

That Vicious Viscous Coupler!

By George Huitron

When the first automobiles became dependable enough for public use, the industry started looking for a 4x4. The first ones failed and failed: parts didn't hold up and new ideas didn't work. The industry knew they had to have a 4x4 vehicle. Back then there were only dirt roads or trials between cities. There was basically just one type of tire, and it wasn't an off-road mudder. Some vehicles had a type of positraction, but still no 4x4.

Then came a somewhat reliable, fulltime-only 4x4. There was no easy way to make that switch from 2WD to 4WD. A knuckle joint that was quite reliable got the first 4x4 ready for the workforce. Those early 4x4s were mainly trucks, and they still had their problems... not the least of which being that the average homemaker couldn't drive it conveniently to the store and back with the kids in tow.

That was then; it's a different story today. Now you have a show where 4x4s jump over cars, then fly over the finish line. Then there are those mud pit races — what a dirty sport! — and those are just a few. Sounds like they've become the supermen of the automobiles, and they may be.

But as tough as they are, there's also a 4x4 for the family, with all

the comfort features you could want, including air conditioning, power steering, and electric this and that. Most comfortable 4x4s also use a viscous coupler, which allows them to drive smooth. You push a button, and just like that it's in 4 wheel drive. Some vehicles are always in 4 wheel drive; most of them have a viscous coupler of some type, too.

Today we're only going to look at transfer cases that use a viscous coupler; this will include early 119, 228, 129, some late 4411, 247, 4405, 226, 246 and many more. And, while the viscous coupler provides smooth performance, it brings a whole series of problems with it. So let's look at how they work, how they fail, and how to keep them in working order.

Learning how the viscous coupler works will help with diagnostics and repairs. When engaged, all transfer cases drive the rear output when the

input is turned, so we won't waste any more time with that. The part we are concerned with is turning the front differential. This is the job of the viscous coupler, if the vehicle uses one. Some transfer cases have the viscous coupler engaged full time, while others may be engaged and disengaged. The most problematic are the fulltime ones.

The Basics of Viscous Coupler Operation

Here's how they work. The drive is the mainshaft, and the mainshaft connects and drives the viscous coupler. All viscous couplers have a clutch-and-steel system in the drum (figures 1-3). Most drums drive the steel plates; the steel plates drive the clutch plates, and the clutch plates are attached to the chain cog. The chain cog drives the chain, which drives the front differential. This clutch system works smoothly when the coupler is working correctly.

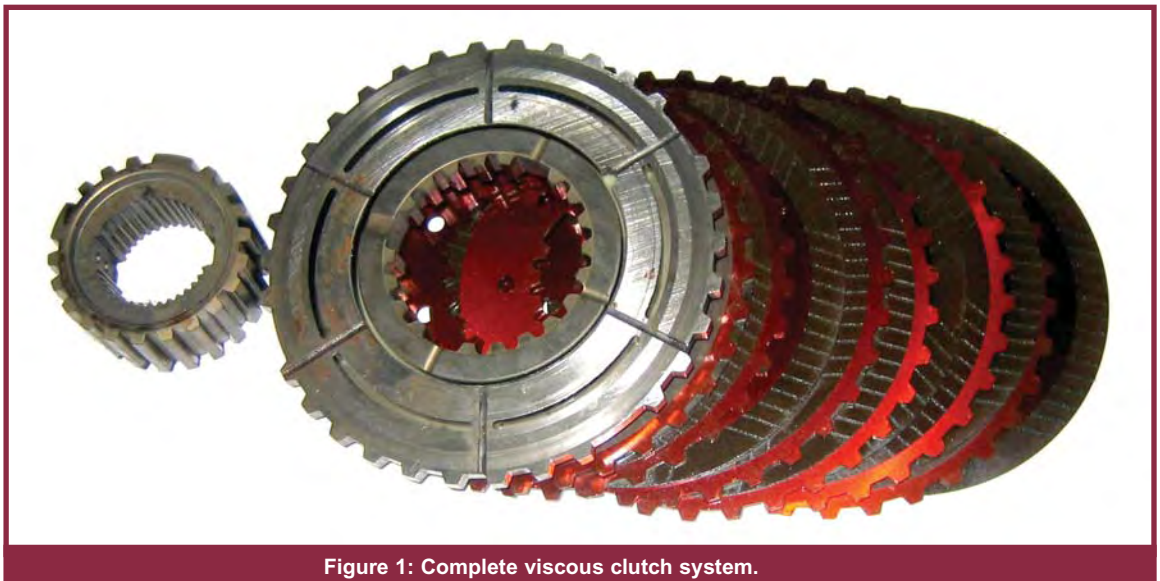


Figure 1: Complete viscous clutch system.

