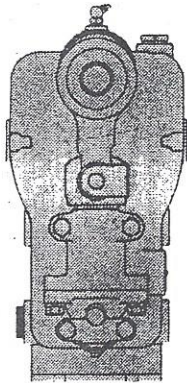
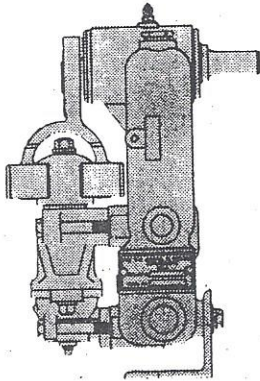


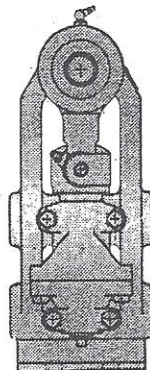
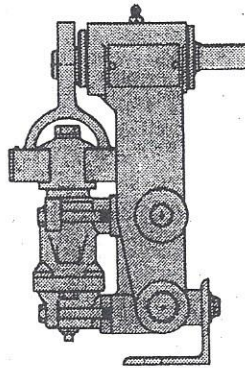
Instructions for Du-All Industrial Pumps

N.D.S. Drilling Supply
26041 Newton Circle
Elko, MN 55020
Phone #952-461-3400
Fax # 952-461-3403



2 GPM, 340 RPM
Single Cylinder Double Acting

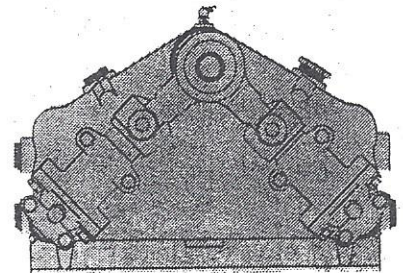
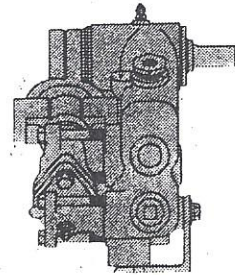
Pump No.	Maximum Pressure	Maximum H.P.
A02-6	600	1.2



2 GPM
A02-6C 575 RPM

Chamberless
Single Cylinder Double Acting

Pump No.	Maximum Pressure	Maximum H.P.
A02-6C	600	1.1



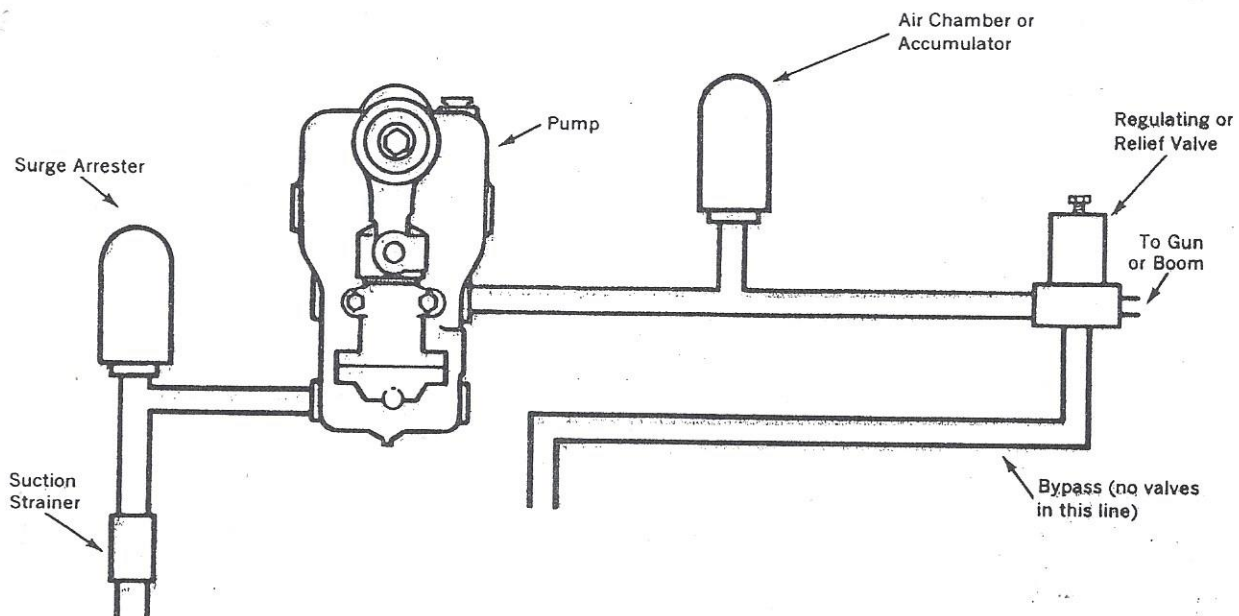
4 GPM, 340 RPM
2 Cylinder Double Acting

Pump No.	Maximum Pressure	Maximum H.P.
A04-6	600	2.1

8 GPM, 360 RPM
2 Cylinder Double Acting

Pump No.	Maximum Pressure	Maximum H.P.
A08-4	400	2.7

CAUTION: These are positive displacement pumps. They must have proper size and type pressure relief, or regulating valve installed in discharge line to prevent injury to personnel or damage to pump parts or plumbing. Check accessory section to determine proper valve for capacity and pressure desired. A suitable strainer should be put in the suction line before the pump is placed in operation.



