

8N Hydraulic Lift –How To Repair Economically

by Tim Daley

If you have problems with your hydraulic lift on your N-Series tractor not performing the way it should, here is a method of first determining the problem, then working to resolve it. My '48n 8N has had lift issues for a few years and I finally decided to tackle it before winter hit when I would be in dire need of the tractor and the Dearborn back blade for plowing snow. At this point I want to suggest, because now, in hindsight, I should have taken care of the problem three years ago when the lift first started behaving badly, that you should not wait as I did which caused extra work on my part. I believe I ruined my cylinder, p/n 9N-510-D by running it with a bad piston for three years. It caused gouging in the cylinder wall from the original three-ring style piston that only got worse with each use and therefore would not hold pressure and leaked. The lift would drop within ten minutes after engine shutoff from the top of stroke with or without a load. Here, I will go through my steps in hopes that someone else may benefit from my experience and realize this is not a big project and that you have to be a licensed mechanic to do it. We must remember that these machines were designed so that the average farmer could tear them down in the field if necessary. I had a limited budget and so, after careful thought and inspection, did not drop my hydraulic pump and do a more thorough job of cleaning, *after* I determined my pump was fine based on a few observations. You, however, may have to drop your pump though, based on what your test results show. Shown for reference purposes are the scans from the Master Parts Catalogue for the 8N hydraulic pump and top cover, FIGS 1 and 2, with the hydraulic cylinder and the linkages. I strongly suggest you read this document all the way through before you begin wrenching so you get an idea of what you need to do and what parts you may need to buy. You may elect to do some preventative maintenance while you have the top cover off and will need to inspect all the linkages for worn parts and replace if you do. As I said, I had a limited budget, and made the decision not to drop the pump as it was in good shape, but did check out all the internal working parts. If I had found excessively worn out parts, I would have made the effort to buy them new. You will only need some basic tools to do this so let's begin.

I. TOOLS REQUIRED

Air Compressor –I used a small single cylinder, electric 2HP model –not much pressure, really only good for blowing off parts. It certainly would not power pneumatic tools.

Wet/Dry Vacuum

Drip Pans & Large Washtub or Plastic Kiddie Swimming Pool

9/16" Open End Wrench (I used all hand tools - I suppose you could use air tools)

11/16" Open End Wrench/6-pt. Box End

11/16" 6-Pt. Sockets & Wrenches w/ both 3/8" and 1/2" drives

1-1/16" Combination Wrench or the Ford Plow Wrench, 9N17014, 11/16" x 1-1/16"

Pliers –standard and needle nose

Hemostats –optional if you have a small, long nose pair of needle-nose pliers

Screwdriver

Knife

File and honing stone

Putty knife/scrapper

Workbench

Mineral Spirits, 3-5 Gallons

Hand Garden Sprayer

Rubber Gloves, Safety Glasses, Safety Boots –steel toe is best

Shop Rags, Shop Grade Paper Towels, Scotch-Brite™ Pads

8N Operator's Manual –original or copy

8N Master Parts Catalogue; I&T F-04 Manual

Torque Wrench

II. *NEW PARTS

NAA-530-B Piston –this is a better design than the three steel ring style used from the 9N up to the NAA, however will work on all N-Series Models. It uses a rubber O-Ring in a groove on the piston OD. Some pistons come with the O-Ring and back-up washer, but most times they are sold separately. The backup washer/wiper is a leather ring, however, some claim that a better neoprene wiper is available from CNH.

