

2021 AUTOMATIC TRANSMISSION

(Electronic Shift Module (ESM) - Electrical Diagnostics) - Gladiator

DIAGNOSTIC CODE INDEX

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DIAGNOSIS AND TESTING

B2204-00-ECU CONFIGURATION MISMATCH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- System voltage between 6.0 - 16.0 volts.
- Ignition on.

SET CONDITION

- Electronic Shift Module (ESM) Configuration does not match vehicle configuration.

DEFAULT ACTION

- PRNDM LEDs will blink.

POSSIBLE CAUSES

Possible Causes
INCORRECT ELECTRONIC SHIFT MODULE (ESM) INSTALLED

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

CHECK RELATED HARNESS CONNECTIONS

NOTE: This DTC sets when the wrong ESM is installed. Check the part number to verify the correct one is installed. If the correct ESM is installed, perform the following checks.

1. Disconnect all ESM harness connectors.
2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Terminals that have been pushed back into the connector cavity.
 - Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Reconnect all ESM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
6. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Using the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ESM DTCs.

Did the DTC return?

Yes

- Replace the Electronic Shift Module (ESM) in accordance with the Service information. Refer to **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION**, or **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION**.
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

P0607-00-ECU INTERNAL PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates there is an issue with the ESM internal processor.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

Ignition on.

System voltage between 6.0 - 16.0 volts.

SET CONDITION

If the ESM has detected an internal micro controller or memory failure.

Default Actions:

- All PRNDM LEDs will blink.
- PRNDM backlighting will be turned off.
- Brake Transmission Shift Interlock (BTSI) Solenoid may not function properly (shifter may be locked).
- Gear selection will not be available.

POSSIBLE CAUSES

Possible Causes
ELECTRONIC SHIFTER MODULE (ESM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**](#) .**

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Using the schematics as a guide, check the Electronic Shift Module (ESM) terminals for corrosion, damage, or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the Shift Lever Assembly in accordance with the Service Information. Refer to [SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION](#) , or [SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION](#) .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P0814-00-TRANSMISSION RANGE DISPLAY CIRCUIT

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates there is an issue with the shifter Light Emitting Diodes (LED) display.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition is on.
- System voltage between 6.0 - 16.0 volts.

SET CONDITION

- LED output test failure.
- LED driver temperature greater than or equal to a calibrated value.

DEFAULT ACTION

- All PRNDM LEDs will be turned off.
- All backlight LEDs will be turned on.

POSSIBLE CAUSES

Possible Causes
PRNDM DISPLAY MODULE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#).

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to all power and ground circuits. If no problems are found, replace the PRNDM.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#).

P0820-00-GEAR LEVER X-Y POSITION SENSOR CIRCUIT

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This DTC indicates that there is an issue with the PRNDM circuitry or the ESM.

WHEN MONITORED

- This diagnostic runs continuously when the following conditions are met:
- The ignition is on.
- System voltage between 6.0 - 16.0 volts.

SET CONDITION

- The ESM detects an error in the internal X/Y position sensor.

DEFAULT ACTION

- If both sensors fail the sensor signal output will be disabled.

POSSIBLE CAUSES

Possible Causes
ELECTRONIC SHIFT MODULE (ESM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [**PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**](#).

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.

3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the ESM terminals for corrosion, damage or terminal push out. Pay particular attention to power and ground circuits. Check Service Information or Service Bulletins for possible causes that may apply. If no trouble is found, replace the ESM. Refer to **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION** , or **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION** .
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P0930-00-BTSI CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates that there is an internal error with the Brake Transmission Shift Interlock (BTSI) Solenoid that is located within the ESM assembly.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- The ESM voltage between 6.0 and 16.0 volts.

SET CONDITION

- If the solenoid current is less than 50.0 mA and the solenoid driver reports a shorted condition for 0.2 second during activation.

DEFAULT ACTION

- Shifter may be stuck in PARK or NEUTRAL (Mechanical override may be required to shift).
- Shifter unblock function may be disabled. (Shifter can be moved without applying the brake pedal).

POSSIBLE CAUSES

Possible Causes
SOLENOID WIRE SHORTED TO GROUND
ELECTRONIC SHIFT MODULE (ESM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. VISUALLY INSPECT THE BRAKE TRANSMISSION SHIFTER INTERLOCK (BTSI) SOLENOID CIRCUITS

1. Turn the ignition Off.
2. Remove any necessary console parts for access to the Shifter Assembly. Refer to **CONSOLE, FLOOR, REMOVAL AND INSTALLATION** , or **CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION** .
3. Visually inspect the wiring to the BTSI solenoid.

Were problems found?

Yes

- Repair the circuit(s).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to the appropriate information .

No

- Replace the ESM in accordance with the Service information. Refer to **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION** , or **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION** .
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST** .

P0931-00-BTSI CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates that there is an internal error with the Brake Transmission Shift Interlock (BTSI) Solenoid that is located within the Shifter assembly.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- ESM voltage between 6 and 16 volts.

SET CONDITION

Set Conditions:

- If the solenoid current is less than 50.0 mA and the solenoid driver does not report a shorted condition for 0.2 second during activation.

DEFAULT ACTION

- Shifter may be stuck in PARK or NEUTRAL (Mechanical override may be required to shift).

POSSIBLE CAUSES

Possible Causes
BRAKE TRANSMISSION SHIFTER INTERLOCK (BTSI) SOLENOID WIRE OPEN ELECTRONIC SHIFT MODULE (ESM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To the appropriate information

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. VISUALLY INSPECT THE BRAKE TRANSMISSION SHIFTER INTERLOCK (BTSI) SOLENOID CIRCUITS

1. Turn the ignition Off.
2. Remove any necessary console parts for access to the Shifter Assembly. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) , or [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .
3. Visually inspect the wiring to the BTSI solenoid.
4. Make sure the wiring is securely connected at the solenoid.

Were problems found?

Yes

- Repair the circuit(s).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to the appropriate information .

No

- Replace the ESM in accordance with the Service information. Refer to [SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION](#) , or [SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION](#) .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

P1C86-14-PRNDL DISPLAY-CIRCUIT SHORT TO GROUND OR OPEN

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This DTC indicates that there is an issue with the Shifter PRNDM Display backlighting Light Emitting Diodes (LEDs).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- The ignition in the run position.
- System voltage between 6.0 - 16.0 volts.

SET CONDITION

- Backlighting error is present for 0.5 second.
- LED output fault test failed.
- Shifter PRNDM Display backlighting over-temperature condition.

DEFAULT ACTION

- Shifter backlighting will not illuminate.
- ESM will continue to illuminate the correct gear position indicator via the Transmission Control Module (TCM) signals received on Controller Area Network (CAN) C or CAN Dedicated Powertrain (D-PT) BUS.

POSSIBLE CAUSES

Possible Causes
PRNDM DISPLAY

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to all power and ground circuits. If no problems are found, replace the PRNDM.
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

P1C8B-16-BATTERY VOLTAGE - CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Electronic Shift Module (ESM) monitors battery voltage. The DTC sets if the monitored voltage supply for the Analog to Digital (A/D) Converter too low or the A/D Converter voltage is inaccurate.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- Battery voltage is below 7.4 (+/- 0.6) volts for greater than 15.0 seconds.

DEFAULT ACTION

- If the voltage is below 6.0 volts, the following conditions may be present:
- BTSI function may be impaired if voltage is less than 8.7 volts.
- PRNDM display may not function if voltage is less than 5.1 volts.

POSSIBLE CAUSES

Possible Causes
VEHICLE CHARGING SYSTEM
ESM BATTERY CIRCUIT
ELECTRONIC SHIFT MODULE (ESM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK FOR ENGINE CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCs)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Engine Charging System DTCs set?

Yes

- Repair Engine Charging System DTCs.

- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Go To [2](#)

2. CHECK THE ELECTRONIC SHIFT MODULE (ESM) POWER CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#).

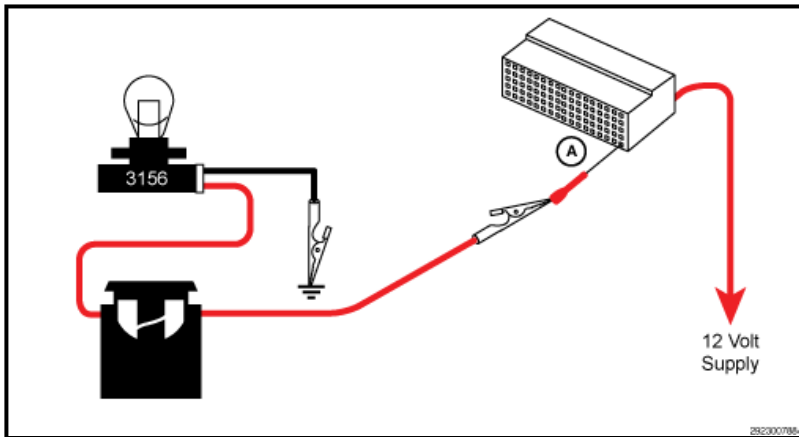
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and

alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [3](#)

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

3. ISOLATE AND CHECK THE ELECTRONIC SHIFT MODULE (ESM) GROUND CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the appropriate wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the ECU harness connector and measure the resistance of the circuit.

NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

Is the resistance below 3.0 Ohms?

Yes

- Go To [4](#)

No

- Repair the circuit for an open or high resistance.
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

4. CHECK FOR AN ACTIVE DTC

1. Reconnect all disconnected harness connectors.
2. With the scan tool, clear ESM DTCs.
3. Start the Engine and raise the engine speed to 2, 000 rpm for 10 seconds.
4. With the scan tool, read ESM DTCs and record on the repair order.

Did the DTC return?

Yes

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to all power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION** , or **SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION** .
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

No

- Test complete.

P1C8B-17-BATTERY VOLTAGE - CIRCUIT VOLTAGE ABOVE THRESHOLD

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) monitors battery voltage. The DTC sets if the monitored voltage supply for the Analog to Digital (A/D) Converter too high or the A/D Converter voltage is inaccurate.

WHEN MONITORED

SET CONDITION

- The ESM voltage supply is above 18.2 volts for a calibrated period of time (approximately 15 seconds).

DEFAULT ACTION

- PRNDM display will be disabled once the DTC matures, and will be re-enabled when the DTC dematures.
- BTSI function may be impaired if the voltage is above 16.0 volts for 1 hour or above 24.0 volts for 1 minute.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM DTCS VEHICLE WAS JUMP STARTED INCORRECTLY ELECTRONIC SHIFT MODULE (ESM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#).

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCs)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Charging System DTCs set?

Yes

- Repair Charging System DTCs. Refer to the appropriate information. .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Go To [2](#)

2. CHECK IF VEHICLE WAS JUMP STARTED WITH 24-VOLT SYSTEM

NOTE: **Some Recreational Vehicles (RVs), Buses, and Semi Tractors use 24-volt systems.**

1. Ask the customer if the vehicle was jump started by a vehicle with a 24-volt charging system.

Was the vehicle jump started by a vehicle with a 24-volt charging system?

Yes

- This is the cause of the DTC. Erase the DTC and return the vehicle to the customer.
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Go To [3](#)

3. CHECK INDICATED ESM BATTERY VOLTAGE

1. Start the Engine and raise the engine speed to 2, 000 rpm.
2. With the scan tool, monitor the ESM Battery Voltage for 60 seconds.

Does the ESM Battery Voltage read above 18.3 volts at any time during the test?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. COMPARE ESM VOLTAGE TO BATTERY VOLTAGE

1. Raise the engine speed to 2, 000 rpm.
2. With the scan tool, read the ESM Battery Voltage.
3. Measure the voltage at the Battery.
4. Compare the readings.

Does the measured voltage reading match the scan tool ESM Battery Voltage reading?

Yes

- Repair the Charging System for an over charging condition in accordance with the Service Information.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to [**SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION**](#) , or [**SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION**](#) .
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

5. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).
- Test complete.

P1C8C-16-SYSTEM VOLTAGE-CIRCUIT VOLTAGE BELOW THRESHOLD

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) monitors vehicle system voltage via the CAN C Bus. The DTC sets if the battery voltage message received by the ESM drops below 10.0 volts for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition is on.

SET CONDITION

- Battery system voltage message received by the ESM is below 10.0 volts for a calibrated amount of time.

POSSIBLE CAUSES

Possible Causes
VEHICLE CHARGING SYSTEM ELECTRONIC SHIFT MODULE (ESM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

2. CHECK FOR ENGINE CHARGING SYSTEM DTCS

1. With the scan tool, read Engine DTCs.

Are any Engine Charging System DTCs present?

Yes

- **Refer to the appropriate information** and perform the appropriate diagnostic procedure.
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

No

- Go To [3](#)

3. ELECTRONIC SHIFT MODULE

1. Reconnect all disconnected harness connectors.
2. With the scan tool, clear ESM DTCs.
3. Start the engine and raise the engine speed to 2,000 rpm for 10 seconds.

4. With the scan tool, read ESM DTCs.

Did the DTC reset?

Yes

- Using the schematics as a guide, check the Electronic Shift Module (ESM) terminals for corrosion, damage or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the ESM in accordance to the Service Information. Refer to **MODULE, ELECTRONIC SHIFT (ESM), REMOVAL AND INSTALLATION** .
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

No

- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.
- Test Complete.

P1C8C-17-SYSTEM VOLTAGE-CIRCUIT VOLTAGE ABOVE THRESHOLD

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) monitors vehicle system voltage via the CAN C Bus. The DTC sets if the battery voltage message received by the ESM is above 16.0 volts for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition is on.

SET CONDITION

- Battery system voltage message received by the ESM is above 16.0 volts for a calibrated amount of time.

POSSIBLE CAUSES

Possible Causes
VEHICLE CHARGING SYSTEM
VEHICLE WAS JUMP STARTED INCORRECTLY

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

2. CHECK FOR ENGINE CHARGING SYSTEM DTCS

1. With the scan tool, read Engine DTCs.

Are any Engine Charging System DTCs present?

Yes

- **Refer to the appropriate information** and perform the appropriate diagnostic procedure.
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Go To [3](#)

3. VEHICLE WAS JUMP STARTED INCORRECTLY

NOTE: **Some Recreational Vehicles (RVs), Buses, and Semi Tractors use 24 volt systems.**

1. Verify if the vehicle was jump started by another vehicle using a 24-volt charging system or incorrectly jump started with the 12 volt battery in series.

Was the vehicle jump started by another vehicle?

Yes

- This is the cause of the DTC. Clear the DTC and return the vehicle to the customer.
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Go To [4](#)

4. ELECTRONIC SHIFT MODULE

1. Reconnect all disconnected harness connectors.
2. With the scan tool, clear ESM DTC's.
3. Start the engine and raise the engine speed to 2, 000 rpm.
4. With the scan tool, read ESM DTC's.

Did the DTC reset?

Yes

- Using the schematics as a guide, check the Electronic Shift Module (ESM) terminals for corrosion, damage or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the ESM in accordance to the Service Information. Refer to [MODULE, ELECTRONIC SHIFT \(ESM\), REMOVAL AND INSTALLATION](#) .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).
- Test Complete.

U0001-00-CAN C BUS

NOTE: This DTC may not be listed in the Body Control Module (BCM) diagnostic procedures. If this DTC is not found in the BCM diagnostic procedures, perform the comparable CAN C Bus diagnostic test, such as CAN C BUS-NO SIGNAL, CAN C BUS OFF PERFORMANCE or CAN C SIGNAL MISSING.

Perform the comparable CAN C Bus diagnostic tests in the BCM. Refer to [BODY CONTROL MODULE \(BCM\) - DIAGNOSTIC CODE INDEX](#) .

U0002-00-CAN C BUS OFF PERFORMANCE

NOTE: This DTC may not be listed in the Body Control Module (BCM) diagnostic procedures. If this DTC is not found in the BCM diagnostic procedures, perform the comparable CAN C Bus diagnostic test, such as CAN C BUS-NO SIGNAL, CAN C BUS OFF PERFORMANCE or CAN C SIGNAL MISSING.

Perform the comparable CAN C Bus diagnostic tests in the BCM. Refer to [BODY CONTROL MODULE \(BCM\) - DIAGNOSTIC CODE INDEX](#) .

U0074-00-DEDICATED POWERTRAIN-D-PT-CAN BUS OFF

THEORY OF OPERATION

The CAN Dedicated Powertrain (DPT) ESHIFT bus is also known as the Private CAN BUS.

The Electronic Shift Module (ESM) communicates with the Transmission Control Module (TCM) on the CAN Dedicated Powertrain (DPT) ESHIFT bus. If the ESM loses communication with the TCM on the CAN DPT ESHIFT bus, this CAN BUS OFF DTC sets.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on, off, run, or accessory.
- System voltage is between 10.0 and 16.0 volts.

SET CONDITION

- The ESM loses communication with the Transmission Control Module on the Controller Area Network (CAN) Dedicated Powertrain (DPT) ESHIFT bus.

DEFAULT ACTION

- If CAN C is still functioning:
 - ESM will continue to communicate over the CAN C bus. Customer will not notice any problems with vehicle.
- If both CAN DPT and CAN C are not functioning:
 - Brake Transmission Shift Interlock (BTSI) solenoid will be disabled. (Shifter may be locked in PARK or Neutral.)
 - Gear selection will be disabled.
 - Shift indicator LEDs will be turned on.
 - Shifter background illumination LEDs will be turned off.
- A Stored Diagnostic Trouble Code (DTC) will be cleared after 100 ignition cycles if the failure does not reoccur.

POSSIBLE CAUSES

Possible Causes
CAN DPT ESHIFT CIRCUIT OPEN CIRCUIT CAN DPT ESHIFT CIRCUIT SHORTED TO GROUND CAN DPT ESHIFT CIRCUIT SHORTED TO VOLTAGE ELECTRONIC SHIFT CONTROL MODULE (ESM) TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: For vehicle communication problems, use the scan tool to refer to the **Network Review Screen**. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red. Selecting any of the network components allows access to the source of the problem.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK THE CONTROLLER AREA NETWORK (CAN) DEDICATED POWERTRAIN (DPT) CIRCUIT VOLTAGE

1. Turn the ignition off.
2. Disconnect the ESM harness connector.
3. Turn the ignition on.
4. Measure the voltage between ground and the (D441) CAN DPT (+) circuit at the ESM harness connector.
5. Measure the voltage between ground and the (D440) CAN DPT (-) circuit at the ESM harness connector.

Is the voltage between 2.4 and 2.6 volts for each circuit?

Yes

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to [MODULE, ELECTRONIC SHIFT \(ESM\), REMOVAL AND INSTALLATION](#) .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Go To [3](#)

3. CHECK CAN DPT CIRCUITS FOR AN OPEN

1. Turn the ignition off.
2. Disconnect the TCM harness connector.
3. Measure the resistance of the (D441) CAN DPT (+) circuit between the ESM harness connector and the TCM harness connector.
4. Measure the resistance of the (D440) CAN DPT (-) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the affected CAN DPT circuit(s) for an open or high resistance.
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

4. CHECK CAN DPT CIRCUITS FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D441) CAN DPT (+) circuit at the TCM harness connector.
2. Check for continuity between ground and the (D440) CAN DPT (-) circuit at the TCM harness connector.

Is there continuity between ground and the either of the CAN DPT circuits?

Yes

- Repair the affected CAN DPT circuit(s) for a short to ground.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Go To [**5**](#)

5. CHECK CAN DPT CIRCUITS FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D441) CAN DPT (+) circuit and all other circuits at the TCM harness connector.
2. Check for continuity between the (D440) CAN DPT (-) circuit and all other circuits at the TCM harness connector.

Is there continuity between either CAN DPT circuit and any other circuit?

Yes

- Repair the affected CAN DPT circuit(s) for a short to another circuit.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the TCM in accordance with the Service Information.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#). Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .

U0100-00-LOST COMMUNICATION WITH ECM/PCM

NOTE: Perform this diagnostic procedure **ONLY** when the DTC status is "Active". If the DTC status is "Stored" **DO NOT** proceed with this diagnostic procedure. A "Stored" DTC will not affect the performance of the vehicle.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U0101-08-LOST COMMUNICATION WITH TCM-BUS SIGNAL / MESSAGE FAILURES

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U0140-00-LOST COMMUNICATION WITH BODY CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U0402-00-IMPLAUSIBLE DATA RECEIVED FROM TCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0422-00-IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE

NOTE: This DTC indicates a communication issue has occurred between the Sending control module (Body Control Module - BCM) and the Reporting control module(s) that set this DTC.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U114C-00-LOST COMMUNICATION WITH PRNDL DISPLAY

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- System voltage between 6.0 - 16.0 volts.

SET CONDITION

- Communications with the PRNDM display LED board are lost for more than 4 seconds.

NOTE: This code will set if the PRNDM display harness is disconnected while the ESM is awake.

DEFAULT ACTION

- All PRNDM display LEDs and backlighting are turned off.

POSSIBLE CAUSES

Possible Causes
PRNDM DISPLAY LED BOARD DISCONNECTED
PRNDM DISPLAY HARNESS OPEN OR SHORTED CIRCUIT
PRNDM DISPLAY
ELECTRONIC SHIFT MODULE (ESM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

- 1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**
1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
 2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
 3. With the scan tool, erase all DTCs.
 4. Turn the ignition off for a minimum of 10.0 seconds.
 5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Go To [5](#)

2. CHECK PRNDM DISPLAY HARNESS CONNECTION

1. Check the PRNDM Display harness connection for corrosion, backed out, or damaged terminals.

Is the PRNDM Display harness connection in good condition and connected properly?

Yes

- Go To [3](#)

No

- Repair the connection as necessary.
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

3. CHECK PRNDM DISPLAY HARNESS FOR OPEN OR SHORTED CIRCUITS

1. Check the PRNDM Display circuits for opens and shorts.

Do the PRNDM Display circuits have proper continuity and not shorted?

Yes

- Go To [4](#)

No

- Repair the PRNDM Display circuits as necessary.
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

4. CHECK RELATED HARNESS CONNECTIONS

1. Disconnect all ESM harness connectors.
2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Terminals that have been pushed back into the connector cavity.

- Perform a terminal drag test on each connector terminal to verify proper terminal tension.

Repair any conditions that are found.

5. Reconnect all ESM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
6. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
10. With the scan tool, read ESM DTCs.

Did the DTC return?

Yes

- Replace the PRNDM Display in accordance with the Service information.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).
- If the DTC returns, replace the Electronic Shift Module (ESM) in accordance with the Service information. Refer to [**SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION**](#) , or [**SHIFTER, TRANSMISSION, REMOVAL AND INSTALLATION**](#) .
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).
- Test complete.

5. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were there any problems found?

Yes

- Repair as necessary.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Test complete.

U11C3-00-ESM LOST COMMUNICATION WITH TCM ON D-PT CAN

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates that an expected message was not received from the Transmission Control Module (TCM) on the CAN D-PT BUS.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage message received over Controller Area Network (CAN) is between 10.0 and 16.0 volts
- If system voltage over CAN is not available, Electronic Shift Module (ESM) sensed voltage is used and must be between 6.0 and 16.0 volts.
- No CAN C Bus Off Diagnostic Trouble Codes (DTCs) set.
- The ESM is programmed.
- The Transmission Control Module (TCM) is available on the CAN bus.

SET CONDITION

- The ESM loses communication with the TCM on the CAN DPT (Eshift) bus for more than 100ms.

DEFAULT ACTION

- If CAN C is still functioning:
 - ESM will continue to communicate over the CAN C bus. Customer will not notice any problems with vehicle.
- If both CAN Dedicated Powertrain (DPT) and CAN C are not functioning:
 - Brake Transmission Shift Interlock (BTSI) solenoid will be disabled. (Shifter may be locked in Park or Neutral.)
 - Gear selection will be disabled.
 - Shift indicator Light Emitting Diodes (LEDs) will be blinking.
 - Shifter background illumination LEDs will be turned off.
- A Stored DTC will be cleared after 100 ignition cycles if the failure does not reoccur.

POSSIBLE CAUSES

Possible Causes
CAN DPT (ESHIFT) BUS CIRCUIT OPEN CIRCUIT
CAN DPT (ESHIFT) BUS CIRCUIT SHORTED TO GROUND
CAN DPT (ESHIFT) BUS CIRCUIT SHORTED TO VOLTAGE
TCM CAN DPT (ESHIFT) BUS SHORTED OR OPEN INTERNALLY
ELECTRONIC SHIFT CONTROL MODULE (ESM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#).

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN
 1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
 2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.

3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Go To [6](#)

2. CHECK THE CONTROLLER AREA NETWORK (CAN) DEDICATED POWERTRAIN (DPT) CIRCUIT VOLTAGE

1. Turn the ignition off.
2. Disconnect the ESM harness connector.
3. Turn the ignition on.
4. Measure the voltage between ground and the CAN DPT (+) circuit at the ESM harness connector.
5. Measure the voltage between ground and the CAN DPT (-) circuit at the ESM harness connector.

Is the voltage between 2.4 and 2.6 volts for each circuit?

Yes

- Using the schematics as a guide, check the ESM terminals for corrosion, damage or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the ESM in accordance to the Service Information. Refer to **MODULE, ELECTRONIC SHIFT (ESM), REMOVAL AND INSTALLATION** .
- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

No

- Go To [3](#)

3. CHECK CAN DPT CIRCUITS FOR AN OPEN

1. Turn the ignition off.
2. Disconnect the Transmission Control Module (TCM) harness connector.
3. Measure the resistance of the CAN DPT (+) circuit between the ESM harness connector and the TCM harness connector.
4. Measure the resistance of the CAN DPT (-) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the affected CAN DPT circuit(s) for an open or high resistance.

- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

4. CHECK CAN DPT CIRCUITS FOR A SHORT TO GROUND

1. Check for continuity between ground and the CAN DPT (+) circuit at the TCM harness connector.
2. Check for continuity between ground and the CAN DPT (-) circuit at the TCM harness connector.

Is there continuity between ground and the either of the CAN DPT circuits?

Yes

- Repair the affected CAN DPT circuit(s) for a short to ground.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Go To [**5**](#)

5. CHECK CAN DPT CIRCUITS FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the CAN DPT (+) circuit and all other circuits at the TCM harness connector.
2. Check for continuity between the CAN DPT (-) circuit and all other circuits at the TCM harness connector.

Is there continuity between either CAN DPT circuit and any other circuit?

Yes

- Repair the affected CAN DPT circuit(s) for a short to another circuit.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Using the schematics as a guide, check the ESM terminals for corrosion, damage or terminal push out. Pay particular attention to all power and ground circuits. If no problems are found, replace the ESM in accordance to the Service Information. Refer to [**MODULE, ELECTRONIC SHIFT \(ESM\), REMOVAL AND INSTALLATION**](#) .
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

6. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the ESM VERIFICATION TEST. Refer to [**ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST**](#).

No

- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.
- Test complete.

U145D-00-IMPLAUSIBLE DATA RECEIVED FROM TCM ON D-PT

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Electronic Shift Module (ESM) performs various internal tests to verify proper controller operation. This DTC indicates there is a communication issue between the ESM and Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage message received over Controller Area Network (CAN) is between 10.0 and 16.0 Volts.
- Network Configuration status is programmed.
- No active CAN Bus Diagnostic Trouble Codes (DTCs) set.
- No active CAN Bus Off DTCs set.
- No active CAN DPT Bus Off errors present.

SET CONDITION

- The TCM has transmitted a message indicating that the expected data is not valid 23 consecutive times.

DEFAULT ACTION

- If CAN C is still functioning:
 - ESM will continue to communicate over the CAN C bus.
- If both CAN Dedicated Powertrain (DPT) and CAN C are not functioning:
 - If the Ignition Lock is activated, all Shifter background illumination LEDs will be turned on and all Gear position indicators will be turned on.
 - If the Ignition Lock is not activated, all Shifter background illumination LEDs will be turned off and all Gear position indicators will be turned on. If the voltage is greater than 16.0 all Shifter background illumination LEDs and all Gear position indicators will be turned off.
 - Brake Transmission Shift Interlock (BTSI) solenoid will remain unlocked until shifted to PARK. Once in PARK, the BTSI will remain locked.
 - Shift indicator Light Emitting Diodes (LEDs) will be blinking.
 - Shifter background illumination LEDs will be turned off.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) DTCS ARE SET
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**

NOTE: Make sure the battery voltage is between 10 and 16 volts before proceeding.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Go To [3](#)

2. CHECK FOR TRANSMISSION CONTROL MODULE (TCM) DTCs

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any TCM DTCs set?

Yes

- Repair TCM DTCs. Refer to the appropriate information .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the ESM VERIFICATION TEST. Refer to [ELECTRONIC SHIFT MODULE \(ESM\) VERIFICATION TEST](#).

3. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.

- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.

No

- Perform the ESM VERIFICATION TEST. Refer to **ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST**.
- Test complete.

STANDARD PROCEDURE

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

Pre-Diagnostic Troubleshooting Procedure

The Pre-Diagnostic Troubleshooting Procedure is intended to provide the technician with a common starting point for all DTC troubleshooting procedures. The DTC troubleshooting procedures assume that the following steps have been performed and therefore are not always repeated. Failure to follow the steps in this procedure can lead to misdiagnosis.

If any repairs are performed, perform the appropriate VERIFICATION TEST.

NOTE: **Do not perform repairs not related to the customer complaint.**

1. With the scan tool, **read DTCs and record on the repair order**.
2. With the scan tool, **run a Vehicle Scan Report and a ECU Configuration Report** and save the files for future use.
3. **Check the vehicle repair history** for any recent repairs that may be related to the customer complaint.
4. If possibly related to the customer complaint, **verify the vehicle build configuration** with the OEM Vehicle Build Configuration on TechCONNECT. Properly configure the vehicle if necessary.
5. If possibly related to the customer complaint, **verify all Electronic Control Units (ECU)s have the same Original Vehicle Identification Number (VIN)**. If a mismatch is found, this could indicate the source of the problem. Typically, this condition will cause multiple communication DTCs to set however, this is not always the case.
6. With a scan tool, **check all ECUs for available software updates** that are related to the customer complaint.
 - Read Service Bulletins to determine if the software update is applicable to the customer complaint.
 - Update the (ECU)s if necessary.
7. Use the Search function in TechCONNECT to **read any related information under SERVICE ACTIONS/TIPS**.
 - Perform any Service Bulletins or other procedures that may apply.
8. **Check for aftermarket electrical accessories**. Be certain they are installed properly and do not interfere with any related power, ground, signal, or communication circuits. Be certain aftermarket wiring harnesses are routed away from vehicle wiring harness to avoid electromagnetic interference (EMI) where applicable.

NOTE: **A low battery State Of Charge (SOC) or a charging system that is not operating properly can cause many symptoms and DTCs to set.**

9. If possibly related to the customer complaint, **check the vehicle charging system and battery for proper operation**. Refer to the appropriate Service Information.
10. **Check other ECUs for DTCs** that could cause this DTC to set.
11. If multiple DTCs are set in one ECU, and no detectable pattern is evident (i.e. the DTCs are not related to just one or two components or subsystems), **check the applicable ECU ground circuit(s) for proper**

continuity . As a general rule, **diagnose the DTCs in the following order** unless instructed otherwise by the specific DTC procedure:

1. ECU Configuration DTCs
 2. ECU Voltage DTCs
 3. ECU Internal Error DTCs
 4. Communication DTCs (See below)
 5. Circuit Fault DTCs (Low voltage, High Voltage, Open Circuit, Short Circuit, Low Current, High Current, etc.,)
 6. Performance / Rationality DTCs
 7. Implausible or Invalid Data
 8. Missing Message
 9. Other
12. If multiple communication DTCs are set, **diagnose the DTCs in the following order** unless instructed otherwise by the specific DTC procedure:
1. CAN Bus Off
 2. CAN Bus Off Performance
 3. Lost Communication
 4. Other

NOTE: **IMPORTANT:** Some Control Modules simply pass information from one Control Module to the other. In some cases, a U-code DTC may be set that implicates the "pass-through" module that sent the information. For example, if an Engine Coolant Temperature (ECT) Sensor DTC is set in the Powertrain Control Module (PCM), the HVAC module may set an "Implausible Data from BCM" DTC because the BCM is the module that normally passes that information from the PCM to the HVAC module. However, the BCM may not set any DTCs related to the faulted ECT Sensor because the BCM does not use the ECT information. In this case, the PCM ECT DTC should be diagnosed before the Implausible Data DTC. If you suspect a scenario like this, diagnose the non U-code DTC(s) before diagnosing any Implausible Data, Implausible Signal, Invalid Data, or Missing Message DTCs.

ELECTRONIC SHIFT MODULE (ESM) VERIFICATION TEST

Perform the following procedure to verify proper Electronic Shift Module (ESM) operation after repairs have been performed.

ESM VERIFICATION TEST

PERFORM THE ESM VERIFICATION TEST

1. Reinstall any removed components.
2. Reconnect any disconnected electrical connectors.
3. With the scan tool, erase DTCs.
4. With the scan tool, display the Transmission Temperature.
5. Start the engine and allow the Transmission fluid temperature to reach 43°C (110°F).
6. With the brakes applied, slowly change the Shifter position to each of the available positions.
7. The Shift indicators should indicate the correct position for each of the available positions.
8. With the scan tool, read ESM DTCs and record on the repair order.

Did any ESM DTCs set?

Yes

- Repair ESM DTCs. Refer to **DIAGNOSIS AND TESTING**.

No

- Test complete.
-

2021 AUTOMATIC TRANSMISSION

8HP50/850RE Automatic Transmission - Diagnostic Code Index - Gladiator [EBH, EC1, EC3, ERC]

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
P0219-00	ENGINE OVERSPEED CONDITION
P0562-00	SYSTEM VOLTAGE LOW
P0563-00	SYSTEM VOLTAGE HIGH
P0601-00	INTERNAL CONTROL MODULE MEMORY CHECKSUM ERROR
P0607-00	ECU INTERNAL PERFORMANCE
P0613-00	INTERNAL TRANSMISSION PROCESSOR
P061B-00	INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE
P062F-00	INTERNAL CONTROL MODULE EEPROM ERROR
P0634	PCM/ECM/TCM INTERNAL TEMPERATURE TOO HIGH
P0642-00	SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW
P0643-00	SENSOR REFERENCE VOLTAGE 1 CIRCUIT HIGH
P0667-00	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 PERFORMANCE
P0668-00	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT LOW
P0669-00	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT HIGH
P06AC-00	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 PERFORMANCE
P06AD-00	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT LOW
P06AE-00	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT HIGH
P0701-00	TRANSMISSION CONTROL SYSTEM RANGE/PERFORMANCE
P0712-00	TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT LOW
P0713-00	TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT HIGH
P0714-00	TRANSMISSION FLUID TEMPERATURE SENSOR A CIRCUIT INTERMITTENT
P0716-00	INPUT SHAFT SPEED SENSOR 1 PERFORMANCE
P0721-00	OUTPUT SHAFT SPEED SENSOR CIRCUIT PERFORMANCE
P0729-00	GEAR 6 SHIFT INCORRECT RATIO
P0731-00	GEAR 1 SHIFT INCORRECT RATIO
P0732-00	GEAR 2 SHIFT INCORRECT RATIO
P0733-00	GEAR 3 SHIFT INCORRECT RATIO
P0734-00	GEAR 4 SHIFT INCORRECT RATIO
P0735-00	GEAR 5 SHIFT INCORRECT RATIO
P0746-00	PRESSURE CONTROL SOLENOID "A" PERFORMANCE
P0750-00	SHIFT SOLENOID 1 CONTROL CIRCUIT - OPEN
P0755-00	SHIFT SOLENOID 2 CONTROL CIRCUIT - OPEN
P075B-00	SHIFT SOLENOID "G" PERFORMANCE/STUCK OFF
P076F-00	GEAR 7 SHIFT INCORRECT RATIO
P0776-00	PRESSURE CONTROL SOLENOID "B" PERFORMANCE/STUCK OFF
P077C-00	OUTPUT SHAFT SPEED SENSOR CIRCUIT LOW
P077D-00	OUTPUT SHAFT SPEED SENSOR CIRCUIT HIGH
P077E-00	TRANSMISSION FLUID TEMPERATURE MULTIPLE SENSOR CORRELATION
P07B3-00	TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT LOW

DTC	Description
<u>P07B4-00</u>	TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT HIGH
<u>P07B9-00</u>	TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT LOW
<u>P07BA-00</u>	TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT HIGH
<u>P07BF-00</u>	INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT LOW
<u>P07C0-00</u>	INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT HIGH
<u>P07D9-00</u>	GEAR 8 SHIFT INCORRECT RATIO
<u>P07E4-00</u>	UNABLE TO ENGAGE PARK
<u>P0850-00</u>	PARK-NEUTRAL SWITCH PERFORMANCE
<u>P093A-00</u>	HYDRAULIC ACCUMULATOR SOLENOID OPEN
<u>P093B-00</u>	HYDRAULIC ACCUMULATOR SOLENOID SHORT TO GROUND
<u>P093C-00</u>	HYDRAULIC ACCUMULATOR SOLENOID SHORT TO BATTERY
<u>P0960-00</u>	PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT OPEN
<u>P0962-00</u>	PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT LOW
<u>P0963-00</u>	PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT HIGH
<u>P0972-00</u>	SHIFT SOLENOID 1 CONTROL CIRCUIT PERFORMANCE
<u>P0973-00</u>	SHIFT SOLENOID 1 CONTROL CIRCUIT LOW
<u>P0974-00</u>	SHIFT SOLENOID 1 CONTROL CIRCUIT HIGH
<u>P0975-00</u>	SHIFT SOLENOID B CONTROL CIRCUIT PERFORMANCE
<u>P0976-00</u>	SHIFT SOLENOID 2 CONTROL CIRCUIT LOW
<u>P0977-00</u>	SHIFT SOLENOID 2 CONTROL CIRCUIT HIGH
<u>P0978-00</u>	SHIFT SOLENOID 3 CONTROL CIRCUIT RANGE-PERFORMANCE
<u>P0979-00</u>	SHIFT SOLENOID 3 CONTROL CIRCUIT LOW
<u>P0980-00</u>	SHIFT SOLENOID 3 CONTROL CIRCUIT HIGH
<u>P0981-00</u>	SHIFT SOLENOID 4 CONTROL CIRCUIT RANGE-PERFORMANCE
<u>P0982-00</u>	SHIFT SOLENOID 4 CONTROL CIRCUIT LOW
<u>P0983-00</u>	SHIFT SOLENOID 4 CONTROL CIRCUIT HIGH
<u>P0984-00</u>	SHIFT SOLENOID 5 CONTROL CIRCUIT RANGE-PERFORMANCE
<u>P0985-00</u>	SHIFT SOLENOID 5 CONTROL CIRCUIT LOW
<u>P0986-00</u>	SHIFT SOLENOID 5 CONTROL CIRCUIT HIGH
<u>P1614-00</u>	ECU RESET-RECOVERY OCCURRED
<u>P1634-00</u>	TCM INTERNAL - INTERNAL WATCHDOG PERFORMANCE
<u>P167A-00</u>	CALIBRATION MISMATCH
<u>P1731-00</u>	INCORRECT GEAR ENGAGED
<u>P1778-00</u>	INPUT-TURBINE SHAFT SPEED SENSOR A OUT OF RANGE HIGH
<u>P177F-00</u>	OUTPUT SHAFT SPEED SENSOR OUT OF RANGE HIGH
<u>P1B13-00</u>	PARK BY WIRE UNINTENDED OUT OF PARK POSITION
<u>P1B14-00</u>	PARK BY WIRE UNINTENDED PARK POSITION
<u>P1D25-00</u>	SHIFT CONTROL RATIONALITY
<u>P1D78-00</u>	PARK SOLENOID CIRCUIT LOW
<u>P1D79-00</u>	PARK SOLENOID CIRCUIT HIGH
<u>P1D8A-00</u>	PARK PAWL SOLENOID CIRCUIT LOW
<u>P1D8B-00</u>	PARK PAWL SOLENOID CIRCUIT HIGH
<u>P1D8C-00</u>	PARK PAWL SOLENOID CIRCUIT OPEN
<u>P1D8F-00</u>	INCORRECT GEAR RATIO CLUTCH 1 DEFECTIVE
<u>P1D90-00</u>	INCORRECT GEAR RATIO - CLUTCH 2 DEFECTIVE
<u>P1D91-00</u>	INCORRECT GEAR RATIO - CLUTCH 3 DEFECTIVE
<u>P1D92-00</u>	INCORRECT GEAR RATIO - CLUTCH 4 DEFECTIVE
<u>P1D93-00</u>	INCORRECT GEAR RATIO - CLUTCH 5 DEFECTIVE

DTC	Description
<u>P1D94-00</u>	TCM INTERNAL SBW CALIBRATION MISMATCH
<u>P1D95-00</u>	TCM CLUTCH FAILURE UNDETERMINED
<u>P1D96-00</u>	INCORRECT GEAR RATIO CLUTCH A OR B DEFECTIVE
<u>P1D97-00</u>	INCORRECT GEAR RATIO CLUTCH A OR D DEFECTIVE
<u>P1D98-00</u>	INCORRECT GEAR RATIO CLUTCH B OR D DEFECTIVE
<u>P1D99-00</u>	INCORRECT GEAR RATIO CLUTCH B OR E DEFECTIVE
<u>P1D9A-00</u>	INCORRECT GEAR RATIO CLUTCH C OR D DEFECTIVE
<u>P1D9B-00</u>	INCORRECT GEAR RATIO CLUTCH A OR E DEFECTIVE
<u>P1D9C-00</u>	INCORRECT GEAR RATIO CLUTCH A OR C DEFECTIVE
<u>P1D9D-00</u>	INCORRECT GEAR RATIO CLUTCH B OR C DEFECTIVE
<u>P1D9E-00</u>	INCORRECT GEAR RATIO CLUTCH C OR E DEFECTIVE
<u>P1D9F-00</u>	INCORRECT GEAR RATIO CLUTCH D OR E DEFECTIVE
<u>P1DA0-00</u>	INCORRECT GEAR RATIO CLUTCH A B OR C DEFECTIVE
<u>P1DA1-00</u>	INCORRECT GEAR RATIO CLUTCH A B OR E DEFECTIVE
<u>P1DA2-00</u>	INCORRECT GEAR RATIO CLUTCH B C OR E DEFECTIVE
<u>P1DA3-00</u>	INCORRECT GEAR RATIO CLUTCH B D OR E DEFECTIVE
<u>P1DA4-00</u>	INCORRECT GEAR RATIO CLUTCH B C OR D DEFECTIVE
<u>P1DA5-00</u>	INCORRECT GEAR RATIO CLUTCH C D OR E DEFECTIVE
<u>P1DA6-00</u>	INCORRECT GEAR RATIO CLUTCH A C OR D DEFECTIVE
<u>P1DA7-00</u>	INCORRECT GEAR RATIO CLUTCH A D OR E DEFECTIVE
<u>P1DA8-00</u>	INCORRECT GEAR RATIO CLUTCH A B OR D DEFECTIVE
<u>P1DA9-00</u>	TRANSMISSION FLUID TEMPERATURE RATIONALITY
<u>P1DAA-00</u>	TRANS TEMP UNDETERMINED
<u>P1DAB-00</u>	VEHICLE SPEED UNDETERMINED
<u>P1DAC-00</u>	ENGINE SPEED UNDETERMINED
<u>P1DAD-00</u>	INPUT SHAFT-OUTPUT SHAFT DIRECTION CORRELATION
<u>P1DAF-00</u>	INCOMPATIBLE LIMP IN ACTION REQUESTED
<u>P1DB1-00</u>	TCM SYSTEM VOLTAGE EXCESSIVELY LOW
<u>P1DB2-00</u>	ACTUATOR SUPPLY VOLTAGE A CIRCUIT
<u>P1DB3-00</u>	TCM ECU RESET-RECOVERY OCCURRED
<u>P1DB6-00</u>	VEHICLE SPEED SIGNAL PERFORMANCE
<u>P1DB7-00</u>	TORQUE CONVERTER CLUTCH PERFORMANCE
<u>P1DB8-00</u>	UNINTENDED TORQUE APPLIED WHILE IN NEUTRAL
<u>P1DB9-00</u>	TCM ECU RESET EXTENDED LOW VOLTAGE
<u>P1DC8-00</u>	CLUTCH TEMP THRESHOLD ACHIEVED AUTOSTICK INHIBIT
<u>P1DCD-00</u>	TCM MONITORING PROCESSOR PERFORMANCE MULTIPLE CLUTCHES LOCKED UP
<u>P1DCE-00</u>	TCM MONITORING PROCESSOR PERFORMANCE INCORRECT DRIVING DIRECTION
<u>P1DD0-00</u>	TCM MONITORING PROCESSOR PERFORMANCE UNALLOWED PARK ENGAGEMENT
<u>P1DD2-00</u>	TORQUE REQUEST SIGNAL FROM TCM DENIED
<u>P1DDD-00</u>	TCM MONITORING PERFORMANCE UNABLE TO DISENGAGE DRIVE OR REVERSE
<u>P1DF3-00</u>	ECU NOT INITIALIZED
<u>P215C-00</u>	OUTPUT SHAFT SPEED WHEEL SPEED CORRELATION
<u>P2761-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT-OPEN

DTC	Description
<u>P2762-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT RANGE-PERFORMANCE
<u>P2763-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT HIGH
<u>P2764-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT LOW
<u>U0001-00</u>	CAN C BUS
<u>U0074-00</u>	DEDICATED POWERTRAIN (DPT) CAN BUS OFF
<u>U0100-00</u>	LOST COMMUNICATION WITH ECM/PCM
<u>U0102-00</u>	LOST COMMUNICATION WITH TRANSFER CASE CONTROL MODULE / AWD
<u>U0103-00</u>	LOST COMMUNICATION WITH ELECTRIC GEAR SHIFT MODULE
<u>U0104-00</u>	LOST COMMUNICATION WITH CRUISE CONTROL MODULE
<u>U0120-00</u>	LOST COMMUNICATION WITH STARTER/GENERATOR CONTROL MODULE
<u>U0121-00</u>	LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE
<u>U0140-00</u>	LOST COMMUNICATION WITH BODY CONTROL MODULE
<u>U0155-00</u>	LOST COMMUNICATION WITH CLUSTER-CCN
<u>U0212-00</u>	LOST COMMUNICATION WITH STEERING COLUMN CONTROL MODULE
<u>U0401-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM
<u>U0403-00</u>	IMPLAUSIBLE DATA RECEIVED FROM TCASE
<u>U0404-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ESM
<u>U0405-00</u>	INVALID DATA RECEIVED FROM CRUISE CONTROL MODULE
<u>U0415-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ABS
<u>U0422-00</u>	IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE
<u>U0423-00</u>	IMPLAUSIBLE DATA RECEIVED FROM CLUSTER-CCN
<u>U0429-00</u>	IMPLAUSIBLE DATA RECEIVED FROM SCM
<u>U0469-00</u>	INVALID DATA RECIEVED FROM STARTER/GENERATOR CONTROL MODULE
<u>U11E3-00</u>	TCM LOST COMMUNICATION WITH ESM ON DPT CAN
<u>U11E4-00</u>	CAN COMMUNICATION MESSAGES MISSING
<u>U1267-00</u>	NO VALID DATA FROM ESM ON CAN-C OR CAN-DPT
<u>U1400-00</u>	IMPLAUSIBLE TPS SIGNAL RECEIVED
<u>U1401-00</u>	IMPLAUSIBLE ENGINE SPEED SIGNAL RECEIVED
<u>U1412-00</u>	IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED
<u>U1424-00</u>	IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED
<u>U1428-00</u>	IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED
<u>U1461-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ESM ON DPT
<u>U1465-00</u>	IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED
<u>U1466-00</u>	IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED ON DPT CAN
<u>U1477-00</u>	IMPLAUSIBLE PADDLE SHIFTER DATA RECEIVED

2021 AUTOMATIC TRANSMISSION

8HP50/850RE Automatic Transmission - DTCS P1DAD-00 To U1477-00 - Gladiator [EBH, EC1, EC3, ERC]

DIAGNOSIS AND TESTING

P1DAD-00-INPUT SHAFT-OUTPUT SHAFT DIRECTION CORRELATION

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect an unwanted driving direction. A rationality check is performed between the measured directions of Input Speed Sensor and Output Speed Sensor signals and the calculated driving direction. The calculated driving direction is based on the commanded currents of the pressure regulators.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Input Speed Sensor or Output Speed Sensor Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal and Output Speed Sensor signal above a calibrated value.
- Shift not in progress.
- No clutch slip control function active.