I. INSTALLATION SUGGESTION:

- A. Always have suction plumbing the same size or larger than suction tapping on pump. A suitable size surge arresting device on the suction will assure smoother operation.
- B. A surge arresting device is recommended for the suction side to help eliminate water hammer. Precharge is not necessary where suction lift conditions are present. It is desirable, however, to precharge the surge arrester when there is a positive head on the pump.
- C. If there is a positive head on the inlet side, this should not exceed 20 PSI. For best operation, incoming pressure should be kept to a minimum.
- D. Use suction strainer and screen of proper size to avoid clogging pump or valves when in operation. (Keep screen clean to avoid starving suction which causes noisy operation.)
- E. When pumping liquids that are heated, reduce pump speed to avoid suction problems. (Consult factory for temperature limitations and speed recommendations.)
- F. For industrial service additional pulsation devices such as accumulators (of proper size) or air chambers (with provision for charging with air) must be added to avoid shock to pump parts and plumbing. (Consult factory for size and location. In general, always locate as close to pump as possible.)
- G. Some Du-All models have built-in air chambers which must be allowed to refill with air frequently. This can be done by draining the

chamber through a suitable valve or by operating the pump at no discharge pressure with the suction opened.

- H. Make sure drive is adequate for horsepower transmitted and has proper alignment and tension.
- I. Make sure all bolts and nuts are properly tightened.

II. STARTING PUMP:

- A. Turn pump over by hand to make sure pump is operating free and clear of surrounding equipment.
- B. Adjust regulator or relief valve out so the pump will be relieved of pressure.
- C. Make sure suction is submerged in liquid and agitation and bypass plumbing is as far away as possible from suction entrance.
- D. Start pump and allow time to prime. At this time adjust relief or regulating valve for desired pressure (watching pressure gauge) making sure valve is bypassing.
- E. Never operate pump dry as this causes excessive cup and liner wear.
- F. Adjust regulator for desired operating pressure when discharge is open. Turn discharge off and check pressure on gauge. This should not exceed 10% of set pressure. If it does, then check discharge flow which very likely is exceeding pump capacity. **This would cause excessive pressure when discharge is closed causing injury to personnel and possibly failure of pump parts.**

Du-All Pump Instructions

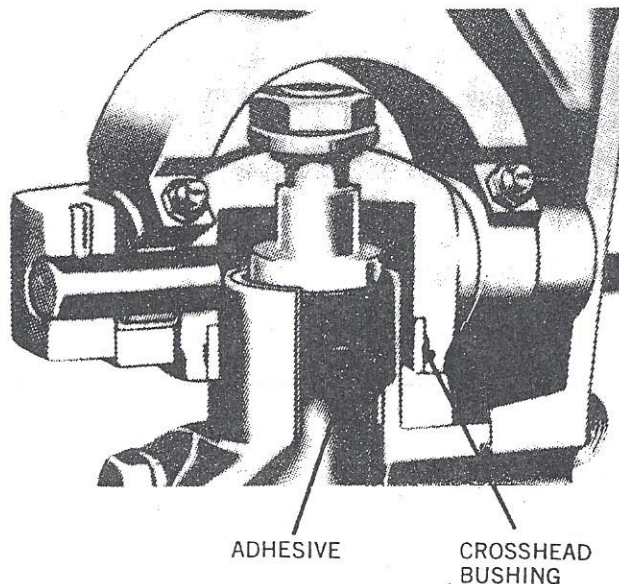
III. TROUBLE SHOOTING CHART:

LOSS OF PRESSURE MAY BE CAUSED BY ONE OR MORE OF THE FOLLOWING:

1. Pump may be performing satisfactorily, but pressure gauge is not registering properly.
2. Worn nozzle disc allowing greater discharge than capacity of pump.
3. Air leak in suction line.
4. Clogged suction line or strainer.
5. Relief valve or regulator worn, dirty or improperly adjusted.
6. Pump valves worn or sticking due to dirt or other foreign material.
7. Worn plunger cups.
8. Pump running too slow. See operating specifications for proper pump speed.
9. Pump air locked. Stop pump and open discharge valve until all pressure is removed. Then start pump with discharge open.

IV. REPLACING WRIST PINS AND BEARINGS IN CROSSHEAD

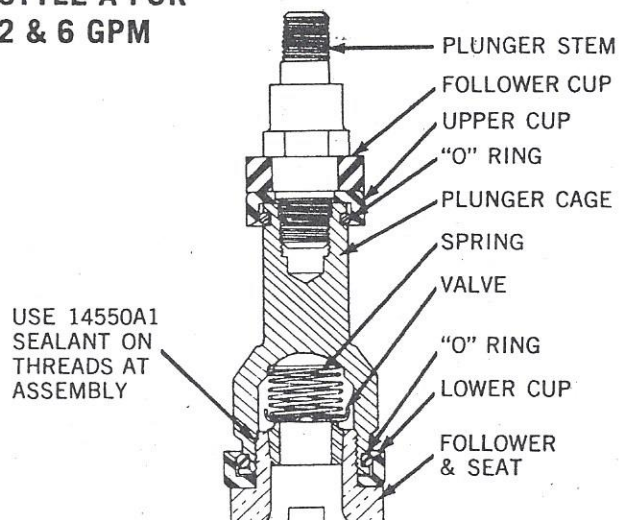
Remove locking roll pins, wrist pins, and old needle bearings. Press only against the outer edges of the replacement bearing shell to avoid damage; be sure to align the grease holes to permit relubrication of the bearing. Push new wrist pins into place and install the roll pins. **Important:** Apply a waterproof adhesive like Armstrong A-31 epoxy cement to the hole inside the crosshead to prevent moisture from entering the wrist pin and bearing area.



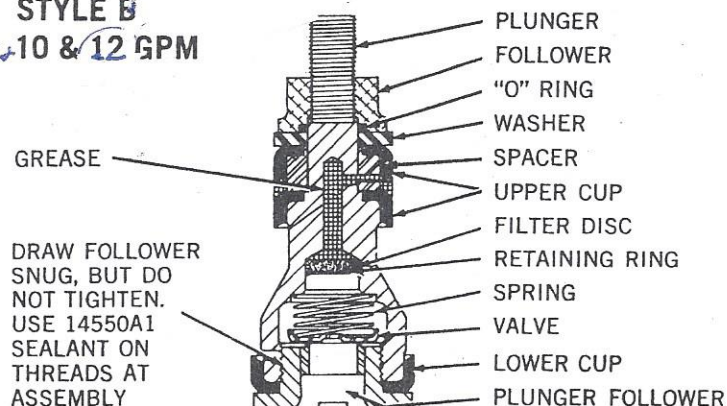
Crosshead bushing: This does the very important job of keeping the plunger assembly centered within the cylinder body and must be frequently relubricated and **replaced** whenever worn—the best way to check is to slip the crosshead onto the guide and see if looseness is apparent.

