

## Transmission Control Systems: Testing and Inspection Component Tests

### Digital Transmission Range (TR) Sensor Diagnosis Chart

#### Digital Transmission Range (TR) Sensor Diagnosis Chart

Selector Position	PID: TR	PID: TR_D				PID: TR_V (volts)
		TR4	TR3A	TR2	TR1	TR3A (PCM Pin 64 to sigtrn)
PARK	P/N	0	0	0	0	0.0 Volts
In Between	REV	0	1	0	0	1.3 - 1.8 Volts
REVERSE	REV	1	1	0	0	1.3 - 1.8 Volts
In Between	REV	0	1	0	0	1.3 - 1.8 Volts
NEUTRAL	NTRL	0	1	1	0	1.3 - 1.8 Volts
In Between	O/D*	1	1	1	0	1.3 - 1.8 Volts
OVERDRIVE	O/D*	1	1	1	1	1.3 - 1.8 Volts
In Between	Man 2	1	0	1	1	0.0 Volts
Manual 2	Man 2	1	0	0	1	0.0 Volts
In Between	Man 2	1	0	1	1	0.0 Volts
Manual 1	Man 1	0	0	1	1	0.0 Volts

a Will read "Drive" if O/D is canceled.

- A. TR\_V is the voltage at the PCM pin 64 (TR3A Circuit) to signal return.
- B. "In Between" reading could be caused by a shift cable or digital TR sensor misaligned or a digital TR sensor circuit failure of TR1, TR2, TR3A, or TR4.
- C. TR\_D: 1= Open Digital TR switch, 0= Closed Digital TR switch.
- D. EEC-V Control System Breakout Box Readings: Taken from PCM signal pins for TR1, TR2, TR3A, TR4 to signal return.
- **Voltagess for TR1, TR2, TR4:**
    - 0 = 0.0 volts.
    - 1 = 9.0 - 14.0 volts.
  - **Voltage for TR3A:**
    - 0 = 0.0 volts.
    - 1 = 1.3 - 1.8 volts.

#### Wiggle Test Information For Open/Shorts

- TR4, TR3A, TR2, and TR1 are all closed in PARK. PARK is a good position to check for intermittent open circuits (with scan tool monitoring TR\_D).
- TR4, TR3A, TR2, and TR1 are all open in OVERDRIVE, so OVERDRIVE is a good position to check for shorts to ground. To determine the shorted components while observing TR\_D, unplug the TR and see if the short goes away. If the short is still present, unplug the transmission harness and see if the short goes away. If the short is still present, then the short is in the PCM or vehicle harness. Remove the suspect circuit(s) wire from the PCM vehicle harness. If the short is still present, then the PCM has an internal failure. Otherwise the failure is in the vehicle harness.

## Torque Converter Diagnosis

### Torque Converter Diagnosis

Prior to torque converter installation, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of good torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary Inspection. See: Initial Inspection/Preliminary Inspection
2. Know and understand the customers concern.
3. Verify the condition-carry out the torque converter operation test.
4. Carry out diagnostic procedures.
  - Carry out on-board diagnostics; refer to Diagnostics.
    - Repair all non-transmission related DTCs first.
    - Repair all transmission DTCs.
    - Rerun on-board diagnostic to verify repair.

- Carry out Line Pressure Test. See: Special Test Procedures/Line Pressure Test
- Carry out Stall Speed Test. See: Special Test Procedures/Stall Speed Test
- Carry out Diagnostic Routines. See: Diagnosis By Symptom
  - Use the Diagnosis by Symptom Index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and repair as required before changing the torque converter. See: Diagnosis By Symptom/Symptom Index (Diagnosis By Symptom Index)

## Torque Converter Operation Test

### Torque Converter Operation Test

This test verifies that the torque converter clutch control system and the torque converter are operating correctly.

