2002 Excursion

Subarticles

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SECTION 307-01: Automatic Transaxle/Transmission	2002 F-Super Duty 250-550/Excursion Workshop Manual
DIAGNOSIS AND TESTING	Procedure revision date: 09/23/2004

Diagnostics

Special Tool(s)

 ST1300-A	UV Leak Detector Kit 164-R0756 or equivalent
 ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)
 ST1137-A	Automotive Meter 73 III 105-R0057 or equivalent
 ST1532-A	E4OD Transmission Cable 418-F037 (007-00107) or equivalent

 ST1391-A	Breakout Box, EEC-V Control System 418-049 (T94L-50-EEC-V) or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent scan tool
 ST1389-A	Transmission Tester 307-F016 (007-00130) or equivalent
 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
 ST1533-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
 ST1761-A	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent

Diagnosing an electronically controlled automatic transmission is simplified by using the following procedures. One of the most important things to remember is that there is a definite procedure to follow. DO NOT TAKE SHORTCUTS OR ASSUME THAT CRITICAL CHECKS OR ADJUSTMENTS HAVE ALREADY BEEN MADE. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics with Scan Tool

NOTE: For detailed instruction and other diagnostic methods using the scan tool, refer to the tester manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual

These quick tests should be used to diagnose the powertrain control module (PCM) and should be carried out in order.

- Quick Test 1.0-Visual Inspection
- Quick Test 2.0-Set Up
- Quick Test 3.0-Key On, Engine Off
- Quick Test 4.0-Continuous Memory

- Quick Test 5.0-Key On, Engine Running
- Special Test Mode
    - Wiggle Test
    - Output Test Mode
- PCM Reset Mode
- Clearing DTCs
- OBD II Drive Cycle
- Other NGS Features
- For further information on other diagnostic testing features using the scan tool, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Other diagnostic methods include the following.
    - Parameter Identification (PID) Access Mode
    - Freeze Frame Data Access Mode
    - Oxygen Sensor Monitor Mode

Transmission Drive Cycle Test

NOTE: If equipped, turn the power take-off (PTO) unit off for correct test results. For a description of PTO operation, refer to Transmission Electronic Control System in this section.

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Cycle Test must be followed exactly. Malfunctions must occur four times consecutively for the shift error DTC to be set, and five times consecutively for the continuous torque converter clutch code to be set.

NOTE: When carrying out the Transmission Drive Cycle Test refer to the Solenoid Operation Chart for correct solenoid operation.

After carrying out the Quick Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then erase the Quick Test codes.
2. Warm the engine to normal operating temperature.
3. Make sure the transmission fluid level is correct.
4. With the transmission in OVERDRIVE, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into fourth gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in OVERDRIVE, press transmission control switch (TCS) (transmission control illuminator lamp [TCIL] should illuminate) and moderately accelerate from stop to 64 km/h (40 mph). This allows the transmission to shift into third gear. Hold speed and throttle open steady for a minimum of 15 seconds (30 seconds above 4,000 ft altitude).
6. Press TCS (TCIL should turn off) and accelerate from 64 km/h (40 mph) to 80 km/h (50 mph). This allows transmission to shift into fourth gear. Hold speed and throttle position steady for a minimum of 15 seconds.

7. **NOTE:** For 7.3L diesel applications: Tapping the brake pedal in fourth gear during an open throttle condition will not disengage the torque converter clutch (TCC). The TCC will disengage during a 4-3 coast downshift.

   With transmission in fourth gear and maintaining steady speed and throttle opening, lightly apply and release brake to operate stoplamps. Then hold speed and throttle steady for an additional 5 seconds (minimum).

8. Brake to a stop and remain stopped for a minimum of 20 seconds.
9. Repeat Steps 4 through 8 at least five times.
10. Carry out Quick Test and record continuous codes.

After On-Board Diagnostics

NOTE: The vehicle wiring harness, powertrain control module and non-transmission sensors can affect transmission operations. Repair these concerns first.

After the On-Board Diagnostics procedures are completed, repair all DTCs.

Always repair all non-transmission-related DTCs first, then repair any transmission-related DTCs. Refer to the following Diagnostic Trouble Code Chart for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and to aid in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing electrical concerns of the transmission. Make sure the vehicle wiring harness and the powertrain control module are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission-related electronic components.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the powertrain control module (PCM) wiring harness for correct connections, bent or broken pins, corrosion, loose wires, correct routing, correct seals and their condition. Check the PCM, sensors and actuators for damage. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE: If a concern still exists after electrical diagnosis has been carried out, refer to Diagnosis By Symptom in this section.

If DTCs appear while carrying out the on-board diagnostics, refer to the Diagnostic Trouble Code Chart for the appropriate procedure. Prior to entering pinpoint tests, refer to any TSBs and OASIS messages for transmission concerns.

Diagnostic Trouble Code Charts

Diagnostic Trouble Code Chart

Diagnostic Trouble	Component	Description	Condition	Symptom	Action

Code					
P1111	System	Pass	No concern detected.	Concern not detected by PCM.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0340, P0341, P0344	DI	DI system concern.	Engine rpm circuit failure.	CKP sensor failure/engine will stall or not run. May flash TCIL. [b]	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0237	Manifold Absolute Pressure (MAP) Sensor	MAP sensor out of On-Board Diagnostics range.	MAP sensor signal higher or lower than expected or no response during Dynamic Response (Goose) Test.	—	Rerun On-Board Diagnostics.
P0236	Manifold Absolute Pressure (MAP) Sensor	MAP sensor vacuum circuit failure.	MAP sensor signal higher or lower than expected or no response due to vacuum hose, circuit damaged, disconnected or restricted.	Firm shift feel, late shifts at altitude.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0235	Manifold Absolute Pressure (MAP) Sensor	MAP sensor inactive.	MAP sensor or circuit open, shorted to ground or 5V.	Firm shift feel, late shift at altitude.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1124	Throttle Position (TP) Sensor	TP sensor out of On-Board Diagnostics range.	TP sensor (gasoline engines) not at idle position during KOEO.	—	Rerun at appropriate TP sensor position per the engine application.
P0500, P1502	VSS/ABS	Insufficient or intermittent vehicle speed input.	PCM detected a loss of vehicle speed signal during operation.	Harsh engagements, firm shift feel, abnormal shift schedule, unexpected downshifts may occur at closed throttle, abnormal TCC operation or engages only at WOT. May flash TCIL.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0500, P1502	VSS/ABS	Insufficient or intermittent	PCM detected a loss of vehicle	Harsh engagements, firm shift feel, abnormal shift	Refer to the Powertrain

		vehicle speed input.	speed signal during operation.	schedule, unexpected downshifts may occur at closed throttle, abnormal TCC operation or engages only at WOT. May flash MIL.	Control/Emissions Diagnosis (PC/ED) manual.
P0503	VSS/ABS	Vehicle speed sensor intermittent.	PCM detected a loss, or an unrealistic change of vehicle speed signal during operation.	Possible fluctuation in the speedometer. May flash TCIL.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0781, P0731 [a]	SSA, SSB or Internal Transmission Components	1-2 shift error.	Engine rpm drop not detected when 1-2 shift was commanded by PCM.	Incorrect gear selection depending on failure mode and transmission range selector lever position. Refer to the Solenoid Operation Chart. Shift errors may also be due to other internal transmission concerns such as stuck valves or damaged friction material. May flash TCIL.	Go To Pinpoint Test A.
P0782, P0732, P0733[a]	SSA, SSB or Internal Transmission Components	2-3 shift error.	Engine rpm drop not detected when 2-3 shift was commanded by PCM.	Incorrect gear selection depending on failure mode and transmission range selector lever position. Refer to the Solenoid Operation Chart. Shift errors may also be due to other internal transmission concerns such as stuck valves or damaged friction material. May flash TCIL.	Go To Pinpoint Test A.
P0783[a]	SSA, SSB or Internal Transmission Components	3-4 shift error.	Engine rpm drop not detected when 3-4 shift was commanded by PCM.	Incorrect gear selection depending on failure mode and transmission range selector lever position. Refer to the Solenoid Operation Chart. Shift errors may also be due to other internal transmission concerns such as stuck valves or damaged friction material. May flash TCIL.	Go To Pinpoint Test A.
P0122	TP or AP	TP or AP	Voltage above or	Harsh engagements, firm	Refer to the

	Sensor	sensor circuit below minimum voltage, (open/shorted to ground).	below specification for On-Board Diagnostics or during normal vehicle operation.	shift feel, abnormal shift schedule, abnormal TCC operation or does not engage. May flash MIL.	Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0123	TP or AP Sensor	TP or AP sensor circuit above maximum voltage (short to vehicle power).	Voltage above or below specification for On-Board Diagnostics or during normal vehicle operation.	Harsh engagements, firm shift feel, abnormal shift schedule, abnormal TCC operation or does not engage. May flash MIL.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1120	Throttle Position (TP) Sensor	TP sensor voltage lower than expected.	Voltage below specification.	Harsh engagements, firm shift feel, abnormal shift schedule, abnormal TCC operation or does not engage.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1780	TCS	TCS not changing state.	TCS not cycled during On-Board Diagnostics/circuit open or shorted.	No overdrive cancel when switch is cycled.	Rerun diagnostics and cycle switch. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0712	TFT Sensor	157°C (315°F) indicated, TFT sensor circuit grounded.	Voltage drop across TFT sensor exceeds scale set for temperature of 157°C (315°F).	TCC and stabilized shift schedule may be enabled sooner after cold start. May flash TCIL.	Go To Pinpoint Test B.
P0713	TFT Sensor	-40°C (-40°F) indicated, TFT sensor circuit open.	Voltage drop across TFT sensor exceeds scale set for temperature -40°C (-40°F).	TCC and stabilized shift schedule may be enabled sooner after cold start. May flash TCIL.	Go To Pinpoint Test B.
P1711	TFT Sensor	TFT sensor out of On-Board Diagnostics range.	Transmission not at operating temperature during On-Board Diagnostics.	—	Warm vehicle to normal operating temperature and rerun On-Board Diagnostics.
P1713	TFT	No change in TFT — Low range.	PCM has detected no TFT change at low range during operation.	May flash TCIL.	Go To Pinpoint Test B.
P1718	TFT	No change in	PCM has detected	May flash TCIL.	Go To Pinpoint

		TFT — High range.	no TFT change at high range during operation.		Test B.
P1783	TFT Sensor	Transmission overtemp condition.	Transmission fluid temperature exceeded 132°C (270°F).	Slight increase in electronic pressure control pressure when RPMs are greater than 2,500. May flash TCIL.	Go To Pinpoint Test B.
P1460 P1463 P1464	A/C	A/C switch error.	DTC can result from A/C being ON during On-Board Diagnostics.	Failed on — electronic pressure control pressure slightly low with A/C off. Failed off — electronic pressure control pressure slightly low with A/C on.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0705	Digital TR Sensor	Digital TR circuit failure.	Digital TR circuits, indicating an invalid pattern in TR_D. Condition caused by a short to ground or an open in TR4, TR3A, TR2, and/or TR1 circuits.	Increase in EPC pressure (harsh shifts). Defaults to (D) or D for all gear positions. In (D) position transmission stuck in D or manual 2. May flash MIL.	Go To Pinpoint Test D.
P0708	Digital TR	Digital TR sensor circuit TR3A open.	Digital TR sensor circuit TR3A reading 2.6v - 5.0v (open circuit).	Increase in EPC pressure. Defaults to (D)or D for all gear ranges. May flash MIL.	Go To Pinpoint Test D.
P1702	Digital TR	Intermittent DTC codes P0705 or P0708.	Refer to DTC codes P0705 or P0708 condition.	Refer to DTC codes P0705 or P0708 symptom. May flash TCIL.	Go To Pinpoint Test D.
P1704	Digital TR	Digital TR circuit reading in between gear position during KOEO.	Digital TR sensor or shift cable incorrectly adjusted, or digital TR circuit failure.	Wrong commanded EPC pressure. Digital TR reading the wrong gear position.	Go To Pinpoint Test D.
P1705	Digital TR Sensor	Digital TR sensor circuits not reading PARK or NEUTRAL during KOEO/KOER.	KOEO/KOER not run in PARK or NEUTRAL, or Digital TR circuit failure.	Rerun on-board diagnostic in Park. KOEO/KOER.	Go To Pinpoint Test D.
P0102, P0103,	MAF Sensor	MAF sensor DTC.	MAF sensor system fails to operate in a	High electronic pressure control pressure. Firm shifts	Refer to the Powertrain Control/Emissions

P1100, P1101			normal manner, which may cause a transmission concern.	and engagements. May flash TCIL.	Diagnosis (PC/ED) manual.
P0107	BARO	BARO circuit failure.	BARO signal lower than expected.	Firm shift feel, late shifts at altitude.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0108	BARO	BARO circuit failure.	BARO signal higher or lower than expected.	Firm shifts, late shifts at altitude.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1703	BPP Switch	Brake not actuated during On-Board Diagnostics.	Brake not cycled during KOER.	Failed on or not connected — TCC will not engage at less than one-third throttle.	Rerun On-Board Diagnostic and activate BPP switch. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0730, P0751	BPP	BPP switch circuit failed.	BPP circuit failure.	Failed off — TCC will not disengage when brake is applied.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0750 [b]	SSA	Shift solenoid circuit failure.	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during KOEO.	Incorrect gear selection depending on failure mode and transmission range selector lever position. Refer to the Solenoid Operation Chart. May flash MIL.	Go To Pinpoint Test A.
P0753	SSA	Shift solenoid circuit failure.	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during KOEO.	Incorrect gear selection depending on failure mode and transmission range selector lever position. Refer to the Solenoid Operation Chart. May flash TCIL.	Go To Pinpoint Test A.
P0755[b]	SSB	SSB circuit failure.	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or	Incorrect gear selection depending on failure mode and transmission range selector lever position. Refer to the Shift Solenoid	Go To Pinpoint Test A.