V. PLUNGER ASSEMBLY

STYLE A FOR 2 & 6 GPM



STYLE B 8+10 & 12 GPM



A. Assemble as shown above, use "Locktite Grade 271" locking sealant on threads.

B. The plunger parts should be drawn up until snug. Drawing up too tight causes cups to distort causing heel wear and excess friction.

Put oil or grease on both plunger cups before inserting plunger assembly in cylinder body.

Clean the "O" ring seating surfaces (lower cap, suction port and discharge port). Replace "O" rings if damaged. Do not use flat gaskets since they will cause misalignment, which will result in pump damage.

When assembling pump, draw cylinder cap bolts only until they just start to tighten. Insert pump in crosshead and tighten nut which holds plunger to crosshead. Attach pump to main casting by alternately tightening the four mounting bolts. Tighten cylinder cap bolts last.

Torque to 20 Ft. Lbs. Max. for 300# Models.
Torque to 38 Ft. Lbs. Max. for 600# Models.

VI. TO REMOVE AND REPLACE CYLINDER LINERS:

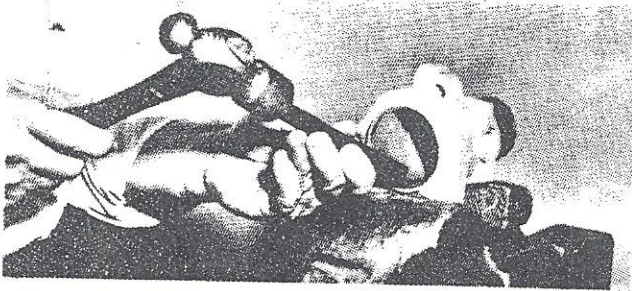


FIGURE 1

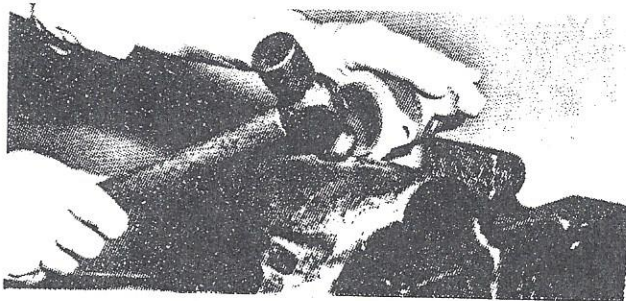


FIGURE 2

- A. Cut old liner out with a chisel. See Fig. 1.
- B. Smooth inside of cylinder body if necessary.
- C. Add Permatex or suitable sealant to I.D. of cylinder body and press liner in place.
- D. Roll or flare the edges as shown in Fig. 2; a long rod tapered to a $\frac{1}{4}$ " dia. with the corners

rounded makes a good tool for peening the inner end of the small liner.

VII. STORAGE:

1. **Daily**—Flush the pump and discharge equipment with water until it comes out clear.
2. **Extended**

The pump cylinders should be drained by removing the drain plug in the lower cylinder cap and operating the pump about one minute to throw all water out of the plunger assembly. Then open the suction valve by inserting a wire nail or similar object into the drain plug hole. Holding the suction valve open in this manner will complete the draining of the cylinder assembly.

Prevent excessive corrosion by oiling crosshead and link pin bearings before storage. Apply oil to the suction valves through the drain plug openings and replace the drain plugs. Using an oil can, apply oil to the upper plunger through the small hole in the crosshead.

If desired, even better protection against corrosion may be obtained by disassembling pump and thoroughly coating all parts with grease.

VIII. LUBRICATION:

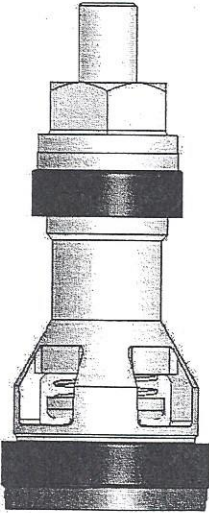
1. **Before reassembly be sure all parts are in good condition. Check crosshead bushing for fit on crosshead guide—replace bushing if wear and looseness are apparent.**
2. **Apply a good waterproof grease (Lubriplate 630-AA or equivalent) to crosshead guide on cylinder body and in bushing in crosshead. This is very important in prolonging the life of the upper cup and the pump.**
3. **Lubricate all Zerk fittings every 24 hours of operating time.**

PART NUMBER

FWS-15422B002

PLUNGER ASSEMBLY

For Use with A08 Series Pumps



Ref #	Part #	Description	Qty Req
1	FWS-18241B000	Plunger Stem	1
2	FWS-15424A000	Follower Nut	1
3	FWS-05876A068	O-ring	1
4	FWS-05030A110	Washer	1
5	FWS-06737A021	Rubber Cup	1
6	FWS-05876A013	O-ring	1
7	FWS-11432A000	Valve Spring	1
8	FWS-17714A001	Valve	1
9	FWS-05876A029	O-ring	1
10	FWS-06737A020	Rubber Cup	1
11	FWS-15426A001	Follower w/ Valve Seat	1
12	FWS-M02168A002	Valve Seat	1