1. Carry out Quick Test with scan tool. Check for DTCs.
2. Connect a tachometer to the engine.
3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in (D) position.
4. After normal operating temperature is reached, maintain a constant vehicle speed of about **80 km/h (50 mph)** and tap brake pedal with the left foot.
5. Engine rpm should increase when brake pedal is tapped, and decrease about five seconds after pedal is released. If this does not occur, see torque converter operation concerns.
6. If the vehicle stalls in (D) or manual 2 at idle with vehicle at a stop, move the transmission range selector lever to manual 1 position. If the vehicle stalls, see torque converter operation concerns. If the vehicle does not stall in (D), refer to Diagnosis By Symptom. See: Diagnosis By Symptom
7. If the vehicle exhibits a vibration during the road test, complete the Road Test Evaluation Form. This form will aid the technician in determining the source of the vibration.

Torque Converter Road Evaluation Form		
1) Does the torque converter engage/disengage?	Yes	<ul style="list-style-type: none"> <li>• GO to Step 2.</li> </ul>
	No	<ul style="list-style-type: none"> <li>• REFER to Diagnosis By Symptom — Torque Converter No Apply Routine 240/340 and Always Applied Routine 241/341 for further diagnosis information. Repair as required, verify converter operation and then continue.</li> </ul>
2) Does vibration occur during 3-4 or 4-3 shift at: light, medium, or heavy throttle?	Light	<ul style="list-style-type: none"> <li>• May be torque converter clutch shudder, GO to Step 3.</li> </ul>
	Medium	<ul style="list-style-type: none"> <li>• May be torque converter clutch shudder, GO to Step 3.</li> </ul>
	Heavy	<ul style="list-style-type: none"> <li>• Not torque converter clutch shudder — converter does not engage due to PCM strategy, REFER to Diagnosis By Symptom — Noise/Vibration Routine 254/354 for further diagnosis.</li> </ul>

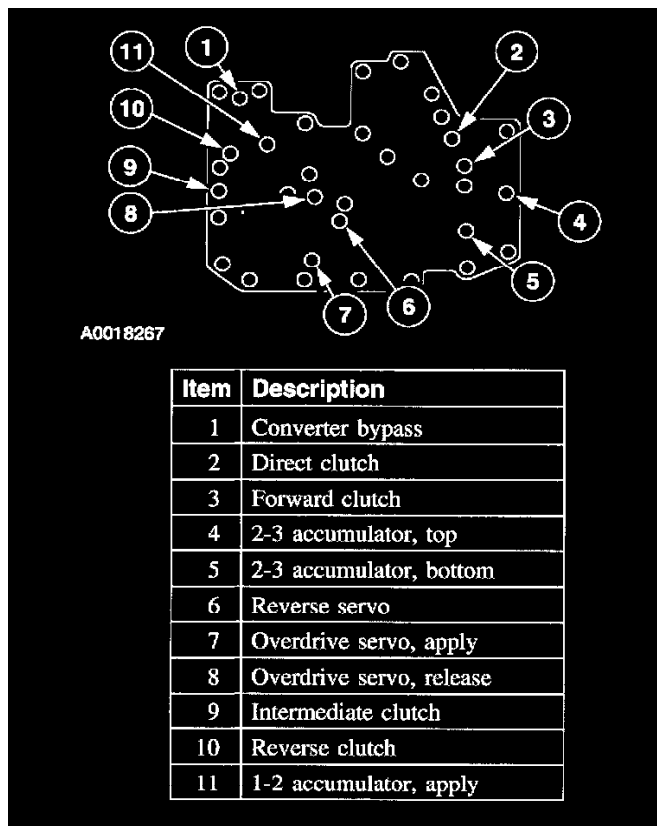
Torque Converter Road Evaluation Form		
3) Is the problem vehicle speed dependent (operating at steady speed, i.e. 64 km/h (40 mph) regardless of transmission range. Verify by manually selecting 2nd, OD cancel, and OD.	Yes	• Not torque converter clutch shudder • REFER to Diagnosis By Symptom - Noise/Vibration Routine 254/354 for further diagnosis.
	No	• GO to Step 4.
4) Is the problem engine-rpm dependent? (Occurs at the same engine rpm independent of transmission gear. Verify by holding same rpm in each transmission gear.)	Yes	• Not torque converter clutch shudder • REFER to Diagnosis By Symptom - Noise/Vibration Routine 254/354 for further diagnosis.
	No	• GO to Step 5.
5) Does the problem occur in coast, steady speed, or reverse range?	Yes	• Not torque converter clutch shudder • REFER to Diagnosis By Symptom - Noise/Vibration Routine 254/354 for further diagnosis.
	No	• GO to Step 6.
6) Does vibration occur during extended light brake application?	Yes	• Not torque converter clutch shudder • REFER to Diagnosis By Symptom - Noise/Vibration Routine 254/354 for further diagnosis.
	No	• GO to Step 7.
7) If one of the driving modes in Step 2 identifies a vibration which was not present in steps 3-6, then there is a strong possibility that the vibration is caused by the torque converter clutch function. Carry out the repair procedures as found under Disassembly/Assembly.		

