

# I NEED HELP WITH MY TRANS-AXLE.

## THE PROBLEMS

By and large, the trans-axle in your tractor is relatively trouble free for two reasons.

ONE: it is over-built for the size and weight of the tractor.

TWO: it is protected by the relief valve in the hydraulic system and that relief limits the amount of torque that can be applied to the trans-axle components.

However, nothing lasts forever without needing some sort of repair. Axle seals do fail due to age and axle bushings do wear, causing seals to fail. A minor issue can be the seals where the brake shaft enters the housing or where the shift rod enters the housing or where the hydraulic drive motor seals against the housing. The motor seal is an O-ring and rarely goes bad but sloppy installation can cause oil leakage. Note that the brake shaft uses the same seal as the axle stubs. Another bit of Case simplicity.

The gasket between the sheet metal cover of the trans-axle and the cast steel housing of the trans-axle can become compromised and allow moisture to enter. This is not a good thing. Water in the oil compromises the ability of the oil to do its job. Either a new gasket is required or a careful application of a silicone gasket material is needed.

The final problem is related to the four bolts inside the trans-axle that hold most of the rotating parts together. It is these bolts that are the focus of this document.

## **THE HISTORY**

The trans-axle used in the Hydriv garden tractors underwent a redesign in the late 60's and was introduced in 1969 when the 220, 222, 442 and 444 models replaced the previous 155 and 195 tractors. This new unit was a huge improvement over the trans-axle used previously. Every aspect of the new trans-axle was stronger than its predecessor. However, over time a weakness began to emerge.

The center section or carrier in this axle used four Grade 8 3/8" diameter bolts to sandwich the differential between the Hi gear on one side and the Lo gear on the other. The design relied solely on the four bolts to hold all the parts in alignment. In the early years, the bolts used were 4 3/4" long and had N/C or National Course thread on them. About seven years later, Case switched to 5" long bolts that had N/F or National Fine thread. Locknuts were always used although the part number for both the bolts and the nuts did change.

Owners began to experience trans-axle failures. I can't tell you when the first failure happened because the Internet hasn't been around that long and there are no factory records to examine that might reveal this date. However, the archives of Colt/Case/Ingersoll forum on Yahoo document many owners who had this happen and that forum began in 1999.

Case allegedly blamed those failures on a "bad batch of bolts from our supplier". Whether that is true or not, I cannot say to a certainty but blaming some unnamed bolt manufacturer would appear to be a convenient way to salvage any potential loss of reputation Case felt might be in jeopardy. Whether it was "bad bolts" or just a slip up in the design, there is no question that nuts were coming loose, falling off the bolts and bolts were being sheared off. The result was not nice.

Bolt shrapnel dropped to the bottom of the trans-axle and became trapped between the trans-axle housing and the large diameter low range gear. This sometimes resulted in a hole being punched into the cast steel housing and instant loss of the trans-axle oil. Another sign of trouble with the bolts was a deformed top cover plate. Bolts that worked their way out of the carrier sometimes became bent in an L shape and these came in contact with the top cover and made a ridge in it. Some owners got lucky. The tractor stopped working in one gear and they realized something was wrong before the housing was broken open.

It would be advantageous to know if the "bad batch of bolts" explanation was actually true or not. If it was true, then the question becomes simple. Which serial numbers of which models received these bad bolts? In the alternative, disclosure of which year/s of tractors were affected by these bolts would have been helpful? So far, nothing has ever been released by either Case or Ingersoll to answer these questions and it likely never will be.

As it happens, I have quite a few original parts manuals that were issued at the time the models underwent change from the old style trans-axle to the redesigned one that is essentially still in use today. That allowed me to check each book to look

at part numbers for key parts that may have changed over the years. Ingersoll bought the garden and lawn tractor division from J. I. Case in late 1983 and essentially inherited the trans-axle problem. However, Ingersoll had a deal in place to continue building Case branded GT's for the Case dealership network for an unknown number of years. Therefore, it is reasonable to conclude that the plant engineers were already working on a solution.

