INSTRUCTION MANUAL

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

LINC 94P-11 & 12 Series Chemical Metering Pump
Pneumatic Plunger

LINC
MILTON ROY

METERING PUMPS

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Pub. no. 94P - 11 & 12 ver. 04212003

METERING PUMPS

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PNEUMATIC PLUNGER

General Specifications: 94P-11 & 12 Series - Pneumatic, Plunger-Type Metering Pump

Wetted Parts:	
Pump Body:	316 ss
Plunger:	Ceramic
Plunger Seal:	Refer to Ordering Chart
O-Rings:	TFE
Check Valves:	
Body:	316ss
Ball:	Carbide
Spring - Discharge:	316ss
Seat:	TFE

Pneumatic Section:	
Piston Housing:	316 ss
Timer:	316ss
Relay: (94-12 series only)	316ss
Plunger Diameter:	1/4" & 1/2"
Pressure:	To 15,000 psi, maximum
Optional Materials:	Hastelloy, Monel & Titanium

Selection Chart: LINC 94P-11 & 12 Series - Pneumatic, Plunger-Type Metering Pump

Model Number	Plunger Diameter	Piston Diameter	Max. Rate Gal/Hr	Max. Rate Liter/Hr	Min. Rate Gal/Hr	Min. Rate Liter/Hr	Max. Pressure psi	Max. Pressure bar	Theoretical Amp. Ratio	Strokes Per Minute	Volume Per Stroke	Stroke Length
1/4" Plunger with Timer												
94P-11	1/4"	3"	0.64	2.42	0.006	0.024	15,000	1030	144:1	4 - 50	0.80 cc	1"
1/2" Plunger with Timer and Relay												
94P-12	1/2"	5"	2.0	7.6	0.03	0.10	12,000	820	100:1	4 - 40	3.20 cc	1"

Notes:

1. Maximum rates are based on 1" stroke.
2. Minimum rates are based on 1/8" stroke.
3. The timer supply pressure range is 20 to 150 psi.
4. Maximum pressure based on 130psi supply pressure for 1/4", 150psi supply pressure for 1/2".
5. Volume per stroke shown is maximum available. Volume per stroke may decrease by up to 20% at maximum pressure.

Ordering Chart: LINC 94P Series Pneumatic Plunger Metering Pump

Series:
94P – Pneumatic plunger type metering pump

Plunger Diameter/Pump Control:
11 – 1/4" plunger diameter, timer
12 – 1/2" plunger diameter, timer/relay combination

Plunger Seal:
4 – Mechanical seal - TFE/Graphite
5 – Mechanical seal - TFE/Glass/Moly
6 – Mechanical seal - Ultra High Molecular Weight Polyethylene

Piston Size:
2 – 3" piston diameter used with 1/4' Plunger
5 – 5" piston diameter used with 1/2" plunger

Discharge Check Valve Options:
1 – 1/4" NPT (Female)
2 – Autoclave/HIP medium pressure (20,000 psi) 7/16"-20 (Female)
3 – Autoclave/HIP high pressure (60,000 psi) 9/16"-18 (Female)

Other:
5 – Specify your Requirements

Option Number:
(x) – If the pump does not require any special modifications, Omit "Other" and "Option Number" from the part number. If the pump does require special modifications, use "5" for "Other", and "(x)" for the option number when placing an order. The factory will replace the "(x)" with an unique option code at the time of pump production.
Example: 94P-12-55-25(3).

LINC 94P -_ _- _ _- _ _( )
Example: 94P-11-42-1

METERING PUMPS

PNEUMATIC PLUNGER

Scope Of This Manual:

This manual describes and provides instructions and parts list for the Linc 94P-11 & 12 Series Chemical Metering Pump. This pump is a pneumatically operated plunger pump.