			PCM driver failure during KOEO.	Operation Chart. May flash MIL.	
P0758	SSB	SSB circuit failure.	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during KOEO.	Incorrect gear selection depending on failure mode and transmission range selector lever position. Refer to the Shift Solenoid Operation Chart. May flash TCIL.	Go To Pinpoint Test A.
P1714	SSA	SSA malfunction.	Mechanical failure of the solenoid detected.	Incorrect gear selection depending on condition, mode and manual lever position. Refer to Solenoid Operation Chart. May flash TCIL. May flash MIL.	Go To Pinpoint Test H.
P1715	SSB	SSB malfunction.	Mechanical failure of the solenoid detected.	Incorrect gear selection depending on condition, mode and manual lever position. Refer to Solenoid Operation Chart. May flash MIL.	Go To Pinpoint Test H.
P1636	SSA, SSB	Inductive signature chip communication error.	PCM has detected an internal error.	Incorrect gear selection depending on condition, mode and manual lever position. Refer to Solenoid Operation Chart. May flash MIL.	Go To Pinpoint Test H.
P1740	TCC	TCC malfunction.	Mechanical failure of the solenoid detected.	Harsh shift, may flash TCIL.	Go To Pinpoint Test H.
P1754[b]	CCS	CCS circuit failure.	CCS failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during KOEO.	Failed off — no third gear engine braking in overdrive cancel. Failed on — third gear engine braking in overdrive range. Coast clutch may be damaged causing eventual failure. May flash TCIL.	Go To Pinpoint Test G.
P0743[b]	TCC solenoid	TCC solenoid circuit failure.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during KOEO.	Short circuit — engine stalls in DRIVE or MANUAL 2 at idle with brake applied. Open circuit — TCC never engaged. May flash MIL.	Go To Pinpoint Test C.

P0740[b]	TCC solenoid	TCC solenoid circuit failure.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during KOEO.	Short circuit — engine stalls in DRIVE or MANUAL 2 at idle with brake applied. Open circuit — TCC never engaged. May flash TCIL.	Go To Pinpoint Test C.
P1746[b]	EPC	PCM failure — electronic pressure control driver.	Current through EPC circuit is checked and compared after a time delay. An error will be noted if tolerance is exceeded during KOEO and continuous On-Board Diagnostics.	Open circuit — causes maximum electronic pressure control, harsh engagements and shifts. May flash TCIL.	Go To Pinpoint Test E.
P1747[b]	EPC	EPC circuit failure, shorted circuit or PCM.	Current through EPC circuit is checked and compared after a time delay. An error will be noted if tolerance is exceeded during KOEO and continuous On-Board Diagnostics.	Short circuit — causes minimum electronic pressure control pressure (minimum capacity). Limits engine torque (partial fuel shut-off, heavy misfire). May flash MIL.	Go To Pinpoint Test E.
P1760	EPC	EPC signal intermittent short.	PCM has detected an intermittent short.	Short circuit causes minimum EPC pressure (minimum capacity). May flash TCIL.	Go To Pinpoint Test E.
P0741[a]	TCC	TCC slippage detected.	The PCM picked up an excessive amount of TCC slippage during normal vehicle operation.	TCC slippage erratic or no torque converter clutch operation. May flash TCIL.	Refer to Diagnosis By Symptom in this section.
P1744[a]	TCC	TCC slippage detected.	The PCM picked up an excessive amount of TCC slippage during normal vehicle operation.	TCC slippage erratic or no torque converter clutch operation. May flash MIL.	Refer to Diagnosis By Symptom in this section.

P1280	ICP Sensor	ICP sensor circuit failure. Out of range low.	Open/grounded circuit, biased sensor or PCM.	May result in firm shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1281	ICP Sensor	ICP sensor circuit failure. Out of range high.	Short circuit to 5 volt ref., biased sensor or PCM.	May result in firm shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0715	TSS	Insufficient input from TSS sensor.	PCM has detected a loss of TSS signal during operation.	Harsh shifts. Set DTC. May flash TCIL. May flash MIL Schedule Operation.	Go To Pinpoint Test F.
P0717	TSS	TSS signal intermittent	PCM has detected an intermittent TSS signal	Harsh shifts, or erratic shifts. Set DTC. May flash TCIL.	Go To Pinpoint Test F.
P0718	TSS	TSS signal noisy.	PCM has detected a noisy TSS sensor signal.	Harsh shifts, or erratic shifts. Set DTC. May flash TCIL	Go To Pinpoint Test F.
P0720	OSS	Insufficient input from OSS sensor.	PCM has detected a loss of OSS signal during operation.	Set DTC. Flash TCIL. May flash MIL.	Go To Pinpoint Test F.
P0721	OSS	OSS signal noisy.	PCM has detected a noisy OSS sensor signal.	Set DTC. May flash TCIL.	Go To Pinpoint Test F.
P0722	OSS	Insufficient input from OSS sensor.	PCM has detected a loss of OSS signal during operation.	Set DTC. May flash TCIL. May flash MIL.	Go To Pinpoint Test F.
P1781	4x4L	4x4 low switch failure.	Switch closed or shorted during KOEO.	Early or delayed shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1729	4x4L	4x4 low switch failure.	Circuit open/closed. Shorted during KOEO.	Early or delayed shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

[b] Distributor ignition (DI) system.
[a] May also be generated by other non-electronic-related transmission hardware condition.
[b] Output circuit check, generated only by electrical conditions.

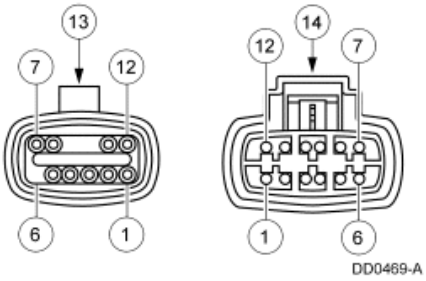
Rotunda Transmission Tester

The Transmission Tester is used to diagnose the electronically controlled transmission and is used in conjunction with the pinpoint tests. The tests should be carried out in order. Installing the Transmission Tester allows separation of the vehicle electronics from transmission electronics. Refer to the Transmission Tester manual for these tests and instructions.

- Bench Testing—Engine Off
- Resistance/Continuity Test
- Solenoid Voltage Test
- Dynamic Testing—Engine On
- EPC Solenoid
- Transmission Engagements
- Upshifts/Downshifts
- Torque Converter Clutch (TCC) Engagement
- Coast Clutch Engagements
- Turbine Shaft Speed (TSS) Sensor
- Output Shaft Speed (OSS) Sensor
- Digital Transmission Range (TR) Sensor Testing
- Resistance/Continuity Test
- Sensor Tests
- Switch Test—PARK/NEUTRAL, Backup Lamp and Optional Circuits

Transmission Connector Layouts

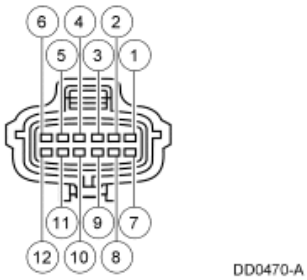
Transmission Vehicle Harness Connector



12-Pin Connector	Description	PCM Connector
1	Vehicle Power (VPWR)	71, 97
2	Shift Solenoid B (2)	11
3	Shift Solenoid A (1)	6
4	Torque Converter Clutch	54
5	Coast Clutch Solenoid	20
6	—	—
7	Transmission Fluid Temperature Sensor	37

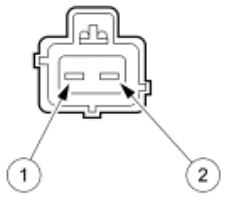
8	Signal Return (SIG RTN)	91
9	—	—
10	—	—
11	Electronic Pressure Control	81
12	Electronic Pressure Control Power	71, 97
13	Solenoid Body Connector	—
14	Harness Connector	—

Digital Transmission Range (TR) Sensor Connector



Pin Number	Circuit Function	PCM Pin
1	Not Used	—
2	SIG RTN	91
3	TR3A	64
4	TR1	17
5	TR2	49
6	TR4	50
7	Not Used	—
8	Not Used	—
9	FSD PWR FD	—
10	STR Control	—
11	Back Up	—
12	STR to INT	—

Output Shaft Speed (OSS) Sensor Harness Connector



AD2453-A

Pin Number	Circuit	Circuit Function
1	59	Output Shaft Speed Sensor (OSS)
2	91	Signal Return

Turbine Shaft Speed Sensor (TSS) Harness Connector

AD1885-A

Pin Number	Circuit	Circuit Function
1	84	Turbine Shaft Speed (TSS) Sensor
2	91	Signal Return

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 SIGRTN)
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 [a]	1	1	1	0	1.3 - 1.8 Volts
OVERDRIVE	O/D[a]	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. Breakout Box Readings: Taken from PCM signal pins for TR1, TR2, TR3A, TR4 to signal return.
    - **Voltages 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.
    - 1.8 - 5.0 volts = Invalid reading (open in wires or bad resistor in digital TR sensor).

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.

Pinpoint Tests

NOTE: If equipped, turn the power take-off (PTO) unit off for correct test results. For a description of PTO operation, refer to Transmission Electronic Control System in this section. On-Board Diagnostic is not accessible when the PTO unit is in operation. SSB is on when the PTO is in operation.

Any time an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoids Pre-Diagnosis

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

Solenoid Operation Chart

Transmission Range Selector Lever	PCM Commanded Gear	SSA	SSB	TCC	CCS

Position					
P/R/N	1	ON	OFF	[a]	[a]
(D)	1	ON	OFF	[a]	OFF
(D)	2	ON	ON	[a]	OFF
(D)	3	OFF	ON	[a]	OFF
(D)	4	OFF	OFF	[a]	OFF
(D) Cancel	First Through Third Gear Only, SSA, SSB, TCC, Same as OVERDRIVE, CCS Always On.				
MANUAL 2	2	[a]	[a]	[a]	ON
MANUAL 1	2	OFF	OFF	OFF	ON
MANUAL 1	1	ON	OFF	OFF	ON

[a] Powertrain control module-controlled.

Shift Solenoid Failure Mode Chart Always OFF

Failed OFF due to PCM/vehicle wiring concerns; solenoid electrically or hydraulically stuck off.

SSA Always Off

PCM Gear Commanded	Gear Lever Position		
	(D)	2	1
	Actual Gear Obtained		
1	4	2	1
2	3	2	2
3	3	2	2
4	4	2	2

SSB Always Off [*]

PCM Gear Commanded	Gear Lever Position		
	(D)	2	1
	Actual Gear Obtained		
1	1	2	1
2	1	2	1
3	4	2	2
4	4	2	2

[*] PTO will not operate.

Shift Solenoid Failure Mode Chart Always ON

Failed ON due to PCM/vehicle wiring concerns; solenoid electrically or hydraulically stuck on.

SSA Always On

PCM Gear Commanded	Gear Lever Position		
	(D)	2	1
	Actual Gear Obtained		
1	1	2	1
2	2	2	1
3	2	2	1
4	1	2	1

SSB Always On *

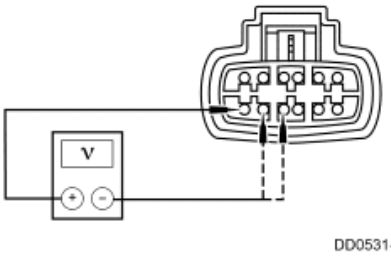
PCM Gear Commanded	Gear Lever Position		
	(D)	2	1
	Actual Gear Obtained		
1	2	2	1
2	2	2	1
3	3	2	2
4	3	2	2

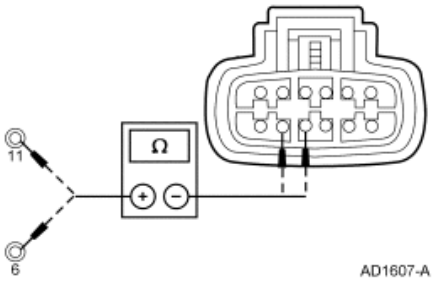
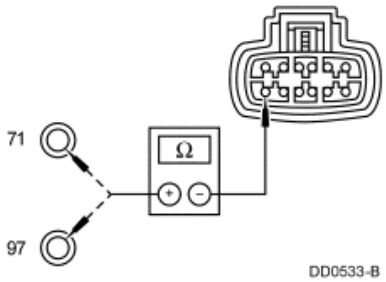
* PTO will always be on.