**NOTE:** The following is a list of common vehicle concerns that have been misdiagnosed as torque converter clutch shudder.

- spark plugs - check for cracks, high resistance or broken insulators
- plug wires
- fuel injector - filter may be plugged
- fuel contamination - engine driveability concerns
- EGR valve - valve may let in too much exhaust gas and cause engine to run lean
- vacuum leak - engine will not get correct air/fuel mixture
- MAP/MAF sensor - incorrect air/fuel mixture
- H02S sensor - too rich/lean air/fuel mixture
- fuel pressure - may be too low
- engine mounts - loose/damaged mounts can cause vibration concerns
- axle joints - check for vibration

## Air Pressure Tests

### Air Pressure Tests



### Transmission Air Test Plate

A no-drive condition can exist even with correct transmission fluid pressure because of inoperative clutches or bands. An erratic shift can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the malfunction.

Follow the procedure to determine the location of the inoperative clutch or band by introducing air pressure into the various test plate passages.

**NOTE:** Use only dry, regulated **276 kPa (40 psi)** maximum air pressure.

Apply air to the appropriate passage(s). A dull thud should be felt or heard or movement could be observed when the clutch component applies. There should be no hissing sound when the component is applied.

Cover the vent hole in the test plate with a clean, lint-free shop towel to prevent spray when the air is applied. Plugging the vent hole during testing will result in inaccurate results.

1. Drain transmission fluid and remove the transmission fluid pan.
2. Remove the main control valve body.
3. Install transmission test plate and gasket. Tighten bolts to **10 Nm (89 inch lbs.)**.

4. **NOTE:** Do not apply air to the test plate vent hole.

Apply air to the appropriate clutch port (refer to the Transmission Air Test Plate illustration). A dull thud may be heard or movement felt when the component is applied or released. If clutch seals or check balls are leaking a hissing sound may be heard.

If the servos do not operate, disassemble, clean and inspect them to locate the source of the concern.

If air pressure applied to the clutch passages fails to operate a clutch, or operates clutches simultaneously, inspect the fluid passages in the case.

If air pressure applied to the accumulator fails to operate an accumulator, remove and inspect case passages and piston.

## Clutch Pressure Test

### Clutch Pressure Test

The Clutch Pressure Test will diagnose a low-pressure condition or leakage in a clutch circuit. A difference of **103 kPa (15 psi)** or more between the clutch pressure and line pressure will prevent a normal shift.

1. **CAUTION:** Pressure gauges affect the shift quality of the transmission. Care must be taken not to accelerate or decelerate rapidly. Possible transmission failure can result.

Attach **0 - 2068 kPa (0 - 300 psi)** pressure gauges to the line pressure tap and the appropriate clutch pressure tap according to Band/Clutch

Application Chart 601. Gauges must be accurate enough to distinguish a **103 kPa (15 psi)** difference. (If this test is done in conjunction with a control pressure test, pressure gauges will be attached to all pressure taps.) Have sufficient flexible hose available to read the gauges in the vehicle.

2. Drive the vehicle. When pressure is applied to the clutch, note the difference between the line pressure gauge and the corresponding clutch pressure gauge.
3. If the difference in pressures is less than **103 kPa (15 psi)**, the corresponding clutch circuit does not have a pressure loss. The gauges on the line pressure tap and appropriate clutch pressure tap can be switched to confirm that gauge calibration differences are not the cause.
4. If the difference is greater than **103 kPa (15 psi)**, there is a leak in the corresponding clutch pressure circuit. The gauges on the line pressure tap and clutch pressure tap can be switched to confirm that gauge calibration differences are not the cause. Carry out the appropriate procedure to correct the clutch leak problem.

