

It's A Brave New World

Ford's New Venture 271 Transfer Case



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Contributing Editor**

It used to be that 4WD transfer cases were very basic, perhaps even crude, machines. When you wanted 4X4 operation, you stopped the vehicle, climbed out and locked the front hubs, placed the transfer-case shift lever in the 4WD range desired and restarted the vehicle.

In most instances the transfer case still is a simple device that takes torque from the transmission output shaft and splits it between the front and rear axles. What has changed significantly is the operation or control systems on late-model transfer cases. As 4X4 vehicles became more expensive and luxurious, it was not a good marketing idea to have the driver leave the comfort of the cabin to negotiate snow, ice, mud or rain to lock hubs. Shift levers are on their way to becoming antique curiosities.

With the mega-growth of computer-control systems, we have seen the

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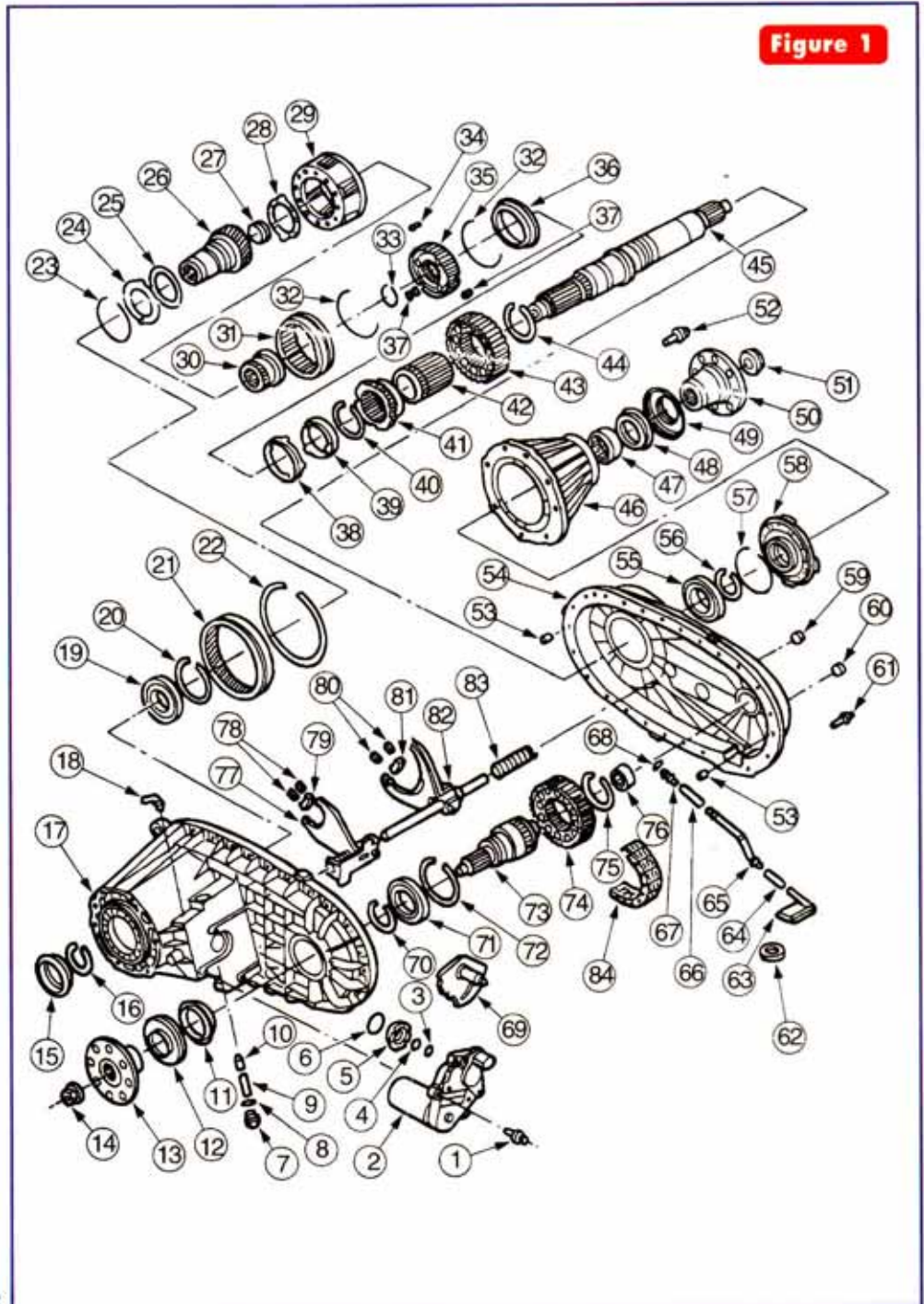


