SECTION 308-07A Four Wheel Drive (4WD) Systems

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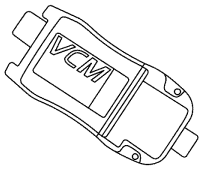
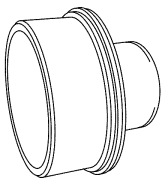
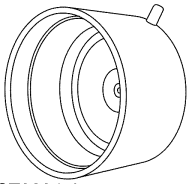
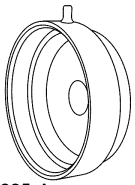
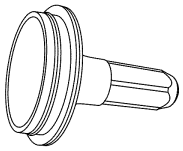
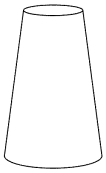
DIAGNOSIS AND TESTING

Four Wheel Drive (4WD) Systems — Electronic Shift

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
 ST1176-A	Vacuum Pump 014-R1054 or equivalent
 ST2823-A	Test Tool, Vacuum Hub 205-827
 ST2824-A	Vacuum Test Stand, Hublock 205-829
 ST2825-A	Vacuum Test Stand, Hub Bearing 205-828

DIAGNOSIS AND TESTING (Continued)

 ST2851-A	Vacuum Test Tool, Knuckle Seal 205-826
 ST2852-A	Vacuum Test Plug, ABS Sensor 205-796

General Equipment

Pressure Vacuum Module 105-R0099 or equivalent

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (Canada CXG-1-C)	ESA-M1C75-B

Principles of Operation — Electronic Shift on the Fly (ESOF) System

The electronic shift on the fly (ESOF) system is an electronic shift system that allows the operator to choose between 2 different 4x4 modes as well as two wheel drive (2H). The operator can switch between 2H and 4H mode at speeds up to 88 km/h (55 mph). To engage or disengage 4L, the 4X4 control module requires that the vehicle speed be less than 5 km/h (3 mph), the brake pedal pressed and the transmission in NEUTRAL (or clutch pedal applied on manual transmission vehicles). This system contains pulse vacuum hublocks (PVH). The selector on the hublock, when turned fully counterclockwise to the AUTO position, engages/disengages the hub depending on the driver-selected 4x4 mode of operation. The hublocks also contain a manual override. When the selector is rotated fully clockwise to the LOCK position, the 4WD vacuum and electronic system used for coupling the front axle to the wheels is bypassed.

The transfer case is equipped with a dual-cone synchronous clutch. This clutch is used to synchronize the front driveline to the rear. All other internals operate in the same manner as the manual shift system. When the mode select switch (MSS) on the instrument panel is turned, the 4X4 control module powers the transfer case shift motor, which activates a shift fork and engages the clutch. When the shift motor reaches the desired position, as determined by the encoder position inputs to the 4X4 control module, power to the shift motor is removed. When the transfer case front and rear output shafts are synchronized, the lockup collar mechanically engages the mainshaft hub to the drive sprocket. At this point, the front axle PVHs are engaged. Instrument panel "4x4" and "Low Range" indicator operation is controlled via hardwired outputs from the 4X4 control module.

Electronic Shift Transfer Case

The New Venture Gear NV 273 electronic shift transfer case is a 3-piece aluminium design. The unit transfers engine power from the transmission to the front and rear axles. Under normal driving conditions the unit is in two wheel drive high (2H), but when desired, the operator may shift into four wheel drive high (4H) or 4-wheel drive low (4L). The transfer case is shifted electronically. The unit is lubricated by a positive displacement fluid pump that channels fluid flow through holes in the mainshaft.

The encoder assembly used for mode indication is of a Hall-effect type. The system uses a total of 4 independent transistors for mode recognition. Each transistor is associated with a specific range of motor movement. When the circuit to each transistor is closed, a ground path to any of the A, B, C or D encoder pins is accomplished. When the circuit to each transistor is open, the connection to any of the A, B, C or D encoder pins is pulled to voltage. Mode indication is "decoded" by the 4X4 control module based on the varying combinations of signals coming from the transistors.

Pulse Vacuum Hublocks

The electronic shift-on-the-fly (ESOF) system has a feature which allows the driver to override the vacuum-operated hublocks. When the front hublock dials are manually turned to the LOCK position, the hublocks are locked through the dial at all times, regardless of the position of the instrument panel mode select switch (MSS).

When the front hublock dials are manually turned to the AUTO position, the hublocks use an internal spring-locking mechanism that is vacuum-operated by the ESOF system, and are locked with the MSS in the 4H or 4L position and unlocked with the MSS in 2H position. Refer to Hublock Operation in this section for additional AUTO hublock system operation.

Hublock Operation

With the hublocks in the AUTO position, the 4WD ESOF system uses timed vacuum sequences to lock and unlock the wheel ends when switching the instrument panel MSS between 2WD and 4x4 modes. A high vacuum level (222 mm [8.75 in] Hg and greater) is applied to the hublocks to lock the internal

DIAGNOSIS AND TESTING (Continued)

spring mechanism that engages (locks) the hublocks for 4x4 mode, and a lower vacuum level (114 to 184 mm [5.9 to 7.1 in] Hg) is applied to unlock the spring mechanism that disengages (unlocks) the hublocks for 2WD mode. The vacuum signals are supplied to the hublocks by system components, including the 4X4 control module, wiring harness, solenoid, vacuum harness and vacuum seals. As a first step in service, eliminate obvious items such as loose wiring connections, loose vacuum connections or damaged vacuum lines.

Hublock Engagement/Disengagement Time

With the hublock dials in the AUTO position, switching the instrument panel MSS to 4x4 HIGH or 4x4 LOW results in the high vacuum level being applied to the hublocks, which lasts for at least 51 seconds (including a venting cycle). The hublocks should engage during this time through the spring mechanism. Switching the MSS to 2WD less than 51 seconds after the MSS has been switched to 4x4 HIGH or 4x4 LOW will not interrupt the high vacuum level; instead, the lower vacuum level will be applied after the high vacuum level cycle is completed.

With the hublock dials in the AUTO position, switching the MSS to 2WD results in the lower vacuum level being applied to the hublocks, which lasts for about 15 seconds. However, the actual time required for the hublocks to disengage by spring force can vary considerably due to the effects of driveline wind-up. Road bumps, vehicle speed, acceleration cycles or momentary reversal of direction can assist this process. Switching the MSS to 4x4 HIGH or 4x4 LOW always overrides the lower vacuum level cycle and results in an immediate high vacuum level and in locking of the hublocks.

Manual Override

The AUTO hublocks have a manual override selector dial, which, when turned to the LOCK position, will keep the hublocks locked (through the dial) at all times, regardless of the position of the instrument panel MSS. (Always set both hublock dials to the same position.) If the hublock dials are manually turned from the AUTO to the LOCK position, and the high vacuum level is applied to the hublocks (by switching the MSS from 2WD to 4x4 HIGH or 4x4 LOW), the hublocks will be locked through the dial as well as through the internal spring mechanism. In this case, turning the hublock dials back to the AUTO position will leave the hublocks in (spring) locked mode until the lower vacuum level is applied to the hublocks (by switching the MSS from 4x4 HIGH or 4x4 LOW to the 2WD). (This is not an issue if the hublock dials have been in the AUTO position and the MSS has been switched from 4x4 HIGH or 4x4 LOW to 2WD at least once.) Alternatively, the hublock mechanism can be reset to free mode at any time by turning the hublock dial from AUTO to LOCK to AUTO at least 2 times.

Electronic Shift On-the-Fly (ESOF) Automatic Hublock Operation

Hublock Operational State	Hublock Dial Switching Procedure
"Locked" position - Manual Override	Switch to the hublock dial to LOCK
"Free" Mode (for Troubleshooting or Recreational Towing)	Switch the hublock dial from AUTO to LOCK and back to AUTO to least 2 times
"Automatic" Operation via ESOF	Switch the hublock dial to AUTO
"Automatic" Vacuum Control with MSS in 4x4 HIGH or 4x4 LOW	**NOTE:** This cycle will always be completed and cannot be interrupted by switching the MSS to 2WD. If vehicle speed goes below 5 MPH during the 45-second cycle and the MSS remains in 4x4 HIGH or 4x4 LOW, the locking cycle will repeat. Switch the hublock dial to AUTO PVH solenoid activated for 45 seconds/ vacuum at knuckle is 216 mm (8.5 in) Hg or more. PVH solenoid vents for 6 seconds.
"Automatic" Vacuum Control with MSS in 2WD	**NOTE:** Switching the MSS to 4x4 HIGH or 4x4 LOW will interrupt this cycle. Switch the hublock dial to AUTO PVH solenoid activated for 15 seconds/ vacuum at knuckle is 150 to 180 mm (5.9 to 7.1 in) Hg.

Hublock Replacement

NOTICE:
Make sure to follow the Removal and Installation procedure exactly as instructed or damage to the hub may occur.

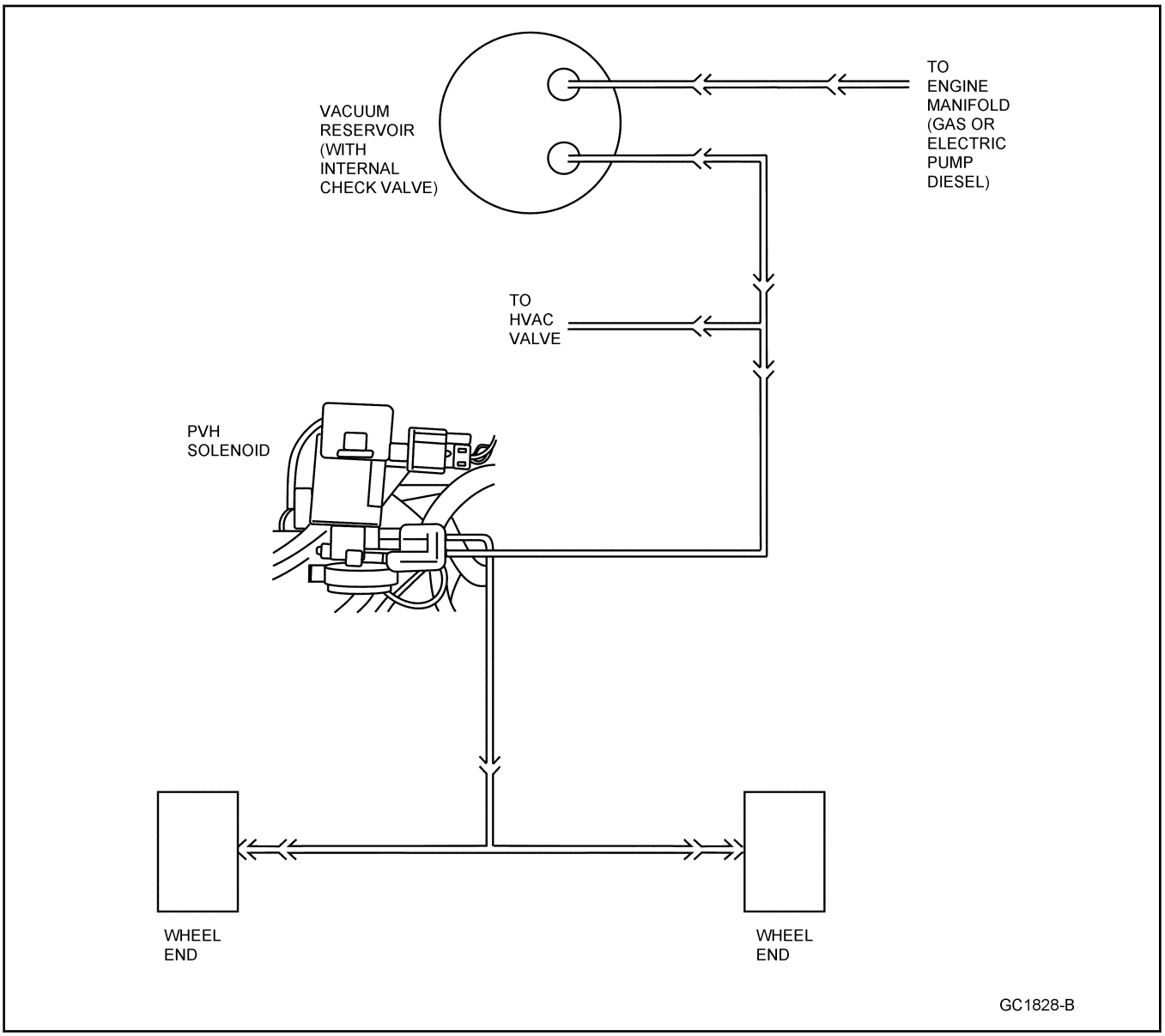
Left- and right-side hublocks are not connected, other than by the common vacuum supply line. If a malfunction in either hublock is diagnosed, it should be installed as an individual unit; there is no need to "balance" an axle with new hublocks on both sides. It is highly unlikely that both hublocks are malfunctioning at the same time on a vehicle. If both sides appear to be malfunctioning, be sure to verify upstream integrity before installing new hublocks on both sides.

Many system components are involved in the correct operation of the ESOF hubs. Before diagnosing the hublocks themselves as the cause of four wheel drive (4WD) concerns, be sure to verify all related system components.

After removing the hublock retaining ring, be sure not to use tools other than hands or "grip" gloves to remove the hublock. Damage may occur to either the paint or the function of the hublock. Pliers or locking Channel-Locks® should be considered as a last resort, and will usually damage the hublock, making it necessary to install a new hublock. Carefully shake the U-joint while attempting to remove the hublock; this should reduce hublock-to-axle shaft spline friction and ease removal.

DIAGNOSIS AND TESTING (Continued)

Electronic Shift Vacuum Schematic



Feature Inputs:

- Mode select switch (MSS)
- Vehicle speed (hardwired to 4X4 control module via ABS)
- Encoder position inputs A, B, C or D
- Transmission neutral position (automatic transmission)
- Clutch apply signal (manual transmission)
- Brake ON/OFF (BOO - hardwired from brake pedal switch)

Feature Outputs:

- Transfer case dual-cone synchronization clutch
- Transfer case shift motor and Hall-effect encoder assembly
- Transfer case shift motor relays
- Pulse vacuum hublock (PVH) solenoid assembly
- PVH vacuum pump (certain diesel applications only)
- Cluster indicators (hardwired to instrument cluster [IC] via 4X4 control module)

During 4WD Initialization at Startup:

DIAGNOSIS AND TESTING (Continued)

- The 4X4 control module will verify the MSS position
- If the transfer case is not in the desired mode, the 4X4 control module will attempt to perform a range shift. If input conditions for 4L are not present, then the module will either shift to or remain in 4H
- Once the transfer case is engaged, or is already in the correct mode, the PVH lock/unlock and/or lock solenoids will be energized
- If the MSS position is 2H, the PVH lock/unlock solenoid will be commanded to energize ONLY at speeds below 8 km/h (5 mph). Once this speed threshold is met, the solenoid will be de-energized. This procedure is to prevent ratcheting induced by an attempt to unlock an already unlocked hub

For a Shift Attempt From 2H to 4H or 4L, the Following Sequence Occurs:

- MSS is switched from 2H to 4H or 4L
- For shift attempts into 4L:
  - the brake must be applied.
  - transmission must be in NEUTRAL (or clutch pedal applied).
  - vehicle speed must be below 8 km/h (5 mph).
- Shift motor moves range fork in transfer case, which engages dual-cone synchronizers
- If a blocked shift condition occurs, the shift motor will perform 10 shift attempts (2H to 4H or 4H to 4L) totaling 5 clockwise movements and 5 counterclockwise movements with an approximate 1-second delay between each motor movement attempt
- If, after 10 attempts, a shift is not completed, then the module will command a shift motor rest time of 40 seconds, before it attempts any further shifts
- After the 40 seconds have expired, the motor will make 10 more attempts to complete the shift. The motor will continue to repeat this sequence a total of 6 times (60 shift attempts) before ceasing operation. No further shift attempts will be made, nor will any further MSS commands be recognized. The vehicle must be restarted for 4WD function to be restored. If this occurs, DTC C1728 (for 2H to 4H attempts) or DTC C1729 (for 4H to 4L shift attempts) will be stored in memory
- If the vehicle is driven above 5 km/h (3 mph) during a 40-second rest period, the module will reattempt the shift strategy outlined previously. Generally, the transfer case will engage as the probability of gear teeth blockage is greatly reduced while rolling
- If no gear teeth blockage is present, the transfer case synchronizers bring the front driveshaft to same speed as rear driveshaft
- Shift fork completes movement and the "4x4" and (if 4L) "Low Range" lamp will illuminate. This ONLY occurs when the driveshafts are synchronized. If they are not, then the "4x4" lamp will not illuminate
- Once the 4x4 lamp is illuminated, the PVH lock and lock/unlock solenoids are energized for 45 seconds, with approximately 62 kPa (9 psi) of vacuum or more at the hubs. The PVH lock sequence cannot be overridden at any time (a mode shift change back to 2H)
- After 45 seconds have elapsed, the solenoids undergo a 6-second vent period, whereby no commands to either the lock or lock/unlock solenoids are allowed, regardless of MSS position
- If the vehicle is driven above 8 km/h (5 mph) the PVH lock and lock/unlock solenoids are re-energized in the same manner, regardless of whether the hubs are engaged or the original 45-second engagement timer has expired

