

# Plunger Pumps

## Torque Specifications in/lbs:(ft/lbs)

Oil Capacity	Manifold (Head)	Piston Nut	Rear Cover	Side Cover	Valve Cap	Connecting Rods
12	92/(5)	N/A	71/(6)	N/A	442/(37)	N/A

## LIMITED WARRANTY

Annovi Reverberi (A.R.) *Cam Shaft Plunger Pumps* are warranted for a period of five years and *Axial Radial Pumps* are warranted for a period of one year to the original purchaser. *Electric Pressure Washers* are warranted for a period of one year to the original purchaser. This is from the date shipped from factory or U.S. Warehouse. **AR, ArrowLine** and **GF** accessories are warranted for a period of 90 days.

Warranty covers manufacturing defects or workmanship that may develop under normal use and service in a manner up to the directions and usage recommended by the manufacturer.

Warranty does not apply to misuse or when pump or accessory is altered or used in excess of recommended speeds, pressures, temperatures or handling fluids not suitable for pump or accessory material construction. Warranty does not apply to normal wear, freight damage, freezing damage or damage caused by parts or accessories not supplied by AR North America, Inc.

Liability of manufacturer for warranty is limited to repair or replacement at the option of the manufacturer when such products are found to be of original defect or workmanship at the time it was shipped from factory. This warranty is in lieu of all other warranties, expressed or implied, including any warranty of merchantability and of any and all other obligations or liabilities on the part of the manufacturers or equipment.

## WARRANTY RETURNS

Items returned for warranty consideration must have a **Returned Merchandise Authorization (RMA)** number. All unauthorized returns will be refused and shipped back to sender. Please fax requests to: 763-398-2009 or e-mail to [shop@arnorthamerica.com](mailto:shop@arnorthamerica.com).

# Plunger Pumps

*Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.*

## Description

Plunger Pumps are designed for a wide variety of high pressure washing applications. They are constructed with die-cast bodies and feature a brass head. Internal components include coated ceramic plungers for long life and durability. Precision cast cooling fins are anodized for maximum heat dissipation. Oversized needle bearings on the drive side, and ball on the non-drive side together with the precision supports assure positive alignment and centering in relation to the crankcase. Valve cages of special designed Ultra-Form provide positive seating and extended life. One-piece connecting rods are special alloy aluminum, bronze rods over 4,000 psi units, oversized for strength and load disbursement. These pumps are designed for gasoline driven systems.



Figure 1  
Hollow Shaft



Figure 2  
Hollow Shaft

## RSV 3400 rpm D Version - 3/4"

Model	Max GPM	Max PSI
RSV2.5G25D-F25	2.5	2500
RSV3G25D-F25	3	2500

## RSV 3400 rpm D Version - 1"

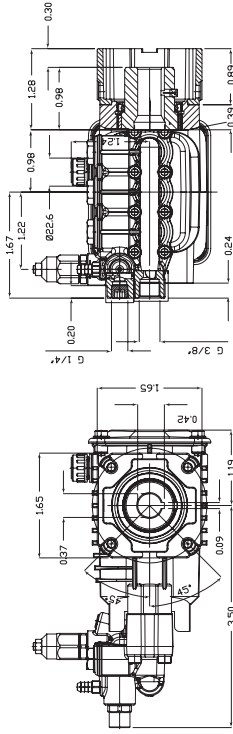
Model	Max GPM	Max PSI
RSV3G35D-F40	3	3500
RSV3.5G35D-F40	3.5	3500
RSV4G40D-F40	4	3000
RSV4G40D-F40	4	4000