Installation:

1. *Connect the suction line, through a filter or strainer, to the suction check valve (fig. 1, item 14). These pumps require a flooded suction and must therefore be located lower than the chemical supply tank. Vertical installation of the pump is required.*
2. *Connect the discharge line from the discharge check valve (fig. 1, item 10) to the desired injection location.*

Note: *An in-line check valve at the point of injection is recommended to prevent back flow to the pump during shutdown or servicing. See figure 4 in this section of the manual.*

3. *Connect the supply pressure to the timer (fig. 1, item 3 and fig. 2). When installing the 94P-12, also connect a separate supply pressure line to the relay (fig. 1, item 28 and fig. 3). Air is the recommended supply, but any dry filtered gas may be used. A filter/regulator is required to prevent contamination from entering the timer and pump piston housing. The timer supply pressure and the relay supply pressure should be between 20 and 150 PSI.*
4. *For the 94P-11, set the regulator (that supplies gas to the timer) to the pressure needed to generate the required pump discharge pressure. See the section of this manual titled "How to Determine Supply Pressure".*
5. *For the 94P-12, set the regulator (that supplies gas to the relay) to the pressure needed to generate the required pump discharge pressure. See the section of this manual titled "How to Determine Supply Pressure". Next, set the regulator (that supplies the timer) to the pressure that is needed to reliably stroke the relay, which in turn will stroke the pump.*
6. *After supplying pressure to the timer (and relay) regulator, adjust the timer knob until the desired stroke rate is achieved.*
7. *The pump stroke length is adjusted by first loosening the jam nut (fig.1, item 2) and then rotating the stroke adjustment screw (fig. 1, item 1). The minimum stroke for the 94P pump is 1/8". Retighten the jam nut. Be sure the stroke adjustment screw has several threads engaged in the piston housing before tightening the jam nut. The stroke length should not be adjusted when the pump is stroking.*
8. *The pump must be primed to remove air from its pumping chamber. To prime the pump, loosen the bleed screw (fig. 1, item 19). Allow the liquid that will be pumped to flow into the pumping chamber, venting air out the bleed screw. Tighten the bleed screw when liquid flows freely. Start the pump and run for a minimum of one minute. Open the bleed screw again to let the remaining air vent. Retighten the bleed screw.*
9. *Use a liquid rate gauge to check the pumping rate. If the pumping rate must be adjusted, reset the timer knob and/or the stroke adjusting screw.*

Maintenance:

Refer to all sectional drawing and parts lists in this manual. All repairs should be preformed in a clean environment.

The following steps must be taken before proceeding with any maintenance operations:

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 and relay.*
3. *Close the upstream and downstream valves on the chemical lines.*
4. *Open the bleed screw (fig. 1, item 19) to release the pressure in the pump.*
5. *Disconnect the suction and discharge lines from the check valves.*

Timer:

Figure 1, item 3 & Figure 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.*
8. *After installing the adjustment screw, turn it in by hand, without the knob installed until it lightly seats. During this operation 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.*

Single Acting Relay,
Figure 1, item 28 &
Figure 3:

1. *Disconnect the supply pressure from the relay.*
2. *Unscrew the relay from the nipple (Fig. 1, item 31).*
3. *If the relay is not functioning properly and/or is leaking, the parts in the repair kit #25183 should be replaced. This repair kit consists of two o-rings, a piston seal, spring and poppet.*
4. *Remove the four socket head screws that hold the three body sections together (Fig. 3, item 10).*
   ***Note** the location of all ports so that the location can be the same when the unit is reassembled. Separate the body parts and the lid. Remove the lock nut which will allow each individual part to be inspected (Fig. 3, item 3). Replace the old parts with the parts from the new repair kit and reassemble. Special care should be taken to see that each part, especially the piston spacer and the seal poppet (fig. 3, items 5 & 6) is put back into the same when reassembling.*
5. *To test the relay prior to reassembly, connect 40 psi supply to the port marked "IN". Supply should be*

routed to the port marked "OUT" with no leakage to the port marked "E". Connect another 40 psi supply to 1/8" NPT port in the lid. The supply pressure to the "IN" port should now be shut off from all other points.