For a Shift Attempt from 4L to 4H to 2H, the Following Sequence Occurs:

- Mode select switch is placed from 4H or 4L to 2H
- For shift attempts out of 4L:
  - the brake must be applied.
  - transmission must be in NEUTRAL (or clutch pedal applied).
  - vehicle speed must be below 8 km/h (5 mph).
- Shift motor moves range fork in transfer case, which disengages dual-cone synchronizers
- If a blocked shift condition occurs, the shift motor will perform 10 shift attempts from 4H or 4L to 2H to 4H or 4L to 2H totaling 5 clockwise movements and 5 counterclockwise movements with an approximate 1-second delay between each motor movement attempt
- If, after 10 attempts, a shift is not completed, then the module will command a shift motor rest time of 40 seconds, before it attempts any further shifts
- After the 40 seconds have expired, the motor will make 10 more attempts to complete the shift. The motor will continue to repeat this sequence a total of 6 times (60 shift attempts) before ceasing operation. No further shift attempts will be made, nor will any further MSS commands be recognized. The vehicle must be restarted for 4x4 function to be restored. If this occurs, DTC C1728 (for attempts between 2H and 4H) or DTC C1729 (for attempts between 4H and 4L) will be stored in memory.
- If the vehicle is driven above 3 mph (5 km/h) during a 40-second rest period, the module will reattempt a shift (4H to 2H only). Generally, the transfer case will disengage as the probability of torque trapping is lower while rolling
- If no torque trapping is present, the transfer case synchronizers decouple the front driveshaft
- Shift fork completes movement and de-energizes "4x4", and if 4L, "Low Range" lamps. Once the 4x4 lamp is de-energized, the PVH lock/unlock solenoid is energized for 15 seconds, pulling approximately 41 kPa (6 psi) of vacuum at the hubs
- The PVH unlock sequence can be overridden at any time such as a mode shift change back to 4H or 4L, relocking the hubs
- After 15 seconds, the solenoids undergo a 6-second vent period; the vent period can be overridden at any time by a shift attempt to 4H or 4L

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Front axle assembly	• Battery junction box (BJB) fuse 3 (30A)

DIAGNOSIS AND TESTING (Continued)

Visual Inspection Chart (Continued)

Mechanical	Electrical
• Pulse vacuum hublocks (PVH) • Shift motor • Synchronization clutch • Driveshaft and U-joints • Vacuum leaks • Fluid leaks • Matching tire sizes • Transfer case	• Central junction box (CJB) fuse: — 19 (10A) — 27 (15A) — 33 (15A) — 45 (10A) • Wiring harness • 4X4 control module • Shift relays • Shift motor encoder assembly • Mode select switch (MSS) • Connector(s) • PVH solenoid assembly • Vacuum solenoid (diesel only) • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **NOTE:**
   Make sure to use the latest scan tool software release.

   If the cause is not visually evident, connect the diagnostic tool to the Data Link Connector (DLC).

- check that the program card is correctly installed (if using NGS+).
- check the connections to the vehicle.
- check the ignition switch position.

5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.
6. Carry out the data link diagnostics test. If the diagnostic tool responds with:

- SCP+, SCP-, UBP, CAN or ISO circuits fault; all electronic control units no response/not equipped, refer to Section 418-00.
- No response/not equipped for powertrain control module (PCM). Refer to Section 418-00 to diagnose module communication problems.
- No response/not equipped for 4X4 control module, GO to Pinpoint Test G.
- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self-test diagnostics for the 4X4 control module.

7. If the DTCs retrieved are related to the concern, go to the 4X4 Control Module (DTC) Chart to continue diagnostics.
8. If no DTCs related to the concern are retrieved, GO to the Symptom Chart.

4X4 Control Module (DTC) Chart

NOTICE:
After repairing the cause of the 4WD system faults, the engine must be started in order to clear the 4X4 control module DTCs.

4X4 Control Module (DTC) Chart

DTC	Description	Source	Action
B1317	Battery Voltage High	4X4 Control Module	REFER to Section 414-00.
B1318	Battery Voltage Low	4X4 Control Module	REFER to Section 414-00.
B1342	ECU is Defective	4X4 Control Module	CLEAR DTCs. REPEAT the self-test. If DTC B1342 is retrieved, INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. CLEAR the DTCs. REPEAT the self-test.
B1355	Ignition RUN Circuit Failure	4X4 Control Module	CHECK CJB fuse 45 (10A) for an open. If the fuse is blown, GO to Pinpoint Test J. If missing, INSTALL a new fuse. TEST the system for normal operation.
B1359	Ignition RUN/ACC Circuit Failure	4X4 Control Module	CHECK CJB fuse 33 (15A) for an open. If the fuse is blown, GO to Pinpoint Test J. If missing, INSTALL a new fuse. TEST the system for normal operation.
B1483	Brake Pedal Input Circuit Failure	4X4 Control Module	REFER to Section 417-01.
B1485	Brake Pedal Input Circuit Short to Battery	4X4 Control Module	REFER to Section 417-01.

DIAGNOSIS AND TESTING (Continued)

4X4 Control Module (DTC) Chart (Continued)

DTC	Description	Source	Action
B2477	Module Configuration Failure (Unconfigured, Incorrect or Rejected)	4X4 Control Module	REFER to Section 418-01.
C1728	Transfer Case Unable to Transition Between 2H and 4H	4X4 Control Module	GO to Pinpoint Test J.
C1729	Transfer Case Unable to Transition Between 4H and 4L	4X4 Control Module	GO to Pinpoint Test L.
P0500	Vehicle Speed Sensor (VSS) Malfunction	4X4 Control Module	GO to Pinpoint Test L.
P1804	Transmission 4-Wheel Drive High Indicator Circuit Failure	4X4 Control Module	GO to Pinpoint Test H.
P1806	Transmission 4-Wheel Drive High Indicator Short Circuit to Battery	4X4 Control Module	GO to Pinpoint Test H.
P1808	Transmission 4-Wheel Drive Low Indicator Circuit Failure	4X4 Control Module	GO to Pinpoint Test H.
P1810	Transmission 4-Wheel Drive Low Indicator Short Circuit to Battery	4X4 Control Module	GO to Pinpoint Test H.
P1815	Transmission 4-Wheel Drive Mode Select Short Circuit to Ground	4X4 Control Module	GO to Pinpoint Test Q.
P1819	Transmission Neutral Safety Switch Short Circuit to Ground	4X4 Control Module	GO to Pinpoint Test L.
P1820	Transmission Transfer Case Clockwise Shift Relay Coil Circuit Failure	4X4 Control Module	GO to Pinpoint Test K.
P1822	Transmission Transfer Case Clockwise Shift Relay Coil Short Circuit to Battery	4X4 Control Module	GO to Pinpoint Test K.
P1828	Transmission Transfer Case Counterclockwise Shift Relay Coil Circuit Failure	4X4 Control Module	GO to Pinpoint Test K.
P1830	Transmission Transfer Case Counterclockwise Shift Relay Coil Short Circuit to Battery	4X4 Control Module	GO to Pinpoint Test K.
P1832	Transmission Transfer Case Differential Lock-Up Solenoid Circuit Failure	4X4 Control Module	CHECK CJB fuse 27 (15A) for an open. If the fuse is OK, GO to Pinpoint Test I. If missing, INSTALL a new fuse. TEST the system for normal operation.
P1834	Transmission Transfer Case Differential Lock-Up Solenoid Short Circuit to Battery	4X4 Control Module	GO to Pinpoint Test I.
P1865	Transmission Transfer Case Contact Plate Power Short to Ground	4X4 Control Module	GO to Pinpoint Test J.
P1866	Transmission Transfer Case System Concern — Servicing Required	4X4 Control Module	GO to Pinpoint Test J.
P1867	Transmission Transfer Case Contact Plate General Fault	4X4 Control Module	GO to Pinpoint Test J.
P1876	Transmission Transfer Case 2-Wheel Drive Solenoid Circuit Failure	4X4 Control Module	CHECK CJB fuse 27 (15A) for an open. If the fuse is blown, GO to Pinpoint Test I. If missing, INSTALL a new fuse. TEST the system for normal operation.
P1877	Transmission Transfer Case 2-Wheel Drive Solenoid Circuit Short to Battery	4X4 Control Module	GO to Pinpoint Test I.

Symptom Chart

Symptom Chart — Electronic Shift

Condition	Possible Sources	Action
• No communication with the 4X4 control module	• Diagnostic tool • Data link connector (DLC) • 4X4 control module • Circuitry	• GO to Pinpoint Test G.
• The instrument cluster (IC) 4x4 and Low Range indicators do not operate correctly/do not operate	• IC • Circuitry • 4X4 control module	• GO to Pinpoint Test H.

DIAGNOSIS AND TESTING (Continued)

Symptom Chart — Electronic Shift (Continued)

Condition	Possible Sources	Action
• The transfer case does not shift between 2H and 4H modes correctly	• Mode select switch (MSS) • Transfer case • Transfer case clutch • Pulse vacuum hublocks (PVH) • 4X4 control module • Circuitry	• GO to Pinpoint Test J.
• The transfer case does not shift between 4H and 4L modes correctly	• Transfer case • Mode select switch • 4X4 control module • Transmission drag	• GO to Pinpoint Test L.
• 4WD does not engage at speed correctly	• Transfer case synchronizer • 4X4 control module • Pulse vacuum hublocks (PVH)	• GO to Pinpoint Test M.
• The front axle does not engage/disengage correctly	• Pulse vacuum hublocks (PVH) • PVH solenoid assembly • Circuitry • Vacuum leaks • 4X4 control module • Front axle assembly	• GO to Pinpoint Test I.
• The 4WD system jumps out of gear	• Transfer case • PVH system • Mode select switch	• GO to Pinpoint Test N.
• Straightline driveline wind-up	• Tire inflation pressure • Tire and wheel size • Tire wear • Axle ratio	• GO to Pinpoint Test O.
• Clunking noise during 4WD engagement, especially at high speeds	• Vehicle speed • Torque to the front axle	• GO to Pinpoint Test M
• The transfer case makes noise	• Tire inflation pressure • Tire and wheel size	• MAKE SURE that all tires and wheels are the same size and that the inflation pressures are correct.
	• Tire tread wear	• CHECK tire tread wear to see if there is more than 0.15 mm (0.06 in) difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again.
	• Internal components	• OPERATE the vehicle in all transmission gears. If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission. REFER to Section 307-01. If there is noise in all gears, DISASSEMBLE the transfer case. REFER to Section 308-07B. CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary.
	• Fluid level	• FILL with automatic transmission fluid. REFER to Section 308-07B.
• Unable to duplicate customer concern	• 4WD system and/or related components	• Carry out the Electronic Shift on the Fly (ESOF) Functional Test. GO to Pinpoint Test P.

Pinpoint Tests

Pinpoint Test G: No Communication With the 4X4 control module

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

In order for the 4X4 control module to communicate with the diagnostic tool, the operating voltage required to supply the 4X4 control module is in a range between 9 and 16 volts.

DIAGNOSIS AND TESTING (Continued)

Possible Causes

- Power supply circuits:
  - 1306 (PK/WH)
  - 1306 (PK/WH)
- Ignition circuits:
  - 640 (RD/YE)
  - 1002 (BK/PK)
- Central junction box (CJB) fuses:
  - 19 (10A)
  - 45 (10A)
  - 33 (15A)

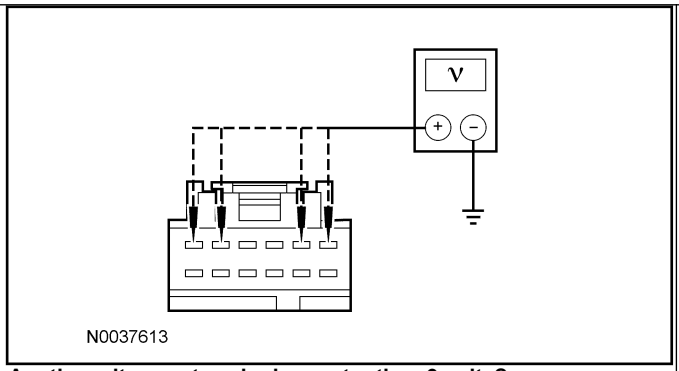
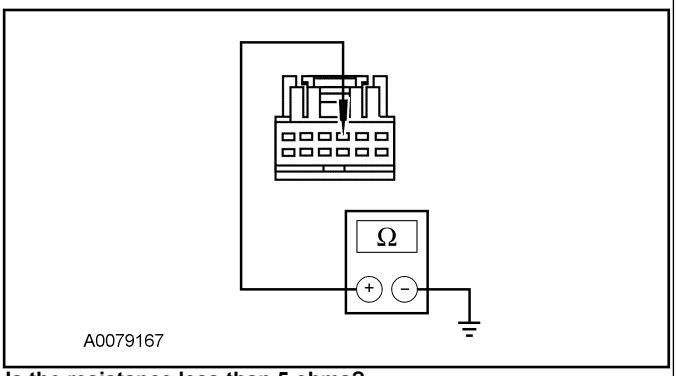
PINPOINT TEST G: NO COMMUNICATION WITH THE 4X4 CONTROL MODULE

NOTICE:
Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

<table>
<tr><th colspan="2">Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>G1</td><td colspan="2">CHECK FOR DIAGNOSTIC TOOL COMMUNICATION WITH THE 4X4 CONTROL MODULE</td></tr>
<tr><td></td><td>• Connect the scan tool.
• Ignition OFF.
• Using the scan tool, carryout the Network Test.
• Does the scan tool communicate with the vehicle?</td><td>Yes
REFER to Section 418-00 to diagnose the vehicle communication network.
No
GO to G2.</td></tr>
<tr><td>G2</td><td colspan="2">CHECK THE 4X4 CONTROL MODULE IGNITION SWITCH STATUS PIDS</td></tr>
<tr><td></td><td>• Cycle the ignition switch through each position while monitoring the ignition switch status PIDs as indicated in the following table:
<table><tr><th>Ignition Switch Position</th><th>PID</th><th>Expected Value</th></tr><tr><td>OFF</td><td>IGN_O/L</td><td>OFF</td></tr><tr><td>ACCESSORY</td><td>IGN_ACC</td><td>ACCY</td></tr><tr><td>RUN</td><td>IGN_R</td><td>RUN</td></tr><tr><td>START</td><td>IGN_S</td><td>START</td></tr></table>• Do the ignition switch PIDs match the ignition switch positions?</td><td>Yes
GO to G3.
No
CHECK the ignition switch. REFER to Section 211-05. After the fault is repaired, CLEAR the DTC. REPEAT the self-test.</td></tr>
<tr><td>G3</td><td colspan="2">CHECK FOR VOLTAGE INPUT TO THE FOUR WHEEL DRIVE 4X4 CONTROL MODULE</td></tr>
<tr><td></td><td>• Ignition OFF.
• Disconnect: 4X4 Control Module C281a.
• Ignition ON.
• Measure the voltage between 4X4 control module C281a, harness side and ground as follows:
<table><tr><th>C281a Pin</th><th>Circuit</th></tr><tr><td>1</td><td>1306 (PK/WH)</td></tr><tr><td>2</td><td>1306 (PK/WH)</td></tr><tr><td>5</td><td>640 (RD/YE)</td></tr><tr><td>6</td><td>1002 (BK/PK)</td></tr></table></td><td>Yes
GO to G7.
No
GO to G4.</td></tr>
</table>

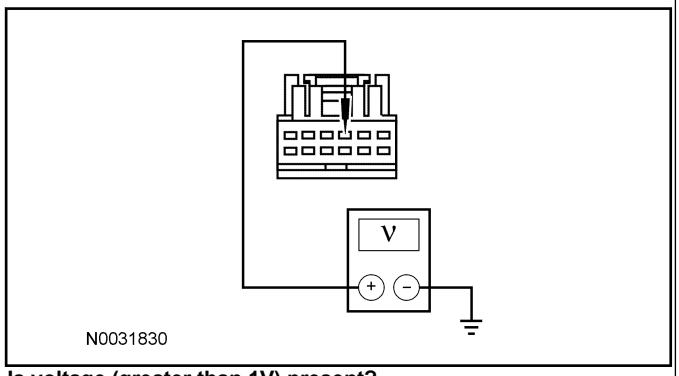
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST G: NO COMMUNICATION WITH THE 4X4 CONTROL MODULE (Continued)

G3	**CHECK FOR VOLTAGE INPUT TO THE FOUR WHEEL DRIVE 4X4 CONTROL MODULE (Continued)**	
	 • **Are the voltages at each pin greater than 9 volts?**	
G4	**CHECK THE CENTRAL JUNCTION BOX (CJB) MINI-FUSES**	
	• Check CJB mini-fuses: — 19 (10A). — 45 (10A). — 33 (15A). • **Are the fuses okay?**	**Yes** GO to G5. **No** REFER to the Wiring Diagrams manual to identify the possible causes for the circuit short. REPEAT the self-test.
G5	**CHECK FOR BATTERY VOLTAGE AT THE BJB AND CJB POWER INPUT FUSE CAVITIES**	
	• Ignition ON. • Measure the voltage between CJB input side fuse cavities and ground: — 19 (10A). — 45 (10A). — 33 (15A). • **Are the voltages greater than 9 volts?**	**Yes** GO to G7. **No** GO to G6.
G6	**CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING**	
	• Start the engine. • Measure the battery voltage at the positive battery terminal. • **Is the voltage greater than 9 volts?**	**Yes** GO to G7. **No** CHECK the charging system. REFER to Section 414-00.
G7	**CHECK THE GROUND CIRCUIT FOR AN OPEN**	
	• Ignition OFF. • Disconnect the battery ground cable. Refer to section Section 414-00 • Disconnect: 4X4 Control Module C281a. • Measure the resistance between 4X4 control module C281a-3, circuit 57 (BK), harness side and ground.  • **Is the resistance less than 5 ohms?**	**Yes** GO to G8. **No** REPAIR circuit 57 (BK). REPEAT the self-test.
G8	**CHECK FOR A FLOATING GROUND**	

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST G: NO COMMUNICATION WITH THE 4X4 CONTROL MODULE (Continued)

	Test Step	Result / Action to Take
G8	**CHECK FOR A FLOATING GROUND (Continued)**	
	• Ignition ON. • Measure the voltage between 4X4 control module C281a-3, circuit 57 (BK), harness side and ground.  • **Is voltage (greater than 1V) present?**	**Yes** REPAIR circuit 57 (BK). REPEAT the self-test. **No** GO to G9.
G9	**CHECK THE FOUR WHEEL DRIVE 4X4 CONTROL MODULE CONNECTOR**	
	• Ignition OFF. • Disconnect the 4X4 control module connectors C281a and C281b. • Check for corrosion and/or pushed out pins. • **Is the connector corroded and/or damaged?**	**Yes** REPAIR or CLEAN the connector(s) as necessary. RECONNECT and REPEAT the self-test. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. TEST the system for normal operation.