SET CONDITION

- The failure is detected if the measured directions of input speed and output speed signal do not correspond to the calculated driving direction for a calibrated amount of time.
 - When Calculated Driving Direction is Forward:
 - The measured directions of input speed and output speed signal do not correspond to the calculated driving direction for a calibrated amount of time.
 - When Calculated Driving Direction is Reverse:
 - A failure is detected if the input speed and output speed direction are the same.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Maintain Park position if the DTC detected while in Park.
- Drive will be disabled.
- Reverse will be disabled.
- Torque Converter Clutch (TCC) Low Side Pressure Regulator Switch will be commanded off.
- Clutch adaptation functions will be disabled.
- Any driver requests that are not yet honored will be cleared.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION - INTERNAL

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. With the scan tool, read Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs) and record on the repair order.
2. Record the Event Data and Environmental Data.
3. With the scan tool, erase DTCs.
4. Raise the vehicle on the hoist.
5. Start the Engine.
6. With the scan tool, monitor the Output Speed Sensor rpm.
7. Firmly apply the brakes and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

8. Release the brakes and raise the engine speed to allow the Transmission to upshift to the 1-2 and 2-3 shift schedule.

Did the Output Speed Sensor display an rpm below 1, 000?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of a internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information. Refer to **DISASSEMBLY AND ASSEMBLY** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DAF-00-INCOMPATIBLE LIMP IN ACTION REQUESTED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to determine unique failure situations when multiple failures requiring conflicting limp-in actions occur. If conflicting Limp-in actions are commanded, the mechanical Limp-home mode is activated as the final Limp-in action.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- Multiple failures requiring conflicting limp-in actions occur.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
OTHER TRANSMISSION CONTROL MODULE (TCM) DIAGNOSTIC TROUBLE CODES (DTCS) ARE SET
POWERTRAIN CONTROL MODULE (PCM) DTCS ARE SET

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR OTHER TCM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any other TCM DTCs set?

Yes

- Repair other TCM DTCs. Refer to the appropriate information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To [2](#)

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCs.

Are any PCM DTCs set?

Yes

- Repair PCM DTCs. Refer to the appropriate information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: **Read Service Bulletins to determine if the software update is applicable to the customer complaint.**

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Perform the TCM PROGRAMMING PROCEDURE. Refer to [MODULE PROGRAMMING](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [4](#).

4. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DB1-00-TCM SYSTEM VOLTAGE EXCESSIVELY LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the system voltage level at the TCM supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low
- System Voltage High

If the TCM supply voltage is below a threshold that is lower than the System Voltage Excessively Low threshold, the TCM will not supply power to the solenoid valves and pressure regulators. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- High side switch is activated.
- When Shifter Position is in PARK or NEUTRAL:
 - Solenoid valves and regulators are powered.
 - Engine speed via Controller Area Network (CAN) or input speed signal is above a calibrated value for a calibrated amount of time.
 - Engine Start timer is elapsed.
- When Shifter Position is **not** in PARK or NEUTRAL:
 - Solenoid valves and regulators are powered.
 - Engine speed via CAN or input speed signal is above a calibrated value or a failure is detected in the engine speed monitoring.
- When Shifter Position is **not** in PARK:
 - TCM is powered.

SET CONDITION

- A failure is detected if one of the following occur:
 - The system voltage is less than a calibrated value for a calibrated amount of time.
 - Diagnostic switch is not powered due to undervoltage when **not** in PARK.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.

- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
OPEN FUSE LOW BATTERY VOLTAGE ENGINE CHARGING SYSTEM BATTERY VOLTAGE CIRCUIT HIGH RESISTANCE TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR ENGINE CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Engine Charging System DTCs set?

Yes

- Repair Charging System DTCs. Refer to the appropriate information .

No

- Go To [2](#)

2. CHECK THE BODY CONTROL MODULE (BCM) FOR VEHICLE VOLTAGE RELATED DTCS

1. With the scan tool, read BCM DTCs.

Are any vehicle voltage related DTCs set?

Yes

- Repair vehicle voltage related DTCs. Refer to **3.0L DIESEL - DIAGNOSTIC CODE INDEX** .

No

- Go To [3](#)

3. CHECK TCM SYSTEM VOLTAGE

1. Start the Engine.
2. With the scan tool, under Transmission, check system voltage.

Is the Transmission system voltage above 9.0 volts?

Yes

- Go To [6](#)

No

- Go To [4](#)

4. CHECK THE (A190) 12 VOLT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

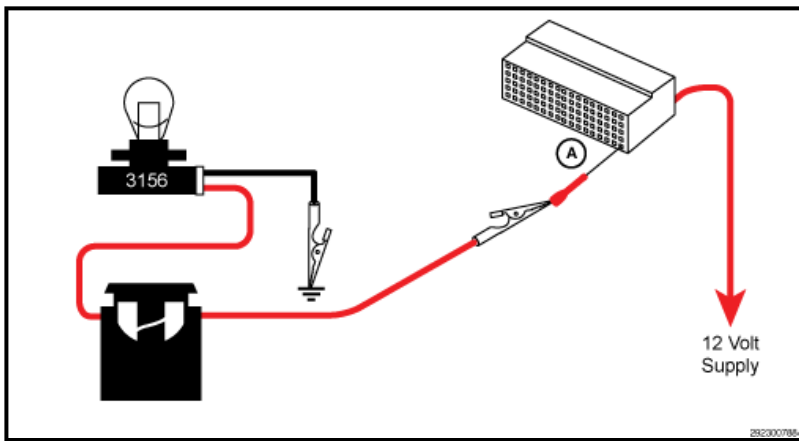
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [5](#)

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

5. CHECK THE (Z909) TCM GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the ground circuit.
2. Connect the positive lead of the load test tool to the positive side of the Battery.
3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the [CIRCUIT LOAD TESTING PROCEDURE](#) for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).

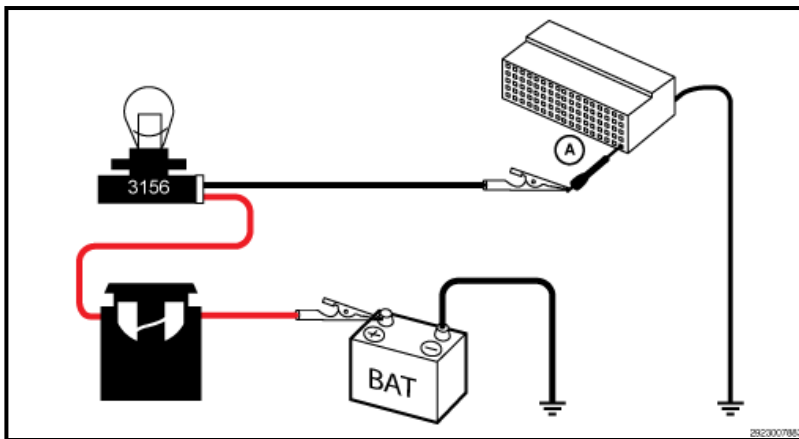
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE:

Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).

**NOTE:**

When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE:

Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Repair the ground circuit for an open or high resistance.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

6. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1DB2-00-ACTUATOR SUPPLY VOLTAGE A CIRCUIT

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The voltage supply circuit(s) for the solenoids and pressure regulators are monitored for open circuits, shorts to ground, and shorts to voltage. If a failure is detected, the Transmission Control Module (TCM) will deactivate the affected power supply circuit and set a corresponding Diagnostic Trouble Code (DTC) relevant to the fault that was detected.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Transmission Control Module (TCM) is in initialization.
- Output power supply is switched off or switched on, battery voltage is greater than or equal to a calibrated value and the time since the last switching of the power supply is greater than a calibrated value.

SET CONDITION

- The failure is detected if the activation of the output stage power supply has not succeeded during TCM initialization.
- The failure is detected if the power supply voltage is greater than a calibrated value after the power supply voltage is either switched on or switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.

- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DB3-00-TCM ECU RESET-RECOVERY OCCURRED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to determine the reason of a reset after the reset occurred. Some of these are initiated by the Transmission Control Module (TCM) software and others may be caused by an under voltage condition. If the TCM detects a condition for initiating a reset, the reason of the reset is stored in an area of Random Access Memory (RAM) that is not initialized during TCM startup. Upon TCM startup this information is read out to store an appropriate Diagnostic Trouble Code (DTC) indicating the reason for the reset.

This diagnostic detects an under voltage reset of the TCM during normal operation (no engine start present). Under voltage resets during engine start will not be stored within the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Reset monitoring is performed during initialization which occurs at power-up or after a reset.

SET CONDITION

- The following failures can cause resets of the high level software:
 - Monitoring of Shift-By-Wire safety functions indicates a failure.
 - Monitoring of Signal I/O safety functions indicates a failure.
 - Failure to store safety relevant fault in the error handler (Error Reaction Manager).
 - Failure to set safety relevant limp in action in the error handler (Error Reaction Manager).
 - Monitoring of Shift-Control safety functions indicates a failure (electrical current not plausible, inconsistency of actual gear or target gear, power flow implausible, power flow inconsistent to actual gear, implausible combination of valves/clutches).
- If no information about the cause of the reset is stored, it is understood to be an under voltage condition. In this case, the active state (operation mode) of the operating system when the reset occurred is stored during:
 - Initialization
 - Normal operation mode
 - Standby

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the second consecutive trip that the diagnostic fails.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. CHECK THE TRANSMISSION CONTROL MODULE (TCM) SOFTWARE

1. Check for any applicable Service Bulletins or software updates that are applicable.

Were any applicable software updates available?

Yes

- With the scan tool, Program the TCM with the latest calibrations in accordance with the Service Information. Refer to [**MODULE PROGRAMMING**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [**3**](#)

3. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1DB6-00-VEHICLE SPEED SIGNAL PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the input (turbine) speed sensor and output speed sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.

- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Input or Output Speed Sensor supply voltage Diagnostic Trouble Codes (DTCs) set.
- No Speed Sensor signal DTCs set.
- No Engine Speed or Wheel Speed Controller Area Network (CAN) signal DTCs set.

SET CONDITION

- The failure is detected if the difference between the wheel speed received via CAN and the following signals are both greater than a calibrated value for a calibrated amount of time:
 - The calculated wheel speed from the output speed measured by the Transmission Control Module (TCM).
 - The calculated wheel speed from the input speed measured by the TCM.

POSSIBLE CAUSES

Possible Causes
ANTI LOCK BRAKE SYSTEM (ABS) DTCS ARE SET
POWERTRAIN CONTROL MODULE (PCM) DTCS ARE SET
OUTPUT SPEED SENSOR IMPROPERLY INSTALLED
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: Diagnose Powertrain Control Module (PCM) and communication DTCs before proceeding. If no PCM or communication DTCs are set, diagnose Anti-Lock Brake System (ABS) DTCs before proceeding.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. VEHICLE SPEED RELATED DTCS

1. Using the DTC data recorded earlier, check for vehicle speed related DTCS in other modules.
2. Perform any Service Bulletins that may apply.

Were any vehicle speed related DTCS in other modules present?

Yes

- Perform the appropriate diagnostic procedure in accordance with the Service Information.

No

- Go To [**3**](#)

3. INSPECT THE OUTPUT SPEED SENSOR

1. Remove the Transmission Oil Pan in accordance with the Service Information.

NOTE: If excessive debris is found in the Transmission Oil Pan, correct the cause of the debris before proceeding with this Diagnostic Test.

2. If equipped, remove the Hydraulic Impulse Solenoid (HIS).
3. Inspect the Output Speed Sensor for proper installation.

Is the Output Speed Sensor properly installed?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [**4**](#)

4. CHECK OUTPUT SPEED SENSOR FOR DAMAGE

1. Carefully remove the Output Speed Sensor from the transmission case.
2. Inspect the Output Speed Sensor for any visible damage.

Is there any damage to the Output Speed Sensor?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Properly install the Output Speed Sensor in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1DB7-00-TORQUE CONVERTER CLUTCH PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The purpose of the monitoring is to detect a failure in the Torque Converter Clutch (TCC) system. The TCC is used to bypass the torque converter. The TCC can be open, closed or in closed loop control mode where a specific clutch slip is controlled. The actual slip and the target slip are compared to detect a failure.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Torque Converter Clutch (TCC) closed or in closed loop control mode.

SET CONDITION

- The difference between the actual slip and target slip of the TCC is greater than a calibrated threshold for an amount of time.
- Engine torque must be lower than a calibrated threshold.
- Calculated pressure inside the TCC must be greater than a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Torque Converter Clutch (TCC) will be commanded open.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL TORQUE CONVERTER INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#).

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#).

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. REPLACE THE TORQUE CONVERTER

1. Replace the Torque Converter in accordance with the Service Information. Refer to [TORQUE CONVERTER, REMOVAL AND INSTALLATION](#) .
2. With the scan tool, erase TCM DTCs.
3. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the Transmission in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test Complete.

P1DB8-00-UNINTENDED TORQUE APPLIED WHILE IN NEUTRAL

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect an unwanted power flow in the transmission. A rationality check of the ratio of input speed to engine speed is done while no power flow is requested.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is shifted from Drive to the Neutral or Park position.
- No Input Speed Sensor signal DTCs are set.
- No failure in engine speed signal via CAN detected.
- Engine speed signal via CAN or output speed signal is above a calibrated value.
- No mechanical limp home mode commanded.
- No power flow requested.
- No Output Speed Sensor signal DTCs are set.

SET CONDITION

- The ratio of input speed to engine speed is less than a calibrated value for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Any driver requests that are not yet honored will be cleared.
- The Transmission will shift into Sixth Gear via Neutral
- Maintain Park position if the DTC is detected while in Park.
- Reverse will be disabled.
- Drive will be disabled.
- Clutch adaptation functions will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL INCORRECT
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR INCORRECT GEAR RATIO (DTCS)

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any Incorrect Gear Ratio DTCs set?

Yes

- Repair Incorrect Gear Ratio DTCs. Refer to **8HP50/850RE AUTOMATIC TRANSMISSION - DIAGNOSTIC CODE INDEX** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID LEVEL

1. Check the Transmission fluid level. Refer to [CHECK FLUID LEVEL](#) .

Was the Transmission fluid level at the correct level?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Check transmission for leaks and repair in accordance with the Service Information.
- Fill Transmission to the proper fluid level. Refer to [CHECK FLUID LEVEL](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DB9-00-TCM ECU RESET EXTENDED LOW VOLTAGE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of the diagnostic is to ensure power flow after a Transmission Control Module (TCM) reset during a mechanical limp-in action or after an under voltage reset due to a low voltage condition of the TCM source voltage.

WHEN MONITORED

SET CONDITION

- Mechanical Limp-In Action was active.
- Reset has occurred during an under voltage condition and the shifter position and driving direction information stored in Random Access Memory (RAM) has been cleared.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM DTCS PRESENT TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Charging System DTCs set?

Yes

- Repair the Charging System DTCs. Refer to **3.0L DIESEL - DIAGNOSTIC CODE INDEX**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK THE (A190) 12 VOLT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

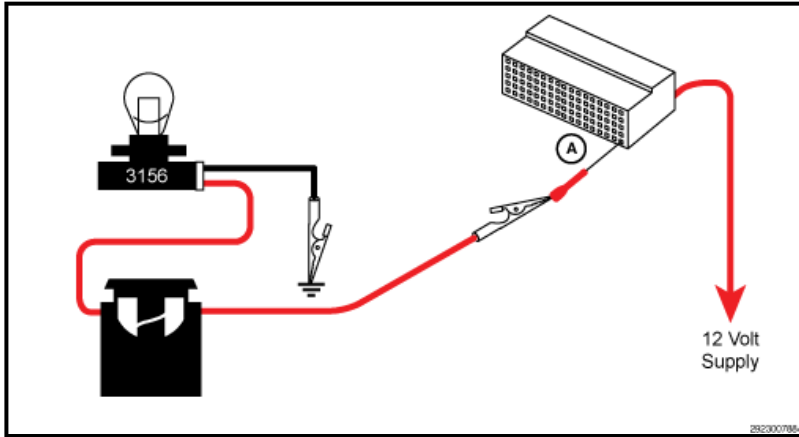
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [4](#)

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

4. ISOLATE AND CHECK THE (A190) 12 VOLT CIRCUIT FOR A SHORT TO GROUND

1. The ignition must be off when checking a circuit for continuity to ground.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the appropriate wiring diagram as a guide to follow the path of the circuit.
3. Connect the negative lead of the DVOM to a known good ground.
4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: There should be no continuity between ground and the circuit being tested.

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the appropriate wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#).

No

- Go To [**5**](#)

5. CHECK THE (Z909) TCM GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the ground circuit.
2. Connect the positive lead of the load test tool to the positive side of the Battery.
3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#).

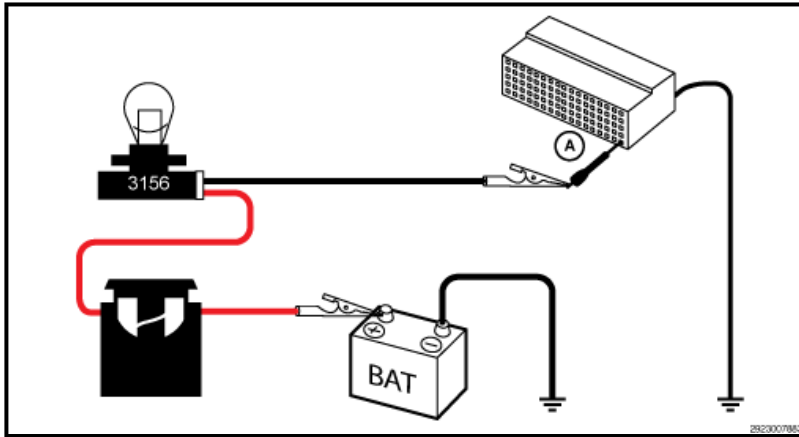
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and

alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [6](#)

No

- Repair the (Z909) TCM ground circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

6. ISOLATE AND CHECK THE (Z909) TCM GROUND CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. The ignition must be off when checking a circuit for continuity to another circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the appropriate wiring diagram as a guide to follow the path of the circuit.
3. Connect the positive lead of the DVOM to the circuit being tested.
4. With the negative lead of the DVOM, probe all of the other circuits at the component harness connector and check for continuity between the circuit and any other circuit.

NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: There should be no continuity between the circuit being tested and any other circuit.

Is there continuity between the circuit being tested and any other circuit?

Yes

- Repair the circuit for a short to another circuit. Use the appropriate wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [7](#)

7. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [8](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

8. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to [MODULE PROGRAMMING](#).
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) performs several diagnostic checks to determine whether the temperature of a clutch is above a calibrated temperature value. These diagnostic checks use temperature models which are based upon input speed and output speed, current gear, target gear, calculated effective pressure on engaging clutch and on the disengaging clutch. The Diagnostic Trouble Codes (DTCs) set by these diagnostics are used to protect the durability of the clutches by controlling the shift operation.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- A gear shift or gear engagement is active.

SET CONDITION

- The calculated clutch temperature is above a calibrated value.

DEFAULT ACTION

- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
INCORRECT TRANSMISSION FLUID LEVEL
TRANSMISSION COOLING SYSTEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to 2.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. CHECK THE TRANSMISSION COOLING SYSTEM CONDITION

1. Inspect the transmission cooling system for damage and proper operation.

Were any problems found?

Yes

- Repair the transmission cooling system.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P1DCD-00-TCM MONITORING PROCESSOR PERFORMANCE MULTIPLE CLUTCHES LOCKED UP

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the pressure regulator and solenoid logic to detect a failure in the activation of the pressure regulators and solenoids. The pressure regulators are used to control the pressure to the clutches and the solenoids are used to activate the pressure to the Parking Lock and to the Position Valve. The commanded currents of all regulators and solenoids are monitored. The monitoring consists of several diagnostic strategies:

- Transmission blocking (Multiple clutches locked up)
- Wrong driving direction (Incorrect driving direction)

- Gear engagement of Reverse gear while driving forward (Unallowed Reverse engagement)
- Unwanted engaging or disengaging of Parking Lock (Unallowed Park engagement)

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Limp home mode is not active.
- Position valve monitoring not active.
- Transmission oil temperature must be above a calibrated value.

SET CONDITION

- More than three pressure regulators are activated at the same time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P1DCE-00-TCM MONITORING PROCESSOR PERFORMANCE INCORRECT DRIVING DIRECTION

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the pressure regulator and solenoid logic to detect a failure in the activation of the pressure regulators and solenoids. The pressure regulators are used to control the pressure to the clutches and the solenoids are used to activate the pressure to the Parking Lock and to the Position Valve. The commanded currents of all regulators and solenoids are monitored. The monitoring consists of several diagnostic strategies:

- Transmission blocking (Multiple clutches locked up)
- Wrong driving direction (Incorrect driving direction)
- Gear engagement of Reverse gear while driving forward (Unallowed Reverse engagement)
- Unwanted engaging or disengaging of Parking Lock (Unallowed Park engagement)

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Limp home mode is not active.
- Position valve monitoring not active.
- Shifter is in DRIVE or REVERSE position.

SET CONDITION

- When Shifter is in DRIVE:
 - A pressure regulator combination for reverse gear is detected (clutches A, B and D activated).
- When Shifter is in REVERSE:
 - A pressure regulator combination different from reverse gear is detected (clutch C or E activated).

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

1. CHECK THE TRANSMISSION CONTROL MODULE (TCM) SOFTWARE

1. Check for any applicable Service Bulletins or software updates that are applicable.

Were any applicable software updates available?

Yes

- With the scan tool, Program the TCM with the latest calibrations in accordance with the Service Information. Refer to .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DD0-00-TCM MONITORING PROCESSOR PERFORMANCE UNALLOWED PARK ENGAGEMENT

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the pressure regulator and solenoid logic to detect a failure in the activation of the pressure regulators and solenoids. The pressure regulators are used to control the pressure to the clutches and the solenoids are used to activate the pressure to the Parking Lock and to the Position Valve. The commanded currents of all regulators and solenoids are monitored. The monitoring consists of several diagnostic strategies:

- Transmission blocking (Multiple clutches locked up)
- Wrong driving direction (Incorrect driving direction)
- Gear engagement of Reverse gear while driving forward (Unallowed Reverse engagement)
- Unwanted engaging or disengaging of Parking Lock (Unallowed Park engagement)

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Limp home mode is not active.
- Position valve monitoring is not active.
- Shifter is in PARK position.

SET CONDITION

- The solenoid for the position valve or the pressure regulator of clutch C is activated for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .**

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DD2-00-TORQUE REQUEST SIGNAL FROM TCM DENIED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to monitor the accuracy of the engine torque signals by monitoring the engine flag "TCM torque request allowed".

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage within a calibrated range.
- No Controller Area Network (CAN) Bus monitoring Diagnostic Trouble Codes (DTCs) set.
- No CAN Bus message monitoring DTCs set.

SET CONDITION

- Engine signal notifies the TCM that torque interventions are not possible.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The Torque Converter Clutch (TCC) will be commanded open.

- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- The TCM will limit the current to the Torque Converter Clutch (TCC) solenoid to 50mA. The TCC will be open.
- Maximum system hydraulic pressure will be limited.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
BODY CONTROL MODULE (BCM) CAN BUS DTCS SET
POWERTRAIN CONTROL MODULE (PCM) DTCS SET
TRANSMISSION CONTROL MODULE (TCM) DTCS SET
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR BODY CONTROL MODULE (BCM) CONTROLLER AREA NETWORK (CAN) BUS DTCS

1. With the scan tool, read BCM DTCS.

Are any BCM CAN bus DTCS set?

Yes

- Repair BCM CAN Bus DTCS in accordance with the Service Information. If DTC U0002-00 is set, perform that diagnostic first. Refer to **BODY CONTROL MODULE (BCM) - DIAGNOSTIC CODE INDEX** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To **2**

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCS.

Are any PCM DTCS set?

Yes

- Repair PCM DTCS. Refer to **3.0L DIESEL - DIAGNOSTIC CODE INDEX** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To **3**

3. CHECK FOR OTHER TRANSMISSION CONTROL MODULE (TCM) DTCS

1. With the scan tool, read TCM DTCS and record on the repair order.

Are any other TCM DTCs set?

Yes

- Repair other TCM DTC(s). Refer to the appropriate information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DDD-00-TCM MONITORING PERFORMANCE UNABLE TO DISENGAGE DRIVE OR REVERSE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect a failure in the activation of the pressure regulators during gear disengagement or while NEUTRAL or PARK position is engaged. This is a rationality check between the activated pressure regulators and the shifter selected gear.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Gear Disengagement:
 - Shifter is in PARK or NEUTRAL.
 - Three pressure regulators are activated.
- Neutral or Park:
 - Shifter is in PARK or NEUTRAL.
 - Since the requested position change to PARK or NEUTRAL, the number of activated pressure regulators has been less than three for more than a calibrated amount of time.

SET CONDITION

- Gear Disengagement:
 - A failure is detected during gear disengagement if three or more pressure regulators are activated at the same time for a calibrated amount of time.
- Neutral or Park:
 - A failure is detected while in Neutral or Park position is engaged if in addition to the two pressure regulators a third pressure regulator is activated at the same time for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.

- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [3](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

3. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to **MODULE PROGRAMMING** .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DF3-00-ECU NOT INITIALIZED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the time period of the Electronic Shift Module (ESM) initialization state. The Transmission Control Module (TCM) receives the status of the initialization state from the ESM on the Controller Area Network (CAN) Bus while evaluating a counter in the TCM to determine if the initialization time is excessive.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No Controller Area Network (CAN) monitoring Diagnostic Trouble Codes (DTCs) set.
- Battery voltage is above a calibrated value.
- No shifter reset requested.

SET CONDITION

- The time period of the Electronic Shift Module (ESM) initialization is greater than a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.

- Maintain Park position if the DTC is detected while in Park.
- Shut off engine to engage Park if there is a lever fault.
- Any driver requests that are not yet honored will be cleared.
- Car wash Neutral hold feature is disabled.
- Reverse will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.

POSSIBLE CAUSES

Possible Causes
ELECTRONIC SHIFT MODULE (ESM)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK FOR TRANSMISSION CONTROL MODULE (TCM) CONTROLLER AREA NETWORK (CAN) BUS DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read TCM DTCs and record on the repair order.

Are any TCM CAN Bus DTCs set?

Yes

- Repair TCM CAN bus DTCs. If DTC U0001-00-CAN C BUS is set, perform that diagnostic first. Refer to **8HP50/850RE AUTOMATIC TRANSMISSION - DIAGNOSTIC CODE INDEX**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Go To **2**

2. CHECK IF ELECTRONIC SHIFT MODULE (ESM) DTCS ARE PRESENT

1. With the scan tool, read ESM DTCs and record on the repair order.

Are any ESM DTCs set?

Yes

- Repair ESM DTC(s). Refer to **DIAGNOSIS AND TESTING**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

P215C-00-OUTPUT SHAFT SPEED WHEEL SPEED CORRELATION

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of this diagnostic is to detect failures of the Wheel Speed Sensor signal via Bus and the Output Speed Sensor signal. The DTC is set when the difference between output speed and wheel speed is greater than a calibrated threshold during shifting, which depends on the axle ratio.

JL, JT and some DJ vehicles that are equipped with oversized tires need to have the proper tire size calibration programmed to the vehicle. Refer to STAR Online Publication, subject "Oversized Tire Calibration For Customized Jeep Wrangler, Gladiator, 2019 Ram Heavy Duty DJ, MVP Update Required, MVP Hotline" for more information.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No Wheel Speed Sensor failures are detected while a gear is engaged.
- No Output Speed Sensor failures are detected while a gear is engaged.
- Engine speed signal is valid.
- Engine speed is greater than a calibrated value.
- Output speed or calculated output speed from the driven wheels is greater than a calibrated threshold.
- Output speed is greater than calibrated threshold.
- Wheel speed is greater than calibrated threshold.
- If equipped, Transfer Case shifting state signal is valid.

SET CONDITION

- A failure is detected if the absolute difference between the output speed measured by the TCM and the output speed calculated from the wheel speed signal via BUS during a shifting operation is greater than a calibrated threshold for a calibrated amount of time.

DEFAULT ACTION

- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).

POSSIBLE CAUSES

Possible Causes
LOSS OF COMMUNICATION WITH THE ANTI LOCK BRAKE SYSTEM (ABS)
INCORRECT TIRE SIZE
MECHANICAL DRIVELINE FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

1. CHECK IF THE VEHICLE WILL DRIVE

1. Attempt to drive the vehicle.

Does the vehicle drive?

Yes

- Go To

Refer to [2](#).

No

- Inspect the driveline for broken components and repair. Items to inspect include:
 - Driveshaft and driveshaft joints.
 - Axle shafts or halfshafts.
 - Ring and pinion or differential gears.
 - If equipped, transfer case or Power Transfer Unit (PTU).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. CHECK FOR PROPER TIRE SIZE

1. Compare the tires on the vehicle to the vehicle placard label typically located in the drivers door opening.

Does the tire size match the vehicle placard?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: If the DTC C0078-86-TIRE DIAMETER - SIGNAL INVALID is present in the ABS module, diagnose this DTC before continuing. Refer to [ANTILOCK BRAKE SYSTEM \(ABS\) - DIAGNOSTIC CODE INDEX](#).

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [7](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

4. CHECK FOR OVERSIZE TIRES

1. Check the tire size on the vehicle sidewall.

Are the tires on the vehicle 33 inches or greater in diameter?

Yes

- Check for STAR Online cases for Oversized Tire Calibration and perform procedure.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [5](#).

5. CHECK THE BODY CONTROL MODULE (BCM) CONFIGURATION

NOTE: The Vehicle Identification Number (VIN) of the Body Control Module (BCM) must match the vehicles VIN.

NOTE: There is some variation in tire circumference depending on inflation pressure and amount of tire wear. A properly inflated tire circumference should typically be within 6 mm (0.250 in) of the Dynamic Tire Circumference stored in the BCM.

1. With the scan tool, run a vehicle configuration report.
2. Measure the tire circumference.
3. Compare the measured tire circumference to the Dynamic Tire Circumference stored in the BCM.

Does the tire circumference on the vehicle closely match the Dynamic Tire Circumference stored in the BCM?

Yes

- Go To [6](#)

No

- Install the correct tires for the vehicle.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

6. CHECK THE BODY CONTROL MODULE FOR AVAILABLE PRODUCTION TIRE SIZES

NOTE: A non-production size tire cannot be programmed into the BCM. The production Powertrain, with the production size tires, is the only emissions certified configuration that is available for reprogramming.

1. Check if the tire size installed on the vehicle is an available option for the vehicle configuration for this vehicle.

Is there a production tire size (Dynamic Tire Circumference) option that can be programmed into this BCM?

Yes

- Update the vehicle configuration.

Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Install the correct size tires for this vehicle.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

7. CHECK FOR DTC U0121-00-LOST COMMUNICATION WITH ABS MODULE

1. With the scan tool, read TCM DTCs.

Is DTC U0121-00-LOST COMMUNICATION WITH ABS MODULE present?

Yes

- Repair DTC U0121-00-LOST COMMUNICATION WITH ABS MODULE. Refer to [3.0L DIESEL - DIAGNOSTIC CODE INDEX](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P2761-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT-OPEN

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated.
- Torque Converter Clutch (TCC) Low Side Pressure Regulator Switch will be commanded off.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [**PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**](#).

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.

4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P2762-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)

- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

Condition One:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.
- No shifting is in progress.

Condition Two:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.
- No shifting is in progress.
- Clutch involved in shifting.

Condition Three:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.
- No shifting is in progress.
- No clutch involved in shifting.

Condition Four:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

Condition One:

- A current too low failure is detected if the calculated pressure control solenoid feedback current is less than or equal to a calibrated value.
- A current too high failure is detected if the calculated pressure control solenoid feedback current is greater than or equal to a calibrated value.

Condition Two:

- A current too low failure is detected if the calculated pressure control solenoid feedback current is less than or equal to a calibrated value.
- A current too high failure is detected if the calculated pressure control solenoid feedback current is greater than or equal to a calibrated value.

Condition Three:

- A current too low failure is detected if the calculated pressure control solenoid feedback current is less than or equal to a calibrated value.
- A current too high failure is detected if the calculated pressure control solenoid feedback current is greater than or equal to a calibrated value.

Condition Four:

- A Serial Peripheral Interface (SPI) communication failure in the SPI communication between the Central Processing Unit (CPU) and the ASIC is detected based upon the validity of the check-byte, the timing and the feedback signal of the message.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID
TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCS.
7. Road test the vehicle and check for DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P2763-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated.
- Torque Converter Clutch (TCC) Low Side Pressure Regulator Switch will be commanded off.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID
TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).
- Test complete.

P2764-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID
TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.

2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

U0001-00-CAN C BUS

NOTE: This DTC may not be listed in the Body Control Module (BCM) diagnostic procedures. If this DTC is not found in the BCM diagnostic procedures, perform the comparable CAN C Bus diagnostic test, such as CAN C BUS-NO SIGNAL, CAN C BUS OFF PERFORMANCE or CAN C SIGNAL MISSING.

Perform the comparable CAN C Bus diagnostic tests in the BCM. Refer to [BODY CONTROL MODULE \(BCM\) - DIAGNOSTIC CODE INDEX](#) .

U0074-00-DEDICATED POWERTRAIN (DPT) CAN BUS OFF

THEORY OF OPERATION

The purpose of the diagnostic is to detect existing failures on the Dedicated Powertrain Controller Area Network (DPT CAN) Bus. The TCM software monitors the state of the BUS controller(s) and reports any failures.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage within a valid range.
- CAN bus diagnosis delay timer has elapsed.

SET CONDITION

- The Transmission Control Module (TCM) detects the DPT CAN is in an OFF state.

DEFAULT ACTION

- Any driver requests that are not yet honored will be cleared.

POSSIBLE CAUSES

Possible Causes
DPT CAN BUS (+) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (-) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (+) CIRCUIT SHORT TO GROUND
DPT CAN BUS (-) CIRCUIT SHORT TO GROUND
DPT CAN BUS (+) CIRCUIT SHORT TO ANOTHER CIRCUIT
DPT CAN BUS (-) CIRCUIT SHORT TO ANOTHER CIRCUIT
ELECTRONIC SHIFT MODULE (ESM)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: For vehicle communication problems, use the scan tool to refer to the **Network Review Screen**. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red. Selecting any of the network components allows access to the source of the problem.

- With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
- With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
- With the scan tool, erase all DTCs.
- Turn the ignition off for a minimum of 10.0 seconds.
- Turn the ignition on.
- Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
- With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK THE DEDICATED POWERTRAIN (DPT) CONTROLLER AREA NETWORK (CAN) CIRCUIT VOLTAGE

- Turn the ignition off.
- Disconnect the ESM harness connector.
- Turn the ignition on.

4. Measure the voltage between ground and the (D441) DPT CAN (+) circuit at the TCM harness connector.
5. Measure the voltage between ground and the (D440) DPT CAN (-) circuit at the TCM harness connector.

Is the voltage between 2.4 and 2.6 volts for each circuit?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TCM VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Go To [3](#)

3. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.
3. Measure the resistance of the (D441) DPT CAN (+) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the (D441) DPT CAN (+) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

4. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.
3. Measure the resistance of the (D440) DPT CAN (-) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms for each circuit?

Yes

- Go To [5](#)

No

- Repair the (D440) DPT CAN (-) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

5. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D441) DPT CAN (+) circuit at the TCM harness connector.

Is there continuity between ground and the either of the CAN DPT circuits?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [6](#)

6. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D440) DPT CAN (-) circuit at the TCM harness connector.
2. Check for continuity between ground and the (D440) CAN DPT (-) circuit at the TCM harness connector.

Is there continuity between ground and the either of the CAN DPT circuits?

Yes

- Repair the (D440) CAN DPT (-) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [7](#)

7. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D441) DPT CAN (+) circuit and all other circuits at the TCM harness connector.

Is there continuity between either CAN DPT circuit and any other circuit?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [8](#)

8. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D440) DPT CAN (-) and all other circuits at the TCM harness connector.

Is there continuity between the (D440) DPT CAN (-) and any other circuit?

Yes

- Repair the (D440) DPT CAN (-) for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to **MODULE, ELECTRONIC SHIFT (ESM), REMOVAL AND INSTALLATION** .
- Perform the TCM VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

U0100-00-LOST COMMUNICATION WITH ECM/PCM

NOTE: Perform this diagnostic procedure **ONLY** when the DTC status is "Active". If the DTC status is "Stored" **DO NOT** proceed with this diagnostic procedure. A "Stored" DTC will not affect the performance of the vehicle.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0102-00-LOST COMMUNICATION WITH TRANSFER CASE CONTROL MODULE / AWD

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0103-00-LOST COMMUNICATION WITH ELECTRIC GEAR SHIFT MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0104-00-LOST COMMUNICATION WITH CRUISE CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0120-00-LOST COMMUNICATION WITH STARTER/GENERATOR CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0121-00-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0140-00-LOST COMMUNICATION WITH BODY CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0155-00-LOST COMMUNICATION WITH CLUSTER-CCN

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0212-00-LOST COMMUNICATION WITH STEERING COLUMN CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0401-00-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0403-00-IMPLAUSIBLE DATA RECEIVED FROM TCASE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0404-00-IMPLAUSIBLE DATA RECEIVED FROM ESM

NOTE: This DTC indicates a communication issue has occurred between the Sending control module (Electronic Shift Module (ESM) and the Reporting control module(s) that set this fault.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0405-00-INVALID DATA RECEIVED FROM CRUISE CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0415-00-IMPLAUSIBLE DATA RECEIVED FROM ABS

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0422-00-IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE

NOTE: This DTC indicates a communication issue has occurred between the Sending control module (Body Control Module - BCM) and the Reporting control module(s) that set this DTC.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0423-00-IMPLAUSIBLE DATA RECEIVED FROM CLUSTER-CCN

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U0429-00-IMPLAUSIBLE DATA RECEIVED FROM SCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to COMMUNICATION DIAGNOSTIC PROCEDURE .

U0469-00-INVALID DATA RECIEVED FROM STARTER/GENERATOR CONTROL MODULE

NOTE: Treat this DTC as an **IMPLAUSIBLE SIGNAL DTC** when performing the **COMMUNICATION DIAGNOSTIC PROCEDURE**.

Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to COMMUNICATION DIAGNOSTIC PROCEDURE .

U11E3-00-TCM LOST COMMUNICATION WITH ESM ON DPT CAN

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the Controller Area Network (CAN) bus, the transmitted messages on the CAN bus and the validity of the CAN signals. Several control units are connected to the CAN bus which send their messages cyclically in a defined time window. The messages contain multiple signals representing vehicle information.

CAN Bus Monitoring: To distinguish general problems with the CAN bus (e.g. electrical problems) from problems with certain messages or signals, the general state of the CAN bus is monitored.

CAN Message Monitoring: All messages received and used by the Transmission Control Module (TCM) are monitored for timeout and validity of the Data Length Code (DLC) information in the message header. If available, the message is also monitored for the validity of a checksum and for the correct behavior of an alive-counter that the sending control unit is expected to increment on each transmittal.

CAN Signal Monitoring: If the sending control unit does not have valid information to send, it may send a defined failure value indicating an invalid signal. Incoming signals with a defined failure value are monitored for signal validity.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is switched on.
- Battery voltage is within a calibrated range.
- The Electronic Shifter Module (ESM) is active on the CAN bus.
- A calibrated amount of time has expired after the ignition is switched On.
- No failure is detected in CAN bus monitoring.

SET CONDITION

- DPT CAN Bus messages not received from the Electronic Shift Module (ESM) for a calibrated amount of time.

POSSIBLE CAUSES

Possible Causes
DPT CAN BUS (+) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (-) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (+) CIRCUIT SHORT TO GROUND
DPT CAN BUS (-) CIRCUIT SHORT TO GROUND
DPT CAN BUS (+) CIRCUIT SHORT TO ANOTHER CIRCUIT
DPT CAN BUS (-) CIRCUIT SHORT TO ANOTHER CIRCUIT
ELECTRONIC SHIFT MODULE (ESM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: For vehicle communication problems, use the scan tool to refer to the **Network Review Screen**. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red. Selecting any of the network components allows access to the source of the problem.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.
3. Measure the resistance of the (D441) DPT CAN (+) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms?

Yes

- Go To [3](#)

No

- Repair the (D441) DPT CAN (+) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

3. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.

3. Measure the resistance of the (D440) DPT CAN (-) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms?

Yes

- Go To [4](#)

No

- Repair the (D440) DPT CAN (-) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

4. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D441) DPT CAN (+) circuit at the TCM harness connector.

Is there continuity between ground and the (D441) DPT CAN (+) circuit?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [5](#)

5. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D440) DPT CAN (-) circuit at the TCM harness connector.
2. Check for continuity between ground and the (D440) CAN DPT (-) circuit at the TCM harness connector.

Is there continuity between ground and the (D440) CAN DPT (-) circuit?

Yes

- Repair the (D440) CAN DPT (-) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [6](#)

6. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D441) DPT CAN (+) circuit and all other circuits at the TCM harness connector.

Is there continuity between the (D441) DPT CAN (+) circuit and any other circuit?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [7](#)

7. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D440) DPT CAN (-) and all other circuits at the TCM harness connector.

Is there continuity between the (D440) DPT CAN (-) and any other circuit?

Yes

- Repair the (D440) DPT CAN (-) for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to [**MODULE, ELECTRONIC SHIFT \(ESM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TCM VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

U11E4-00-CAN COMMUNICATION MESSAGES MISSING

NOTE: This DTC may not be listed in the Body Control Module (BCM) diagnostic procedures. If this DTC is not found in the BCM diagnostic procedures, perform the comparable CAN C Bus diagnostic test, such as CAN C BUS-NO SIGNAL, CAN C BUS OFF PERFORMANCE or CAN C SIGNAL MISSING.