Available Repair Kits

*** 1 Kit Required for 2 Plungers

NP = Not Pictured

A08-4Kit

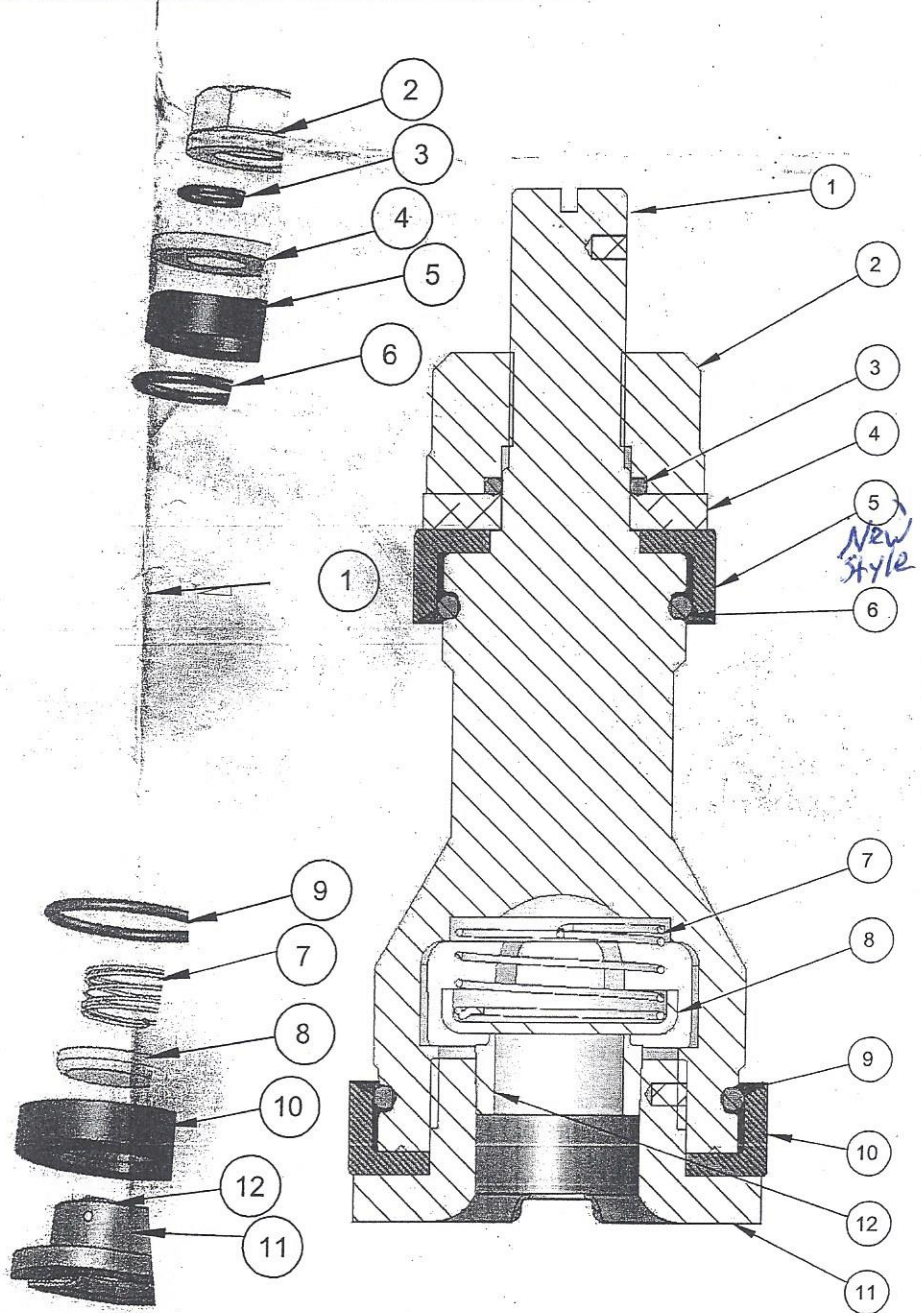
Ref #	Part #	Description	Qty Incl.
5	FWS-06737A021	Rubber Cup	2
10	FWS-06737A020	Rubber Cup	2
NP	FWS-05876A052	O-ring	2
NP	FWS-05876A053	O-ring	2
3	FWS-05876A068	O-ring	4
6	FWS-05876A013	O-ring	2
9	FWS-05876A029	O-ring	2
7	FWS-11432A000	Valve Spring	4
8	FWS-17714A001	Valve	4
4	FWS-05030A110	Washer	2

A08-4SKit

Ref #	Part #	Description	Qty Incl.
5	FWS-05505A013	Fabric & Rubber Cup	2
10	FWS-05505A014	Fabric & Rubber Cup	2
NP	FWS-05876A052	O-ring	2
NP	FWS-05876A053	O-ring	2
3	FWS-05876A068	O-ring	4
6	FWS-05876A013	O-ring	2
9	FWS-05876A029	O-ring	2
7	FWS-11432A000	Valve Spring	4
8	FWS-17714A001	Valve	4
4	FWS-05030A110	Washer	2

A08-4003Kit

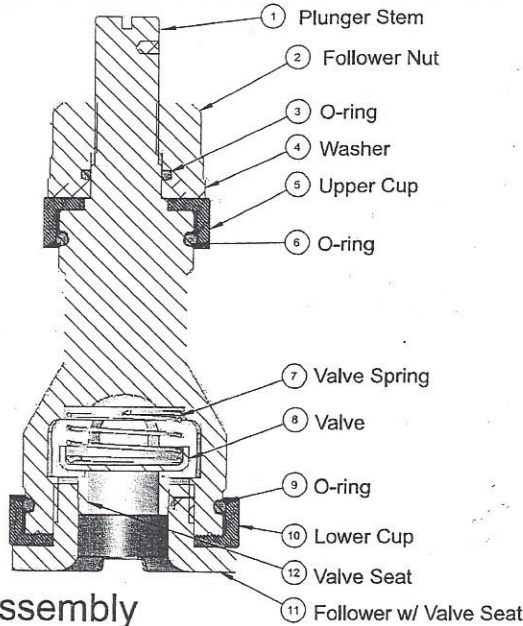
Ref #	Part #	Description	Qty Incl.
5	FWS-06737A021	Rubber Cup	2
10	FWS-06737A020	Rubber Cup	2
NP	FWS-05876A052	O-ring	2
NP	FWS-05876A053	O-ring	2
3	FWS-05876A068	O-ring	4
6	FWS-05876A013	O-ring	2
9	FWS-05876A029	O-ring	2
7	FWS-11432A000	Valve Spring	4
8	FWS-17714A001	Valve	4
4	FWS-05030A110	Washer	2
NP	FWS-15427C002A	Liner, Upper	2
NP	FWS-15427C003A	Liner, Lower	2
NP	FWS-15429A000	Retainer	2



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Maintenance Guide

FIGURE I



Plunger Assembly

A. Assemble as shown above in Figure I. locking sealant not required if nylon tabs are in place.

B. The plunger parts should be drawn up until snug. Over tightening causes cups to distort causing heel wear and excess friction.

