

Subject:

Common problems with four-wheel-drive systems

Units:

NV4500, 3500 and 1500 transmissions; NV136, 231, 233, 236, 242, 243, 246 transfer cases; BW 4405, 4406, 4411 transfer cases; ZF 5- and 6-speed manuals

Essential Reading:

- ☑ Rebuilder
- Shop Owner
- Center Manager
- ☑ Diagnostician
- ☑ R & R

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Myths and Mysteries: The Top 15 Tech Calls Involving Transfer Cases

The first consideration for anyone in the automotive-repair business must be customer satisfaction, as the best advertising is the word of mouth generated by happy customers. As a buyer of parts you also should be concerned with customer satisfaction, since you are the customer. One of the necessities of this increasingly complex business is that your vendors supply you with not only quality parts but also technical help to ensure your success in diagnosing and repairing the unit you are working on. This article covers the 15 most-frequent transfer-case inquiries that we receive on the tech line, with No. 1 being the most-commonly asked question.

Before going further it is critically important to outline several issues that you must understand to successfully repair modern transfer cases of all types. The first relates to the No. 1 problem that creates endless mistakes and wasted time for the technician, and that is tires. Before you do anything with a transfer case you **MUST** confirm that all four tires on the vehicle are the same size and are inflated to the same pressure.

The problem starts with size. The tire size on the sidewall is meaningless for several reasons; the first is tire wear, and the second is that no two tires ever grow to the same size when you inflate them. *You must measure tire size.*

There are three ways to do this. The easiest and quickest is to use a stagger gauge – a large, direct-reading caliper that, when centered on the wheel,

reads tire circumference directly in inches. The second is to raise the vehicle and use a tape measure to measure around the circumference of each tire at the center of the tread. This is slow and time consuming, and a decent stagger gauge costs less than \$75. The third option is to place the vehicle on flat blacktop where it can be driven straight ahead for about 20 vehicle lengths. With a piece of chalk or other marker, make a mark at the 6 o'clock position on each tire. Drive the vehicle forward about 20 car lengths in a straight line and stop. Look at the marks on the tires and see whether they are all in the same clock position. If they are not this will indicate tire wear.

Late-model “active” or computer-controlled transfer cases must have no more than $\frac{1}{4}$ inch difference in tire wear among the four wheels. Anything more than this will create problems and set codes. Tires that are mismatched on size will quickly cause failure of the viscous coupling in a transfer case equipped with one. Mismatched tire sizes also will damage differentials and cause problems and codes in many late-model automatic transmissions in vehicles that have steering-angle sensors, ABS, traction control and stability control.

Tire pressures also are important, as certain transfer cases will not shift from four-wheel drive to two-wheel drive if one tire is under-inflated by 3-5 psi even though the transfer-case shift lever is in two-wheel drive.

These late-model transfer cases meas-
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ure prop-shaft speeds, which the computer uses to indicate a slip and activate the clutch packs to send power to the front axle when necessary.

The second area that needs to be understood is what the transfer-case modes and ranges are. Mode indicates two-wheel drive (2WD), four-wheel drive (4WD) high and four-wheel drive low. Ranges are high and low. There are no transfer cases that can be operated on the highway in four-wheel drive high or low without having problems. The modes are for use only in snow, grass, mud, sand or loose gravel, and not in the rain.

Mode descriptions

2WD – Power to the rear wheels only, for use on pavement

4WD high – Power locked to both axles 50/50; cannot be used on hard-surface roads

4WD low – Power locked to both axles 50/50 with reduction gearing of 2.5 or more; for use only off road or in snow etc.

4WD part time – power locked to both axles 50/50; not to be used on pavement

4WD full time – Power flows to both axles through a differential or torque-biasing device; can be used on all surfaces

Auto 4WD – Power flows to rear wheels unless slippage is detected, and then the unit sends power to the front axle until the prop-shaft speeds equalize, at which time power flows to the rear wheels again. Suitable for use on all surfaces.

The Top 15 Hit Parade

15: Transfer case grinds on a shift from 4WD high to 4WD low range.

Range shifts from 4WD high to 4WD low can never be made on the fly. The range fork must en-

gage the range sleeve (hub) into the planetary. The planetary will be moving if the transmission output shaft is moving. In automatic transmissions a tight forward-clutch pack may have the planet moving even in neutral. The correct way to make this unsynchronized shift is to have the vehicle stopped, the transmission in neutral and the engine off. If the transfer case is an electrically shifted unit, have the engine off and the key on. To make a shift from 4WD low to 4WD high it may be necessary to put the vehicle in reverse for a few feet and then neutral to relieve any spline lock in the transfer case.

14: Which direction do the sliders face on the synchro hubs?

This is both transmission and transfer-case related. When disassembling a unit, match-mark the slider to the hub on the side of the synchro assembly that faces the input shaft. This does two things: It places the slider on the hub in the same wear pattern on the splines for smooth shifts, and it locates the slider in the correct direction should the assembly come apart. It takes only a minute with a high-speed rotary tool or die grinder to prevent an hour or two of wasted time.

13: Poor clutch release on a New Venture 4500 transmission after replacement with aftermarket clutch sets.

Our experience is that these problems do not occur when an OEM clutch from the dealership is used.

12: Gear rattle or neutral-rollover noise after clutch replacement on light-duty trucks

ZF five- and six-speed truck

transmissions and NV 4500, 3500 and 1500 transmissions are prone to neutral gear rattle and rollover noise. This noise is easy to diagnose: Start the vehicle with the transmission in neutral and the clutch engaged (pedal up). *Slowly* raise the engine speed to 2,500-3,000 rpm. If the noise goes away, there is nothing wrong with the transmission. Harmonic vibrations are causing the gears to rattle because of firing pulses in the engine. The usual causes are bad or worn dual-mass flywheels, replacement clutches with improper hub damping, engine misfire or out-of-time diesel injection pumps, or worn fuel injectors. This problem, while unacceptable to the driver, will not damage the transmission. Taking the unit apart will not fix the problem, as the cause is outside of the transmission.