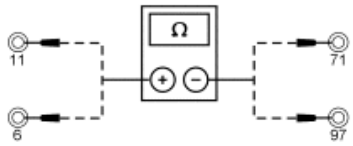
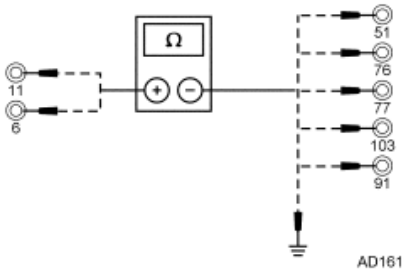
PINPOINT TEST A: SHIFT SOLENOIDS

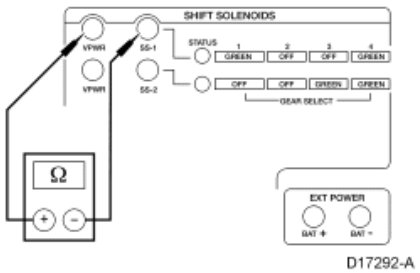
NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

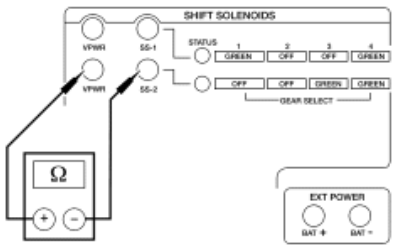
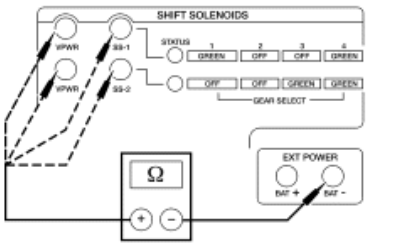
CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 ELECTRONIC DIAGNOSTICS	
	1 Check to make sure the transmission harness connector is fully seated, terminals are engaged in the connector and in good condition before proceeding.
2 	
	3 Carry out the KOEO Test until continuous DTCs have been displayed.
	4 Enter the Output Test Mode (OTM).
	5 Select the ALL ON mode. Push START to turn outputs on. Push STOP to turn outputs off.

	• **Does the vehicle enter OTM?** → **Yes** REMAIN in OTM. GO to A2 . → **No** PRESS START. If the vehicle does not enter OTM, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
A2 CHECK THE ELECTRICAL SIGNAL OPERATION	
1  Transmission Connector	1 **CAUTION: Remove the heat shield, if so equipped, from the transmission before removing the connector. Remove the solenoid body connector by pushing on the center tab and pulling on the harness connector. Do not attempt to pry the tab with a screwdriver. Always reinstall the heat shield when the procedure is completed.**
	2 Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
3 	3 Measure the voltage between the VPWR pin 1 and the appropriate solenoid signal circuit pins 2 and 3 at the transmission vehicle harness connector.
	4 Place VOM on the 20-volt scale.
	5 While observing the VOM, press START and STOP to cycle the solenoid output on and off.
	• **Is the solenoid output voltage changed to approximately battery voltage?** → **Yes** GO to A5. → **No** GO to A3.

A3 CHECK THE CONTINUITY OF THE SOLENOID SIGNAL AND VPWR CIRCUITS	
1 	
2  Powertrain Control Module (PCM)	2 Inspect for damaged or pushed-out pins, corrosion or loose wires.
	3 Install the EEC-V Control System Breakout Box.
4 	4 Measure the resistance between PCM signal test pins 11 and 6 at the EEC-V Control System Breakout Box and the signal pins 2 and 3 at the transmission harness connector.
5 	5 Measure the resistance between the VPWR test pins 71 or 97 at the EEC-V Control System Breakout Box and the VPWR pin 1 at the transmission harness connector.
	• **Is each resistance less than 5 ohms?** → **Yes** GO to A4. → **No** REPAIR the open circuit(s). REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
A4 CHECK THE SHIFT SOLENOID CIRCUITS FOR SHORTS TO POWER AND GROUND	
1	1

 AD1609-A	Measure the resistance between PCM signal test pins 11 and 6 and the VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box.
2  AD1611-A	2 Measure the resistance between PCM signal test pins 11 and 6 and test pins 51, 76, 77, 103 and 91 at the EEC-V Control System Breakout Box and chassis ground.
	• **Is each resistance greater than 10,000 ohms?** → **Yes** GO to A5. → **No** REPAIR the short circuit(s). REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
A5 SOLENOID FUNCTIONAL TEST	
	1 Install the Transmission Tester to the transmission connector.
	2 **NOTE:** The LED will turn GREEN when the solenoid activates and turn off when deactivated. The LED will turn RED if an ACTIVATED solenoid is shorted to battery positive. The LED will remain off if an ACTIVATED solenoid is shorted to ground or no continuity (open circuit). Carry out the Solenoid Voltage Test.
	• **Does the solenoid (LED GREEN) activate?** → **Yes** GO to A6. → **No**

	GO to A7.
A6 TRANSMISSION DRIVE TEST	
1  Powertrain Control Module (PCM)	
	2 Carry out the Dynamic Testing — Engine On.
	• **Does the vehicle upshift when commanded by the tester?** → **Yes** INSTALL a new PCM. ERASE all codes and CARRY OUT the Transmission Drive Cycle Test. RERUN the Quick Tests. If DTCs are still present, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual in this section. → **No** GO to A7.
A7 CHECK THE RESISTANCE OF THE SOLENOIDS	
NOTE: Refer to the Transmission Tester for terminal locations.	
	1 Place the bench/drive switch to the BENCH mode.
	2 Rotate the gear select switch to the OHMS CHECK position.
3  D17292-A	3 Measure the resistance between the SSA/SS-1 jack and the VPWR jack on the transmission tester. This is to test SSA.
	4 Record the resistance. (The resistance should be between 18 and 26 ohms.)
5	5 Measure the resistance between the SSB/SS-2 jack and the VPWR jack on the transmission tester. This is to test SSB.

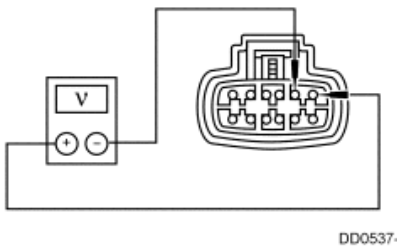
 D17293-A	
	6 Record the resistance. (The resistance should be between 18 and 26 ohms.)
	• **Is the resistance for each solenoid between 18 and 26 ohms?** → **Yes** GO to A8. → **No** INSTALL a new solenoid body assembly. RECORD and ERASE the codes. REPEAT the Quick Tests.
A8 CHECK THE SOLENOIDS FOR SHORT TO GROUND	
1  D17294-A	1 Check for continuity between the BAT(-) jack (engine ground) and the appropriate jack with a digital ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity). Solenoid / Tester Jack SSA/SS1 / SSA/SS1/VPWR SSB/SS2 / SSB/SS2/VPWR
	• **Does the connection show continuity?** → **Yes** INSTALL a new solenoid body assembly. RECORD and ERASE the codes. REPEAT the Quick Tests. → **No** REFER to Diagnosis By Symptom in this section.

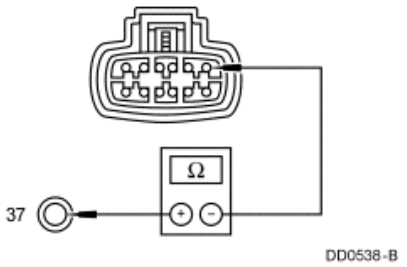
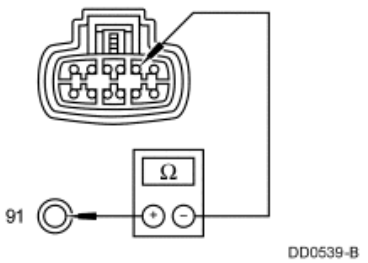
PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

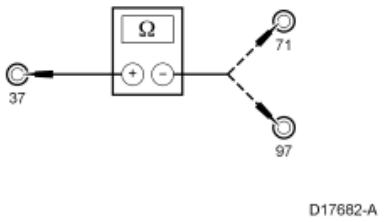
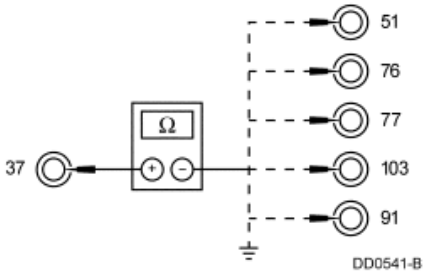
NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

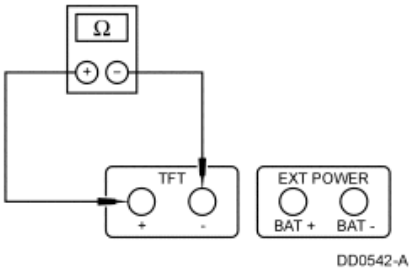
NOTE: This vehicle is equipped with a transmission fluid temperature gauge in the dash. The transmission fluid temperature gauge may be used as a quick reference to the operating temperature. It should not be used as a diagnostic tool to tell the temperature of the transmission. The WDS, NGS or transmission tester should be used to obtain the actual temperature of the transmission.

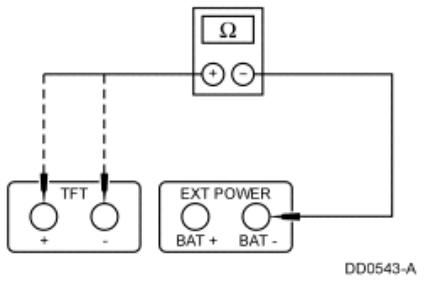
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 ELECTRONIC DIAGNOSTICS	
	1 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in the connector and in good condition before proceeding.
2 	
3 	
	4 Select Diagnostic Data Link.
	5 Select PCM.
	6 Select PID/Data Monitor and Record.
7  PIDs; TFT, TFTV	
	• **Does the vehicle enter PID/Data Monitor and Record?** → **Yes** REMAIN in PID/Data Control. GO to B2 . → **No** REPEAT procedure to enter PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
B2 WARM-UP/COOL-DOWN CYCLE	

	1 While monitoring the TFT PIDs, carry out the following test: If transmission is cold, run transmission to warm it up. If transmission is warm, allow transmission to cool down.
	• **Do the TFT PIDs increase as the transmission is warmed up or decrease as the transmission is cooled or does the TFT or TFTV drop in and out of range?** → **Yes** If the TFT PIDs increase as the transmission is warmed or decrease as the transmission is cooled, CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose transmission overheating. If the TFT or TFTV drop in and out of range, INSPECT for intermittent concern in the internal/external harness, sensor or connector. → **No** GO to B3.
B3 CHECK THE ELECTRICAL SIGNAL OPERATION	
1 	
2  Transmission Connector	2 **CAUTION: Remove the heat shield, if so equipped, from transmission before removing the connector. Remove the solenoid body connector by pushing on the center tab and pulling on the harness connector. Do not attempt to pry the tab with a screwdriver. Always reinstall the heat shield when the procedure is completed.**
	3 Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
4  	4 Measure the voltage between TFT signal circuit pin 7 and the SIG RTN circuit pin 8 at the transmission harness connector.
	5

	Place the VOM on the 20-volt scale.
6 	
	• **Is the voltage between 4.75 and 5.25 volts?** → **Yes** GO to B7. → **No** GO to B4.
B4 CHECK THE CONTINUITY OF THE TFT SIGNAL AND SIG RTN CIRCUITS	
1 	
2  Powertrain Control Module (PCM)	2 Inspect for damaged or pushed-out pins, corrosion or loose wires.
	3 Install the EEC-V Control System Breakout Box.
4 	4 Measure the resistance between the PCM signal test pin 37 at the EEC-V Control System Breakout Box and the signal pin 7 at the transmission harness connector.
5 	5 Measure the resistance between the PCM SIG RTN test pin 91 at the EEC-V Control System Breakout Box and the SIG RTN pin 8 at the transmission harness connector.