Perform the comparable CAN C Bus diagnostic tests in the BCM. Refer to [**BODY CONTROL MODULE \(BCM\) - DIAGNOSTIC CODE INDEX**](#) .

U1267-00-NO VALID DATA FROM ESM ON CAN-C OR CAN-DPT

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the Controller Area Network (CAN) C and CAN DPT circuits for failures. This Diagnostic Trouble Code (DTC) sets when there is a problem with both CAN busses and the TCM can not receive data from the Electronic Shift Module (ESM) to determine the shifter position.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- The battery voltage is greater than a calibrated threshold.
- CAN BUS communications are active.
- The delay time since the ignition is switched On has elapsed.

SET CONDITION

- No valid data from Electronic Shift Module (ESM) on CAN C or DPT CAN.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Shut off engine to engage Park if there is a lever fault.
- Maintain Park position if the DTC is detected while in Park.

- Reverse will be disabled.
- Car wash Neutral hold feature is disabled.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.
- Remote Start feature, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
RELATED CAN BUS DTC PRESENT
RELATED ESM DTC PRESENT
ELECTRONIC SHIFT MODULE (ESM)

Always perform the **DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE DTC

1. With the scan tool, read TCM DTCs and record on the repair order.
2. Record the Event Data and Environmental Data.
3. With the scan tool, erase DTCs.
4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
5. With the scan tool, read all DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK FOR TRANSMISSION CONTROL MODULE (TCM) CONTROLLER AREA NETWORK (CAN) BUS DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read TCM DTCs and record on the repair order.

Are any TCM CAN bus DTCs set?

Yes

- Repair TCM CAN bus DTCs. If DTC U0001-00 CAN C BUS or U0074-00 DEDICATED POWERTRAIN (DPT) CAN BUS OFF are set, perform that diagnostic first. Refer to the appropriate information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To [3](#)

3. CHECK FOR ESM DTCS

1. With the scan tool, read ESM DTCs and record on the repair order.

Are any ESM DTCs set?

Yes

- Repair ESM DTCs. Refer to [**DIAGNOSIS AND TESTING**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to [**MODULE, ELECTRONIC SHIFT \(ESM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

U1400-00-IMPLAUSIBLE TPS SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U1401-00-IMPLAUSIBLE ENGINE SPEED SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U1412-00-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U1424-00-IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U1428-00-IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U1461-00-IMPLAUSIBLE DATA RECEIVED FROM ESM ON DPT

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [**COMMUNICATION DIAGNOSTIC PROCEDURE**](#) .

U1465-00-IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U1466-00-IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED ON DPT CAN

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U1477-00-IMPLAUSIBLE PADDLE SHIFTER DATA RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

2021 AUTOMATIC TRANSMISSION

8HP50/850RE Automatic Transmission - DTCS P0219-00 To P0974-00 - Gladiator [EBH, EC1, EC3, ERC]

DIAGNOSIS AND TESTING

P0219-00-ENGINE OVERSPEED CONDITION

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

This diagnostic monitors the Input (Turbine) Speed Sensor signal and Engine Speed signal through the Controller Area Network (CAN) in order to detect conditions that could indicate a transmission that is slipping or does not engage a gear properly. This diagnostic monitors for these conditions while the transmission is in a fixed gear and during shift events. Under certain conditions, an Engine mechanical problem can cause this Diagnostic Trouble Code (DTC) to set.

WHEN MONITORED

- When in a fixed gear:
 - The Shifter position is in DRIVE or REVERSE.
 - Not in 7th or 8th gear while in LOW mode.
- When a shift event is in progress:
 - The Shifter position is in DRIVE or REVERSE.

SET CONDITION

- When in a fixed gear:
 - The engine speed is greater than a calibrated value for a calibrated amount of time.
- When a shift event is in progress:
 - The calculated input speed of the target gear is greater than a calibrated value for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
MECHANICAL TRANSMISSION PROBLEM
MECHANICAL ENGINE PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

1. CHECK FOR OTHER DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any Gear Ratio or Speed Sensor DTCs set?

Yes

- Repair the TCM DTCs. Refer to [8HP50/850RE AUTOMATIC TRANSMISSION - DIAGNOSTIC CODE INDEX](#).

No

- Go To [2](#)

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCs.

Are any PCM DTCs set?

Yes

- Repair the PCM DTCs. Refer to [8HP50/850RE AUTOMATIC TRANSMISSION - DIAGNOSTIC CODE INDEX](#).

No

- Go To [3](#)

3. CHECK FOR ENGINE MECHANICAL PROBLEMS

1. Determine if any Engine mechanical problems are present.

Are any Engine mechanical problems present?

Yes

- Repair Engine in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [4](#)

4. CHECK FOR TRANSMISSION MECHANICAL PROBLEMS

1. Turn the ignition off.
2. Remove the Transmission Oil Pan and inspect for excessive debris or a plugged Transmission Oil Filter.

Is there any debris, plugged Transmission Oil Filter, or signs of an internal Transmission problem?

Yes

- Repair the Transmission in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [5](#)

5. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P0562-00-SYSTEM VOLTAGE LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the system voltage level at the TCM supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low
- System Voltage High

If the TCM supply voltage is below a threshold that is lower than the System Voltage Excessively Low threshold, the TCM will not supply power to the solenoid valves and pressure regulators. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- High side switch is activated.
- When shifter is in PARK or NEUTRAL:
 - Engine speed signal via Controller Area Network (CAN) or Input Speed Sensor signal is above a calibrated value.

- When shifter is in DRIVE or REVERSE:
 - Engine speed via CAN is above a calibrated value or engine speed via CAN is invalid.

SET CONDITION

- The Transmission Control Module (TCM) system voltage is less than a calibrated value.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
OPEN FUSE LOW BATTERY VOLTAGE ENGINE CHARGING SYSTEM TCM FUSED B+ (BATTERY VOLTAGE) CIRCUIT OPEN OR HIGH RESISTANCE TCM GROUND CIRCUIT OPEN OR HIGH RESISTANCE TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Charging System DTCs set?

Yes

- Repair the Charging System DTCs. Refer to the appropriate information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.

3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Go To [5](#)

3. CHECK THE (A190) FUSED B+ CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the (A190) Fused B+ circuit.
2. Connect the positive lead of the load test tool to the (A190) Fused B+ circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .

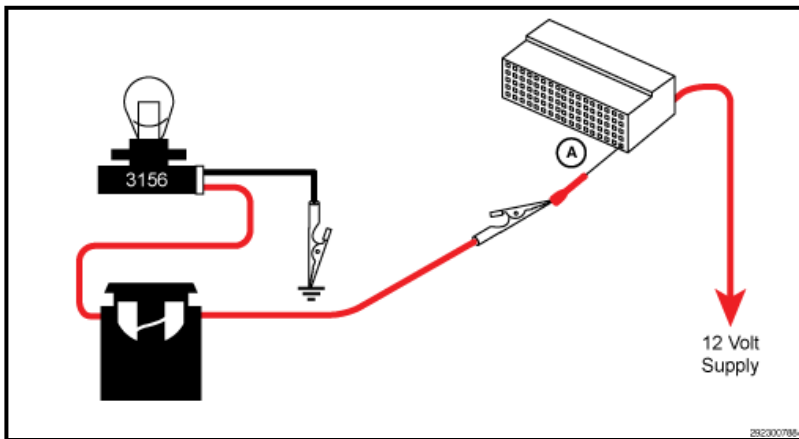
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.

3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [4](#)

No

- Repair the (A190) Fused B+ circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

4. CHECK THE (Z909) TCM GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the ground circuit.
2. Connect the positive lead of the load test tool to the positive side of the Battery.
3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing

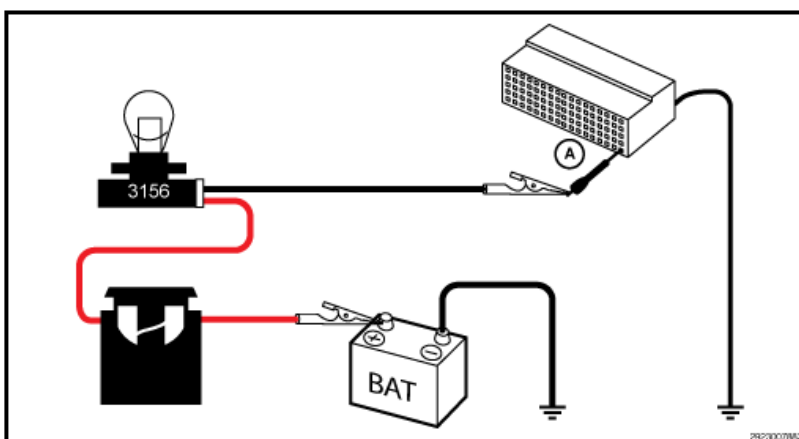
circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Repair the (Z909) TCM ground circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

5. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0563-00-SYSTEM VOLTAGE HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the system voltage level at the TCM supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low
- System Voltage High

If the TCM supply voltage is below a threshold that is lower than the System Voltage Excessively Low threshold, the TCM will not supply power to the solenoid valves and pressure regulators. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

- Engine speed via Controller Area Network (CAN) is above a calibrated value or engine speed via CAN is invalid.
- No jump start identified when:
 - Failure detected in Engine speed signal monitoring and no jump start identified.

SET CONDITION

- Battery voltage is above a calibrated value.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM OVERCHARGE CONDITION
JUMP START FROM A 24 VOLT SYSTEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DTCS

1. With the scan tool, read PCM DTCS.

Are any Charging System DTCS set?

Yes

- Repair Charging System DTCS. Refer to **3.0L CHARGING SYSTEM (SERVICE INFORMATION)** .
- Perform the TRANSMISSION VERIFICATION TEST to verify the Transmission and or TCM was not damaged. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To **2**

2. CHECK IF VEHICLE WAS JUMP STARTED WITH 24-VOLT SYSTEM

NOTE: **Some Recreational Vehicles (RVs), Buses, and Semi Tractors use 24-volt systems.**

1. Check if the vehicle was jump started by a vehicle with a 24-volt charging system.

Was the vehicle jump started by a vehicle with a 24-volt charging system?

Yes

- This is the cause of the DTC. Erase the DTC and return the vehicle to the customer.
- Perform the TRANSMISSION VERIFICATION TEST to verify the Transmission and or TCM was not damaged. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [3](#)

3. CHECK INDICATED TCM BATTERY VOLTAGE

1. Start the Engine and raise the engine speed to 2, 000 rpm.
2. With the scan tool, monitor the TCM Battery Voltage for 60 seconds.

Does the TCM Battery Voltage read above 16 volts at any time during the test?

Yes

- Go To [4](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

4. COMPARE TCM VOLTAGE TO BATTERY VOLTAGE

1. Start the Engine and raise the engine speed to 2, 000 rpm.
2. With the scan tool, read the TCM Battery Voltage.
3. Measure the voltage at the Battery.
4. Compare the readings.

Does the measured voltage reading match the scan tool TCM Battery Voltage reading?

Yes

- Repair the Charging System for an over charging condition in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0601-00-INTERNAL CONTROL MODULE MEMORY CHECKSUM ERROR

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the validity of the Read Only Memory (ROM) flash memory. A Cyclic Redundancy Check (CRC) checksum is calculated for each memory block of the flash memory and compared with the stored reference checksum. There is a different stored reference checksum for each memory

block. If the checksum rationality check of the last memory block has finished, the calculation starts all over again beginning with the first memory block.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE REQUIRES AN UPDATE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: **Read Service Bulletins to determine if the software update is applicable to the customer complaint.**

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [2](#).

No

- Go To

Refer to [3](#).

2. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to [MODULE PROGRAMMING](#) .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P0607-00-ECU INTERNAL PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates there is an issue with the TCM internal computing process.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- The ignition is on.

SET CONDITION

- If the TCM detects the battery voltage or switched voltage is less than 4.0 volts for a calibrated amount of time.
- The redundant signal of the speed sensor signals do not correspond.
- The results of two independently performed calculation within the TCM are not equal.
- A communication problem is detected between the Main Microprocessor (MMP) and the second microprocessor is detected for a calibrated amount of time.
- An internal failure of the second microprocessor has occurred.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- Clutch adaptation functions will be disabled.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

P0613-00-INTERNAL TRANSMISSION PROCESSOR

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information**.

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for internal hardware and software failures. If a failure is detected, a Diagnostic Trouble Code (DTC) will set that indicates the exact nature of the failure.

WHEN MONITORED

- The ignition is on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE.**

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE (TCM)

Repair

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P061B-00-INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the positive engine torque request calculation in the Transmission Control Module (TCM) and the engine response resulting from the positive engine torque request. This diagnostic includes, comparison of the calculated torque request versus commanded torque request. The rationality of the actual crankshaft torque signal received from the Powertrain Control Module (PCM). The rationality of the actual input and output speed gradient of the transmission. The comparison of two torque request signals that are managed separately in the software which come after the torque request calculation but before the torque request is sent to the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE (TCM)

Repair

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P062F-00-INTERNAL CONTROL MODULE EEPROM ERROR

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect if the Electronic Erasable Programmable Read Only Memory (EEPROM) data has been corrupted or access to the data is not possible anymore. If the access is not possible anymore the Flash Control Unit (FCU) Application-Specific Integrated Circuit (ASIC) sets a hardware failure. The corruption of the data is detected by calculating a checksum and comparing it to a reference value. The EEPROM includes all data that can change from transmission to transmission but has to be stored in non-volatile memory (e.g. fault memory, customer specific data such as part numbers, etc). The physical EEPROM emulation memory in flash is sub divided into several sector groups. Each sector group holds one set of data that was stored at the moment of an update. If all sector groups are filled, the sector group with the oldest set of data is used for the update. Updating the sector group results in erasing the entire sector group memory and then programming the current data to it. To always ensure a valid backup of the EEPROM data, at least 2 non-defective sector groups are needed. Each sector group is checksum protected and the validity of the checksum is verified before reading and after writing the data.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- An Electronic Erasable Programmable Read Only Memory (EEPROM) read or write operation has occurred.

SET CONDITION

- The number of sector groups with a valid checksum is less than two.
- The Flash Control Unit is defective.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM) ASSEMBLY

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

CHECK IF TRANSMISSION CONTROL MODULE (TCM) IS PROGRAMMABLE

1. With the scan tool, program the TCM with the latest software. Perform the TCM PROGRAMMING PROCEDURE. Refer to **MODULE PROGRAMMING** .

Were you able to program the TCM successfully?

Yes

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0634-PCM/ECM/TCM INTERNAL TEMPERATURE TOO HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect an over temperature shutdown of the Transmission Control Module (TCM) to protect the TCM hardware.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- One of the microchip temperature sensors indicates a temperature that is greater than a calibrated value.
- A failure is detected on either microchip temperature sensor.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
INCORRECT TRANSMISSION FLUID LEVEL
CASE VENT PLUGGED OR DAMAGED
TRANSMISSION COOLER AIRFLOW IS COMPROMISED
RESTRICTION IN TRANSMISSION COOLING SYSTEM
TORQUE CONVERTER
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE .**

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR CONDITIONS THAT COULD CAUSE OVERHEATING

1. Check for the following conditions:
 - Incorrect Transmission Fluid level. Refer to [CHECK FLUID LEVEL](#) .
 - Case vent plugged or damaged.
 - Transmission Cooler air flow restriction.
 - Fluid restriction in the Transmission Cooler.
 - Bad Torque Converter.

Were any problems found?

Yes

- Repair the condition as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0642-00-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) provides the various sensors in transmission with Supply Voltage circuits. One Supply Voltage circuit can provide power for one or more sensors. This diagnostic monitors one of the sensor voltage supply circuits for faults. This diagnostic also monitors the Input and Output Speed Sensors. If both speed sensors indicate an error at the same time or, if the Voltage Supply circuit voltage is out of normal range, this Diagnostic Trouble Code (DTC) will set.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Transmission Control Module (TCM) voltage is above a calibrated value.

SET CONDITION

- Sensor Voltage Supply circuit voltage is less than a calibrated value.
- Both the Input and Output Speed Sensor signals indicate a short to ground or break failure for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- Remote Start feature, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination. Pay particular attention to power and ground circuits.
5. Reinstall the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .
- Test complete.

P0643-00-SENSOR REFERENCE VOLTAGE 1 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) provides the various sensors in transmission with Supply Voltage circuits. One Supply Voltage circuit can provide power for one or more sensors. This diagnostic monitors one of the sensor voltage supply circuits for faults. This diagnostic also monitors the Input and Output Speed Sensors. If both speed sensors indicate an error at the same time or, if the Voltage Supply circuit voltage is out of normal range, this Diagnostic Trouble Code (DTC) will set.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Transmission Control Module (TCM) voltage is above a calibrated value.

SET CONDITION

- The Sensor Voltage Supply circuit voltage is greater than a calibrated value for a calibrated amount of time.
- Both the Input and Output Speed Sensor signals indicate a short to battery failure for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- Remote Start feature, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination. Pay particular attention to power and ground circuits.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0667-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: **If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.**

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms

TEMPERATURE vs RESISTANCE	
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No engine speed signal failure detected.
- No turbine speed signal failure detected.
- No monitoring failure of TCM Internal Temperature Sensor 1 detected.
- Engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal is above a calibrated value for five consecutive minutes.

SET CONDITION

- The difference between TCM Internal Temperature Sensor 1 and the TCM Internal Temperature Sensor 2 and Oil Temperature Sensor exceeds a calibrated value when the system is in a steady thermodynamic state.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0668-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 1 is less than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P0669-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 1 is greater than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

P06AC-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 PERFORMANCE

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature

shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No engine speed signal failure detected.
- No turbine speed signal failure detected.
- No monitoring failure of TCM Internal Temperature Sensor 2 detected.
- Engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal is above a calibrated value for five consecutive minutes.

SET CONDITION

- The difference between TCM Internal Temperature Sensor 2 and the TCM Internal Temperature Sensor 1 and Oil Temperature Sensor exceeds a calibrated value when the system is in a steady thermodynamic state.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P06AD-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 2 is less than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P06AE-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 2 is greater than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0701-00-TRANSMISSION CONTROL SYSTEM RANGE/PERFORMANCE

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The Transmission Control Module (TCM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates that the TCMs second microprocessor detected an excessive negative gradient of the Output Speed Sensor.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- An excessive negative gradient of the transmission output speed is detected by the second microprocessor.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Shut off engine to engage Park if there is a lever fault.

- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK DRIVING CONDITION PRESENT WHEN DTC OCCURRED

1. Obtain information from the operator of the vehicle whether it was being operated in a manner or condition that created a rapid deceleration event.

Was an unusual driving situation present that caused a rapid vehicle deceleration event present?

Yes

- This is the likely cause of the DTC. Clear the DTC.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To

Refer to [2](#).

2. INSPECT DRIVELINE FOR DAMAGE

1. Inspect the driveline for any broken or damaged that would cause the vehicle to rapidly decelerate.

Is there any driveline failures present?

Yes

- Repair the driveline as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To

Refer to [3](#).

3. CHECK THE BRAKE SYSTEM

1. With scan tool, check to see if there are any DTC present in the Antilock Brake System (ABS) module.

Were any DTCs present in the ABS module?

Yes

- Diagnose and repair the ABS DTCs in accordance with the Service Information.

Refer to [ANTILOCK BRAKE SYSTEM \(ABS\) - DIAGNOSTIC CODE INDEX](#) .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [4](#).

4. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: **Read Service Bulletins to determine if the software update is applicable to the customer complaint.**

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [5](#).

No

- Go To

Refer to [6](#).

5. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to [MODULE PROGRAMMING](#) .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P0712-00-TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: **If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.**

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature

shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- A short to ground malfunction is detected for the Transmission Fluid Temperature Sensor located in the oil sump.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

CHECK FOR DTCS RELATED TO OTHER INTERNAL TCM TEMPERATURE SENSORS

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any DTCs set for the other internal temperature sensors?

Yes

- Replace the TCM in accordance with the Service information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Repair is not necessary. If only one of the internal TCM temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

P0713-00-TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- A short to battery malfunction is detected for the Transmission Fluid Temperature Sensor located in the oil sump.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED

Possible Causes

TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

CHECK FOR DTCS RELATED TO OTHER INTERNAL TCM TEMPERATURE SENSORS

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any DTCs set for the other internal temperature sensors?

Yes

- Replace the TCM in accordance with the Service information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Repair is not necessary. If only one of the internal TCM temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

P0714-00-TRANSMISSION FLUID TEMPERATURE SENSOR A CIRCUIT INTERMITTENT

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: **If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.**

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- A malfunction is detected on the Transmission Fluid Temperature Sensor located in the oil sump.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

CHECK FOR DTCS RELATED TO OTHER INTERNAL TCM TEMPERATURE SENSORS

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any DTCs set for the other internal temperature sensors?

Yes

- Replace the TCM in accordance with the Service information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Repair is not necessary. If only one of the internal TCM temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

P0716-00-INPUT SHAFT SPEED SENSOR 1 PERFORMANCE

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Engine speed signal is valid.
- Engine RPM is equal to or greater than a calibrated threshold.

SET CONDITION

- The difference between the input speed measured by the Transmission Control Module (TCM) and both of the following signals are greater than a calibrated value for a calibrated amount of time when there is no electrical or rationality failures of the Output Speed Sensor and no shifting is in progress:
 - The calculated input speed from the wheel speed signal from the CAN.
 - The calculated input speed from the output speed measured by the TCM.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- The Torque Converter Clutch (TCC) will be commanded open.
- Clutch adaptation functions will be disabled.
- Maximum system hydraulic pressure will be limited.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE CONDITION**
 1. Turn the ignition on.
 2. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
 3. Raise the vehicle on the hoist.

4. Start the Engine.
5. With the scan tool, monitor the Input Speed Sensor rpm.
6. Firmly apply the brake pedal and place the gear selector in DRIVE.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

7. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 7,700 rpm?

Yes

- Go To [2](#)

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of an internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P0721-00-OUTPUT SHAFT SPEED SENSOR CIRCUIT PERFORMANCE

For a complete TRANSMISSION wiring diagram, refer to the appropriate information.

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Engine speed signal is valid.
- Engine RPM is equal to or greater than a calibrated threshold.

SET CONDITION

- The difference between the output speed measured by the Transmission Control Module (TCM) and both of the following signals are above a calibrated value for a calibrated amount of time with no shifting in progress:
 - Error in driving direction detected.
 - The calculated output speed from the wheel speed signal from the CAN.
 - The calculated output speed from the input speed measured by the TCM.

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [**PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**](#) .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**
 1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
 2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
 3. With the scan tool, erase all DTCS.
 4. Turn the ignition off for a minimum of 10.0 seconds.
 5. Turn the ignition on.
 6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK IF THE DTC SET DURING A 4L TO 4H SHIFT

NOTE: The P0721-00 can set during a 4L to 4H transfer case shift if the vehicle transmission is shifted from N to D before the transfer case completes its shift to 4H. If the transmission is shifted to D before the transfer case completes the shift to 4H, the transfer case will default back to 4L, causing the TCM to set this DTC.

1. Determine if the P0721-00 set following a failed 4L to 4H transfer case shift.

Did the P0721-00 set during a 4L to 4H transfer case shift?

Yes

- Clear the DTC.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [3](#)

3. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of a internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P0729-00-GEAR 6 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (for example: slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the ratio of input speed to output speed to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Sixth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 6th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH C
CLUTCH D
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to [CLUTCH AIR PRESSURE TESTS](#) .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0731-00-GEAR 1 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from First gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- When in a fixed gear the Transmission Control Module (TCM) did not detect a gear ratio equal to 1st Gear when commanded.

- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into First Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH B
CLUTCH C
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to [**CLUTCH AIR PRESSURE TESTS**](#) .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P0732-00-GEAR 2 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Second gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 2nd Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Second Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH B
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [**PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**](#) .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to **CLUTCH AIR PRESSURE TESTS** .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P0733-00-GEAR 3 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information**.

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Third gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 3rd Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH B
CLUTCH C
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION REMOVAL**

AND INSTALLATION .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to TRANSMISSION VERIFICATION TEST .

No

- Go To

Refer to 3.

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to CLUTCH AIR PRESSURE TESTS .

Did the clutches pass the air pressure tests?

Yes

- Go To 4

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to REMOVAL AND INSTALLATION .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to TRANSMISSION VERIFICATION TEST .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to TRANSMISSION VERIFICATION TEST .

No

- Replace the TCM in accordance with the Service information. Refer to MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to TRANSMISSION VERIFICATION TEST .

P0734-00-GEAR 4 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Fourth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 4th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH B
CLUTCH D
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCs AND ENVIRONMENTAL DATA - ERASE DTCs AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to [CLUTCH AIR PRESSURE TESTS](#) .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0735-00-GEAR 5 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Fifth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 5th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.

- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH B
CLUTCH C
CLUTCH D

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to [CLUTCH AIR PRESSURE TESTS](#) .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0746-00-PRESSURE CONTROL SOLENOID "A" PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the monitoring is to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes. Current controlled mode pressure regulators and switched mode or PWM controlled solenoids.

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the CPU. Short to battery, bypass to ground (high resistance short to ground) and short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA) In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time

to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated table to identify the following electrical failures. Short to battery, open circuit and short to ground in case the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case the TCM status information is used to detect the failure.

WHEN MONITORED

- Once per driving cycle.
- No Controller Area Network (CAN) Engine Speed signal failures via.
- Engine has been off.
- Parking Lock Sensor indicates an engaged parking lock at key on prior to engine restart.
- Brake pressure is above a calibrated threshold.
- Engine has been in Run mode.

Set Condition:

- Parking lock is disengaged.

Default Actions:

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Second Gear via Neutral.
- Remote start feature, if equipped, will be disabled.
- Any driver requests that are not yet honored will be cleared.
- Reverse will be disabled.
- The Torque Converter Clutch (TCC) will be commanded open.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID A TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P0750-00-SHIFT SOLENOID 1 CONTROL CIRCUIT - OPEN

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status

information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- Reverse will be disabled.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Shift adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID A
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0755-00-SHIFT SOLENOID 2 CONTROL CIRCUIT - OPEN

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- Reverse will be disabled.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Shift adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID B
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P075B-00-SHIFT SOLENOID "G" PERFORMANCE/STUCK OFF

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs once per driving cycle when the following conditions are met:

- No failure with engine speed signal.
- Engine has been off for a calibrated amount of time.
- Parking lock sensor indicates an engaged Parking Lock before engine restart.
- Engine has been restarted and running for a calibrated amount of time.

SET CONDITION

- Parking lock is disengaged.

DEFAULT ACTION

- Service Transmission message will be displayed.
- Disable remote start release from TCM.
- Disable storage of driver requests for Reverse/Drive.
- The Transmission will shift into 2nd gear via Neutral.
- Clutch adaptation functions will be disabled.

- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Reverse gear will not be available.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
MANUAL PARK RELEASE (MPR) ACTIVATED
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK THE MANUAL PARK RELEASE (MPR) LEVER AT THE TRANSMISSION

1. Have a helper operate the shifter.
2. Raise the vehicle in the air on a suitable frame contact hoist.
3. Set the Parking Brake.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

4. Start the vehicle.
5. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [6](#)

No

- Go To [2](#)

2. DISCONNECT THE MPR CABLE AT THE TRANSMISSION

1. Shut off the vehicle.
2. Disconnect the MPR cable from the lever at the transmission.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

3. Start the vehicle.
4. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [3](#)

No

- Go To

Refer to [5](#).

3. CHECK MPR LEVER IN THE CABIN COMPARTMENT FOR ACTIVATION, OBSTRUCTIONS AND DAMAGE

1. Check the Emergency MPR Lever for activation, obstructions, binding, and damage.

Were any problems found?

Yes

- Deactivate the MPR, remove the obstruction, repair the cause of binding or, if necessary, replace the Emergency MPR Lever in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [4](#)

4. CHECK MPR CABLE FOR BINDING AND DAMAGE

1. Check MPR Cable for binding or damage that could cause this condition.

Is the MPR Cable or Lever causing this condition?

Yes

- Repair or replace the MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [5](#)

5. CHECK MPR LINKAGE ON TRANSMISSION FOR BINDING OR DAMAGE

1. Check MPR linkage on transmission for obstructions, binding, and damage.

Were any problems found?

Yes

- Remove the obstruction, repair the cause of binding or, if necessary, replace the valve body in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [6](#)

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [7](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

7. REPLACE THE TRANSMISSION CONTROL MODULE (TCM) AND RETEST FOR DTCS

1. Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
2. Connect the component and Electronic Control Unit (ECU) harness connectors.
3. Turn the ignition on.
4. With the scan tool, erase DTCs.
5. Using the Environmental Data or When Monitored Conditions above, operate the vehicle within the conditions that set the DTC.
6. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the Transmission in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replacing the TCM repaired the fault.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P076F-00-GEAR 7 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.

- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Seventh gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 7th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Seventh Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH C
CLUTCH D

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCs AND ENVIRONMENTAL DATA - ERASE DTCs AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to [CLUTCH AIR PRESSURE TESTS](#) .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0776-00-PRESSURE CONTROL SOLENOID "B" PERFORMANCE/STUCK OFF

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the monitoring is to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes. Current controlled mode pressure regulators and switched mode or PWM controlled solenoids.

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the CPU. Short to battery, bypass to ground (high resistance short to ground) and short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA) In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated table to identify the following electrical failures. Short to battery, open circuit and short to ground in case the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case the TCM status information is used to detect the failure.

WHEN MONITORED

- Continuously after the ignition switch is turned to the run position.

Set Condition:

- A short to battery failure is detected when the TCM detects a short to battery failure or the PWM feedback signal at the output stage is 0%.
- An open circuit or short to ground failure is detected when the TCM detects a short to ground or open circuit failure or the PWM feedback signal at the output stage is 100%.
- An open circuit failure is detected when the TCM detects an open circuit failure in reaction to the output stage being switch off after an open circuit or short to ground failure detection.
- A short to ground failure is detected when the TCM detects a short to ground failure in reaction to the output stage being switch off after an open circuit or short to ground failure detection.

Default Actions:

DEFAULT ACTION

- Service Transmission lamp will be illuminated.
- Remote Start, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID B

Possible Causes

TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-Diagnostic Troubleshooting procedure before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).
- Test complete.

P077C-00-OUTPUT SHAFT SPEED SENSOR CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information**.

THEORY OF OPERATION

The purpose of this diagnostic is to detect circuit failures of the Output Speed Sensor. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCs) are set.

SET CONDITION

- The signal acquisition Application-Specific Integrated Circuit (ASIC) reports an open or short to ground condition for the output speed sensor to the main microprocessor.

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME OPEN OR SHORTED TO GROUND
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#).

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- If no problems are found, replace the TCM in accordance with the Service Information.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P077D-00-OUTPUT SHAFT SPEED SENSOR CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect circuit failures of the Output Speed Sensor. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCS) are set.

SET CONDITION

- The signal acquisition Application-Specific Integrated Circuit (ASIC) reports a short to power condition for the output speed sensor to the main microprocessor.

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) - WIRING HARNESS LEADFRAME OPEN OR SHORTED TO POWER
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- If no problems are found, replace the TCM in accordance with the Service Information.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P077E-00-TRANSMISSION FLUID TEMPERATURE MULTIPLE SENSOR CORRELATION

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: **If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.**

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms

TEMPERATURE vs RESISTANCE	
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No failure detected in the engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal.
- No failure detected in the Oil Temperature Sensor monitoring.
- Engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal is above a calibrated value for a calibrated amount of time.

SET CONDITION

- A malfunction is detected on more than one of the three temperature sensors.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID TEMPERATURE SENSOR DTC SET TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to power and ground circuits. Check Service Bulletins for possible causes that may apply. Replace and program the TCM in accordance with the Service Information.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

P07B3-00-TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Electric Stop/Start function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
SENSOR SUPPLY VOLTAGE CIRCUIT OPEN
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**](#) .**

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and

program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P07B4-00-TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
PARK POSITION SENSOR SIGNAL CIRCUIT OPEN CIRCUIT
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P07B9-00-TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Electric Stop/Start function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
SENSOR SUPPLY VOLTAGE CIRCUIT OPEN
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P07BA-00-TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
PARK POSITION SENSOR SIGNAL CIRCUIT OPEN CIRCUIT
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

P07BF-00-INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect Input Speed Sensor circuit failures. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCs) set.

SET CONDITION

- The Transmission Control Module (TCM) detects a short to ground or open circuit condition in the Input Speed Sensor circuit.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- System hydraulic pressure will be set to maximum.
- The Torque Converter Clutch (TCC) will be commanded open.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.

- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME OPEN OR SHORTED TO GROUND
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. Read and record all DTCs.
3. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
4. Raise the vehicle on the hoist.
5. Start the Engine.
6. With the scan tool, monitor the Input Speed Sensor rpm.
7. Firmly apply the brake pedal and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

8. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 7, 700 rpm?

Yes

- Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination. Repair Transmission Internal components as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P07C0-00-INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, refer to the appropriate information .

THEORY OF OPERATION

The purpose of this diagnostic is to detect Input Speed Sensor circuit failures. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial

Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCs) set.

SET CONDITION

- The Transmission Control Module (TCM) detects a short to voltage condition in the Input Speed Sensor circuit.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- The Torque Converter Clutch (TCC) will be commanded open.
- System hydraulic pressure will be set to maximum.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME SHORTED TO POWER
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

CHECK FOR AN ACTIVE CONDITION

1. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
2. Raise the vehicle on the hoist.
3. Start the Engine.
4. With the scan tool, monitor the Input Speed Sensor rpm.
5. Firmly apply the brake pedal and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

6. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 7, 700 rpm?

Yes

- Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination. Repair Transmission internal components as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P07D9-00-GEAR 8 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Eighth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 8th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Eighth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).

- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH D
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To [3](#)

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to [CLUTCH AIR PRESSURE TESTS](#) .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P07E4-00-UNABLE TO ENGAGE PARK

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect a disengaged park pawl when the PARK position is commanded and the conditions to engage PARK are met.

A binding or obstructed Manual Park Release (MPR) can cause this DTC to set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Park Lock Sensor circuit Diagnostic Trouble Codes (DTCs) set.
- TCM is commanding PARK position.
- Engine speed is above a calibrated threshold.
- Vehicle speed is below a calibrated threshold.

SET CONDITION

- Park pawl does not engage in the lock position within a calibrated amount of time, or park pawl disengages.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Shut off engine to engage Park if there is a lever fault.
- Remote Start feature, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
MANUAL PARK RELEASE (MPR) ACTIVATED
PARK HOLD SOLENOID
PARK RELEASE SOLENOID
PARK HOLD SOLENOID WIRE HARNESS OR LEADFRAME
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK THE MANUAL PARK RELEASE (MPR) LEVER AT THE TRANSMISSION

1. Have a helper operate the shifter.
2. Raise the vehicle in the air on a suitable frame contact hoist.
3. Set the Parking Brake.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

4. Start the vehicle.
5. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [6](#)

No

- Go To [2](#)

2. DISCONNECT THE MPR CABLE AT THE TRANSMISSION

1. Shut off the vehicle.
2. Disconnect the MPR cable from the lever at the transmission.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

3. Start the vehicle.
4. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [3](#)

No

- Go To

Refer to [5](#).

3. CHECK MPR LEVER IN THE CABIN COMPARTMENT FOR ACTIVATION, OBSTRUCTIONS AND DAMAGE

1. Check the Emergency MPR Lever for activation, obstructions, binding, and damage.

Were any problems found?

Yes

- Deactivate the MPR, remove the obstruction, repair the cause of binding or, if necessary, replace the Emergency MPR Lever in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [4](#)

4. CHECK MPR CABLE FOR BINDING AND DAMAGE

1. Check MPR Cable for binding or damage that could cause this condition.

Is the MPR Cable or Lever causing this condition?

Yes

- Repair or replace the MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [5](#)

5. CHECK MPR LINKAGE ON TRANSMISSION FOR BINDING OR DAMAGE

1. Check MPR linkage on transmission for obstructions, binding, and damage.

Were any problems found?

Yes

- Remove the obstruction, repair the cause of binding or, if necessary, replace the valve body in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [6](#)

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P0850-00-PARK-NEUTRAL SWITCH PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the rationality of the park pawl sensor signal. The sensor has two pins to determine the position of the park pawl as shown in the table below.

PIN 1 = 0	PIN 2 = 0	Undefined Output
PIN 1 = 1	PIN 2 = 0	Park Pawl Engaged
PIN 1 = 0	PIN 2 = 1	Park Pawl Disengaged
PIN 1 = 1	PIN 2 = 1	Intermediate Position

This diagnostic monitors for two types of faults:

- Undefined output of the sensor
- Sensor too long in intermediate position

If the output of the sensor is undefined or the sensor is in the intermediate position too long, this Diagnostic Trouble Code (DTC) will set.

NOTE: **A binding or obstructed Manual Park Release (MPR) can cause this DTC to set.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

- No sensor supply voltage Diagnostic Trouble Codes (DTCs) set.
- No Park Pawl Sensor circuit DTCs set.

SET CONDITION

- A failure is detected if one of the following occurs:
 - Undefined output signal of the park pawl sensor (Pin 1 = 0, Pin 2 = 0).
 - Sensor signal in the intermediate position for longer than a calibrated amount of time (Pin 1 = 1, Pin 2 = 1).

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
MANUAL PARK RELEASE (MPR) OBSTRUCTION
MANUAL PARK RELEASE (MPR) BINDING
PARK PAWL SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK THE MANUAL PARK RELEASE (MPR) LEVER AT THE TRANSMISSION

1. Have a helper operate the shifter.
2. Raise the vehicle in the air on a suitable frame contact hoist.
3. Set the Parking Brake.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

4. Start the vehicle.
5. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [6](#)

No

- Go To [2](#)

2. DISCONNECT THE MPR CABLE AT THE TRANSMISSION

1. Shut off the vehicle.
2. Disconnect the MPR cable from the lever at the transmission.

WARNING:

BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

3. Start the vehicle.
4. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [3](#)

No

- Go To

Refer to [5](#).

3. CHECK MPR LEVER IN THE CABIN COMPARTMENT FOR ACTIVATION, OBSTRUCTIONS AND DAMAGE

1. Check the Emergency MPR Lever for activation, obstructions, binding, and damage.

Were any problems found?

Yes

- Deactivate the MPR, remove the obstruction, repair the cause of binding or, if necessary, replace the Emergency MPR Lever in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [4](#)

4. CHECK MPR CABLE FOR BINDING AND DAMAGE

1. Check MPR Cable for binding or damage that could cause this condition.

Is the MPR Cable or Lever causing this condition?

Yes

- Repair or replace the MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [5](#)

5. CHECK MPR LINKAGE ON TRANSMISSION FOR BINDING OR DAMAGE

1. Check MPR linkage on transmission for obstructions, binding, and damage.

Were any problems found?

Yes

- Remove the obstruction, repair the cause of binding or, if necessary, replace the valve body in accordance with the Service Information.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [6](#)

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P093A-00-HYDRAULIC ACCUMULATOR SOLENOID OPEN

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of

the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.
- Condition Two:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty or no duty phase.
- Condition Two:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty phase.
 - Voltage of output signal is greater than a calibrated threshold during PWM no duty phase.
 - Voltage of output signal is less than a calibrated threshold during PWM no duty phase.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
HYDRAULIC IMPULSE SOLENOID (HIS) DISCONNECTED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR DTC P1D8C-00

1. Using the scan tool, check if DTC P1D8C-00 is set in conjunction with P093A-00.

Is the DTC P1D8C-00 set in the TCM also?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [3](#)

3. CHECK THE HYDRAULIC IMPULSE SOLENOID (HIS) HARNESS CONNECTOR

1. Remove the transmission oil pan.
2. Inspect the HIS connector is properly connected at the solenoid.

Is the HIS harness connector properly connected to the solenoid?

Yes

- Go To [4](#)

No

- Properly connect the harness to the HIS.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Cleaning the leadframe corrected the condition.

P093B-00-HYDRAULIC ACCUMULATOR SOLENOID SHORT TO GROUND

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending

on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.
- Condition Three:
 - Output stages power supply is activated.
 - Output stage is commanded to 100% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty or no duty phase is less than a calibrated value.
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Two:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Three:
 - A short to ground failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Remote Start feature, if equipped, will be disabled.

- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P093C-00-HYDRAULIC ACCUMULATOR SOLENOID SHORT TO BATTERY

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.

- Output stage is commanded above 5% Pulse Width Modulated (PWM).
- Output stages power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the voltage of the output signal during PWM duty phase is greater than or equal to a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Hydraulic Impulse System (HIS) Low Side Switch will be turned off.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.

5. Reinstall the TCM.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0960-00-PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT OPEN

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- MIL is illuminated on the first trip that the diagnostic fails.
- System Pressure Regulator Low Side Switch will be turned off.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID 1 TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN
1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.

3. With the scan tool, erase all DTCS.

4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0962-00-PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only

distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**
 1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0963-00-PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two

different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the second consecutive trip that the diagnostic fails.
- Low Side System Pressure Regulator Switch will be turned off.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID 1 TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

- Test complete.

P0972-00-SHIFT SOLENOID 1 CONTROL CIRCUIT PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.
- Output stages power supply is active.
- Power supply voltage is within a calibrated range.

SET CONDITION

- The calculated solenoid current is less than a calibrated value and no shifting is in progress.
- The calculated solenoid current is greater than a calibrated value and no shifting is in progress.
- A Serial Peripheral Interface (SPI) communication failure in the SPI communication between the Central Processing Unit (CPU) and the ASIC is detected based upon the validity of the check-byte, the timing and the feedback signal of the message.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 1 TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.

5. Reinstall the TCM.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0973-00-SHIFT SOLENOID 1 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [**PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**](#) .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0974-00-SHIFT SOLENOID 1 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)

- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- Any driver requests that are not yet honored will be cleared.
- Reverse will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
 - Test complete.
-

2021 AUTOMATIC TRANSMISSION

8HP50/850RE Automatic Transmission - DTCS P0975-00 To P1DAC-00 - Gladiator [EBH, EC1, EC3, ERC]

DIAGNOSIS AND TESTING

P0975-00-SHIFT SOLENOID B CONTROL CIRCUIT PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is active.
- Power supply voltage is within a calibrated range.

SET CONDITION

- The calculated solenoid current is less than a calibrated value and no shifting is in progress.
- The calculated solenoid current is greater than a calibrated value and no shifting is in progress.
- A Serial Peripheral Interface (SPI) communication failure in the SPI communication between the Central Processing Unit (CPU) and the ASIC is detected based upon the validity of the check-byte, the timing and the feedback signal of the message.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID B TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0976-00-SHIFT SOLENOID 2 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 2
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.

4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0977-00-SHIFT SOLENOID 2 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- Any driver requests that are not yet honored will be cleared.
- Reverse will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 2
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

- Test complete.

P0978-00-SHIFT SOLENOID 3 CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 3
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0979-00-SHIFT SOLENOID 3 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID C
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0980-00-SHIFT SOLENOID 3 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Shift adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 3
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCS.
7. Road test the vehicle and check for DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0981-00-SHIFT SOLENOID 4 CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Shut off engine to engage Park if there is a lever fault.

- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 4 TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0982-00-SHIFT SOLENOID 4 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.

- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 4 TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.
- Test complete.

P0983-00-SHIFT SOLENOID 4 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 4
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**
 1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
 2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
 3. With the scan tool, erase all DTCS.
 4. Turn the ignition off for a minimum of 10.0 seconds.
 5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0984-00-SHIFT SOLENOID 5 CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 5

Possible Causes

TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).
- Test complete.

P0985-00-SHIFT SOLENOID 5 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.

- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 5
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.

4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .
- Test complete.

P0986-00-SHIFT SOLENOID 5 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 5
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1614-00-ECU RESET-RECOVERY OCCURRED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to determine the reason of a reset after the reset occurred. Some of these are initiated by the Transmission Control Module (TCM) software and others may be caused by an under voltage condition. If the TCM detects a condition for initiating a reset, the reason of the reset is stored in an area of Random Access Memory (RAM) that is not initialized during TCM re-initialization. Upon TCM initialization this information is read out to store an appropriate DTC indicating the reason for the reset.

This diagnostic detects an under voltage reset of the TCM during normal operation (no engine start present). Under voltage resets during engine start will not be stored within the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- The TCM is powered and the Output Speed Sensor is greater than or equal to 100 RPM or engine speed is greater than or equal to 600 RPM, or ignition is on and no engine start is detected.

SET CONDITION

- A reset code for low level software or under voltage condition has been stored in the non volatile RAM, or startup flag is present in the EEPROM and no shutdown flag present in the EEPROM.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the second consecutive trip that the diagnostic fails.

POSSIBLE CAUSES

Possible Causes
LOW BATTERY VOLTAGE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Charging System DTCs set?

