nitrile          | 1   |
| 7             | 13246  | Nameplate        | 18-8 ss          | 1   |
| 8             | 10324  | Drive Screw      | 18-8 ss          | 2   |
| 9             | 13253  | Knob Spring      | Stainless Steel  | 1   |
| 10            | 25149  | Adjustment Screw | 303 ss           | 1   |
| 11            | 13243  | Knob             | Polycarbon       | 1   |
| 12            | 10326  | O-Ring           | Nitrile          | 1   |
| 13 *          | 31663  | Front Body       | 303 ss           | 1   |
| 14            | 12952  | Muffler          | Plastic          | 1   |
| 15            | 13225  | Disc             | Aluminum/Nitrile | 1   |
| 16 *          | 13222  | Disc Spring      | Stainless steel  | 1   |
| 17            | 31665  | Rear Body        | 303 ss           | 1   |
| 18 *          | 10244  | Screen           | Stainless Steel  | 1   |
| *             | 25183  | Repair Kit       |                  | 1   |

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## P N E U M A T I C B E L L O W S

Figure 3, Discharge Check Valve

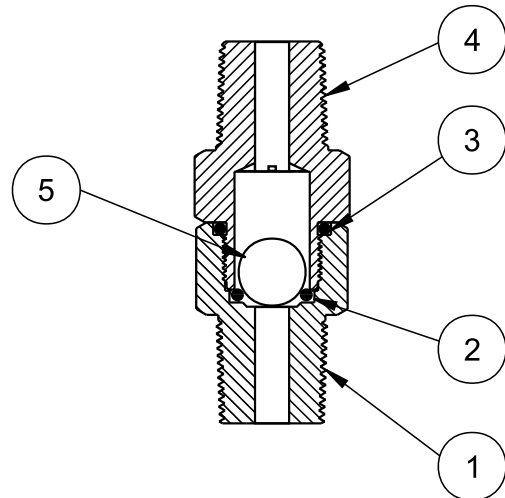
Reference fig. 1, item 18



P/N 24751

Figure 4, Suction Check Valve

Reference fig. 1, item 21



P/N 22879

| Assembly    | 24751         | Discharge Check Valve - Two Piece Body | Port Size: 1/4" NPTF |            |
|-------------|---------------|--|----------------------|------------|
| <b>Item</b> | <b>Part #</b> | <b>Description</b>                     | <b>Material</b>      | <b>Qty</b> |
| 1           | 23257         | Inlet Body                             | 316 ss               | 1          |
| 2           | 10313         | Seat                                   | TFE                  | 1          |
| 3           | 11485         | Seal                                   | Fluorocarbon         | 1          |
| 4           | 24755         | Outlet Body                            | 316 ss               | 1          |
| 5           | 13276         | Ball                                   | Carbide              | 1          |
| 6           | 11438         | Spring                                 | 316 ss               | 1          |

| Assembly    | 22879         | Suction Check Valve - Two Piece Body | Port Size: 1/4" NPTM |            |
|-------------|---------------|--------------------------------------|----------------------|------------|
| <b>Item</b> | <b>Part #</b> | <b>Description</b>                   | <b>Material</b>      | <b>Qty</b> |
| 1           | 23257         | Inlet Body                           | 316 ss               | 1          |
| 2           | 10313         | Seat                                 | TFE                  | 1          |
| 3           | 11485         | Seal                                 | Fluorocarbon         | 1          |
| 4           | 23256         | Outlet Body                          | 316 ss               | 1          |
| 5           | 13276         | Ball                                 | Carbide              | 1          |