	• **Is each resistance less than 5 ohms?** → **Yes** GO to B5. → **No** REPAIR the open circuits. REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
B5 CHECK THE TFT SIGNAL CIRCUIT FOR SHORT TO VPWR AND GROUND	
1  	1 Measure the resistance between the PCM signal test pin 37 and VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box.
2  	2 Measure the resistance between the PCM signal test pin 37 and test pins 51, 76, 77, 103, 91 at the EEC-V Control System Breakout Box and chassis ground.
	• **Is each resistance greater than 10,000 ohms?** → **Yes** GO to B6. → **No** REPAIR the short circuit(s). REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
B6 CHECK THE RESISTANCE OF THE TFT SENSOR	
	1 Install the Transmission Tester to the transmission connector.
	2

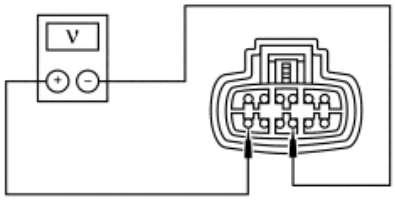
	Set the bench/drive switch to the BENCH mode.
	3 Rotate the gear select switch to the OHMS CHECK position.
4  DD0542-A	4 **NOTE:** While carrying out Tests 1 and 2 below, observe resistance. DTC P0713 is set if the resistance value exceeds 1,062 ohms (open circuit). DTC P0712 is set if the resistance value falls below 597 ohms (short circuit). Measure the resistance between the TFT- jack and the TFT+ jack on the tester.
	5 **TEST 1**
	6 Record the resistance. Resistance should be approximately in the following ranges: **Transmission Fluid Temperature** °C / °F / Resistance (Ohms) -40 to -20 / -40 to -4 / 1,062 k-284 k -19 to -1 / -3-31 / 284 k-100 k 0-20 / 32-68 / 100 k-37 k 21-40 / 69-104 / 37 k-16 k 41-70 / 105-158 / 16 k-5 k 71-90 / 159-194 / 5 k-2.7 k 91-110 / 195-230 / 2.7 k-1.5 k 111-130 / 231-266 / 1.5 k-0.8 k 131-150 / 267-302 / 0.8 k-0.54 k
	7 **TEST 2**
	8 Check for an intermittent short or open.
	9 If the resistance was between 0.8 k and 100 k ohms, carry out the following test. If the transmission is cold, start and run the engine until transmission reaches its normal operating temperature. If the transmission is warm, allow the transmission to cool. Check the TFT sensor resistance again. Compare the resistance with the initial resistance. The resistance should decrease if the transmission was warmed and should increase if the transmission was allowed to cool. If the correct change in resistance occurs, repeat the Quick Test.

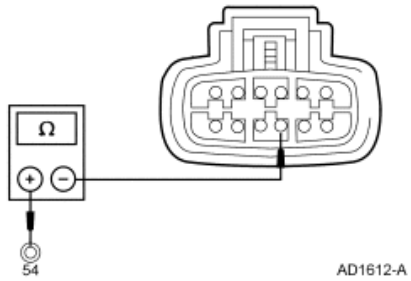
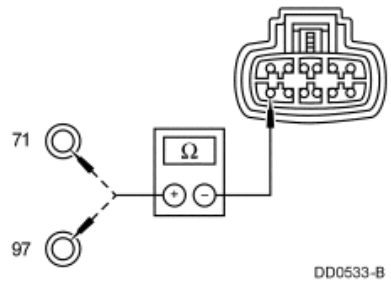
	• **Is the resistance in the specified range?** → **Yes** GO to B7. → **No** INSTALL a new solenoid assembly. RECORD and ERASE the codes. REPEAT the Quick Tests.
B7 CHECK THE TFT SENSOR FOR SHORT TO GROUND	
1  	1 Check for continuity between the BAT(-) jack (engine ground) and the appropriate jack (-TFT or +TFT) with a digital ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity).
	• **Does the connection show continuity?** → **Yes** INSTALL a new solenoid assembly. REPEAT the Quick Tests. → **No** INSTALL a new PCM. REPEAT the Quick Tests. If the DTC is still present and overtemp condition exists, CHECK the fluid condition. CHECK the overheat condition. REFER to Diagnosis By Symptom in this section. REPAIR as required. REPEAT the Quick Tests.

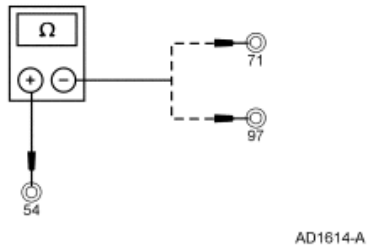
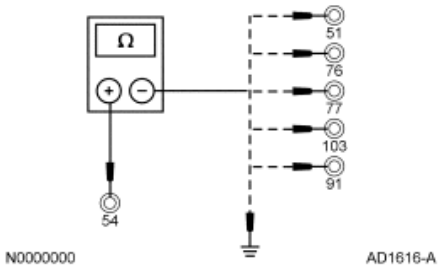
PINPOINT TEST C: TORQUE CONVERTER CLUTCH (TCC) SOLENOID

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

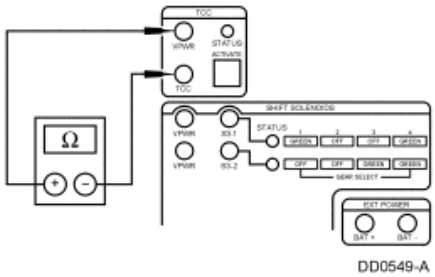
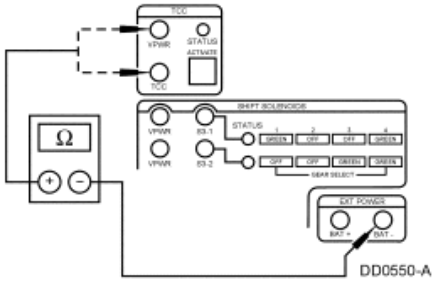
CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 ELECTRONIC DIAGNOSTICS	
	1 Check to make sure the transmission harness connector is fully seated, terminals are engaged in the connector and in good condition before proceeding.
2	

	
	3 Carry out KOEO Test until continuous DTCs have been displayed.
	4 Enter Output Test Mode (OTM).
	5 Select the ALL ON mode. Push START to turn the outputs on. Push STOP to turn the outputs off.
	• **Does the vehicle enter OTM?** → **Yes** REMAIN in OTM. GO to C2 . → **No** PRESS START. If vehicle does not enter OTM, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
C2 CHECK THE ELECTRICAL SIGNAL OPERATION	
1  Transmission Connector	1 **CAUTION: Remove the heat shield, if so equipped, from the transmission before removing the connector. Remove the solenoid body connector by pushing on the center tab and pulling on the harness connector. Do not attempt to pry the tab with a screwdriver. Always reinstall the heat shield when the procedure is completed.**
	2 Use a mirror to inspect both ends of the connector for damaged or pushed-out pins, corrosion, loose wires and missing or damaged seals.
3  	3 Measure the voltage between the VPWR circuit pin 1 and the TCC signal circuit pin 4 at the transmission vehicle harness connector.
	4 Place the VOM on the 20-volt scale.
	5 While observing the VOM, press START and STOP to cycle the solenoid output on and off.

	• **Is the solenoid output voltage changed to approximately battery voltage?** → **Yes** GO to C6. → **No** GO to C3.
C3 CHECK THE CONTINUITY OF THE TCC SIGNAL AND VPWR CIRCUITS	
1 	
2  Powertrain Control Module (PCM)	2 Inspect for damaged or pushed-out pins, corrosion or loose wires.
	3 Install the EEC-V Control System Breakout Box.
4 	4 Measure the resistance between the PCM signal test pin 54 at the EEC-V Control System Breakout Box and the signal pin 4 at the transmission harness connector.
5 	5 Measure the resistance between the VPWR test pin 71 or 97 at the EEC-V Control System Breakout Box and the VPWR pin 1 at the transmission harness connector.
	• **Is each resistance less than 5 ohms?** → **Yes** GO to C4.

	→ **No** REPAIR the open circuits. REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
C4 CHECK THE TCC CIRCUIT FOR SHORT TO POWER	
1  	1 Measure the resistance between the PCM signal test pin 54 and VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box.
	• **Is each resistance greater than 10,000 ohms?** → **Yes** GO to C5. → **No** REPAIR the open circuits. REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
C5 CHECK THE TCC CIRCUIT FOR SHORT TO GROUND	
1  	1 Measure the resistance between the PCM signal test pin 54 and test pins 51, 76, 77, 103 and 91 at the EEC-V Control System Breakout Box and chassis ground.
	• **Is each resistance greater than 10,000 ohms?** → **Yes** GO to C6. → **No**

	REPAIR the short circuit(s). REMOVE the EEC-V Control System Breakout Box . RECONNECT all of the components. REPEAT the Quick Tests.
C6 SOLENOID FUNCTIONAL TEST	
	1 Install the Transmission Tester to the transmission connector.
	2 **NOTE:** The LED will turn GREEN when the TCC solenoid activates and turn off when deactivated. The LED will turn RED if an ACTIVATED solenoid is shorted to battery positive. The LED will remain off if an ACTIVATED solenoid is shorted to ground or no continuity (open circuit). Carry out the Solenoid Voltage Test.
	• **Does the solenoid (LED GREEN) activate when tester switch is pressed?** → **Yes** GO to C7. → **No** GO to C8.
C7 TRANSMISSION DRIVE TEST	
1  Powertrain Control Module (PCM)	
	2 Carry out the Dynamic Testing — Engine On.
	• **Does the torque converter clutch solenoid activate (LED GREEN) and does the engine rpm drop?** → **Yes** INSTALL a new PCM. ERASE all DTCs. CARRY OUT the Transmission Drive Cycle Test. REPEAT the Quick Tests. If the symptoms are still present, REFER to Diagnosis By Symptom — Torque Converter Clutch Operation Concerns in this section. → **No**

	GO to C8.
C8 CHECK THE RESISTANCE OF THE SOLENOID	
NOTE: Refer to the Transmission Tester for terminal locations.	
	1 Place the bench/drive switch to the BENCH mode.
	2 Rotate the gear select switch to the OHMS CHECK position.
3  DD0549-A	3 Measure the resistance between the TCC jack and the VPWR jack on the transmission tester.
	4 Record the resistance. The resistance should be between 13 and 20 ohms.
	• **Is the resistance between 13 and 20 ohms?** → **Yes** GO to C9. → **No** INSTALL a new solenoid body assembly.
C9 CHECK THE SOLENOID FOR SHORT TO GROUND	
1  DD0550-A	1 Check for continuity between the BAT(-) jack (engine ground) and the appropriate jack with a digital ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity).
	• **Does the connection show continuity?** → **Yes** INSTALL a new solenoid body assembly. →

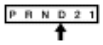
	No REFER to the Diagnosis By Symptom — Torque Converter Clutch Operation Concerns in this section.

PINPOINT TEST D: DIGITAL TRANSMISSION RANGE (TR) SENSOR

NOTE: Refer to the Digital Transmission Range (TR) Sensor Connector illustration preceding these pinpoint tests.

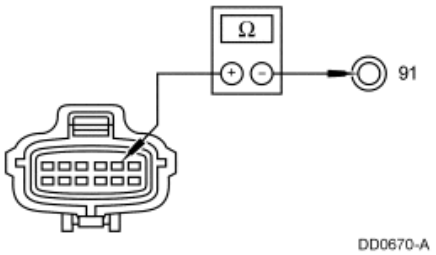
NOTE: Refer to the Digital Transmission Range (TR) Sensor Diagnosis Chart preceding these pinpoint tests.

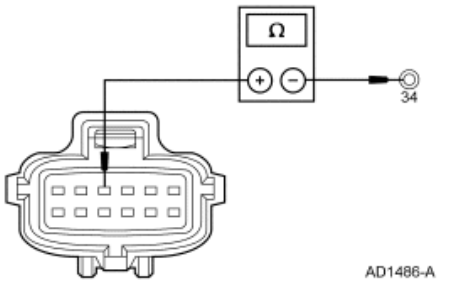
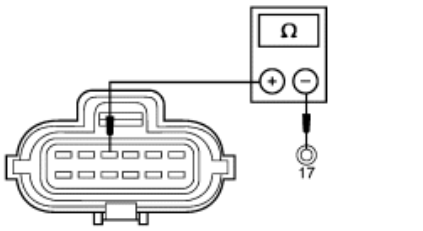
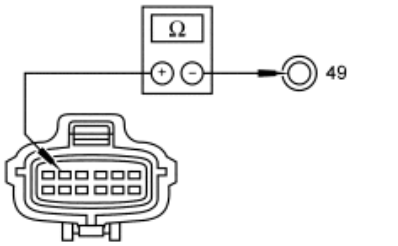
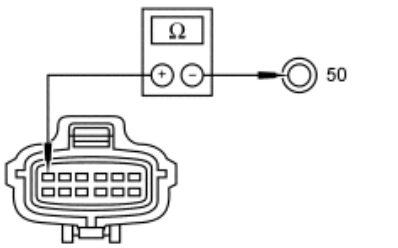
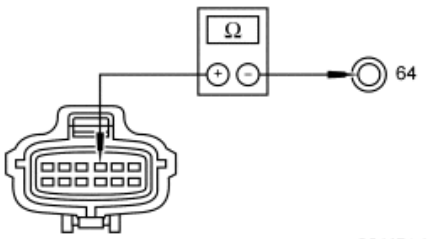
CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 VERIFY DIAGNOSTIC TROUBLE CODES	
1 	
2 	
	3 Carry out on-board diagnostic test. DTC codes P0705 and P0708 cannot be set by an incorrectly adjusted digital TR sensor.
	• **Are only DTC codes P0705, P0708 present?** → **Yes** GO to D4. → **No** GO to D2.
D2 VERIFY DIGITAL TRANSMISSION RANGE SENSOR ALIGNMENT	
1 	
2 	
	3