Pinpoint Test H: The Instrument Cluster (IC) 4X4 And Low Range Indicators Do Not Operate Correctly/Do Not Operate
Refer to Wiring Diagrams Cell 34, Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation
The 4x4 and Low Range indicator status is transmitted to the instrument cluster (IC) via independent hardwired ground paths from the 4X4 control module through circuits 975 (BN/YE) and 210 (LB). A steady indicator is displayed whether the vehicle is in 4H or 4L, according to the driver selection. Indicators do not flash under any circumstances. When the vehicle is in 4L, the 4x4 and Low Range indicator circuits are displayed. When the 4WD system is in 4H, only the 4x4 indicator circuit is displayed.

This pinpoint test is intended to diagnose the following:

- IC
- 4WD system fault
- 4X4 control module
- 4L indicator circuit — 975 (BN/YE)

PINPOINT TEST H: THE IC 4X4 AND LOW RANGE INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE

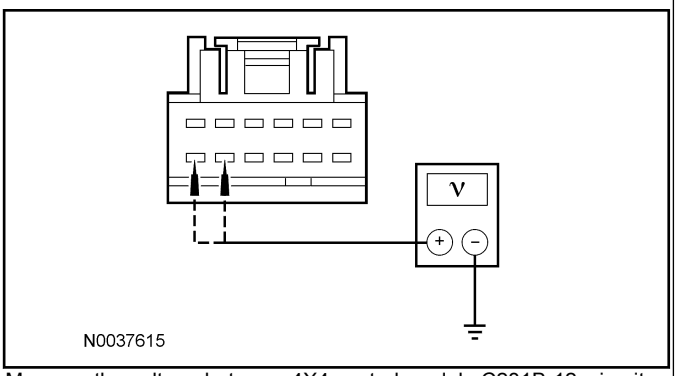
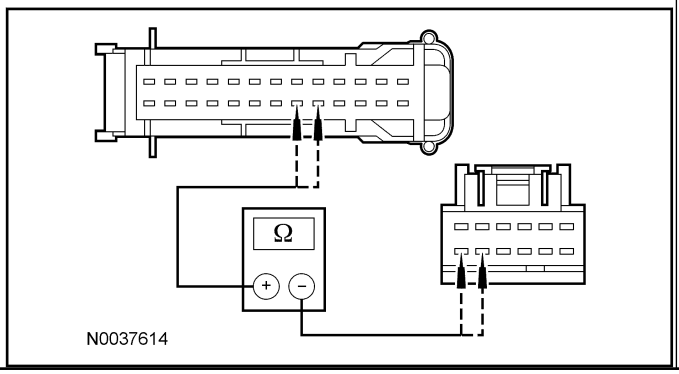
	Test Step	Result / Action to Take
H1	**CHECK THE 4X4 INDICATOR PROVE-OUT**	
	• Ignition ON. • Observe the 4X4 LOW and 4X4 indicators in the IC. • **Do the 4X4 LOW and 4X4 indicators prove out correctly?**	**Yes** GO to H2. **No** CHECK the IC. REFER to Section 413-01. TEST the system for normal operation.
H2	**CHECK FOR 4X4 CONTROL MODULE DTCs**	
	• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are DTCs present?**	**Yes** If DTC P1806 or P1810, GO to H4. If DTC P1806 or P1808, GO to H5. If other DTCs, REFER to the 4X4 Control Module DTC Chart.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST H: THE IC 4X4 AND LOW RANGE INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE (Continued)

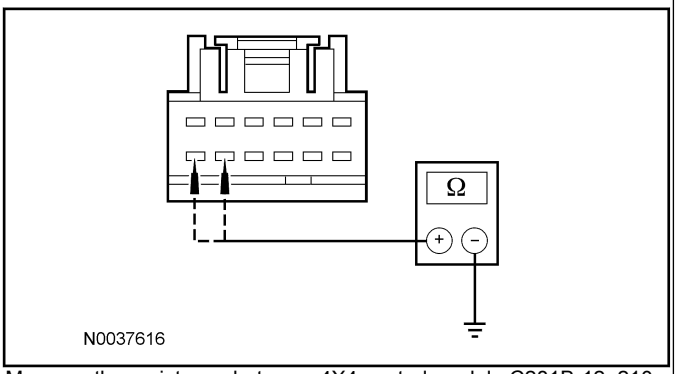
H2	**CHECK FOR 4X4 CONTROL MODULE DTCs (Continued)**	
		No GO to H3.
H3	**CHECK THE CONTACT PLATE ENCODER PIDs**	
	• Monitor the 4X4 control module Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs. Refer to the following chart:	

MSS Position	Contact Plate Position			
	PLATE_A	PLATE_B	PLATE_C	PLATE_D
2H Mode	OPEN	OPEN	CLOSED	OPEN
4H Mode	CLOSED	OPEN	CLOSED	OPEN
4L Mode	CLOSED	CLOSED	OPEN	OPEN

• **Does the contact plate position PID indicate that the transfer case shift motor is in 4X4 AUTO?**	**Yes** GO to H4. **No** GO to Pinpoint Test J.
H4	**CHECK 4X4 INDICATOR CIRCUITS FOR A SHORT TO VOLTAGE**
• Ignition OFF. • Disconnect: 4X4 Control Module C281B. • Ignition ON. • Measure the voltage between 4X4 control module C281B-11, circuit 975 (BN/YE), harness side and ground.  • Measure the voltage between 4X4 control module C281B-12, circuit 210 (LB), harness side and ground. • **Is any voltage present?**	**Yes** REPAIR the affected circuit(s). TEST the system for normal operation. CLEAR the DTCs. TEST the system for normal operation. REPEAT the self-test. **No** GO to H5.
H5	**CHECK 4X4 INDICATOR CIRCUITS FOR AN OPEN**
• Disconnect: IC C220B. • Measure the resistance between 4X4 control module C281B-11, harness side and IC C220B-22, harness side, circuit 975 (BN/YE).  	**Yes** GO to H6. **No** REPAIR the affected circuit(s). TEST the system for normal operation. CLEAR the DTCs. TEST the system for normal operation. REPEAT the self-test.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST H: THE IC 4X4 AND LOW RANGE INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE (Continued)

H5	**CHECK 4X4 INDICATOR CIRCUITS FOR AN OPEN (Continued)**	
	• Measure the resistance between 4X4 control module C281B-12, harness side and IC C220B-21, harness side, circuit 210 (LB). • **Is the resistance less than 5 ohms?**	
H6	**CHECK 4X4 INDICATOR CIRCUITS FOR A FOR A SHORT TO GROUND**	
	• Ignition OFF. • Measure the resistance between 4X4 control module C281B-11, 975 (BN/YE), harness side and ground.  • Measure the resistance between 4X4 control module C281B-12, 210 (LB), harness side and ground. • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to H7. **No** REPAIR the affected circuit(s). TEST the system for normal operation. CLEAR the DTCs. TEST the system for normal operation. REPEAT the self-test.
H7	**CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION**	
	• Ignition OFF. • Disconnect all 4X4 control module connectors. • Check for: — corrosion. — pushed-out pins. • Connect all 4X4 control module connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. REFER to 4X4 control module in this section. TEST the system for normal operation. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. TEST the system for normal operation. REPEAT the self-test.

Pinpoint Test I: The Front Axle Does Not Engage/Disengage Correctly

Normal Operation

When shifting between from 2H to 4H/4L, the 4X4 control module supplies a timed ground path to the lock and lock/unlock solenoids to apply vacuum to the pulse vacuum hublocks (engaging the front hubs to the front axle). When shifting from 4H/4L to 2H, the 4X4 control module supplies a timed ground path to the lock/unlock solenoid only (disengaging the front hubs from the front axle). Once the hubs are set to their intended state, they remain in that state until another timed vacuum "pulse" is delivered to the hublocks. Systematically check the necessary inputs and outputs at the 4X4 control module, internal components of the transfer case, mode select switch (MSS), pulse vacuum hublocks (PVH) components and drive axles.

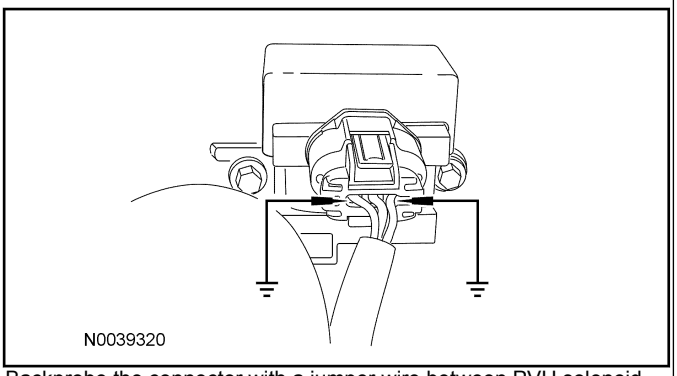
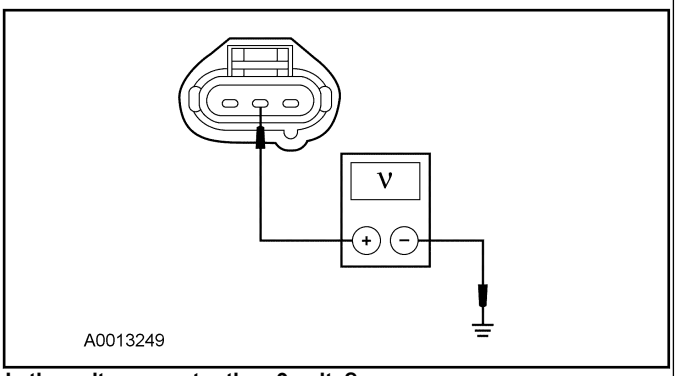
Possible Causes

- Pulse vacuum hublocks (PVH)
- PVH solenoid
- Vacuum leaks
- Front axle assembly
- 4X4 control module
- Circuit 295 (GY/BK)
- Circuit 605 (RD)
- Central junction box (CJB) fuses:
  - 19 (10A)
  - 27 (15A)
  - 33 (15A)
  - 45 (10A)

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY

NOTICE:
Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step		Result / Action to Take
I1	**CHECK THE PVH SOLENOID OPERATION**	
	• Ignition ON. • Backprobe the connector with a jumper wire between PVH solenoid C1247-3, circuit 605 (RD) harness side and ground.  • Backprobe the connector with a jumper wire between PVH solenoid C1247-1, circuit 145 (GY/BK) harness side and ground. • **Does the PVH solenoid click when either pin is grounded?**	**Yes** GO to I3. **No** GO to I2.
I2	**CHECK CIRCUIT 295 (LB/PK) FOR VOLTAGE**	
	• Ignition OFF. • Disconnect: PVH Solenoid C1247. • Ignition ON. • Measure the voltage between PVH solenoid C1247-2, circuit 295 (LB/PK) harness side and ground.  • **Is the voltage greater than 9 volts?**	**Yes** INSTALL a new PVH solenoid. CLEAR the DTCs. REPEAT the self-test. **No** VERIFY CJB fuse 27 (15A) is OK. If OK, REPAIR circuit 295 (LB/PK). If not OK, REFER to the Wiring Diagrams manual to identify the possible cause of the circuit short. CLEAR the DTCs. TEST the system for normal operation.
I3	**CHECK FOR 4X4 CONTROL MODULE DTCs**	
	• Connect the scan tool. • Enter the following diagnostic mode on the scan tool: Self-test — 4X4 Control Module. • Carry out the on-demand self test. • **Were DTCs P1832, P1834, P1876 or P1877 retrieved?**	**Yes** If DTC P1832, P1834, P1876 or P1877, GO to I10 . For all other DTCs, REFER to the 4X4 Control Module (DTC) Chart. **No** GO to I4.
I4	**CHECK THE TRANSFER CASE SHIFT TO 2H**	
	• Monitor the 4X4 control module shift motor encoder position PID while shifting the MSS to 2H.	**Yes** GO to I5. **No** GO to Pinpoint Test J.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY (Continued)

I4 CHECK THE TRANSFER CASE SHIFT TO 2H (Continued)

Mode Select Switch Position	Shift Motor Encoder Position			
	A	B	C	D
2H	OPEN	OPEN	CLOSED	OPEN

- **Do the PIDs indicate that the shift motor is in the 2H position?**

I5 CHECK THE PVH DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02.
- **NOTE:** The engine must be idling during the following steps to supply vacuum to the PVH solenoid.

  Start the engine and allow to idle.
- Switch the MSS to 2H and wait 15 seconds.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front axle U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front axle U-joint.
- **Did either front axleshaft rotate?**

Yes
GO to I6.

No
GO to I7.

I6 CHECK THE PVH SOLENOID 2H OUTPUT WITH THE SCAN TOOL

- **NOTE:** The engine must be idling during the following steps to supply vacuum to the PVH solenoid.

  Using the scan tool, command the PVH solenoid to disengage the PVHs (lock/unlock solenoid ON).
- Using a vacuum gauge, measure the vacuum at the lock/unlock solenoid output port of the PVH solenoid.
- **Is the vacuum at the PVH solenoid output port between 144 and 184 mm (5.7 and 7.25 in) Hg?**

Yes
End the active command. GO to I14 .

No
End the active command. GO to I9 .

I7 CHECK THE PVH ENGAGEMENT

- **NOTE:** The engine must be idling during the following steps to supply vacuum to the PVH solenoid.

  Switch the MSS to the 4H position.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front U-joint.
- **Did both front axleshafts rotate?**

Yes
CHECK that all driveline fasteners are present and tightened to specification. REFER to Section 205-00 for further diagnosis of the front axle.

No
GO to I8.

I8 CHECK THE PVH SOLENOID 4H OUTPUT WITH THE SCAN TOOL

- **NOTE:** The engine must be idling during the following steps to supply vacuum to the PVH solenoid.

  Using the scan tool, command the PVH solenoid to engage the hublocks (lock and lock/unlock solenoid energized).
- Measure the vacuum at the lock/unlock solenoid output port.
- **Is the vacuum at the PVH solenoid output port greater than 228 mm (9 in) Hg?**

Yes
End the active command. GO to I14 .

No
End the active command. GO to I9 .