C. To reassemble cylinder, plunger and lower cap.

1. Put oil or grease on both plunger cups before inserting plunger assembly into cylinder body.

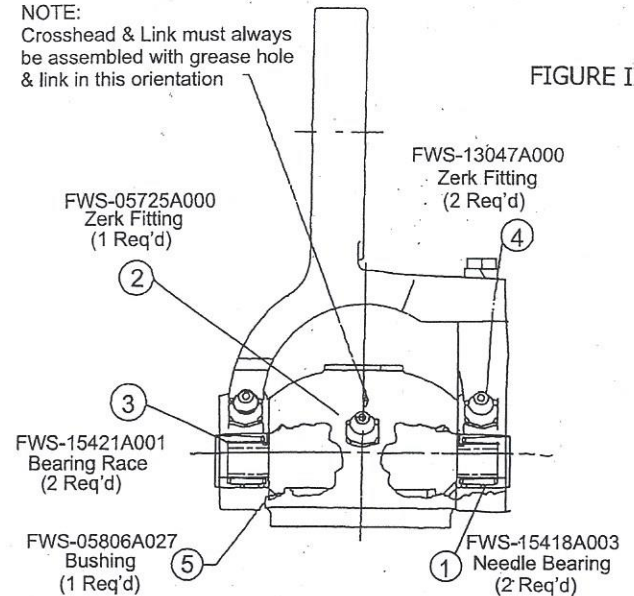
2. Clean the O-ring seating surfaces (lower cap, suction port, and discharge port). Replace O-rings if damaged. Do not use flat gaskets since they will cause misalignment, which will result in pump damage.

3. When assembling pump, draw lower cylinder cap bolts until they just start to tighten. Insert cylinder into crosshead and tighten nut which holds plunger to crosshead. Attach cylinder to main casting by alternately tightening the four mounting bolts. Tighten lower cylinder cap bolts last. Torque all bolts to 38ft.lbs. max

D. Turn pump shaft by hand to be sure plunger operates freely.

NOTE:
Crosshead & Link must always be assembled with grease hole & link in this orientation

FIGURE II



Bearing Races & Bearings in Crosshead

Instructions for removing and replacing crosshead bearing races and bearings.

A. Remove bolts on link ear. Separate link and crosshead. Cut bearing races from crosshead being careful not to damage crosshead ear. Press needle bearings from link.

B. Clean all parts to be assembled.

C. Press needle bearing into link. Ensure oil hole in the needle bearing is aligned with the hole for the grease fitting.

D. Press bearing races on to crosshead ears. Use removable Loctite #242 to secure bearing races to ears. Wipe excess Loctite from surfaces.

E. Reassemble crosshead to link. Tighten ear bolts. Grease zerk fittings and rotate crosshead to ensure coverage of grease in needle bearing.

To Remove and Replace Cylinder Liners

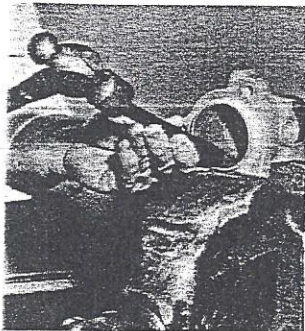


FIGURE III

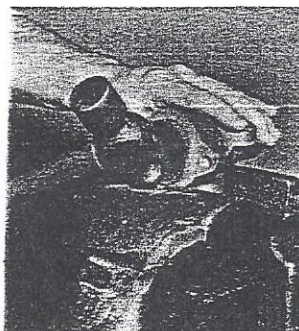


FIGURE IV

A. Cut old liner out with chisel. See Fig. III.

B. Smooth inside of cylinder body if necessary.

C. Add Removable Loctite #242 or suitable sealant to cylinder I.D., and both ends of cylinder liners. Press liner into cylinder. Roll or peen edges as shown. See Fig. IV.

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Troubleshooting Guide

Loss of Pressure

May Be Caused By One Or More Of The Following:

1. Clogged suction line or strainer - Remove foreign material from suction line or strainer. If necessary replace strainer screen or suction line to remove clog.
2. Air leak in suction line - Repair or replace damaged section of suction line.
3. Pump air locked - Stop pump and open discharge valve until all pressure is released. Start pump with discharge open. Once pump builds pressure resume operation as normal.
4. Discharge exceeds the capacity of pump - Reduce flow from discharge. Replace worn nozzles, manifolds, etc. with properly sized components
5. Pump running too slow - See operating specifications for proper pump speed.
6. Relief valve or regulator worn, dirty, or improperly adjusted - Clean, repair, or replace relief or regulator valve.
7. Pump valves worn or sticking due to foreign material - Inspect, clean, repair, or replace pump valves, valve springs, and valve seats.
8. Worn plunger cups - Replace plunger cups and perform required service as necessary.
9. Operating pump at RPM exceeding manufacturer's recommendations will cause pump to hammer and produce substantially less flow (gpm) - Reduce operating speed of pumping unit.
10. Pump may be performing satisfactorily, but pressure gauge is not registering properly - Replace pressure gauge.