Yes

- Repair the Charging System DTCs. refer to the appropriate wiring information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To **2**

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To **3**

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

3. CHECK THE (A190) 12 VOLT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

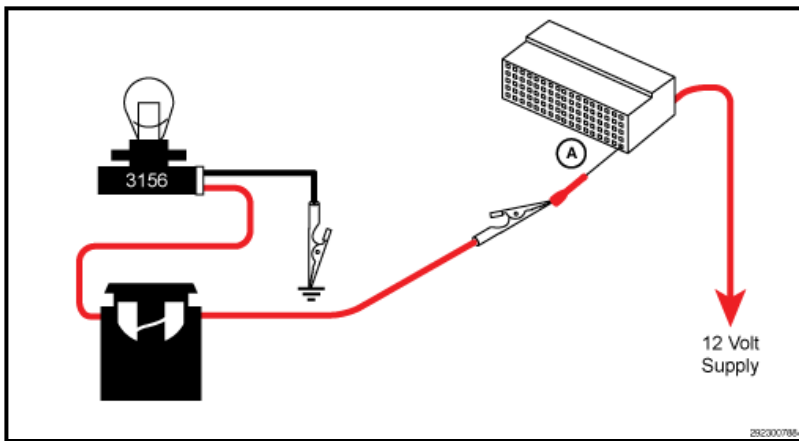
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#) .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#) .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1634-00-TCM INTERNAL - INTERNAL WATCHDOG PERFORMANCE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the correct functionality of the Transmission Control Module (TCM) Central Processing Unit (CPU) by checking several rationalities of a question-answer communication between the CPU and the independent watchdog Application-Specific Integrated Circuit (ASIC).

Rationality Check between the CPU and the watchdog ASIC: The watchdog ASIC provides a question randomly out of a number of predefined questions, which the CPU receives via the Serial Peripheral Interface (SPI) bus. The CPU must respond correctly within a defined time period. A wrong answer leads to an increment and a correct answer leads to a decrement of the watchdog internal error counter (minimum value: 0, maximum value: 8). Values between 0 and 4 indicate normal behavior because the CPU does not necessarily always answer correctly (see following paragraph). If the value of the error counter reaches 5, the output stages to the solenoids will be switched off by the watchdog ASIC. If the value of the error counter reaches 8, the watchdog ASIC will initiate a TCM reset and the CPU will store a failure.

In order to check the correct behavior of the watchdog ASIC, the CPU purposely does not always answer the questions of the watchdog correctly. The watchdog monitoring software in the TCM occasionally sends wrong answers or sends correct answers too early or too late (failure in timing) to the watchdog ASIC. The CPU then compares the error counter of the watchdog ASIC, which is transmitted in a SPI message, with the expected value calculated in the CPU. If the received watchdog error counter value is unequal to the expected value, the CPU increments its own error counter. A failure is detected if the CPU error counter is greater than a threshold.

Program Flow Control: To ensure that all safety relevant software modules are processed in the correct sequence, the questions transmitted by the watchdog ASIC to the CPU are answered by an algorithm that uses the checksums of all safety relevant software modules. This algorithm responds back to the watchdog ASIC with a correct answer only if all software module checksums are processed in the right order.

WHEN MONITORED

- This diagnostic runs continuously with the ignition on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: **Read Service Bulletins to determine if the software update is applicable to the customer complaint.**

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [2](#).

No

- Go To

Refer to [3](#).

2. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to [MODULE PROGRAMMING](#) .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P167A-00-CALIBRATION MISMATCH

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) performs various internal tests to verify proper controller operation. If the TCM detects that the variables that dictate the vehicle application are not present, the controller will enter Limp-in mode and illuminate the Malfunction Indicator Lamp (MIL).

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Transmission Control Module (TCM) detects the variables that dictate the vehicle application are not present.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
GENERIC CALIBRATIONS PROGRAMMED IN TCM TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

PROGRAM THE TRANSMISSION CONTROL MODULE (TCM)

NOTE: Controller is programmed with generic boot and trim calibrations and will not allow the correct vehicle Powertrain management.

1. With the scan tool, attempt to program the TCM with the latest calibrations in accordance with the Service Information. refer to the appropriate wiring information .

Were you able to program the TCM successfully?

Yes

- Test complete.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular

attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1731-00-INCORRECT GEAR ENGAGED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to make sure that the input and output of the Transmission Control Module (TCM) shift by wire software corresponds. The input to the TCM shift by wire software is the driver request, vehicle and transmission conditions.

The following conditions are monitored by this diagnostic:

- A change in transmission position has occurred that was not requested.
- A requested change in transmission position from R/N/D has not occurred.
- The shift by wire stored values in Random Access Memory (RAM) have been corrupted.
- The transmission position transmitted between the shift by wire and the shift control software has been corrupted.
- The engaged transmission position is not displayed to the driver.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- TCM initialization completed.

SET CONDITION

- The TCM has determined a gear position based on input signals that does not correlate with the actual Gear Shift position as determined by the Electronic Shift Module (ESM).
- The TCM does not recognize a request to a change in driving direction from the ESM.
- The TCM determines that one of the conditions for an Auto Neutral is present that does not correlate with the ESM signal.
- The TCM determines that one of the conditions for an Auto Park is present when the vehicle speed is less than or equal to a calibrated value that does not correlate with the ESM signal.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [2](#).

No

- Go To

Refer to [3](#).

2. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to **MODULE PROGRAMMING** .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

P1778-00-INPUT-TURBINE SHAFT SPEED SENSOR A OUT OF RANGE HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- The raw value of the turbine speed measured by the Transmission Control Module (TCM) is greater than a calibrated value for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
3. Raise the vehicle on the hoist.
4. Start the Engine.
5. With the scan tool, monitor the Input Speed Sensor rpm.
6. Firmly apply the brake pedal and place the gear selector in DRIVE.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

7. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 14, 000 rpm?

Yes

- Go To [2](#)

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of an internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P177F-00-OUTPUT SHAFT SPEED SENSOR OUT OF RANGE HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- The raw value of the transmission output speed measured by the Transmission Control Module (TCM) is above a calibrated value for a calibrated amount of time:

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
3. Raise the vehicle on the hoist.
4. Start the Engine.

5. With the scan tool, monitor the Output Speed Sensor rpm.
6. Firmly apply the brake pedal and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

7. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Output Speed Sensor display a value above 10,000 rpm?

Yes

- Go To [2](#)

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of a internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1B13-00-PARK BY WIRE UNINTENDED OUT OF PARK POSITION

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information.

THEORY OF OPERATION

The purpose of the diagnostic is to detect a disengaged park pawl when the PARK position is commanded and the conditions to engage PARK are met.

A binding or obstructed Manual Park Release (MPR) can cause tis DTC to set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Park Lock Sensor circuit Diagnostic Trouble Codes (DTCs) set.
- TCM is commanding PARK position.
- Vehicle speed is below a calibrated value.

SET CONDITION

- Park pawl does not engage in the lock position within a calibrated amount of time, or park pawl disengages.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) may be illuminated.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- Remote Start feature, if equipped, will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK RELEASE SOLENOID PARK HOLD SOLENOID MANUAL PARK RELEASE (MPR) ACTIVATED PARK HOLD SOLENOID WIRE HARNESS OR LEADFRAME TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK THE MANUAL PARK RELEASE (MPR) LEVER AT THE TRANSMISSION

1. Have a helper operate the shifter.
2. Raise the vehicle in the air on a suitable frame contact hoist.
3. Set the Parking Brake.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

4. Start the vehicle.
5. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [6](#)

No

- Go To [2](#)

2. DISCONNECT THE MPR CABLE AT THE TRANSMISSION

1. Shut off the vehicle.
2. Disconnect the MPR cable from the lever at the transmission.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

3. Start the vehicle.
4. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [3](#)

No

- Go To

Refer to [5](#).

3. CHECK MPR LEVER IN THE CABIN COMPARTMENT FOR ACTIVATION, OBSTRUCTIONS AND DAMAGE

1. Check the Emergency MPR Lever for activation, obstructions, binding, and damage.

Were any problems found?

Yes

- Deactivate the MPR, remove the obstruction, repair the cause of binding or, if necessary, replace the Emergency MPR Lever in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [4](#)

4. CHECK MPR CABLE FOR BINDING AND DAMAGE

1. Check MPR Cable for binding or damage that could cause this condition.

Is the MPR Cable or Lever causing this condition?

Yes

- Repair or replace the MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [5](#)

5. CHECK MPR LINKAGE ON TRANSMISSION FOR BINDING OR DAMAGE

1. Check MPR linkage on transmission for obstructions, binding, and damage.

Were any problems found?

Yes

- Remove the obstruction, repair the cause of binding or, if necessary, replace the valve body in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [6](#)

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P1B14-00-PARK BY WIRE UNINTENDED PARK POSITION

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect an engaged park pawl when the Shifter is in the DRIVE, NEUTRAL, or REVERSE position.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Engine speed is above a calibrated value.
- No Park Lock Sensor circuit Diagnostic Trouble Codes (DTCs) set.
- Shifter is in DRIVE, NEUTRAL or REVERSE position.
- The supply voltage for the Pressure Regulators and Solenoid Valves is greater than a calibrated value.

- Mechanical Limp In condition is not active.

SET CONDITION

- The park pawl does not disengage for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Start/Stop feature, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
MANUAL PARK RELEASE (MPR) BINDING OR OBSTRUCTED
LOW LINE PRESSURE ON STARTUP
PARK RELEASE SOLENOID
PARK HOLD SOLENOID
TRANSMISSION

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE DIAGNOSTIC TROUBLE CODE (DTC)

NOTE: If there are any active line pressure, solenoid or gear ratio/clutch DTCs present, diagnose and repair those first before proceeding with this test.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Record the Event Data and Environmental Data.
3. With the scan tool, erase DTCs.

NOTE: Stop the vehicle and place shifter into PARK position multiple times during the next step.

4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
5. With the scan tool, read TCM DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK MANUAL PARK RELEASE (MPR) CABLE AND LEVER

1. Check MPR Cable and Lever for binding, obstruction, or damage that could cause this condition.
 - Check that the system operates smoothly from the lever inside the vehicle.
 - Check that the cable is properly routed with no sharp bends or kinks.

- Check the levers at the operator end and transmission ends for any obstructions that could prevent full range of movement.
- If necessary, disconnect the MPR cable from the lever at the transmission to isolate any conditions found.

Is the MPR Cable or Lever binding, obstructed or damaged?

Yes

- Repair MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#).

No

- Go To [3](#)

3. CHECK TRANSMISSION FLUID LEVEL AND CONDITION

1. Check the transmission fluid level in accordance with the Service Information. Refer to [**CHECK FLUID LEVEL**](#).

Is the transmission fluid level correct and appear in good condition?

Yes

- Go To [6](#)

No, transmission fluid level is low but appears in good condition.

- Go To

Refer to [4](#).

Transmission fluid condition is deteriorated.

- Go To [5](#)

4. FILL THE TRANSMISSION FLUID TO THE CORRECT LEVEL

1. Correct the transmission fluid level in accordance with the Service Information. Refer to [**CHECK FLUID LEVEL**](#).
2. Turn the ignition on.
3. With the scan tool, erase DTCs.

NOTE: Stop the vehicle and place shifter into PARK position multiple times during the next step.

4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.

Did the DTC return?

Yes

- Go To [5](#)

No

- Correcting the transmission fluid level repaired the fault.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

5. REMOVE THE TRANSMISSION OIL PAN FOR INSPECTION

1. Remove the transmission oil pan.
2. Check the transmission oil pan for debris that indicates an internal transmission problem.
3. Inspect the Transmission oil filter for damage or visual indications of flow restriction.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [6](#)

6. REPLACE THE VALVE BODY AND RETEST FOR DTCS

1. Replace the valve body in accordance with the Service Information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
2. Turn the ignition on.
3. With the scan tool, erase DTCs.

NOTE: Stop the vehicle and place shifter into PARK position multiple times during the next step.

4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.

Did the DTC return?

Yes

- Replace the Transmission in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replacing the faulty component repaired the fault.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D25-00-SHIFT CONTROL RATIONALITY

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of this diagnostic is to detect a faulty position on the interface between the shift by wire software and the shift control software. This diagnostic also compares the target position sent to the shift control software to the read back position from this interface.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The commanded gear position received by the TCM from the Electronic Shifter Module and the actual gear position of the transmission do not correlate for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Remote Start feature, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To

Refer to [2](#).

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

1. With the scan tool, check if a TCM software update is available.

Is an update available?

Yes

- Go To

Refer to [3](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to [MODULE PROGRAMMING](#) .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D78-00-PARK SOLENOID CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.
- Condition Three:
 - Output stages power supply is activated.
 - Output stage is commanded to 100% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty or no duty phase is less than a calibrated value.
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Two:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Three:

- A short to ground failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK SOLENOID
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.

3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1D79-00-PARK SOLENOID CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery

- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Output stage is commanded above 5% Pulse Width Modulated (PWM).
- Output stages power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the voltage of the output signal during PWM duty phase is greater than or equal to a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission lamp will be illuminated.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK SOLENOID
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1D8A-00-PARK PAWL SOLENOID CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery

- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.
- Condition Three:
 - Output stages power supply is activated.
 - Output stage is commanded to 100% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty or no duty phase is less than a calibrated value.
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Two:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Three:
 - A short to ground failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK LOCK SOLENOID TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. DETERMINE IF THE TRANSMISSION IS AN 850RE OR AN 8HP50

1. Using the VIN and either the Service or Parts Information, determine what transmission is installed in the vehicle.

What transmission is installed?

850RE

NOTE: Although these transmissions are similar in appearance, the components are **NOT** interchangeable between the two different transmissions.

- Go to [3](#)

8HP50

- Go To [4](#)

3. REPLACE THE PARK LOCK SOLENOID-ERASE DTC AND CHECK FOR DTC TO RETURN

1. Replace the Park Lock Solenoid in accordance with the Service Information.
2. With the scan tool, erase all DTCs.
3. Turn the ignition off for a minimum of 10.0 seconds.
4. Turn the ignition on.
5. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
6. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [4](#)

No

- Replacing the Park Lock Solenoid repaired the condition.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1D8B-00-PARK PAWL SOLENOID CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Output stage is commanded above 5% Pulse Width Modulated (PWM).
- Output stages power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the voltage of the output signal during PWM duty phase is greater than or equal to a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Low Side Switch is turned off to the Park Lock Magnet.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK LOCK SOLENOID
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

2. DETERMINE IF THE TRANSMISSION IS AN 850RE OR AN 8HP50

1. Using the VIN and either the Service or Parts Information, determine what transmission is installed in the vehicle.

What transmission is installed?

850RE

NOTE: Although these transmissions are similar in appearance, the components are **NOT** interchangeable between the two different transmissions.

- Go to [3](#)

8HP50

- Go To [4](#)

3. REPLACE THE PARK LOCK SOLENOID-ERASE DTC AND CHECK FOR DTC TO RETURN

1. Replace the Park Lock Solenoid in accordance with the Service Information.
2. With the scan tool, erase all DTCs.
3. Turn the ignition off for a minimum of 10.0 seconds.
4. Turn the ignition on.

5. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
6. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [4](#)

No

- Replacing the Park Lock Solenoid repaired the condition.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D8C-00-PARK PAWL SOLENOID CIRCUIT OPEN

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The diagnostics are able to detect circuit failures on any of the output stages in the Transmission Control Module (TCM). All output stages are controlled by a current controller that can operate an output stage in two different modes:

- Current controlled mode (pressure regulators)
- Switched mode or Pulse Width Modulated (PWM) controlled (solenoids)

Pressure Regulator Monitoring: The current regulator in the TCM indicates the following circuit failures to the Central Processing Unit (CPU):

- Short to battery
- Bypass to ground (high resistance short to ground)
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a PWM feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a limp home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

Solenoid Monitoring: The TCM measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.
- Condition Two:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty or no duty phase.
- Condition Two:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty phase.
 - Voltage of output signal is greater than a calibrated threshold during PWM no duty phase.
 - Voltage of output signal is less than a calibrated threshold during PWM no duty phase.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK LOCK SOLENOID

Possible Causes

TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. DETERMINE IF THE TRANSMISSION IS AN 850RE OR AN 8HP50

1. Using the VIN and either the Service or Parts Information, determine what transmission is installed in the vehicle.

What transmission is installed?

850RE

NOTE: Although these transmissions are similar in appearance, the components are NOT interchangeable between the two different transmissions.

- Go to [3](#)

8HP50

- Go To [4](#)

3. REPLACE THE PARK LOCK SOLENOID-ERASE DTC AND CHECK FOR DTC TO RETURN

1. Replace the Park Lock Solenoid in accordance with the Service Information.
2. With the scan tool, erase all DTCs.
3. Turn the ignition off for a minimum of 10.0 seconds.
4. Turn the ignition on.

5. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
6. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [4](#)

No

- Replacing the Park Lock Solenoid repaired the condition.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D8F-00-INCORRECT GEAR RATIO CLUTCH 1 DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.

- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2.**

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1D90-00-INCORRECT GEAR RATIO - CLUTCH 2 DEFECTIVE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D91-00-INCORRECT GEAR RATIO - CLUTCH 3 DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2**.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D92-00-INCORRECT GEAR RATIO - CLUTCH 4 DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.

- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D93-00-INCORRECT GEAR RATIO - CLUTCH 5 DEFECTIVE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear

ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION**.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D94-00-TCM INTERNAL SBW CALIBRATION MISMATCH

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect if the shift by wire stored values in RAM have been corrupted.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- A failure is detected if the calibration data stored in two different locations of the Random Access Memory (RAM) has changed at only one location.
- A failure is detected if the initially determined transmission range (P, R, N or D) after Transmission Control Module (TCM) initialization which is determined with two different methods has unequal results.
- A failure is detected if the calculated transmission range stored in the buffer does not match the current transmission position.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
GENERIC CALIBRATIONS PROGRAMMED IN TRANSMISSION CONTROL MODULE (TCM) TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

PERFORM TRANSMISSION CONTROL MODULE (TCM) PROGRAMMING PROCEDURE

1. With the scan tool, attempt to program the TCM with the latest calibrations in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), MODULE PROGRAMMING** .

Were you able to program the TCM successfully?

Yes

- Test complete.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1D95-00-TCM CLUTCH FAILURE UNDETERMINED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- The TCM detects a ratio failure for a single clutch element and then a further symptom is detected in a gear that the clutch element is not involved.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Any driver requests that are not yet honored will be cleared.
- The Transmission will shift into Sixth Gear via Neutral.
- Maintain PARK position if the DTC is detected while in PARK.
- REVERSE gear will not be available.
- DRIVE will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to 2.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Replace the Transmission in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D96-00-INCORRECT GEAR RATIO CLUTCH A OR B DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is above a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2**.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be

needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D97-00-INCORRECT GEAR RATIO CLUTCH A OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is above a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
TRANSMISSION - INTERNAL COMPONENTS

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to **VALVE BODY, REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1D98-00-INCORRECT GEAR RATIO CLUTCH B OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).

- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [**VALVE BODY, REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1D99-00-INCORRECT GEAR RATIO CLUTCH B OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D9A-00-INCORRECT GEAR RATIO CLUTCH C OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.

- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1D9B-00-INCORRECT GEAR RATIO CLUTCH A OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information**.

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [**VALVE BODY, REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1D9C-00-INCORRECT GEAR RATIO CLUTCH A OR C DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a

failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D9D-00-INCORRECT GEAR RATIO CLUTCH B OR C DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.

- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or Reverse position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. (Refer to - Transmission and Transfer Case/Automatic/FLUID and FILTER/Standard Procedure).

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Replace the Valve Body in accordance with the Service information. Refer to **VALVE BODY, REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1D9F-00-INCORRECT GEAR RATIO CLUTCH D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not

involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#).

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. (Refer to - Transmission and Transfer Case/Automatic/FLUID and FILTER/Standard Procedure).

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.

3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA0-00-INCORRECT GEAR RATIO CLUTCH A B OR C DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.

- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Second Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2.**

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1DA1-00-INCORRECT GEAR RATIO CLUTCH A B OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA2-00-INCORRECT GEAR RATIO CLUTCH B C OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2**.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA3-00-INCORRECT GEAR RATIO CLUTCH B D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.

- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2.**

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA4-00-INCORRECT GEAR RATIO CLUTCH B C OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear

ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to [PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE](#) .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION**.

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION**.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA5-00-INCORRECT GEAR RATIO CLUTCH C D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Seventh Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.

- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA6-00-INCORRECT GEAR RATIO CLUTCH A C OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE**.

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL**.

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2**.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be

needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA7-00-INCORRECT GEAR RATIO CLUTCH A D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Seventh Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to **VALVE BODY, REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DA8-00-INCORRECT GEAR RATIO CLUTCH A B OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into First Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).

- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA9-00-TRANSMISSION FLUID TEMPERATURE RATIONALITY

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE

TEMPERATURE vs RESISTANCE	
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No failures detected in the transmission oil temperature monitoring.

SET CONDITION

- Transmission oil temperature delta between 2 measurements exceeds a calibrated threshold for a calibrated amount of time.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DAA-00-TRANS TEMP UNDETERMINED

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- A malfunction is detected by any combination of two transmission temperature sensors indicating a failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- Any driver requests that are not yet honored will be cleared.

- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID TEMPERATURE SENSOR DTC SET
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DAB-00-VEHICLE SPEED UNDETERMINED

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

THEORY OF OPERATION

This diagnostic is a continuous test that monitors the Vehicle Speed Sensor (VSS) for lack of activity. The test will not run if a limp-in condition exists for the Manifold Absolute Temperature (MAP), Throttle Position, or Engine Coolant Temperature. If the VSS signal is below a calibrated value for a period of time after the vehicle is operated at a sufficient load, a Diagnostic Trouble Code (DTC) will set.

WHEN MONITORED

When Monitored:

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Engine speed sensor signal is valid.
 - Engine speed above 430 RPM.
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - Rationality failure is detected for the Input Speed Sensor, Output Speed Sensor and Wheel Speed Sensor.
- Condition Two:
 - With the engine running there is an electrical sensor failure of more than one internal sensor signal used for the rationality monitoring.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- Any driver requests that are not yet honored will be cleared.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
WHEEL SPEED DEVIATION RELATED VEHICLE SPEED DTC TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: Diagnose communication DTCs before proceeding. If no communication DTCs are set, diagnose Antilock Brake System (ABS) DTCs before proceeding.

NOTE: This DTC can set due to differences in tire diameter. Check tire diameters

to make sure the tires are the same size.

NOTE: This DTC can set due to wheel spin.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

2. VISUAL INSPECTION

NOTE: This DTC can set due to differences in tire diameter.

NOTE: This DTC may set on a hard acceleration on loose gravel or during other off road driving conditions.

1. Check all of the tires for the correct pressure.
2. Check tire wear on all the tires.
3. Check that all tire sizes are the same.
4. Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes

- Repair as necessary. If the DTC set during a front or rear wheel spin condition, no repair is necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [3](#)

3. VEHICLE SPEED RELATED DTCS

1. Using the DTC data recorded earlier, check for vehicle speed related DTCS.
2. Perform any Service Bulletins that may apply.

Were any vehicle speed related DTCS present?

Yes

- Perform the appropriate diagnostic procedure in accordance with the Service Information.

No

- Go To [4](#)

4. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [5](#).

No

- Go To

Refer to [6](#).

5. PROGRAM THE TRANSMISSION CONTROL MODULE (TCM)

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to [MODULE PROGRAMMING](#) .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM assembly in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

6. CHECK THE TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid level correct?

Yes

- Go To [7](#)

No

- Correct the transmission oil level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

7. INSPECT THE OUTPUT SPEED SENSOR

1. Remove the Transmission Oil Pan in accordance with the Service Information.

NOTE: If excessive debris is found in the Transmission Oil Pan, correct the cause of the debris before proceeding with this Diagnostic Test.

2. If equipped, remove the Hydraulic Impulse Solenoid (HIS).
3. Visually inspect the Output Speed Sensor for proper installation.

Is the Output Speed Sensor properly installed?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [8](#)

8. CHECK OUTPUT SPEED SENSOR FOR DAMAGE

1. Carefully remove the Output Speed Sensor from the transmission case.
2. Inspect the Output Speed Sensor for any visible damage.

Is there any damage to the Output Speed Sensor?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Properly install the Output Speed sensor in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

For a complete TRANSMISSION wiring diagram, **refer to the appropriate wiring information** .

THEORY OF OPERATION

This diagnostic monitors for a double failure of the Engine Speed signal received via Controller Area Network (CAN) and an electrical or rationality failure of the Input Speed Sensor. If the Transmission Control Module (TCM) detects a failure with both tests this Diagnostic Trouble Code (DTC) will set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No sensor power supply failures detected.

SET CONDITION

- Electrical failure or rationality failure at the Input Speed Signal.
- Controller Area Network (CAN) failure at engine speed signal.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) DTCS ARE SET
BUSSED SPEED SIGNAL
TRANSMISSION SPEED SENSOR TERMINAL CONTAMINATION
INTERNAL TRANSMISSION FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**
 1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
 2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
 3. With the scan tool, erase all DTCS.
 4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCs.

Are any engine speed related PCM DTCs set?

Yes

- Repair the PCM DTCs. refer to the appropriate wiring information .

No

- Go To [3](#)

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
 - Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
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2021 AUTOMATIC TRANSMISSION

8HP50/850RE Automatic Transmission - Pre-Diagnostic Troubleshooting Procedure, Transmission Verification Test & TCM Adaptation - Gladiator [EBH, EC1, EC3, ERC]

STANDARD PROCEDURE

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For a complete TRANSMISSION wiring diagram, refer to the appropriate wiring information .

DIAGNOSTIC TROUBLESHOOTING PROCEDURE

The Pre-Diagnostic Troubleshooting Procedure is intended to provide the technician with a common starting point for all DTC troubleshooting procedures. The DTC troubleshooting procedures assume that the following steps have been performed and therefore are not always repeated. Failure to follow the steps in this procedure can lead to misdiagnosis.

If any repairs are performed, perform the appropriate VERIFICATION TEST.

NOTE: Do not perform repairs not related to the customer complaint.

1. With the scan tool, **read DTCs and record on the repair order** .
2. With the scan tool, **run a Vehicle Scan Report and a ECU Configuration Report** and save the files for future use.
3. **Check the vehicle repair history** for any recent repairs that may be related to the customer complaint.
4. If possibly related to the customer complaint, **verify the vehicle build configuration** with the OEM Vehicle Build Configuration on Service Library or TechCONNECT. Properly configure the vehicle if necessary.
5. If possibly related to the customer complaint, **verify all Electronic Control Units (ECU)s have the same Original Vehicle Identification Number (VIN)** . If a mismatch is found, this could indicate the source of the problem. Typically, this condition will cause multiple communication DTCs to set however, this is not always the case.
6. With a scan tool, **check all ECUs for available software updates** that are related to the customer complaint.
 - Read Service Bulletins to determine if the software update is applicable to the customer complaint.
 - Update the (ECU)s if necessary.
7. Use the Search function in Service Library or TechCONNECT to **read any related information under SERVICE ACTIONS/TIPS** .
 - Perform any Service Bulletins or other procedures that may apply.
8. **Check for aftermarket electrical accessories** . Be certain they are installed properly and do not interfere with any related power, ground, signal, or communication circuits. Be certain aftermarket wiring harnesses are routed away from vehicle wiring harness to avoid Electromagnetic Interference (EMI) where applicable.

NOTE: A low battery State Of Charge (SOC) or a charging system that is not operating properly can cause many symptoms and DTCs to set.

9. If possibly related to the customer complaint, **check the vehicle charging system and battery for proper operation** . Refer to the appropriate Service Information.

NOTE: Incorrect fluid level, incorrect fluid, fluid contamination, and poor fluid condition can cause many Transmission symptoms.

10. **Check the Transmission Fluid for proper level and condition** . Visually inspect for external leaks and repair as necessary in accordance with the Service Information.

NOTE: **The Engine must be operating properly for the Transmission to operate properly.**

11. With the scan tool, read Powertrain Control Module (PCM) DTCs. **Repair all PCM DTCs prior to performing Transmission diagnostic procedures.**

12. **Check other ECUs for DTCs** that could cause this DTC to set.

13. If multiple DTCs are set in one ECU, and no detectable pattern is evident (for example, the DTCs are not related to just one or two components or subsystems), **check the applicable ECU ground circuit(s) for proper continuity** . As a general rule, **diagnose the DTCs in the following order** unless instructed otherwise by the specific DTC procedure:

1. ECU Configuration DTCs
2. ECU Voltage DTCs
3. ECU Internal Error DTCs
4. Circuit Fault DTCs (Low voltage, High Voltage, Open Circuit, Short Circuit, Low Current, High Current,)
5. Communication DTCs (See below)
6. Performance / Rationality DTCs
7. Implausible or Invalid Data
8. Missing Message
9. Other

14. If multiple communication DTCs are set, **diagnose the DTCs in the following order** unless instructed otherwise by the specific DTC procedure:

1. CAN Bus Off
2. CAN Bus Off Performance
3. Lost Communication
4. Other

NOTE: **IMPORTANT: Some Control Modules simply pass information from one Control Module to the other. In some cases, a U-code DTC may be set that implicates the "pass-through" module that sent the information. For example, if an Engine Coolant Temperature (ECT) Sensor DTC is set in the Powertrain Control Module (PCM), the HVAC module may set an "Implausible Data from BCM" DTC because the BCM is the module that normally passes that information from the PCM to the HVAC module. However, the BCM may not set any DTCs related to the faulted ECT Sensor because the BCM does not use the ECT information. In this case, the PCM ECT DTC should be diagnosed before the Implausible Data DTC. If you suspect a scenario like this, diagnose the non U-code DTC(s) before diagnosing any Implausible Data, Implausible Signal, Invalid Data, or Missing Message DTCs.**

TRANSMISSION VERIFICATION TEST

Perform the following procedure to verify proper Transmission operation after repairs have been performed.

VERIFICATION-8-SPEED

1. Reinstall any removed components.
2. Reconnect any disconnected electrical connectors.
3. With the scan tool, erase TCM DTCs.

4. With the scan tool, erase ESM DTCs.
5. With the scan tool, erase ABS DTCs.
6. With the scan tool, erase PCM DTCs.

CAUTION: Apply the parking brake.

7. With the scan tool, display the Transmission Temperature.
8. Start the engine and allow the transmission fluid temperature to reach 43B° C (110B° F).
9. Check for Transmission fluid leaks.
10. If internal transmission components were repaired or replaced check the Transmission fluid level and adjust if necessary. Refer to **FLUID/FILTER SERVICE**.
11. If any internal transmission repairs were performed or the Transmission Control Module (TCM) was replaced, perform the TCM ADAPTATION procedure. Refer to **TRANSMISSION CONTROL MODULE (TCM) ADAPTATION**.
12. Perform the ROAD TEST PROCEDURE

ROAD TEST PROCEDURE

1. Operate the vehicle in a manner that will allow 15-20 upshifts through all of the gears.
2. Allow these shifts to occur from 0 kPh (0 mph) to 72 kPh (45 mph) with a constant throttle opening of 20 to 25 degrees.
3. Operate the vehicle below 40 kPh (25 mph) and then perform a throttle kick-down maneuver to 1st gear. Do this several times from below 40 kPh (25 mph).
4. With the scan tool, read TCM DTCs.

Did any TCM DTCs set?

Yes

- Repair TCM DTCs. Refer to **8HP50/850RE AUTOMATIC TRANSMISSION - DIAGNOSTIC CODE INDEX**.

No

- Test complete.

TRANSMISSION CONTROL MODULE (TCM) ADAPTATION

The TCM controls the fluid pressure and fill time of each clutch pack to give optimal shift quality. As the clutches wear, the TCM will adapt and make adjustments to keep the shift quality consistent over the life of the vehicle. The initial clutch filling pressure and fill times are set at the factory. When a transmission assembly or transmission component is replaced, or when the adaptation values are reset, the adaptation values must be relearned. This procedure should also be followed when it is suspected that a vehicle has not been driven in a manner that encourages clutch adaptation learning in highway or city driving conditions.

NOTE: The scan tool, for many 8-Speed Transmissions now has a QUICK LEARN or STATIC ADAPTATION (STADA) routine that should be performed if the customer has any shift quality concerns or after any internal repairs are performed on the transmission. If the QUICK LEARN or STATIC ADAPTATION routine is not available on the scan tool for the application you are working on or the shift quality concern is not corrected by performing the QUICK LEARN or STATIC ADAPTATION routine then the TCM ADAPTATION PROCEDURES below need to be performed.

QUICK LEARN PROCEDURE

NOTE: The QUICK LEARN PROCEDURE requires that the Transmission fluid temperature be at least 55B°C (131B°F).

1. Drive the vehicle briefly to ensure all clutches have been engaged at least twice. Keep the engine running throughout the remainder of this procedure.
2. With the scan tool, activate the RESET ADAPTIVE VALUES routine.
3. With the scan tool, activate the QUICK LEARN routine and follow the on-screen instructions. This procedure requires about 2-5 minutes to complete.

TCM ADAPTATION PROCEDURES

The two procedures to relearn these values are called Fast Filling Adaptation and Standard Clutch Filling Adaptation. Depending on the repair or complaint, one or both procedures must be performed as described below.

NOTE: Performing a reset of the Transmission Adaptation values does not automatically trigger the TCM to relearn the Adaptation values. If a reset is performed, both procedures must be performed to restore optimal shift quality. Do not reset these values unless specifically instructed to do so.

NOTE: This procedure does not need to be performed if the existing TCM is re-flashed and that was the only repair performed.

One or both TCM Adaptation procedures should be performed depending on the situation. Failure to perform these procedures when required could cause shift quality issues.

Fast Filling Adaptation Procedure

Perform the following procedure when the TCM or Transmission assembly has been replaced, or when the adaptation values have been reset. This procedure should be performed before performing the Standard Clutch Filling Adaptation Procedure when these components are replaced.

NOTE: Perform this procedure on a smooth road surface. The TCM will abort the adaptation process if it senses rough road conditions. The road should be clear of traffic due to the start, stop, and slow vehicle speeds required during this procedure.

1. With the Scan Tool, erase Diagnostic Trouble Codes (DTCs).
2. Setup the scan tool to display the Transmission Oil Temperature, Torque, Turbine (Input) Speed Sensor rpm, and Clutch 'X' - Filling Counter for each clutch.
3. Drive the vehicle until the Transmission Oil Temperature is above 30B° C (86B° F).
4. Stop the vehicle.
5. Drive the vehicle to perform upshifts for all gears under the following conditions:
 - Light to medium throttle position
 - Turbine (Input) Speed between 1, 250 - 2, 000 rpm
 - Torque between 100 N.m and 150 N.m (74 ft. lbs. and 111 ft. lbs.)
6. Release the throttle (0% position) to coast and allow a 6-5 down-shift.
7. Perform steps 4-6 until the Filling Counters for each clutch displays 10 counts.

The tables below may be used as an alternate reference for the optimal conditions required to learn the Fast Filling Adaptations.

Conditions Where Fast Filling Adaptations Occur

Conditions Where Fast Filling Adaptations Occur			
Condition	Transmission Temperature	Torque N.m (ft. lbs.)	Input Speed (rpm)
Upshifts	Between 30B° C and 100B° C (86B° F and 212B° F)	Between 100 N.m and 150 N.m (74 ft. lbs. and 111 ft. lbs.)	Between 1250 and 2000 rpm
6-5 Downshifts for B Clutch	Between 30B° C and 100B° C (86B° F and 212B° F)	Between negative (-) 60 N.m and negative (-) 40 N.m (negative (-) 44 ft. lbs. and negative (-) 30 ft. lbs.)	Between 750 and 1100 rpm

Shifts Where Each Clutch Will Fast Adapt

Shifts Where Each Clutch Will Fast Adapt					
B	A Clutch	B Clutch	C Clutch	D Clutch	E Clutch
Shift	6 - 7	6 - 5	2 - 3 and 4 - 5	3 - 4	1 - 2 and 5 - 6
Optimal conditions under which adaptation learning occurs.	Best performed at highway speeds in excess of 80 kph (50 mph).	Coasting with throttle at 0% position.	Best performed at light to medium-throttle - normal vehicle launch.	Best performed at light to medium-throttle - normal vehicle launch.	Best performed at light to medium-throttle - normal vehicle launch.

8. Perform the Standard Clutch Filling Adaptation Procedure.

Standard Clutch Filling Adaptation Procedure

Perform the following procedure when a Transmission internal component, Torque Converter, TCM, or Transmission has been replaced, or when the adaptation values have been reset. This procedure should also be performed if it is suspected that the vehicle has not been driven in a manner that encourages clutch adaptation learning in highway or city driving conditions.

NOTE: Perform this procedure on a smooth road surface. The TCM will abort the adaptation process if it senses rough road conditions. The road should be clear of traffic due to the start, stop, and slow vehicle speeds required during the procedure.

NOTE: The TCM learns the Standard Clutch Filling Adaptation values when the applicable clutch is not applied.

1. With the Scan Tool, erase DTCs.
2. Setup the scan tool to display the Transmission Oil Temperature, Torque, Turbine (Input) Speed Sensor rpm, and Clutch 'X' - Fast Filling Counter for each clutch.
3. Drive the vehicle until the Transmission Oil Temperature is above 50B° C (122B° F).

NOTE: Adaptation learning will be aborted if the Transmission Oil Temperature is above 100B° C (212B° F).

4. Stop the vehicle.
5. Drive the vehicle using the paddle shifters or Gear +/- buttons on steering wheel in order to hold the transmission in the desired gear.

NOTE: First and second gears do not require a Standard Clutch Filling Adaptation procedure.

NOTE: If attempting to resolve a specific shift quality issue, use the Gear vs Clutch Table below to see which clutches require further adaptation. For instance, if a rough 2-1 downshift is noted, note that clutch C and clutch E are applying and releasing. Then use the Clutch vs Shift Table above to note that clutch C and clutch E require the adaptation procedure performed in 4th and 7th gear.

6. In 3rd gear, drive the vehicle within the following conditions until the Clutch D - Fast Filling Counter increments by one count:
 - Vehicle speed between 32-56 kph (20-35 mph)
 - Turbine (Input) speed between 950 - 1750 rpm
 - Torque between 25 N.m - 180 N.m (18 ft. lbs. - 133 ft. lbs.)
7. In fourth gear, drive the vehicle within the following conditions until the Clutch C - Fast Filling Counter increments by one count:
 - Vehicle speed between 32-56 kph (20-35 mph)
 - Turbine (Input) speed between 950 - 1750 rpm
 - Torque between 25 N.m - 120 N.m (18 ft. lbs. - 89ft. lbs.)

NOTE: Fifth gear does not require a Standard Clutch Filling Adaptation procedure.

8. In sixth gear, drive the vehicle within the following conditions until the Clutch A - Fast Filling Counter increments by one count:
 - Vehicle speed between 73-81 kph (45-50 mph)
 - Turbine (Input) speed between 950 - 1750 rpm
 - Torque between 50 N.m - 120 N.m (37 ft. lbs. - 89ft. lbs.)
9. In seventh gear, drive the vehicle within the following conditions until the Clutch B- Filling Counter and Clutch E Fast Filling Counter each increment by one count:
 - Vehicle speed between 73-81 kph (45-50 mph)
 - Turbine (Input) speed between 950-1750 rpm
 - Torque between 50 N.m-120 N.m (37 ft. lbs.-89ft. lbs.)

The **Standard Clutch Filling Adaptation Conditions Table** below may be used as an alternate reference for the optimal conditions required to learn the Standard Clutch Filling Adaptations.

Steady State Gears And Conditions Where Each Clutch Will Adapt

Steady State Gears And Conditions Where Each Clutch Will Adapt					
Clutch	Gear	Optimal Vehicle Speed	Input Speed (rpm)	Torque N.m (ft. lbs.)	Transmission Temperature
A Clutch	6th	73-81 kph (45-50 mph).	Between 950 and 1750 rpm	Between 50 N.m and 120 N.m (37 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)
B Clutch	7th	73-81 kph (45-50 mph).	Between 950 and 1750 rpm	Between 50 N.m and 120 N.m (37 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)
C Clutch	4th	32-56 kph (20-35 mph).	Between 950 and 1750 rpm	Between 25 N.m and 120 N.m (18 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)
D Clutch	3rd	32-56 kph (20-35 mph).	Between 950 and 1750 rpm	Between 25 N.m and 180 N.m (18	Between 50B° C and 100B° C (122B° F

Steady State Gears And Conditions Where Each Clutch Will Adapt					
Clutch	Gear	Optimal Vehicle Speed	Input Speed (rpm)	Torque N.m (ft. lbs.)	Transmission Temperature
				ft. lbs. and 133 ft. lbs.)	and 212B° F)
E Clutch	7th	73-81 kph (45-50 mph).	Between 950 and 1750 rpm	Between 50 N.m and 120 N.m (37 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)

10. Perform steps 4-9 until the Fast Filling Counters for each clutch has incremented by at least five counts.
11. Evaluate shift performance for all gears. If the shift quality for any gear is insufficient, execute the appropriate driving conditions until shift quality improves. Incrementing the Fast Filling Counters by 12 counts for each clutch may be necessary to properly learn the adaptation values.

The following table Controller Area Network (CAN) be used to determine which clutches are involved in a specific up-shift or down-shift quality issue. 'X' indicates when a clutch is applied. The Standard Clutch Filling Adaptation learning occurs when the applicable clutch is not applied and the transmission is in a steady state (not shifting).

Controller Area Network

Gear	Clutch A	Clutch B	Clutch C	Clutch D	Clutch E
1st	X	X	X	B	B
2nd	X	X	B	B	X
3rd	B	X	X	B	X
4th	B	X	B	X	X
5th	B	X	X	X	B
6th	B	B	X	X	X
7th	X	B	X	X	B
8th	X	B	B	X	X
Reverse	X	X	B	X	B

Read the information below for details regarding this procedure.

Reading Clutch Adaptation Data

The Clutch Packs will each have 4 scan tool data labels to observe under the TCM information. Using Clutch A as an example, the data labels are:

- **Clutch A- Fast Filling Counter:** This data label displays the number of Clutch Filling Pressure adaptations that have been performed. These adaptations are the first learned values on a new transmission or after clutch adaptation values are reset. You will need to allow 5 to 12 fast filling counts per clutch to properly learn the clutch adaptations. If the shift quality is sufficient after 5 counts, no further adaptation learns for that clutch are necessary.
- **Clutch A- Filling Counter:** This data label displays the number of Clutch Filling Time adaptations that have been performed. You will need to allow 5 to 12 filling counts per clutch to properly learn the clutch adaptations. If the shift quality is sufficient after 5 counts, no further adaptation learns for that clutch are necessary.
- **Clutch A- Filling Pressure:** This data label displays the clutch filling pressure value that is learned during the TCM Adaptation procedure. The TCM adaptation software will increase or decrease the clutch fluid filling pressure to improve shift performance. The clutch Filling Pressure value will change over the life of the transmission based first on initial transmission build variation and then due to normal clutch wear.
- **Clutch A- Filling Time:** This data label displays the clutch filling time value that is learned during the TCM Adaptation procedure. The TCM adaptation software will increase or decrease the Clutch Filling

Time to improve shift performance. The clutch Filling Time value will change over the life of the transmission based first on initial transmission build variation and then due to normal clutch wear.

MODULE PROGRAMMING

PROGRAMMING THE TRANSMISSION CONTROL MODULE (TCM)

NOTE: New TCMs are supplied with generic software. When replacing a TCM, it must be programmed with vehicle specific software.

NOTE: Failure to properly program the TCM will cause Diagnostic Trouble Codes (DTCs) to be set.

1. The following conditions must be met during the reprogramming procedure:
 - Battery must be maintained between 10 and 16 volts. Connect a battery charger if necessary.
 - Ambient temperature must be between 0B°C (32B°F) 60B°C (140B°F).
 - Gear Selector must be in PARK.
2. With the scan tool, download the appropriate TCM flash file to the scan tool.
3. Turn the ignition on.
4. Following the menu on the scan tool, program the TCM.
5. Perform the TCM ADAPTATION procedure. Refer to **TRANSMISSION CONTROL MODULE (TCM) ADAPTATION** .
6. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

Is the Programming Procedure and TCM Adaptation Procedure complete?