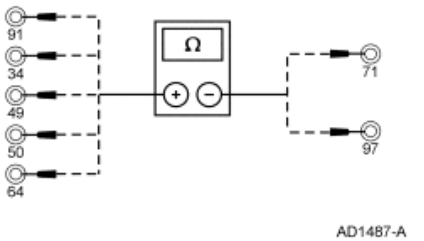
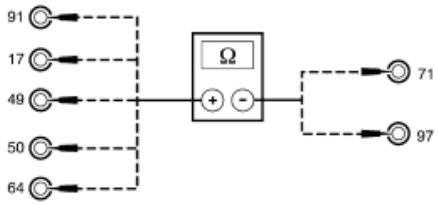
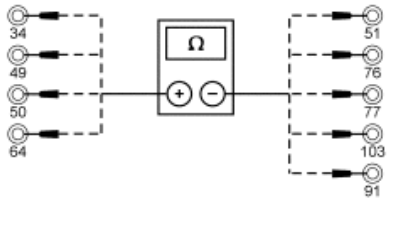
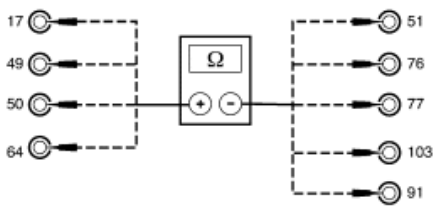
	Check to make sure the digital TR sensor harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.
	4 Apply the parking brake.
5 	
	6 Disconnect the shift cable/linkage from the manual lever.
	7 Verify that the TR Sensor Alignment Gauge fits in the appropriate slots.
	• **Is the digital TR sensor correctly adjusted?** → **Yes** GO to D3. → **No** ADJUST the digital TR sensor. PLACE transmission range selector lever into PARK and CLEAR DTCs. RERUN OBD Tests.GO to D3 .
D3 VERIFY SHIFT CABLE/LINKAGE ADJUSTMENT	
	1 Place the manual lever in the OVERDRIVE position.
2 	
	3 Reconnect the shift cable/linkage.
	4 Verify that the shift cable/linkage is correctly adjusted. Refer to Section 307-05.
	• **Is the shift cable/linkage correctly adjusted?** → **Yes** GO to D4. → **No** ADJUST the shift cable/linkage. REFER to Section 307-05. GO to D4 .
D4 CHECK ELECTRICAL SIGNAL OPERATION	

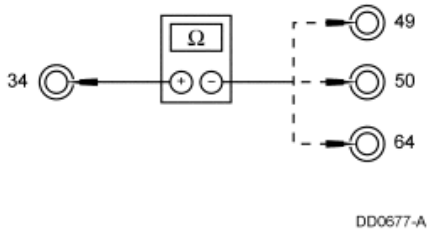
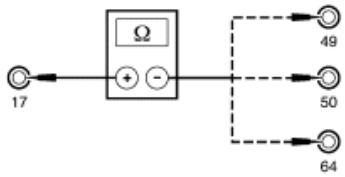
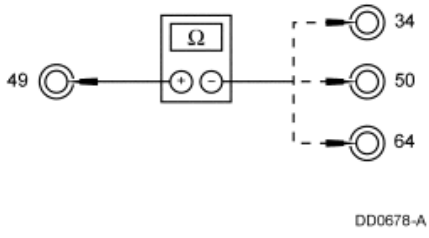
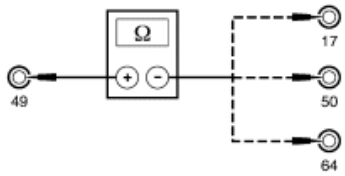
1 	
2  Digital TR Sensor	2 **CAUTION: Do not pry on connector. This will damage the connector and result in a transmission concern.** Press the button and pull out on the digital TR harness connector.
	3 Inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
	• **Is there damage to the connector, pins or harness?** → **Yes** REPAIR as required. CLEAR DTCs and RERUN OBD Tests. → **No** If diagnosing a DTC, GO to D5 . If diagnosing a starting concern or a backup lamp concern, GO to D10 .
D5 CHECK ELECTRICAL SYSTEM OPERATION (DIGITAL TR AND PCM)	
1 	
2 	
3  Digital TR Sensor	
4 	
5	

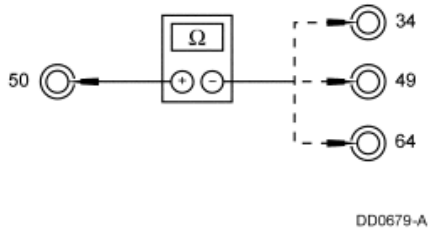
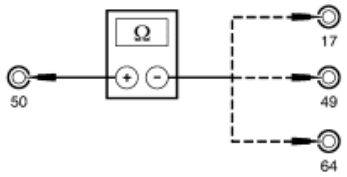
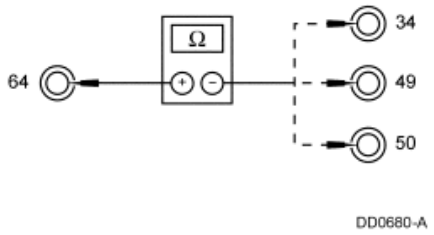
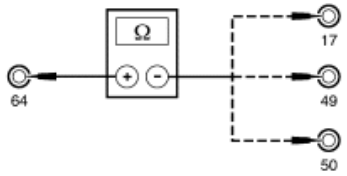
 TR PIDS TR, TR_D, TR_V	
	6 Move transmission range selector lever into each gear and stop.
	7 Observe any of the following PIDs, TR and TR_D, TR_V (vehicle dependent) while wiggling harness, tapping on sensor, and/or driving the vehicle. Use PIDs TR, and TR_D for DTCs P0705, P1704, and P1705. Use PIDs TR, and TR_V for DTC P0708.
	8 Compare the PIDs to the Digital Transmission Range (TR) Sensor Diagnosis Chart.
	• **Do the PIDs TR, TR_D and TR_V match the Digital Transmission Range (TR) Sensor Diagnosis Chart, and does the TR_D PID remain steady when the harness is wiggled, the sensor is tapped, or the vehicle driven?** → **Yes** The problem is not in the digital TR sensor system. REFER to Diagnosis By Symptom in this section for further diagnosis. → **No** If TR_D changes when wiggling harness, tapping on the sensor, or driving the vehicle, the problem may be intermittent. GO to D6.
D6 CHECK THE DIGITAL TRANSMISSION RANGE SENSOR OPERATION	
1  Digital TR Sensor	1 **CAUTION: Do not pry on the connector. This will damage the connector and result in a transmission concern. Press the button and pull out on the harness connector.**
	2 Connect the tester cable E to the Transmission Tester. Connect the tester cable E black connector marked DIGITAL to the digital TR sensor.
	3 Place the Digital TR Overlay onto the Transmission Tester.
	4 Carry out the sensor test as instructed on the Digital TR Overlay.

	• **Do the status lamps on the tester TR-E cable match the selected gear positions?** → **Yes** The concern is not in the digital TR sensor. GO to D7 . → **No** INSTALL and ADJUST a new digital TR sensor. REFER to Digital Transmission Range (TR) Sensor in this section. CLEAR the DTCs. REPEAT the Quick Tests.
D7 CHECK THE PCM HARNESS CIRCUITS FOR OPENS	
1 	
2  Powertrain Control Module	2 Inspect for damaged or pushed-out pins, corrosion or loose wires.
3  Digital TR Sensor	3 **CAUTION: Do not pry on the connector. This will damage the connector and result in a transmission concern. Press the button and pull out on the digital TR sensor harness connector.** Disconnect digital TR sensor connector.
	4 Install the EEC-V Control System Breakout Box.
5 	5 Measure the resistance between PCM test pin 91 at the EEC-V Control System Breakout Box and the signal return circuit pin 2 at the vehicle harness connector.
6	6 Vehicles equipped with 7.3L (Cal.) DI diesel, and all gasoline engines, measure the resistance between PCM test pin 34 at the EEC-V Control System Breakout Box, and TR1 circuit pin 4 at the vehicle harness connector.

	
7 	7 Vehicles equipped with 7.3L (49-state) DI diesel engine, measure the resistance between PCM test pin 17 at the EEC-V Control System Breakout Box, and TR1 circuit pin 4 at the vehicle harness connector.
8 	8 Measure the resistance between PCM test pin 49 at the EEC-V Control System Breakout Box and TR2 circuit pin 5 at the vehicle harness connector.
9 	9 Measure the resistance between PCM test pin 50 at the EEC-V Control System Breakout Box and TR4 circuit pin 6 at the vehicle harness connector.
10 	10 Measure the resistance between PCM test pin 64 at the EEC-V Control System Breakout Box and TR3A circuit pin 3 at the vehicle harness connector.
	• **Is each resistance less than 5 ohms?** →

	Yes GO to D8. → **No** REPAIR the open circuit(s). RECONNECT all of the components. CLEAR the DTCs. REPEAT the Quick Tests.
D8 CHECK THE PCM HARNESS CIRCUITS FOR A SHORT TO GROUND OR TO POWER	
1  AD1487-A	1 Vehicles equipped with 7.3L (Cal.) DI diesel, and all gasoline engines, measure the resistance between PCM test pins 91, 34, 49, 50 and 64, and VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box.
2  A0011874	2 Vehicles equipped with 7.3L (49-state) DI diesel engine, measure the resistance between PCM test pins 91, 17, 49, 50 and 64, and VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box.
3  AD1488-A	3 Vehicles equipped with 7.3L (Cal.) DI diesel, and all gasoline engines, measure the resistance between PCM test pins 34, 49, 50 and 64, and test pins 51, 76, 77, 103 and 91 at the EEC-V Control System Breakout Box.
4  A0011875	4 Vehicles equipped with 7.3L (49-state) DI diesel engine, measure the resistance between PCM test pins 17, 49, 50 and 64, and test pins 51, 76, 77, 103 and 91 at the EEC-V Control System Breakout Box.
	• **Is each resistance greater than 10,000 ohms?**

	→ **Yes** GO to D9. → **No** REPAIR the short circuit(s). RECONNECT all of the components. CLEAR the DTCs. REPEAT the Quick Tests.
D9 CHECK FOR A SHORT BETWEEN THE TR/PCM INPUT SIGNAL CIRCUITS	
1  DD0677-A	1 Vehicles equipped with 7.3L (Cal.) DI diesel, and all gasoline engines, measure the resistance between test pin 34 and test pins 49, 50 and 64 at the EEC-V Control System Breakout Box.
2  A0011876	2 Vehicles equipped with 7.3L (49-state) DI diesel engine, measure the resistance between test pin 17 and test pins 49, 50 and 64 at the EEC-V Control System Breakout Box.
3  DD0678-A	3 Vehicles equipped with 7.3L (Cal.) DI diesel, and all gasoline engines, measure the resistance between test pin 49 and test pins 34, 50 and 64 at the EEC-V Control System Breakout Box.
4  A0011879	4 Vehicles equipped with 7.3L (49-state) DI diesel engine, measure the resistance between test pin 49 and test pins 17, 50 and 64 at the EEC-V Control System Breakout Box.
5	5

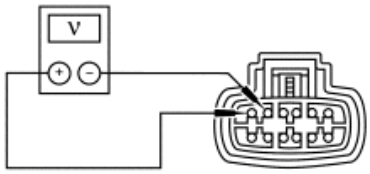
	Vehicles equipped with 7.3L (Cal.) DI diesel, and all gasoline engines, measure the resistance between test pin 50 and test pins 34, 49 and 64 at the EEC-V Control System Breakout Box.
6 	6 Vehicles equipped with 7.3L (49-state) DI diesel engine, measure the resistance between test pin 50 and test pins 17, 49 and 64 at the EEC-V Control System Breakout Box.
7 	7 Vehicles equipped with 7.3L (Cal.) DI diesel, and all gasoline engines, measure the resistance between test pin 64 and test pins 34, 49 and 50 at the EEC-V Control System Breakout Box.
8 	8 Vehicles equipped with 7.3L (49-state) DI diesel engine, measure the resistance between test pin 64 and test pins 17, 49 and 50 at the EEC-V Control System Breakout Box.
	• **Is each resistance greater than 10,000 ohms?** → **Yes** INSTALL a new PCM. RECONNECT all of the components. CLEAR the DTCs. RERUN the Quick Tests. → **No** REPAIR shorts on the circuits having less than 10,000 ohms resistance between other TR/PCM input signal circuits. RECONNECT all of the components. CLEAR the DTCs. REPEAT the Quick Tests.