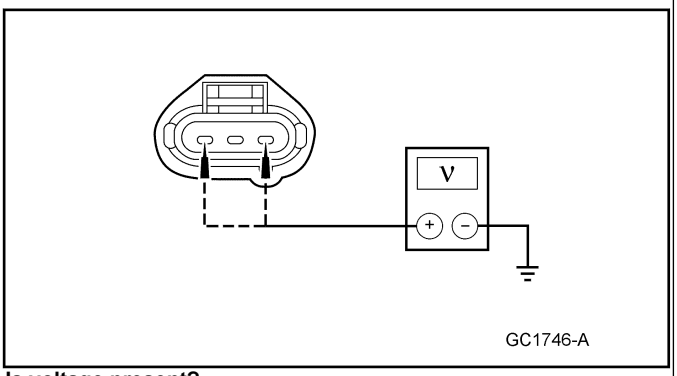
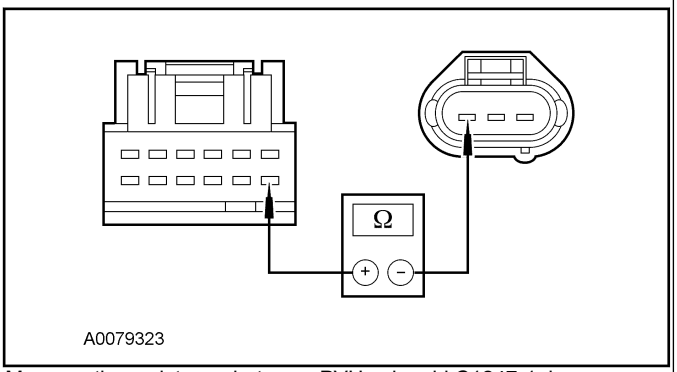
I9 CHECK PVH SOLENOID INPUT VACUUM

- Measure the vacuum at the input vacuum tube of the PVH solenoid.
- **Is the vacuum greater than 228 mm (9 in) Hg?**

Yes
GO to I10.

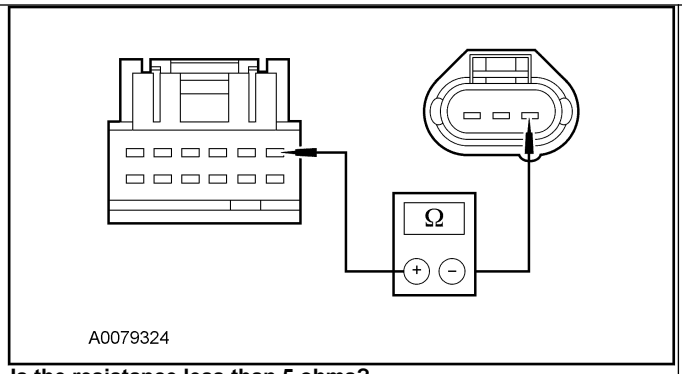
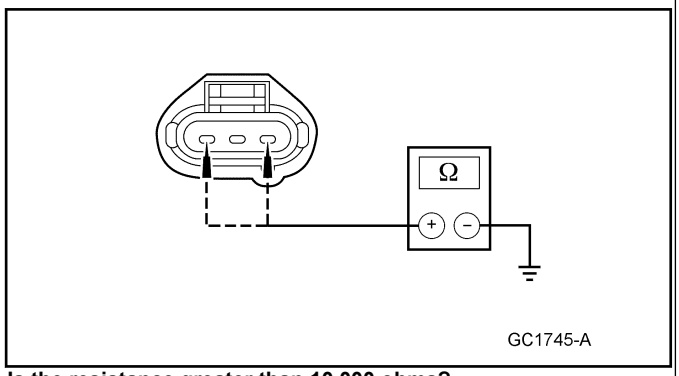
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY (Continued)

I9	**CHECK PVH SOLENOID INPUT VACUUM (Continued)**	
		No For gasoline engines, REPAIR the vacuum leak. TEST the system for normal operation. For diesel engines, GO to I23 .
I10	**CHECK CIRCUIT 605 (RD) AND 145 (GY/BK) FOR A SHORT TO VOLTAGE**	
	• Ignition OFF. • Disconnect: PVH Solenoid C1247. • Disconnect: 4X4 Control Module C281b. • Ignition ON. • Measure the voltage between PVH solenoid C1247-3, circuit 605 (RD), harness side and ground; and between PVH solenoid C1247-1, circuit 145 (GY/BK), harness side and ground.  GC1746-A • **Is voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to I11.
I11	**CHECK CIRCUIT 605 (RD) AND 145 (GY/BK) FOR AN OPEN**	
	• Ignition OFF. • Measure the resistance between PVH solenoid C1247-3, harness side and 4X4 control module C281b -7, circuit 605 (RD), harness side.  A0079323	**Yes** GO to I12.
	• Measure the resistance between PVH solenoid C1247-1, harness side and 4X4 control module C281b -1, circuit 145 (GY/BK), harness side.	**No** REPAIR the affected circuit(s). CLEAR the DTC(s). REPEAT the self-test.

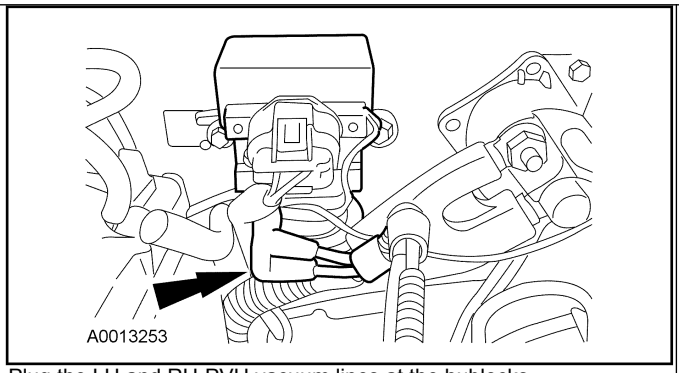
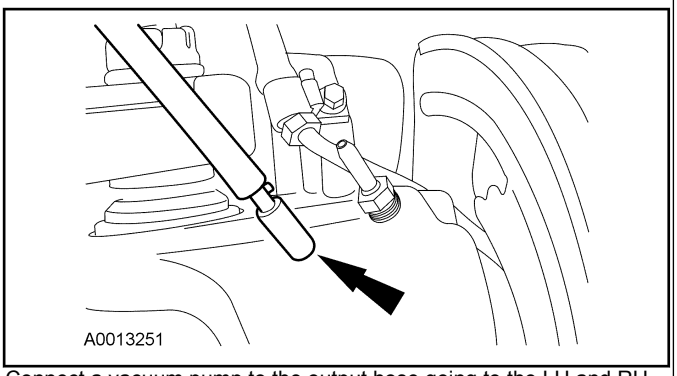
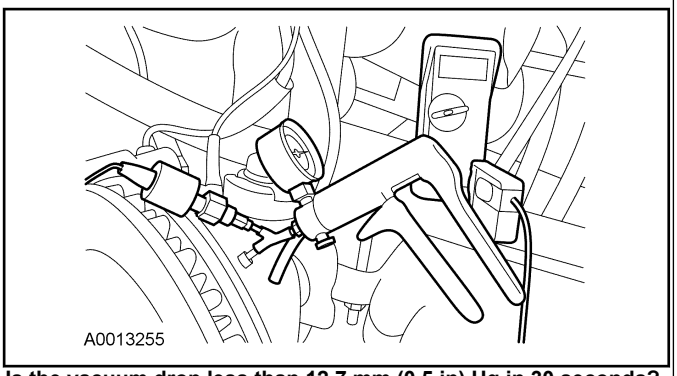
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY (Continued)

I11	**CHECK CIRCUIT 605 (RD) AND 145 (GY/BK) FOR AN OPEN (Continued)**	
	 • **Is the resistance less than 5 ohms?**	
I12	**CHECK CIRCUIT 605 (RD) AND 145 (GY/BK) FOR A SHORT TO GROUND**	
	• Measure the resistance between PVH solenoid C1247-3, circuit 605 (RD), harness side and ground; measure the resistance between PVH solenoid C1247-1, circuit 145 (GY/BK), harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to I13. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
I13	**CHECK THE 4X4 CONTROL MODULE**	
	• Disconnect and inspect the 4X4 control module C281a and C281b connectors. • Check for: — corrosion. — pushed-out pins. • Connect all 4X4 control system connectors and make sure they are seated correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. REFER to4X4 Control Module in this section. REPEAT the self-test. **No** The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
I14	**CHECK THE PVH VACUUM HOSES**	
	• Ignition OFF. • Disconnect the vacuum harness from the PVH solenoid.	**Yes** INSTALL new vacuum lines as necessary. TEST the system for normal operation. **No** GO to I15.

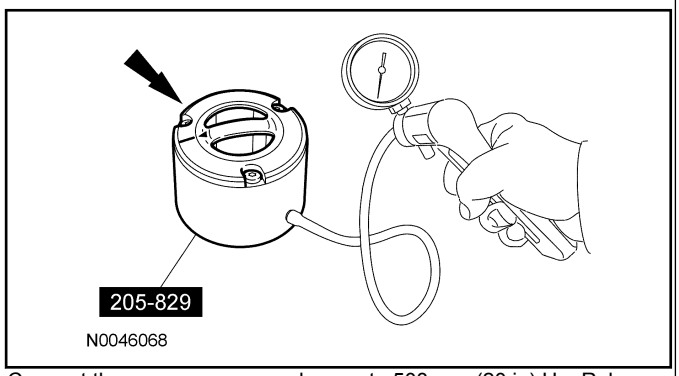
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY

I14	**CHECK THE PVH VACUUM HOSES (Continued)**	
	 • Plug the LH and RH-PVH vacuum lines at the hublocks.  • Connect a vacuum pump to the output hose going to the LH and RH hublocks at the PVH solenoid connection. Apply 508 mm (20 in) Hg of vacuum to the PVH apply vacuum circuit and observe the vacuum reading. • **Did the vacuum drop more than 25 mm (0.98 in) Hg per minute?**	
I15	**CHECK FOR LEAKS AT THE LH AND RH PVH**	
	• Disconnect the vacuum line at the knuckle (LH and RH side). • Using a T-fitting, connect a calibrated vacuum gauge and a vacuum pump to the knuckle fitting. • Apply 508 mm (20 in) Hg of vacuum. Observe the vacuum reading for 30 seconds.  • **Is the vacuum drop less than 12.7 mm (0.5 in) Hg in 30 seconds?**	**Yes** GO to I17. **No** GO to I16.

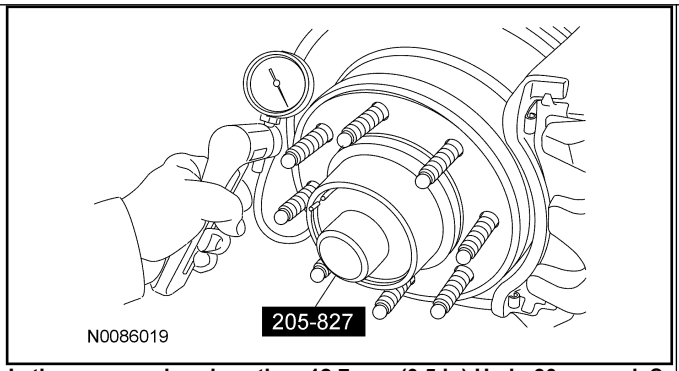
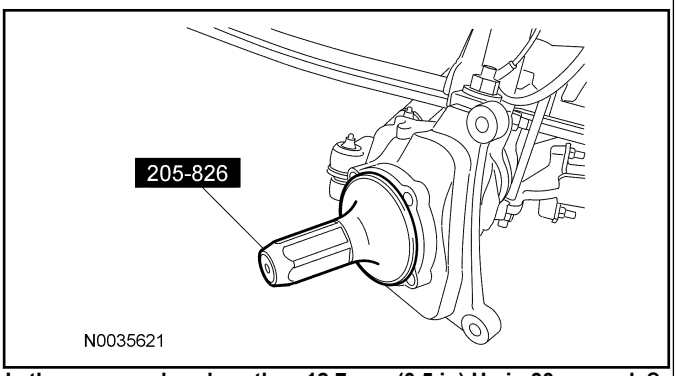
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY

I16	**CHECK FOR A LOOSE KNUCKLE FITTING**	
	• Remove the vacuum pump from the knuckle. • Make sure the knuckle fitting is tightened to 20 Nm (15 lb-ft). • Install the vacuum pump on the knuckle and pump to 508 mm (20 in) Hg. • Observe the vacuum reading for 30 seconds. • **Is the vacuum drop less than 12.7 mm (0.5 in) Hg in 30 seconds?**	**Yes** The knuckle fitting was the source of the leak. TEST the system for normal operation. **No** GO to I17.
I17	**CHECK FOR A DYNAMIC VACUUM LEAK AT THE LH AND RH PVH**	
	• Make sure the vacuum is still at 508 mm (20 in) Hg. • Rotate the front tire for 30 seconds while observing the vacuum reading. • **Is the vacuum reading drop greater than 12.7 mm (0.5 in) Hg in 20 seconds?**	**Yes** GO to I18. **No** The 4x4 system is operating correctly. TEST the system for normal operation.
I18	**CHECK FOR A HUBLOCK VACUUM LEAK**	
	• Remove the hublock. Refer to Hublock in this section. • Remove and discard the hublock O-ring. • Rotate the hublock to AUTO position. • Install the hublock into the special tool. Be sure that the hublock is completely seated into the special tool.  • Connect the vacuum pump and pump to 508 mm (20 in) Hg. Release the vacuum pressure, then remove the hublock. The hublock should be in the engaged position. The inner drive gear will not rotate. • Reinstall the hublock into the special tool. Pump to 147.32 mm (5.8 in) to 198.12 mm (7.8 in) Hg. Release the vacuum pressure, then remove the hublock. The hublock should be in the disengaged position. The inner drive gear will rotate freely. • **Did the hublock engage and disengage correctly?**	**Yes** The hublock is okay. GO to I19 . **No** INSTALL a new hublock. REFER to Hublock in this section. TEST the system for normal operation.
I19	**CHECK THE HUBLOCK SEAL**	
	NOTE: Install a new O-ring on the Vacuum Hub Test Tool. The O-ring used is the same as in the hublock. Apply a light film of lubricant on the O-ring. **NOTE:** Using emery cloth, clean the sealing surface of the wheel hub before testing. • Install the Vacuum Hub Test Tool and the retainer ring. Make sure the retainer ring is seated in the groove. • Connect the vacuum pump and pump to 508 mm (20 in) Hg. Observe the vacuum reading for 30 seconds.	**Yes** The old hublock seal was worn or damaged. REMOVE the special tool. INSTALL the hublock with a new O-ring. TEST the system for normal operation. **No** GO to I20.

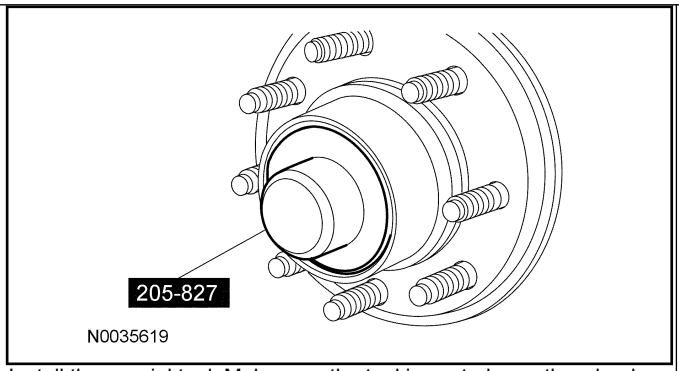
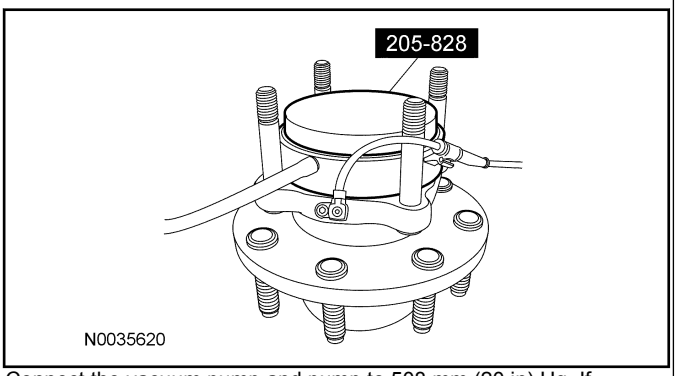
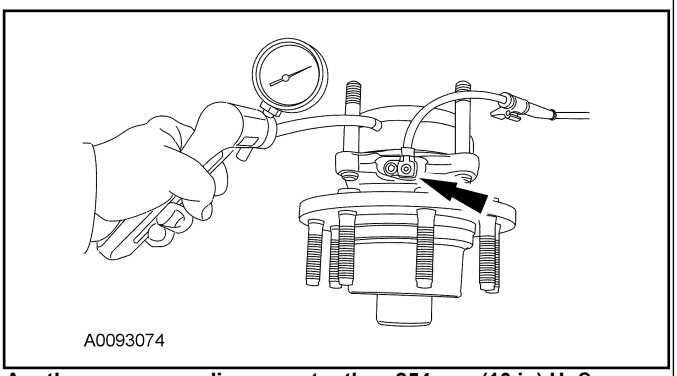
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY

I19	**CHECK THE HUBLOCK SEAL (Continued)**	
	 • **Is the vacuum drop less than 12.7 mm (0.5 in) Hg in 30 seconds?**	
I20	**CHECK THE KNUCKLE SEAL**	
	• Remove the wheel hub assembly. Refer to Section 204-01B. • **NOTE:** Install a new O-ring on the special tool. The O-ring used is the same as in the hublock. Apply a light film of lubricant on the O-ring. **NOTE:** Using emery cloth, clean the sealing surface of the wheel hub before testing. Install the special tool. • Connect the vacuum pump to the knuckle fitting and apply 508 mm (20 in) Hg of vacuum. If checking for a dynamic leak, carefully rotate the U-joint while observing the vacuum reading for 30 seconds.  • **Is the vacuum drop less than 12.7 mm (0.5 in) Hg in 30 seconds?**	**Yes** GO to I21. **No** INSTALL a new knuckle seal. REFER to Section 204-01B. RESTORE the system to normal condition. TEST the system for normal operation.
I21	**CHECK THE WHEEL HUB ASSEMBLY**	
	• Remove and discard the wheel hub O-ring. • **NOTE:** Apply a light film of lubricant on the special tool O-ring. **NOTE:** Do not remove the ABS sensor. Install the special tool and the retainer ring. Make sure the retainer ring is seated in the groove. • Install a new O-ring on the wheel hub.	**Yes** The old wheel hub O-ring was worn or damaged. REMOVE the special tools. RESTORE the system to normal condition. TEST the system for normal operation. **No** GO to I22.