Figure 1A

Item	Description	Item	Description
1	Bolt	43	Drive Sprocket
2	Gearmotor Encoder Assy	44	Sprocket Retaining Ring
3	Plastic Retainer	45	Mainshaft
4	O-Ring Motor Seal	46	Rear Retainer
5	Motor Adapter	47	Needle Bearing
6	O-Ring Support Seal	48	Rear Output Seal
7	Poppet Screw	49	Slinger
8	O-Ring Seal	50	Rear Flange
9	Spring	51	Nut
10	Poppet	52	Retainer Bolt
11	Front Output Seal	53	Bushing Dowel
12	Slinger	54	Rear Half Case
13	Front Flange	55	Ball Bearing
14	Hex Lock Nut	56	Retaining Ring
15	Input Seal	57	Retaining Ring
16	Input Bearing Retaining Ring	58	Oil Pump Assy
17	Front Half Case	59	Fill Plug
18	Vent	60	Drain Plug
19	Ball Bearing, Front Input	61	Rear Case Bolt
20	Front Input Bearing Retaining Ring	62	Chip Collector Magnet
21	Annulus Gear	63	Oil Screen
22	Annulus Retaining Ring	64	Lower Tube Connector
23	Lock Plate Retaining Ring	65	Lower Oil Tube
24	Lock Plate	66	Upper Tube Connector
25	Front Input Gear Thrust Washer	67	Upper Oil Tube
26	Input Gear	68	O-Ring Seal
27	Pilot Bearing	69	Sector Assy
28	Rear Input Gear Thrust Washer	70	Front Oil Pump Retaining Ring
29	Planetary Carrier Assy	71	Front Oil Pump Ball Bearing
30	Range Shift Sleeve	72	Retaining Ring
31	Synchronizer Sleeve	73	Front Output Shaft
32	Synchronizer Spring	74	Driven Sprocket
33	Hub Retaining Ring	75	Sprocket Retaining Ring
34	Synchronizer Strut	76	Needle Bearing
35	Synchronizer Hub	77	Range Fork Assy
36	Outer Ring	78	Range Shift Fork End Pad
37	Synchronizer Strut	79	Range Shift Fork Center Pad
38	Middle Ring	80	Mode Fork End Pad
39	Inner Ring	81	Mode Fork Center Pad
40	Clutch Gear Retaining Ring	82	Mode Fork Assy
41	Clutch Gear	83	Mode Spring
42	Drive Sprocket Hub	84	Drive Chain

advent of shift-on-the-fly electronic transfer-case controls, automatic locking hubs and new types of transfer-case designs. These newer designs have ever-more-complex wiring and electronic controls and sensors that, on occasion, have our industry scratching for answers. Believe me, this is a good thing. The more complex and all-encompassing the control systems become, the more chance you will be paid what you are worth, provided you place a proper value on your work and charge accordingly. This is called job security, and the way you achieve it is to continue to learn the new systems. Don't bitch and moan about all the changes

and new designs. Make it your business (your business absolutely depends on this) to beg, borrow, buy or, as a last resort, steal the factory service manual.

My brother was a hotshot tax attorney who made buckets of money. One day I was with him when UPS delivered his copy of the new United States Internal Revenue Service Tax Code, all 26,000 pages of it. I asked him how it was possible for him to learn and understand 26,000 pages of complex, arcane lunacy. His answer surprised me. He said, "This is an annuity for me, and if I can understand the concepts involved I will make nothing but money and

never be out of work."

This logic applies to us. The more complex and far-reaching electronic control systems become, the more valuable the people become who can diagnose and repair these systems. This is our annuity. Don't become one of those who is left behind because they didn't make the effort to become educated, knowledgeable technicians.

The case in point here is the New Venture 271 transfer case. This unit will be used in the F-250, 350, 450 and 550 series trucks. The NV271 comes in manual- and electric-shift variations. We will look at the electric model here and give you an overview of the control systems involved. The transfer case itself is a heavy-duty piece with no radical departure from previous designs.

This being the age of acronyms, we have to learn some new language here. ESOF stands for electronic shift-on-the-fly. GEM means generic electronic module (computer). These models use a vacuum system to lock the front-axle hubs. The GEM sends a signal to a PVH solenoid to port vacuum to the front-wheel hubs, and this locks the front axle to the wheels. When 2WD is selected the opposite occurs, and the hubs are unlocked and permit the wheels to freewheel in 2WD.