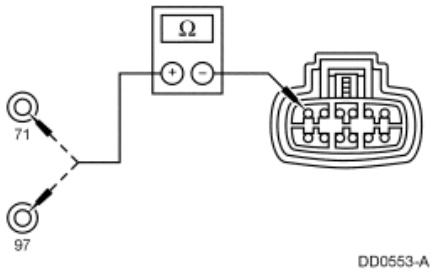
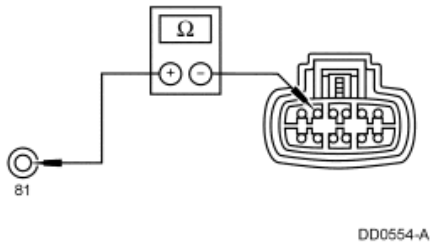
D10 CHECK THE NON-PCM INTERNAL CIRCUITS OF SENSOR	
	1 Connect the tester cable E to the Transmission Tester.
	2 Connect the cable E connector marked DIGITAL to the digital TR sensor.
	3 Place the Digital TR Overlay onto the Transmission Tester.
	4 Carry out the switch test as instructed on the Digital TR Overlay.
	• **Does the status lamp on the tester indicate RED for the correct gear position?** → **Yes** The concern is not in the digital TR sensor. For starter system concerns, REFER to Section 303-06A for gasoline engines and Section 303-06B for diesel engines. For backup lamp concerns, REFER to Section 417-01. → **No** INSTALL and ADJUST a new digital TR sensor. REFER to Digital Transmission Range (TR) Sensor in this section. CLEAR the DTCs. REPEAT the Quick Tests.

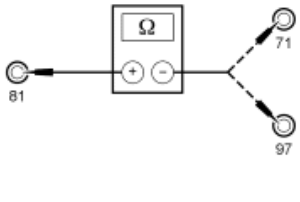
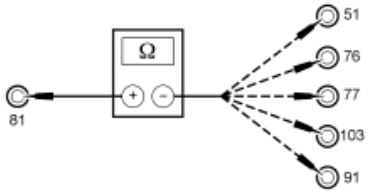
PINPOINT TEST E: ELECTRONIC PRESSURE CONTROL (EPC) SOLENOID

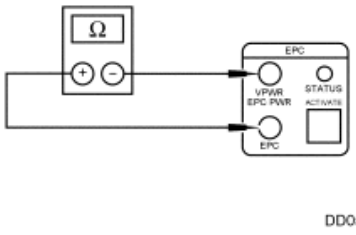
NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

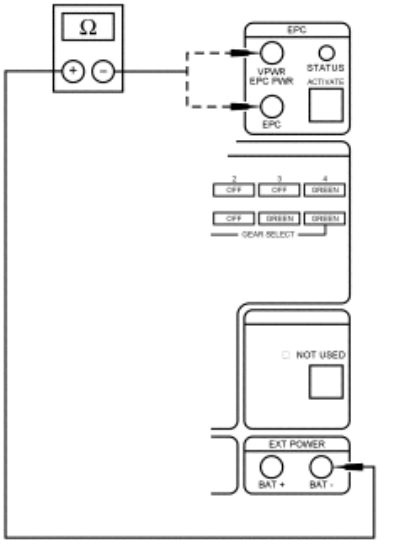
CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 ELECTRONIC DIAGNOSTICS	
	1 Check to make sure the transmission harness connector is fully seated, terminals are engaged in the connector and in good condition before proceeding.
2 	
	3 Carry out KOEO Test until continuous DTCs have been displayed.
	4 ENTER Output Test Mode (OTM).
	5

	Select the ALL ON mode. Push START to turn the outputs on. Push STOP to turn the outputs off.
	• **Does the vehicle enter OTM?** → **Yes** REMAIN in OTM. GO to E2 . → **No** PRESS START. If the vehicle does not enter OTM, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
E2 CHECK THE ELECTRICAL SIGNAL OPERATION	
1  Transmission Connector	1 **CAUTION: Remove the heat shield, if so equipped, from the transmission before removing the connector. Remove the solenoid body connector by pushing on the center tab and pulling on the harness connector. Do not attempt to pry the tab with a screwdriver. Always reinstall the heat shield when the procedure is completed.**
	2 Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
3  DD0552-B	3 Measure the voltage between EPC PWR pin 12 and EPC signal circuit pin 11 at the transmission vehicle harness connector.
	4 Place the VOM on the 20-volt scale.
	5 While observing the VOM, press START and STOP to cycle the solenoid output on and off.
	• **Is the solenoid output voltage changed to approximately battery voltage?** → **Yes** GO to E5. → **No**

	GO to E3.
E3 CHECK THE CONTINUITY OF THE SOLENOID SIGNAL AND VPWR CIRCUITS	
1 	
2  Powertrain Control Module (PCM)	2 Inspect for damaged or pushed-out pins, corrosion or loose wires.
	3 Install the EEC-V Control System Breakout Box.
4 	4 Measure the resistance between the VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box and the EPC PWR circuit pin 12 at the transmission harness connector.
5 	5 Measure the resistance between the PCM signal test pin 81 at the EEC-V Control System Breakout Box and the EPC signal pin 11 at the transmission harness connector.
	• **Is each resistance less than 5 ohms?** → **Yes** GO to E4. → **No** REPAIR the open circuit(s). REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. ERASE the codes. REPEAT the Quick Tests.
E4 CHECK THE HARNESS FOR SHORTS TO POWER AND GROUND	
1	1

 D17329-A	Measure the resistance between the PCM signal test pin 81 and VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box.
2  D17330-A	2 Measure the resistance between the PCM signal test pin 81 and test pins 51, 76, 77, 103 and 91 at the EEC-V Control System Breakout Box.
	• **Is each resistance greater than 10,000 ohms?** → **Yes** GO to E5. → **No** REPAIR the short circuit(s). REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. ERASE the codes. REPEAT the Quick Tests.
E5 TRANSMISSION FUNCTIONAL TEST	
1  Powertrain Control Module (PCM)	
	2 Install a Line Pressure Gauge at the line tap on the case.
	3 Install the Transmission Tester to transmission connector.
	4 Set the bench/drive switch to the DRIVE mode.
	5 Rotate the gear select switch to the first gear position.
	6 **NOTE:** The LED will turn GREEN when the EPC solenoid activates and turn off when deactivated. The LED will turn RED if an ACTIVATED

	solenoid is shorted to battery positive. The LED will remain off if an ACTIVATED solenoid is shorted to ground or no continuity (open circuit). Carry out the EPC Solenoid Functional Test.
	7 Observe line pressure on the gauge while pressing the EPC switch (engine must be running).
	• **Does the EPC (GREEN LED) activate and line pressure drop when the EPC switch is pressed?** → **Yes** INSTALL a new PCM. REPEAT the Quick Tests. → **No** GO to E6.
E6 CHECK THE RESISTANCE OF THE SOLENOID	
NOTE: Refer to the Transmission Tester for terminal locations.	
	1 Set the bench/drive switch to the BENCH mode.
	2 Rotate the gear select switch to the OHMS CHECK position.
3  DD0557-A	3 **CAUTION: Make sure the tester power is off or damage to the ohmmeter can result.** Measure the resistance between the VPWR jack and the EPC jack on the transmission tester.
	4 Record the resistance. (The resistance should be between 3.0 and 5.0 ohms.)
	• **Is the resistance between 3.0 and 5.0 ohms?** → **Yes** GO to E7. → **No**

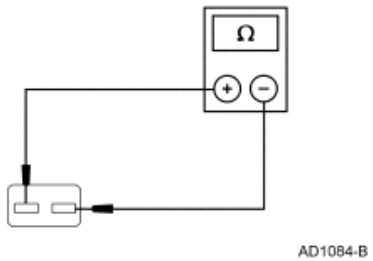
	INSTALL a new solenoid body assembly. RECORD and ERASE all codes. REPEAT the Quick Tests.
E7 CHECK THE SOLENOID FOR SHORT TO GROUND	
1  DD0558-A	1 Check for continuity between the BAT(-) jack (engine ground) and the appropriate jack with a digital ohmmeter or other low current tester (less than 200 milliamps). The connection should show infinite resistance (no continuity). Solenoid: EPC — Tester Jack: VPWR, EPC PWR
	• **Does the connection show continuity?** → **Yes** INSTALL a new solenoid body assembly. RECORD and ERASE codes. REPEAT the Quick Tests. → **No** REFER to Diagnosis By Symptom in this section.

PINPOINT TEST F: TURBINE SHAFT SPEED (TSS) AND OUTPUT SHAFT SPEED (OSS) SENSORS

NOTE: Refer to the Output Shaft Speed (OSS) Sensor Connector illustration preceding these pinpoint tests.

CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 ELECTRONIC DIAGNOSTICS	
	1 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.
2 	

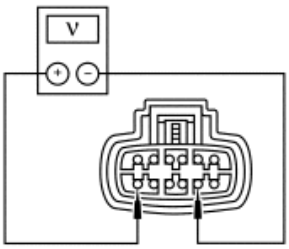
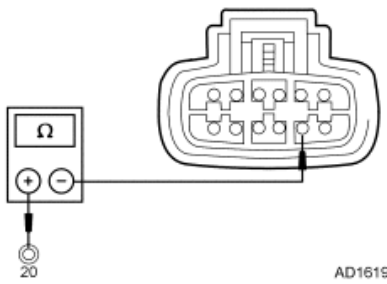
3 	
4  Diagnostic Data Link	
5  PCM	
	6 Select PID/Data Monitor and Record.
	7 Select the following PIDs: TSS, OSS.
	• **Does vehicle enter PID/Data Monitor and Record?** → **Yes** REMAIN in PID/Data. GO to F2 . → **No** REPEAT procedure to ENTER PID. If vehicle did not enter PID, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
F2 DRIVE CYCLE TEST	
	1 While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears.
	• **Does the TSS, or OSS Speed PID increase and decrease with engine and vehicle speed or is the sensor signal erratic (drop to zero or near zero and return to normal operation)?** → **Yes** If the TSS or OSS Speed PID increase and decrease with engine and vehicle speed, CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in

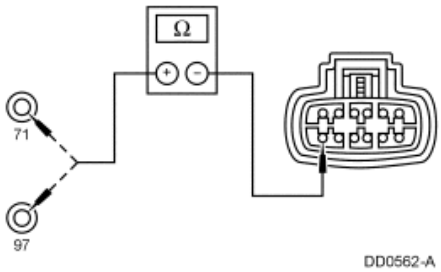
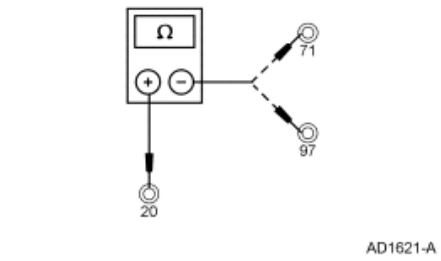
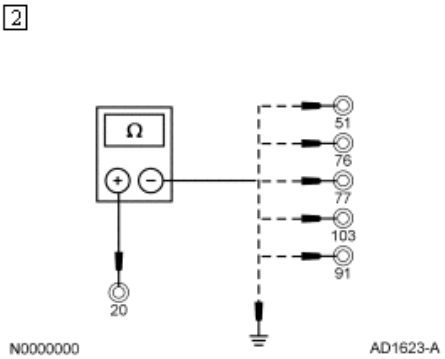
	this section for diagnosis. If the sensor signal is erratic, INSPECT for intermittent concern in the internal/external harness, sensor or connector. → **No** If the TSS, or OSS Speed PID does not increase and decrease with engine and vehicle speed, INSPECT for open or short in vehicle harness, sensor, a PCM concern, or internal hardware concern. If the sensor signal is steady, GO to F3 .
F3 CHECK RESISTANCE OF TSS OR OSS SENSOR	
	1 Disconnect the appropriate vehicle harness connector from the TSS and or OSS sensor.
2  	2 For TSS or OSS: Measure the resistance between pin 1 and pin 2 at the sensor.
	3 Record the resistance. Resistance should be as follows: **Sensor** / **Resistance (ohms)** TSS — PTO Only Applications: 496-1,244 TSS — Non-PTO Applications: 781-1,979 OSS — All Applications: 781-1,979
	• **Is the resistance within specification for the appropriate sensor?** → **Yes** REFER to Diagnosis By Symptom in this section for concern diagnosis. → **No** For TSS and OSS, INSTALL a new sensor.