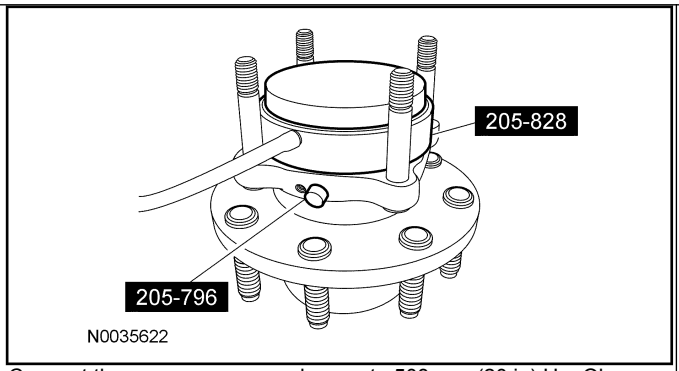
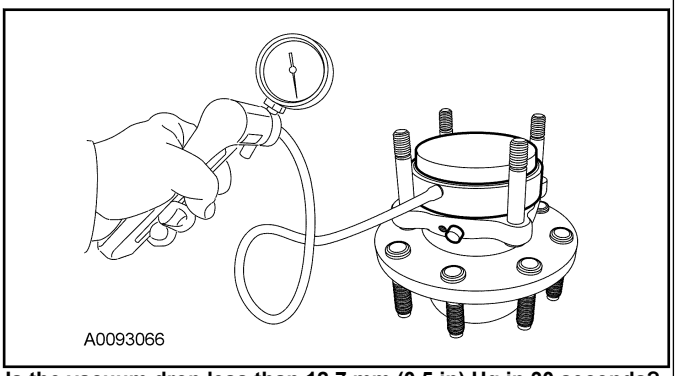
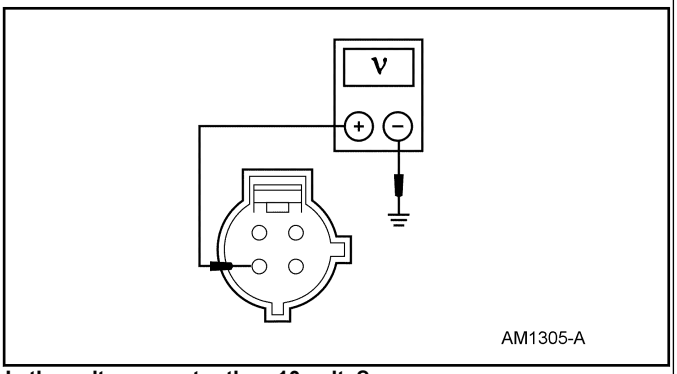
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY

I21	**CHECK THE WHEEL HUB ASSEMBLY (Continued)**	
	 • Install the special tool. Make sure the tool is seated over the wheel hub seal.  • Connect the vacuum pump and pump to 508 mm (20 in) Hg. If checking for a dynamic leak, carefully rotate the hub flange relative to the wheel bearing flange while observing the vacuum reading for 30 seconds.  • **Are the vacuum readings greater than 254 mm (10 in) Hg?**	
I22	**CHECK THE WHEEL HUB ASSEMBLY**	
	• Remove the wheel speed sensor. • Install the special tool.	**Yes** REMOVE the special tools. INSTALL a new wheel speed sensor. REFER to Section 206-09. TEST the system for normal operation. **No** REMOVE the special tools. INSTALL a new wheel hub assembly. REFER to Section 204-01B. TEST the system for normal operation.

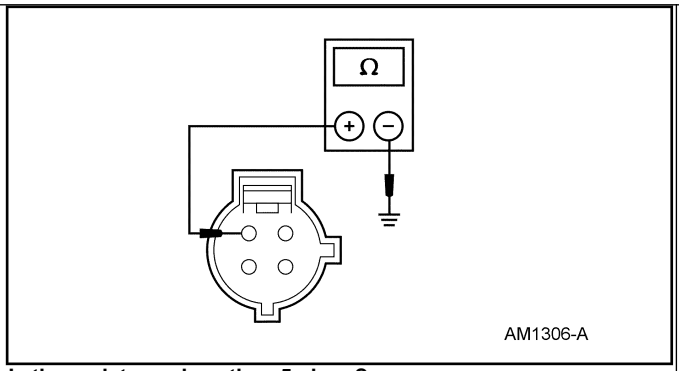
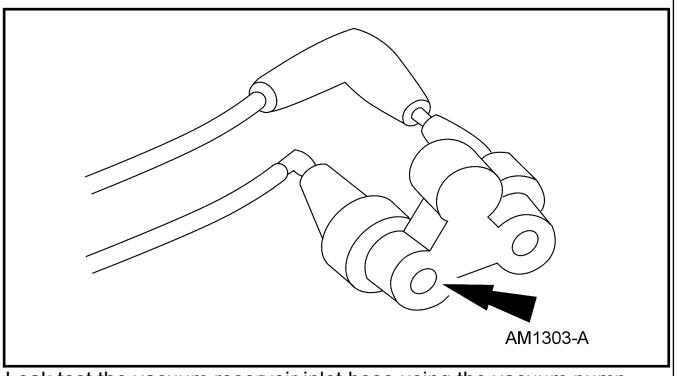
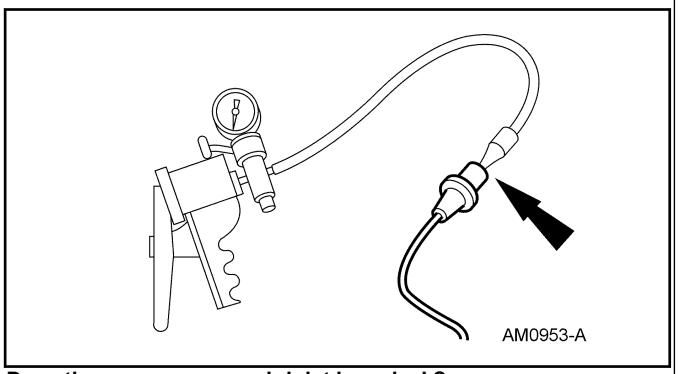
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY

I22	**CHECK THE WHEEL HUB ASSEMBLY (Continued)**	
	 • Connect the vacuum pump and pump to 508 mm (20 in) Hg. Observe the vacuum reading for 30 seconds.  • **Is the vacuum drop less than 12.7 mm (0.5 in) Hg in 30 seconds?**	
I23	**CHECK THE VOLTAGE AT THE VACUUM PUMP**	
	• Ignition OFF. • Disconnect: Vacuum Pump C1119. • Ignition ON. • Measure the voltage between vacuum pump C1119-4, circuit 295 (LB/PK) and ground.  • **Is the voltage greater than 10 volts?**	**Yes** GO to I24. **No** VERIFY CJB fuse 27 (15A) is OK. If OK, REPAIR circuit 295 (LB/PK). If not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. TEST the system for normal operation.
I24	**CHECK THE VACUUM PUMP GROUND**	
	• Ignition OFF. • Measure the resistance between vacuum pump C1119-2, circuit 57 (BK) and ground.	**Yes** GO to I25. **No** REPAIR circuit 57 (BK). TEST the system for normal operation.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST I: THE FRONT AXLES DO NOT ENGAGE/DISENGAGE CORRECTLY

I24	**CHECK THE VACUUM PUMP GROUND (Continued)**	
	 • **Is the resistance less than 5 ohms?**	
I25	**CHECK THE VACUUM RESERVOIR INLET HOSE FOR BLOCKAGE**	
	• Disconnect: Vacuum Reservoir Inlet Hose. • Connect a vacuum pump to the vacuum reservoir inlet hose and try to pull a vacuum. If the vacuum pump pulls and holds a vacuum, the hose is plugged. If the vacuum pump pulls a vacuum that slowly decays, the hose is restricted. • **Is the vacuum reservoir inlet hose plugged or restricted?**	**Yes** INSTALL a new vacuum reservoir inlet hose. TEST the system for normal operation. **No** GO to I26.
I26	**CHECK THE VACUUM RESERVOIR INLET HOSE FOR A LEAK**	
	• Plug the vacuum reservoir inlet hose.  • Leak test the vacuum reservoir inlet hose using the vacuum pump.  • **Does the vacuum reservoir inlet hose leak?**	**Yes** INSTALL a new vacuum reservoir inlet hose. TEST the system for normal operation. **No** INSTALL a new vacuum pump. TEST the system for normal operation.

Pinpoint Test J: The Transfer Case Does Not Shift Between 2H And 4H Modes Correctly

Normal Operation

The mode select switch communicates the operator's choice to the 4X4 control module. The 4X4 control module then controls the transfer case motor and pulse vacuum hublocks (PVHs) as necessary. If the vehicle is not responding to the operator's intentions, systematically check the necessary inputs and outputs of the 4X4 control module, components of the transfer case, PVH components and axle shafts. Check all circuits for opens and shorts to power or ground.

DIAGNOSIS AND TESTING (Continued)

Possible Causes

- Transfer case
- PVH solenoid
- Vacuum leaks
- 4X4 control module
- Front axle assembly
- Mode select switch (MSS)
- Relays

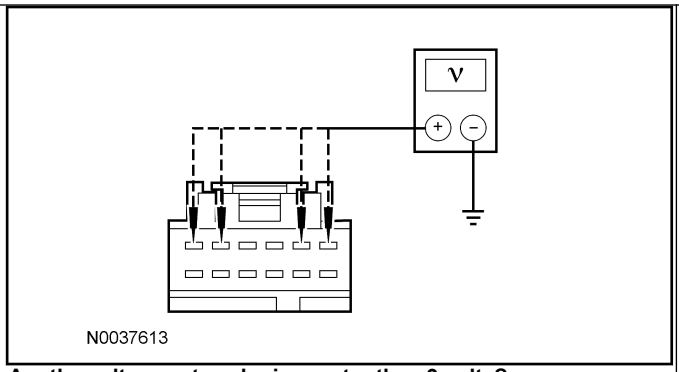
PINPOINT TEST J: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 2H AND 4H MODES CORRECTLY

NOTICE:
Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

<table>
<tr><th colspan="2">Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>J1</td><td colspan="2">CHECK FOR DTCs</td></tr>
<tr><td></td><td colspan="2">• Connect the scan tool.
• Carry out the 4X4 control module on-demand self test.
• Are DTCs are retrieved?</td><td>Yes
If DTC B1355 or B1359, GO to J2 .
If DTC P1865, P1866 or P1867, GO to J8 .
If DTC C1728, GO to J18 .
If DTC P1820, P1828, P1822 or P1830, GO to Pinpoint Test K.
If other DTCs, GO to the 4X4 Control Module (DTC) Chart.
No
GO to J2.</td></tr>
<tr><td>J2</td><td colspan="2">CHECK IGNITION SWITCH STATUS PID</td></tr>
<tr><td></td><td colspan="2">• Cycle the ignition switch through each position while monitoring the ignition switch status PIDs as indicated in the following table:
<table><tr><th>Ignition Switch Position</th><th>PID</th><th>Expected Value</th></tr><tr><td>OFF</td><td>IGN_O/L</td><td>OFF</td></tr><tr><td>ACCESSORY</td><td>IGN_ACC</td><td>ACCY</td></tr><tr><td>RUN</td><td>IGN_R</td><td>RUN</td></tr><tr><td>START</td><td>IGN_S</td><td>START</td></tr></table>• Do the ignition switch PIDs match the ignition switch positions?</td><td>Yes
GO to J3.
No
CHECK the ignition switch. REFER to Section 211-05. After the fault is repaired, CLEAR the DTC. REPEAT the self-test.</td></tr>
<tr><td>J3</td><td colspan="2">CHECK FOR VOLTAGE INPUT TO THE 4X4 CONTROL MODULE</td></tr>
<tr><td></td><td colspan="2">• Ignition OFF.
• Disconnect: 4X4 Control Module C281a.
• Ignition ON.
• Measure the voltage between 4X4 control module C281a and ground as follows:
<table><tr><th>C281a Pin</th><th>Circuit</th></tr><tr><td>1</td><td>1306 (LB/BK)</td></tr><tr><td>2</td><td>1306 (LB/BK)</td></tr><tr><td>5</td><td>640 (RD/YE)</td></tr><tr><td>6</td><td>1002 (BK/PK)</td></tr></table></td><td>Yes
GO to J4.
No
REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.</td></tr>
</table>

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST J: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 2H AND 4H MODES CORRECTLY (Continued)

J3	**CHECK FOR VOLTAGE INPUT TO THE 4X4 CONTROL MODULE (Continued)**	
	 • **Are the voltages at each pin greater than 9 volts?**	
J4	**CHECK FOR TRANSFER CASE 4H ENGAGEMENT**	
	• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • Switch the MSS to 4H. • Rotate the rear driveshaft. • Observe the front driveshaft. • **Did the front driveshaft rotate?**	**Yes** GO to J5. **No** GO to J8.
J5	**CHECK FOR PVH ENGAGEMENT**	
	NOTE: The engine must be at idle during the following steps to supply vacuum for PVH engagement/disengagement. • Start the engine and allow it to idle. • Switch the MSS to 4H. • Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front axle shaft and U-joint. • Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front axle shaft and U-joint. • **Did the axle shafts rotate?**	**Yes** GO to J6. **No** GO to Pinpoint Test I.
J6	**CHECK FOR TRANSFER CASE 2H DISENGAGEMENT**	
	• Switch the MSS to 2H. • Rotate the rear driveshaft. • Observe the front driveshaft. • **Did the front driveshaft rotate?**	**Yes** GO to J7. **No** GO to J8.
J7	**CHECK FOR PVH DISENGAGEMENT**	
	• Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front axle shaft and U-joint. • Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front axle shaft and U-joint. • **Did either front axle shaft and U-joint rotate?**	**Yes** CHECK that all driveline fasteners are present and tightened to specification. Section 205-00 for further diagnosis of the front axle. **No** GO to J8.
J8	**CHECK THE TRANSFER CASE ENCODER POSITION PIDS**	
	• Monitor the shift motor encoder position PID.	**Yes** GO to J19. **No** GO to J9.

Mode Select Switch Position	Shift Motor Encoder Position			
	A	B	C	D
2H	OPEN	OPEN	CLOSED	OPEN

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST J: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 2H AND 4H MODES CORRECTLY (Continued)

J8 CHECK THE TRANSFER CASE ENCODER POSITION PIDS (Continued)

(Continued)

Mode Select Switch Position	Shift Motor Encoder Position			
	A	B	C	D
4H	CLOSED	OPEN	CLOSED	OPEN
4L	CLOSED	CLOSED	OPEN	OPEN

- Toggle the MSS from 2H to 4H.
- **Do the PIDs agree with the shift motor positions?**

J9 CHECK THE SHIFT MOTOR OPERATION

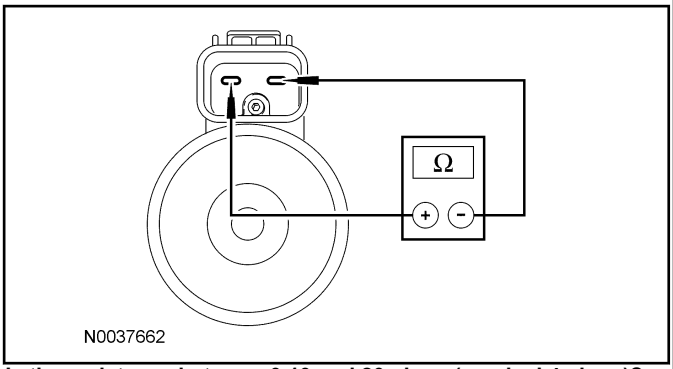
- Ignition OFF.
- Remove the shift motor from the transfer case, leaving the wiring connector connected. Refer to Gearmotor Encoder Assembly in this section.
- Ignition ON.
- Observe the shift motor and encoder position PIDs while switching the MSS from 2H to 4H.
- **Does the shift motor rotate from the 2H position to the 4H position?**

Yes
GO to J19.

