

## **Servicing rear axles on Ford 2n 9n tractors**

**So you've heard that these tractors have poor brakes. Well, that's not true, they have a poor axle seal design that when failed allows axle oil into the brakes. Many tractors were never worked on so long as they ran and the brakes were often neglected. When properly serviced, the 9n has very effective brakes. The following is a photo journal of how to service the brakes and related areas while the axles are out. I've decided to provide large pictures which will waste a lot of space in the document but I believe big pictures are necessary.**

**Begin by jacking up the tractor and placing it on something secure like jack stands. You will be beating and tugging on parts at times and the tractor needs to be secure. Remove the fenders and rear wheels.**

**A word about gasket sealers. Everyone has their favorite. I use Permatex #2 (non-hardening) on anything I don't expect to have to take apart again. It's an excellent sealer and I believe it penetrates the gasket and keeps it from weeping oil through the fibers to the outside. The drawback is it's miserable to remove from surfaces later. On parts that I expect to have to service routinely I use silicone based sealants. While I don't believe it penetrates the gaskets it's a breeze to remove later. I use sealers on everything with paper gaskets but I use it sparingly. I use a wood matchstick to help spread the material. Once assembled you should have almost no sealer oozing out of the joints otherwise you are using too much.**

**Drain all the transmission/hydraulic fluid. There are 3 drains, a 1/2" pipe plug under the differential, and the 1.5" drain under the hydraulic and transmission areas. Drain the rear end first. While the system is drained you should give serious consideration to removing the hydraulic pump, pto shaft, and lift cover and thoroughly cleaning the sumps. I will not cover that in this document but I did it at the same time and some of the pictures will show these parts out as well.**

**The brake adjusters must be backed off completely in order for the brakes to come out of the brake drum. No amount of beating will remove the brakes which will still be attached to the backer plate if the adjusters are still out. Most of these tractors will have wear in the brake drum creating a lip that the pads will hang on preventing them from coming out. The adjuster is turned counter clockwise to back off the adjustment. Your adjusters may be seized. If so add your favorite penetrating oil and keep working it. Place a drip pan under the end of the axle.**

Remove the 6 nuts that hold the bearing retainer to the axle. Once removed tap on the brake drum using a soft hammer to separate it from the axle. You will also be removing the brake actuator shaft from the axle casting. You will need multiple hands to hang on to everything.



The brake backer plate may come out with or without the brake drum and it doesn't matter. I chose to separate the backer plate from the drum as it comes off the tractor as it's a little lighter that way. Have a long bolt or something handy to shove through the axle and backer plate if you wish to leave it on the tractor.



With the drum removed, make note as to the color of the springs and their locations. The proper location is green on top, red on bottom. The large spring is blue. I prefer to clean the assembly before disassembly. Once clean, remove all the parts and set aside.



Now that the axles are out it's a good time to service other needs. Most tractors leak oil from the lower lift pins. While I've heard of people reaching through the PTO shaft hole to gain access to the bolts, my hands do not fit and it's not that hard to pull the axle castings. The bolts are retained with cotter pins which have to be removed, At this point you only need spend a few more dollars for gaskets.

Begin by pulling the left axle casting (trumpet). Remove the bolts or nuts depending on your model. The casting weighs around 75lbs and you should consider having help or a lift of some sorts. I use a lift because I have one.



**With the left trumpet off reach in and remove the differential. This is another very heavy part. Take care not to drop it. Place several layers of heavy cardboard on the floor in case you do. Once out inspect the ring gear, bearings, the bolts, and the rivets that fasten the ring gear to the carrier. Broken rivets are not uncommon and there are bolt kits available to replace them.**



Replace the actuator shaft bushings. They are inexpensive and likely worn out. It's best to do these off the tractor as its possible to drive the plug in the hole out which leaves it under the differential. In manufacturing the hole was bored then a steel plug was inserted from the back. Guess how I learned this?