Excessive Noise

May Be Caused by one or more of the following:

1. Clogged suction line or strainer - Remove foreign material from suction line or strainer. If necessary replace strainer screen or suction line to remove clog.
2. Air leak in suction line - Repair or replace damaged section of suction line.
3. Pump air locked - Stop pump and open discharge valve until all pressure is released. Start pump with discharge open. Once pump builds pressure resume operation as normal.
4. Relief valve or regulator worn, dirty or improperly adjusted - Clean, repair, or replace relief or regulator valve.
5. Pump valves worn or sticking due to foreign material - Inspect, clean, repair, or replace pump valves, valve springs, and valve seats .
6. Operating pump at RPM exceeding manufacturer's recommendations will cause pump to hammer and produce substantially less flow (gpm) - Reduce operating speed of pumping unit.

Storage Guide

Between Uses:

1. Flush the pump, plumbing, and discharge equipment with appropriate liquid or solvent until system is clear.
2. Check suction strainer for obstructions.
3. Inspect hoses and other plumbing for signs of leaks.
4. If temperature is anticipated to fall below freezing point of material being pumped be sure to drain the system to prevent damage.

For Long Term Storage:

1. Flush system with appropriate neutralizing agent.
2. Drain equipment thoroughly to avoid damage in freezing weather. The pump cylinders should be drained by removing the drain plug in the lower cylinder cap and operating the pump for about one minute to force all material from the plunger assembly.
3. Fill the crankshaft housing with grease and rotate the shaft several times to make sure all bearing and shaft surfaces are coated with grease to prevent corrosion.
4. Prevent excessive corrosion by greasing crossheads and links at appropriate lubrication points. Apply oil to the suction valves through the drain plug openings and replace the drain plugs.
5. If desired, the best protection against corrosion is disassembling pump and thoroughly coating all parts with grease.
6. Disconnect and drain the suction and discharge plumbing. Hose should be coiled and stored in a cool dry place to avoid dry rot.

Lubrication Guide

Lubricate with waterproof grease:

- A. Main bearings on air chamber using zerk fitting every 12 hours of normal operation.
- B. Apply waterproof grease to crosshead guides on cylinder body.
- C. Link Bearings at zerks every 12 hours of normal operation.

Time interval between required greasing varies based upon operating temperature, liquid pumped, and quality of grease. Synthetic and other alternative greases are available on the market that may extend greasing time interval. Testing of such greases has not been completed by manufacturer and may void warranty.

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Operation Guide

CAUTION:

Failure to adhere to the following operational guidelines effectively voids the manufacturer's warranty. The following are guidelines to ensure best practices for safety and longevity of the pump. Questions can be addressed to your dealer, manufacturer's representative, or the factory prior operating any Du-All Pump.

Do not operate the pump dry except for the short time required to prime and/or recharge the air chamber. Dry operation may cause excessive wear on cups and cylinder liners. A suitable relief valve must be used and a pressure gauge should be installed in the discharge line between pump and shut-off. Refer to installation guide prior to operating the pump to ensure safe operation

A. Read All Documentation Carefully:

Take the time to review and become familiar with all of the included documentation. If questions arise, call your dealer, manufacturer's representative, or the factory prior to operation of any Du-All Pump.

B. Check Lubrication:

Check all points of lubrication. Lubricate the pump crankshaft bearing with a grease gun at the grease fitting on top of the main bearing housing. Lubricate the link bearings and plungers at corresponding lubrication points.

C. Check All Plumbing:

Check suction strainer for obstructions. Inspect drain plugs and plumbing for drips or leaks. Check pressure in surge arresting devices, accumulators, and air chambers. Ensure pressure relief valves are functioning properly.

D. Check Clearances:

Turn the pump over by hand to make sure the pump is operating free and clear of any obstructions. Visually inspect drive assembly for proper alignment and uneven wear. Make sure that all mounting bolts and nuts are tight. Ensure all appropriate guards and safety equipment are in place and functional.

E. Adjust Regulator:

Before starting pump make sure the regulator or pressure relief valve are in the bypass position.

F. Inspect Supply:

If a tank is used to supply materials to the pump, inspect interior of tank to ensure it is clean with no foreign materials present. Confirm the suction line is submerged in liquid and agitation or bypass plumbing does not interfere with intake suction. For all installations, make sure suction line is free from obstruction and foreign materials. Check suction strainer for debris. Inspect suction line for evidence of leaks.

G. Using Dissolved Agents Or Chemicals:

Follow manufacturer's instructions for dissolving agents into solution. Ensure solution is a consistency which will flow. Inadequate flow of material to the pump can cause cavitation, excessive wear on components, and noisy operation.

I. Operating The Pump Dry:

Operating the pump dry causes excessive wear to cups and liners. Be sure suction lines are free from obstructions. Only when priming, recharging the air chamber, or during the winterization process should the pump be operated without material passing through the system.

I. Open All Valves In Discharge Line:

During startup, make sure all valves in the discharge line are open to minimize back pressure. If a tank and spray gun are in use, gun may be placed to discharge back into tank. Once pump has reached operational rpm close valves leaving pressure regulator or relief valve to function as normal.

K. Starting Pump:

Start pump and allow time to prime. Adjust the relief or regulating valve for desired pressure. Use functional pressure gauge to accurately set desired pressure. Make sure pressure bypass is functioning properly.

DO NOT OPERATE PUMP ABOVE MANUFACTURERS SPECIFICATIONS. OPERATING THE PUMP AT HIGHER PRESSURE OR RPM VOIDS THE WARRANTY. DOING SO PLACES THOSE SURROUNDING THE EQUIPMENT AT RISK.

L. Adjusting Pressure:

Adjust pressure regulator for desired operating pressure when discharge is open. Close discharge and check pressure on gauge. Static pressure should not exceed 10% of the operational pressure. If static pressure is greater than 10% of operational pressure, check volume of discharge flow. Discharge flow is likely greater than the pump capacity. This condition will cause excessive pressure when discharge is closed. Reduce discharge flow to meet pump specification. Failure to operate within specified operational limits can cause injury to personnel and failure of pump components.