# Plunger Pumps

## Notes

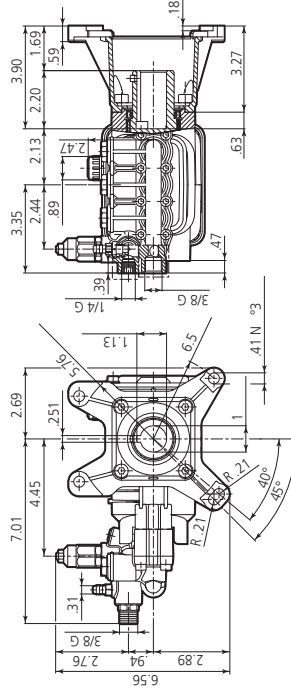
RSV

D version + F25  
Hollow shaft pump  $\varnothing$  3/4"



RSV

D version + F40  
Hollow shaft pump  $\varnothing$  1"



# Plunger Pumps

## Notes

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# Plunger Pumps

## Formulas

### Nozzles:

$$\text{Impact Force (lbs.)} = .0526 \times \text{GPM} \times \sqrt{\text{PSI}}$$

$$\text{Nozzle \#} = \text{GPM} \times \frac{4000}{\sqrt{\text{PSI}}}$$

$$\text{GPM} = \text{Nozzle \#} \times \frac{\text{PSI}}{\sqrt{4000}}$$

$$\text{PSI} = \left( \frac{\text{GPM/Nozzle \#}^2}{4000} \right) \times 4000$$

### Horse Power:

$$\text{GPM} \times \text{PSI} = \text{Hydraulic HP} \times 1714$$

$$\text{GPM} \times \text{PSI} = \text{EBHP} \times 1457$$

$$\text{EBHP} \times 1457 = \text{GPM} \times \text{PSI}$$

$$\frac{\text{EBHP} \times 1457}{\text{GPM}} = \text{PSI}$$

$$\text{HP loss due to altitude} = 3\% \text{ per } 1000 \text{ FT above sea level}$$

### Pump Speed and Flow:

$$\text{Rated GPM} = \text{Desired GPM}$$

$$\text{Rated RPM} = \text{Desired RPM}$$

$$\frac{\text{Motor Pulley } \varnothing}{\text{Pump RPM}} = \frac{\text{Pump Pulley } \varnothing}{\text{Motor RPM}}$$

## Conversions

$$\text{Gallons} \times 3.785412 = \text{Liters}$$

$$\text{Gallons} \times 128 = \text{Oz.}$$

$$\text{PSI} \times .06896 = \text{Bar}$$

$$\text{Bar} \times 14.5038 = \text{PSI}$$

$$1 \text{ inches} = 25.4 \text{ millimeters}$$

$$\text{Liters} \times .2642 = \text{Gallons (US)}$$

$$\text{Ft. Lbs.} \times 1.356 = \text{Newton Meters}$$

$$\text{Inch Lbs.} \times .11298 = \text{Newton Meters}$$

$$\text{Newton Meters} \times .737562 = \text{Ft. Lbs. (force)}$$

$$\text{Newton Meters} \times 8.85 = \text{In. Lbs. (force)}$$

$$\text{Temperature} = 1.8(\text{C}^\circ + 17.78) + \text{F}^\circ - 555(\text{F}^\circ - 32) = \text{C}^\circ$$

$$1 \text{ U.S. Gallon of freshwater} = 8.33 \text{ lbs.}$$

$$1 \text{ PSI} = 2.31 \text{ feet of water}$$

$$1 \text{ PSI} = 2.04 \text{ inches of mercury}$$

$$1 \text{ Foot of water} = .433 \text{ PSI}$$

$$1 \text{ Foot of water} = .885 \text{ inches of mercury}$$

$$1 \text{ Meter of water} = 3.28 \text{ feet of water}$$

$$\text{Kilograms} \times 2.2 = \text{Lbs.}$$

## General Safety Information

### ⚠️ WARNINGS

#### Gasoline Drive Pumps



The pump is designed to pump non-flammable or non-explosive fluids.

These pumps are intended to pump clean filtered water only.



Do not operate in or around an explosive environment.



Always wear safety glasses or goggles and appropriate clothing.



Do not alter the pump from the manufacturers design.



Do not allow children to operate the pump.



Never point the high-pressure discharge at a person, any part of the body or animals.