## Line Pressure Test

### Line Pressure Test

**CAUTION:** Carry out the line pressure test prior to carrying out the stall speed test. If the line pressure is low at stall, do not carry out stall speed test or further transmission damage will occur. Do not maintain Wide Open Throttle (WOT) in any transmission range for more than five seconds.

This test verifies that the line pressure is within specification.

1. Connect pressure gauge to line pressure tap.
2. Start engine and check line pressures. Refer to the Line Pressure Chart to determine if line pressure is within specification.

Application	Range	Idle		WOT Stall	
		EPC	Line Pressure	EPC	Line Pressure
4.2L, 4.6L	P, N, OD, 2, 1	207-276 kPa (30-40 psi)	552-689 kPa (80-100 psi)	689-758 kPa (100-110 psi)	1,310-1,448 kPa (190-210 psi)
4.2L, 4.6L	R	138-207 kPa (20-30 psi)	552-689 kPa (80-100 psi)	551-620 kPa (80-90 psi)	1,397-2,068 kPa (200-300 psi)
5.4L	P, N, OD, 2, 1	207-276 kPa (30-40 psi)	552-689 kPa (80-100 psi)	689-793 kPa (100-115 psi)	1,289-1,689 kPa (187-245 psi)
5.4L	R	138-207 kPa (20-30 psi)	552-689 kPa (80-100 psi)	558-655 kPa (81-95 psi)	1,397-1,930 kPa (200-280 psi)

### Line Pressure Chart

Transmission Pressures with TP at 1.5 Volts and Vehicle Speed Above 8 Km/h (5 MPH)					
Gear	EPC Tap <sup>1</sup>	Line Pressure Tap	Forward Clutch Tap	Intermediate Clutch Tap	Direct Clutch Tap
M1	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	0-34 kPa (0-5 psi)	0-34 kPa (0-5 psi)
M2	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	482-620 kPa (70-90 psi)	0-34 kPa (0-5 psi)
1	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	0-34 kPa (0-5 psi)	0-34 kPa (0-5 psi)
2	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	482-620 kPa (70-90 psi)	0-34 kPa (0-5 psi)
3	206-275 kPa (30-40 psi)	551-724 kPa (80-105 psi)	482-620 kPa (70-90 psi)	551-689 kPa (80-100 psi)	482-620 kPa (70-90 psi)
4	206-275 kPa (30-40 psi)	551-689 kPa (80-100 psi)	0-34 kPa (0-5 psi)	551-689 kPa (80-100 psi)	482-620 kPa (70-90 psi)

1 EPC readings will vary due to EEC strategy. These values are approximate pressures. Actual clutch apply pressures should be within 69-103 kPa (10-15 psi) of line pressure. For additional information on testing, refer to the Clutch Pressure Test

### Clutch Pressure Chart 4.2L and 4.6L

<b>Transmission Pressures with TP at 1.5 Volts and Vehicle Speed Above 8 Km/h (5 MPH)</b>					
<b>Gear</b>	<b>EPC Tap<sup>1</sup></b>	<b>Line Pressure Tap</b>	<b>Forward Clutch Tap</b>	<b>Intermediate Clutch Tap</b>	<b>Direct Clutch Tap</b>
M1	275-344 kPa (40-50 psi)	689-827 kPa (100-120 psi)	620-758 kPa (90-110 psi)	0-34 kPa (0-5 psi)	0-34 kPa (0-5 psi)
M2	241-310 kPa (35-45 psi)	620-689 kPa (90-100 psi)	551-689 kPa (80-100 psi)	586-724 kPa (85-105 psi)	0-34 kPa (0-5 psi)
1	275-344 kPa (40-50 psi)	689-827 kPa (100-120 psi)	620-758 kPa (90-110 psi)	0-34 kPa (0-5 psi)	0-34 kPa (0-5 psi)
2	241-310 kPa (35-45 psi)	620-689 kPa (90-100 psi)	551-689 kPa (80-100 psi)	586-724 kPa (85-105 psi)	0-34 kPa (0-5 psi)
3	241-310 kPa (35-45 psi)	620-689 kPa (90-100 psi)	551-689 kPa (80-100 psi)	586-724 kPa (85-105 psi)	551-689 kPa (80-100 psi)
4	241-310 kPa (35-45 psi)	620-689 kPa (90-100 psi)	0-34 kPa (0-5 psi)	586-724 kPa (85-105 psi)	551-689 kPa (80-100 psi)