NAA-533-A -O-RING for the NAA piston

NAA-473-A – Leather Backup Washer, or

87051231 –Case/New Holland part number Neoprene Backup Washer/Wiper

8N-638 – Safety Relief Valve –optional but recommended you change it

5 Gallons Special Ford Spec MC-134-D Hydraulic Oil or equivalent

Hydraulic Lift Cover Gasket Kit

Gasket Sealer –optional

1" x 2" x 16" piece of wood

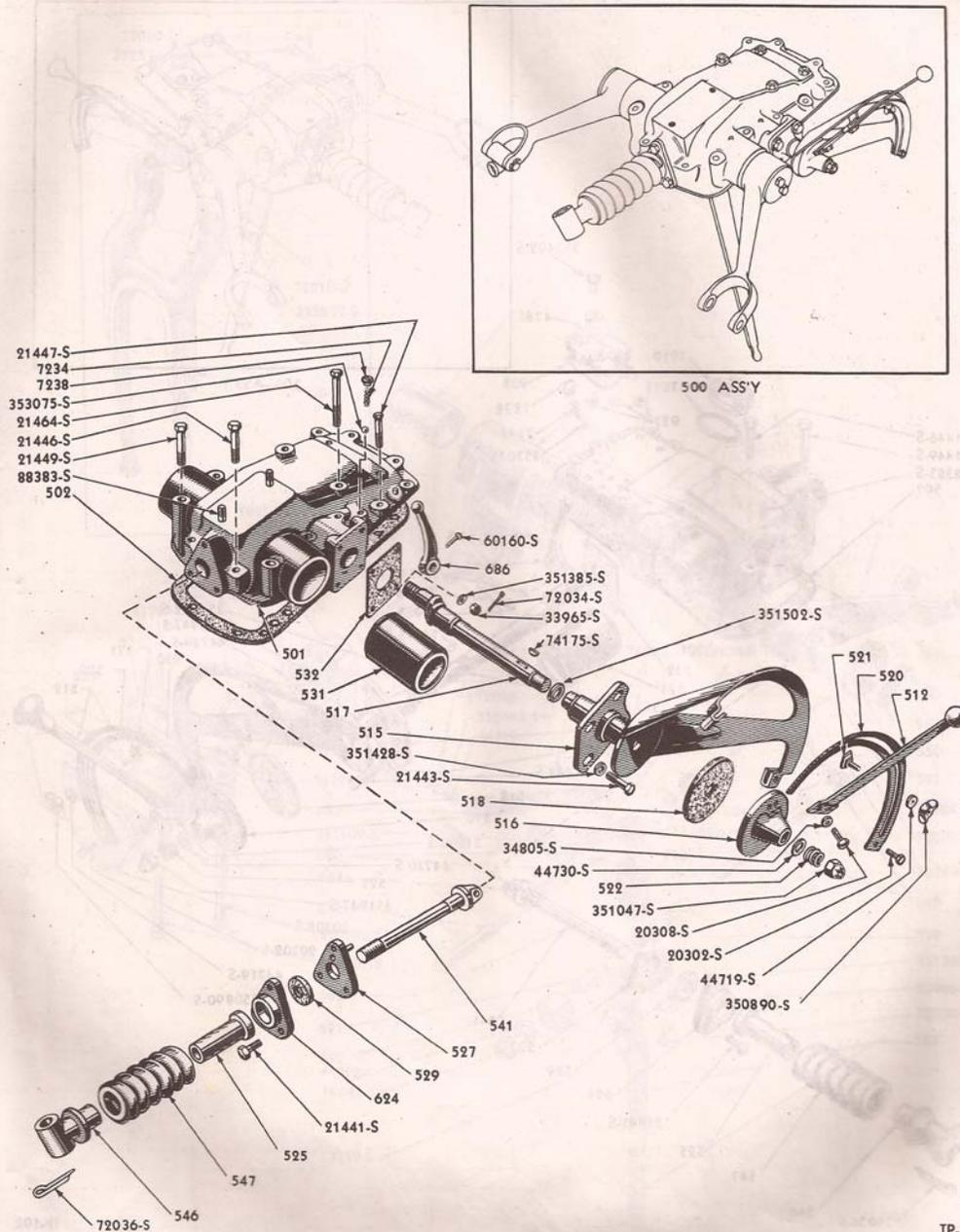
Troublelight; worklight; and flashlight

*It may be necessary that you will have to purchase additional new parts based on your particular situation after you remove everything and perform visual inspections of all major parts involved. I also recommend that you check your cam follower pin for wear and purchase a new one if excessive wear is present. The draft control linkage must be adjusted correctly too in order to get optimum performance from your lift. The I&T F04 Manual describes proper adjustment procedure and Mr. Zane Sherman in Alabama makes and sells a special jig/fixture to adjust the 8N linkage. He can be contacted at: wzsherman@bell-south.net –your choice on which method you want to use.



FIG 00 –Part Number 8N-638, Safety Relief Valve and stub-style wrench.

Often times your lift problems can be solved with a quick, easy, inexpensive fix. Everything may be working properly but your safety relief valve is bad and so replacing it is relatively a fifteen minute to half hour job. It does *not* require you to remove the pump or top cover. You simply remove the left side inspection cover, reach inside to the bottom where the pump is, loosen the valve, and replace it with a new one. You will, however, need a very short handle 11/16 open end wrench. You can cut off an old wrench you have lying around your shop that doesn't have too much sentimental value to it or get a special stub-length wrench available from most all tool manufacturers. The reason for the short length wrench is that it needs to clear the inside wall of the center housing and a standard length tool won't work. You also need to use the open end side. The PTO drive shaft is right above the valve and runs through the pump so clearances are minimal. If you need to remove the pump, then the PTO shaft is removed and the valve is much easier to get to.



1948-52 HYDRAULIC LIFT COVER AND RELATED PARTS

Basic numbers only shown on illustration. Order by Part Numbers shown in list of parts.

TP-101

FIG 1 -8N Lift Cover parts diagram from the Master Parts Catalogue.

III. PROCEDURE

The first thing you need to do is put a load on your lift arms like hooking up an implement of some sort. I used my Dearborn back blade because it was handy. You can also chain down your lift arms to the axles to simulate a load. You are going to determine if you can see any leaking coming from the hydraulic cylinder or pump.

Engage your PTO shifter lever, located on the left side of the seat as you are sitting, clutch pedal in, engine off.

Remove the six bolts that hold the PTO shifter plate and lever on using an 11/16" wrench. See Figure 3. You will also need to remove the running board bolts on the front bracket only as the whole running board assembly needs to come off first. Two bolts also hold the brake pawl bracket on and two bolts hold the running board bracket on. Carefully work the plate off and place in a safe place –a wash basin is good. There should be a paper gasket on the back of the plate too, remove that also. Remember where the bolts go. There are three different sizes, all are 7/16-14 hex head, Grade 5 bolts. Two are ¾" long; two are 1.0" long; and two are 1-1/8" long. Be sure to get them in their correct positions at reassembly. Likewise, the right side inspection cover where your dip stick goes in needs to be removed as well. Take the dip stick out and set in a safe place. Remove the running board bolts from the front bracket. Remove the six 7/16-14 hex head bolts that hold the inspection cover on. You also have the brake pawl plate and running board bracket attached here too. Keep the running board bracket attached to the running board. Then like the left side, carefully remove the plate and paper gasket and set aside. The bolts are listed in the MPC as:

21440-S8 ... 7/16-14 x ¾" Hex Head Bolt ...4 per tractor, 2 per side, one on top, one on bottom on each cover

21441-S8 ...7/16-14 x 1-1/8" Hex Head Bolt ...4 per tractor, 2 per side, brake sector to cover to housing

21443-S8 ... 7/16-14 x 1.0" Hex Head Bolt ...4 per tractor, 2 per side, running board to cover to housing



FIG 3 –Left Side Inspection Cover Removed

Start engine. Warm up for 10-15 minutes then raise implement by moving the Touch Control Lever located on the right side of seat, to the upper most part of the quadrant. This will put the lift up to its highest position.

CAUTION: With engine running DO NOT PUT YOUR HANDS INTO THE PUMP HOUSING as the PTO drive shaft is turning. Get down on ground next to the open inspection cover, and with a good light in hand, look into housing and see if anything is obvious. Bubbles or drips would be an indication of trouble areas. Next, SHUT OFF ENGINE and look upwards at the hydraulic cylinder and note if there is any leakage coming from the cylinder. In my case, there was a constant drip, moderately heavy, and my lift dropped completely down within ten minutes. Usually, replacing the piston would fix this problem, so I proceeded to do just that.

Get a drain tub/pan underneath the differential case and using a 9/16" open end wrench and the Ford Plow Wrench or a 1-1/16" wrench, first loosen the diffy drain plug with the 9/16" open end wrench (you need an open end 9/16" wrench as the plug is a pipe fitting with a square head) and let it drain the hydraulic oil from the rear end. Then, position the drain pan under the big hydraulic oil drain plug, the one in the middle, NOT the one furthest to the front of tractor as that is your engine oil drain plug. You should have a large enough drain pan to ensure both diffy case and hydraulic pump drain plugs are capable of catching all the old oil. Using a 1-1/16" wrench, remove the drain plug and rubber gasket to let the pump oil drain. Set both plugs in a wash pan for later.