Remove the lower link pin and casting. Replace the pin if its worn. When you reassemble use sealer on both the gasket and shaft of the pin and bolt. Oil can't leak if it doesn't get past the bolts. The pin should be tightened and new cotter pins installed. I've heard that the link pin should be tightened to 150ftlbs but I was not able to confirm that in a manual.



Inspect the ends of the brake actuator shafts as they are likely worn. If worn you need to make a decision as to run them as is, repair them, or replace them. I doubt there are many used ones available that are not worn regardless of what sellers say. You can remove them from the backer plates (4 rivets) and have them welded and trued on a lathe. Due to the low rpm speed of this shaft I chose to build mine up with a welder and work into shape using a grinder and files. I've done this type of work for years and if you haven't you should find an experienced welder to do it. The left side is likely worn where the clutch shaft rides as well. This is the left side and the wear from the clutch pedal is on the back side in the photo and is as bad as the wear on the end. Note the before and after pictures.



The clutch pedal has a steel bushing in it where it rides on the brake actuator shaft. The bushing is available. I replaced mine, drilled and tapped the pedal for a grease zerk, and repaired the hole for the clutch rod as mine as nearly worn through the casting. I use welding rod for cast iron but it does not machine easily. The existing egg shaped hole was welded shut and re-drilled. I ruined several drill bits drilling the new hole. The hole is centered but due to the shape of the casting it appears not centered.



At this point you are ready to re-assemble your tractor and want to decide what to do about axle seals. The original seals are located next to the hub and are not visible unless the bearing carrier and bearings are removed. Sure seals are an aftermarket part that allow you to install a new seal that performs the same function without removing the lock collars and axle bearings. My opinion is that the Sure Seal is as effective as the original seal and the neither are optimal but given the design of the axle these are our only choices. Should you decide to replace the original seals as I did on an earlier tractor, set back and get ready for more work. If you are replacing the original seals you will need to purchase the seals, 2 replacement collars, and probably the bearing cones and cups. This is not a cheap exercise just to know the seals are new.

The heat shrink collar that holds the bearing retainer has to be removed. Its removed by drilling a .25" hole through it and cutting with a chisel. You need to be careful so that you don't drill into the axle. The bearing is hard enough that you won't be able to drill into it. As you can see drilling the collar subjects the bearing to metal fillings.



**Cut the collar with a chisel where you drilled. The collar is soft and easy to break at this point. Once broke its easily removed.**



Here the retainer collar has been removed. You can see where a previous mechanic used a cutting torch to remove the collar and hit the axle. At this point I looked at the bearings and while it's not possible to get a good look on them I decided they were ok and did not go further. This tractor is an early 40 and it will never really work again. When I repaired my 43 it was a work horse and I replaced everything. If you were going to replace the original seals you now have to remove the bearing retainer either with a gear puller long enough to span the axle, or carefully cut through the bearings with a cutting torch to free the interference fit. This is not a place to learn how to run a cutting torch. I've done this before and do not believe it's worth the risk unless the bearings need replaced. I did not take pictures the first time I did this, suffice it to say you have a lot of work left.



To install a bearing retaining collar place a clamp just above the shoulder of the axle and set the collar on it. The collar needs to be heated to red to get it to expand enough to drop into place. If not hot enough, the collar may contact the axle part way on and cool shrinking in place. If this happens you will have to cut it off and start over. once the collar is on the axle you can't heat it enough to get it hot enough to move as the axle acts as a heat sink. Once the collar is red pull the clamp and the collar will drop into place. I used a brass drift and tapped it making sure it was seated while still hot.