6. *Reinstall the relay on the nipple on the pump piston housing. Making sure that the nipple is connected to the proper port on the relay, port marked "OUT".*

Suction Check Valve:

(fig. 1, item 13, 14, 15, & 29)

1. *Disconnect the piping from the check valve.*
2. *Unscrew the check valve body (fig. 1, item 14) from the pump.*
3. *Remove and discard the o-rings (fig.1, items 13 & 15).*
4. *Inspect the ball (fig. 1, item 29) for damage and replace if necessary. Reassemble the check valve using a new o-ring. If the seat o-ring is Teflon, install it onto the check valve body (fig. 1, item 14) and "peen" the ball into the seat to ensure proper sealing.*
5. *Install the repaired suction check valve into the pump body and tighten securely.*

Discharge Check Valve:

(fig. 1, item 10 , 11, 12, 13, 17)

1. *Disconnect the piping from the check valve.*
2. *Unscrew the check valve body (fig. 1, item 10) from the pump.*
3. *Replace the o-rings, ball and spring as required (fig. 1, items 11,12, 13, & 17).*
4. *Install repaired discharge check valve into the pump body. Tighten securely.*

Piston/Plunger:

(fig. 1, items 16 and 24)

1. *Secure the pump housing assembly (fig. 1, item 18) in a vise.*
2. *Remove the piston housing screws (fig. 1, item 20). Loosen the screws alternately as there is an upward spring load on the piston housing (fig. 1, item 4). Lift the piston housing straight up to prevent any chance of breaking the ceramic plunger.*
3. *The piston (fig. 1, item 24) can be pulled from the piston housing. Inspect the guide ring and U-cup (fig. 1, item 23 & 25) and replace if necessary.*
4. *The plunger head and plunger (fig. 1, items 5 and 16) are permanently assembled. Pull this assembly out of the pump housing assembly, bein careful not to bump the brittle ceramic plunger.*
5. *Inspect the plunger for wear, especially axial grooves. Replace if necessary.*

Plunger Seal:

(fig. 1, item 22, two req'd)

1. *With the piston housing still removed from the pump.*
2. *Secure the pump housing in a vise.Loosen the screws holding the seal retainer (fig. 1, item 20 & 7) to the center housing.*
3. *Remove the seal retainer and plunger seal (fig. 1, item 22) (and backup if required) from the center housing. Be careful to not scratch the wall of the seal gland. The seal spacer (fig. 1, item 21 can remain in the seal gland.*
4. *With a pipe wrench or strap wrench, separate the center housing from the lower housing. Remove the plunger seal (and backup if required) from the lower seal gland. Be careful not to scratch the wall of the seal gland.*

Reassembling the Pump:

1. *Before reinstalling the plunger seals, lubricate them and their glands with a light grease. Install the seals with their lips facing the pumping chamber of the pump. If the seals that are being installed require seal backup rings, install the backup rings behind the heel of the seal.*
2. *Reassemble the center housing with the lower housing, using a pipe wrench or a strap wrench to tighten the two parts.*
3. *Lubricate the ceramic plunger with a light grease. Place the plunger return spring over the plunger, nesting it on the plunger head. Insert the plunger into the housing assembly, pressing it through the plunger seals.*
4. *Before reinserting the piston in the piston housing, liberally lubricate the U-cup, guide ring and inside of the piston housing with a light grease. The area of the piston between the U-cup and guide ring can be used to hold extra grease.*
5. *Place the piston housing with the piston installed over the housing assembly that has the plunger and spring installed.*
6. *Press down on the piston housing to overcome the plunger return spring force and install and tighten the piston housing screws.*
7. *If the bleed screw has been removed, install and tighten it.*

Plunger and Plunger Seal Lubrication:

1. *Remove the plugs (fig. 1, item 8) from the pump center housing.*
2. *Add silicone based lubricant (Dow Corning DC-7, part number 10354) or equal into the unplugged opening.*
3. *Silicone lubricant should be added every 4-6 seeks depending on operating conditions.*
4. *If silicone lubricant is not available, 30 weight motor oil will serve as a substitute for most applications.*

Note: *To prevent damage to plunger or plunger seals, do not use a grease gun or metal rod to force lubricant into the pump.*

IMPORTANT: How To Determine Supply Pressure:

For consistent performance and long pump life, it is recommended that a pressure regulator be used upstream of the pump timer (or the relay when the 94P-12 pump is being used), to properly adjust the supply pressure. The supply pressure requirement will vary from 20 to 150 PSI.