Do not operate gasoline engines in a confined area; always have adequate ventilation.



Do not exceed the pump specifications in speed or pressure.

# Plunger Pumps

## General Safety Information (continued)



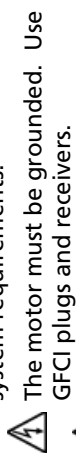
All positive displacement plunger pumps must have a safety relief valve installed on the discharge side of the pump, this valve could be either an unloader or regulator and must be of adequate flow and pressure for the pump.

Adequate protective guards must cover all moving parts. Perform routine maintenance on the pump and components.

Use only components that are rated for the flow and pressure of the pump, this would include hose, fittings, safety valves, spray guns etc.

## Electric Drive Pumps

Your power supply must conform to the system requirements.



Do not handle the pump/motor with wet hands.



Never pull the unit by the power cord.

Never spray or clean the unit with water

**Failure to follow these warnings may result in personal injury or damage to property.**

## Installation

### Direct Drive Gasoline Pumps

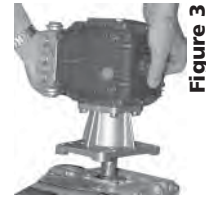


Figure 3

1. Install the shaft key into the keyway and apply a light coating of anti-seize on the engine shaft. (See Figure 3)

2. Align the two key ways and push the pump completely onto the engine.

3. Install all four (4) bolts and tighten evenly.



Figure 4

4. Remove the red shipping oil cap and install the black crankcase vent cap. (See Figure 4)

5. Install the appropriate unloader valve and other accessories.

6. Install the appropriate water inlet and discharge fittings.

7. Connect the water supply hose and high-pressure discharge hose/spray gun.

8. Turn on the water supply.

9. Open the spray gun to purge the system of any air.

10. Start the engine.

11. Adjust the engine speed and unloader valve.

## Winter or Long Time Storage

1. Drain all of the water out of the pump.

2. Run a 50% solution of a RV or non-toxic/biodegradable antifreeze

Pos. Code	Description	Qty.
1	Nut M6	1
2	Grub screw M6x12	1
3	Unloader knob	1
4	Spring plate	2
5	Spring	1
6	Valve piston	1
7	O-Ring ø6.02x2.62	1
8	O-Ring ø6.07x1.78	1
9	Ring	1
10	Piston guide	1
11	O-Ring ø15.6x1.78	4
12	O-Ring ø12.42x1.78	2
13	By-pass Jet	1
14	Seat	1
15	O-Ring ø11.11x1.78	1
16	Hose nipple	2
17	O-Ring ø4.48x1.78	1
18	Ball	1
19	Spring	1
20	Detergent injector 3/8" G	1
21	O-Ring ø12x1	1
22	O-Ring ø9x1	1
23	Injector insert	1
24	Spring	1
25	Jet	1
26	O-Ring ø4x2.5	1
27	Bolt M6x50	8 (ø2 in/lbs)
28	Lockwasher	8
29	Head	1
30	Ez-start plug	1
31	Ball	1
32	Spring	1
33	Plug 1/4" G	2
34	Plug	3 (ø42 in/lbs)
35	Complete valve	6
36	Support ring	3
37	Gasket	3
38	Ring	1

## Legend

Ø 15	Ø 15	Ø 15
For Y	For A	For B
RSV2.5G25	RSV3G25	RSV3.5G35
For O	For A	For B
RSV3G30	RSV3G25	RSV4G40
For ●	For ○	For □
RSV3G35	RSV3G30	RSV4G30