No
GO to J10.

J10 CHECK THE SHIFT MOTOR FOR INTERNAL SHORT

- Ignition OFF.
- Disconnect: Transfer Case C350b.
- Measure the resistance between transfer case C350b pins 1 and 2, component side.



- **Is the resistance between 0.10 and 20 ohms (nominal 4 ohms)?**

Yes
GO to J11.

No
INSTALL a new shift motor. CLEAR the DTC(s). REPEAT the self-test, then GO to J18 .

J11 CHECK THE MOTOR POSITION AND RETURN CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: 4X4 Control Module C281a.
- Measure the resistance of the following circuits between 4X4 control module C281a, harness side and transfer case C350a, harness side:

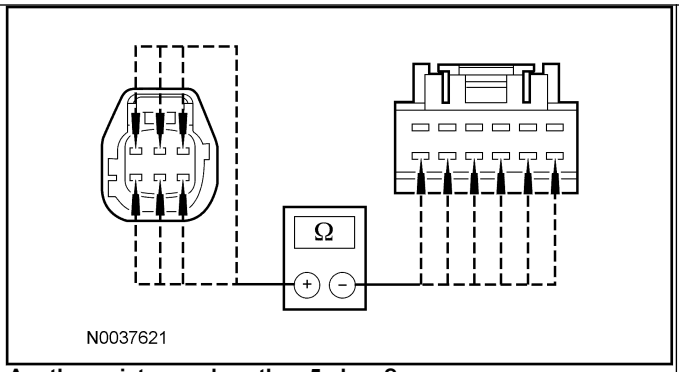
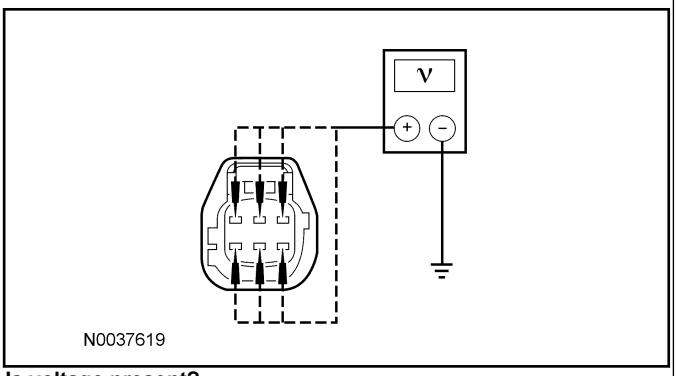
Circuit	C281a	C350a
763 (OG/WH)	12	1
764 (BN/WH)	10	3
770 (WH)	11	6
771 (VT/YE)	9	5
976 (OG)	7	2
3659 (BK/PK)	8	4

Yes
GO to J12.

No
REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

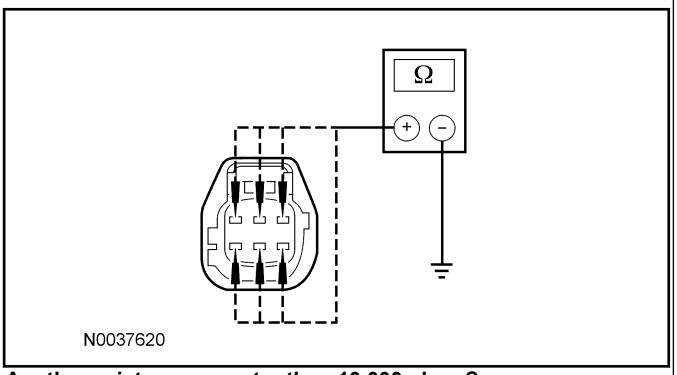
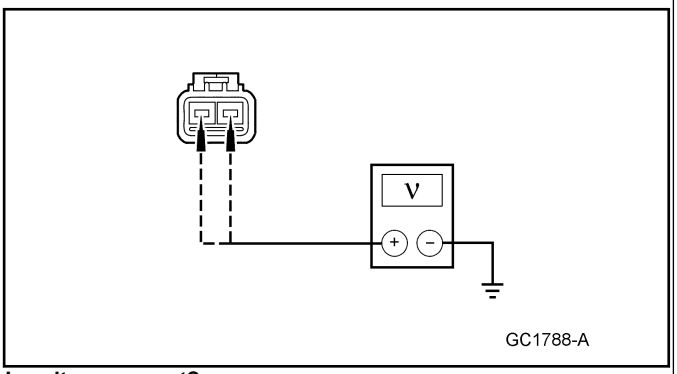
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST J: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 2H AND 4H MODES CORRECTLY (Continued)

J11	CHECK THE MOTOR POSITION AND RETURN CIRCUITS FOR AN OPEN (Continued)	
	 • **Are the resistances less than 5 ohms?**	
J12	CHECK THE MOTOR POSITION AND RETURN CIRCUITS FOR A SHORT TO VOLTAGE	
	• Ignition ON. • Measure the voltage between the following circuits at the transfer case C350a, harness side and ground: **Circuit** / **C350a** 763 (OG/WH) / 1 764 (BN/WH) / 3 770 (WH) / 6 771 (VT/YE) / 5 976 (OG) / 2 3659 (BK/PK) / 4  • **Is voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTC(s). REPEAT the self-test. **No** GO to J13.
J13	CHECK THE MOTOR POSITION AND RETURN CIRCUITS FOR A SHORT TO GROUND	
	• Ignition OFF. • Measure the resistance between the following circuits at the transfer case C350a, harness side and ground: **Circuit** / **C350a** 763 (OG/WH) / 1 764 (BN/WH) / 3 770 (WH) / 6	**Yes** GO to J14. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.

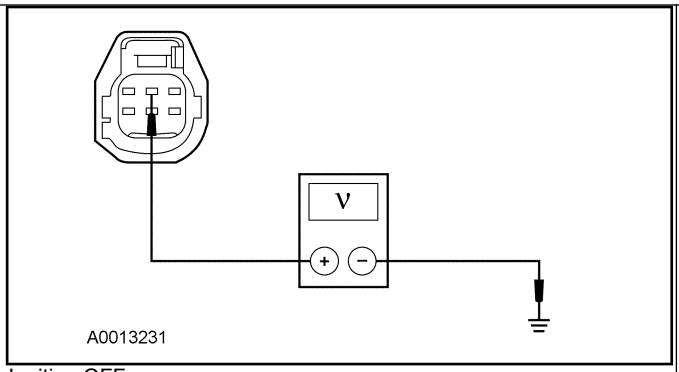
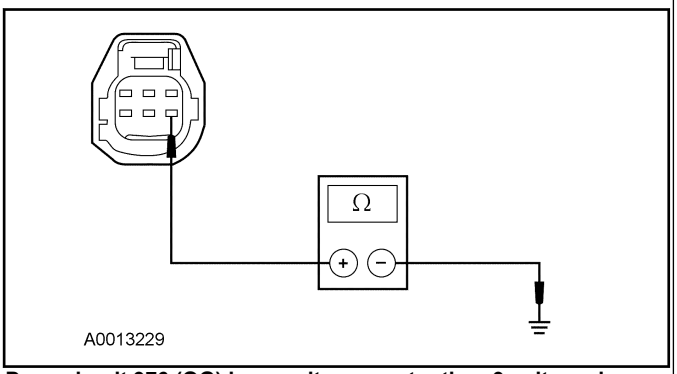
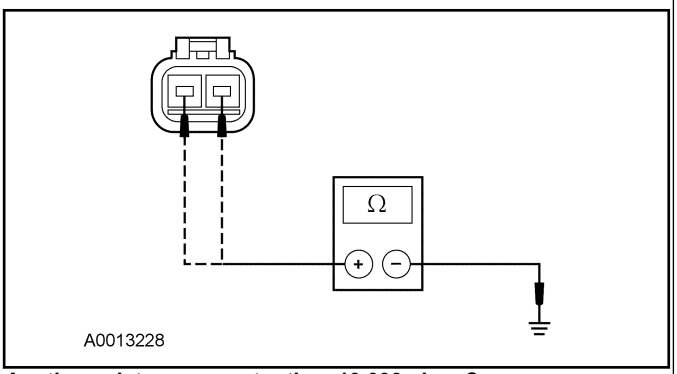
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST J: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 2H AND 4H MODES CORRECTLY

J13	**CHECK THE MOTOR POSITION AND RETURN CIRCUITS FOR A SHORT TO GROUND (Continued)**	
	(Continued) **Circuit** / **C350a** 771 (VT/YE) / 5 976 (OG) / 2 3659 (BK/PK) / 4  • **Are the resistances greater than 10,000 ohms?**	
J14	**CHECK CIRCUIT 777 (YE) AND CIRCUIT 778 (OG) FOR A SHORT TO POWER**	
	• Ignition OFF. • Disconnect: Transfer Case C350b. • Ignition ON. • Disconnect: Transfer Case Low to High Relay C1129. • Disconnect: Transfer Case High to Low Relay C1173. • Measure the voltage between transfer case C350b-2, circuit 777 (YE), harness side and ground. • Measure the voltage between transfer case C350b-1, circuit 778 (OG), harness side and ground.  • **Is voltage present?**	**Yes** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test. **No** GO to J15.
J15	**VERIFY THE SHIFT MOTOR POWER AND GROUND CIRCUITS**	
	• Connect: 4X4 Control Module C281a. • Disconnect: Transfer Case C350A. • Ignition ON. • **NOTE:** This is a Pulse Width Modulated (PWM) voltage. Voltage should pulse between 0 volt and at least 9 volts. Measure the voltage between transfer case C350a-2, circuit 976 (OG) harness side and ground.	**Yes** GO to J16. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. TEST the system for normal operation.

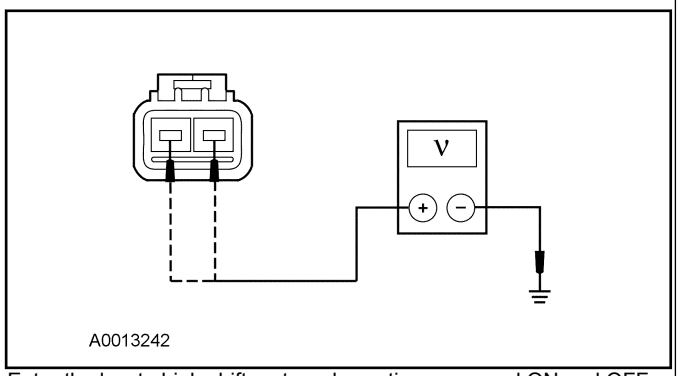
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST J: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 2H AND 4H MODES CORRECTLY

J15	**VERIFY THE SHIFT MOTOR POWER AND GROUND CIRCUITS (Continued)**	
	 • Ignition OFF. • Measure the resistance between transfer case C350a-4, circuit 3659 (BK/PK) harness side and ground.  • **Does circuit 976 (OG) have voltage greater than 9 volts and circuit 3659 (BK/PK) have resistance to ground less than 5 ohms?**	
J16	**CHECK CIRCUIT 777 (YE) AND CIRCUIT 778 (OG) FOR A SHORT TO GROUND**	
	• Ignition OFF. • Measure the resistance between transfer case C350b-1, circuit 778 (OG), harness side and ground. • Measure the resistance between transfer case C350b-2, circuit 777 (YE), harness side and ground.  • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to J17. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
J17	**CHECK CIRCUITS 777 (YE) AND 778 (OG) FOR POWER DURING ACTIVE COMMANDS**	
	• Connect: Transfer Case C350A. • Connect: 4X4 Control Module C281A. • Ignition ON. • Enter the active command mode on the diagnostic tool.	**Yes** INSTALL a new shift motor. REFER to Gearmotor Encoder Assembly in this section. CLEAR the DTC(s). REPEAT the self-test, then GO to J18 .

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST J: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 2H AND 4H MODES CORRECTLY

J17	**CHECK CIRCUITS 777 (YE) AND 778 (OG) FOR POWER DURING ACTIVE COMMANDS (Continued)**	
	• Enter the high to low shift motor relay active command ON and OFF and measure the voltage between transfer case C350b-1, circuit 778 (OG) harness side and ground.  • Enter the low to high shift motor relay active command ON and OFF and measure the voltage between transfer case C350b-2, circuit 777 (YE) harness side and ground. • **Are the voltages 9 volts or greater on the circuit being commanded?**	**No** GO to Pinpoint Test K.
J18	**ATTEMPT TO DUPLICATE THE CONCERN**	
	• Inspect and, if necessary, clean the 4X4 control module and the transfer case low/high and high/low relays and connectors. • Drive the vehicle and attempt to duplicate the concern. • **Is the concern still present?**	**Yes** GO to J19. **No** CLEAR the DTC(s). REPEAT the self-test.
J19	**SHIFT THE TRANSFER CASE TO 4H MANUALLY**	
	• Ignition OFF. • Remove the shift motor from the transfer case. • Using a suitable wrench, rotate the shift cam to the 4H position. • Rotate the rear driveshaft and observe the front driveshaft. • **Does the transfer case shift 4H and the front driveshaft rotate?**	**Yes** GO to J20. **No** REPAIR the transfer case. REFER to Section 308-07B. TEST the system for normal operation.
J20	**CHECK THE TORQUE REQUIRED TO SHIFT THE TRANSFER CASE**	
	• Using a suitable wrench, rotate the shift cam through 4L, N and 4H positions. — Make sure that the driveshafts rotate freely. — Assist the shift by turning the driveshafts. • Measure the torque required to perform the shift. • **Is the torque required to shift the transfer case 45 Nm (33 lb-ft) or less?**	**Yes** GO to J21. **No** REPAIR the transfer case. REFER to Section 308-07B. TEST the system for normal operation.
J21	**SHIFT THE TRANSFER CASE TO 2H MANUALLY**	
	• Using a suitable wrench, rotate the shift cam to the 2H position. • Rotate the rear driveshaft and observe the front driveshaft. • **Does the transfer case shift to 2H and the front driveshaft not rotate?**	**Yes** INSTALL a new transfer case shift motor. REFER to Section 308-07B. TEST the system for normal operation. **No** REPAIR the transfer case. REFER to Section 308-07B. TEST the system for normal operation.

Pinpoint Test K: DTC P1820, P1822, P1828 or P1830

Normal Operation

When the low to high shift occurs, circuit 782 (BR/WH) provides the 4X4 control module-switched ground path for the clockwise rotation relay. While the low to high (clockwise) relay is energized, circuit 777 (YE) sends battery voltage from the battery junction box (BJB) fuse 3 (30A) and circuit 704 (DG/LG). Circuit 778 (OG) provides ground for the transfer case shift motor to operate in the clockwise direction. When the high to low shift occurs, circuit 781 (OG/LB) provides the 4X4 control module-switched ground path for the counterclockwise rotation relay. While the high to low counterclockwise relay is energized, circuit 778 (OG) sends battery voltage from the battery junction box (BJB) fuse 3 (30A) and circuit 704 (DG/LG). Circuit 777 (YE) provides ground for the transfer case shift motor to operate in the counterclockwise direction.