The theoretical amplification ratio shown in the Selection Chart in this section of this manual is the area of the piston divided by the area of the plunger. This amplification ratio is used to determine how much gas supply pressure is required to enable the pump to generate the required liquid discharge pressure. The theoretical gas supply pressure required to generate a specific liquid discharge pressure is calculated by dividing the required liquid pressure by the amplification ratio. However, the amplification ratio is a theoretical number and in an actual application, other factors such as friction and stroke rate require that a higher gas supply pressure be used.

To determine the approximate gas supply pressure to the timer (or the relay when the 94P-12 pump is being used), add 20 PSI (up to 30 PSI for higher pump stroke rates) to the calculated theoretical gas supply pressure.

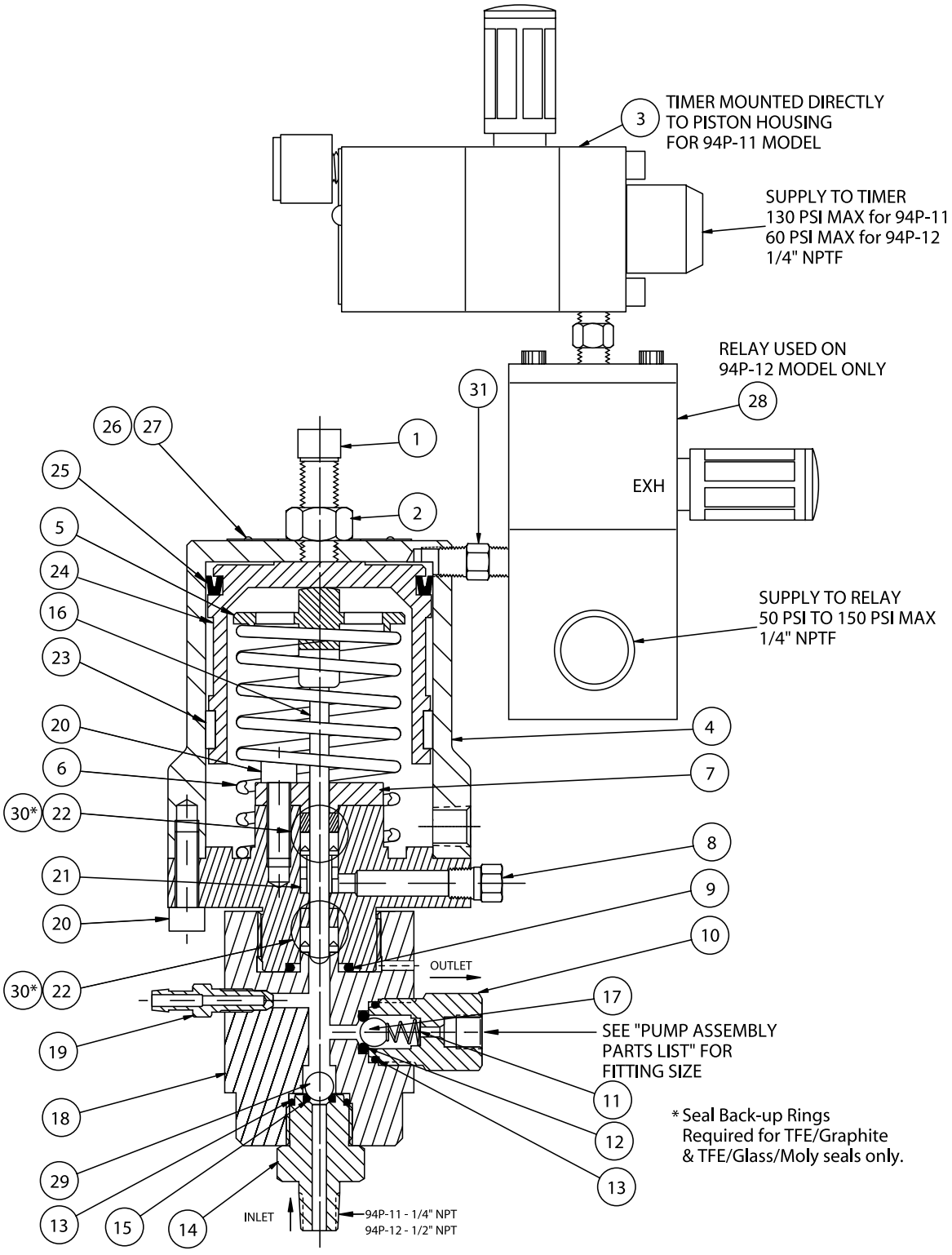
For example, if it is required to generate 6000 PSI with a 94P-12 pump, follow the procedure below to determine the approximate gas supply pressure that must be used.