Pos. Code	Description	Qty.
39	Piston guide	3
40	O-Ring ø23.52x1.78	3
41	Gasket	3
42	O-Ring ø13.95x2.62	3
43	Spacer	3
44	Oil seal	3
45	Pump body	1
46	Bearing cap	1
47	Circlip ø152	1
48	Snap ring	1
49	Bearing	1
50	Bearing	1
51	Oil cap	3
52	Piston	3
53	Piston pin	3
54	Con rod Aluminum	3
55	Con rod Bronze	3
56	O-Ring ø101.27x2.62	3
57	Bolt M6x12	(71 in/lbs) 4
58	Rear cover	1
59	Bearing	1
60	Bearing	1
61	Snap ring	1
62	Complete pump head	1
63	Oil seal	1
64	Bolt M8x20	4
65	Set screw M6	1
66	Hollow shaft ø1"	1
67	Hollow shaft ø1"	1
68	Hollow shaft ø1"	1
69	Hollow shaft ø3/4"	1
70	Hollow shaft ø3/4"	1
71	Flange F25	1
72	Flange F40	1
73	Oil	1
74	OIL CAPACITY - 12 oz	1

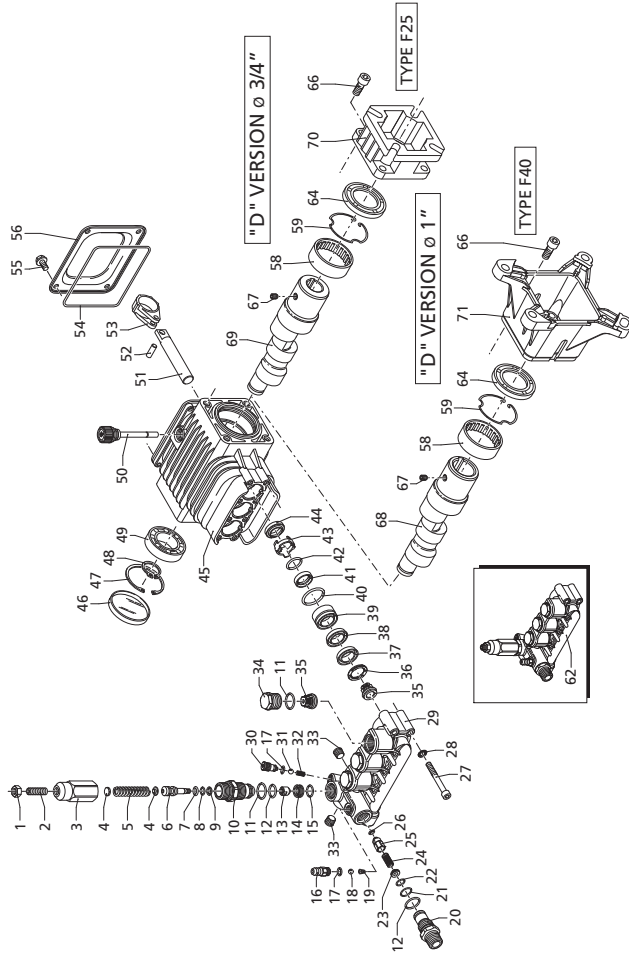


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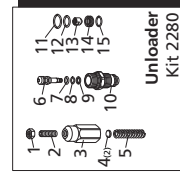
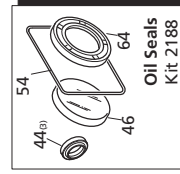
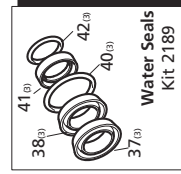
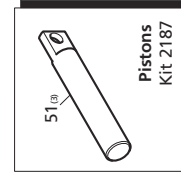
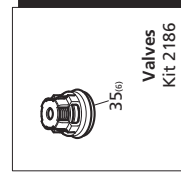


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# RSV 3400 RPM



## Repair Kits



# Plunger Pumps

## Installation (continued)

- through the pump.
- 3. Flush the pump with fresh water before the next use.
- 4. In freezing conditions failure to do this may cause internal pump damage.
- 5. For long periods of storage in non-freezing areas the solution will keep the seals and O-rings lubricated.