At this point if you did not see any areas of leaking from the cylinder, or signs that the pump might have a crack or a bad gasket, many times the problem can be remedied by simply replacing your Safety Relief Valve. This will require an 11/16" open end wrench that you will have to modify by cutting it down short to clear the inside walls of the center housing. I used a Craftsmen short handle wrench specially made for tight places. The Safety Relief Valve is located on the pump below where the PTO shaft comes through. If you plan on removing the pump too, you will need to remove the PTO shaft first so at this point you could remove it now. Either way, with the PTO shaft removed, the Safety Relief Valve is much easier to replace, otherwise you can replace it when you have the pump out. Therefore, if no signs of leaking were obvious, you can try a new Safety Relief Valve and re-assemble in reverse order, add new oil, and then try the lift test procedure again.

IV. REMOVING TOP COVER

Be sure to put the Touch Control Lever all the way down; the Draft Control Lever down (on 8N Models); and the PTO Lever in Engaged Position. Keep the Engine Off.

You will first need to remove the seat and spring from the top cover –two studs with nuts, using an 11/16 wrench. Next, remove the cotter pins that hold the lift arms to the linkage pins (p/n 9N-595) using pliers and a screwdriver. There are four cotter pins here, but you only need to remove two –one on each side from one pin, not both, whichever pin is easiest to remove as sometimes, like in my case, the side with the leveling crank had a frozen pin. Also, now's a good time to make a mental note on the condition of those cotter pins and, if need be, pick up a dozen at your local hardware store. They are all listed as part number 72035-S7, 1/8 x 1 Cotter Pin. Remove linkage pins to free lift arms and carefully set to the sides on the axle trumpets. Next, you have two options here. You can remove the yoke pin, p/n 8N-486 from the 8N-535 rocker,

or, as I had to do because this pin was also frozen, remove the shorter pin, p/n 9N-560. Remove the cotter pin, p/n 72036-S7, 5/32 x 1, that holds the rocker pin to the control spring. Remove pin from rocker. Later 8Ns had a shorter pin replace the long pin. See Figure 4.

Then observe that there are 14 bolts that hold the 8N top cover onto the center housing, 15 bolts on the 9N, which run along the perimeter of the cover. The part numbers are: 21449 (4); 21446 (2); 21447 (7); AND 21464 (1). Caution must be exercised here as there are also four bolts which hold the hydraulic cylinder onto the top cover. DO NOT REMOVE the four bolts which hold the cylinder on.



FIG 4 –Lift Arms & Rocker Pin Removed

Using a crow bar or similar tool, gently pry up from the back, under the control spring. The 8N hydraulic system uses a control arm linkage that pilots into a mating part on the pump in the bottom. Once the top cover is loosened, you will have to reach inside the

right side inspection hole and carefully guide the rod up out of and clear of the pilot hole as you lift the unit up, then once the control arm is out, move unit slightly to the rear off the tractor. Now it is ready to completely remove from the tractor. Have a suitable workbench handy as the cover is a little heavy and you don't want to drop it. Wearing Steel-Toed boots is recommended. Have a buddy help you lift the top cover off to be smart and safe. Remove the cylinder and set the top cover in the wash tank. I used a galvanized wash tub from my local farm supply house, but you could use a plastic kiddie swimming pool too as long as it is large enough to hold the top cover unit for washing. See Figures 5 and 6.

Washing all the parts first will help you to determine function and whether they will need to be replaced. Once cleaned, it is easier to handle the parts without getting messy and constantly having to wipe your hands off.



FIG 5 –Top Cover Removed & On Workbench. Note Control Arm In Vertical Position On Unit.

It will be easier to remove the hydraulic cylinder from the top cover once you get the top cover off the tractor and onto a suitable workbench. You must exercise extreme care with the unit as it is cast iron and heavy, and you do not want to drop it and crack it. Then you will need to find another top cover and that may not be easy or cheap. Also, you do not want to bend the control arm that extends upwards as shown when the top cover is upside down on your workbench.



FIG 6 –Top Cover in wash tank being cleaned. Use wire brushes, old toothbrushes, Scotch-Brite™ pads and a hand garden sprayer. Blow off with compressed air often.

I use mineral spirits to clean my parts with as I have found it to be about the cheapest, and works very well to dissolve grease, oil, crud and whatever else is in the way. It is the same stuff as paint thinner and they use it too for charcoal lighter fluid. The price will vary per gallon however depending on where you buy it. NAPA charged me 13

dollars/gal. TSC has it for about 11-12 dollars/gal. I found the cheapest to be from MEIJERS at 7 dollars/gal. SAF-T-CLEAN systems use it too so if you can get it from them in bulk, it may be the cheapest of all. It does a very good job and you may want to wear rubber gloves as some may have sensitive skin and it will tingle to the unprotected skin. What medium you use will be your choice as others have used kerosene, diesel fuel, brake fluid, and even gasoline. Be safe and be wise whatever you use. Use in well ventilated area and keep all flame sources away.

V.CYLINDER CLEANING, INSPECTION



FIG 7 -Noteworthy here is that the original 9N/2N top cover and linkage is different than the 8N and parts are *not* interchangeable.

Pictured here is a top cover/cylinder from a 2N. Look close and you can see that it uses four *hex* head mounting bolts and the draft control linkage guide rods pilot into the two holes on either side of the nose on the front bolt bosses of the housing. The original 9N design only had draft control –*NO* Position Control. This used cylinder proved to be

in good shape and so it is what I replaced my scored bore 8N cylinder with. The hydraulic cylinder unit is the only part that can be used with the 8N linkage, but you will have to do some snag grinding. The cylinder is the only part from a 9N top cover that can be used on an 8N.



FIG 8 -The 9N-510-D cylinder from my 8N. Note the part number in raised cast letters & numerals as well as the casting date code below.

My cylinder housing from my 8N shown has "74" with a foundry trademark prefix of unknown origin on the lower part of the underside body. I assume this was a casting date code. Also take note of the intake port centered on rear mounting face. This is where the oil is pumped into the cylinder. You will need to put your air nozzle in here to shoot the old piston out exercising caution as it will act as a cannon. Aim at a wood wall or board.