In 1986, it appears that Ingersoll finally dealt with this problem. According to the parts manual, a new Hi Range gear was introduced. This gear now had threaded holes for the bolts, instead of being clearance drilled for the bolts. In order to use this gear, Ingersoll also issued a bolt kit with the part number C-30031 consisting of four bolts and locknuts. This required installing the four bolts from the opposite side that is shown in the parts diagrams in older parts manuals.

Originally, you inserted the bolt through the Hi gear, into the carrier halves and finally through the Lo gear before putting on the lock nuts. The newer trans-axle now requires you to insert the bolts through the Lo gear first, through the carrier-halves and then thread them into the holes in the Hi gear. Of course, you must torque the bolts before installing the locknuts and applying the correct torque to them. The use of Loctite is factory recommended.

The information in the parts manual puts all tractors built prior to the following PIN's on the suspect list for this type of failure. This is not something that should be ignored. If your tractor has a PIN lower than the ones shown below, then you have a potential problem.

220 - 14091014

222 - 14091935

224 - 14092962

226 - 14093844

442 - All

444 - 14094720

446 - 14095849

448 - 14097305

644 - All

646 - All

648 - 14098394

### **THE REASON FOR THE FAILURE**

In conversation with Tom Hanson, a long-time Ingersoll dealer and a member of this forum, he advises that he cannot recall this failure happening to a 200 series. There might be good reason for this. In my opinion, the reason can be summed up with two words. Tire size.

The 600 series FEL's use a 15" rim and the 400 series all use 16" rims. The 200 series all use 12" rims. It comes down to "leverage" and reciprocating mass. Personally, I don't buy into the "bad bolt" theory. If someone purchased a 400

or 600 series tractor, they could put as many as four cast iron wheel weights on each wheel. In addition, they could load the tires with the fluid of their choice. I have yet to come across a 200 series tractor with more than 2 cast iron weights per wheel and those weights weigh less than the ones for the 400/600 models. A 23 x 8:50 x 12 tire on a 200 series holds 50 pounds of pure water when filled to 75%. An 8:00 x 16 tire on a 400 series holds around 80 pounds of pure water when filled to 75%. Those factors cannot be ignored when looking at the trans-axle bolt breakage issue.

One of the key features of the HyDriv system is the ability to travel forward by pushing a lever and then instantaneously reverse by pulling the same lever the opposite way. Even without wheel weights and loaded tires, this "convenience" can exert tremendous torque loads on the trans-axle components and the four bolts in particular. If you add in the tire loading and wheel weights, then the problem is compounded further. When plowing snow, owners often operate in Hi-range and use the travel lever to stop the tractor. After all, the tractor is not equipped with a working brake, just a parking brake.

The huge flywheel action of the 400 and 600 series is more prone to breaking these bolts than that of the 200 series. Just on diameter alone, the 400/600 wheels have more leverage on the axle shafts and differential parts than any 200 series could muster. So while Tom Hanson has not seen any 200's with broken carrier bolts, that does not mean they are exempt from the problem. After all, both rear ends are identical except for the axle shafts installed and the drive motor installed. Whoever was responsible for assembly of the carrier and Hi/Lo gears was pulling bolts from the same bucket and had no knowledge which model tractor those

assemblies would end up in. It is my recommendation that owners of machines identified in the above chart become proactive and perform the following work.

### **THE SOLUTION**

Purchase 3 new axle seals, a shift rod seal, 2 axle bushings, and a new cover plate gasket along with four 3/8" x 5" long N/F Grade 8 machine bolts with lock nuts. Apparently, there is a huge influx of fastening devices from off-shore sources and the tensile strength ratings shown on the bolt heads are being questioned. Therefore, it would be wise to purchase these bolts from a local Caterpillar dealer because Cat is super fussy about where their fasteners come from. Since this is intended to be a "once in a lifetime" fix, the Cat bolts are worth the bit extra in cost and the effort to obtain them.

Remove the seat, fenders, seat pedestal and fuel tank from the tractor and put the frame in the air on safety stands. With the rear wheels removed and a floor jack under the trans-axle after draining it, undo the remaining large bolts holding the trans-axle to the frame. You need a second person on hand to hold onto the drive motor. Carefully lower the trans-axle with the jack while the other person is taking care to not let it rotate forward due to the weight of the drive motor. Remove the cover plate and set it aside with all the bolts.