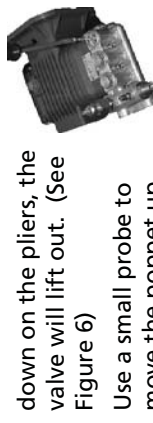


Figure 6

- 4. Use a small probe to move the poppet up and down to assure that the valve is functioning properly and that no debris is stuck in the valve. (See Figure 7)



Figure 7

- 5. Inspect the valve o-ring for any damage, replace if necessary.

## Service Pumps

### Servicing the Valves

The inlet and discharge valves in this series pumps are all the same. The valves are located under the six 19mm hex plugs. The inlet valves are located on the inside portion of the head under the seal assemblies and the discharge valves are located on the top row of the pump head.

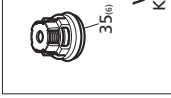


Figure 8

### Discharge Valve Assembly:

- 1. Insert the valve assembly squarely into the port pushing it into place with a deep well socket (you will feel the valve assembly seat). (See Figure 8)

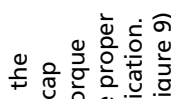


Figure 9

- 3. Install the valve cap and torque to the proper specification. (See Figure 9)

### Discharge Valve Removal:

- 1. Remove the valve cap. (See Figure 5)
- 2. Inspect the valve cap O-ring for any damage, replace if necessary.
- 3. Screw the machine screw into the hole on top of the valve cage (approx 1/8"). Using the diagonal pliers grasp the screw at the lowest reachable point. Using the pump head as a base, push



Figure 5

## Servicing the Packings/Seals and Inlet Valves

To access the water seals and inlet valves for inspection or replacement, you will first need to remove the head of the pump.

Tools required: 5mm hex socket, ratchet, (2) long screwdrivers, channel lock pliers, mechanics pick and torque wrench.

# Plunger Pumps

## Service Pumps (continued)

### Disassembly:

1. First remove the eight 5mm head bolts. (See Figure 10)
2. Place the screwdrivers as shown between the head and crankcase of the pump, lifting one up and the other down. The head should start to lift off of the plungers. (See Figure 11)
3. When you remove the head you may notice that some of the water seals have stayed on the plungers and some in the head. To remove the seals from the plungers simply turn the assemblies and pull off. (See Figure 12)



Figure 10



Figure 11



Figure 12



Figure 13



Figure 14

high-pressure seal and head ring out of the head. (See Figure 15)



Figure 15

7. The low-pressure seal is located in the brass seal retainer. Using the mechanics pick, go in between the seal and retainer and pull the seal toward the center and pull outwards. (See Figure 16)



Figure 16

8. Remove the seal retainer O-ring with the mechanics pick. (See Figure 17)



Figure 17

### Assembly:

1. Install the plastic head ring into the head (the flat side is on the bottom). (See Figure 18)
2. Install the high-pressure seal. Place the seal so the open "V" portion is toward the head ring. You need to place the seal at an angle and pull and push to work the seal into position with your fingers (do not use any tools you may damage the seal). Make sure the seal is totally seated against the head ring. (See Figure 19 & 20)
3. Place the white restop ring so it mates to the top of the high pressure



Figure 18



Figure 19



Figure 20

## Troubleshooting (cont.)

Symptom	Possible Cause(s)	Corrective Action	
Low pressure (cont.)	3 Air leak in inlet plumbing	3 Disassemble, reseat and reassemble	
	4 Relief valve stuck, partially plugged or improperly adjusted valve seat worn	4 Clean and adjust relief valve; check for worn or dirty valve seats	
	5 Worn packing. Abrasive in pumped in cavitation. Inadequate water	5 Install proper filter suction at inlet manifold must be limited to lifting less than 20 feet of water or 8.5 psi vacuum	
	6 Worn inlet, discharge valve blocked or dirty	6 Replace inlet and discharge valve	
	Pump runs extremely rough, pressure very low	1 Inlet restrictions and/or air leaks.	1 Clean out foreign material
		2 Stuck inlet or discharge valve	2 Replace worn valves
Water leakage from under manifold	Worn packing or cracked plunger	Install new packing or plunger	
	Slight leak, oil leaking in the area of crankshaft	1 Worn crankshaft seal or improperly installed oil seal o-ring	1 Remove oil seal retainer and replace damaged O-ring and/or seals
2 Bad bearing		2 Replace bearing	
Excessive play in the end of the crankshaft pulley	Worn main bearing from excessive tension on drive belt	Replace crankcase bearing and/or tension drive belt	
	Water in crankcase	1 Humid air condensing into water inside the crankcase	1 Change oil intervals
2 Worn packing and/or cracked plunger		2 Replace packing. Replace plunger	
Loud knocking noise in pump	1 Cavitation or sucking air	1 Check water supply is turned on	
	2 Pulley loose on crankshaft	2 Check key and tighten set screw	
	3 Broken or worn bearing	3 Replace bearing	