FIG 9 –Here are the two cylinders for comparison. On the left is the one from the 2N top cover.

In the picture of the two cylinders shown in FIG 9, the right side shows my 8N cylinder. Note that the 9N/2N unit used four hex head bolts and the 8N unit used four square head bolts. The square heads butt up against the machined wall of the unit and prevent the bolts from turning. This was a better system than the hex head bolts. If you look close at the legs of the machined bosses and you can see a nice 90 degree area from the mill cutter path. The EC Level Changes made over the years to the cylinder amounts to four as the unit part number added letter suffixes with letter "D" being the last change, 9N-510-D.



FIG 10 -Underside of both units –machined dimensions are identical.

Figure 10 above shows the underside of both units. Dimensionally they are virtually the same as far as machining specs go. Look close and you can see the cast clearance on the nose of the 8N unit on the right. Each unit's pistons are shown too. Both are of the old, three-ring style.

VI. CYLINDER REMOVAL & REINSTALL

Figure 11 shows the hydraulic cylinder mounted to the underside of the top cover by the four bolts that you did not loosen when you took off the top cover. Note draft control linkage. The hydraulic cylinder used on the 8N was slightly modified from the previous 9N/2N cylinder. Because of the difference in the linkage setup, the 8N has a cast scallop, see FIG 12, to ensure clearance of the linkage as to not hit the housing when fully engaged. If you have to replace the cylinder with a new, aftermarket one, chances are the scallop is not present and so you will have to snag grind one in using caution not to go too deep and break through the wall of the housing.

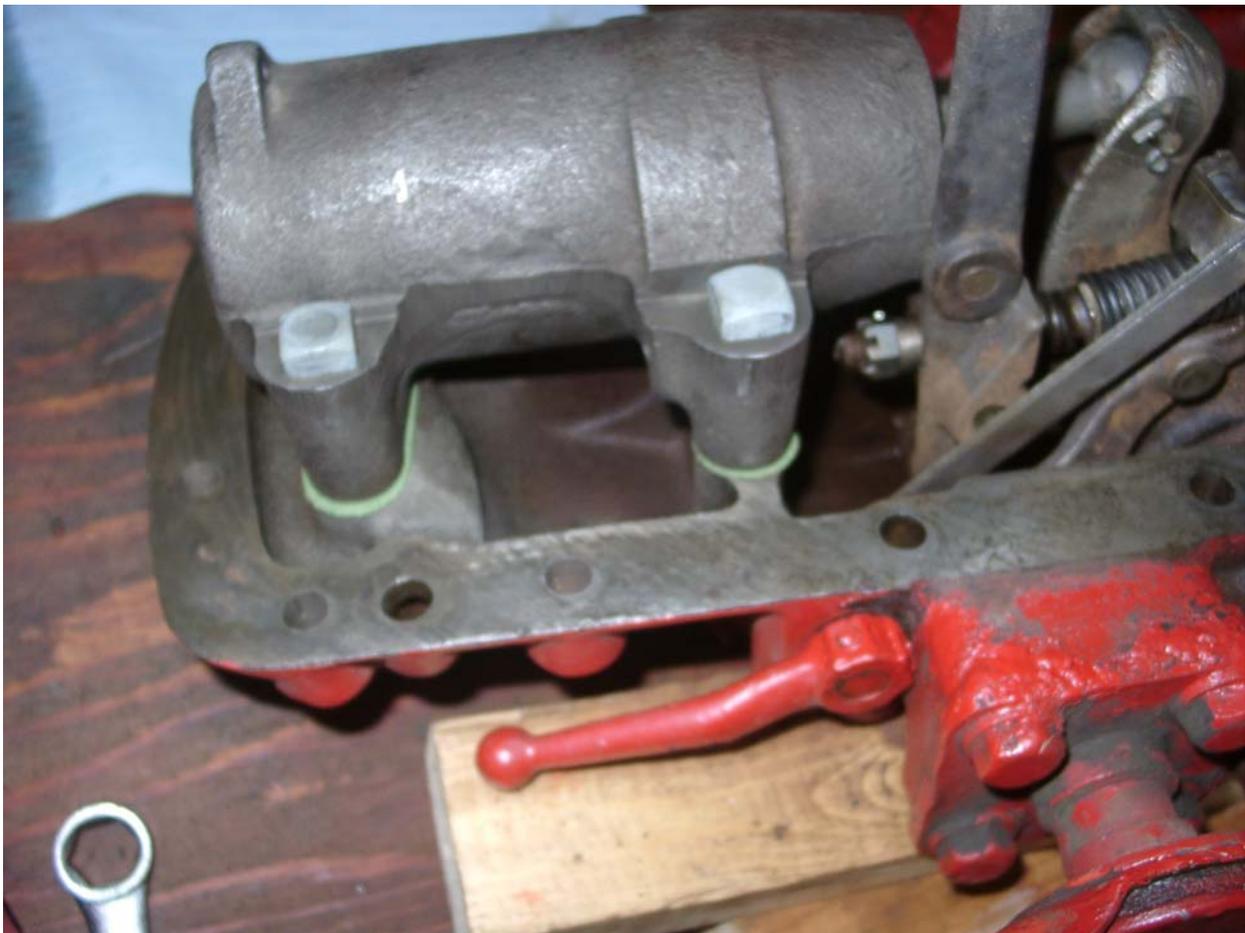


FIG 11 -9N-510-D Hydraulic Lift Cylinder cleaned and assembled with new piston and gaskets. Note the square head bolts. Early 9N/2N setups used hex head bolts.

Remove the four square head bolts and hold the dogbone while sliding the unit off. You will need to remove the old piston, scrape off the old gasket material, and clean up the unit in a bath of mineral spirits. The old piston can be removed by shooting a blast of air into the intake port on the housing face. Be sure to stay clear as it will shoot out like a cannonball. All machined surfaces must be clean and free of old paper gasket so a knife and/or putty knife to scrape off is needed. You can use a file or honing stone to run over the surfaces to ensure they are flat. Check the linkage and make any adjustments if needed. In the picture shown in Figure 11, note the Draft Control Linkage end with the castle nut. The nut is turned too far in and should be backed off so that only one or two threads are showing. This is the correct setting to ensure that when the lift arms are completely all the way down, they do not hit the ground. Cleaning both the cylinder and top cover real good in a tank of mineral spirits using toothbrushes, wire brushes, and Scotch Brite™ pads is an important step so do not skimp on the cleaning. Visually check cylinder bore for unusual wear and defects.