1 EPC readings will vary due to EEC strategy. These values are approximate pressures. Actual clutch apply pressures should be within 69-103 kPa (10-15 psi) of line pressure. For additional information on testing, refer to the Clutch Pressure Test

### Clutch Pressure Chart 5.4L

3. Place the ignition switch in the OFF position. If line pressure is not within specification, check EPC pressure.
4. Connect pressure gauge to EPC pressure tap.
5. Start engine and check EPC pressure. Use the line pressure chart for specifications.
6. If EPC pressure is not within specification, carry out Pinpoint Test E to diagnose EPC operation. If EPC operation is OK, see the line pressure diagnosis chart for line pressure concern causes.

Test Results	Possible Source
High At Idle — In All Positions	Wiring Harnesses Run Quick Test. Refer to the Powertrain Management.  EPC Solenoid Main Regulator Valve
Low At Idle — In All Positions	Low Fluid Level Control Bodies Leakage in Pump Damaged Gaskets on Separator Valve Damaged Separator Plate Restricted Inlet Filter Case Bolts Loose Main Control Valve Body EPC Solenoid O-Ring EPC Solenoid Bracket Case Sticking Main Regulator Valve Damaged Inlet Tube Seal on Inlet Filter
Low In PARK Only	Valve Body Low/Reverse Servo
Low In REVERSE Only	Separator Plate Low/Reverse Servo or Valve Body Reverse Clutch
Low In NEUTRAL Only	Valve Body
Low In OVERDRIVE Only	Forward Clutch Valve Body
Low In 1st Position Only	Forward Clutch Valve Body Low/Reverse Servo
Low In 2nd Position Only	Intermediate Clutch Valve Bodies Forward Clutch

## Line Pressure Diagnosis Chart

### Stall Speed Test

#### Stall Speed Test

**WARNING:** Apply the parking brake Firmly while carrying out each stall test.

**CAUTION:** Carry out line pressure test prior to carrying out stall test. If the line pressure is low at stall, do not carry out stall test or further transmission damage will occur.

The stall speed test checks:

- torque converter clutch operation and installation.
- holding ability of the forward clutch.
- reverse clutch (the low-reverse bands).
- planetary one-way clutch.
- engine driveability.

Conduct this test with the engine coolant and transmission fluid at correct levels and at normal operating temperature.

Apply the parking brake firmly for each stall speed test.

Engine	Stall Speed RPM
E150/250 4.2L	1,984-2,325
HD E250 4.2L	2,019-2,355
E150 4.6L	2,115-2,426
E150/250 5.4L	1,806-2,187
HD E250 5.4L	1,800-2,150

Selector Position	Stall Speeds High	Stall Speeds Low
(D)	Planetary One-Way clutch	
(D) , 2 and 1	Forward clutch or intermediate clutch	
(D) , 2, 1 and R	Carry Out Pressure Test	Torque Converter Stator One-Way clutch or Engine Driveability Concerns
R	Reverse clutch or Low Reverse Band or Servo	

- Find the specified stall rpm for the vehicle; see the stall speed diagnosis chart. Use a grease pencil to mark the rpm on the dial of a tachometer.
- Connect a tachometer to the engine.
- NOTE:** If the rpm recorded by the tachometer exceeds the maximum limits, release the accelerator pedal immediately because clutch or band slippage is indicated.

In each of the following ranges (D), 2, 1, R, press the accelerator pedal to the floor and hold it just long enough to let the engine get to Wide Open Throttle (**WOT**). While making this test, do not hold the throttle open for more than 5 seconds at a time.

- Note the results in each range.
- After each range, move the shift control selector lever to NEUTRAL and run the engine at **1,000 rpm** for about 15 seconds to cool the torque converter before making the next test.
- Refer to the stall speed diagnosis chart for corrective actions.