The required liquid discharge pressure divided by the theoretical amplification ratio = 6000 PSI divided by 100 = 60 PSI. Now add 20 PSI to the theoretical 60 PSI. Therefore the actual gas supply pressure is 60 PSI + 20 PSI = 80 PSI.

When the 94P-12 pump is being used, the above instructions should be followed to determine the supply pressure to it's relay. The supply pressure to the timer of the 94P should be set high enough to make the relay stroke reliably. The timer supply pressure will vary depending on the relay supply pressure.

Note: The discharge pressure of the 94P-11 should never exceed 15,000 psig.
The discharge pressure of the 94P-12 should never exceed 12,000 psig.

Figure 1, 94P Assembly Drawing



METERING PUMPS

PNEUMATIC PLUNGER

Pump Assembly Parts List: 94P-11 & 12

Item	94P-11 Part #	94P-12 Part #	Description	Material	Qty
1	11843	11843	Stroke Adjustment Screw	18-8 ss	1
2	20985	20985	Sealing Jam Nut	18-8 ss	1
3	31735	31735	Timer	316 ss	1
4	31767	31801	Piston Housing	316 ss	1
5	25298	25298	Plunger Head	316 ss	1
6	13254	13254	Piston Spring	316 ss	1
7	25299	25302	Seal Retainer	316 ss	1
8	10278	10278	Pipe Plug 1/8" NPT	304 ss	2
9*	13197	13196	O-Ring	TFE Encapsulated	1
10	20570	20570	Discharge Check Body (1/4" NPT Female Out)	316ss	1
10a	25304	25304	Discharge Check Body (7/16"-20 Female Out)	316ss	1
10b	25419	25419	Discharge Check Body (9/16"-18 Female Out)	316ss	1
11	10068	10068	Spring	316ss	1
12*	10317	10317	Seat O-Ring	TFE	1
13*	10481	10481	Seal O-Ring	TFE	2
14	24760	24762	Body-Suction Check Valve	316 ss	1
15*	10365	10469	Seat O-Ring	TFE	1
16	12946	12967	Plunger	Ceramic	1
17	10283	10283	Ball 3/8"	Carbide	94P-11: 2 94P-12: 1
18	31771	31803	Housing Assy.	316 ss	1
19	20460	20460	Bleed Screw	316 ss	1
20	13255	13255	Bolt 5/16-24x1"	18-8 ss	94P-11: 4 94P-12: 6
21	25300	25303	Seal Spacer	316 ss	1
22a*	11283**	11004**	Seal	TFE/Graphite	2
22b*	13381**	13382**	Seal	TFE/Glass/Moly	2
22c*	13007	13008	Seal	UHMWPE	2
23	13258	13351	Guide Ring	TFE Composite	1
24	31768	31800	Piston	316 ss	1
25*	13259	13352	U-Cup	Polyurethane	1
26	13339	13339	Name Plate	316 ss	1
27	10324	10324	Name Plate Drive Screws	18-8 ss	2
28		31686	Relay	316 ss	1
29		10529	Ball 1/2"	Carbide	1
30***	22581	25450	Seal Back-up	Peek	2
31		25130	Nipple	316 ss	1