FIG 12 –Cylinder used on the 8N has to have the scallop for draft control linkage to clear. Aftermarket and early 9N/2N models do not have this.

Once you have the cylinder and top cover washed and air-blown dry, they are ready for re-assembly. The NAA piston shown in Figure 13 is going to replace the older, three ring piston in this case. The rubber O-Ring is slipped over the piston OD and pressed into the OD Groove of the piston. Next, slip the leather backup washer/wiper or, if you prefer, the CNH neoprene washer over the piston the same way and slip into the groove behind the O-Ring. The wiper goes towards the open side of the piston end, where the dogbone ram fits into. Apply plenty of fresh, clean hydraulic oil liberally over piston, then press into the cylinder with your hands. Do not force it, do not use a hammer, do not use a press.

Using the three gaskets from the new gasket kit, set in place and carefully mount the cylinder. There are two about the size of a quarter and they go under the legs of the front of the cylinder, where the open bore is. The longer oval-like gasket goes under the back legs with the oil inlet port in the center. Do not cheat here and say you don't need gaskets under the two front legs as they keep the whole unit balanced. If you don't put those two round gaskets under the front legs, your unit will tilt just enough to cause misalignment and will leak. You will need to hold the dogbone and help guide it in the piston when doing this taking care not to tear the gaskets. Align gaskets visually then insert the square head bolts and hand tighten nuts. A final check of proper alignment and that the gaskets are seated correctly, you can go ahead and tighten down to 57 ft-lbs. Read further down about torque specs.



FIG 13 –New, NAA-530-B Piston with NAA-533-A O-Ring, shown on top, and neoprene washer/wiper, shown on bottom below the O-Ring, available from Case/New Holland, Part Number 87051231



FIG 14 –Original style hydraulic piston, p/n 9N-530; new NAA-533-A rubber O-Ring; and package for the CNH Neoprene Backup washer, p/n 87051231.



FIG 15 -Note scoring on the old piston. The cylinder wall was just as bad.

Figure 15 shows my old 9N-530 piston. Note the three steel rings, but more importantly, the scarring on the OD. This side was located on the bottom of my cylinder unit and the inside wall of the cylinder was scored with grooves also, if not as bad, worse. I surmise that bad rings, and/or some debris got trapped in between the steel rings and the back and forth motion of the piston caused the scoring. The resulting grooves were enough to prevent a tight oil seal and thus the root cause of my leaking problems. Lessons Learned here –I had issues for three years before I tackled this project and probably could have at least salvaged the hydraulic cylinder by taking on this project when I first showed signs of lift problems. You can use your old piston if it looks good, even replace it with a new, three-ring style piston, but here I would recommend you spring for the NAA-530-A style piston that uses a rubber O-Ring and either the leather backup washer or, what some now claim is better, the CNH neoprene wiper. The neoprene wiper is easier to work with but I'm not totally convinced it is better functionally.



FIG 16 –Shown left to right, NAA-533-A O-Ring; NAA-473-A Leather Backup Washer; and alternative Neoprene Seal/Backup Washer, CNH P/N 87051231

The leather backup washer for the NAA-530-A piston, part number NAA-473-A, is a pain to work with and can be replaced with a neoprene seal, part number 87051231 shown in FIG 16 and available from your local CNH dealer. The problem with the leather backup washer is that you need to expand it some to get it over the OD of the piston by soaking in hot water for 5 minutes, or exposing to a lamp in order to get it heated up to expand. If you just try to slip it over the piston, chances are it will tear. Once the leather washer/wiper is in the OD Groove of the piston, you need to work it in and down so it is recessed and not exceeding the O-Ring diameter. My attempts to use the leather washer were unsuccessful. I don't know if I got the leather expanded too much or what exactly I did wrong, but the leather would not shrink down enough in order to allow a good fit and function. Thus, getting the piston into the cylinder bore would be futile. I sprung for the five dollar CNH seal and we'll see how long it lasts. The seal fits in the groove perfectly. Placement of the wiper/backup washer should be so that it is

on the side of the piston that is open where the dogbone ram fits into with the O-Ring in front or towards the rear of the cylinder unit. See FIG 13.