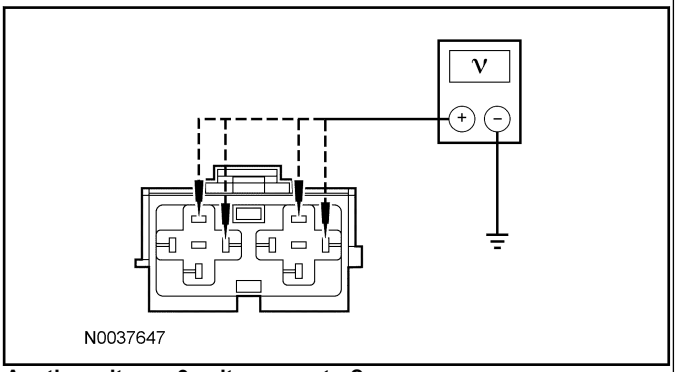
DIAGNOSIS AND TESTING (Continued)

Possible Causes

- Battery junction box fuse 3 (30A)
- Circuits:
  - 704 (DG/LG)
  - 57 (BK)
  - 777 (YE)
  - 778 (OG)
  - 781 (OG/LB)
  - 782 (BN/WH)
  - Low to high relay
  - High to low relay

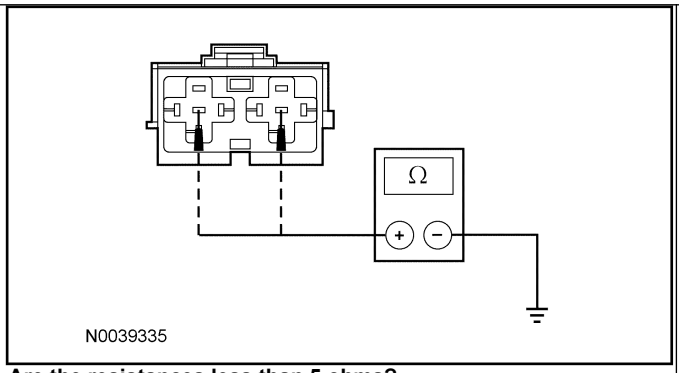
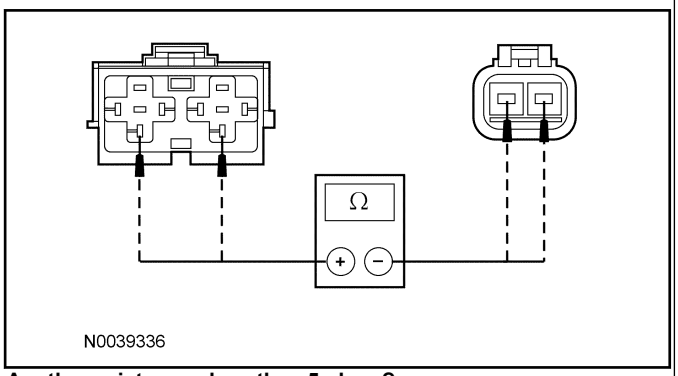
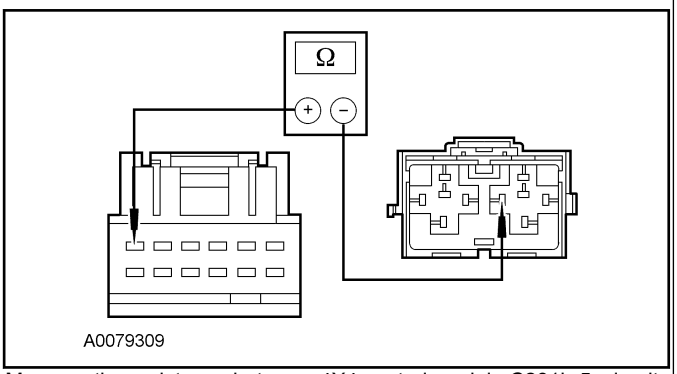
DTC Description	Fault Trigger Condition
P1820:00 — Transmission Transfer Case Clockwise Shift Relay Coil Circuit Failure	Fault sets when 4X4 control module detects an open circuit. Shift motor moves are prevented when this DTC is set.
P1822:00 — Transmission Transfer Case Clockwise Shift Relay Coil Short Circuit To Battery	Fault sets when 4X4 control module detects a short to voltage. Shift motor moves are prevented when this DTC is set.
P1828:00 — Transmission Transfer Case Counterclockwise Shift Relay Coil Circuit Failure	Fault sets when 4X4 control module detects an open circuit. Shift motor moves are prevented when this DTC is set.
P1830:00 — Transmission Transfer Case Counterclockwise Shift Relay Coil Short Circuit To Battery	Fault sets when 4X4 control module detects a short to voltage. Shift motor moves are prevented when this DTC is set.

PINPOINT TEST K: DTC P1820, P1822, P1828 or P1830

Test Step		Result / Action to Take
K1	**CHECK THE LOW TO HIGH/HIGH TO LOW RELAY CIRCUITS FOR VOLTAGE**	
	• Ignition OFF. • Disconnect: Low to High Relay C1129. • Disconnect: High to Low Relay C1173. • Measure the voltage between Low to High motor relay C1129 pins 86 and 87, circuit 704 (DG/LG), harness side and ground. • Measure the voltage between high to low motor relay C1173 pins 86 and 87, circuit 704 (DG/LG), harness side and ground.  N0037647 • **Are the voltages 9 volts or greater?**	**Yes** GO to K2. **No** VERIFY battery junction box (BJB) fuse 3 (30A) is OK. If OK, REPAIR circuit 704 (DG/LG). If not OK, REFER to Wiring Diagrams manual to identify the possible causes of the circuit short. CLEAR the DTCs. REPEAT the self-test.
K2	**CHECK THE LOW/HIGH AND HIGH/LOW RELAY GROUND CIRCUITS**	
	• Measure the resistance between low to high motor relay C1129-87a, circuit 57 (BK), harness side and ground. • Measure the resistance between high to low motor relay C1173-87a, circuit 57 (BK), harness side and ground.	**Yes** GO to K3. **No** REPAIR circuit 57 (BK). CLEAR the DTCs. REPEAT the self-test.

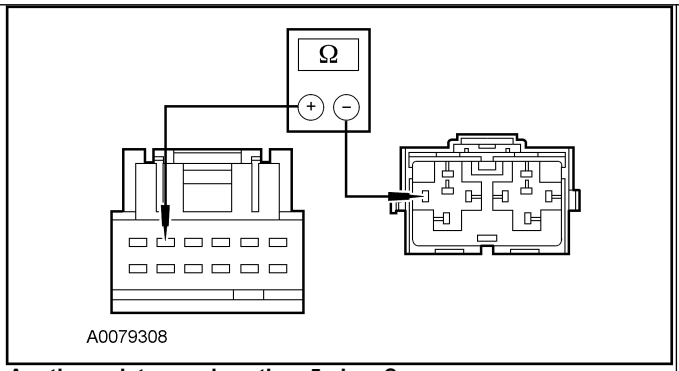
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST K: DTC P1820, P1822, P1828 or P1830 (Continued)

K2	CHECK THE LOW/HIGH AND HIGH/LOW RELAY GROUND CIRCUITS (Continued)	
	 • **Are the resistances less than 5 ohms?**	
K3	CHECK CIRCUIT 777 (YE) AND CIRCUIT 778 (OG) FOR AN OPEN	
	• Disconnect: Transfer Case C350B. • Measure the resistance between transfer case C350b-1, harness side and high to low relay C1173-30, circuit 778 (OG), harness side. • Measure the resistance between transfer case C350b-2, harness side and low to high relay C1129-30, circuit 777 (YE), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to K4. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
K4	CHECK THE RELAY CONTROL CIRCUITS 781 (OG/LB) AND CIRCUIT 782 (BN/WH) FOR AN OPEN	
	• Disconnect: 4X4 Control Module C281b. • Measure the resistance between 4X4 control module C281b-6, circuit 781 (OG/LB), harness side and high to low relay C1173-86, circuit 781 (OG/LB), harness side.  • Measure the resistance between 4X4 control module C281b-5, circuit 782 (BN/WH), harness side and high to low relay C1129-86, circuit 782 (BN/WH), harness side.	**Yes** CARRY OUT the ISO relay component test. Refer to Wiring Diagrams Cell 149 for component testing. INSTALL a new relay(s) as necessary. **No** REPAIR the affected circuit(s). CLEAR the DTCs. INSPECT and if necessary, clean the 4X4 control module and 4WD relay connectors. REPEAT the self-test.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST K: DTC P1820, P1822, P1828 or P1830 (Continued)

K4	CHECK THE RELAY CONTROL CIRCUITS 781 (OG/LB) AND CIRCUIT 782 (BN/WH) FOR AN OPEN (Continued)	
	 • **Are the resistances less than 5 ohms?**	

Pinpoint Test L: The Transfer Case Does Not Shift Between 4H And 4L Modes Correctly

Normal Operation

The high-low shift occurs when the reduction shift fork moves the high-low collar to lock the planetary gear set to the output shaft. The torque transmitted through the sun gear from the input shaft turns the front planetary gear set assembly. The front planetary gear set assembly, now engaged, provides transfer case speed reduction. Certain criteria, such as vehicle speed and transmission range selection, must be met before this shift can occur.

Possible Causes

- Transmission neutral switch (or clutch pedal position [CPP] switch) — hardwired to the 4X4 control module
- Brake ON/OFF (BOO) switch — hardwired to the 4X4 control module
- ABS vehicle speed inputs — hardwired to the 4X4 control module

PINPOINT TEST L: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 4H AND 4L MODES CORRECTLY

NOTICE:
Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

Test Step		Result / Action to Take
L1	CHECK THE 2H TO 4H SHIFT	
	• Drive the vehicle and shift MSS from 2H to 4H while rolling. • **Does the vehicle shift between 2H and 4H correctly?**	**Yes** GO to L2. **No** GO to Pinpoint Test M.
L2	CHECK THE 4H TO 4L SHIFT	
	• Bring the vehicle to a speed below 3 kph (3 mph). With the brake pedal applied and the transmission NEUTRAL (or clutch applied), switch the MSS to 4L. • **Does the transfer case shift from 4H to 4L correctly and the concern is related to a clunk noise during the shift?**	**Yes** Transmission neutral drag torque is excessive. REFER to Section 307-01 for transmission diagnosis. **No** GO to L3.
L3	CHECK THE TRANSMISSION RANGE, BRAKE ON/OFF (BOO) AND VEHICLE SPEED PIDs	
	• Connect the scan tool. • A. Monitor the 4X4 control module neutral safety switch PID (NSAFETYSW) while shifting the transmission through gear ranges (or while applying the clutch). • B. Monitor the brake input switch status PID (GEM_BOO) while pressing and releasing the brake pedal. • C. Monitor the vehicle speed input PID (VSS_GEM) with the vehicle at rest. • **A. Does the NSAFETYSW PID indicate NEUTRAL when the transmission is shifted to NEUTRAL (or when the clutch pedal is applied)?** **B. Does the GEM_BOO PID agree with the actual brake pedal positions?**	**Yes** If all 3 PIDs are accurate, GO to Pinpoint Test O. **No** **A.** REFER to Section 307-01 for further diagnosis of the TR sensor. **B.** REFER to Section 206-09 for further diagnosis of the brake pedal position switch. **C.** REFER to Section 206-09 for further diagnosis of the ABS system.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST L: THE TRANSFER CASE DOES NOT SHIFT BETWEEN 4H AND 4L MODES CORRECTLY (Continued)

L3	CHECK THE TRANSMISSION RANGE, BRAKE ON/OFF (BOO) AND VEHICLE SPEED PIDs (Continued)	
	C. Does the VSS_GEM PID indicate 0 km/h (0 mph)?	

Pinpoint Test M: Four Wheel Drive (4WD) Does Not Engage At Speed Correctly

Normal Operation

When the operator selects four wheel drive (4WD), the 4X4 control module shifts the transfer case to 4H, which engages a dual-cone synchronizer clutch to synchronize the front and rear driveshafts, allowing a mechanical engagement of the transfer case. The 4X4 control module also provides separate ground paths to the lock and lock/unlock solenoids. When the lock solenoid is engaged, a high level of vacuum is provided which rotates the hublocks to their "lock" position. When both the lock/unlock solenoids are engaged, a low level of vacuum is provided, which rotates the hublocks to their "unlocked" position. Systematically check the necessary inputs and outputs at the 4X4 control module, internal components of the transfer case, PVH components and drive axles.

Possible Causes

- Transfer case synchronizer
- 4X4 control module
- Front axle assembly
- Circuit 779 (BN)
- Circuit 92 (LB/YE)

PINPOINT TEST M: 4WD DOES NOT ENGAGE AT SPEED CORRECTLY

Test Step		Result / Action to Take
M1	RETRIEVE DTCs	
	• Connect the scan tool. • Carry out the 4X4 control module self-test. • **Are any DTCs retrieved?**	**Yes** GO to the 4X4 Control Module (DTC) Chart. **No** GO to M2.
M2	CHECK 4H ENGAGEMENT AT REST	
	• Switch the MSS from 2H to 4H. • While on the road, drive the vehicle in turns and check for wind-up. • **Does 4H engage correctly?**	**Yes** GO to M3. **No** GO to Pinpoint Test J.
M3	CHECK 2H TO 4H SHIFT AT SPEED	
	• Switch the MSS to 2H. • Drive the vehicle and carry out a 2H to 4H shift while driving approximately 16 km/h (10 mph). • Stop the vehicle, shift to 2H, drive the vehicle and carry out a 2H and 4H shift while driving at approximately 64 km/h (40 mph). • **Does the 4H engage correctly (or much better) at 16 km/h (10 mph) than at 64 km/h (40 mph)?**	**Yes** GO to M4. **No** GO to Pinpoint Test J.
M4	CHECK THE TRANSFER CASE SYNCHRONIZATION	
	• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • Start the engine. • Place the transmission selector lever in DRIVE and increase the vehicle speed to between 16 km/h (10 mph) and 24 km/h (15 mph). • While observing the front driveshaft, switch the MSS to 4H. • **Did the front driveshaft start to spin?**	**Yes** GO to Pinpoint Test I. **No** REPAIR the transfer case. REFER to Section 308-07B in this section.

Pinpoint Test N: The Four Wheel Drive (4WD) System Jumps Out Of Gear

Normal Operation

Once the four wheel drive (4WD) system engages the user selected mode, that mode should be maintained. If the 4WD system does not stay in the selected position, systematically check the 4WD system components.

Possible Causes

- PVH vent line(s)

DIAGNOSIS AND TESTING (Continued)

- Mode select switch (MSS)
- Transfer case

PINPOINT TEST N: THE FOUR WHEEL DRIVE (4WD) SYSTEM JUMPS OUT OF GEAR

Test Step		Result / Action to Take
N1	**VERIFY THE CONCERN**	
	• Drive the vehicle and attempt to duplicate the concern. • **Is the concern an uncommanded range shift (in or out of 4L)?**	**Yes** GO to N4. **No** GO to N2.
N2	**CHECK THE MODE SELECT SWITCH (MSS) POSITION PIDs**	
	• Connect the diagnostic tool. • Drive the vehicle. • Dynamically monitor the MSS PID while driving the vehicle in each shift position. • **Does the MSS PID always agree with the MSS position?**	**Yes** GO to N3. **No** GO to Pinpoint Test J.
N3	**CHECK FOR DTCs**	
	• Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module (DTC) Chart. **No** GO to Pinpoint Test P.
N4	**CHECK THE 4X4 INDICATORS**	
	• With the vehicle rolling, shift the transmission to NEUTRAL. • Press the brake pedal. • Observe the 4x4 indicators in the instrument cluster (IC) while cycling through each MSS position. • **Do the 4x4 indicators match MSS positions?**	**Yes** GO to N2. **No** GO to N5.
N5	**CHECK FOR DTCs**	
	• Transmission in PARK. • Release the brake pedal. • Carry out the on-demand self test. • **Are DTCs present?**	**Yes** REFER to the 4X4 Control Module (DTC) Chart. **No** CHECK the transfer case fluid level. REFER to Section 308-07B. If the fluid level is OK, CHECK for internal transfer case faults. REFER to Section 308-07B.

Pinpoint Test O: Straightline Driveline Wind-up

Normal Operation

In order for the four wheel drive (4WD) system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

Possible Causes

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST O: STRAIGHTLINE DRIVELINE WIND-UP

NOTE:

4x4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.

Test Step		Result / Action to Take
O1	**VERIFY THE CONCERN**	
	• Drive the vehicle and shift from 2H to 4H. There should be minimal wind-up in 4H mode during straight-line maneuvers, (wind-up in turns is normal; 4x4 high/low is not intended for driving on hard/dry surfaces). • **Is wind-up present?**	**Yes** GO to O2. **No** RETURN the vehicle to the customer and ADVISE about correct 4x4 usage and normal vehicle behavior.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST O: STRAIGHTLINE DRIVELINE WIND-UP (Continued)

O2	**CHECK FOR MATCHING WHEEL AND TIRE SIZES**	
	• Check each of the 4 tire/wheel sizes. • **Do the 4 wheels and tires match?**	**Yes** GO to O3. **No** ADVISE the customer that four wheel drive (4WD) systems require 4 matched, correctly inflated and correctly maintained tires to operate correctly.
O3	**CHECK TIRE WEAR**	
	• Check each of the 4 tires for wear. • **Are the 4 tires worn evenly?**	**Yes** GO to O4. **No** ADVISE the customer that 4WD systems require 4 matched, correctly inflated and correctly maintained tires to operate correctly.
O4	**CHECK TIRE INFLATION PRESSURE**	
	• Check the inflation pressure in each tire. Refer to vehicle certification label. • **Are the tire inflation pressures correct?**	**Yes** GO to O5. **No** ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
O5	**CHECK THE FRONT AND REAR AXLE RATIOS**	
	• Check that front and rear axle ratios match. Refer to Section 205-00. • **Do the front and rear axle ratios match?**	**Yes** RETURN the vehicle to the customer and ADVISE about correct 4WD system operation and normal vehicle behavior. **No** CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to Section 205-00.

Pinpoint Test P: Electronic Shift On The Fly (ESOF) Functional Test

Normal Operation

When operating in 4x4 high (4H), the transfer case and both pulse vacuum hubs (PVHs) are locked. When in 4x4 low (4L), the transfer case low range gear set provides an additional 2.72 gear reduction. When operating in two wheel drive (2H), the transfer case and both PVHs are unlocked.