PINPOINT TEST G: COAST CLUTCH SOLENOID (CCS)

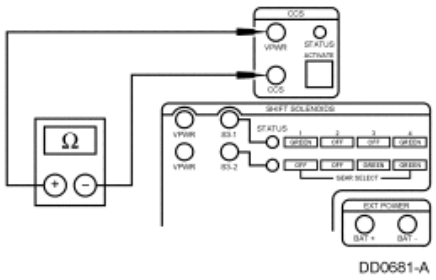
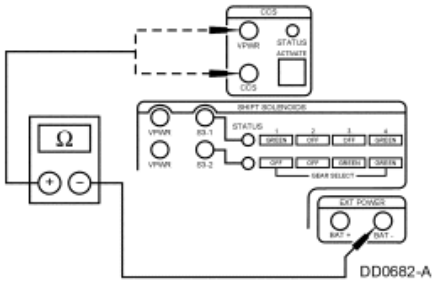
NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 ELECTRONIC DIAGNOSTICS	
	1 **NOTE:** PTO must be turned off. For a description of PTO operation, refer to Transmission Electronic Control System in this section. Check to make sure the transmission harness connector is fully seated, terminals are engaged in the connector and in good condition before proceeding.
2 	
	3 Carry out the KOEO Test until continuous DTCs have been displayed.
	4 Enter the Output Test Mode (OTM).
	5 Select the ALL ON mode. Push START to turn the outputs on. Push STOP to turn the outputs off.
	• **Does the vehicle enter OTM?** → **Yes** REMAIN in OTM. GO to G2 . → **No** PRESS START. If the vehicle does not enter OTM, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
G2 CHECK THE ELECTRICAL SIGNAL OPERATION	
1  Transmission Connector	1 **CAUTION: Remove the heat shield, if so equipped, from the transmission before removing the connector. Remove the solenoid body connector by pushing on the center tab and pulling on the harness connector. Do not attempt to pry the tab with a screwdriver. Always reinstall the heat shield when the procedure is completed.**
	2 Use a mirror to inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.
3	3 Measure the voltage between VPWR circuit pin 1 and CCS signal circuit pin 5 of the transmission vehicle harness connector.

	
	4 Place the VOM on the 20-volt scale.
	5 While observing the VOM, press START and STOP to cycle the solenoid output on and off.
	• **Is the solenoid output voltage changed to approximately battery voltage?** → **Yes** GO to G5. → **No** GO to G3.
G3 CHECK THE CONTINUITY OF THE CCS SIGNAL AND VPWR CIRCUITS	
1 	
2  Powertrain Control Module (PCM)	2 Inspect for damaged or pushed-out pins, corrosion or loose wires.
	3 Install the EEC-V Control System Breakout Box.
4 	4 Measure the resistance between the PCM signal test pin 20 at the EEC-V Control System Breakout Box and the signal pin 5 at the transmission harness connector.
5	5

	Measure the resistance between the VPWR test pin 71 or 97 at the EEC-V Control System Breakout Box and the VPWR pin 1 at the transmission harness connector.
	• **Is each resistance less than 5 ohms?** → **Yes** GO to G4. → **No** REPAIR the open circuits. REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
G4 CHECK THE CCS CIRCUIT FOR SHORTS TO POWER AND GROUND	
1 	1 Measure the resistance between the PCM signal test pin 20 and VPWR test pins 71 and 97 at the EEC-V Control System Breakout Box.
2 	2 Measure the resistance between the PCM signal test pin 20 and test pins 51, 76, 77, 103 and 91 at the EEC-V Control System Breakout Box and chassis ground.
	• **Is each resistance greater than 10,000 ohms?** → **Yes** GO to G5. →

	No REPAIR the short circuit(s). REMOVE the EEC-V Control System Breakout Box. RECONNECT all of the components. REPEAT the Quick Tests.
G5 SOLENOID FUNCTIONAL TEST	
1  Powertrain Control Module (PCM)	
	2 Install the Transmission Tester to the transmission connector.
	3 **NOTE:** The LED will turn GREEN when the CCS activates and turn off when deactivated. The LED will turn RED if an ACTIVATED solenoid is shorted to battery positive. The LED will remain off if an ACTIVATED solenoid is shorted to ground or no continuity (open circuit). Carry out the Solenoid Voltage Test.
	• **Does the solenoid (LED GREEN) activate when the tester switch is pressed?** → **Yes** GO to G6. → **No** GO to G7.
G6 TRANSMISSION DRIVE TEST	
	1 Carry out the Dynamic Testing.
	• **Does the CCS activate (LED GREEN) and engine braking occur?** → **Yes** INSTALL a new PCM. ERASE all DTCs. CARRY OUT the Transmission Drive Cycle Test. REPEAT the Quick Tests. If symptoms are still present, REFER to Diagnosis By Symptom in this section. → **No** GO to G7.

G7 CHECK THE RESISTANCE OF THE SOLENOID	
NOTE: Refer to the Transmission Tester for terminal locations.	
	1 Place the bench/drive switch to the BENCH mode.
	2 Rotate the Gear Select switch to the OHMS CHECK position.
3  DD0681-A	3 Measure the resistance between the CCS jack and the VPWR jack on the transmission tester.
	4 Record the resistance. (The resistance should be between 18 and 26 ohms.)
	• **Is the resistance between 18 and 26 ohms?** → **Yes** GO to G8. → **No** INSTALL a new solenoid body assembly.
G8 CHECK THE SOLENOID FOR SHORT TO GROUND	
1  DD0682-A	1 Check for continuity between the BAT(-) jack (engine ground) and the appropriate jack with a digital ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity).
	• **Does the connection show continuity?** → **Yes** INSTALL a new solenoid body assembly. → **No**

	REFER to Diagnosis By Symptom in this section.

PINPOINT TEST H: SOLENOID MECHANICAL FAILURE

NOTE: Repair all other DTCs before repairing the following DTCs: P1714, P1715, P1740

CONDITIONS	DETAILS/RESULTS/ACTIONS
H1 ELECTRONIC DIAGNOSIS	
1 	
	2 Carry out the KOEO Test until continuous DTCs have been displayed.
	3 If any of the following DTCs are present, continue with this test: P1714, P1715, P1740.
	• **Are other DTCs present for TFT or shift solenoids?** → **Yes** REPAIR the DTCs for TFT or shift solenoids first. CLEAR DTCs and CARRY OUT transmission Drive Cycle Test. RERUN Quick Test. → **No** INSTALL a new appropriate solenoid and/or body. REFER to the Diagnostic Trouble Code chart for code description. GO to H2 .
H2 TRANSMISSION DRIVE CYCLE TEST	
	1 Carry out Transmission Drive Cycle Test.
	2 Carry out the On-Board Diagnostic Test.
	• **Does the vehicle upshift and downshift OK?** → **Yes** GO to H3. → **No** REFER to Diagnosis By Symptom in this section to diagnose shift concerns.
H3 RETRIEVE DTCS	
1	

	2 Carry out KOEO Test until continuous DTCs have been displayed.
	• **Are DTCs P1714, P1715, P1740 still present?** → **Yes** INSTALL a new PCM. Road test and RERUN Quick Test. → **No** Testing completed. If a concern still exists, REFER to Diagnosis By Symptom in this section for concern diagnosis.

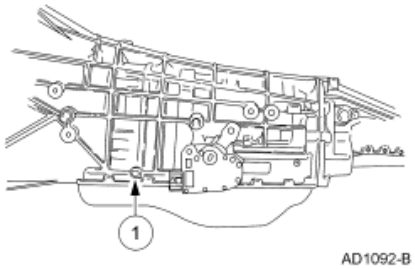
Special Testing Procedures

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portions of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.

Line Pressure Test



Item	Part Number	Description
1	—	Line pressure tap

CAUTION: Carry out the Line Pressure Test prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or further transmission damage will occur. Do not maintain wide-open throttle in any transmission range for more than 5 seconds or transmission damage may occur.

NOTE: If the Transmission Tester is installed it must be removed prior to carrying out the test.

NOTE: If equipped, turn the power take-off (PTO) unit off for correct test results. For a description of PTO operation, refer to Transmission Electronic Control System in this section.

NOTE: Carry out shift linkage check prior to carrying out this test; refer to Section 307-05.

This test verifies the line pressure is within specifications.

1. Connect the Pressure Gauge to the line pressure tap.
2. Start the engine and check the line pressures. Refer to the Line Pressure Chart to determine if the line pressure is within specification.
3. If the line pressure is not within specifications, carry out On-Board Diagnostics and Go To Pinpoint Test E, air pressure check, and clean, inspect and install a new main control system or pump as required.

Line Pressure Chart [1]

	Line Pressure — Idle		Line Pressure — Stall	
Gear	kPa	psi	kPa	psi
P, N	345-448	50-65	—	—
R	483-690	70-100	1,689-2,000	245-290
(D),2	345-448	50-65	1,138-1,276	165-185
1	483-690	70-100	1,207-1,448	175-210

[1] Power take-off must be turned off prior to carrying out test.

Line Pressure Diagnosis Chart

Low at Idle in All Ranges			High at Idle in All Ranges		
Check for low fluid level, restricted inlet filter, loose main body, solenoid body or accumulator body-to-case bolts, excessive leakage in pump, case, control bodies, sticking main regulator valve, damaged filter assembly and seal, damaged gaskets or valve body separating plate.			Check the main regulator valve, solenoid body and wiring harness. Run the Quick Test referred to in the Diagnostic portion of this section.		
Low Only in:					
P	**R**	**N**	**(D)**	**2**	**1**
Check valve bodies 7A100	Check separator reinforcing plate, coast clutch, low/reverse clutch or direct clutch. Valve bodies 7A100, 7G422	Check valve bodies 7A100	Check forward clutch. Valve bodies 7A100	Check forward clutch, coast clutch or intermediate clutch, band, servo assembly. Valve bodies 7A100, 7G422	Check forward clutch, low/reverse clutch or coast clutch. Valve bodies 7A100

Stall Speed Test

WARNING: Apply the service and parking brakes firmly while carrying out each stall test.

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

NOTE: If the Transmission Tester is installed, it must be removed prior to carrying out the test.

NOTE: If equipped, turn the power take-off (PTO) unit off for correct test results. For a description of PTO operation, refer to Transmission Electronic Control System in this section.

NOTE: The stall test should only be carried out with the engine and transmission at normal operating temperatures.

The stall test checks the operation of the following items:

- Torque converter one-way clutch
- Forward clutch
- Low one-way clutch
- Reverse clutch
- Overdrive one-way clutch
- Direct clutch
- Engine driveability concerns

1. Connect a tachometer to the engine.
2. After testing each of the following ranges, (D), 2, 1 and R, move the transmission range selector lever to N (NEUTRAL) and run the engine for about 15 seconds to allow the torque converter to cool before testing the next range.
3. **CAUTION: If the engine rpm recorded by the tachometer exceeds the maximum specified rpm, release the accelerator pedal immediately. Clutch or band slippage is indicated.**

   CAUTION: Do not maintain wide-open throttle (WOT) in any gear range for more than 5 seconds or transmission damage may occur.

   Press the accelerator pedal to floor (WOT) in each range. Record the rpm reached in each range. Stall speeds should be in the appropriate range.

Stall Speed Chart

Engine	Min.	Max.
5.4L	2,243	2,725
6.8L	1,894	2,252
7.3L	2,049	2,381

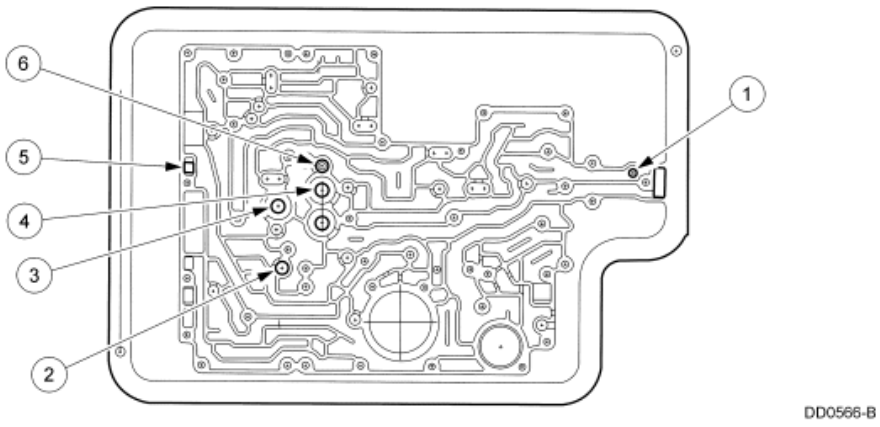
If the stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If the stall speeds were too low, check engine tune-up. If the engine is OK, remove the torque converter and check the torque converter reactor one-way clutch for slippage.

Stall Speed Diagnosis Chart

Range	Possible Source
(D)	• Forward Clutch • Overdrive One-Way Clutch • Low One-Way Clutch
R	• Direct Clutch • Overdrive One-Way Clutch and Coast Clutch • Reverse Clutch
2	• Forward Clutch • Overdrive One-Way Clutch and Coast Clutch
1	• Forward Clutch • Reverse Clutch and Low One-Way Clutch • Coast Clutch and Overdrive One-Way Clutch

Air Pressure Tests

Air Pressure Test Port Locations



Item	Part Number	Description
1	—	Reverse clutch feed
2	—	Intermediate clutch feed
3	—	Overdrive clutch feed

4	—	Forward clutch feed
5	—	Coast clutch feed
6	—	Direct clutch feed

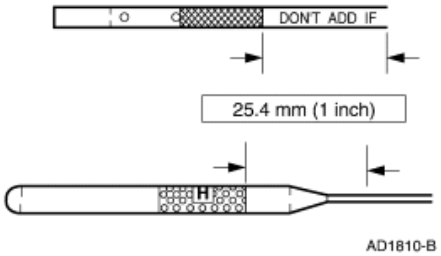
A no-drive condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. Refer to the Band/Clutch Application Chart to determine the appropriate elements. A clutch concern can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the concern.