VII. CENTER HOUSING AND HYDRAULIC PUMP CLEANING

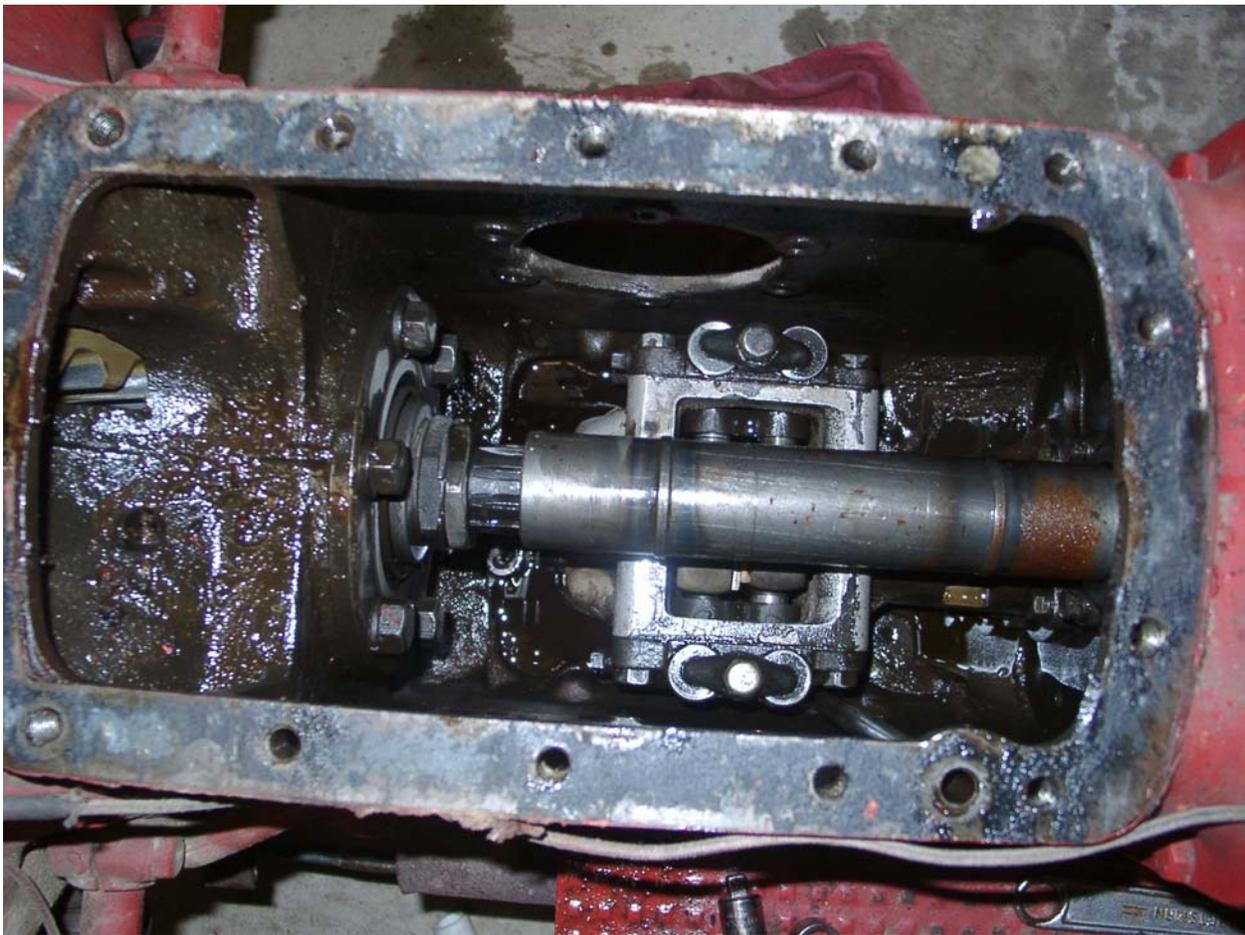


FIG 17 –Center Housing / Top Cover Removed Showing Hydraulic Pump.

The bottom of the center housing holds the hydraulic pump itself –see FIG 17. Note that on either side of the pump are the valve chambers, part numbers 9N 621 and 9N-622, each held on with the top clamp, p/n 9N-609, that looks like a set of Mickey Mouse ears. I determined that my pump did not need dropping and cleaning, however if I had the time, I would certainly do it. I did not show any cracks in the pump, any

leaks from gaskets, nor was the oil dirty as I have always kept it clean. Therefore, after a complete washing and cleaning of the inside, by reaching inside the center housing I was able to remove the valve chamber clamps, remove the pins, plungers, and springs from the chambers, clean out the chambers thoroughly, and clean off the parts as well, then re-install. See FIG 19. I recommend that you clean out the pump and center housing before you take the valve chambers apart.



FIG 18 –Center Housing w/Hydraulic Pump showing below the drive shaft.

The next step is to clean out the bottom of the center housing and hydraulic pump without removing the pump itself. This is why I call this the economical method while working on a limited budget. As I stated earlier, upon inspection of the pump, it was

determined that it did not have any leaks or cracks and it was in relatively good condition. Therefore, since I found that the root cause of my lift troubles was in the leaking cylinder, the pump would not warrant removal. This is going to be your call whether to drop your pump or not. To do the best job, yes, I would go ahead and remove the pump, disassemble, and clean thoroughly especially if you have not pinpointed the trouble with your system. Closer examination of the pump out of the tractor will undoubtedly show any defects. Since access to the valve chambers on the pump can be performed with the pump still attached, I performed this operation too. I recommend that you perform the removal and reinstall procedure whether you drop the pump or leave it in.

Scrape old gasket and crud off the center housing machined surface. I used an old pocket knife, a putty knife, wire brush, file, and lots of elbow grease. Next, reach inside the center housing bottom to remove solid crud that has collected on the bottom. Temporarily insert the drain plugs and wash down the pump reservoir with multiple flushes of mineral spirits. This is where I used a hand garden sprayer with mineral spirits but I suppose you could use a power washer if you have one. **DO NOT USE WATER** to wash down the inside housing! You can remove the drain plugs and catch the mineral spirits, filter the solid crud out and reuse in the sprayer. I suggest you spray down multiple times but you can use fresh, clean mineral spirits each time if you choose. A wet/dry vacuum can also be used to suck out the crud. Do as many washes as needed in order to get the whole inside clean. A final spray down with clean mineral spirits then hand wipe the inside with shop grade paper towels should do the trick.

The next step will be to remove the valve chamber components for cleaning and inspection. There are two valve chambers, one on each side of the pump. It is advised that you work on one side first and only remove one chamber port at a time and keep each separate and identified so it goes back into the same port. Carefully remove all the components noting how they come out as the reinstallation will be important. This is another reason to have a Master Parts Catalogue handy or the I&T F-04 Manual. Wash all parts in a bath of mineral spirits, using a toothbrush to scrub off any solid crud. Blow off with compressed air taking caution not to blast too hard that you lose the parts. Clean out the open ports real good with clean mineral spirits



FIG 19 –Valve chamber components removed, cleaned and inspected.

FIG 19 shows the valve chamber parts, 9N-636; 9N-646; 9N-628; 9N-629; 9N-626; 9N-627; and 9N-647 removed as well as the top clamp and bolt, part numbers, 9N-609 (clamp) and 21442-S (7/16-14 x 1-3/8" hex head bolt). The parts will require using a small pair of needle nose pliers but they have to be long enough to reach all the way to the bottom of each chamber to remove and reinstall the tiny parts. As shown in FIG 19, I used a pair of hemostats and they worked well. If any parts look damaged, you can get them new from Dennis Carpenter, Just8Ns, and others. After the valve chamber ports are cleaned as well as their components, reinstall them in the proper order from the ports that they came out of. You need to hold the top clamp down taking notice that it is well centered over the tops of each side, then tighten the clamp bolt down. Repeat these steps for the other side of the pump now.