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## LINC Chemical Pump Gas Consumption Table

| ACTUATION PISTON DIA. (IN)>> | 1.50   | 2.25                         | 3                            | 4                            | 4                                      | 4                                   | 6                                   | 8                                   | 10                                  |
|------------------------------|--|------------------------------|------------------------------|------------------------------|--|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| >><br>CONFIGURATION<br>>>    | SPRING<br>RETURN<br>NO RELAY                         | SPRING<br>RETURN<br>NO RELAY | SPRING<br>RETURN<br>NO RELAY | SPRING<br>RETURN<br>NO RELAY | SPRING<br>RETURN<br>INCLUDING<br>RELAY | GAS<br>RETURN<br>INCLUDING<br>RELAY | GAS<br>RETURN<br>INCLUDING<br>RELAY | GAS<br>RETURN<br>INCLUDING<br>RELAY | GAS<br>RETURN<br>INCLUDING<br>RELAY |
| SUPPLY<br>PRESS.<br>(PSI)    | VOLUME DISPLACED BY PISTON FOR 1" STROKE(CUBIC FEET) |                              |                              |                              |  |                                     |                                     |                                     |                                     |
|                              | 0.00102265   | 0.00230097                   | 0.00409062                   | 0.00727221                   | 0.00727221                             | 0.01454441                          | 0.03272492                          | 0.05817764                          | 0.09090257                          |
|                              | THEORETICAL GAS CONSUMPTION FOR EACH 1" STROKE (SCF) |                              |                              |                              |  |                                     |                                     |                                     |                                     |
| 0                            | 0.0000   | 0.0000                       | 0.0000                       | 0.0000                       | 0.0000                                 | 0.0000                              | 0.0000                              | 0.0000                              | 0.0000                              |
| 10                           | 0.0017   | 0.0039                       | 0.0069                       | 0.0122                       | 0.0122                                 | 0.0244                              | 0.0550                              | 0.0978                              | 0.1527                              |
| 20                           | 0.0024   | 0.0054                       | 0.0097                       | 0.0172                       | 0.0172                                 | 0.0343                              | 0.0772                              | 0.1373                              | 0.2146                              |
| 30                           | 0.0031   | 0.0070                       | 0.0124                       | 0.0221                       | 0.0221                                 | 0.0442                              | 0.0995                              | 0.1769                              | 0.2764                              |
| 40                           | 0.0038   | 0.0086                       | 0.0152                       | 0.0271                       | 0.0271                                 | 0.0541                              | 0.1218                              | 0.2165                              | 0.3383                              |
| 50                           | 0.0045   | 0.0101                       | 0.0180                       | 0.0320                       | 0.0320                                 | 0.0640                              | 0.1440                              | 0.2561                              | 0.4001                              |
| 60                           | 0.0052   | 0.0117                       | 0.0208                       | 0.0370                       | 0.0370                                 | 0.0739                              | 0.1663                              | 0.2956                              | 0.4619                              |
| 70                           | 0.0059   | 0.0133                       | 0.0236                       | 0.0419                       | 0.0419                                 | 0.0838                              | 0.1886                              | 0.3352                              | 0.5238                              |
| 80                           | 0.0066   | 0.0148                       | 0.0264                       | 0.0468                       | 0.0468                                 | 0.0937                              | 0.2108                              | 0.3748                              | 0.5856                              |
| 90                           | 0.0073   | 0.0164                       | 0.0291                       | 0.0518                       | 0.0518                                 | 0.1036                              | 0.2331                              | 0.4144                              | 0.6474                              |
| 100                          | 0.0080   | 0.0180                       | 0.0319                       | 0.0567                       | 0.0567                                 | 0.1135                              | 0.2553                              | 0.4539                              | 0.7093                              |
| 110                          | 0.0087   | 0.0195                       | 0.0347                       | 0.0617                       | 0.0617                                 | 0.1234                              | 0.2776                              | 0.4935                              | 0.7711                              |
| 120                          | 0.0094   | 0.0211                       | 0.0375                       | 0.0666                       | 0.0666                                 | 0.1333                              | 0.2999                              | 0.5331                              | 0.8330                              |
| 130                          | 0.0101   | 0.0226                       | 0.0403                       | 0.0716                       | 0.0716                                 | 0.1432                              | 0.3221                              | 0.5727                              | 0.8948                              |
| 140                          | 0.0108   | 0.0242                       | 0.0430                       | 0.0765                       | 0.0765                                 | 0.1531                              | 0.3444                              | 0.6123                              | 0.9566                              |
| 150                          | 0.0115   | 0.0258                       | 0.0458                       | 0.0815                       | 0.0815                                 | 0.1630                              | 0.3667                              | 0.6518                              | 1.0185                              |