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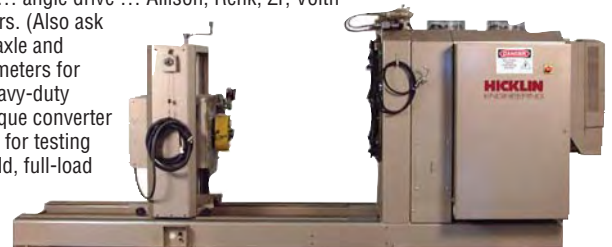
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That Vicious Viscous Coupler!



Figure 2: Clutches that are driven by the mainshaft.

Most viscous couplers' real job is to drive the front drive in a comfortable and consistent, trouble-free manner. Viscous couplers usually fail when they're made to work too hard. If the steel disks slip against the clutch plates at an extended rate or for a long time, they'll either wear out or warp, just like any other clutch system. This is an important point, because it affects how you're going to fix the vehicle.

Fulltime Viscous Couplers

Viscous couplers are either engaged or disengaged, depending on the type of transfer case. Some units — 4410, 4411, 1372, 4472, 247, 249, to name just a few — can't be disengaged; these are considered fulltime. That means

the only way to disconnect them is to remove the driveshaft that goes to the front differential, or by disconnecting some other part, somewhere down the line, which drives the front wheels.

A common cause for viscous coupler failure is if the wheels don't travel the same distance per revolution on a straight road. This is usually caused by a variation in tire size. Check to see if it is running with a spare tire or different size tire. But just fixing the tires at this point may not fix the viscous coupler.

Here's a simple check to make sure the tires are all the same size:

- Find a straight road, about 50 or so yards in length.
- Mark all tires where they contact the roadway.

- Roll the vehicle forward about 50 yards or so, and then continue moving the vehicle until the mark on one of the tires is aligned with the roadway again.
- Check the marks on the other tires; they should all be aligned with the roadway, just like the first tire. If any of the tires' marks is off by an inch or two, there's a problem with tire size.

Computer Controlled Viscous Couplers

Now on to the computer activated 4x4 system. Some are automatic and others are activated by the driver. In most cases the automatic 4x4 systems have two speed sensors on the transfer case: one on each output end. When the vehicle is running straight down the road, the outputs should indicate the exact same speed, so the 4x4 system remains off. In some cases taking a simple turn can activate the viscous coupler.

If both driveshafts aren't rotating at the same speed while the vehicle is driving down a straight road, the computer will turn the 4x4 on. It may turn off again, but will turn right back on; in time, this will burn up the viscous coupler. First the clutches overheat, the seals fail, and then the inner fluid leaks. Meanwhile the chain takes a beating, all of which leads to transfer case failure.

Faulty sensors can sometime mis-

lead you, and may make you think the viscous coupler is bad, so it's important to check them. Remember both sensors must send the same signal to the computer, which tells the computer that the output shafts are traveling at the same speed.

Common complaints include:

- "My vehicle makes a jerking when I go straight."