VIII. REASSEMBLY

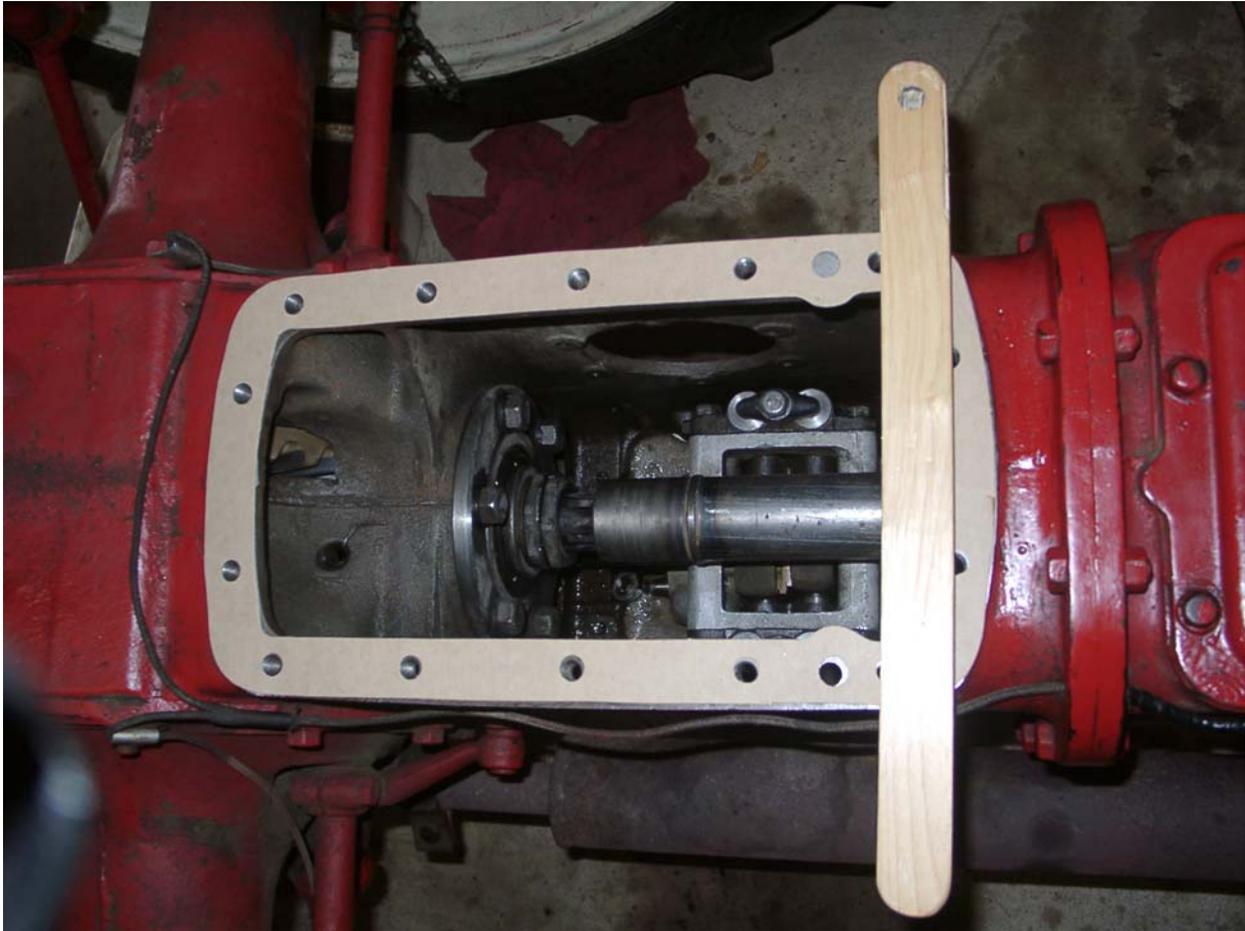


FIG 20 –Center Housing with new gasket applied, 1" wood spacer to hold top cover in place while installing control rod.

The cleaned pump and center housing is all ready for re-installing. A new gasket is in place and you can use a gasket cement, but very little is advised. Use only a minute amount to help hold the gasket in place. Spread it evenly and minimally with your clean finger. Avoid getting any inside the housing and by all means stay clear of all holes, especially the oil pickup tube port. When you set the top cover back on the center housing, set the front on the board so you can reposition yourself to reach your left hand into the inspection cover access hole on the right side, the one where your dip stick goes, and help guide the control arm into the pilot hole with your right hand on the pump base. Then it becomes easy to slide the wood block out carefully letting the top cover down in front. Once the top cover is down, double check that the control arm

is securely in the pilot hole of the pump and should have good movement. Visually align the cover to the bolt holes and begin inserting the bolts but leave loose. Note that there are three different sizes of bolts so it is important that you get them in the right holes. This is where a Master Parts Catalogue comes in handy as it will show you exactly which bolt goes where. If one is not available, use common sense and make a drawing as you take them out so you know which goes where. Basically, the long bolts go through the tallest bosses, the short bolts go in the shorter bosses, with the medium length bolts going in the medium size bosses. All bolts are 7/16-14 Hex Head Grade 5 class bolts and will be torqued down at the final step. Right now you are only going to get them hand snug, relatively loose. The two short $\frac{3}{4}$ long bolts go one on top, one on bottom of covers. Next, two 1-1/8 long bolts hold the brake sector brackets on each side, and finally, 1.0" long bolts hold the running board brackets on.



FIG 21 –Torquing down the lift cover requires a 3-step procedure.



FIG 22 –A good torque wrench is highly recommended for working on this project as well as other technical projects on your N-Series tractor.

Be sure you read and understand the instruction sheet with your torque wrench. It is of great importance when torquing that you perform the procedure correctly. Technically, torque setting is reached as the tool is in motion in the tightening mode. Usually, you work from the inside out when torquing down components. Some parts like cylinder heads have a specific sequence to follow. After you have all the bolts hand tight and the cover positioned exactly where it needs to be, perform a quick test of all the linkage levers to be sure all is right. You will want to double check the control arm at this point to ensure it is still in the pump pilot hole, and there are no areas showing a pinched gasket. Move the draft control lever up and down carefully to be certain that it is working properly. Do not force it if it doesn't move easily. If it seems like it is binding,

something is wrong and you will have to check the control arm and/or the clearance ground on the hydraulic unit itself. Removing the top cover again to check is then required. You want to get it right the first time and not find out later it is binding up. I also highly recommended that you follow the common three-step tightening procedure. For example, the I&T F0-4 Manual states that the 14 bolts on the top cover are to be torqued to 53-60 Foot-Pounds. I torqued mine at around the mean value, 57 ft-lbs. Working in three phases, I first set the wrench to 19 ft-lbs and began tightening the 14 bolts in a criss-cross pattern from the inside towards the outside. Then, phase two, I set the wrench to 38 ft-lbs and repeated the sequence. Phase three had the wrench set at 57 ft-lbs and once final torque setting was applied, was rechecked one last time.