Yes

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
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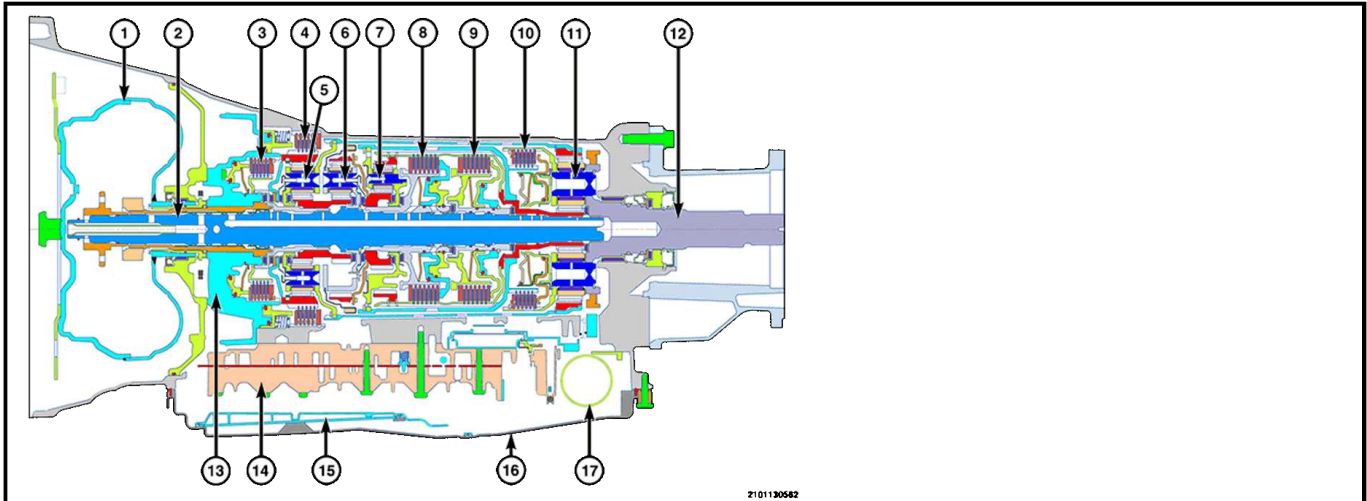
2021 AUTOMATIC TRANSMISSION

8HP50/850RE Automatic Transmission (Service Information) - Gladiator [ERC]

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION



CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

The transmission case is a single-piece unit. The starter pocket, cooler line fittings, and manual park release lever are located on the driver's side of the case. The electrical connector and oil fill plug are located on the passenger side of the case. The 850RE uses a sealed, externally-splined output shaft to form a dry connection between the adapter plate and the transfer case.

OPERATION

- The 850RE is an electronic eight-speed automatic transmission.
- The Transmission Control Module Assembly (TCMA), which is integrated into the valve body, provides fully synchronized clutch-to-clutch shifting through four planetary gear sets.
- The TCMA includes a mounting plate that holds the Transmission Control Module (TCM) and a molded wiring harness for connection to various transmission sensors and solenoids.
- The valve body assembly contains all the sensors and solenoids required for operation, completely inside the transmission.
- Eight speeds allow the engine to maintain its optimal rpm range, increasing fuel economy and performance.
- Transmission control is performed by the TCM based on hard-wired and Controlled Area Network (CAN) bus signals from sensors and modules.
- The TCM receives driveability data from the Powertrain Control Module (PCM) and other modules over the CAN-Chassis (CAN-C) bus.
- The TCM receives shift lever position information from the Electronic Shift Module (ESM) over a dedicated transmission CAN bus.
- The TCM processes this input data and controls operation of the Torque Converter Clutch (TCC), park lock system, solenoid valves, and pressure regulating valve.

- The Input and Output Speed Sensors (ISS and OSS) are Hall-effect sensors that measure shaft rotational speed.
- The ISS is located at the top, near the center, of the of the TCMA and reads input shaft speed from the magnetic ring on the P2 carrier.
- The OSS is located at the back of the TCMA and reads output shaft speed from the P4 carrier.

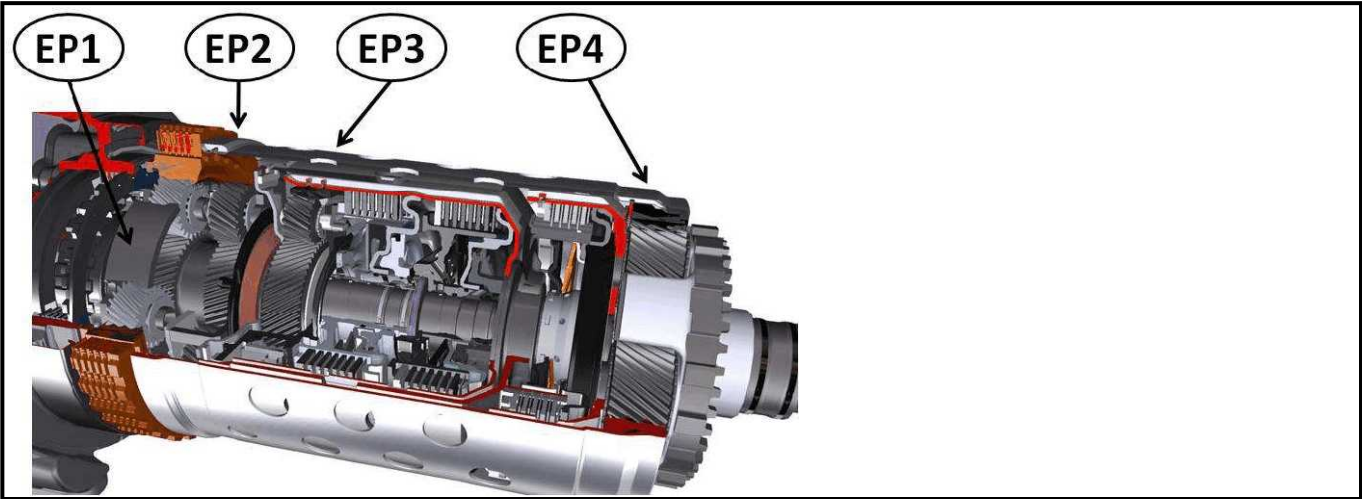
FILTER SERVICE

- The 850RE has a conventional fluid sump design with a independent transmission fluid filter.
- The transmission oil pan gasket is reusable providing it is not damaged during removal.
- If the gasket is damaged the transmission oil pan and gasket are replaced as an assembly.

FLUID CHECK AND FILL

- A transmission fluid fill tube and indicator are not provided.
- All work is performed under the vehicle while raised on a hoist. In the event of a transmission shift quality concern, a fluid leak, or in conjunction with a transmission repair, the transmission fluid level must be validated and topped off as necessary.
- The procedure involves the use of a scan tool to monitor transmission fluid temperature.
- Specific service procedures are necessary to check and fill the transmission with fluid. Refer to [TRANSMISSION FILL AFTER SERVICE](#) .

Epicyclic Gear Sets



Epicyclic gear train (EP1, EP2, EP3, EP4)

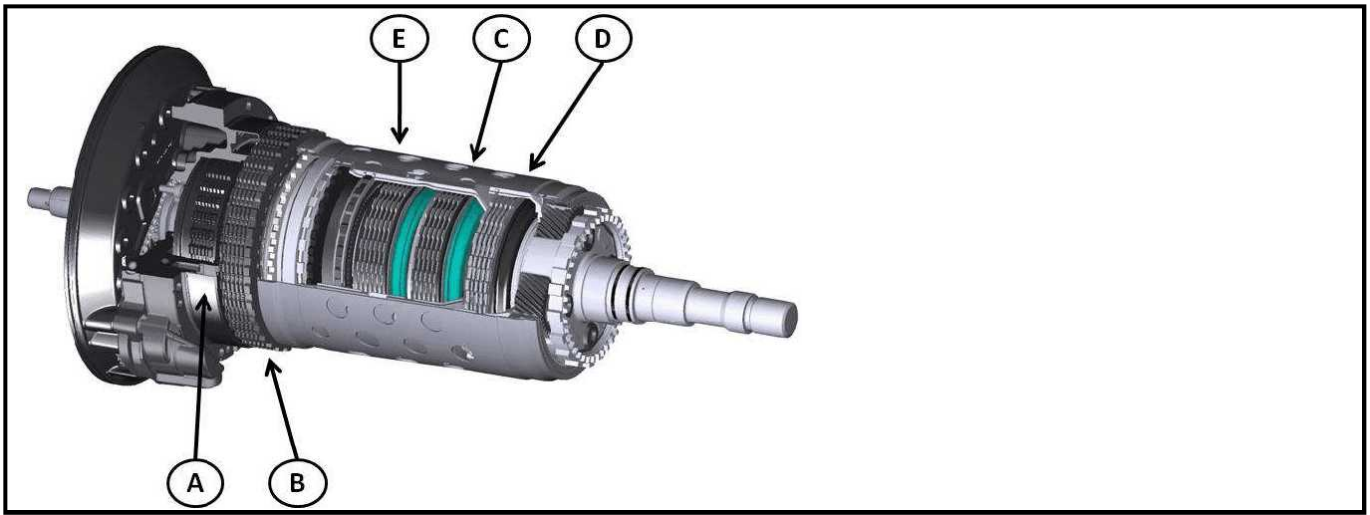
The eight forward gears and the reverse gear are implemented by connecting four single-arm epicyclic gear trains.

The two front gear trains have a common sun gear, while the power is always output through the fourth epicyclic gear train planet carrier.

Engagement Elements

There are five engagement elements divided as follows:

Brakes	A	B	B
Clutches	C	D	E



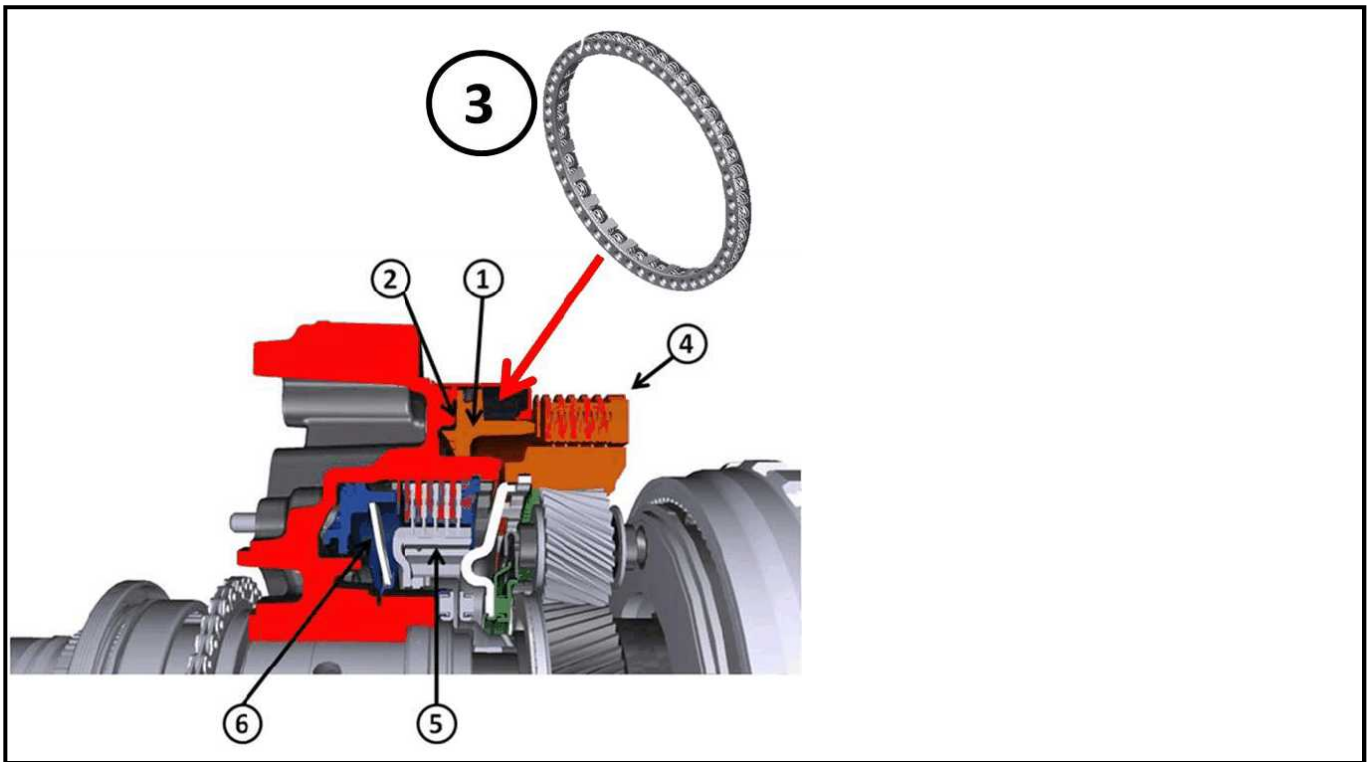
Multiple-disc clutches C, D and E transmit the engine torque to the epicyclic gear train, while brakes A and B off-load the engine torque to the transmission housing.

The engagement elements are hydraulically closed. The fluid pressure compresses the disc pack to engage the clutch. When the hydraulic pressure decreases, the diaphragm spring pushes the piston into its rest position.

The engagement elements serve to engage the gears under load without interrupting the traction force.

For each gear, three engagement elements are always closed, therefore two engagement elements always remain open. Each open engagement element creates drag torque, so this configuration allows an increase in transmission efficiency.

Brakes



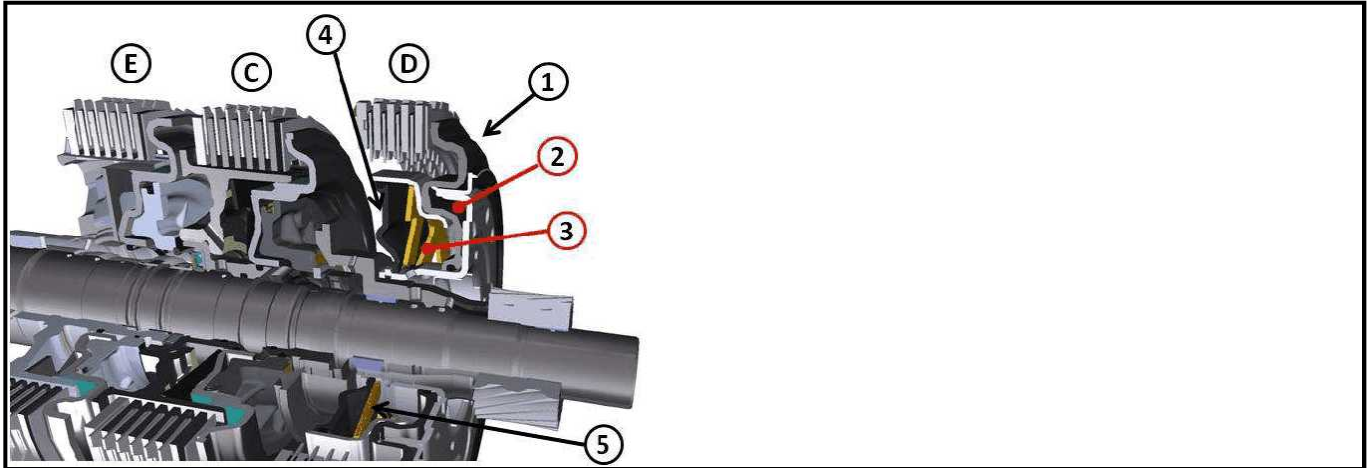
1	Brake B Piston
2	B1 Chamber
3	Return Spring
4	Brake B
5	Brake A
6	Return Spring

Brake B has a spring pack to return the piston into position.

Brake A has a diaphragm return spring.

Clutches

1	Piston
2	Pressure chamber
3	Hydraulic compensation chamber
4	Diaphragm
5	Diaphragm spring



The dynamic pressure of clutches C, D and E is compensated.

The increase in dynamic hydraulic pressure at high speeds is due to the fact that the transmission fluid in the clutch cylinder is subject to considerable centrifugal forces created by the rotation. As a result, the pressure in the clutch cylinder increases in the direction of the maximum radius.

The "dynamic pressure generation" is an undesirable phenomenon because it fruitlessly increases the pressure and obstructs the defined increase or decrease in the pressure chamber.

To ensure the best clutch control even at high speeds, oil is supplied to both sides of the clutch piston, creating a pressure chamber and a pressure compensation chamber.

The transmission fluid in the pressure compensation chamber comes from the lubrication ducts and is therefore at low pressure.

However, once rotating, it is subject to the same dynamic pressure increase due to the centrifugal forces.

In this way, the clutch piston contact pressure is balanced, the shift comfort is significantly improved and safe opening and closing of the clutch is ensured at all speeds.

Brake / Clutch Engagement Matrix

All the gear shifts from the first to the eighth speed and vice versa, are called overlapping engagement/disengagement because during the shift, one clutch must maintain the ability to transmit torque with a reduced pressure, until the other clutch is able to take on the torque.

The gear shift is supported by a brief reduction in torque when shifting up or a brief increase in torque when shifting down. Due to the crossed movements, the freewheel clutches have been replaced by hydraulic clutch control creating a savings in weight and size.

GEAR	Brake A	Brake B	Clutch C	Clutch D	Clutch E
REVERSE	X	X	B	X	B

1st	X	X	X	B	B
2nd	X	X	B	B	X
3rd	B	X	X	B	X
4th	B	X	B	X	X
5th	B	X	X	X	B
6th	B	B	X	X	X
7th	X	B	X	X	B
8th	X	B	B	X	X
PARK/NEUTRAL	X	X	B	B	B

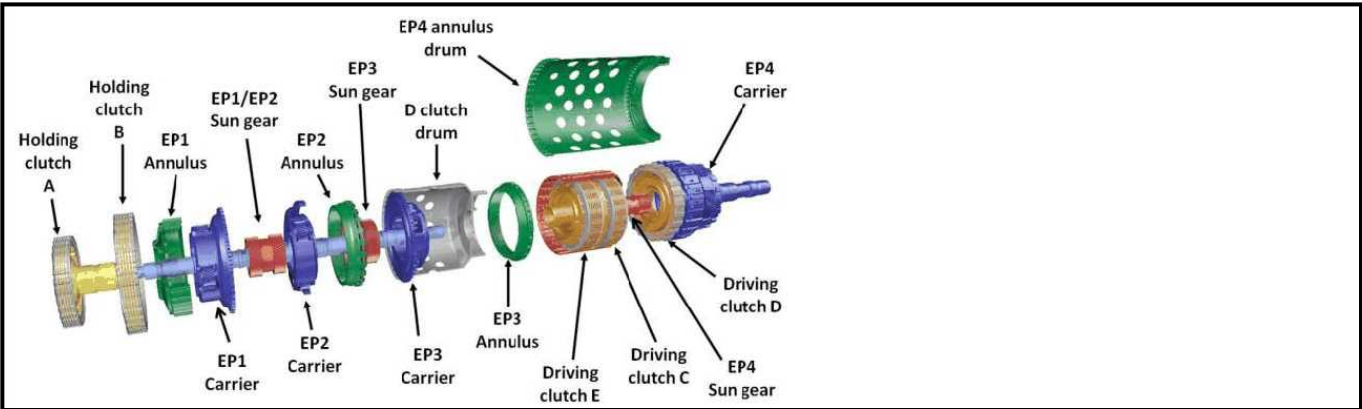
Engaged = X

Brake/clutch engagement control solenoid valves

GEAR	Brake A	Brake B	Clutch C	Clutch D	Clutch E
NEUTRAL	B	B	X	X	X
REVERSE	X	X	X	B	X
1st	X	X	B	X	X
2nd	X	X	X	X	B
3rd	B	X	B	X	B
4th	B	X	X	B	B
5th	B	X	B	B	X
6th	B	B	B	B	B
7th	X	B	B	B	X
8th	X	B	X	B	B

Engaged = X

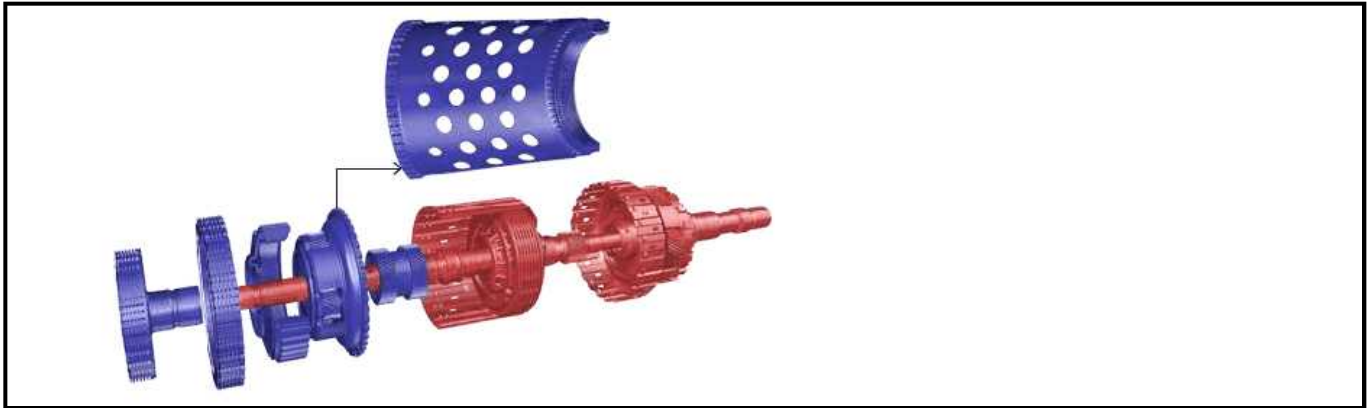
Transmission Components



Holding Clutch
: Brake (Engagement Element)
Driving Clutch
: Clutch (Engagement Element)
Annulus
: Internal Crown Gear
Sun Gear
:

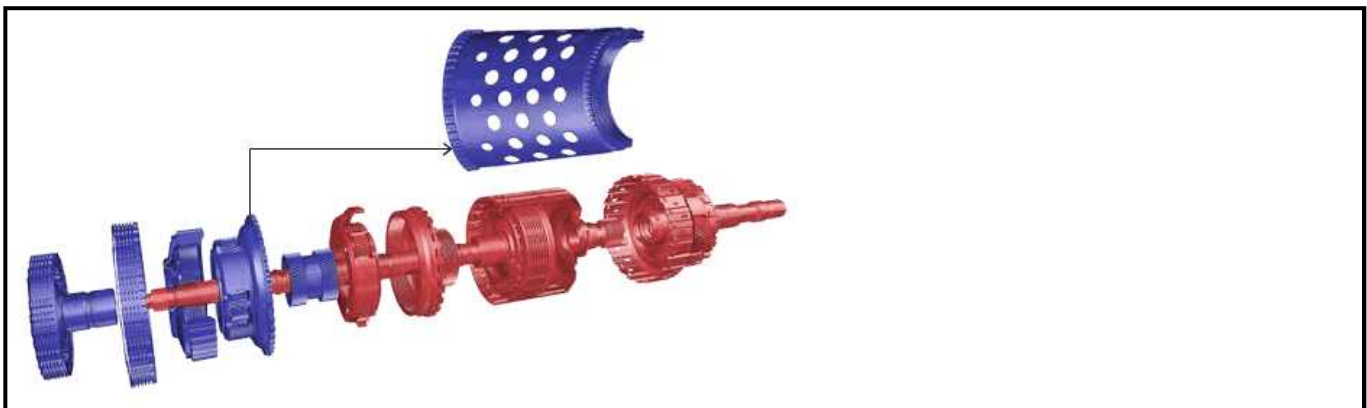
Sun Gear
Carrier
:
Planetary Carrier
Drum
:
Drum

1st GEAR



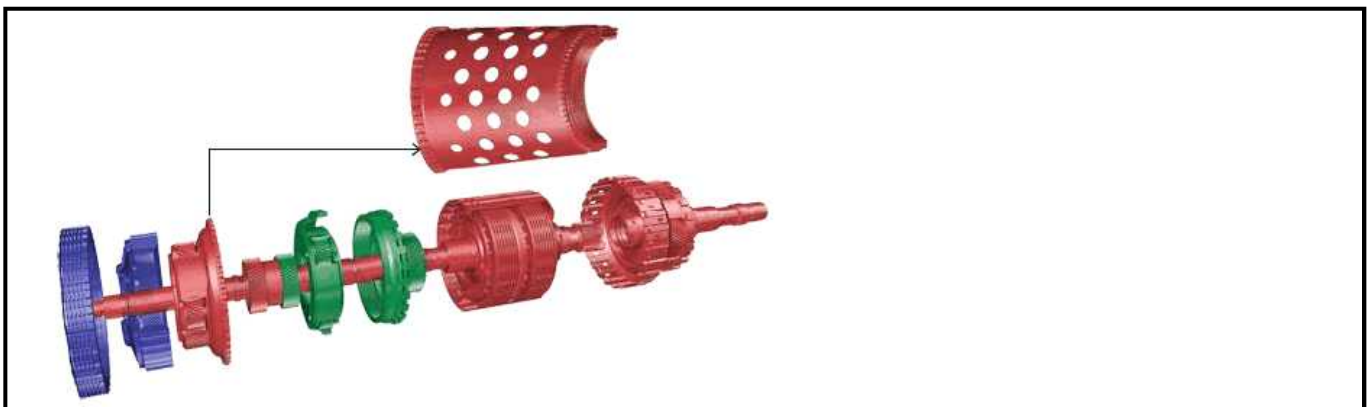
Engagement elements activated: A, B and C Turbine shaft → clutch C → sun gear 4 → planet gears 4 → planet carrier 4.

2nd GEAR



Engagement elements activated: A, B and E Turbine shaft → planet carrier 2 → planet gears 2 → crown gear 2 → clutch E → sun gear 4 → planet gears 4 → planet carrier 4.

3rd GEAR

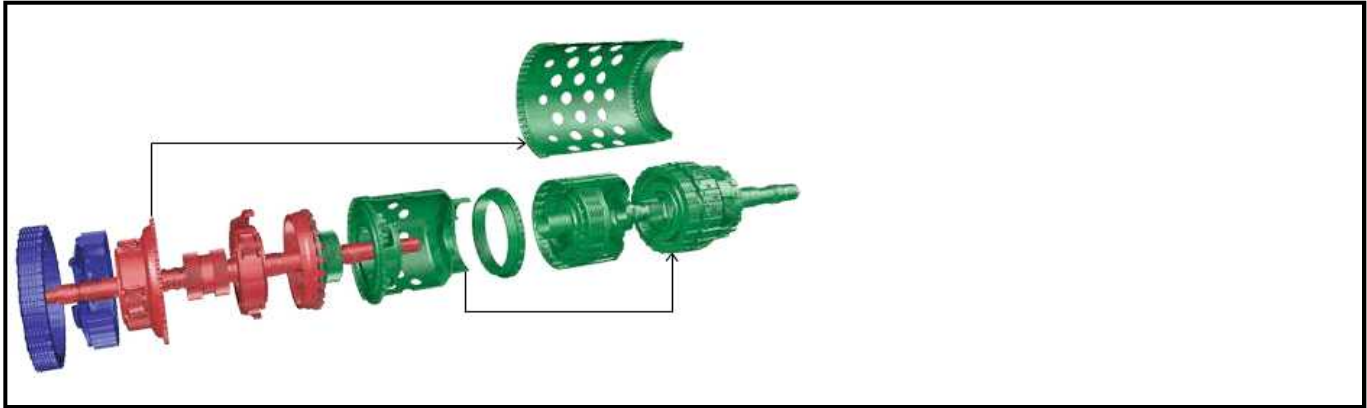


Engagement elements activated: B, C and E.

- Turbine shaft → clutch C → sun gear 4 → planet gears 4 → epicyclic gear train 4.
- Clutch C → clutch E → internal crown gear C2 → planet gears 2 (EP2 is blocked since C2 and PT2 are connected through clutches C and E).
- Turbine shaft → planet carrier 2 (EP2 blocked) → sun gear 1 → planet gear 1 → planet carrier 1 → internal crown gear 4.

The connection from the epicyclic gear train EP1 to the internal crown gear H4 produces a corresponding transmission ratio in the epicyclic gear train EP4 (see force flow in 1st gear).

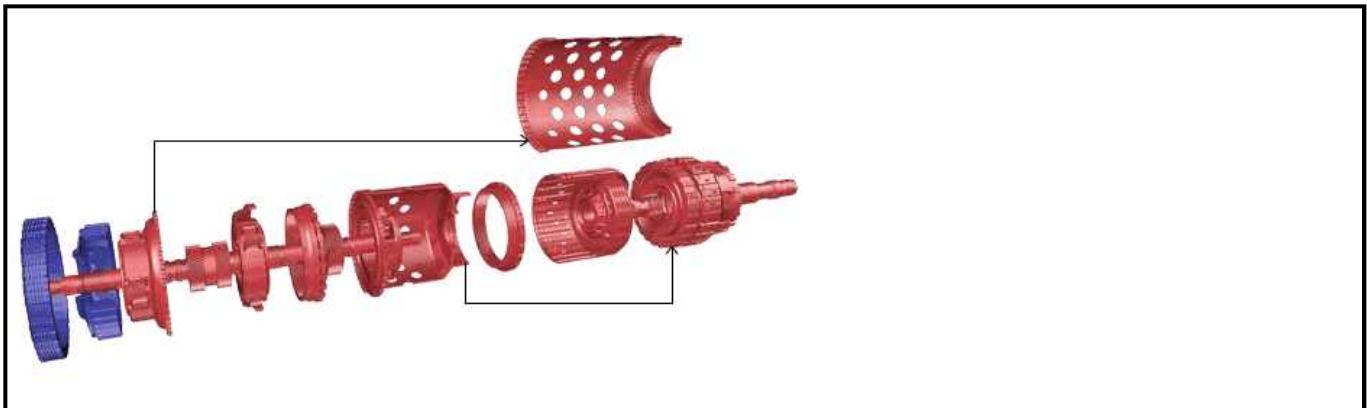
4th GEAR



Engagement elements activated: B, D and E.

- Clutch E blocks the epicyclic gear train EP3 and clutch D and EP3 being blocked cause the epicyclic gear train EP4 to be blocked (gear trains 3 and 4 rotate at the same speed = output).
- Turbine shaft → planet carrier 2 → planet gears 2 → sun gears 1 / 2 → planet gears 1 → planet carrier 1 → internal crown gear 4 → planet gears 4 → planet carrier 4.

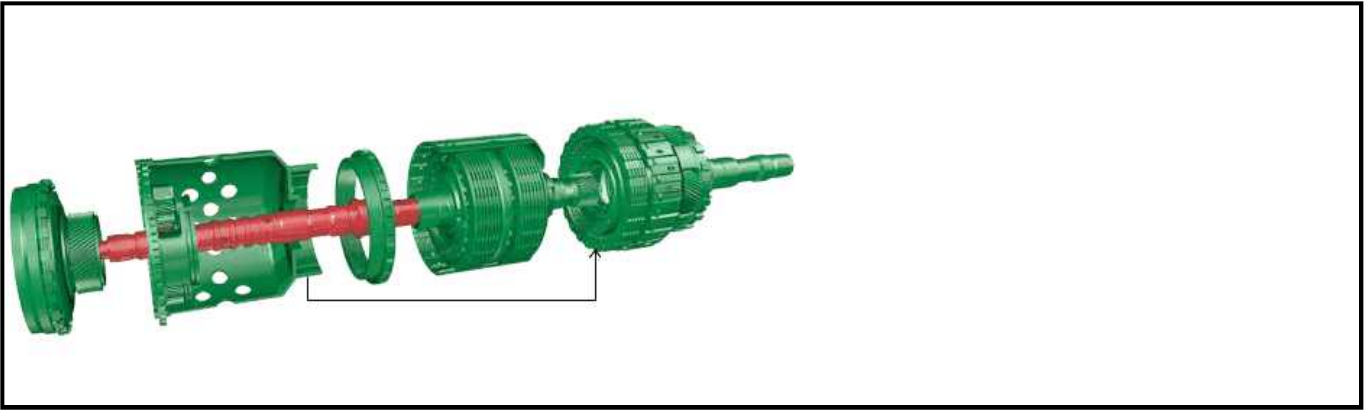
5th GEAR



Engagement elements activated: B, C and D.

- Turbine shaft → clutch C → sun gear 4 + internal crown gear 3 (EP2, C2 and S4 = turbine speed).
- Clutch D connect epicyclic gear train 3 to epicyclic gear train 4 (= output shaft).
- Turbine shaft → planet carrier 2 → planet gears 2 → sun gears 1 / 2 → planet gears 1 → planet carrier 1 → internal crown gear 4 → gives a behavior that depends on the speed ratio of S4 (= turbine speed) to C4 with the corresponding speed on PT4.

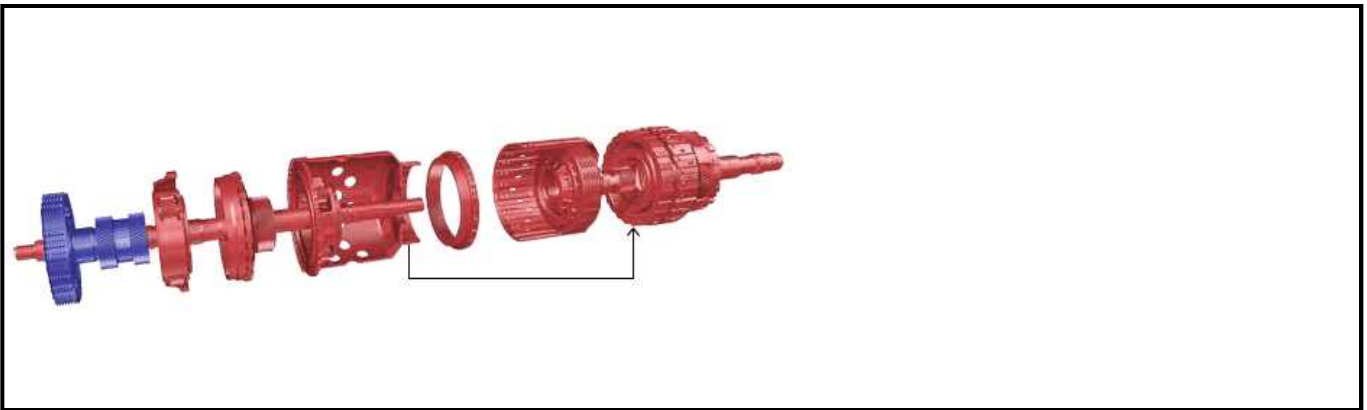
6th GEAR



Engagement elements activated: C, D and E.

- Clutches D and E block epicyclic gear trains EP3 and EP4.
- The torque is applied to the epicyclic gear set through clutch C.
- The whole epicyclic gear set rotates at the same speed as the turbine (blocked).

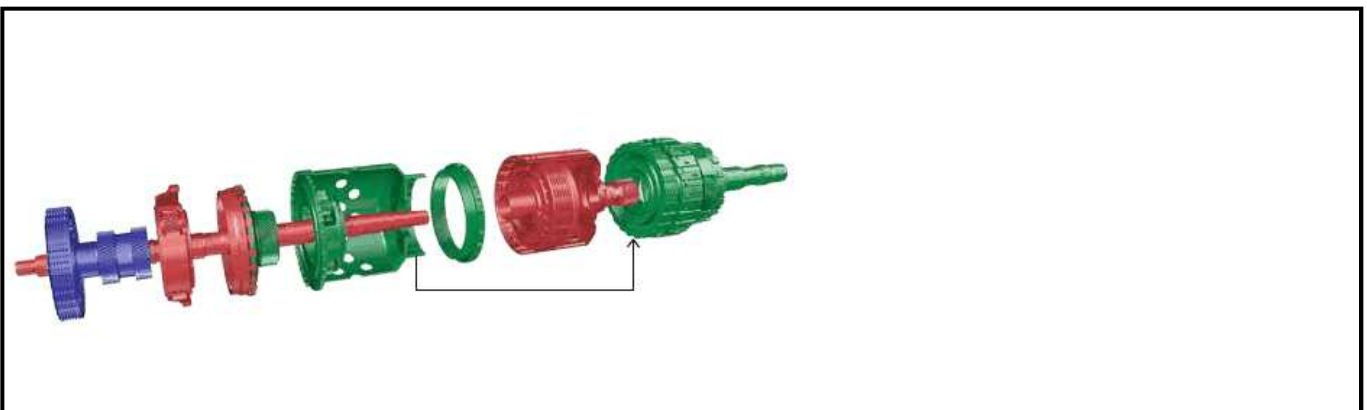
7th GEAR



Engagement elements activated: A, C and D

- Turbine shaft → clutch C → sun gear 4 + internal crown gear 3 (= turbine speed).
- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → sun gear 3 → planet gears 3 → planet carrier 3 → clutch D → planet carrier 4.
- Clutch D connects the epicyclic gear train EP3 to planet carrier PT4 (= output shaft).

8th GEAR

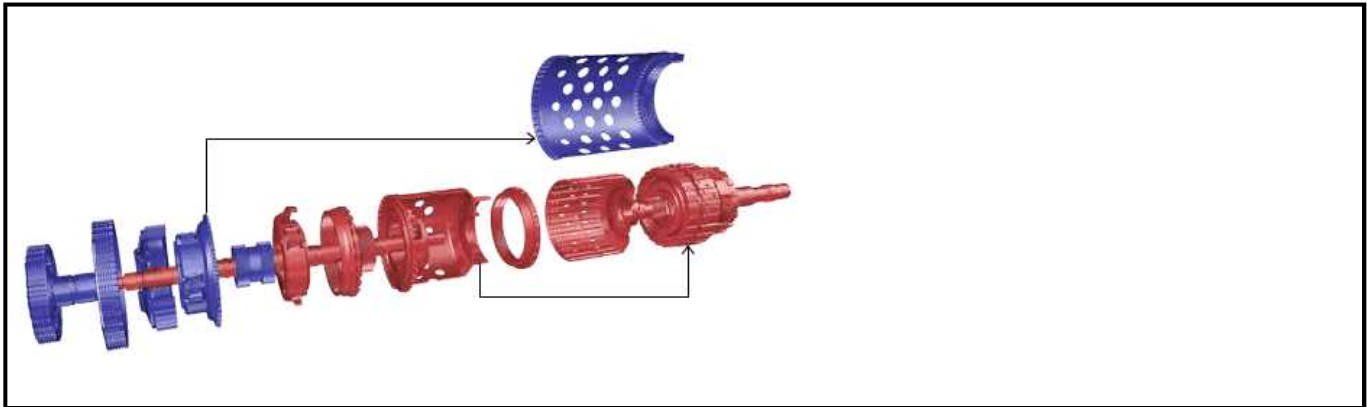


Engagement elements activated: A, D and E.

- Clutch E blocks epicyclic gear train EP3.

- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → epicyclic gear train EP3 (blocked) → clutch D → planet carrier 4.
- Clutch D connects planet carrier 3 to planet carrier 4 (= output shaft).

REVERSE GEAR



Engagement elements activated: A, B and D.

- Clutch D connects planet carrier 3 to planet carrier 4 (= output shaft).
- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → sun gear 3 → planet gears 3 → planet carrier 3 → clutch D → planet carrier 4.
- Internal crown gear C3 is firmly fixed to sun gear S4.
- S4 drives P4 in the opposite direction to that of the engine.
- Gears P4 roll around fixed C4, rotating PT4 with the transmission ratio indicated, in the opposite direction to that of the engine.

Hydraulic Impulse Solenoid (HIS)

A HIS is installed on the transmission, inserted in the transmission housing close to the mechatronic unit solenoid valves. The HIS provides a hydraulic pressure reserve, to be sent to the mechatronic unit during engine starting due to the Engine Stop Start (ESS) function.

The HIS is used for the ESS function as it allows the gear to be engaged in just 350 milliseconds from starting the engine, so that the driver does not perceive the engagement delay.

The HIS charges when the engine is running, since the pump sends part of the oil to the HIS, in addition to sending it to the mechatronic unit.

The HIS is secured to the transmission housing. The HIS receives and accumulates about one litre of oil from the transmission oil pump through a connector.

The oil sent to the HIS by the pump, must pass through a regulating valve.

The valve is composed of a piston with a small hole and a spring. During accumulation, the oil only passes through the small hole in the piston.

When the oil enters the HIS, the pressure overcomes the force of the spring and the piston withdraws.

The spring is compressed and allows the piston to withdraw and attach to a blocking point controlled by a solenoid valve.

If the solenoid valve is powered or the oil pump is operating, the piston will remain blocked.

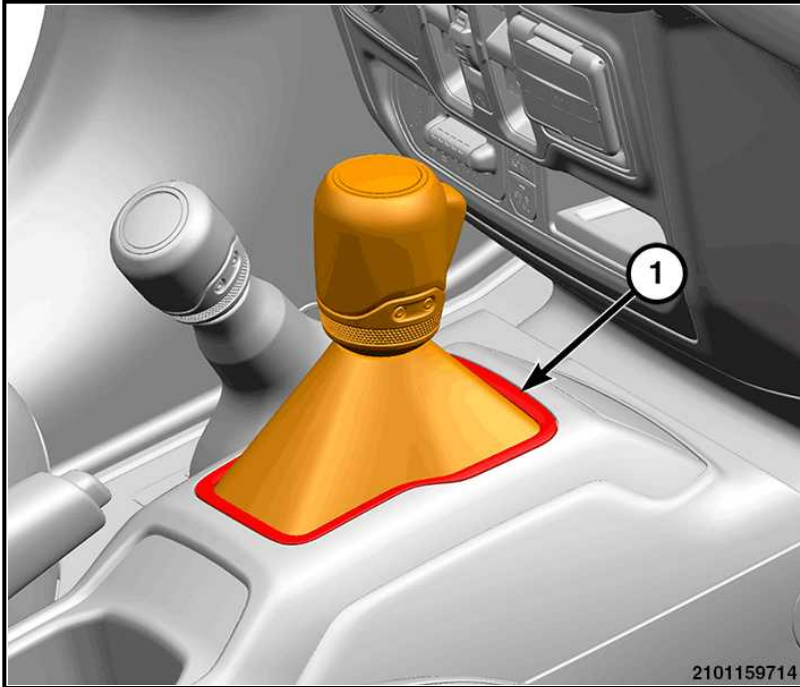
During an ESS engine OFF events the solenoid valve is powered in order to keep the piston blocked even when the oil is no longer being pumped.

When the vehicle is restarted, the solenoid valve will no longer be powered and the spring will be able push the piston, which will send the oil under pressure to the mechatronic unit to engage the gear.

When the piston pushes the oil, the regulating valve spring compresses, opening the valve fully to allow the oil at the HIS outlet to pass.

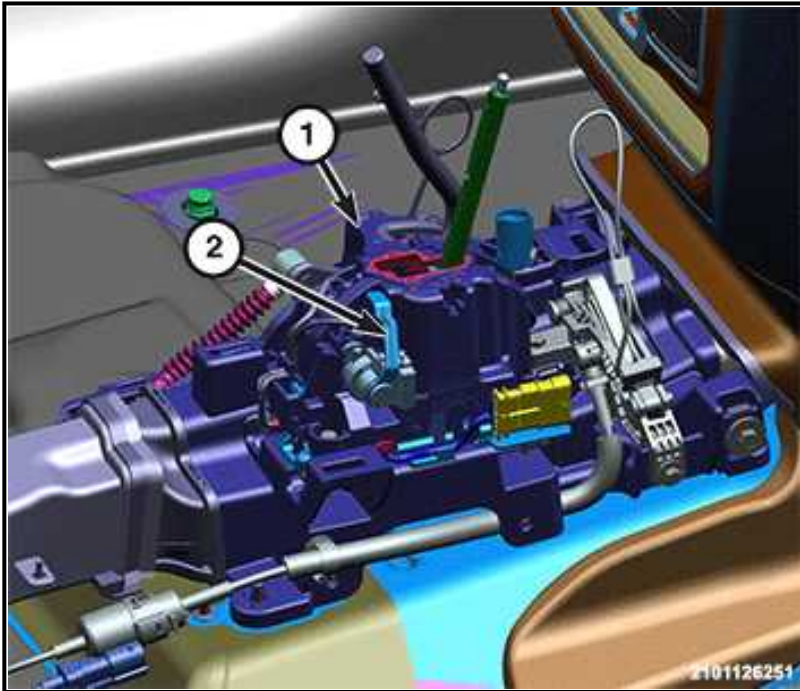
SHIFTER

DESCRIPTION



The automatic transmission is operated with the help of a Shift Lever Assembly (SLA) (1) located in the floor console.

All selector lever positions, as well as selected shift ranges in position "D", are identified by the SLA. The information is then sent to the Transmission Control Module (TCM) via a hard wire connection.



BTSI OVERRIDE

1.	SHIFT LEVER ASSEMBLY
----	----------------------

There are four positions to which the selection lever can be shifted: P, R, N, D. In addition, the selector lever can be moved sideways (+/-) in position "D" to adjust the shift range.

OPERATION

The SLA is comprised of the following functions:

- **Park lock:** The selector lever is not released from position "P" until the brake pedal has been applied and the ignition is in the "ON" position with the engine running. Shift lock is controlled by the brake light switch in conjunction with a locking solenoid in the SLA. As soon as the brake pedal is applied firmly, the locking solenoid is energized and retracted to unlock the selector lever. If the selector lever cannot be moved out of position "P" due to a malfunction, the shift lock function can be overridden. Refer to the appropriate information .
- **Reverse inhibitor:** As soon as the vehicle speed exceeds approximately 6-11 kmh (4-7 mph), it is still possible to move the shift from position "N" to position "R", but the system will not shift into reverse until the vehicle speed has fallen below 7 mph. The reverse inhibit functionality is controlled by the same solenoid as the park lock. As the vehicle accelerates past the calibrated speed threshold, the solenoid is energized to block the sideways motion of the shift lever necessary to move from NEUTRAL to REVERSE. The reverse inhibit is not released until the vehicle speed falls below approximately 4-7 mph and the shifter is moved out of the "D" shifter position.

With the selector lever in position "D", the TCM automatically shifts the gears that are best-suited to the current operating situation. This means that shifting of gears is continuously adjusted to current driving and operating conditions in line with the selected shift range and the accelerator pedal position. Starting off is always performed in 1st gear.