## Troubleshooting

Symptom	Possible Cause(s)	Corrective Action
Oil leak between crankcase and pumping section	Worn rod oil seals	Replace crankcase piston rod seals
Frequent or premature failure of the packing	<ol style="list-style-type: none"> <li>1 Cracked, damaged or worn plunger</li> <li>2 Overpressure to inlet manifold</li> <li>3 Material in the fluid being pumped</li> <li>4 Excessive pressure and/or temperature of fluid being pumped</li> <li>5 Running pump dry</li> </ol>	<ol style="list-style-type: none"> <li>1 Replace plungers</li> <li>2 Reduce inlet pressure</li> <li>3 Install proper filtration on pump inlet plumbing</li> <li>4 Check pressures and fluid inlet temperature; be sure they are within specified range</li> <li>5 Do not run pump without water</li> </ol>
Pump runs but produces no flow	Pump is not primed	Flood suction then restart pump
Pump fails to prime	Air is trapped inside pump	Disconnect discharge hose from pump. Flood suction hose, restart pump and run pump until all air has been evacuated
Pump loses prime, chattering noise, pressure fluctuates	<ol style="list-style-type: none"> <li>1 Air leak in suction hose or inlet</li> <li>2 Clogged suction strainer</li> </ol>	<ol style="list-style-type: none"> <li>1 Remove suction line and inspect it for a loose liner or debris lodged in hose. Avoid all unnecessary bends. Do not kink hose</li> <li>2 Clean strainer</li> </ol>
Low pressure at nozzle	<ol style="list-style-type: none"> <li>1 Unloader valve is by-passing</li> <li>2 Incorrect or worn nozzle</li> <li>3 Worn packing or valves</li> </ol>	<ol style="list-style-type: none"> <li>1 Make sure unloader is adjusted properly and by-pass seat is not leaking</li> <li>2 Make sure nozzle is matched to the flow and pressure of the pump. If the nozzle is worn, replace</li> <li>3 Replace packing or valves</li> </ol>
Pressure gauge fluctuates	<ol style="list-style-type: none"> <li>1 Valves worn or blocked by foreign bodies</li> <li>2 Packing worn</li> </ol>	<ol style="list-style-type: none"> <li>1 Clean or replace valves</li> <li>2 Replace packing</li> </ol>
Low pressure	<ol style="list-style-type: none"> <li>1 Worn nozzle</li> <li>2 Belt slippage</li> </ol>	<ol style="list-style-type: none"> <li>1 Replace with nozzle of proper size</li> <li>2 Tighten or replace with correct belt</li> </ol>

# Plunger Pumps

## Service Pumps (continued)



Figure 21

seal (Make sure it is squarely seated). (See Figure 21)

4. Installing the low-pressure seal: You want the open side of the seal to be pointed toward the water side of the head (toward the high-pressure seal) and the flat side toward the drive end of the pump.



Figure 22

Place the seal into the gland at an angle, with your finger push the exposed side of the seal towards the center and work the seal into position.