GENERAL TORQUE SPECIFICATIONS CHART FOR ENGLISH FASTENERS (in Foot Pounds)*

MATERIAL OR GRADE BOLT SIZE	SAE 2 (Mid Steel)	SAE 5	SAE 8	SOCKET HEAD CAP SCREWS	BRASS	Stainless AISI TYPE 303
1/4-20	6	11	12	13	5	5
1/4-28	7	13	15	16	6	7
5/16-18	13	21	25	27	8	9
5/16-24	14	23	30	33	9	10
3/8-16	23	38	50	52	15	17
3/8-24	26	40	60	60	16	18
7/16-14	37	55	85	86	23	25
7/16-20	41	60	95	95	25	28
1/2-13	57	85	125	130	32	37
1/2-20	64	95	140	145	34	40
9/16-12	80	125	175	180	44	50
9/16-18	91	140	195	210	48	54
5/8-11	111	175	245	255	68	75
5/8-18	128	210	270	290	73	80
3/4-10	180	300	425	410	104	115
3/4-16	200	330	460	445	115	125
7/8-9	275	450	660	580	155	170
7/8-14	300	490	700	615	170	185
1"-8	415	680	990	830	235	260
1"-14	435	715	1050	880	250	270

GENERAL TORQUE SPECIFICATION CHART FOR METRIC FASTENERS (in Newton Meters)*

MATERIAL CLASS BOLT SIZE	4.6	4.8	5.8	8.8	9.8	10.9	12.9	
MM	INCH							
5	.197	3	4	5	7	8	11	12
6	.236	5	6	8	12.5	14	17	20
6.3	.248	5.5	8	9.5	14	16	21	24
8	.315	12	16	20	30	34	44	50
10	.394	23	32	40	60	70	85	100
12	.472	40	56	70	103	120	150	180
14	.551	65	90	110	167	190	240	280
16	.630	100	140	170	270	290	380	440
18	.709	137	177	225	350	—	480	580
20	.787	200	—	330	520	—	740	860

* These torque values are approximate and should not be accepted as accurate limits. Indeterminate factors (surface finish, type of plating and lubrication) in specific applications preclude the publication of accurate values for universal use. Manufacturers of various types of equipment usually provide specific tightening instructions which should be followed. DO NOT USE the above values for gasketed joints or joints of soft materials. DO NOT USE your torque wrench for values greater than its maximum scale reading.

TORQUE UNITS CONVERSION CHART

MULTIPLY NUMBER OF TO OBTAIN	Inch-Ounces	Inch-Pounds	Foot-Pounds	Meter-Kilograms	Newton-Meters
Inch-Ounces	1	16	192	1389	141.6
Inch-Pounds	.0625 ¹	1	12	86.80	8.851
Foot-Pounds	.005208	.08333 ²	1	7.233	.7376
Meter-Kilograms ³	.0007201	.01152	.1383	1	.102
Newton-Meters	.007061	.1130	1.356	9.806	1

¹ or divide by 16
² or divide by 12
³ Meter-Kilogram (mkg) is also known as Meter Kilopond (mkp)

All Armstrong Micrometer Adjustable Torque Wrenches comply with both American Standard ANSI/ASME B107.14M, and International Standard ISO 6789

FIG 23 –Torque reference chart. Be sure torque wrench settings are correct.

The chart shown in FIG 23 shows torque setting values for many common fasteners in both inch and metric units, and a conversion table showing formulas to determine Inch-Pounds; Inch-Ounces; Foot-Pounds; Newton-Meters; and Meter-Kilograms. Ford specs are commonly listed in foot-pounds. The I&T F04 Manual shows the top cover to be torqued at 53-60 Foot-Pounds, or 72-81 Nm. My torque wrenches have both Inch-Pounds and Newton Meters. I had to convert Foot-Pounds to Inch-Pounds in order to set my wrench correctly. By the table shown, I multiplied 57 (mean value) Foot-Pounds by 12 to get 684 Inch-Pounds. I also double checked my work by doing the Nm conversion also. Taking 57 times 1.356 I got a value of 77.29 Newton-Meters. Since my torque wrench has both inch-pound and Newton-Meter scales, I simply set it to the 684 Inch-Pound scale then turned the wrench 180 degrees to the Nm scale and observed the setting to be accurately set at 77.3 Nm. I heavily advise that you read and understand how a torque wrench is used if you haven't used one. You never use it to loosen a fastener and never over torque the fastener.

Once satisfied you have the top cover secure, you can reassemble the lift arms and side inspection covers. The inspection covers on both sides are fastened on with six 7/16-14 Grade 5 hex head bolts but there are three different sizes to them. Assuming you have cleaned the covers well, inspected for burrs, and using new gaskets supplied in the gasket kit, assembly goes like this for each side: 7/16-14 x $\frac{3}{4}$ in the very top and very bottom holes; 7/16-14 x1.0 in the two running board holes; and 7/16-14 x 1-1/4 in the two brake pawl holes. Snug loosely, as you must feel the PTO shifter around (be sure it is in the engaged position) by slightly moving the plate around to be sure it clicks into place. Tighten all the bolts on both side covers. Replace the seat and spring assembly with the tow studs, washers, and nuts. Fill with new, clean hydraulic oil of your choice. Filler cap, 8N-7485, is located on the top transmission cover next to the gear shift lever.

IX. FINAL TEST

Do a final check of all components that you reassembled, put Lift Control lever down; make sure the PTO lever is engaged, and start engine. Let it warm up for ten minutes or so, then slowly raise the quadrant lift lever to the top. The hydraulic lift should rise right up without any hesitation, binding, or noise. Visually check for leaks around top cover gasket, inspection plates, and bottom drain plugs. It might be necessary to readjust the lift touch control –read the 8N Operator's Manual for technique. Once in the raised position, the lift arms should stay there for days if not weeks with a load attached and your hydraulic system will last for many more years. For 9N/2N systems, the only differences are that the linkages are completely different and will require that you read how to remove the wishbone bracket before you pull the top cover off. Enjoy!