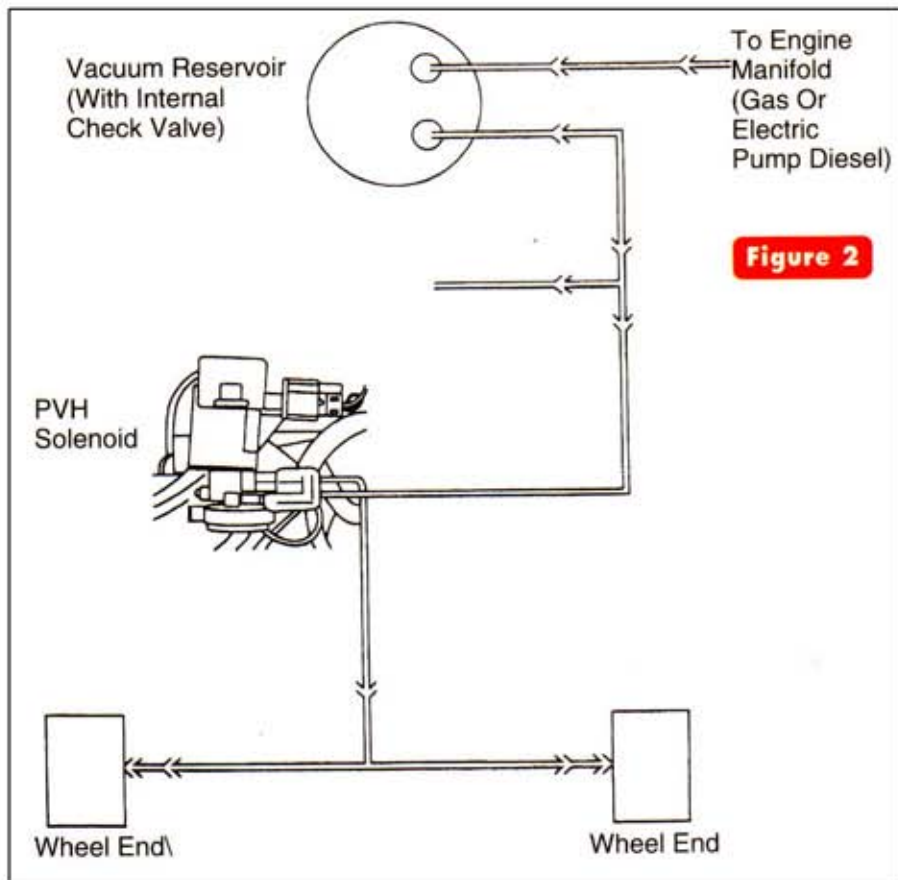


Figure 2

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On the transfer case is a 4X4 electric shift motor with an internal position sensor to inform the GEM which position the shift linkage is in. This shift motor is similar to the encoder on GM vehicles and performs the same function.

On the dashboard is a three-position rotary switch that enables the driver to shift the transfer case between 2WD, 4WD high and 4WD low ranges. Shifts to 4WD high can be made at any speed, hence "shift-on-the-fly." Shifts into or out of 4WD low range can occur only when the GEM sees the vehicle speed at less than 3 mph, the brake is applied and the trans is in neutral. On manual gearboxes, the clutch pedal must be depressed.

The GEM receives input signals from the 4X4 rotary switch, vehicle-speed sensor (provided by the ABS system), the shift-motor position sensor on the transfer case, the brake switch, the digital range sensor (MLP), the clutch-position switch and the ignition switch. With these inputs the GEM can control the transfer case through the various ranges by output signals to the low-to-high relay, the high-to-low relay, the vacuum-hub-lock solenoid, and the transfer-case shift motor.

When working on one of these units, using a systematic diagnostic approach to locate the problem is important. Ford uses a New Generation Star Tester to access GEM codes. There are some 88 DTCs available to the GEM, and they include many diverse circuits

Up To Standards

including horn, wipers, power windows, battery voltage, power door locks, seat belt, ignition switch, wiper/washer, accessory circuits, and parking and head lights. Even the brake-fluid-level sensor can input a code.

Remember the beginning of our discussion; this is a positive for our industry – job security. For example, in the factory service manual there is a warning note: “for vehicles built prior to 2/5/98 the following criteria must be met when performing the GEM On Demand Self Test: Head lamps and park lamps must be off and the power windows must be completely up. Failure to meet this criteria will result in DTCs B1577 and B2357 being set. For vehicles built after 2/5/98 the following criteria must be met when performing the GEM On Demand Self Test: head lamps and park lamps must be on. Failure to meet this criteria will result in DTC 1575 being set.”

So now we know that the GEM is controlling the transfer-

case shift system and a number of other functions. We have arrived at a point in time when the urge to be independent and work out a fix without the wiring diagrams and pinpoint test will be self-defeating. You need the service manual and the schematic. The NV271

diagnosis-and-testing section of the Ford factory manual uses 93 pages of text and diagrams, while the transfer-case repair section is only 53 pages. Get the books, learn the system, make repairs efficiently and count the money your “annuity” throws off. **TD**



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