After the seal is in the gland you can work it into it proper position. (See Figure 22)



Figure 23

5. Install the retainer O-ring. (See Figure 23)



Figure 24

6. Squarely seat the retainer into the head and push with even pressure until it snaps into position. (See Figure 24)

## Inlet Valve Removal:

1. Remove the valve cap.
2. Inspect the valve cap O-ring for any damage, replace if necessary.
3. Screw the machine screw into the hole on top of the valve cage (approx 1/8"). Using the diagonal pliers grasp the screw at the lowest reachable point. Using the pump

head as a base, push down on the pliers, the valve will lift out.

4. Use a small probe to move the poppet up and down to assure that the valve is functioning properly and that no debris is stuck in the valve.

5. Inspect the valve o-ring for any damage, replace if necessary.

## Inlet Valve Assembly:

1. Insert the valve assembly squarely into the port pushing it into place with a deep well socket (you will feel the valve assembly seat).
3. Install the valve cap and torque to the proper specification.

## Pump Head to Drive End

### Installation

1. Turn the crankshaft to align the plungers as shown. (See Figure 25)



Figure 25

2. Place the head evenly onto the plungers and push it until it makes contact with the drive end of the pump. (See Figure 26)



Figure 26

3. Torque the head bolt as shown in the tightening sequence diagram. (See Figure 27 & 28)

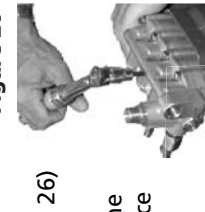


Figure 27

(See Figure 27 & 28)



Figure 28

# Plunger Pumps

## Service Pumps (continued)

### Oil Change

Change oil after first 50 hours of use. Then every 500 hours. Refer to parts breakdown for oil type.

### Servicing the Built-in Unloader and Check Valve

These partw are serviced as assembled kits.

Tools required: 3/8" drive ratchet, 19mm deepwell socket, medium strength thread locker, needle nose pliers.

#### Check Valve Removal:

1. Remove the chemical injector discharge nipple. Use the needle nose pliers to lift out the check valve. (See Figure 29)



Figure 29

#### Check Valve Assembly:

1. Place the check valve into the discharge outlet with the pointed side going in first (NOTE: older model pumps have springs that go into the hollow portion of the valve, newer models do not have springs.) (See Figure 30)



Figure 30

2. Inspect the o-rings on the injection nipple, if damaged replace. Place small amount of thread locker on the thread and tighten. (See Figure 31)



Figure 31

#### Unloader Removal:

Tools required: 3/8" ratchet, 22mm deep well socket, crescent wrench, small hammer, 6mm x approximately 8mm or longer, medium strength thread locker.

#### Unloader assembly removal:

1. Using the 22mm socket rotate the pressure adjusting cap so both set of hexes are aligned. Use screw to remove the complete unloader assembly. (See Figure 32)
1. Screw the 6mm bolt into the unloader piston seat, grab the bolt with the crescent wrench just under the head. Using the hammer tap the bottom of the wrench. The seat will pop out. (See Figure 33)



Figure 32



Figure 33

#### Unloader assembly:

1. Piston seat installation screw the new seat onto the bolt (NOTE: the flat side is the bottom). Push squarely into the unloader base and tap into place with the hammer. (Remove the bolt) (See Figures 34 & 35)
2. Place a small amount of thread locker on the unloader cartridge threads and screw into the base and tighten.



Figure 34



Figure 35

# Plunger Pumps

## Service Pumps (continued)

### Unloader Adjusting Instructions

Follow these easy steps to adjust the pressure:

1. Loosen nut (pos. #3) with 10mm wrench.
2. Turn brass (pos. #4) clockwise until it stops.
3. Start pump, watch pressure gauge and turn (pos. #2) using 3mm hex clockwise until recommended/rated pressure is obtained. Line pressure will be approximately 200 psi less than actual head pressure. DO NOT set line pressure to rated.
4. Release trigger and make sure there is minimal spike (200-300 psi) (Repeat this step two or three times).
5. Tighten nut (pos. #3) down against (pos. #4).