Preventative Maintenance

1. Lubricate points after every 12 hours of operation.
2. Check alignment and/or tension of drive units to ensure maximum life of bearings, shaft, and links. Make sure all mounting bolts are tight and visually inspect for uneven wear.
3. Inspect wrist pins and bearings for wear in crossheads during routine service.
4. Examine cylinder liners during routine service of cups. If scoring is found, replace liners.
5. Examine valve, valve seat, and cup in pressure relief valve if unit is unable to hold steady pressure.
6. Check operating RPM.
7. Check for leaks in suction, bypass, and discharge hoses.
8. Inspect suction strainer prior to each use.

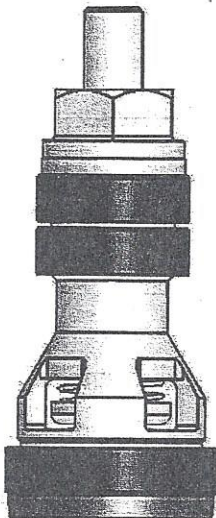
N.D.S. Drilling Supply
26041 Newton Circle
Elko, MN 55020
Phone #952-461-3400
Fax # 952-461-3403

PART NUMBER

FWS-15422B001

PLUNGER ASSEMBLY

For Use with 6110, 6112 & 6412 Series Pumps



Ref #	Part #	Description	Qty Incl.
1	FWS-15423B000	Plunger Stem	1
2	FWS-15424A000	Follower Nut	1
3	FWS-05876A068	O-ring	1
4	FWS-05030A110	Washer	1
5	FWS-05505A013	Fabric & Rubber Cup	2
6	FWS-15425A000	Spacer	1
7	FWS-07227A010	Felt Filter Disc	1
8	FWS-15233A002	Filter Disc Retainer	1
9	FWS-11432A000	Valve Spring	1
10	FWS-17714A001	Valve	1
11	FWS-05505A014	Fabric & Rubber Cup	1
13	FWS-15426A001	Follower w/ Valve Seat	1
12	FWS-M02168A002	Valve Seat	1

Available Repair Kits

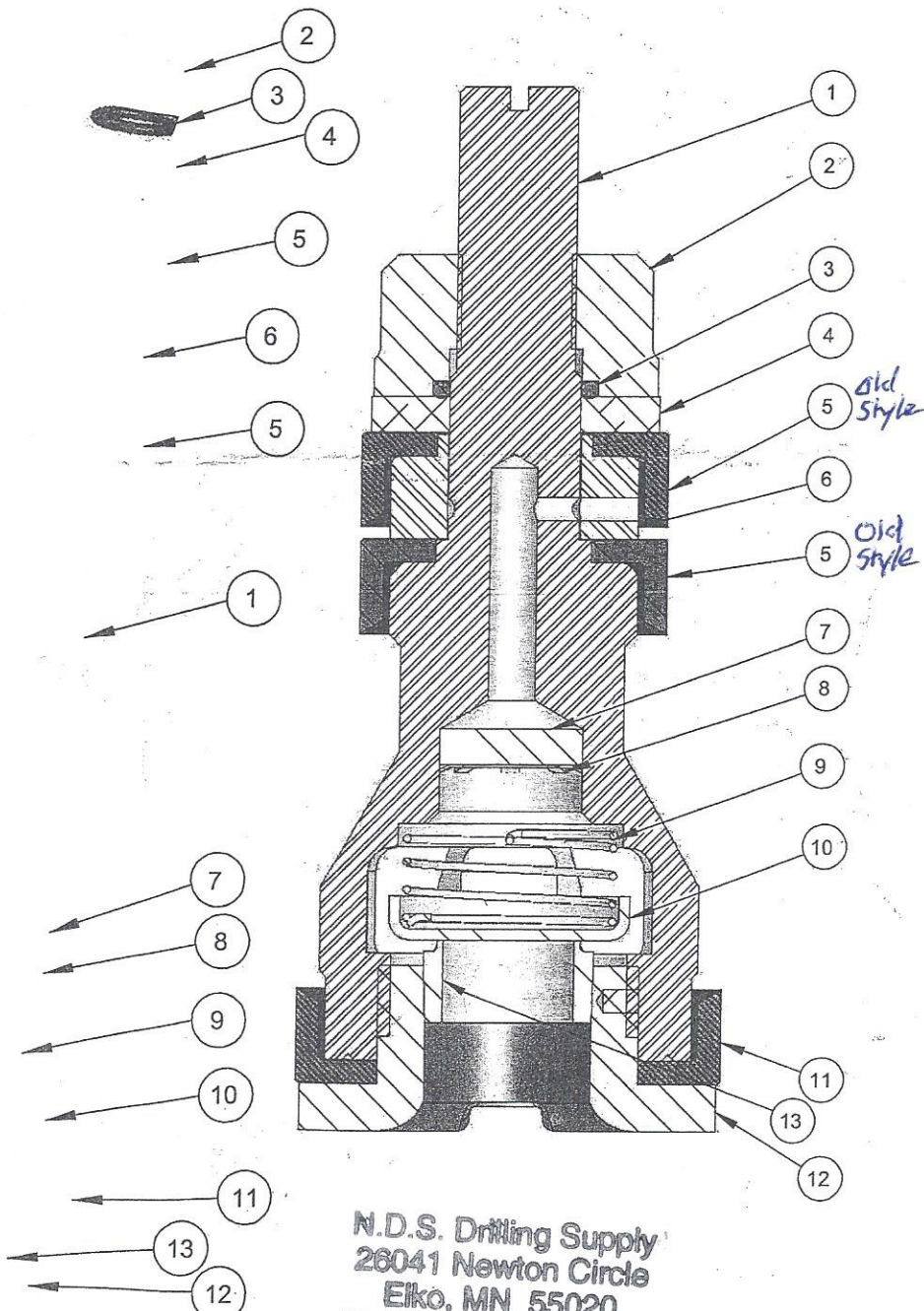
*** 1 Kit Required for 2 Plungers
NP = Not Pictured