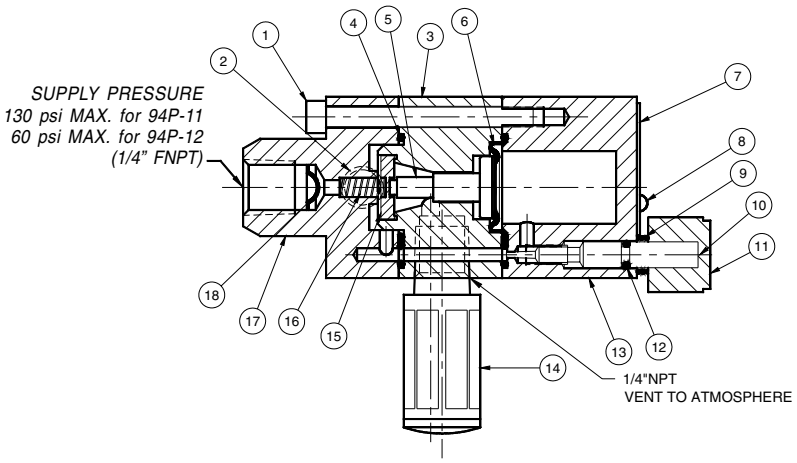
** Recommended Spare*

***Requires Seal Back-up (Item 30)*

****Required for TFE/Graphite or TFE/Glass/Moly seals only. (Item 22a or 22b)*

Figure 2, "T" Series Timer

Reference fig. 1, item 3

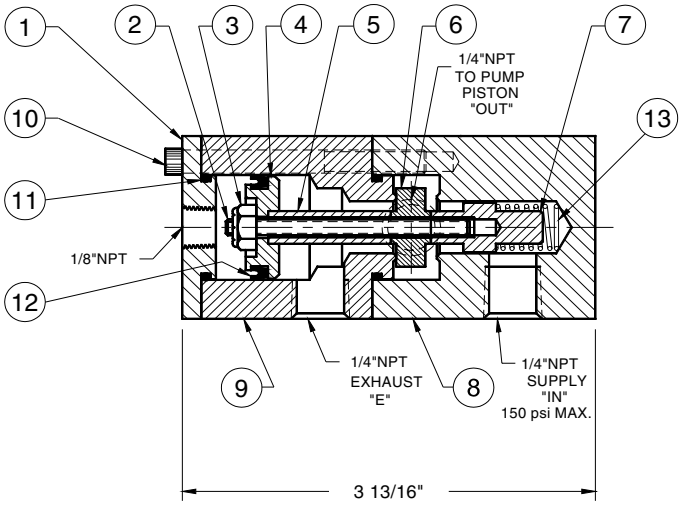


"T" Series Timer Parts List

Assembly: 31735

Item	Part #	Description	Material	Qty
1	13223	Screw	18-8 ss	2
2	25130	Hex Nipple	316 ss	1
3	31733	Center Body	316 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	18-8 ss	1
10	25210	Adjustment Screw	316 ss	1
11	13243	Knob	Polycarbon	1
12	10326	O-ring	Nitrile	1
13	31732	Front Body	316 ss	1
14	12952	Muffler	Plastic	1
15*	13225	Disc	Aluminum / Nitrile	1
16*	13222	Disc Spring	18-8 ss	1
17	31734	Rear Body	316 ss	1
18	10244	Screen	18-8 ss	1
Not Shown	13233	Pin	18-8 ss	3
*Not Shown	25183	Repair Kit	Recommended Spares for the "T" Series Timer	1