**Here is the new collar installed. Polish the shoulder of the axle with 400 grit emery cloth just ahead of the collar as this is where the sure seal forms its seal. Damage to this area has to be repaired if using sure seals.**



**Before the seals are installed on the axles, or the brakes on the backer plates, it's time to set the axle end play clearance.**

**The goal is to shim the axle retainers leaving a small gap between the axle shafts. The way it's checked is that if it's too tight, when rotating one wheel the other attempts to rotate the same direction. If it's too loose, you can grasp the wheel and push pull and detect axle movement. The procedure that follows is my interpretation of the process in the I&T manual.**

**This process used to be accomplished by removing the axles and grinding material off of them. Today we use shims. You may have seen metal shims when pulling the axles. The shims sold today are paper gaskets which may be used in place of the metal shims. I use paper in hopes of a better seal. You should not assume your tractor was shimmed correctly. It's easy to check and with the axles out it's a perfect time to do so.**

**I separate the job of determining axle clearance from that of re-installing the axles. Using the axles and the backer plates without the brakes installed I slip everything into place using 1 paper gasket on each side of the brake backer plate (2 per side). This is the least number of shims I want to use as to use fewer would involve no gaskets in places.**

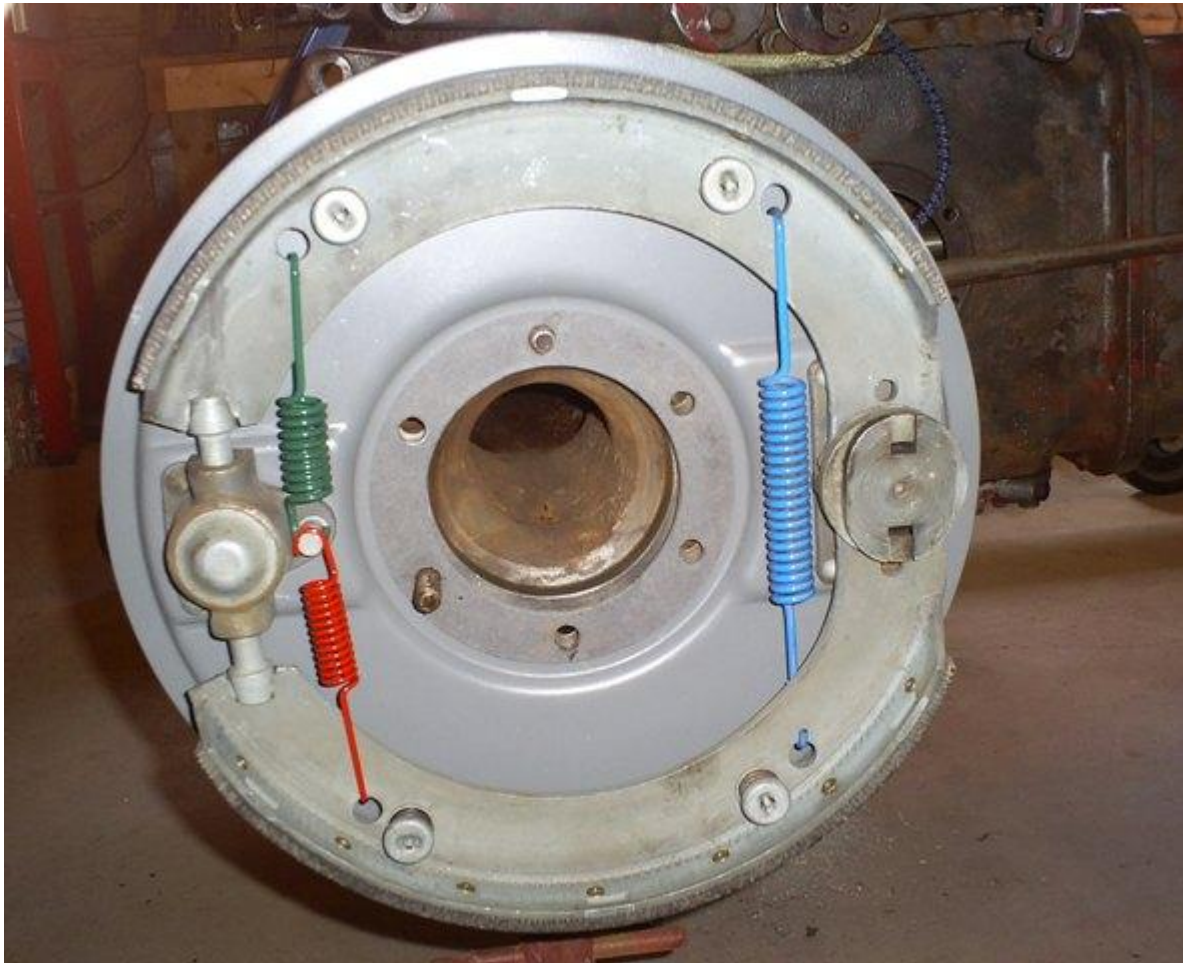
**Tighten everything up and check rotation. On this tractor I was lucky and on the first try I have wheels rotating in opposite direction, and no noticeable end play in the axles. If it were too tight, I would remove one axle and add 1 gasket and re-assemble and test again. If it were still too tight I would remove the other axle and install another shim. My 43 required 3 or 4 shims per side to achieve the correct end play. I prefer seeing it too tight and then shimming just to the point of freeing up that way I know there is little chance of too much end play. Once the shimming exercise is complete, note the number of shims (gaskets) and remove everything. it's time to install the brakes. Here the parts are being installed temporarily to check the axle end play. Note that the brakes are not yet installed. This is also an early 9n backer plate and it has no felt seal.**