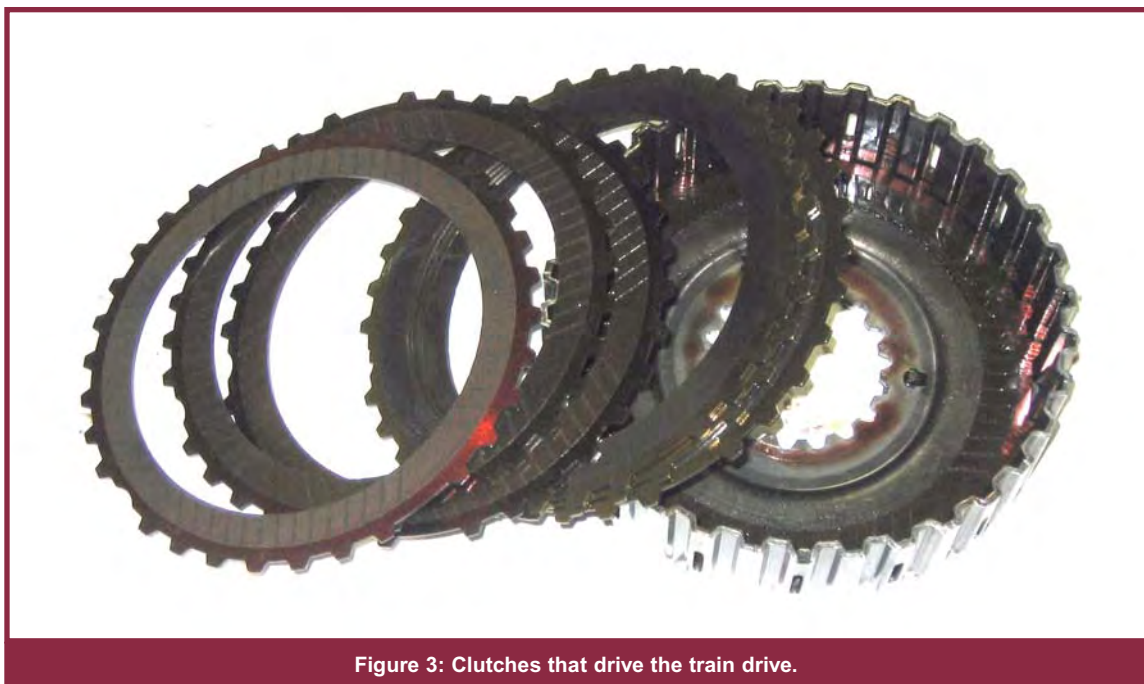


Figure 3: Clutches that drive the train drive.

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COMPLAINT

SECONDARY COMPLAINTS

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- Poor TCC apply and release
- Lube system failure
- Excessive cooler circuit oil loss

CAUSE

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That Vicious Viscous Coupler!



Figure 4: Totally enclosed viscous center hub driven by the mainshaft, the outer drives the chain cog. Inside is the same set of clutches, and the viscous coupler has a special fluid inside that allows it to keep full and provide a smooth slipping action of the clutches.



Figure 5: The inner splines are divided: one is driven by the mainshaft; the other drives a cog that drives the chain. This is an open viscous, as the slots indicate. This unit is called a progressive viscous. This viscous will slip less at one point because pressure will be added to stop it from slipping. And it produces an almost lock system as this occurs.

- "Every time I turn, my car jumps."
- "When I accelerate there's a funny jumping in the front end."

That's the viscous coupler binding and letting go, binding and letting go, again and again. This isn't good for the U-joints, differential, transmission, etc.

Fixing the Viscous Coupler

So let's get down to how to fix them. Mostly it's just a matter of replacing the viscous coupler assembly. More importantly, you have to identify why it failed and fix that problem at the same time. Otherwise you'll end up with repeat failures.

There are two types of viscous couplers: one is totally enclosed (figures 4 and 5); the other will have the transfer case fluid running through it. The first type has to be replaced as a unit; they aren't rebuildable. The second has a high failure rate because the fluid it uses isn't really suited to the viscous coupler. The second may be rebuildable, but use good parts or it will be right back.

Most of the open clutch-type take a special fluid, but not all. So always make sure you're using the right fluid. Some of the open type use regular ATF; for those, a friction modifier may help them work smoother. If you're installing a new 247 viscous coupler, remember to soak it in the proper fluid for 24 hours prior to installation.

Most viscous couplers have to be broken in; some people drive the vehicle in a circle, first one way then the other, two or three times. Others do three or four figure eights and call it good. Both techniques work well, and any jumping or hopping should stop during this break-in period. After the break-in, you're ready to deliver the vehicle... but make sure you've explained the importance of proper tire and vehicle care to the owner or driver.

So now you know how they work, how they fail, and most importantly how to fix the vehicle. That's all it takes to keep a good viscous from becoming vicious.



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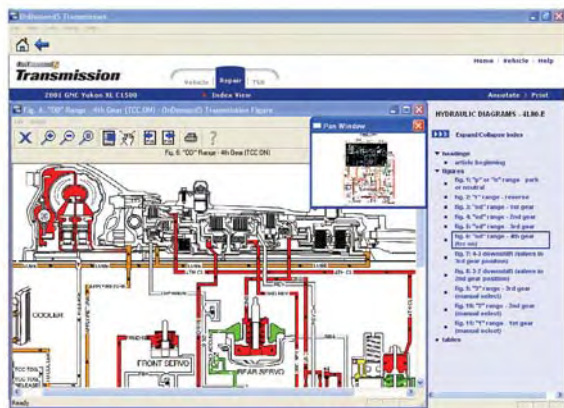


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