The SLA positions are determined by a sensor assembly internal to the SLA. The sensor assembly identifies the various positions of the SLA according to the following table.

SLA Position	Bit 0	Bit 1	Bit 2	Bit 3
Default	0	0	0	0
"D"	1	0	1	0
"N"	0	1	1	0
"R"	1	1	1	0
"P"	0	0	0	1
"+"	1	0	0	1
"-"	0	1	0	1
"ND"	1	1	0	1
"RN"	0	0	1	1
"PR"	1	0	1	1
Implausible	1	1	1	1

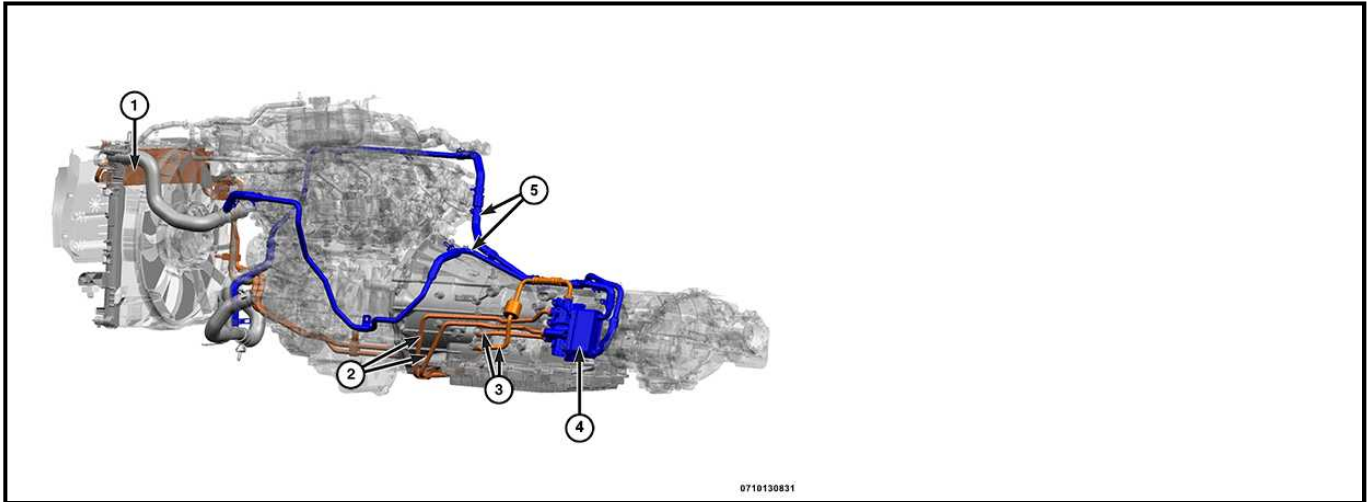
The current SLA position or, if the shift range has been limited, the current shift range is indicated in the instrument cluster display as well as the PRNDM.

The permissible shifter positions and transmission operating ranges are:

- P = Parking lock and engine starting.
- R = Reverse.
- N = Neutral and engine starting (no power is transmitted to the axles).
- D = The shift range includes all forward gears.
- M = Manual mode allows manual input of shifts up or down in all forward gears.

TRANSMISSION COOLING SYSTEM

DESCRIPTION



COMPONENT INDEX

1 - Transmission Fluid Cooler
2 - Cooler Lines
3 - Cooler Lines
4 - Trans Fluid Heat Exchanger
5 - Coolant Hoses

The automatic transmission fluid cooler is located behind the front fascia, and in the front of the condenser. The transmission fluid cooler is a air-to-oil cooler that allows heat in the transmission fluid to be transferred to the air passing over the cooler fins.

OPERATION:

Transmission fluid is routed through the transmission fluid cooler where heat is removed from the transmission fluid before returning to the transmission.

The transmission fluid heat exchanger uses engine coolant to assist in cooling the transmission fluid. It also incorporates the quick connect fittings for the transmission fluid cooler lines.

HEAT EXCHANGER:

- The transmission heat exchanger cools the Automatic Transmission Fluid (ATF) by means of engine coolant.
- The transmission heat exchanger coolant hoses are routed to the engine radiator hoses.
- ATF runs through the transmission heat exchanger through transmission fluid tubes.

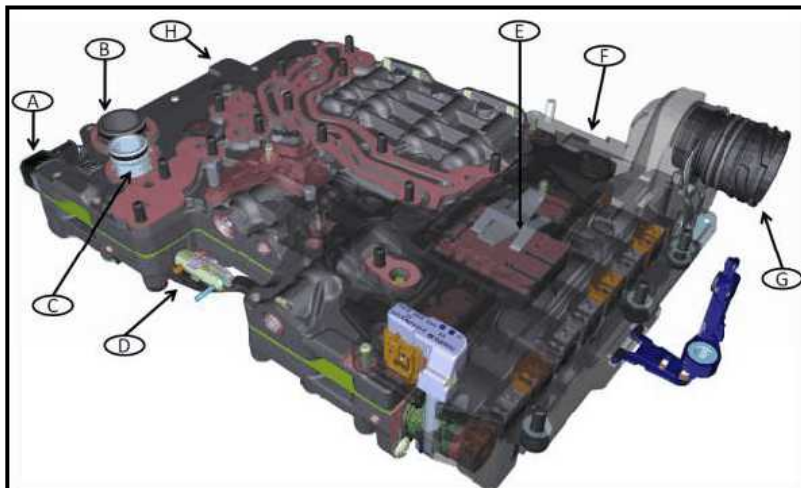
DESCRIPTION AND OPERATION - VALVE BODY

DESCRIPTION

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in ELECTROSTATIC DISCHARGE SENSITIVE DEVICES. Failure to follow these instructions may result in damage to the TCM/TCMA.

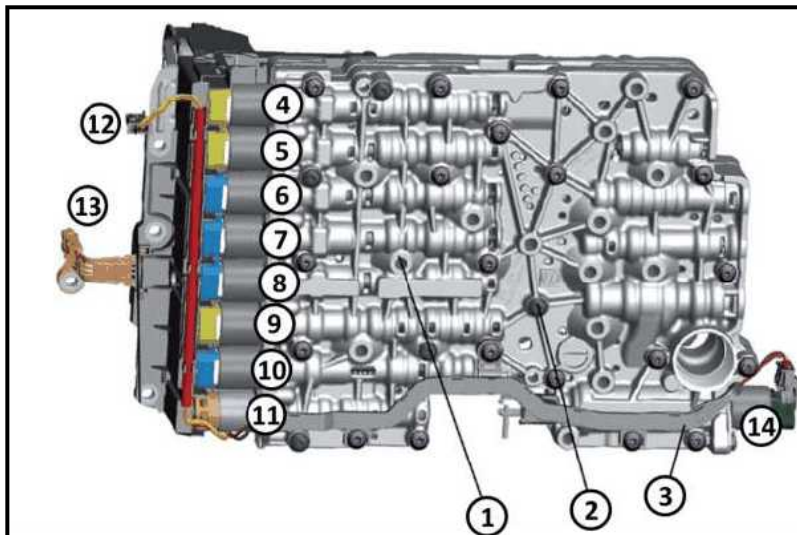
The valve body includes the TCM, all solenoids and sensors, and can be referred to as the TCMA. The TCM is attached to the valve body between the transmission case and the valve body. If any component of the valve

body **including the TCM** sensors or solenoids need replaced, the complete TCMA (valve body) must be replaced. For replacement of the TCMA (valve body). Refer to **VALVE BODY, REMOVAL AND INSTALLATION**.



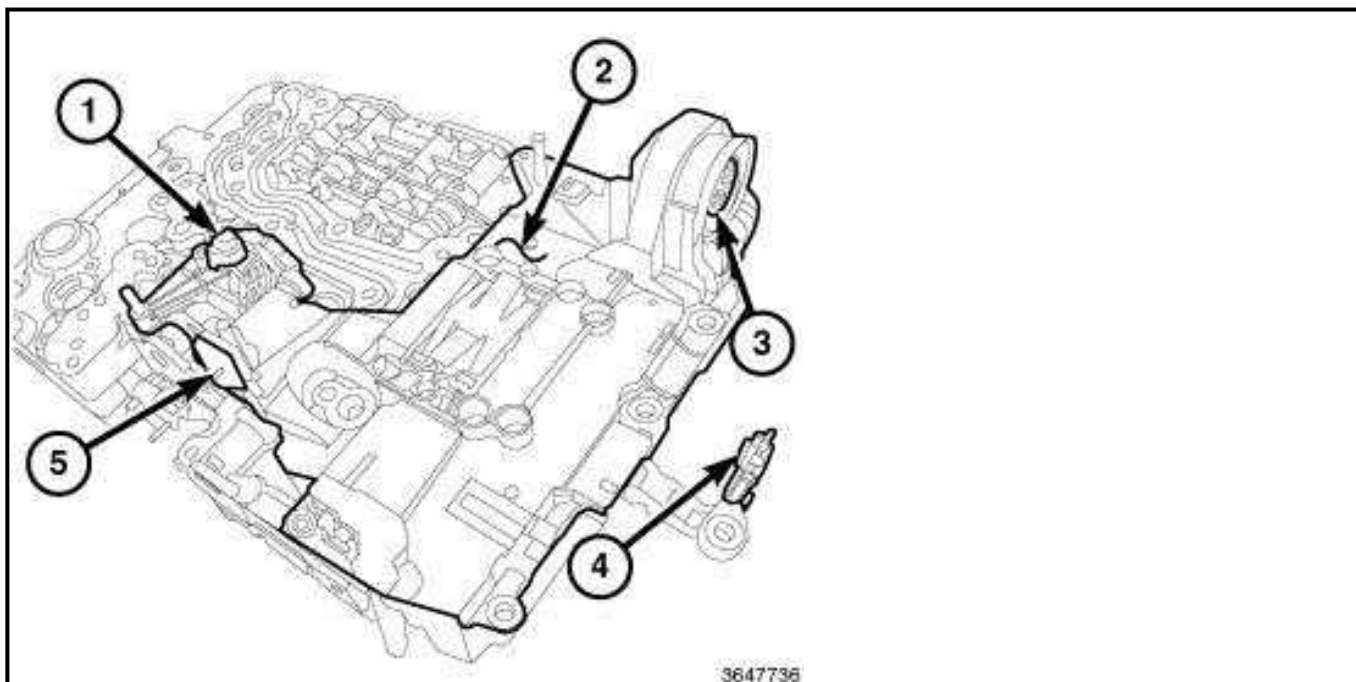
- A - Parking lock electromagnet MV2
- B - Automatic Transmission Fluid (ATF) pump intake connector
- C - Outlet connectors to the ATF pump
- D - Parking lock slider
- E - Automatic transmission control module TCM
- F - Transmission Control Module (TCM)
- G - Vehicle wire harness connector
- H - Hydraulic module

OPERATION



- 1 - M6 Valve Body Bolt Hole
- 2- M5 Valve Body to Solenoid Body Bolt Hole
- 3 - Wiring Harness for Park Release Solenoid
- 4 - Solenoid A
- 5 - Solenoid B
- 6 - Solenoid D
- 7 - Solenoid E
- 8 - Solenoid C
- 9 - Torque Converter Clutch (TCC) Solenoid
- 10 - Line Pressure Solenoid

- 11 - Park Release Solenoid
- 12 - High Impulse Solenoid (HIS) Wire Harness Connector
- 13 - Output Shaft Speed (OSS) Sensor
- 14 - Park Hold Solenoid



- 1 - Input Speed Sensor (ISS)
- 2 - TCM (Includes Transmission Temperature Sensor)
- 3 - External Wire Harness Connector
- 4 - Output Speed Sensor (OSS)
- 5 - Park Position Sensor

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

The valve body, which includes the TCM, controls the delivery and pressure of transmission fluid. The TCM is integrated into the valve body. The TCM regulates the amount of hydraulic pressure used to engage the clutches and the TCC, in addition to directing hydraulic pressure to engage or release any given clutch for any given required gear. The TCM will actuate the valves via solenoids based on the position of the shifter, transmission fluid temperature, engine operating conditions, traction conditions and driver demands. During a shift, the TCM will actuate the solenoids to match the gear ranges to the optimal torque range of the engine based on the position of the accelerator pedal, shifter and vehicle speed as determined by the PCM based on input from the Vehicle Speed Sensor (VSS) and Antilock Brake System (ABS) module. Due to the complexity of the 8HP transmission control system, always refer to the transmission electrical/electronic diagnostics in this information when attempting to diagnose transmission problems.

If the TCMA is replaced, it **must** be programmed and a drive learn needs to be performed before returning the vehicle to the customer. for programming and drive learn procedures. Refer to [TRANSMISSION CONTROL MODULE \(TCM\) ADAPTATION](#) .

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION - GENERAL CONDITIONS

CAUTION: Before attempting any repair on an automatic transmission, check for Diagnostic Trouble Codes (DTC) with the appropriate scan tool.

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

NOTE: ZF transmissions are filled from the factory with UV leak detection dye. Do NOT add leak detection dye to the transmission.

Transmission malfunctions may be caused by these general conditions:

- Poor engine performance.
- Hydraulic malfunctions.
- Mechanical malfunctions.
- Electronic malfunctions.
- Transfer case performance (if equipped).

Diagnosis of these problems should always begin by checking the easily accessible variables: transmission fluid level, transmission fluid condition, and transmission DTCs using the appropriate diagnostic scan tool. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary.

DIAGNOSIS AND TESTING - PRELIMINARY

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

1. Check for transmission Diagnostic Trouble Codes (DTCs) using the appropriate scan tool.
2. Check the transmission fluid level and condition.
3. Road test and note how transmission upshifts, downshifts, and engages.

VEHICLE IS DISABLED

1. Check for transmission fault codes using the appropriate scan tool.
2. Check for cracked or leaking transmission cooler lines.
3. Check the transmission fluid level and condition.
4. With the transmission in the Park position, attempt to rotate driveshaft(s) to ensure transmission output shaft coupler/flange is secure.
5. Check the transfer case operation (if equipped).
6. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE**.
7. Start the engine with the transmission in the Park position and allow the vehicle to idle for several minutes, shift the transmission into gear, and note following:
 - a. If driveshaft turns but wheels do not, the problem is with the differential or axles.
 - b. If driveshaft does not turn and transmission is noisy, turn off the engine. Remove the transmission oil pan and check for debris indicating an internal transmission failure. If debris is present, remove

the transmission for repair. If the transmission oil pan is clear, remove the transmission and check for damaged flexplate, torque converter, transmission oil pump, or input shaft.

8. Check the Transmission Control Module Assembly (TCMA), wiring, valve body, and solenoids (utilize fault codes to diagnose if available).
9. Remove the support and lower the vehicle.

DIAGNOSIS AND TESTING - ROAD TESTING

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

Before road testing, be sure the transmission fluid level has been checked and adjusted if necessary. Verify that all Diagnostic Trouble Codes (DTCs) have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

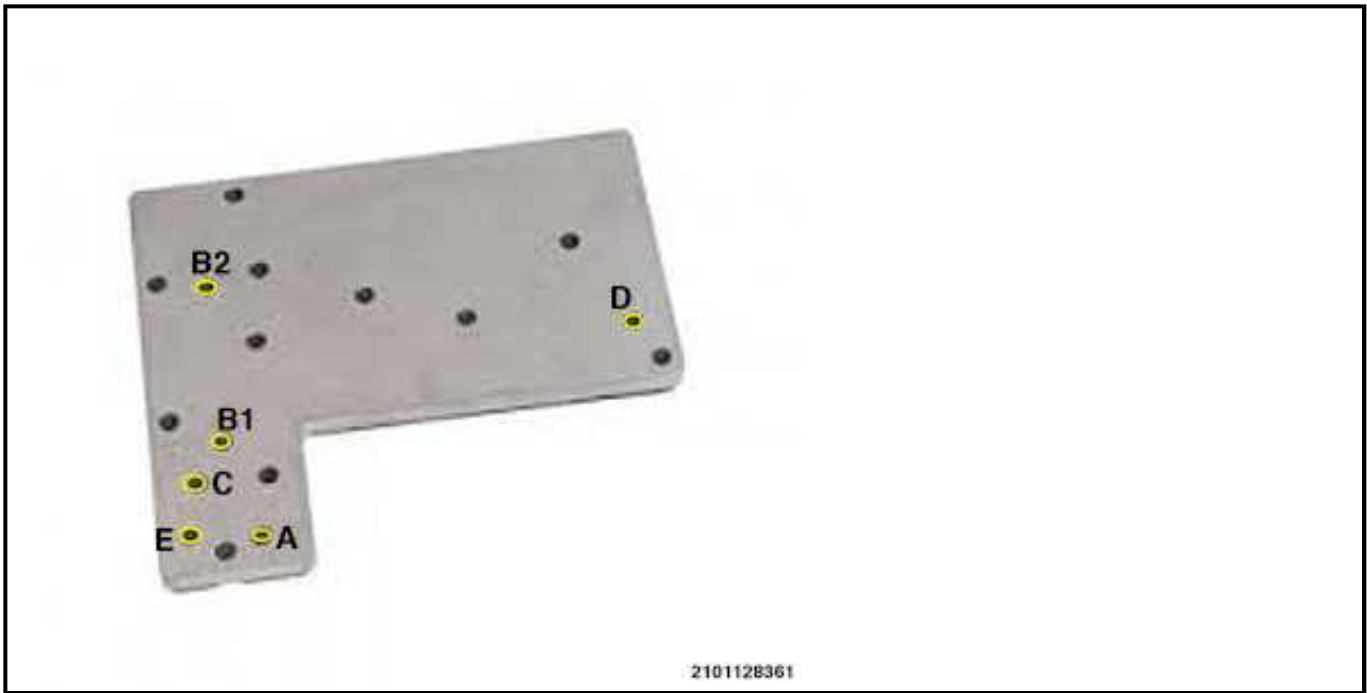
Slippage indicated by engine flare, usually means clutch, overrunning clutch, or line pressure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

CLUTCH APPLICATION

GEAR	A	B	C	D	E	RATIO
1	X	X	X	B	B	4.71: 1
2	X	X	B	B	X	3.14: 1
3	B	X	X	B	X	2.11: 1
4	B	X	B	X	X	1.67: 1
5	B	X	X	X	B	1.29: 1
6	B	B	X	X	X	1.0: 1
7	X	B	X	X	B	.84: 1
8	X	B	B	X	X	.64: 1
P/N	X	X	B	B	B	N/A
R	X	X	B	X	B	3.30: 1

CLUTCH AIR PRESSURE TESTS



Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure using (special tool #10383, Plate, Clutch Pressure Test).

The clutches may be tested by applying air pressure to their respective passages. The valve body must be removed. To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 5-8 bar (73-116 psi).

Remove the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#). Install (special tool #10383, Plate, Clutch Pressure Test) and tighten bolts to 6 N.m (50 in. lbs.). When testing is finished install valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#). Fill the transmission. Refer to [FLUID/FILTER SERVICE](#).

NOTE: If any clutch does not appear to be functioning with the air, add some 8HP transmission fluid and try the test again. Some circuits will not operate without fluid.

STANDARD PROCEDURE

MANUAL PARK RELEASE (MPR) - DISENGAGE AND ENGAGE

DISENGAGE

The Manual Park Release (MPR) lever is used for putting the transmission in neutral anytime the vehicle needs to be moved with the engine off in neutral. This is achieved by a cable attached to the transmission park pawl. When the cable is pulled, the transmission is put into neutral, and when the cable is released, the transmission is back into park.

WARNING: Always secure your vehicle by fully applying the parking brake, before activating the Manual Park Release. Activating the Manual Park Release will allow your vehicle to roll away if it is not secured by the parking brake or by proper connection to a tow vehicle. Activating the Manual Park Release on an unsecured vehicle could lead to serious injury or death for those in or around the vehicle.

1. Set the parking brake.

2. Apply firm pressure to the brake pedal while seated in the driver's seat.



3. Locate the Manual Park Release access cover (1) in front of the shifter.



4. Using a small screwdriver or similar tool, remove the Manual Park Release access cover (1).

NOTE: Take care not to scratch or mar the console or cover.



5. Pull the tether strap (1) out as far as it will go, then release it. The transmission is now in **NEUTRAL** , allowing the vehicle to be moved.

NOTE: When the lever is locked in the released position, the tether will remain outside of the trim panel and the access cover cannot be re-installed.

6. Release the parking brake only after the vehicle is secure.

ENGAGE

WARNING: Always secure your vehicle by fully applying the parking brake, before activating the Manual Park Release. Activating the Manual Park Release will allow your vehicle to roll away if it is not secured by the parking brake or by proper connection to a tow vehicle. Activating the Manual Park Release on an unsecured vehicle could lead to serious injury or death for those in or around the vehicle.

1. Apply firm pressure to the brake pedal while seated in the driver's seat.



2. Pull the tether strap (1) out again, then release it.
3. Allow the tether (1) to retract with the lever back to its original position.
4. Verify that the transmission is in **PARK** .



5. Confirm that the tether has fully retracted and re-install the access cover (1).

CHECK FLUID LEVEL

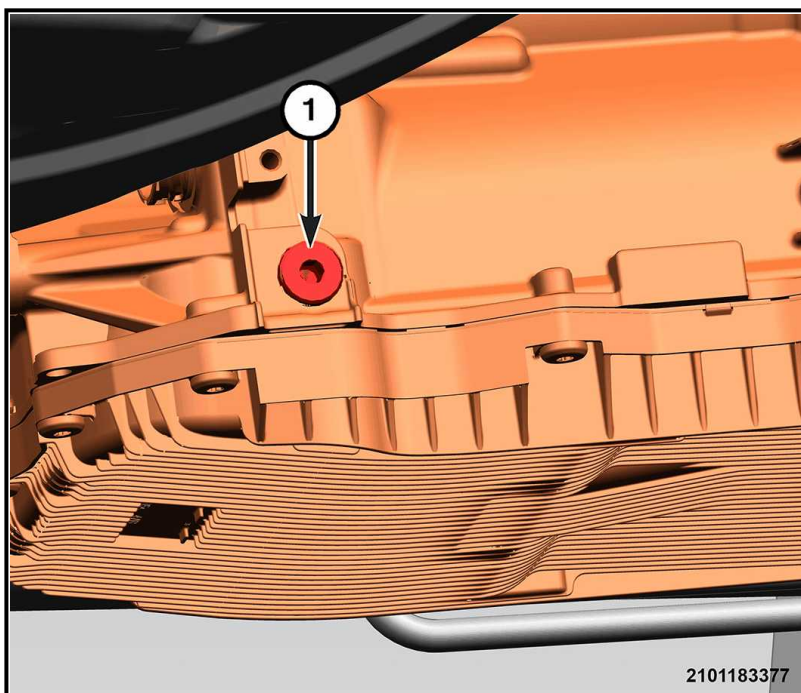
To properly check and fill the transmission, perform the following procedure:

WARNING: There is a risk of accident from vehicle moving when the engine is running. Secure vehicle to prevent it from moving. There is a risk of injury from contusions and burns if you insert your hands into the engine when it is running. Do not touch hot or rotating parts. Wear properly fitted work clothes.

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is **NOT** compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see **FLUIDS, LUBRICANTS AND GENUINE PARTS**.

NOTE: Oil dye is not required to find leaks in the 8HP transmission. The oil dye can cause shift quality issues and is not recommended. The 8HP fluid has illuminance that is visible under a black light.

1. Raise and support the vehicle **on a level hoist** . Refer to **HOISTING, STANDARD PROCEDURE** .
2. Start the engine. The engine must continue to run for the entire test.
3. Using a diagnostic scan tool or the Electronic Vehicle Information Center (EVIC), verify that the transmission fluid temperature is below 30B°C (86B°F).
4. Disable the Electronic Stability Control (ESC).



1 - Fill Plug

5. Remove the transmission fill plug from the right rear of the transmission case.
6. Add transmission fluid until it trickles from the transmission fill plug opening.
7. Install the transmission fill plug.
8. Lower the vehicle for access to inside of the vehicle, leaving the tires at least 8 inches off the ground.
9. With the brakes applied, place the transmission in REVERSE and hold for 5 seconds.
10. Place the transmission in DRIVE and hold for 5 seconds.
11. Release the brakes, slowly accelerate to 2nd gear and hold for 5 seconds.
12. Apply the brakes and place the transmission in NEUTRAL.
13. Raise the engine speed to 2000 RPM for 5 seconds.
14. Return the engine to idle and place the transmission in PARK.

NOTE: A full transmission will have fluid at the transmission fill hole with the transmission between 30B°C (86B°F) and 50B°C (122B°F). Do not over fill.

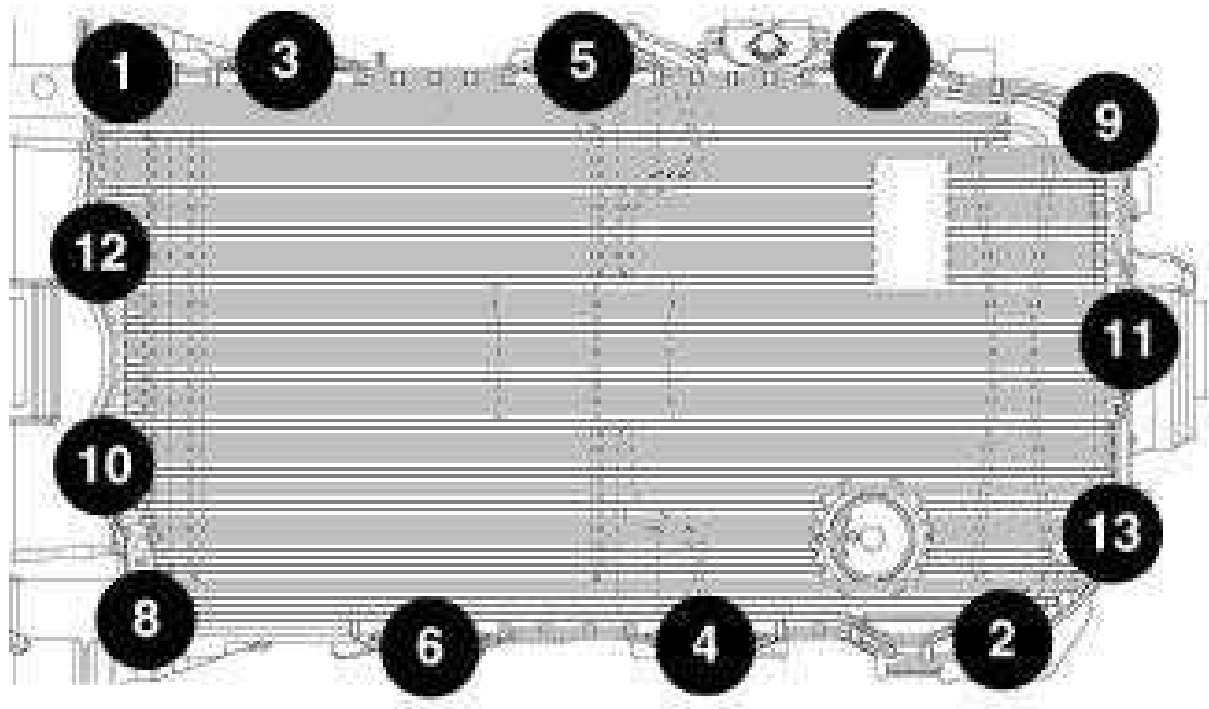
15. Remove the transmission fill plug and allow excess fluid to drain from the transmission fill hole or add fluid as necessary.
16. Install the transmission fill plug.
17. Remove the support and lower the vehicle.
18. Using a diagnostic scan tool, clear any Diagnostic Trouble Codes (DTC).

TORQUE SPECIFICATIONS

8HP50 TRANSMISSION

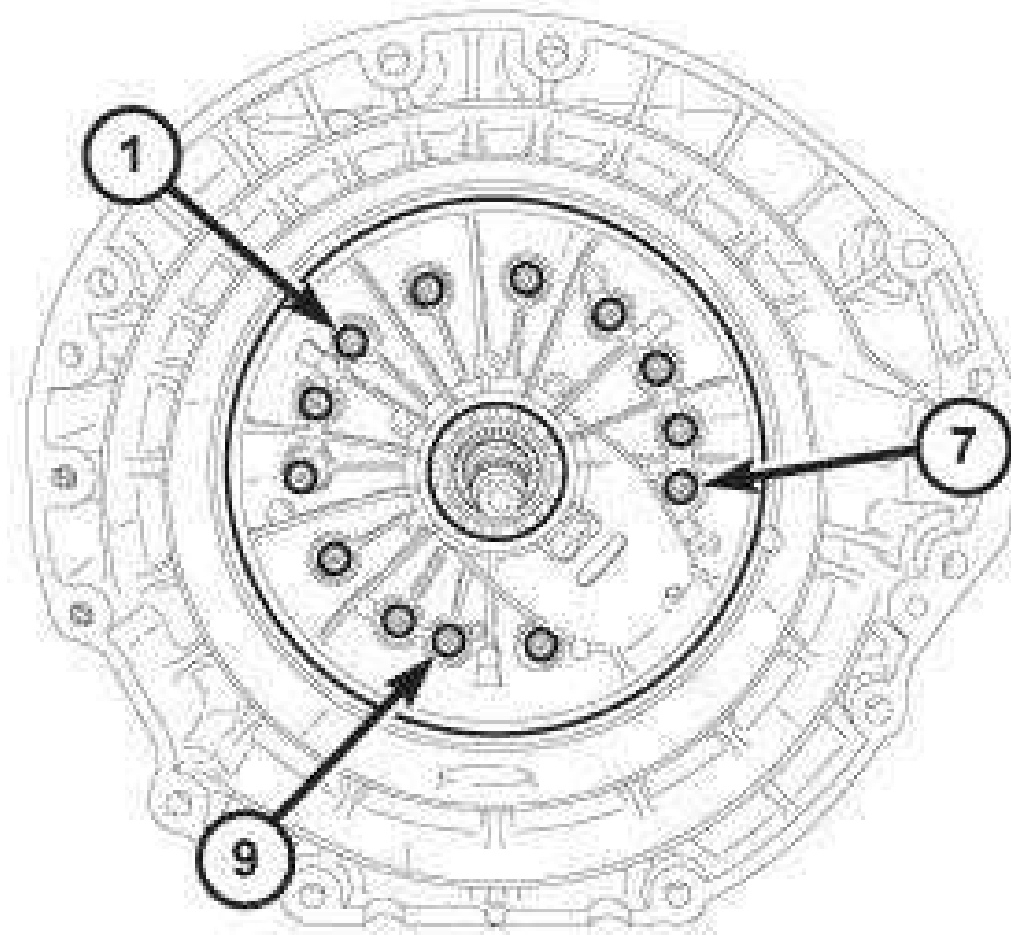
DESCRIPTION	SPECIFICATION	COMMENTS
Hydraulic Impulse Solenoid Bolts	8 N.m (71 In. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Lock Solenoid Screw	6 N.m (53 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	13 N.m (10 Ft. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATION	COMMENTS
Transmission Oil Pan Bolt	11 N.m (8 Ft. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Filter to Transmission Oil Pan	6 N.m (53 In. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	Torque Procedure: 1. Install bolts except for the spots where the locating pins are installed and hand tighten 2. Remove the pins and install the remaining bolts 3. Tighten bolts to 8 N.m (71 In. Lbs.)	Tightening Sequence



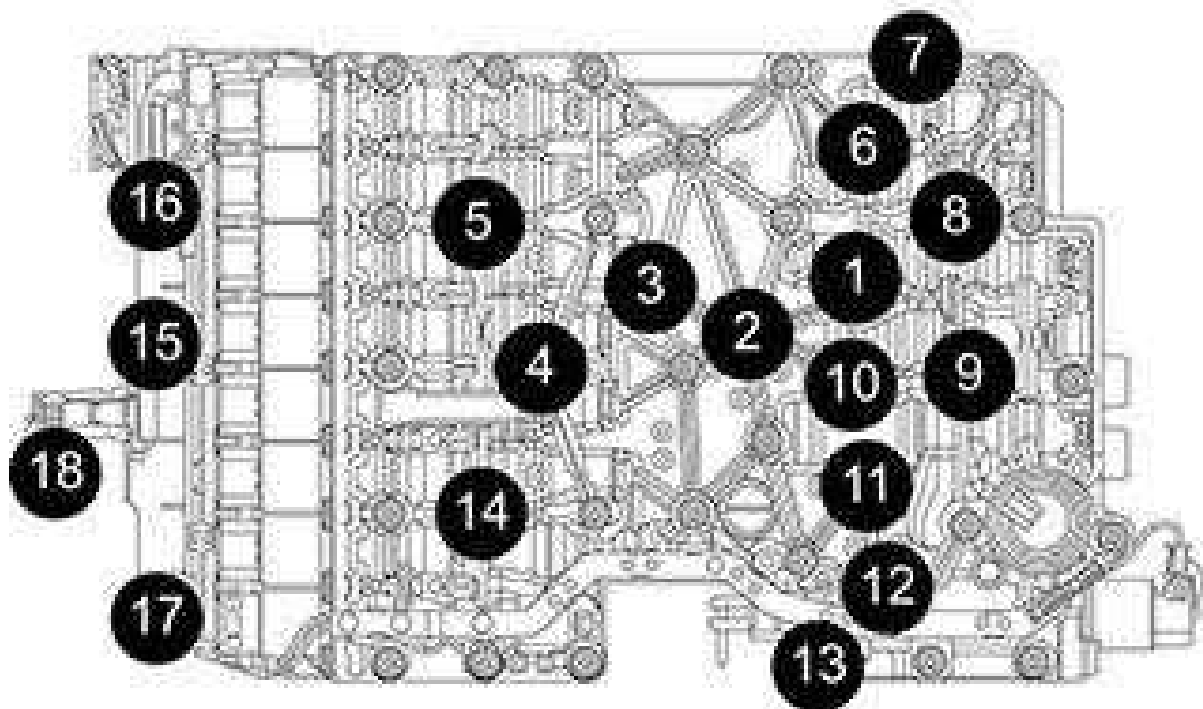
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Fig. 1: Oil Pan Retaining Bolts Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC



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Fig. 2: Oil Pump Cover Retaining Bolts Tightening Sequence
 Courtesy of CHRYSLER GROUP, LLC



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Fig. 3: Valve Body Bolts Loosening And Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

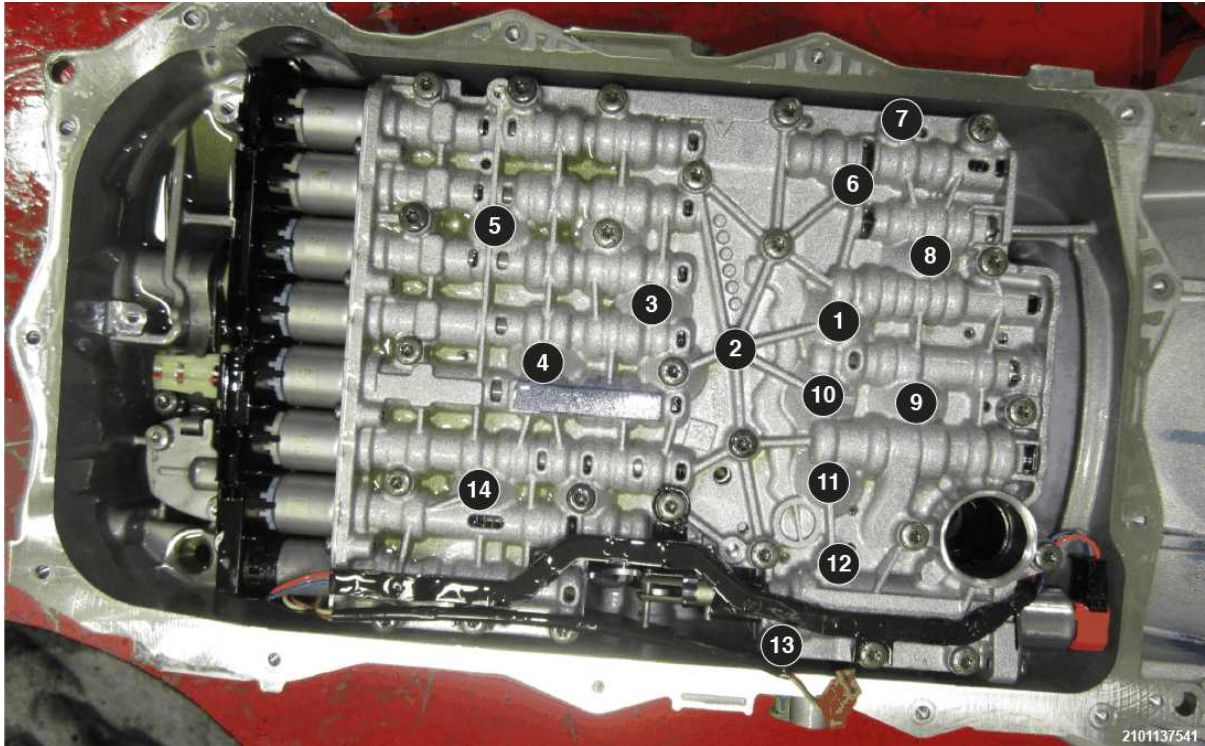
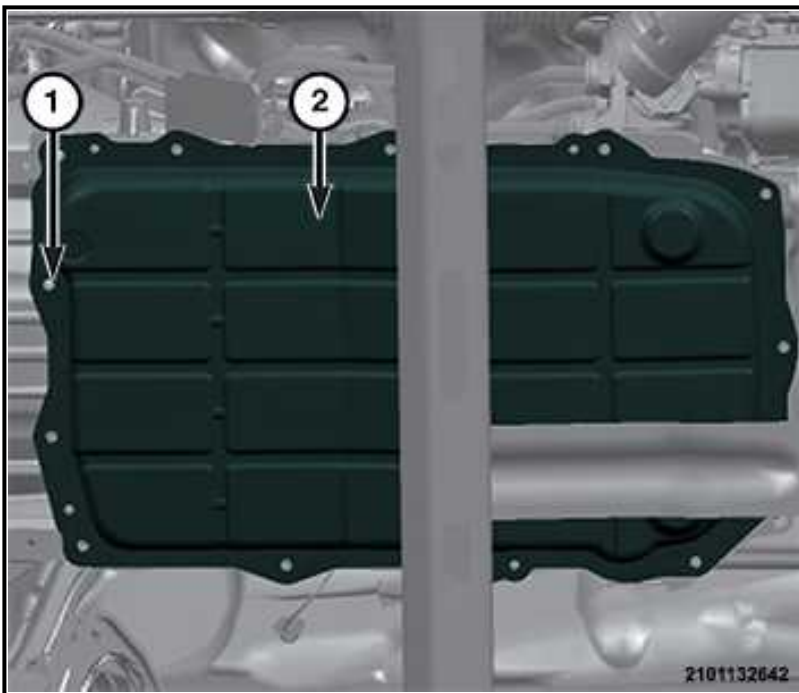


Fig. 4: Valve Body Assembly Bolts Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

FLUID/FILTER SERVICE

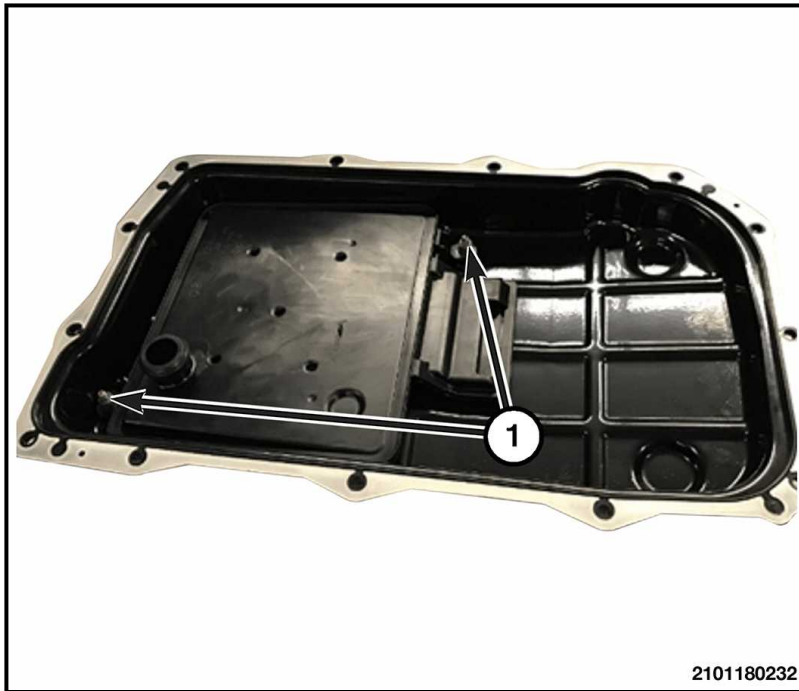
1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Drain the transmission fluid by partially removing the transmission fluid pan bolts and letting the fluid drain from the transmission fluid pan.



1 - Transmission Fluid Pan Bolts
2 - Transmission Fluid Pan

3. Remove the transmission fluid pan bolts and remove the transmission fluid pan.

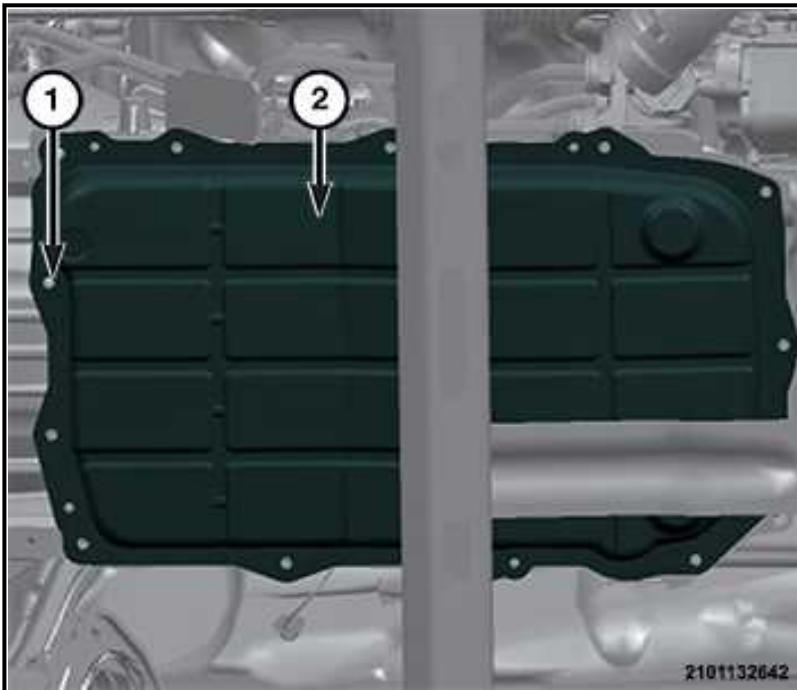
NOTE: Inspect the gasket for reuse. If the seal is cut or torn, replace the gasket.



1 - Transmission Fluid Filter Nuts

NOTE: Check filter availability before removing. The filter is only available with the transmission oil pan in some applications.

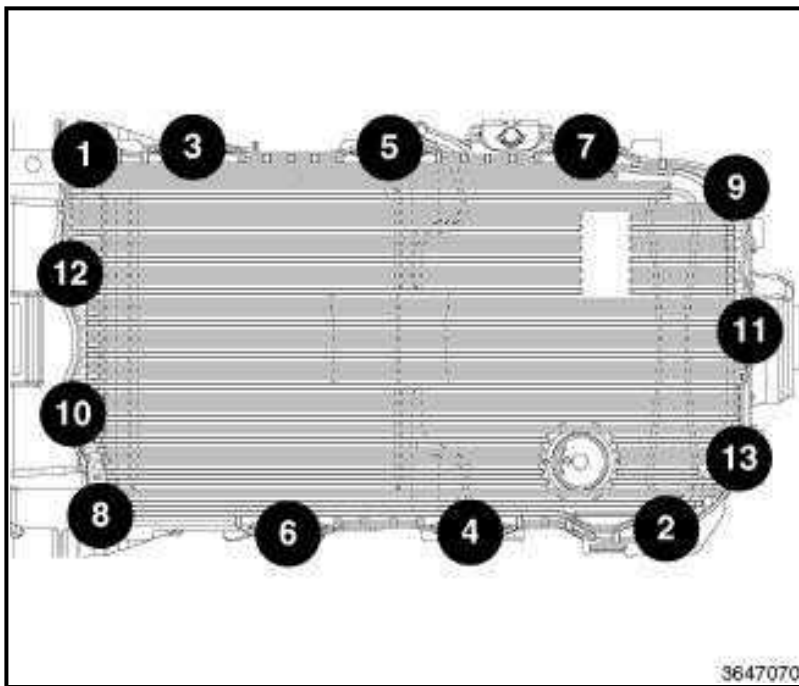
4. Remove the transmission fluid filter nuts and **DISCARD** the transmission fluid filter.
5. Install the **NEW** transmission fluid filter and tighten the nuts securely.



1 - Transmission Fluid Pan Bolts

2 - Transmission Fluid Pan

6. Install the transmission fluid pan and tighten the bolts hand tight.



7. Tighten the transmission fluid pan bolts using the sequence shown.
8. Check and adjust the transmission fluid level. Refer to [CHECK FLUID LEVEL](#) .
9. Remove the support and lower the vehicle.