To install the brakes, mount the backer plate on a firm surface, I use the tractor axle. I have a couple bolts in place to keep it from moving. Start by hooking the blue spring on the shoes then place end on the non-adjuster end. Once the ends are in place it's easy to lift the other end of the shoes over and into the adjuster. Once in place add the retainer clips. Make sure that the pads seat down into the brake adjuster plungers correctly.



**Add the remaining springs, Green on top, red on the bottom. Check to see that the brake pedal and adjuster expand the brakes. Make sure both are retracted. Once complete remove the assembly and set aside.**



**Lube the axle bearings (assuming you are installing Sure Seals). This is the last lube they will receive until the Sure Seals fail. I used high temperature grease in hopes that it will minimize grease getting hot and running out the old seal side back into the brakes. Work the grease into the bearings as best you can. I used a stick and a awl to get the grease down in between the rollers.**



**Even if you installed the original axle seals install a set of Sure Seals. They can be tricky to get started. I've found that using an old axle bearing cup is just right to place on the seal and carefully tap with a hammer to get the seal started strait. An alternative method is a 30" long piece of 3" PVC pipe slipped over the axle and driven with a block of wood. Avoid beating on the seal directly with a hammer.**



**Drive the Sure Seal down until it's flush with the bearing retainer casting and clean up any remaining grease. Pull the bearing retainer up and rotate and see if the seal is running true or moving about the shaft indicating that the seal is not square with the shaft.**



Using the proper number of shims (gaskets) determined from setting the axle end play, add them to the sealing areas. I used a small bead of silicone sealer on both sides of each gasket as unfortunately I expect to back in here again someday.



**Slip the brake backer plate with the brakes installed into the brake hub.**



**Slide the axle and brake backer plate into position on the tractor, make sure the brake cross shaft is seated in trumpet casting and tighten the 6 nuts. You may have to rotate the hob to get the axle to slide into the differential. You can see the silicone oozing out, this should be a very good seal. Test to see that the hub still rotates and that the brake works. You will adjust the brakes later.**



**Stand back and admire your work. The hub is complete. You will need to run the tractor and adjust the brakes several times as the pads seat in and the high spots wear off. Remember to fill the hydraulic/transmission cavity with the correct oil and don't overfill. The capacity of oil far exceeds what is needed to operate the hydraulics so running the level high just adds to the oil present at the axle seal. Running the oil a bit low is far better than a bit high.**

**Once the wheels are installed and the while still off the ground, adjust the brakes until you can no longer turn the wheel by hand, then back off the adjuster until just leaving a slight drag.**