Figure 3, Single Acting Relay
Reference fig. 1, item 28

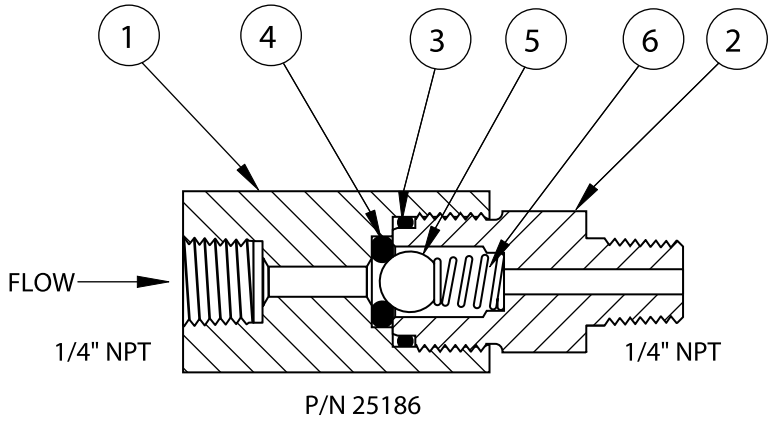


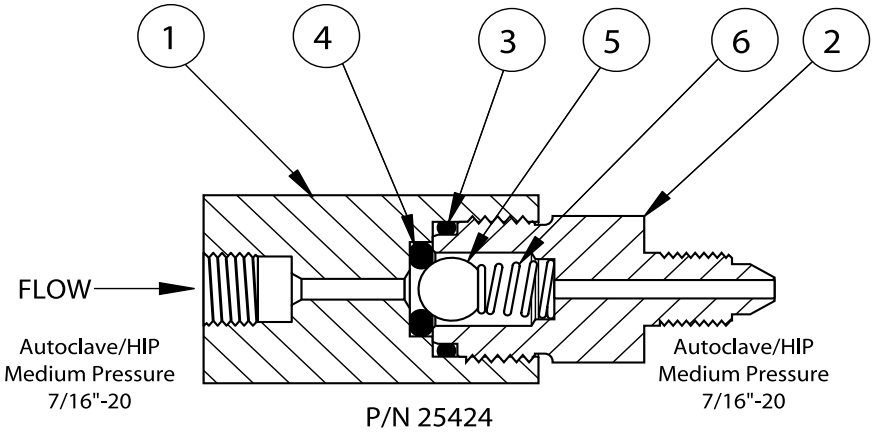
Single Acting Relay Assembly Parts List

Assembly: 31685

Item	*Part #*	*Description*	*Material*	*Qty*
1	*24823*	*Lid*	*316 ss*	*1*
2	*25112*	*Threaded Rod*	*316 ss*	*1*
3	*13078*	*Lock Nut*	*18-8 ss*	*1*
4	*24828*	*Piston*	*316 ss*	*1*
5	*24827*	*Piston Spacer*	*316 ss*	*1*
*6**	*24746*	*Seal Poppet*	*316 ss/Nitrile*	*1*
7	*24923*	*Spring Shaft*	*316 ss*	*1*
8	*31597*	*Lower Body*	*316 ss*	*1*
9	*31560*	*Upper Body*	*316 ss*	*1*
10	*10193*	*Cap Screw*	*18-8 ss*	*4*
*11**	*12364*	*O-ring*	*Nitrile*	*2*
*12**	*12365*	*Piston Seal*	*Nitrile*	*1*
*13**	*13036*	*Spring*	*18-8 ss*	*1*
**Not Shown*	*25182*	*Repair Kit*	*Recommended Spares for the Single Acting Relay*	*1*

Figure 4, 15,000 psi Inline Check Valve





Inline Check Valve Assembly Parts List

Assembly:	25186	25424			
Item	**Part #**	**Part #**	**Description**	**Material**	**Qty**
1	25188	25426	Inlet Body	316 ss	1
2	25187	25425	Outlet Body	316 ss	1
3	10481	10481	O-ring, Seal	TFE	1
4	10317	10317	O-ring, Seat	TFE	1
5	10283	10283	Ball, 3/8"	Carbide	1
6	10068	10068	Spring	316 ss	1

LINC Chemical Pump
Gas Consumption Table

ACTUATION PISTON DIA. (IN)>>	1.50	2.25	3	4	4	4	6	8	10
> > CONFIGURATION > >	SPRING RETURN NO RELAY	SPRING RETURN NO RELAY	SPRING RETURN NO RELAY	SPRING RETURN NO RELAY	SPRING RETURN INCLUDING RELAY	GAS RETURN INCLUDING RELAY	GAS RETURN INCLUDING RELAY	GAS RETURN INCLUDING RELAY	GAS RETURN INCLUDING RELAY
SUPPLY PRESS. (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

NOTES

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