TORQUE SPECIFICATIONS

TRANSMISSION FILL AFTER SERVICE

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

To properly fill the transmission after an in vehicle service or overhaul, perform the following procedure:

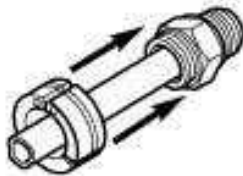
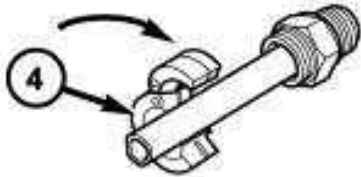
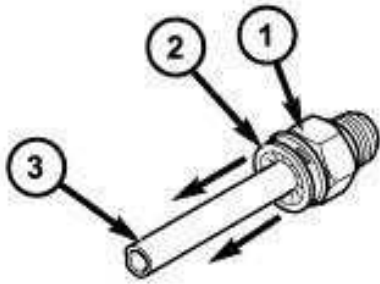
NOTE: If the transmission cooler was replaced, add an additional 0.7L (0.72 qts) of transmission fluid.

1. **If the transmission was overhauled** , prior to installing in the vehicle, tip the transmission on it side, remove the oil fill plug on the right rear side of the case and install 9L (9.5 qts) of transmission fluid. Install the fill plug. After installing the transmission, perform the CHECK FLUID LEVEL procedure. Refer to [CHECK FLUID LEVEL](#) .
2. **If an in vehicle service was performed** , raise and support the vehicle **on a level hoist** , and perform the CHECK FLUID LEVEL procedure. Refer to [HOISTING, STANDARD PROCEDURE](#) . Refer to [CHECK FLUID LEVEL](#) .

TRANSMISSION COOLER LINE QUICK CONNECT FITTINGS

DISCONNECT

TRANSMISSION END



81019138

1 - QUICK CONNECT FITTING

2 - DUST CAP

3 - OIL COOLER LINE

4 - SPECIAL TOOL 8875A for 3/8" Line or 9546 for 1/2 " Line.

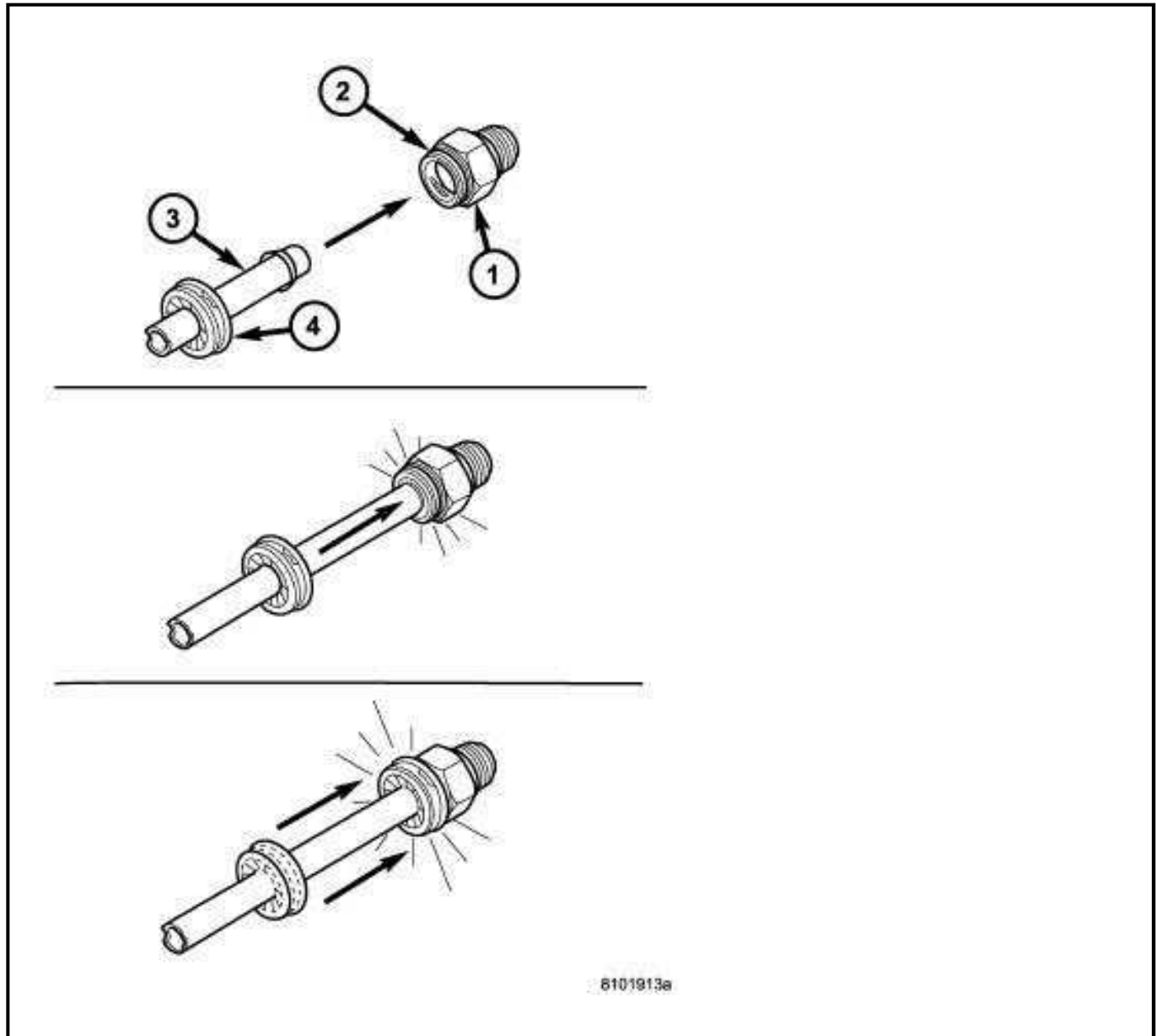
1. Remove dust cap by pulling it straight back off of quick connect fitting
2. Place disconnect Special Tool (special tool #8875A, Disconnect, Transmission Cooler Line) onto a 3/8 inch transmission cooler lines or Special Tool (special tool #9546, Disconnect Tool) onto a 1/2 inch transmission cooler lines with the fingers of the tool facing the quick connect fitting.
3. Slide disconnect tool down the transmission line and attach the fingers of the tool into the retaining clip. When properly attached in the clip, the tool will fit flush against the quick connect fitting.
4. Rotate the disconnect tool 60B° to expand the retaining clip.
5. While holding the disconnect tool against the quick connect fitting, pull back on the transmission cooler line and remove the line.

TRANSMISSION OIL COOLER END

1. Using a suitable tool, remove the spring clips from the connectors.
2. Pull the transmission oil cooler lines out from the transmission oil cooler.

CONNECT

TRANSMISSION END



- 1 - QUICK CONNECT FITTING
- 2 - CLIP
- 3 - OIL COOLER LINE
- 4 - DUST CAP

1. Align transmission cooler line (3) with quick connect fitting while pushing straight into the fitting.
2. Push in on transmission cooler line until a "click" is heard or felt.
3. Slide dust cap (4) down the transmission cooler line and snap it over the quick connect fitting until it is fully seated and rotates freely. Dust cap will only snap over quick connect fitting when the transmission cooler line is properly installed.

NOTE: If dust cap will not snap into place, repeat assembly step #2.

TRANSMISSION OIL COOLER END



1. Position the spring clip in the quick connect fitting (1) so that the three locking tabs (2) appear as pictured.

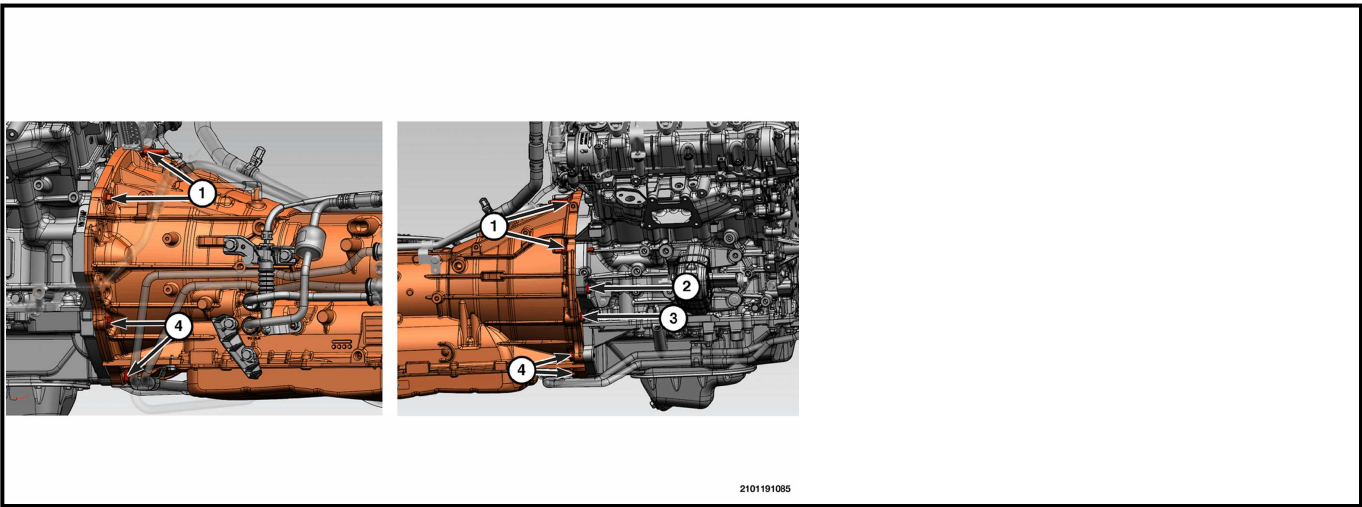
NOTE: Lubricate the end of the transmission cooler oil line with the appropriate fluid to ease installation.

2. Push the transmission oil cooler lines into the fittings until a "click" is heard or felt.
3. Check that the transmission oil cooler line is locked into the fitting by attempting to pull the line out. If the line comes out, inspect the spring clip for correct installation and repeat steps 2 and 3.

TECHNICAL SPECIFICATIONS

TORQUE SPECIFICATIONS

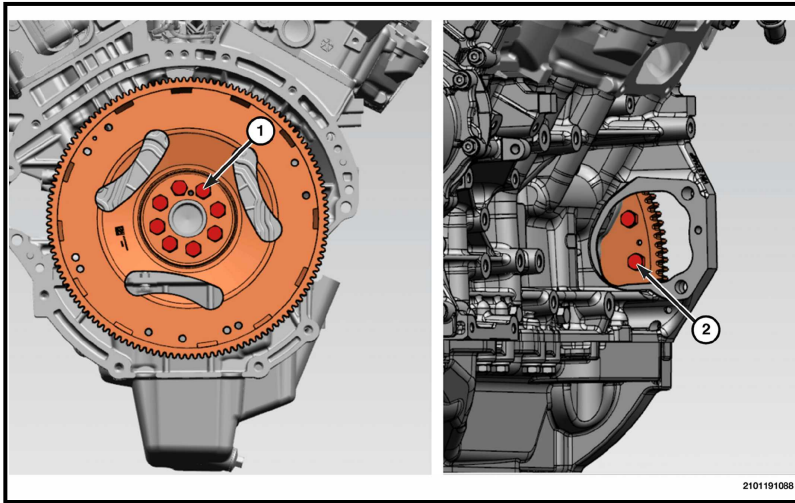
BELLHOUSING AND OIL FILL PLUG



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Bolts	Bolt 50 N.m (37 Ft. Lbs.)	-

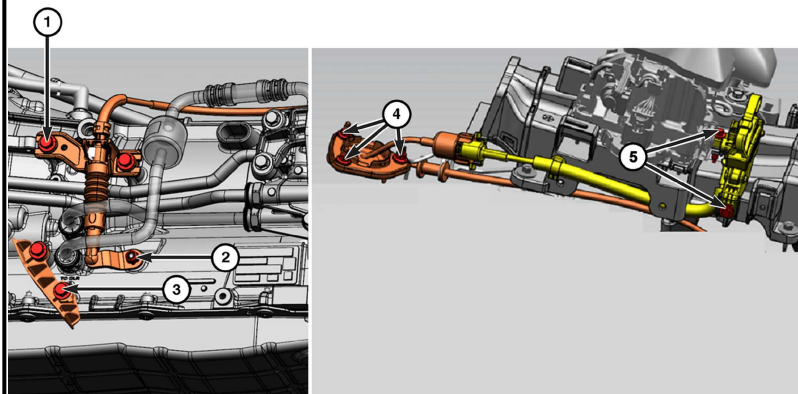
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
		Double Ended Stud 48 N.m (35 Ft. Lbs.)	
2	Engine Block To Transmission Bellhousing Bolt	50 N.m (37 Ft. Lbs.)	-
3	Dust Shield To Transmission Bellhousing Bolt	12 N.m (9 Ft. Lbs.)	-
4	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
Not Shown	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

FLEXPLATE AND TORQUE CONVERTER



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	95 N.m (70 Ft. Lbs.)	Tighten in a crisscross pattern Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.

MANUAL PARK RELEASE

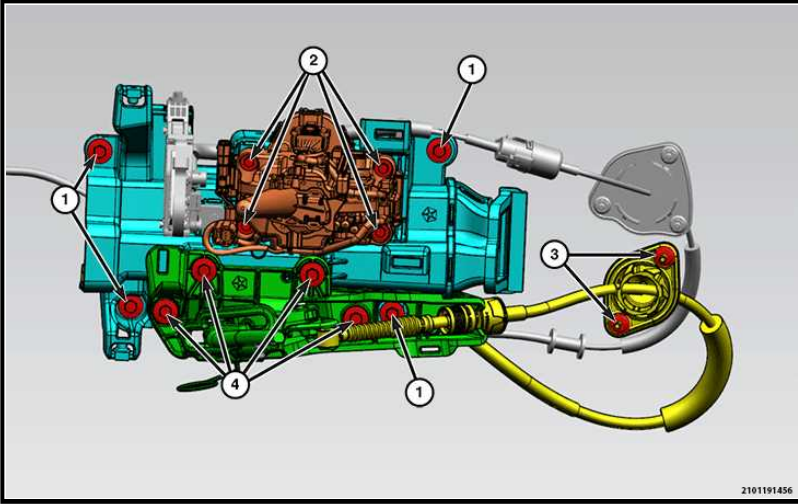


2101191295

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

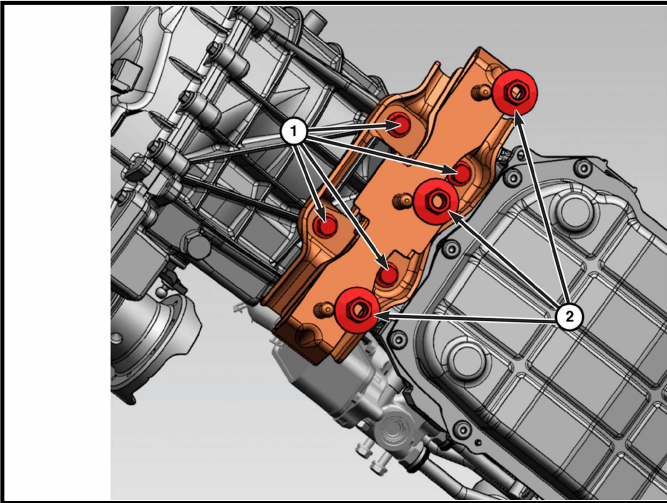
SHIFTER

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Shifter Base to Floor Nuts	6 N.m (53 In. Lbs.)	-
2	Transmission Shifter To Shifter Base Bolts	5 N.m (44 In. Lbs.)	-
3	Transfer Case Shifter Cable Grommet to floor Nuts	9 N.m (80 In. Lbs.)	-
4	Transfer Case Shifter To Shifter Base Bolts	8 N.m (71 In. Lbs.)	-
Not Shown	Transfer Case Shift Knob	3 N.m (27 In. Lbs.)	-
Not Shown	Transmission Shift Knob	3 N.m (27 In. Lbs.)	-



2101191456

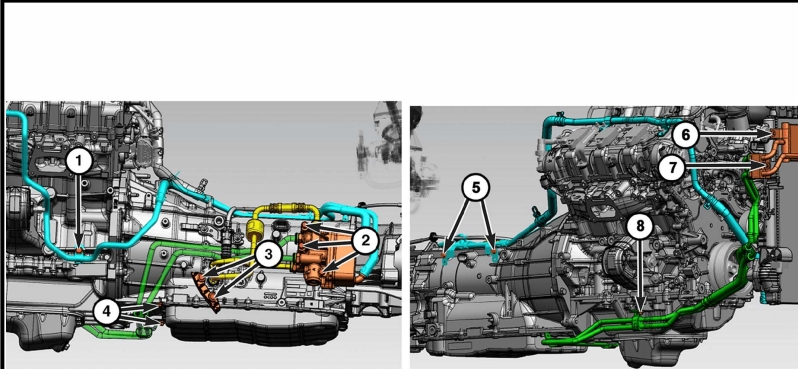
TRANSMISSION MOUNT



2101191087

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

TRANSMISSION OIL COOLER AND HEATER



2101191086

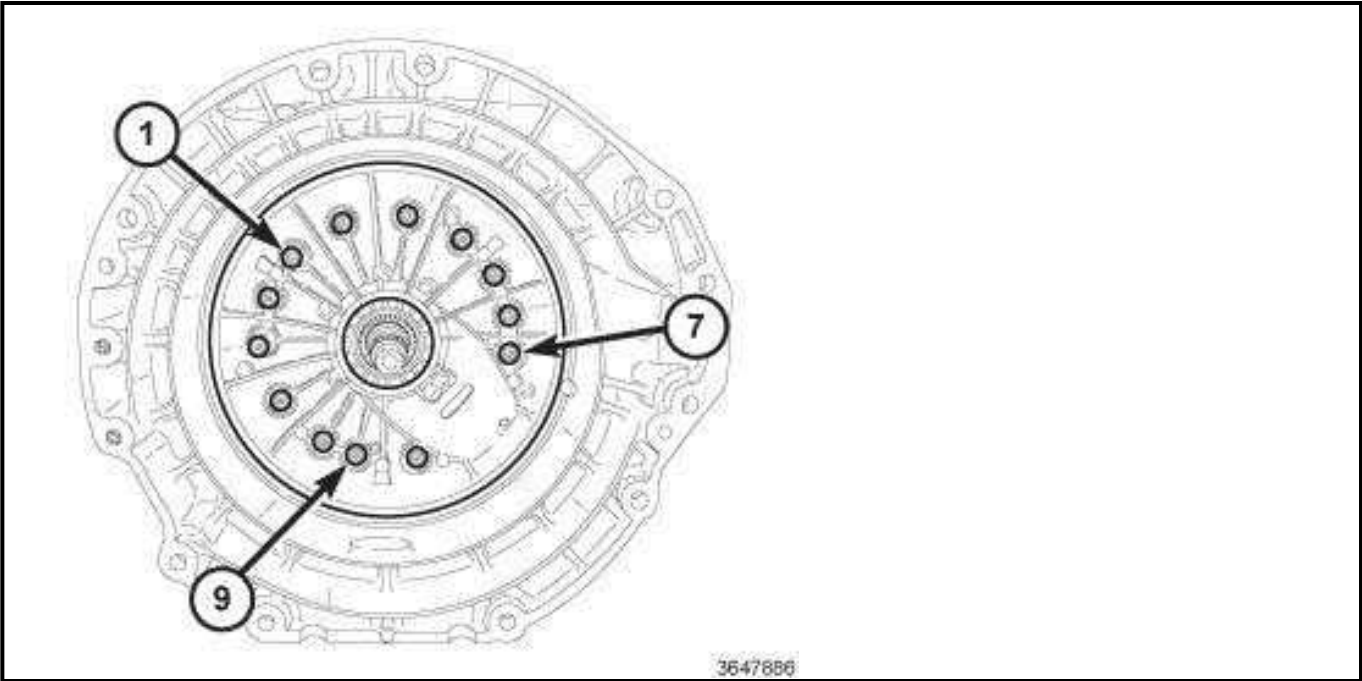
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater	35 N. m (26 Ft. Lbs.)	-

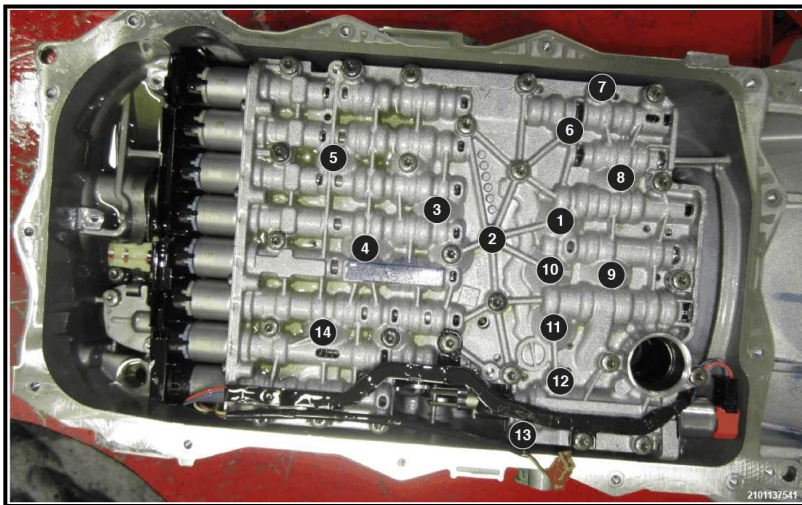
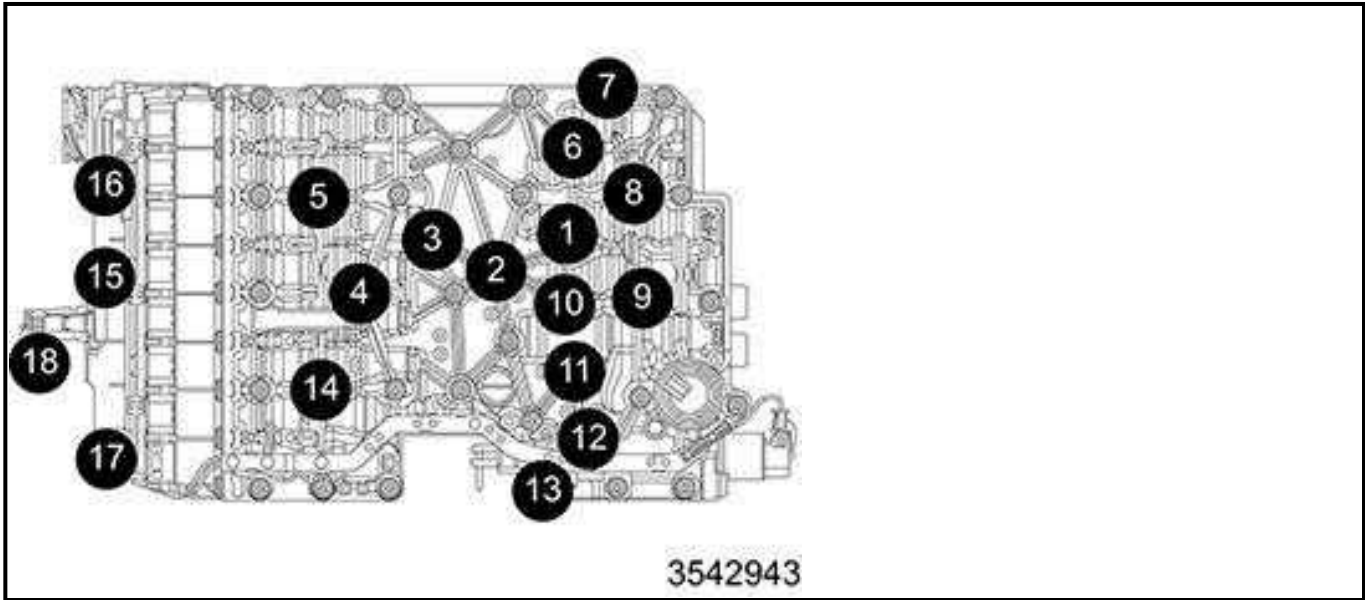
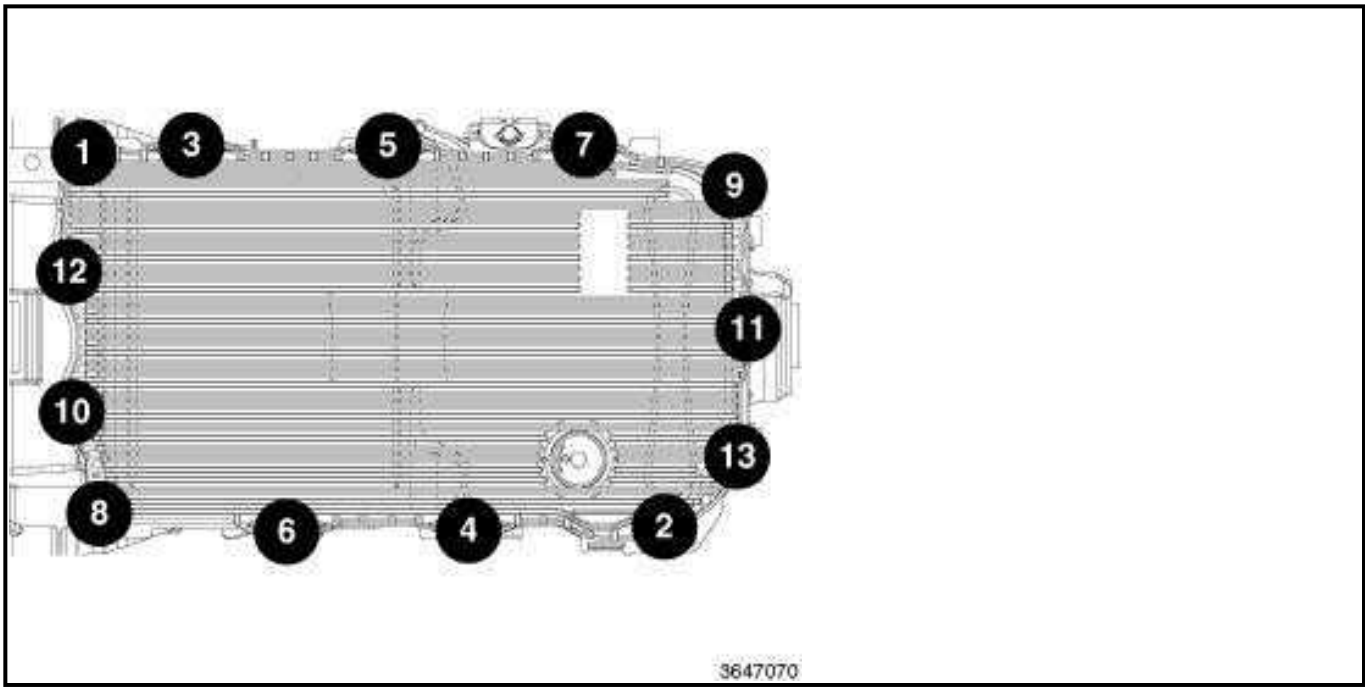
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
	Line Bracket to Engine Bolt		
2	Transmission Oil Heater To Case Bolts	23 N. m (17 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Bolt	-	Tighten Securely
7	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
8	Transmission Oil Cooler Line Bracket To Oil Pan	9 N. m (80 In. Lbs.)	-

8HP50 TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Hydraulic Impulse Solenoid Bolts	8 N.m (71 In. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Lock Solenoid Screw	6 N.m (53 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	13 N.m (10 Ft. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	11 N.m (8 Ft. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Filter to Transmission Oil Pan	6 N.m (53 In. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure:	-

DESCRIPTION	SPECIFICATION	COMMENTS
	1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	
Valve Body Bolt	Torque Procedure: 1. Install bolts except for the spots where the locating pins are installed and hand tighten 2. Remove the pins and install the remaining bolts 3. Tighten bolts to 8 N.m (71 In. Lbs.)	Tightening Sequence



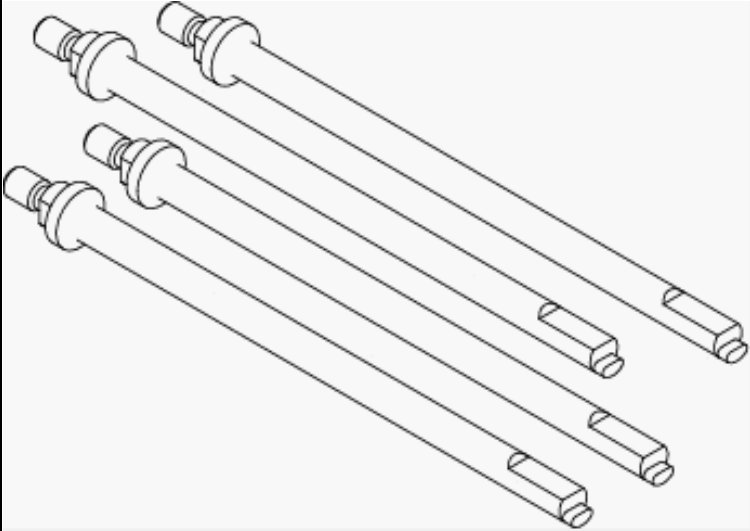


CLUTCH SPECIFICATIONS

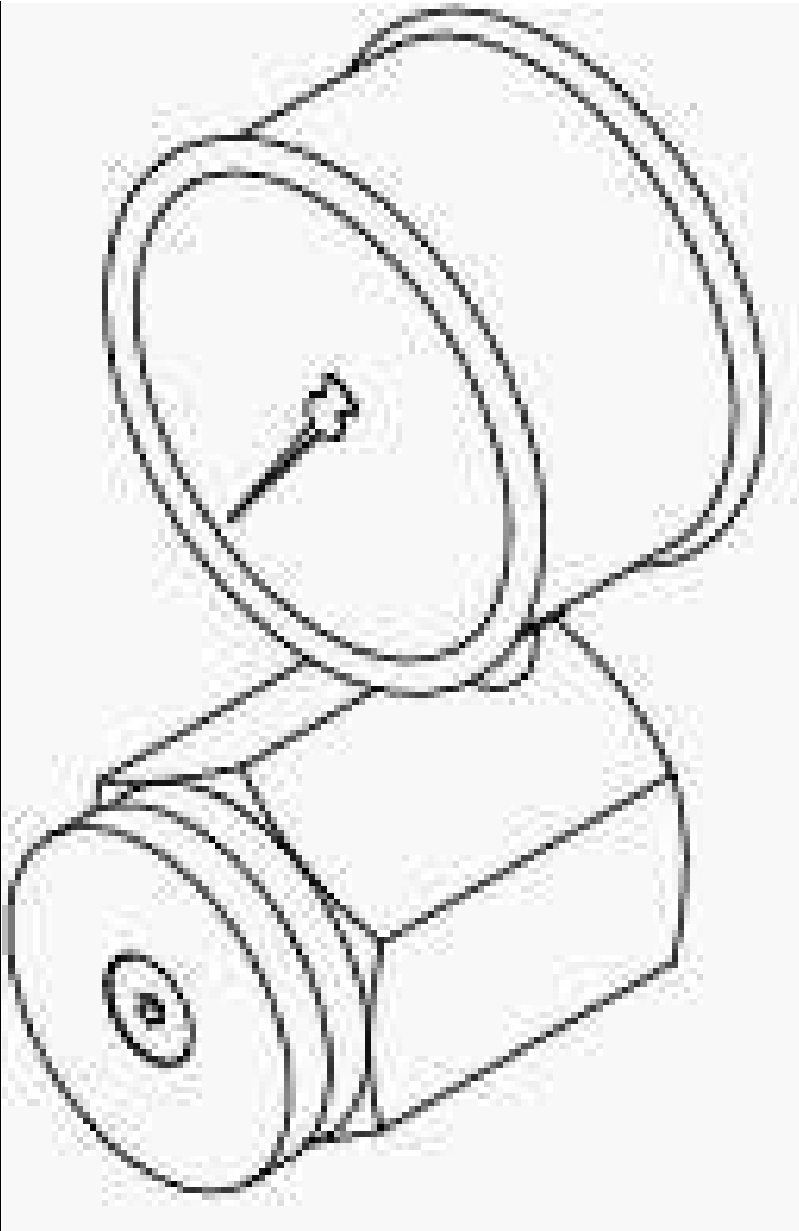
Clutch	Condition	Minimum	Normal	Maximum
A	NEW	1.51 mm	1.665 mm	1.82 mm
		0.059 in	0.066 in	0.072 in

Clutch	Condition	Minimum	Normal	Maximum
	AFTER OPERATION	1.51 mm	1.765 mm	2.02 mm
		0.059 in	0.069 in	0.080 in
B				
B	NEW	1.52 mm	1.725 mm	1.93 mm
		0.060 in	0.068 in	0.076 in
	AFTER OPERATION	1.52 mm	1.825 mm	2.13 mm
		0.060 in	0.072 in	0.084 in
B				
C	NEW	1.71 mm	1.905 mm	2.1 mm
		0.067 in	0.075 in	0.083 in
	AFTER OPERATION	1.71 mm	2.025 mm	2.025 mm
		0.067 in	0.080 in	0.092 in
B				
D	NEW	1.37 mm	1.515 mm	1.66 mm
		0.054 in	0.060 in	0.065 in
	AFTER OPERATION	1.37 mm	1.615 mm	1.86 mm
		0.054 in	0.064 in	0.073 in
B				
E	NEW	1.71 mm	1.905 mm	2.1 mm
		0.067 in	0.075 in	0.083 in
	AFTER OPERATION	1.71 mm	2.025 mm	2.34 mm
		0.067 in	0.080 in	0.092 in
B				

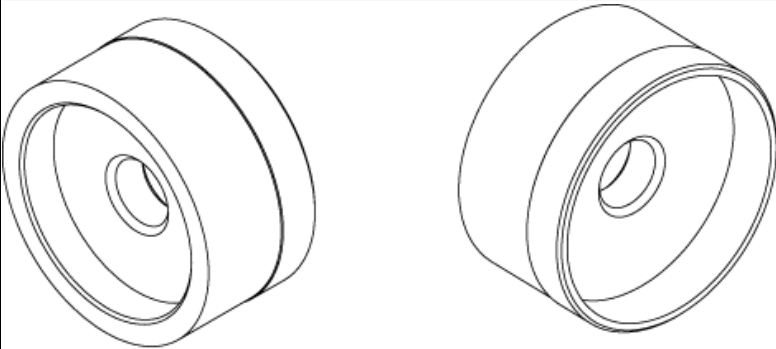
SPECIAL TOOLS



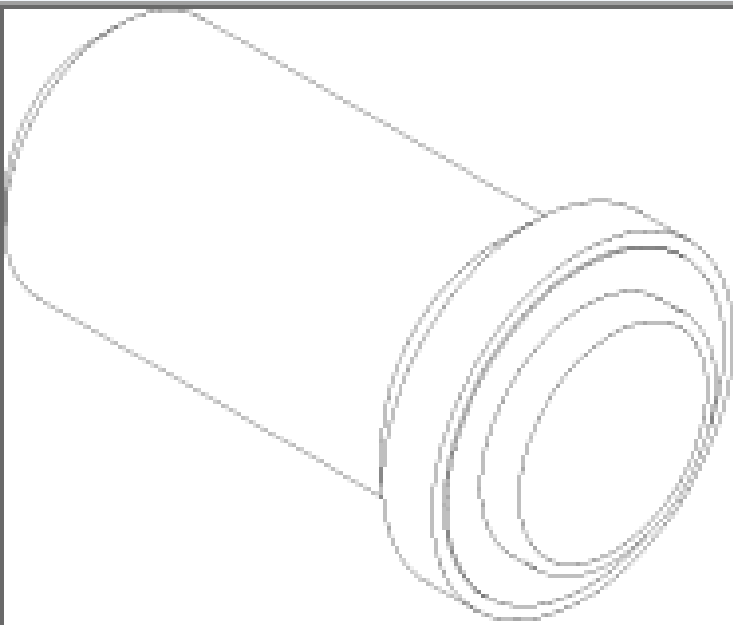
10428 - Adapter, Pressing Tool
(Originally Shipped In Kit Number(s).)



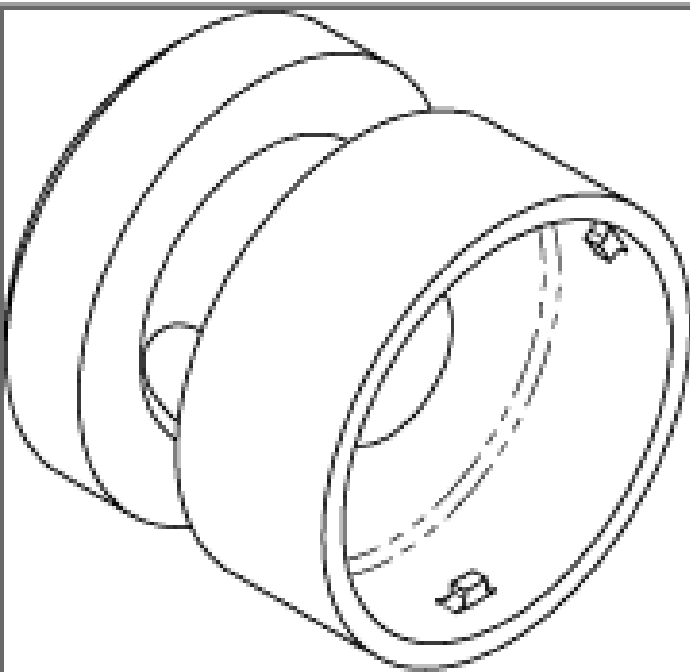
10429 - Gauge, Force
(Originally Shipped In Kit Number(s)
10419.)



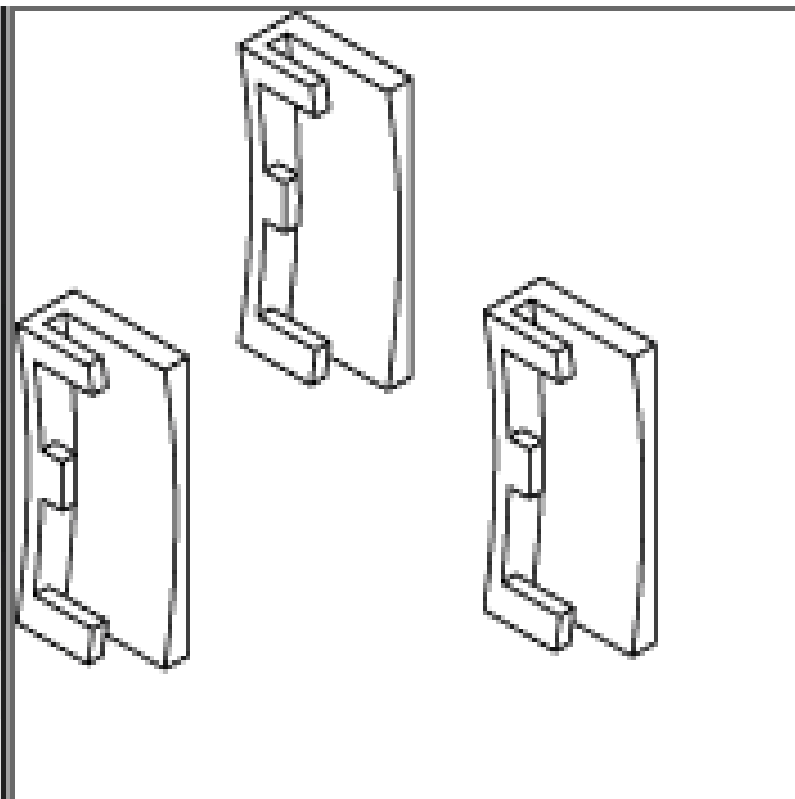
10373A - Installer, Output Needle
Bearing/Rear Oil Dam
(Originally Shipped In Kit Number(s)
10394A.)



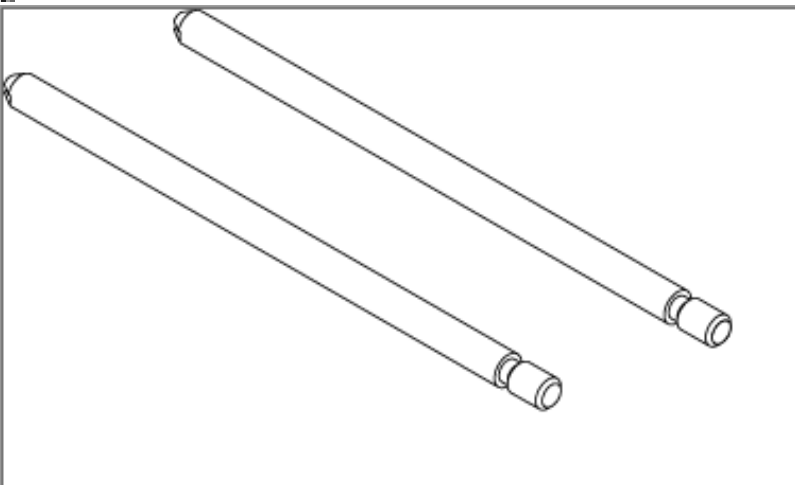
10375 - Installer, Oil Pump Cover Oil Seal



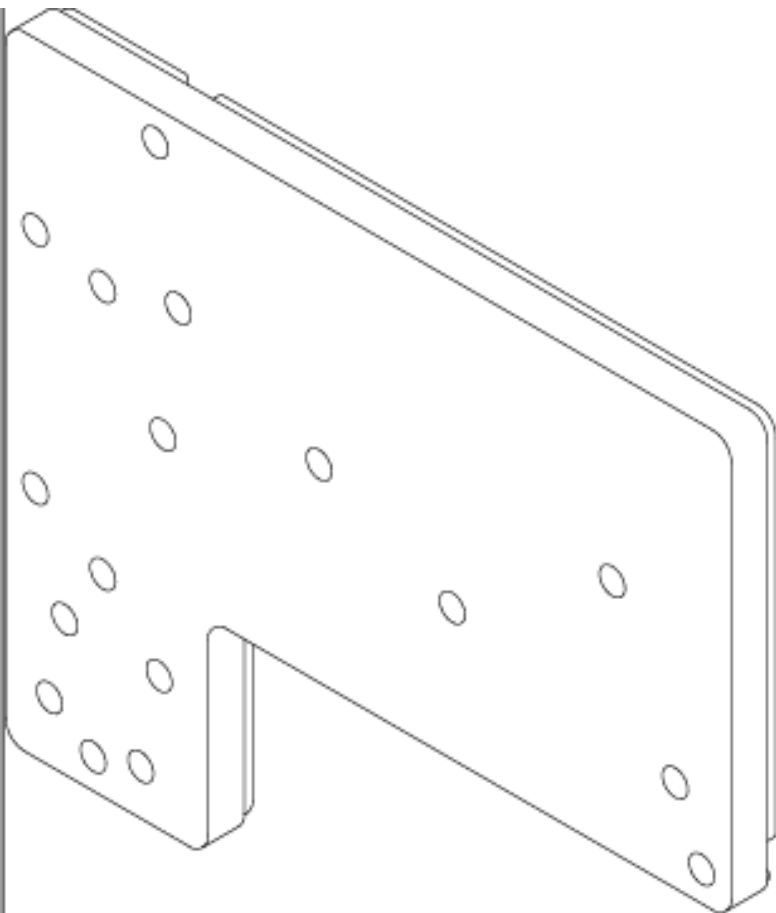
10377 - Remover/Installer, Guide Sleeve



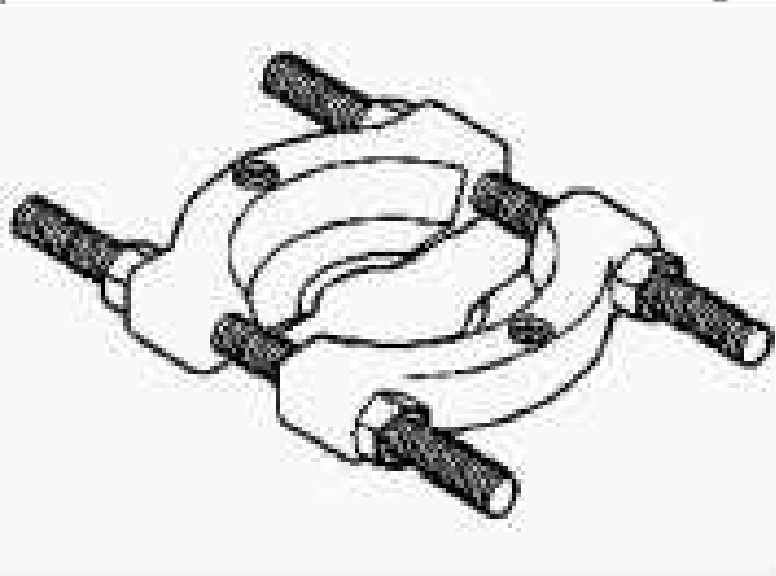
10378 - Rings, Support



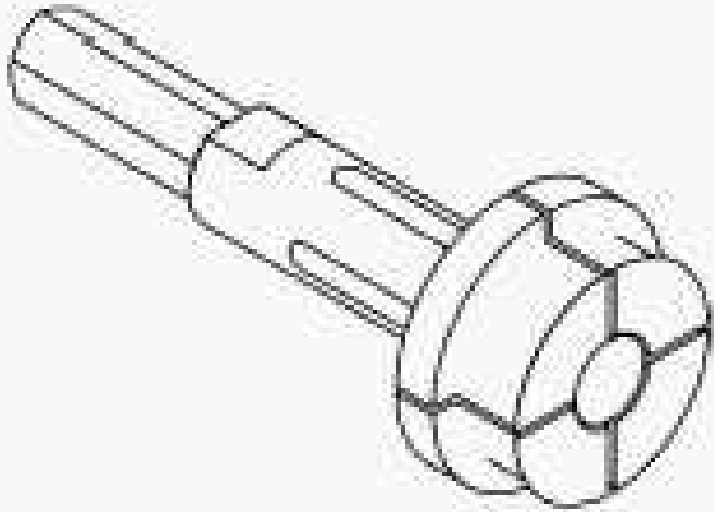
10379 - Pins, Valve Body Alignment



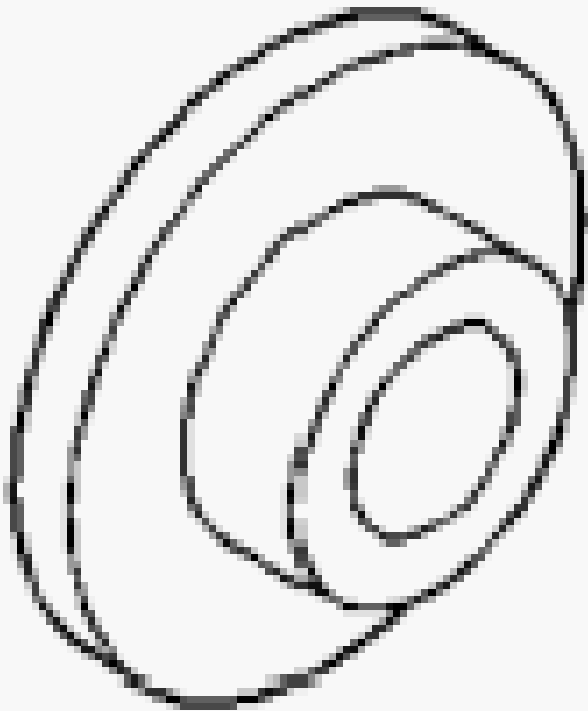
10383 - Plate, Clutch Pressure Test



1130 - Splitter, Bearing/Gear
(Originally Shipped In Kit Number(s)
6745, 6947, 6949, 9202, 9202A-CAN,
9202CC, 9299.)