Use the instructions in the service bulletin for the trans-axle to remove the axle shafts. Pull the axle seals and drive out the old axle bushings. Remove the drive motor and punch out the brake shaft using a length of steel or brass round rod.

Give the rod a solid whack to pop it free from the circle clip you cannot see. You can now remove the differential carrier with the Hi and Lo gears. Take one bolt out at a time and install the new bolt immediately using LockTite on the threads. Torque the new bolts and recheck several times. Take this assembly to a Pro welder familiar with cast iron and have him put one inch of weld right down the seam where the two halves of the carrier meet. Do this to both sides. That will prevent any movement between the halves. The welds can be ground off, if necessary should the carrier have to be dismantled in the future but this is highly remote.

Wash all parts inside and out in solvent to make them scrupulously clean and put the trans-axle back together with the new axle bushings and seals. Put oil on the axle shafts where the seals are going to touch before installing them. You don't want to damage new seals. When you are satisfied that everything is back together correctly, then put the correct amount of oil into the trans-axle before installing the top cover plate and new gasket. On trans-axles with one drain plug and one fill/level plug on the rear, put three quarts of oil in the housing.

For trans-axles with one fill plug on the rear but a level plug and drain plug on the right side, put one quart of oil in the housing. Yes.. I know that the manual calls for only one pint but I prefer to use a quart since we are talking about very little difference in cost to protect an expensive piece of machinery.

There is no pressing need to use 80W90 gear oil because that oil was developed for rear ends with hyperbolically cut gears that slide on each other as they rotate. There are no such gears inside these trans-axles. You can use straight 30W,



20W50, 20W40 or 15W40 instead. Your choice. The motor oils are less expensive, work just fine and don't stink like the hypoid oil does. Read your Operator's Manual. It approves the use of motor oil.

Put the completed trans-axle back onto the floor jack and raise it back into position under the tractor frame. It is wise to have others helping you do this so you do not have the trans-axle fall off the jack. Line it up and install the large bolts that secure it to the frame. The rest is simple so I need not explain it. If you do all of the above right now, you will end up with a trans-axle that should be trouble-free for another thirty plus years of normal homeowner use. When you consider the amount of work involved in dealing with the bolt issue, I think you will agree that changing out those bushings and a few seals at the same time; represents chump change for the peace of mind that results.

### **BROKEN HOUSINGS**

If your tractor has a broken housing, do not despair. Once you have stripped it of all parts, it can be repaired several different ways.

The first thing to do is to wash it clean with solvent to get rid of all the oil. Oil and welding do not mix. The best way is to vee out any cracks with an angle grinder. If pieces broke away, hopefully you find them and vee them as well. A Pro welder will often pre-heat the complete housing in an oven to 400 degrees F and then use rod designed for cast steel to weld it back up. When finished, the housing is left to air cool on its own as slowly as possible to prevent stress cracking.

Some owners have opted to use brazing rod. This too can work just fine and air-cooling is recommended highly. Quenching of any kind can cause more breakage in the way of hairline cracking. Don't do it.

Spider cracks caused during the initial breakage can be arrested by drilling a hole through the housing at the very end of those cracks and then after vee'ing out the cracks, weld or braze it all up.

If you are concerned about the possibility of pinhole leaks in either process, then make sure the area around the repair is free of any oil. If possible, grind the inside of the housing lightly in the areas surrounding the repair. Put on a liberal coating of JB Weld or an epoxy that is similar and let it dry thoroughly before re-assembling the trans-axle. You can even coat the exterior to try and make the repaired area look a bit more respectable. Just make sure the area is scrupulously clean prior to applying the JB Weld if you expect it to stick.

The final option would be to replace the housing with a used one off of e-Bay. The good news is that the 200 and 400 series tractors use the same housing and the same internals. Only the drive motors and axle shafts are different.

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Tom Arnold

Please make use of all safety equipment and practices when carrying out the above repairs. You only get one pair of eyes. Take care of them. Safety glasses, safety shields, gloves, appropriate footwear and clothing are essential when grinding or wire brushing. Welding masks or goggles must be worn while brazing or welding.

A proper fire extinguisher should also be present.

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