11: NV 231 Jeep, Dodge and GM transfer cases with rapid chain failure after replacement

The usual cause is the driver using 4WD high mode in the rain. In 4WD high the power is sent to both axles equally. On part-time transfer cases 4WD high or low ranges must be used only in snow, ice, mud, grass, sand or loose gravel, and never on hard pavement. Without the ability of the tires to slip on snow or loose material, the driveline winds up because of different wheels speeds in turns and puts tremendous loads on the splined parts and the chain.

10: BorgWarner 4411 transfer cases in Ford vehicles banging on hard acceleration

The BW 4411 transfer case is an upgraded version of the 4405. This is an electronic "automatic" transfer case that has an electronically applied clutch pack internally to send power to the front axle when

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needed. An internal magnetic coil applies the clutch pack when requested by the generic electronic module (GEM), which is a computer. The signal to the magnetic coil is pulse-width modulated. Using a scan tool, access the GEM and measure the percentage of signal to the magnetic coil. In a no-load or no-slip condition the apply percentage should be 0-5. Under hard acceleration the percentage should approach 100. If either of the percentages is off, follow the diagnostic trees to find and cure the faults. If the computer is functioning correctly, change the transfer-case fluid to Chatter-Free fluid and road test. If Chatter-Free does not fix the problem, there may be internal damage to the clutch pack.

9: BorgWarner 4406 transfer case in Ford Expedition, Lincoln Navigator or F-150 pickup bangs on takeoff and/or crow hops around turns.

The majority of times this will be due to malfunctioning speed sensors or mismatched tire sizes. Read codes from the GEM and then access the speed sensors to read proper function. If the speed sensors are OK change the fluid to Chatter-Free and the problem will resolve unless too much damage has been done to the clutches. This, of course, assumes you eliminated tire size as the cause.

8: New Venture 233 GM or Dodge or NV243 Chevy transfer case goes from 2WD to 4WD low and cannot attain 4WD High.

Scan for codes and correct any problems found. If the condition persists, replace the encoder motor and the module harness. The computer reads varying resistance from the encoder motor to know

the location of the shift rail in the transfer case. Any corrosion or faults in the harness or encoder motor will change resistance and cause the computer to make an unwanted shift to low range.

7: Whining noises in chain-driven transfer cases, all types

Understanding the difference between a whine type of noise and noisy transfer-case bearings can save you lots of time. There is virtually nothing in a transfer case that can cause a whine, as there are no hypoid gears or gears in mesh. Differentials whine regardless of whether the vehicle is accelerating. Remove one driveshaft at a time to locate the offending differential. Once you've found it, inspect the differential for bad bearings, pinion gears or ring and pinion. Driveshafts act like speakers to transmit noise from the differential through the shaft to the transfer case. Do not remove a transfer case unless you have confirmed that there is an internal problem.

6: BorgWarner 4405 transfer case hopping around turns in automatic 4WD

Most-common cause is mismatched tire sizes. Next is bad speed sensors. Third cause is worn or bad fluid; change to Chatter-Free. Rest the GEM by removing the negative battery lead for five minutes and then road-test again.

5: NV 136, 236 and 246 GM transfer cases - front driveshaft turns in 2WD.

This is correct, because the clutch pack is preloaded. The front driveshaft will turn but the front differential is disconnected from the axle on the passenger side. The axle will connect only in 4WD.

4: Transfer case - any type - is noisy when the vehicle is driven on a lift.

All transfer cases with two speeds have idling planets, with the ring gear being part of the case. The drive chain will make noise with the wheels unloaded. It is a mistake to assume that the transfer case is bad because it sounds noisy when you're under the vehicle. Road-test the vehicle before committing to a noise condition. Do not drive "automatic" or active transfer cases on the lift. Power going to the rear wheels when the front wheels are not rolling signals the computer to engage the clutch pack, sending power to the front axle. This will cause the clutch to cycle like antilock brakes. The noise will sound terrible, because the computer cannot match wheel speeds with the wheels in the air.

3: NV242 in a Jeep does not come out of 4WD even when the shift lever is in the 2WD position.

This is a problem caused by mismatched tire sizes or low air pressure on one or more tires. The mode fork in this unit is spring loaded and cannot release when shifted because the mainshaft components are spline-locked as a result of low tire pressure or mismatched tires. The unit will shift perfectly on a lift when the wheels are unloaded.

2: BW 4405 Ford Explorer - noise on deceleration only. Will bang and neutralize occasionally but will regain power if you lift your foot from the accelerator.

The design of the 4405 causes the shift rail to become side loaded and off the centerline. The case

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Up To Standards

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halves will get wallowed out in the shift-rail bores. Heavy banging and neutralization will require replacement of the unit. The mainshaft rear bearing also wears into the case from clutch-application pressures and creates excess endplay for the mainshaft components, where the range sleeve begins to find a neutral position.

1: BW 4405 transfer case in Ford Explorer produces a high-pitched siren-like whine.

This is caused by one or more of the speed sensors not being flush in the case. Lube the O-ring on the speed sensor and make sure it is flush with the case before tightening the retaining bolt. The noise is from the Hall-effect magnet contacting the tone wheel that it reads inside the transfer case.

These problems account for 70% of all calls we receive on the tech line. Learn to follow the proper procedures on tires and those listed here, and next time we will have a new list of the top 15 problem calls. **TD**

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TRAILBLAZER, ENVOY - MITSUBISHI, MITSUBISHI
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