Example: When the transmission range selector lever is in a forward gear range ((D), 2, 1), a no-drive condition may be caused by an inoperative forward clutch.

1. Drain the transmission fluid. Remove the transmission fluid pan.
2. Remove the filter and seal assembly, the solenoid body, the control assemblies and separator plate, upper/lower gaskets.
3. The inoperative clutches can be located by applying air pressure into the appropriate clutch port. See the Air Pressure Test Port Locations illustration for clutch port locations.
4. Apply air pressure to the appropriate clutch port (see the Air Pressure Test Port Locations illustration). A dull thud may be heard or movement felt when a clutch piston is applied. If the clutch seals or check ball are leaking, a hissing may be heard.
5. If the clutches fail to operate during the air check:
    - inspect the fluid passages in the case.
    - the piston seals are not seated, damaged, not installed.
    - plugged feed holes for clutch apply in the case and or clutch cylinder.
    - damaged piston and or clutch cylinder.
6. Repair as required and recheck.

Torque Converter Drainback Test

1. Drive the vehicle for 30-60 minutes to attain normal operating temperature.
2. Check the transmission fluid level. Add fluid only if required.
3. Drive the vehicle through 8 to 10 cycles of 1/2 throttle, 1-2 upshifts to elevate the transmission temperature. Then proceed as follows:
    - Park the vehicle on level ground.
    - Allow the vehicle to sit for 30-60 minutes.
    - Check and note the fluid level on the fluid level indicator with the engine off, in PARK. The following example shows the fluid level after 45 minutes.



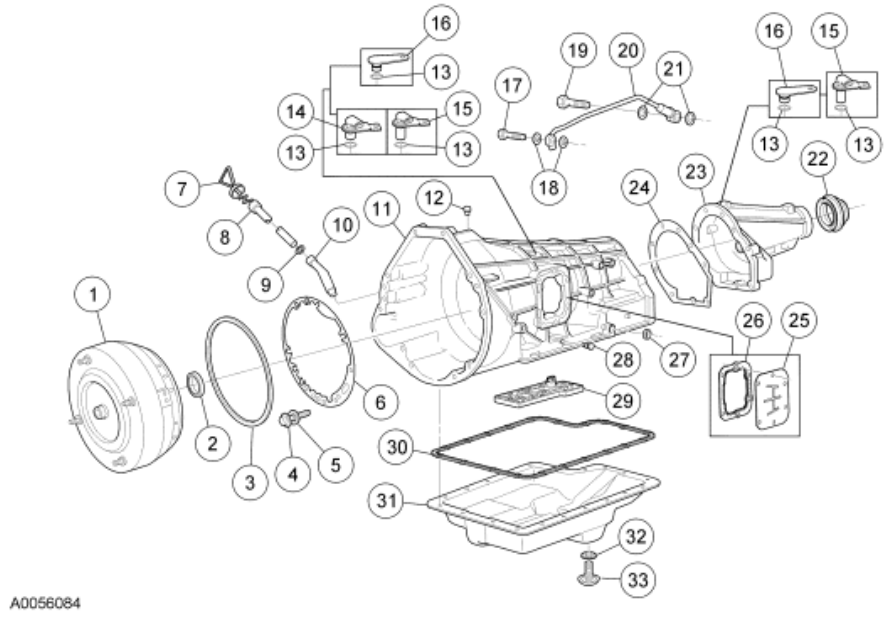
4. Allow the vehicle to sit for a minimum of 24 hours. Check and note the fluid level.
5. If the fluid has risen 25.4 mm (1 in) or more above the level in the first check, excessive converter drainback has occurred.
6. If excessive drainback has occurred:
    - stuck open check ball in rear cooler line case fitting.
    - no check ball in rear cooler line case fitting.
    - incorrect case cooler line case fitting (without check ball) installed.
7. Repair as required and recheck.

Leakage Inspection

The transmission has the following parts to prevent external fluid leakage:

- gaskets
- lip-type seals
- O-ring seals
- seal rings
- seal grommets
- thread sealant
- cooler bypass valve (CBV) sealing washers

External Sealing — 4R100



Item	Part Number	Description
1	7902	Torque converter assembly
2	7A248	Front pump seal
3	7A248	Front pump seal square-cut O.D. seal
4	N805260-S	Bolt and washer assembly
5	7G379	Washer
6	7A136	Pump gasket
7	7A020	Fluid level indicator
8	7A228	Fluid filler tube assembly
9	391308-S	Filler tube O-ring
10	7A160	Short fluid inlet tube assembly
11	7005	Case
12	7034	Case vent assembly
13	N118757-S100	Sensor O-ring (part of 7H183 and 7M101) (model dependent)
14	7M101	Turbine shaft speed (TSS) sensor (model dependent)
15	7M101	Turbine output shaft speed (TSS/OSS) sensor (model dependent)
16	7H183	Plug assembly — case (model dependent)
17	7Z152	Cooler line — case fitting (part of 7H332 CBV assembly)
18	391933-S100	Sealing washers
19	7G118	Cooler line — case fitting (part of 7H332 CBV assembly)
20	7H322	Transmission cooler bypass valve assembly
21	391932-S100	Sealing washers
22	7052	Extension housing seal
23	7A039	Extension housing

24	7086	Extension housing gasket
25	7222	PTO — case cover
26	7223	PTO — cover gasket
27	7B498	Manual control lever seal
28	390685-S	Plug — test port — 1/8-27 hex head
29	7G391	Solenoid valve body assembly
30	7A191	Transmission fluid pan gasket
31	7A194	Transmission fluid pan
32	7F033	Fluid pan drain plug gasket
33	7D479	Fluid pan drain plug

Leakage at the transmission pan-to-case gasket often can be stopped by tightening the retaining bolts to specification. Refer to Torque Specifications in this section. If necessary, install a new pan-to-case gasket only if gasket is damaged.

If leakage is found by the solenoid body connector, refer to Main Control Valve Body — Accumulator Body, Solenoid Body in this section.

Check the transmission sealing washers on the cooler bypass valve (CBV), fluid filler tube connection at the transmission case. If leakage is found, install a new short fluid inlet tube.

Check the transmission sealing washers on the cooler bypass valve (CBV), fluid lines and fittings between the transmission and the fluid inlet short tube in the radiator tank for looseness, wear or damage. If leakage cannot be stopped by tightening a fluid line tube nut, install new parts. When fluid is found to be leaking between the case and the cooler line fitting, tighten the fitting to maximum specification. Refer to Section 307-02.

If vehicle is equipped with power take-off, check the sealing gasket at the power take-off unit for leaks.

CAUTION: Do not try to stop the fluid leak by increasing the torque beyond specification. This can cause damage to the case threads and or case fittings.

If the leak continues, install new cooler line fitting and or sealing washers on cooler bypass valve and tighten to specification. The same procedure should be followed for fluid leaks between the oil-to-air cooler and cooler line fittings.

If leakage is found at the manual control lever shaft, install a new seal.

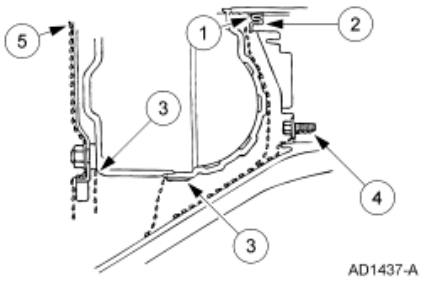
Check for fluid leaking from the end of the extension housing. Leakage can result from a damaged seal, missing garter spring or worn extension bushing, or damaged speed sensor plug. Install a new seal assembly, bushing, or both, as necessary.

Inspect the line pressure plug for leakage. Make sure it is tightened to specification. Refer to Torque Specifications in this section. If tightening the plug does not stop the leak, the case threads and or plug could be damaged. Remove the plug and inspect the plug and case thread for damage repair as necessary.

Check for leakage on or around the cooler bypass valve (CBV). Repair as required.

Fluid Leakage in Torque Converter Area

In diagnosing and correcting fluid leaks in the front pump assembly and torque converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of transmission, as evidenced by fluid around the torque converter housing, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of leak before removing the transmission from the vehicle. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The following five steps correspond with the numbers in the illustration.



1. Fluid leaking by the front pump seal lip will tend to move along the impeller hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing.
2. Fluid leakage by the outside diameter of the front pump seal and front pump body will follow the same path that leaks by the inside diameter of the front pump seal follow.
3. Fluid leakage from the converter seal weld or converter to flexplate stud weld will appear at the outside diameter of the torque converter, on the back face of the flexplate, and in the converter housing only near the flexplate. Fluid leaks from the torque converter will leave a ring of fluid around the inside of the torque converter housing.
4. Fluid that leaks by a front pump to case bolt or pump gasket will be deposited on the inside of the torque converter housing only. Fluid will not be deposited on the back of the torque converter.
5. **NOTE:** White facial tissue may aid in determining the color (transmission fluid is red) and source of the leaking fluid.

   Engine oil leaks are sometimes incorrectly diagnosed as transmission pump gasket leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the concern.
   - Leakage at the valve cover gasket may allow oil to flow over the torque converter housing or seep down between the torque converter housing and cylinder block, causing oil to be present in or at the bottom of the torque converter housing.
   2. Oil galley plug leaks will allow oil to flow down the rear face of the cylinder block to the bottom of the torque converter housing.
   3. Leakage at the crankshaft rear oil seal will work back to the flexplate, and then into the torque converter housing.
   4. Leakage at oil pressure sensor.

Leak Check Test

Determine the cause of the leakage before repair.

1. Remove the fluid level indicator and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. The red color should assist in pinpointing the leak.
2. Remove the torque converter housing cover. Clean off any fluid from the top and bottom of the torque converter housing, front of the case, and rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable non-flammable solvent, and blow dry with compressed air.
3. Wash out the torque converter housing, the front of the flexplate and the converter drain plug. The torque converter housing may be washed out using clean solvent and a squirt-type oil can. Blow-dry all washed areas with compressed air.
4. Start and run the engine until the transmission reaches its normal operating temperature. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Raise the vehicle on a hoist and run the engine at fast idle, then at engine idle, occasionally shifting to the OVERDRIVE and REVERSE ranges to increase pressure within the transmission. Observe the front of the flexplate, back of the cylinder block (in as far as possible), and inside the torque converter housing and front of the case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined.

Leak Check Test with Black Light

Oil soluble aniline or fluorescent dyes premixed at the rate of 2.5 ml (1/2 teaspoon) of dye powder to 0.24 L (0.5 pint) of automatic transmission fluid have proven helpful in locating the source of fluid leakage. Such dyes can be used to determine whether an engine fluid or transmission fluid leak is present, or if the fluid in the transmission fluid cooler hose leaks into the engine coolant system. An ultraviolet light must be used to detect the fluorescent dye solution.

Transmission Fluid Cooler

CAUTION: Whenever a transmission has been disassembled to install new parts, the cooler bypass valve (CBV) and transmission fluid cooler lines must be cleaned and backflushed. Install a new oil-to-air cooler (OTA).

NOTE: Cleaning and backflushing the transmission fluid cooling system and installing a new OTA cooler along with following all the normal cleaning and inspection procedures during disassembly and reassembly will keep contamination from entering the transmission, causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material, or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back into use.

Transmission Fluid Cooler Flow Test

NOTE: The transmission linkage/cable adjustment, fluid level and line pressure must be within specification before carrying out this test. Refer to Fluid Level Check under Verification of Condition in this section. Refer to Line Pressure Test under Special Testing Procedures in this section. For shift linkage/cable adjustment procedures, refer to Section 307-05.

1. Remove the fluid level indicator from the fluid filler tube.
2. Place a funnel in the fluid filler tube.
3. Raise and support the vehicle.
4. Disconnect the cooler return tube (rear fitting) from the transmission cooler bypass valve (CBV). Refer to Section 307-02.
5. Connect one end of a hose to the cooler return tube and route the other end of the hose up to a point where it can be inserted into the funnel at the fluid filler tube.
6. Remove the supports and lower the vehicle.
7. Insert the end of a hose into the funnel.
8. Start the engine and run at idle with the transmission in the NEUTRAL range.
9. Once a steady flow of fluid (without air bubbles) is observed, remove the hose from the funnel and place the hose in a measuring container for 15 seconds. After 15 seconds, place the hose back into the funnel and turn the engine off. Measure the amount of fluid in the container. If adequate flow was observed, approximately 946.24 ml (32 oz) will be in the measuring container; the test is now complete.
10. If adequate flow is not observed, turn off the engine. Disconnect the hose from the cooler return line (transmission inlet).
11. Disconnect the fluid cooler line from the front case fitting and connect the hose to the case fitting (converter out) and repeat Steps 6, 7 and 8.
12. If adequate flow is observed from the transmission, look for a plugged cooler line and/or fluid cooler. Refer to Section 307-02 for diagnosis of the transmission fluid cooler.
13. If adequate flow is still not observed, repair and/or installation of a new pump and/or torque converter may be required.

For transmission fluid cooler tube replacement, refer to Section 307-02.