FWS-17198A000

Ref #	Part #	Description	Qty Incl.
5	FWS-05505A013	Fabric & Rubber Cup	4
11	FWS-05505A014	Fabric & Rubber Cup	2
NP	FWS-05876A052	O-ring	2
NP	FWS-05876A053	O-ring	2
10	FWS-05876A068	O-ring	4
7	FWS-07227A010	Felt Filter Disc	2
8	FWS-15233A002	Filter Disc Retainer	2
9	FWS-11432A000	Valve Spring	4
10	FWS-17714A001	Valve	4
4	FWS-05030A110	Washer	2

FWS-17198A003

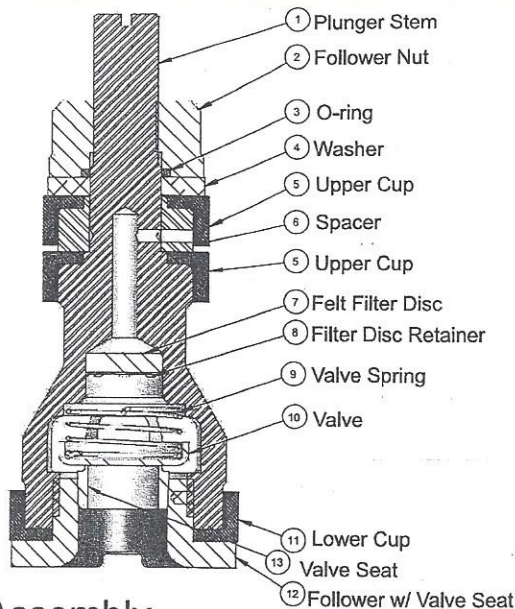
Ref #	Part #	Description	Qty Incl.
5	FWS-05505A013	Fabric & Rubber Cup	4
11	FWS-05505A014	Fabric & Rubber Cup	2
NP	FWS-05876A052	O-ring	2
NP	FWS-05876A053	O-ring	2
10	FWS-05876A068	O-ring	4
7	FWS-07227A010	Felt Filter Disc	2
8	FWS-15233A002	Filter Disc Retainer	2
9	FWS-11432A000	Valve Spring	4
10	FWS-17714A001	Valve	4
4	FWS-05030A110	Washer	2
NP	FWS-15427C002A	Liner, Upper	2
NP	FWS-15427C003A	Liner, Lower	2
NP	FWS-15429A000	Retainer	2



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Maintenance Guide

FIGURE I



Plunger Assembly

A. Assemble as shown above in Figure I. locking sealant not required if nylon tabs are in place.

B. The plunger parts should be drawn up until snug. Over tightening causes cups to distort causing heel wear and excess friction.

C. To reassemble cylinder, plunger and lower cap.

1. Put oil or grease on both plunger cups before inserting plunger assembly into cylinder body.

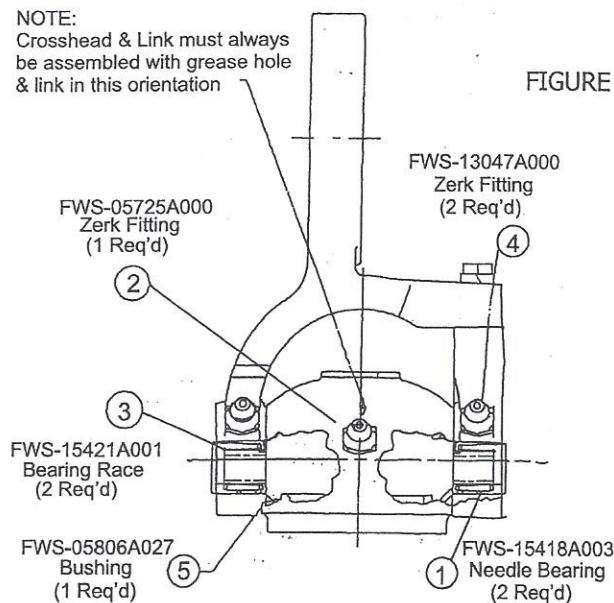
2. Clean the O-ring seating surfaces (lower cap, suction port, and discharge port). Replace O-rings if damaged. Do not use flat gaskets since they will cause misalignment, which will result in pump damage.

3. When assembling pump, draw lower cylinder cap bolts until they just start to tighten. Insert cylinder into crosshead and tighten nut which holds plunger to crosshead. Attach cylinder to main casting by alternately tightening the four mounting bolts. Tighten lower cylinder cap bolts last. Torque all bolts to 38ft lbs. max

D. Turn pump shaft by hand to be sure plunger operates freely.

NOTE:
Crosshead & Link must always be assembled with grease hole & link in this orientation

FIGURE II



Bearing Races & Bearings in Crosshead

Instructions for removing and replacing crosshead bearing races and bearings.

A. Remove bolts on link ear. Separate link and crosshead. Cut bearing races from crosshead being careful not to damage crosshead ear. Press needle bearings from link.

B. Clean all parts to be assembled.

C. Press needle bearing into link. Ensure oil hole in the needle bearing is aligned with the hole for the grease fitting.

D. Press bearing races on to crosshead ears. Use removable Loctite #242 to secure bearing races to ears. Wipe excess Loctite from surfaces.

E. Reassemble crosshead to link. Tighten ear bolts. Grease zerk fittings and rotate crosshead to ensure coverage of grease in needle bearing.

To Remove and Replace Cylinder Liners



FIGURE III



FIGURE IV

A. Cut old liner out with chisel. See Fig. III.

B. Smooth inside of cylinder body if necessary.

C. Add Removable Loctite #242 or suitable sealant to cylinder I.D., and both ends of cylinder liners. Press liner into cylinder. Roll or peen edges as shown. See Fig. IV.

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