Possible Causes

- Transfer case and related components
- PVH and related components
- Wheel/tire assemblies

PINPOINT TEST P: ELECTRONIC SHIFT ON THE FLY (ESOF) FUNCTIONAL TEST

NOTE:
4x4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.

Test Step		Result / Action to Take
P1	**CHECK FOR 4X4 INDICATOR PROVE OUT**	
	• Ignition ON. • **Do the 4x4 indicators illuminate at prove out?**	**Yes** GO to P2. **No** CHECK the instrument cluster (IC) for faults. REFER to Section 413-00.
P2	**CHECK 2WD OPERATION**	
	• Stop the vehicle. • Transmission in NEUTRAL. • Switch the MSS to 2H.	**Yes** GO to P4.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST P: ELECTRONIC SHIFT ON THE FLY (ESOF) FUNCTIONAL TEST (Continued)

P2	**CHECK 2WD OPERATION (Continued)**	
	• **Do the 4x4 indicators turn off?**	**No** GO to P3.
P3	**CHECK FOR 4X4 CONTROL MODULE DTCs**	
	• Transmission in PARK. • Release the brake pedal. • Connect the diagnostic tool. • Enter the following diagnostic mode on the scan tool: Self Test — 4X4 Control Module. • **Are DTCs retrieved?**	**Yes** REFER to the 4X4 Control Module (DTC) Chart. **No** GO to P4.
P4	**CHECK FOR WIND-UP IN TURNS IN 2WD**	
	• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test J. **No** GO to P5.
P5	**CHECK 4H OPERATION**	
	• Stop the vehicle. • Transmission in NEUTRAL. • Lock the LH and RH PVH. • Switch the MSS to 4H. • **Does the 4H indicator illuminate correctly?**	**Yes** GO to P9. **No** GO to P6.
P6	**CHECK FOR RETURNING 4X4 CONTROL MODULE DTCs**	
	• Transmission in PARK. • Release the brake pedal. • Enter the following diagnostic mode on the scan tool: Self Test — 4X4 Control Module. • **Are DTCs retrieved?**	**Yes** REFER to the 4X4 Control Module (DTC) Chart. **No** GO to P7.
P7	**CHECK FOR WIND-UP IN TURNS IN 4H**	
	• Drive the vehicle in 4H while executing turns. • **Is wind-up present?**	**Yes** GO to P8. **No** GO to Pinpoint Test J.
P8	**CHECK FOR STRAIGHTLINE WIND-UP IN 4H**	
	• Drive the vehicle on a dry, hard surface while driving in a straight line. • **Is wind-up present?**	**Yes** GO to Pinpoint Test N. **No** GO to P9.
P9	**CHECK FOR LH AND RH PVH DISENGAGEMENT**	
	NOTE: The engine must be at idle during the following steps to supply vacuum for PVH engagement/disengagement. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • Start the engine and allow to idle. • Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front axle shaft and U-joint. • Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front axle shaft and U-joint. • **Does the LH or RH front axle shaft rotate?**	**Yes** GO to Pinpoint Test I. **No** GO to P10.
P10	**CHECK FOR PVH VACUUM LEAKS**	
	• Ignition OFF. • Disconnect both vacuum lines from the PVH solenoid. • Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the PVH apply vacuum circuit. • Observe the vacuum reading. • **Did the vacuum drop more than 25 mm (0.98 in) Hg per minute?**	**Yes** CHECK the PVH and related components for leaks. GO to Pinpoint Test I **No** CONNECT the PVH solenoid vacuum lines and GO to P11.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST P: ELECTRONIC SHIFT ON THE FLY (ESOF) FUNCTIONAL TEST (Continued)

P11	**CHECK 4L OPERATION**	
	• Bring the vehicle to a speed below 3 kph (3 mph). With the brake pedal applied and the transmission in NEUTRAL (or clutch applied), switch the MSS to 4L. • **Does the 4L indicator illuminate correctly?**	**Yes** GO to P13. **No** GO to P12.
P12	**CHECK FOR DTCs**	
	• Transmission in PARK. • Release the brake pedal. • Enter the following diagnostic mode on the scan tool: Self Test — 4X4 Control Module. • **Are DTCs retrieved?**	**Yes** REFER to the 4X4 Control Module (DTC) Chart. **No** GO to P13.
P13	**CHECK FOR WIND-UP IN TURNS IN 4L**	
	• Drive the vehicle on a dry, hard surface while turning. • **Is wind-up present and 4L operating?**	**Yes** GO to P14. **No** CHECK for 4X4 control module DTCs. REFER to Inspection and Verification. If no DTCs are present, GO to Pinpoint Test K.
P14	**CHECK FOR STRAIGHTLINE WIND-UP IN 4L**	
	• Drive the vehicle in 4L while driving in a straight line. • **Is wind-up present?**	**Yes** GO to Pinpoint Test O. **No** GO to P15.
P15	**CHECK 4L TO 2H SHIFT**	
	• With the vehicle at a stop, brake applied and transmission in NEUTRAL, switch the MSS from 4L to 2H. • **Do the 4WD indicators turn off?**	**Yes** GO to P17. **No** GO to P16.
P16	**CHECK FOR DTCs**	
	• Transmission in PARK. • Release the brake pedal. • Enter the following diagnostic mode on the scan tool: Self Test — Control Module. • **Are DTCs retrieved?**	**Yes** REFER to the 4X4 Control Module (DTC) Chart. **No** GO to P17.
P17	**CHECK FOR WIND-UP IN TURNS IN 2WD**	
	• Drive the vehicle on a dry, hard surface while executing turns. • **Is wind-up present in turns?**	**Yes** GO to Pinpoint Test K. **No** GO to P18.
P18	**CHECK FOR LH AND RH PVH DISENGAGEMENT**	
	NOTE: The engine must be at idle during the following steps to supply vacuum for PVH engagement/disengagement. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • Start the engine and allow to idle. • Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front axle shaft and U-joint. • Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front axle shaft and U-joint. • **Does the LH or RH front axle shaft rotate?**	**Yes** GO to Pinpoint Test I. **No** GO to P19.
P19	**CHECK FOR PVH VACUUM LEAKS**	
	• Ignition OFF. • Disconnect both vacuum lines from the PVH solenoid.	**Yes** CHECK the PVH and related components for leaks. GO to Pinpoint Test I.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST P: ELECTRONIC SHIFT ON THE FLY (ESOF) FUNCTIONAL TEST (Continued)

P19	**CHECK FOR PVH VACUUM LEAKS (Continued)**	
	• Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the PVH apply vacuum circuit. • Observe the vacuum reading. • **Did the vacuum drop more than 25 mm (0.98 in) Hg per minute?**	**No** CONNECT the PVH solenoid vacuum lines and GO to P20.
P20	**CHECK FOR 4H OPERATION**	
	• Switch the MSS to 2H. • Drive the vehicle on the road and shift from 2H to 4H while driving above 32 km/h (20 mph). • **Does the transfer case shift to 4H satisfactorily?**	**Yes** The 4WD system is operating correctly. **No** GO to Pinpoint Test M.

Pinpoint Test Q: Transmission Four Wheel Drive (4WD) Mode Select Switch Failure

Normal Operation

The mode select switch (MSS) communicates the operator's choice to the 4X4 control module. The 4X4 control module controls the shift solenoid, transfer case motor and pulse vacuum hublocks (PVHs) as necessary. If the vehicle is not responding to the operator's intentions, systematically check the necessary inputs and outputs of the MSS and the 4X4 control module. Check all circuits for opens and shorts to power or ground.

Possible Causes

- Mode select switch (MSS)
- Circuit 465 (WH/LB)
- Circuit 780 (DB)
- 4X4 control module

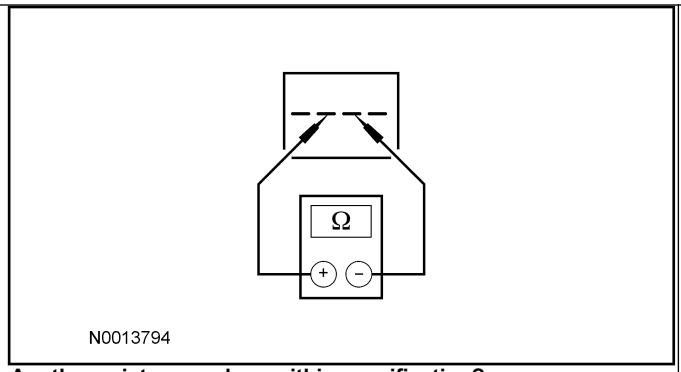
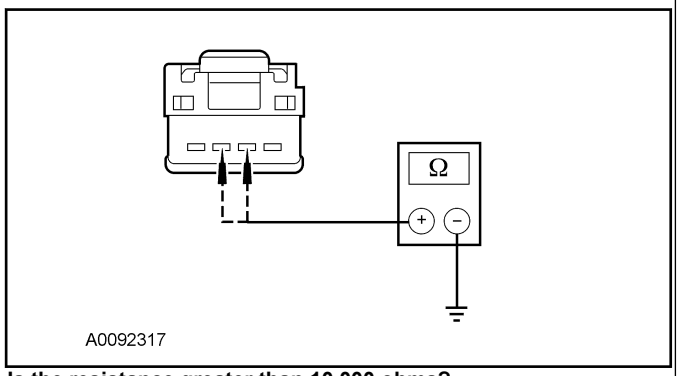
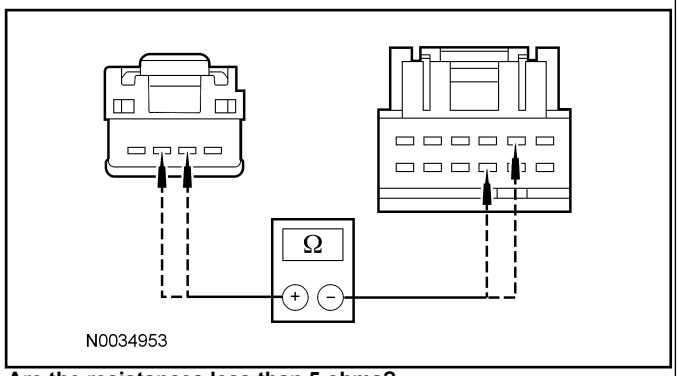
PINPOINT TEST Q: TRANSMISSION FOUR WHEEL DRIVE (4WD) MODE SELECT SWITCH FAILURE

Test Step		Result / Action to Take
Q1	**CHECK THE MSS PIDS**	
	• Connect the scan tool. • Ignition ON. • Monitor each 4WD_SW PID while cycling through each MSS position. • **Does each MSS PID agree with each switch position?**	**Yes** No problem found. CLEAR the DTCs. GO to Pinpoint Test P. **No** GO to Q2.
Q2	**CHECK MSS RESISTANCE VALUES**	
	• Ignition OFF. • Disconnect: MSS C284. • Measure the resistance between MSS C284-, terminals 2 and 3, component side, while rotating the switch through all positions. Refer to the following chart:	**Yes** GO to Q3. **No** INSTALL a new MSS. REFER to Mode Select Switch (MSS) in this section. CLEAR the DTCs. REPEAT the self-test.

Mode Select Switch (MSS) Position Resistance		
4L	**4H**	**2H**
130 ohms	270 ohms	619 ohms

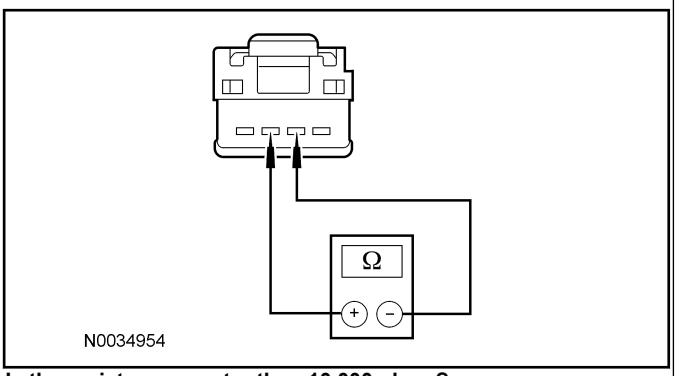
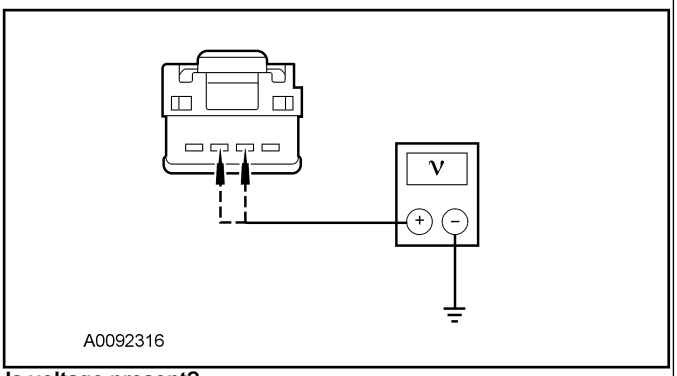
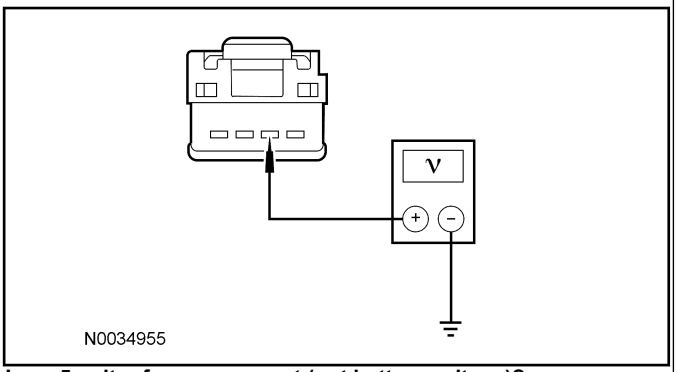
DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST Q: TRANSMISSION FOUR WHEEL DRIVE (4WD) MODE SELECT SWITCH FAILURE (Continued)

Q2	**CHECK MSS RESISTANCE VALUES (Continued)**	
	 • **Are the resistance values within specification?**	
Q3	**CHECK MSS CIRCUITS 465 (WH/LB) AND 780 (DB) FOR SHORT TO GROUND**	
	• Disconnect: 4X4 Control Module C281b. • Measure the resistance between MSS C284-2, circuit 465 (WH/LB) harness side and ground. • Measure the resistance between MSS C284-3, circuit 780 (DB) harness side and ground.  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Q4. **No** REPAIR the affected circuit(s). CLEAR the DTCs. REPEAT the self-test.
Q4	**CHECK MSS CIRCUITS 465 (WH/LB) AND 780 (DB) FOR AN OPEN**	
	• Measure the resistance between MSS C284-2, circuit 465 (VH/LB), harness side and 4X4 control module C281b-9, circuit 465 (WH/LB), harness side. • Measure the resistance between MSS C284-3, circuit 780 (DB), harness side and 4X4 control module C281b-2, circuit 780 (DB), harness side.  • **Are the resistances less than 5 ohms?**	**Yes** GO to Q5. **No** REPAIR the affected circuit(s). CONNECT the 4X4 control module. CLEAR the DTCs. REPEAT the self-test.
Q5	**CHECK MSS CIRCUITS 465 (WH/LB) AND 780 (DB) FOR SHORT TOGETHER**	

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST Q: TRANSMISSION FOUR WHEEL DRIVE (4WD) MODE SELECT SWITCH FAILURE (Continued)

Q5	**CHECK MSS CIRCUITS 465 (WH/LB) AND 780 (DB) FOR SHORT TOGETHER (Continued)**	
	• Measure the resistance between MSS C284-2, circuit 465 (WH/LB) harness side and C284-3, circuit 780 (DB).  • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to Q6. **No** REPAIR the circuits. CLEAR the DTC. REPEAT the self-test.
Q6	**CHECK MSS CIRCUITS 465 (WH/LB) AND 780 (DB) FOR A SHORT TO VOLTAGE**	
	• Ignition ON. • Measure the voltage between MSS C284-2, circuit 465 (WH/LB), harness side and ground. • Measure the voltage between MSS C284-3, circuit 780 (DB), harness side and ground.  • **Is voltage present?**	**Yes** REPAIR the circuit(s). CLEAR the DTC. REPEAT the self-test. **No** GO to Q7.
Q7	**CHECK MSS CIRCUIT 780 (DB) FOR REFERENCE VOLTAGE**	
	• Ignition OFF. • Connect: 4X4 Control Module C281b. • Ignition ON. • Measure the voltage between MSS C284-3, circuit 780 (DB), harness side and ground.  • **Is a +5-volt reference present (not battery voltage)?**	**Yes** No problem found. The condition may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test. **No** INSTALL a new 4X4 control module. REFER to 4X4 Control Module in this section. TEST the system for normal operation.