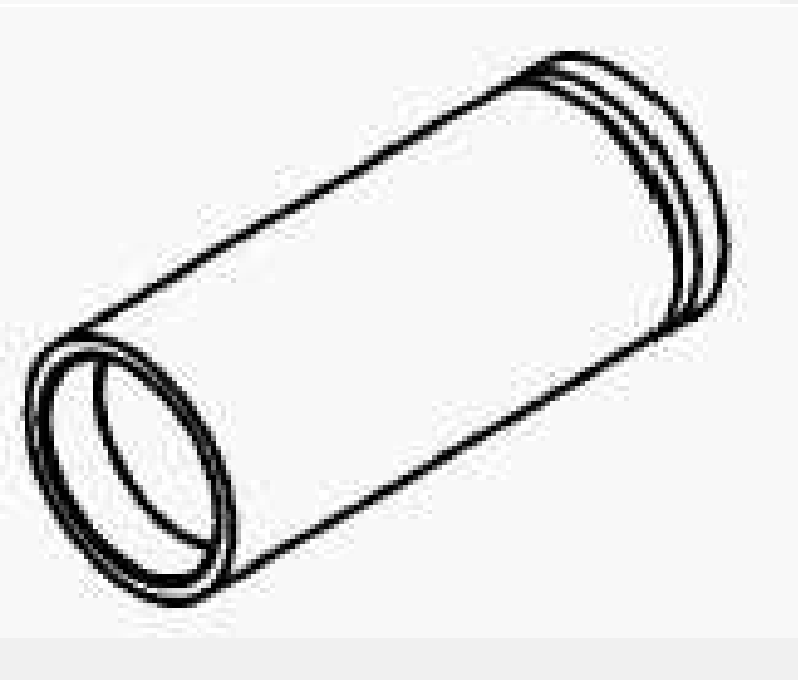
6787A - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
6784, 6809.)



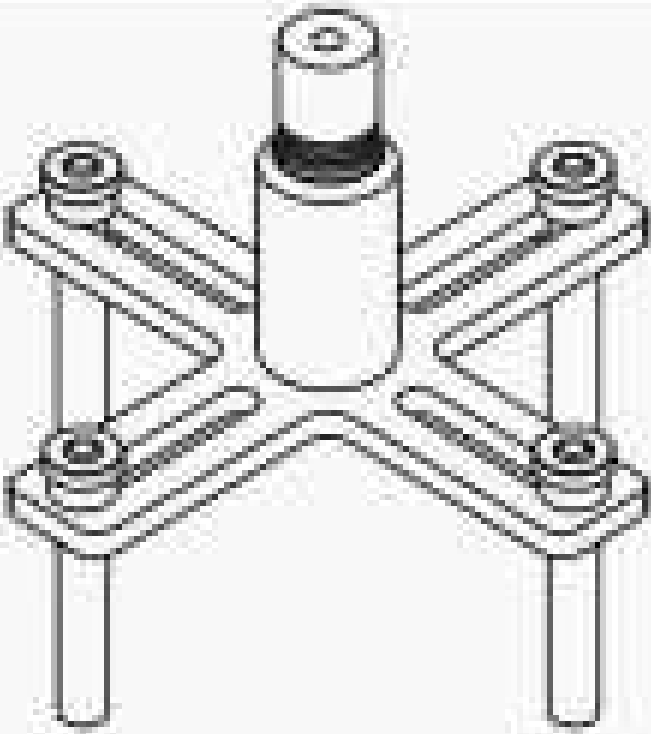
6936 - Spacer
(Originally Shipped In Kit Number(s)
6945, 6946, 6947, 6948.)



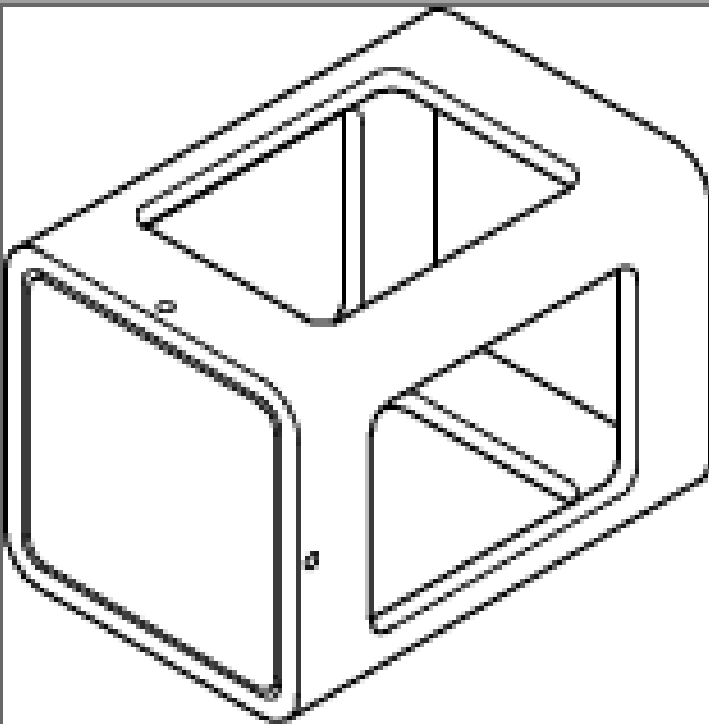
8285 - Compressor, Spring
(Originally Shipped In Kit Number(s)
8283, 8283CC, 8527, 8527CC, 8575,
8575CC, 9975.)



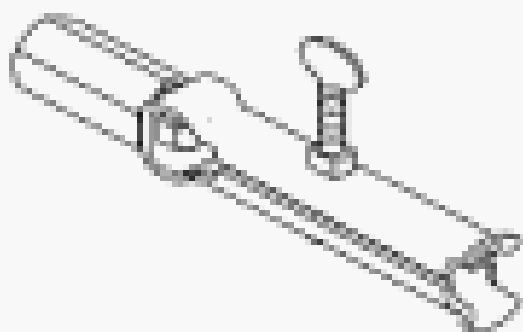
8481 - Installer, Gear
(Originally Shipped In Kit Number(s)
8708, 8708CC.)



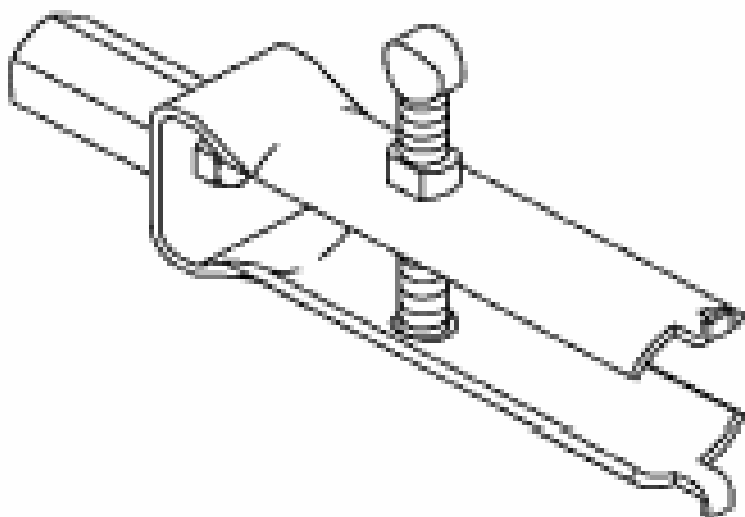
8901A - Pressing Tool
(Originally Shipped In Kit Number(s)
8901A.)



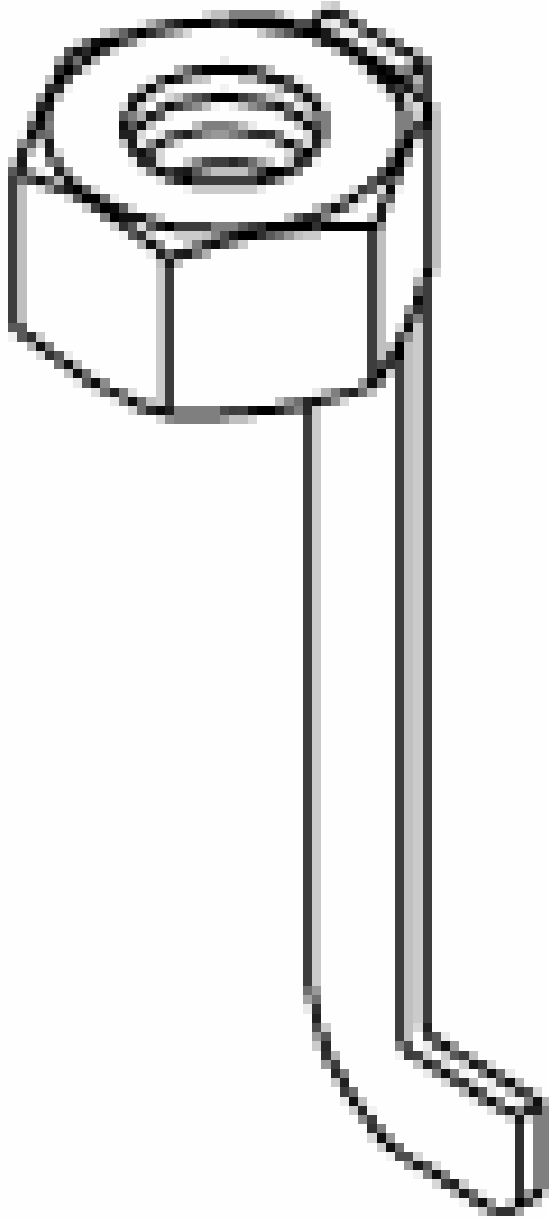
8925-3 - Assembly, Press Fixture
(Originally Shipped In Kit Number(s)
8998, 8998CC.)



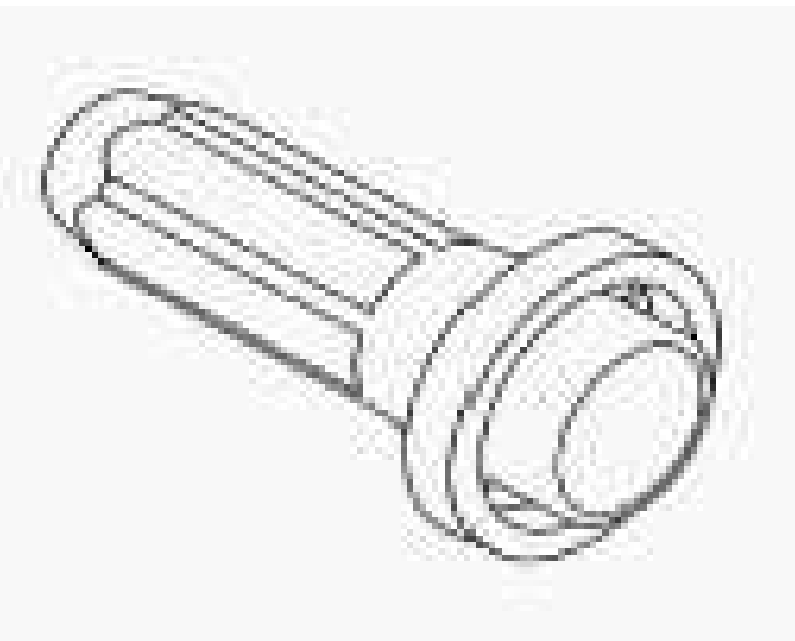
9585 - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
9691.)



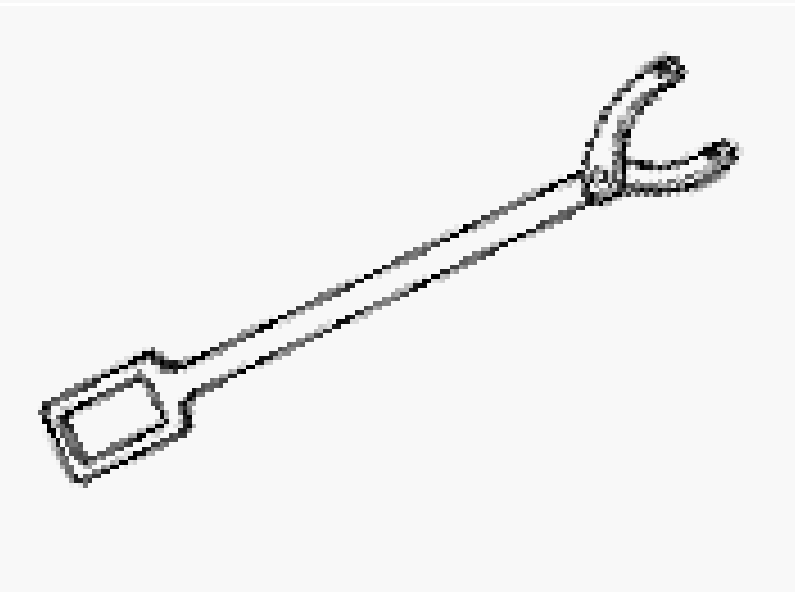
9664 - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
9675, 9685, 9695.)



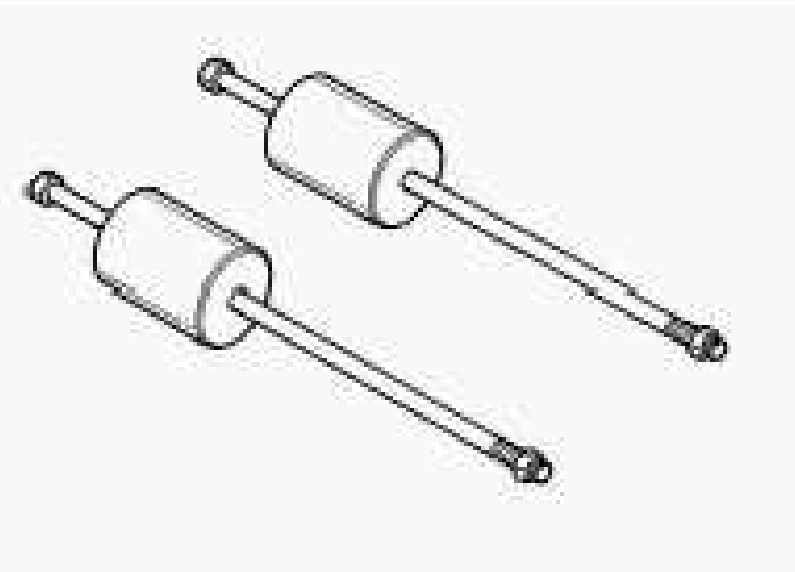
9667 - Remover, Seal
(Originally Shipped In Kit Number(s)
9691.)



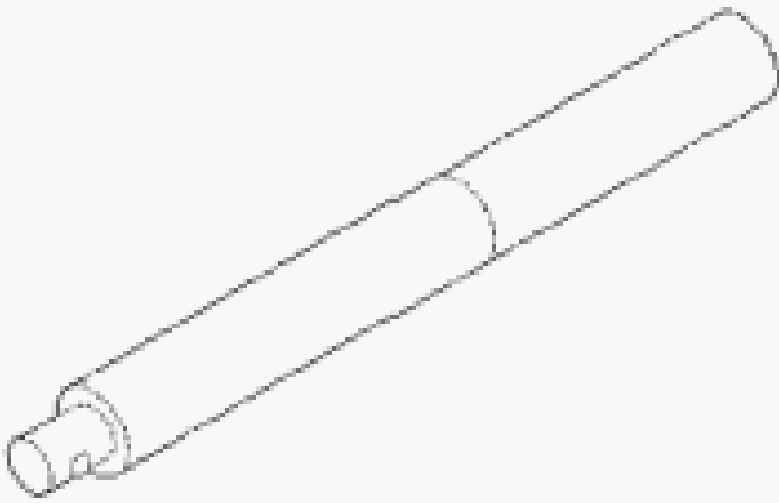
9677 - Installer, Seal
(Originally Shipped In Kit Number(s)
9675, 9685, 9695.)



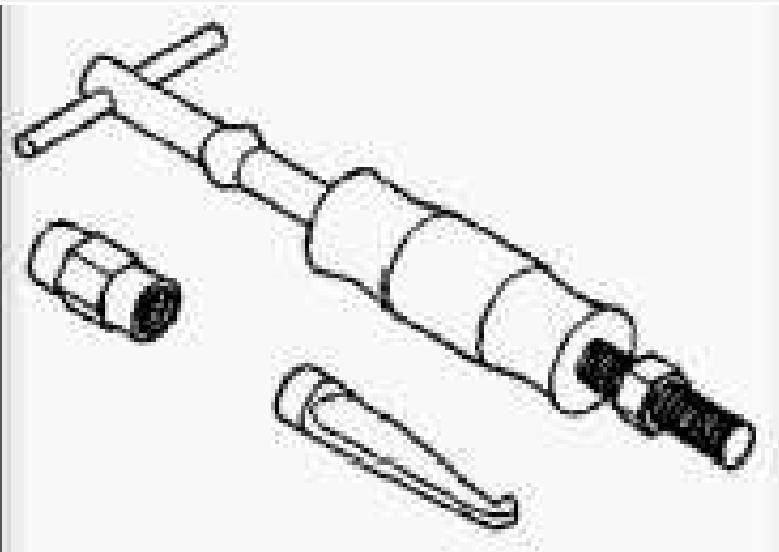
C-3281 - Holder, Flange
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



C-3752 - Slide Hammers
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202-CAN,
9202CC.)



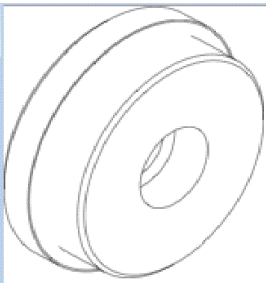
C-4171 - Driver Handle, Universal
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



C-637 - Slide Hammer, Universal
(Originally Shipped In Kit Number(s)
9202.)



10382 - Installer, Oil Pump Housing
Needle Bearing
(Originally Shipped In Kit Number(s)
10394A, 10394-UPD.)



10376 - Installer, Input Shaft Needle Bearing
(Originally Shipped In Kit Number(s) 10394A, 10394-UPD.)

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION - 3.6L

REMOVAL

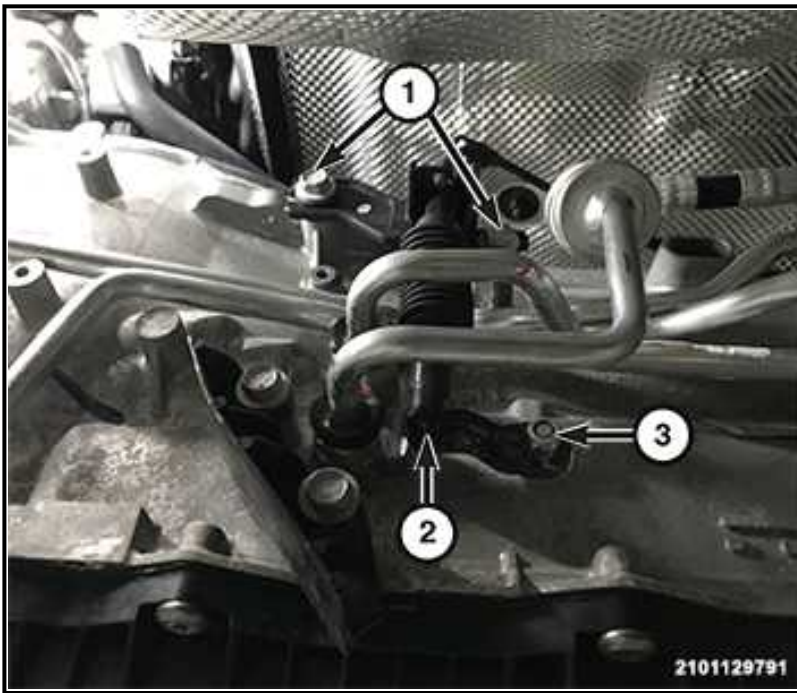
CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter driveplate, oil pump, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and converter as an assembly.

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Transmission Control Module (TCM) Adaptation Procedure using the scan tool. Refer to MODULE, TRANSMISSION CONTROL (TCM), MODULE PROGRAMMING .

1. Disconnect and isolate the negative battery cable(s). Refer to CABLES, BATTERY .
2. Raise and support the vehicle. Refer to HOISTING, STANDARD PROCEDURE .
3. Remove the transmission mount nuts. Refer to INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND INSTALLATION .
4. If equipped, remove the transfer case skid plate. Refer to PLATE, SKID, REMOVAL AND INSTALLATION PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION .
5. Remove the starter. Refer to STARTER, REMOVAL AND INSTALLATION .
6. Support the transmission with a suitable jack and remove the frame cross-member supporting the transmission. Refer to CROSSMEMBER, FRONT REINFORCEMENT, REMOVAL AND INSTALLATION CROSSMEMBER, TRANSMISSION, REMOVAL AND INSTALLATION .

NOTE: Be careful not to damage the transmission pan.

7. Remove the exhaust pipe. Refer to Y-PIPE, EXHAUST, REMOVAL AND INSTALLATION .
8. Remove the heat shield below rear prop shaft.

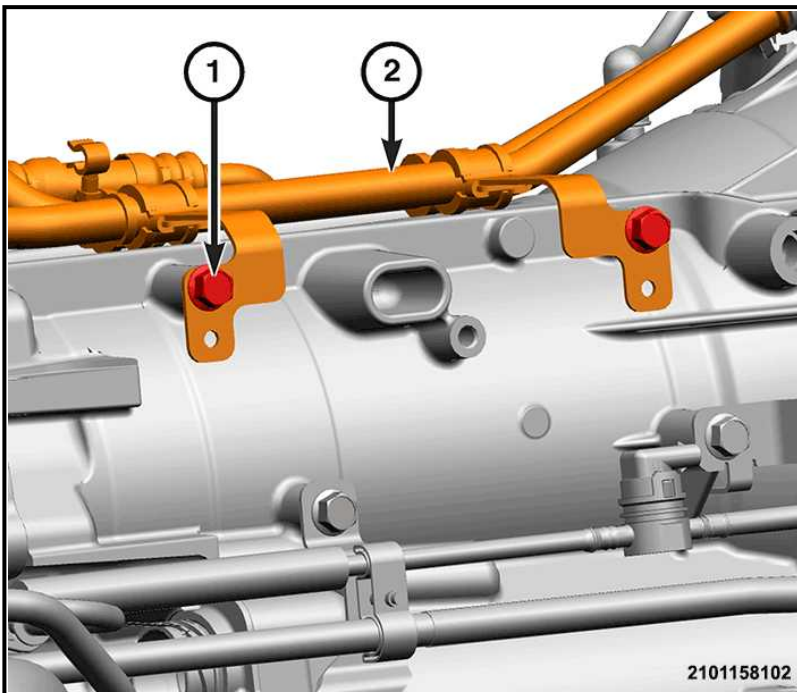


1 - Manual Park Release (MPR) Cable Bracket Bolts

2 - MPR cable

3 - MPR Lever

9. Disconnect the Manual Park Release (MPR) cable from the MPR lever.



1 - Transmission Heater Coolant Hose Bracket Bolts
--

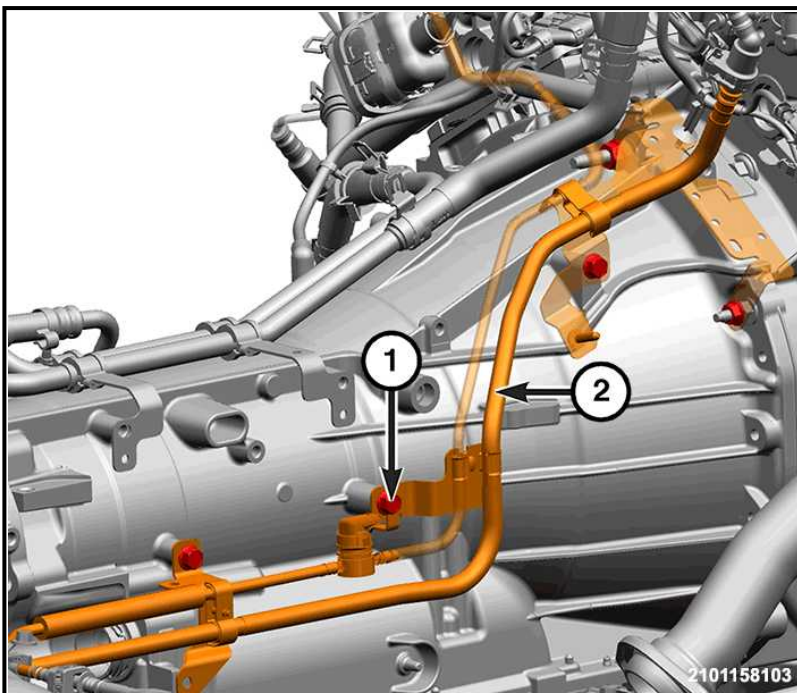
2 - Transmission Heater Coolant Hoses

10. Remove the bolts that hold the transmission heater coolant hoses to the right side of the transmission.



1 - Transmission Wire Harness Connector

11. Disconnect the 13-pin plug connector. Turn the connector counter-clockwise to release.

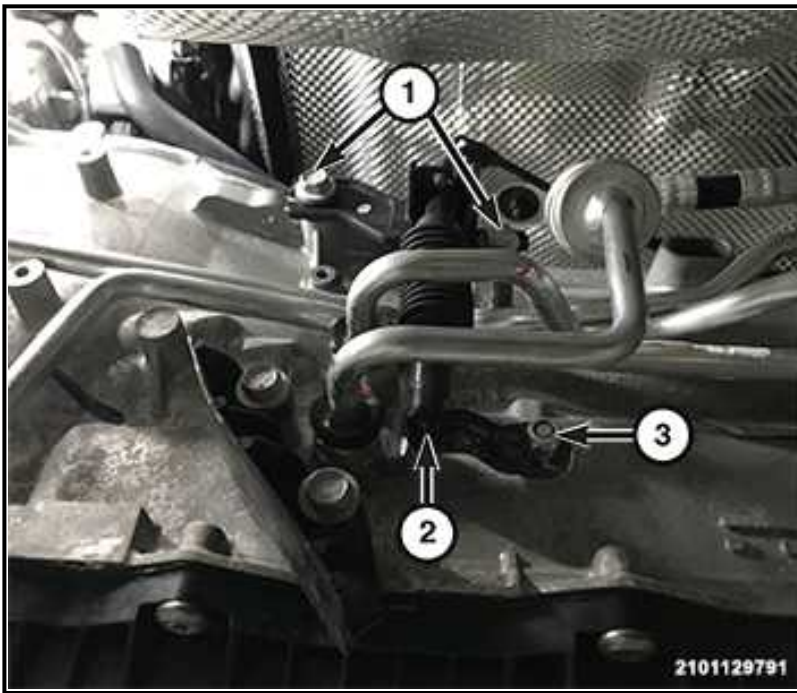


1 - Vapor Line Bracket Bolts

2 - Vapor Line Assembly

12. Remove the vapor line bracket bolts and let the bracket and lines hang freely.

13. Remove all remaining wiring harness retainers from the transmission.



1 - Manual Park Release (MPR) Cable Bracket Bolts

2 - MPR cable

3 - MPR Lever

14. Remove the bolts from the MPR cable bracket and position the cable bracket aside.

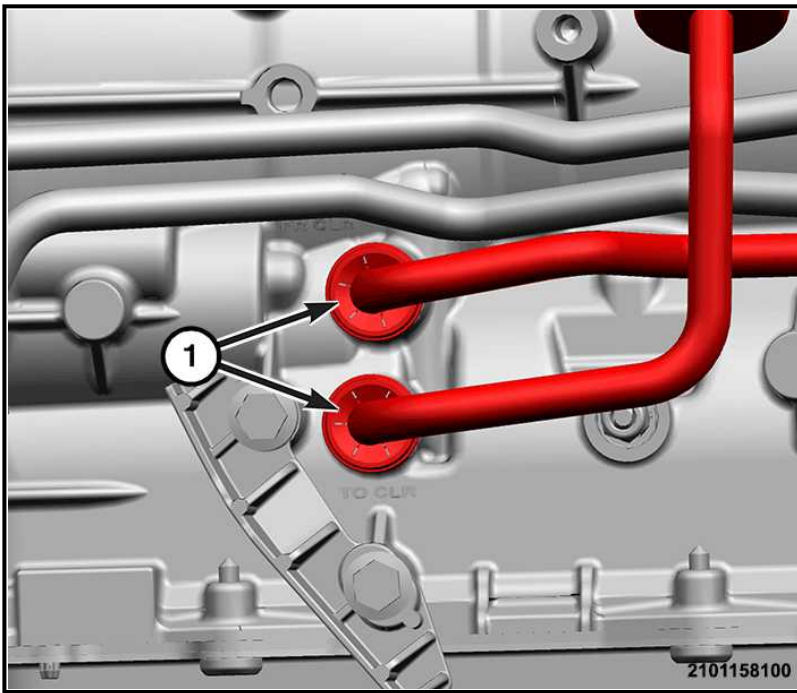


1 - Transmission Oil Cooler Line Clip

2 - Transmission Oil Cooler Line Retaining Bolts
--

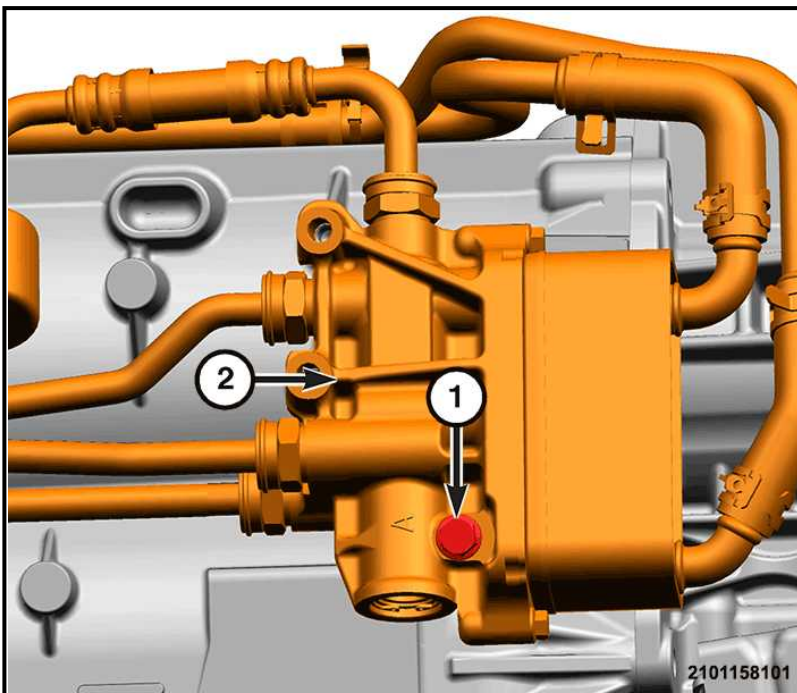
15. Disconnect the left front transmission oil cooler line clip.

16. Remove the two transmission oil cooler line retaining bolts from the transmission, and one transmission oil cooler line retaining bolt from the engine.



1 - Transmission Oil Cooler Lines

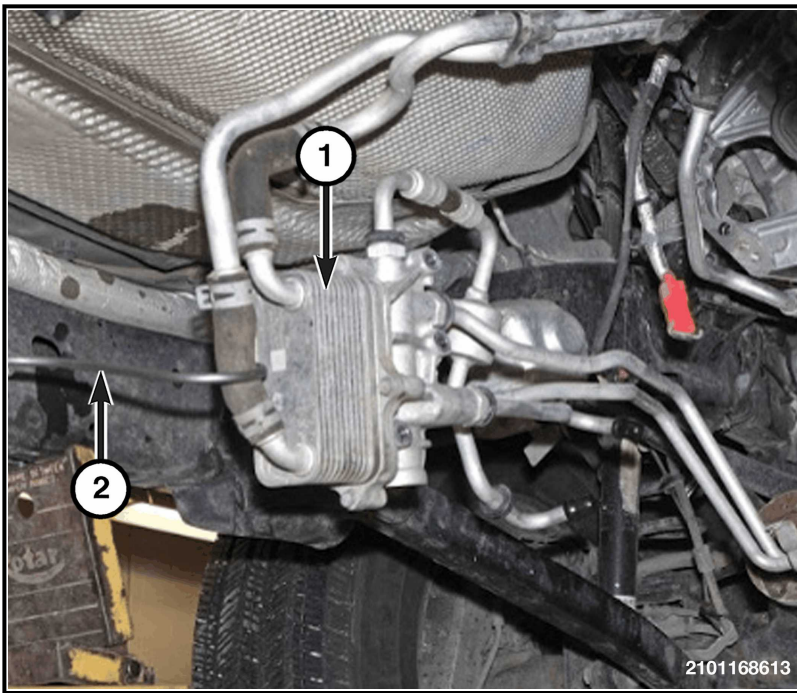
17. Using the (special tool #9546, Disconnect Tool), disconnect the transmission oil cooler lines from the transmission.



1 - Transmission Oil Heater Bolts

2 - Transmission Oil Heater

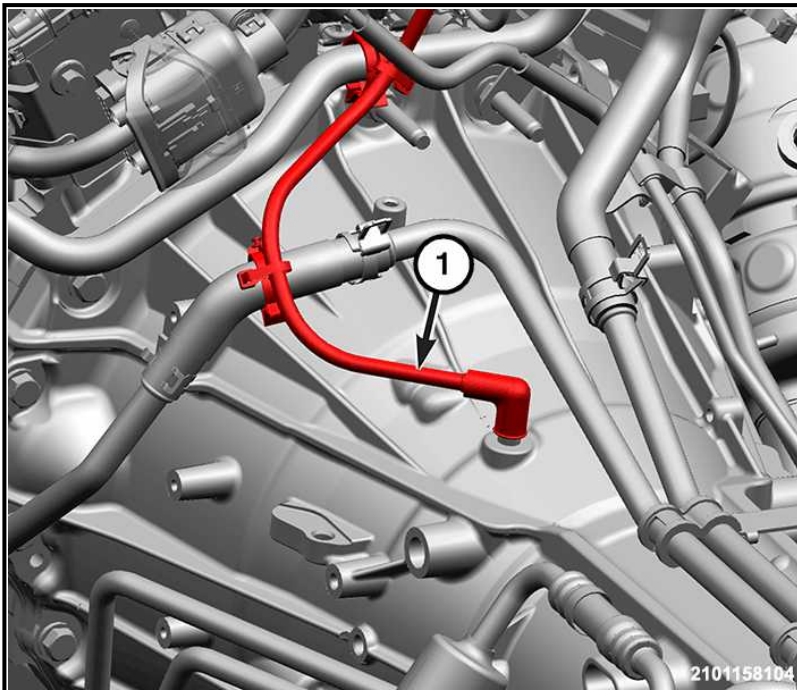
18. Remove the bolts retaining the transmission oil heater. Position the transmission oil heater aside.



1 - Transmission Oil Heater

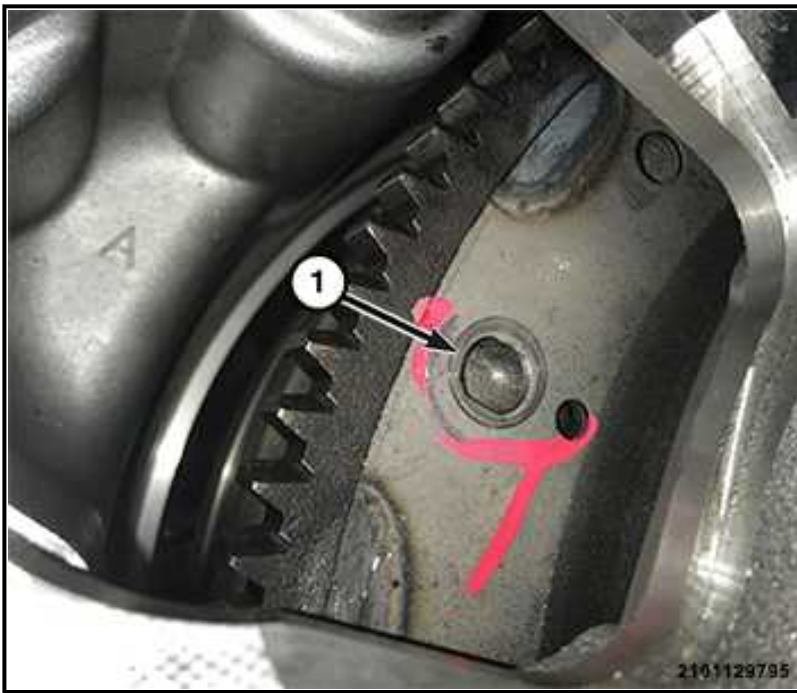
2 - Wire

19. Using a suitable tool, secure the transmission oil heater to the frame.



1 - Transmission Vent Hose

20. Disconnect transmission vent hose.



1 - Torque Converter Bolt Location

21. Rotate the crankshaft clockwise and remove six torque converter bolts through the starter pocket.

NOTE: There are three sets of two torque converter bolts located 120B° apart from each other.

NOTE: If necessary, use a grease pen or similar to mark crankshaft pulley every 120B° for converter bolt location.

22. Remove the transmission to engine bolts.

23. Support engine with a suitable stand before removing transmission.

NOTE: Be careful not to damage the engine oil pan when using the stand. Use a rubber or wood block between the pan and the stand to support the engine.

24. Secure the transmission to a suitable jack.

25. Carefully maneuver the transmission and the torque converter assembly rearward off of the engine block dowels.

NOTE: Be careful not to damage or bend the transmission oil cooler lines.

26. Hold the torque converter in place during removal of the transmission.

27. Lower transmission and remove the assembly from under the vehicle.

28. Remove the torque converter. Refer to [TORQUE CONVERTER, REMOVAL AND INSTALLATION](#).

INSTALLATION

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TRANSMISSION VERIFICATION TEST

Refer to [TRANSMISSION VERIFICATION TEST](#) .

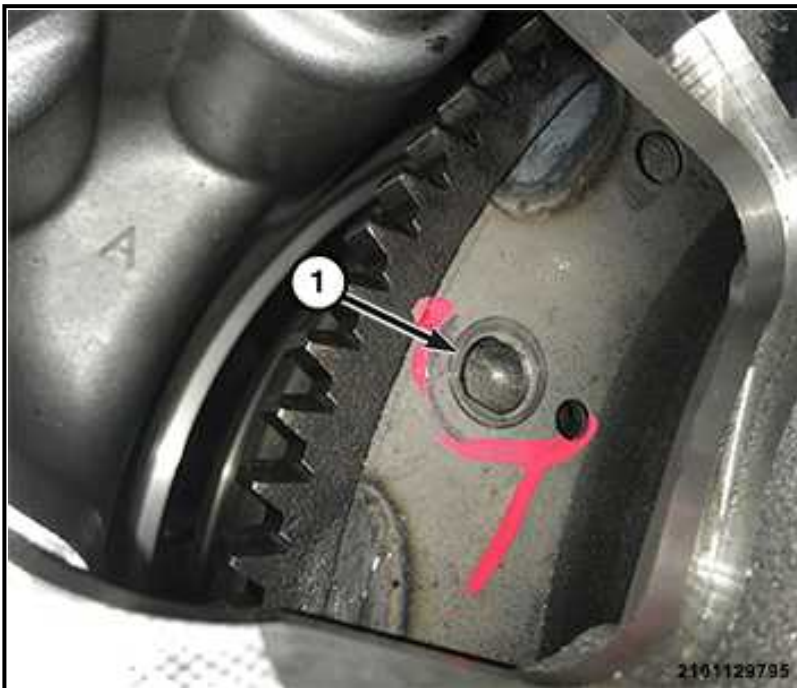
1. If a replacement transmission is being installed, transfer any components necessary such as the shift cable bracket and MPR bracket from the original transmission onto the replacement transmission.
2. Apply a light coating of MoparB® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine crankshaft.
3. Install the torque converter. Refer to **TORQUE CONVERTER, REMOVAL AND INSTALLATION.**
4. Place the transmission on a suitable jack and secure the transmission to the jack.
5. Raise the transmission and align the torque converter with the drive plate and the transmission converter housing with the engine block.

NOTE: If the torque converter was spun or removed, align the torque converter bolt holes with the starter pocket to ease the bolt installation.

6. Move the transmission forward. Then maneuver the transmission to align the converter housing with the engine block dowels.

NOTE: It may be necessary to use a suitable jack to support the rear of the engine during transmission installation.

7. Carefully maneuver the transmission forward and over the engine block dowels until the converter hub is seated in the crankshaft. Verify that there are no wires loose or that the transmission vent hose have become trapped between the engine block and the transmission.
8. Install two bolts to attach the transmission to the engine.
9. Install the remaining torque converter housing to engine bolts. Tighten all of the torque converter housing bolts.

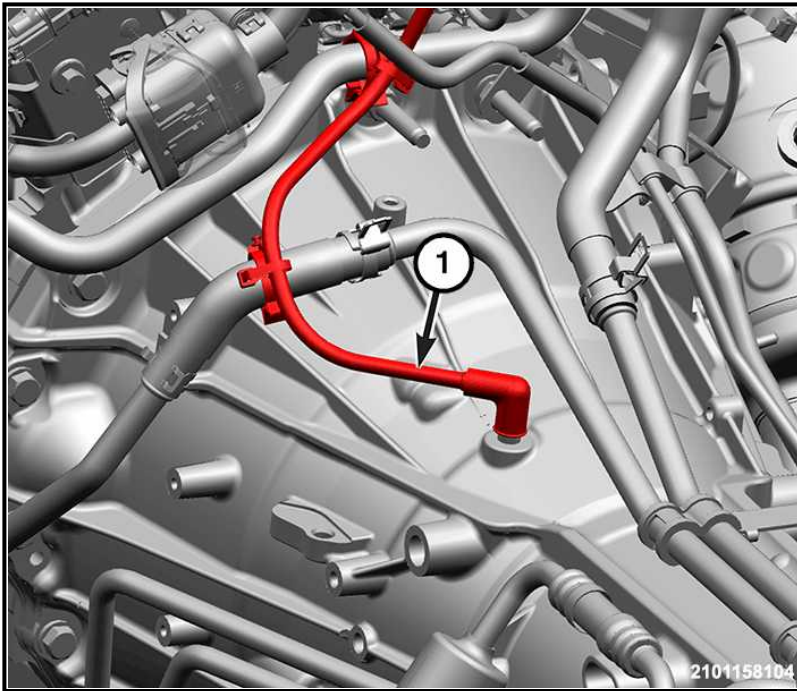


1 - Close Tolerance Torque Converter Bolt Hole

10. Rotate the crankshaft in a clockwise direction to line up the close tolerance torque converter bolt hole in the flex plate, then start the first bolt.
11. Rotate the crankshaft in a clockwise direction until the flexplate to torque converter bolts are accessible. There are three sets of two bolts 120B° apart.

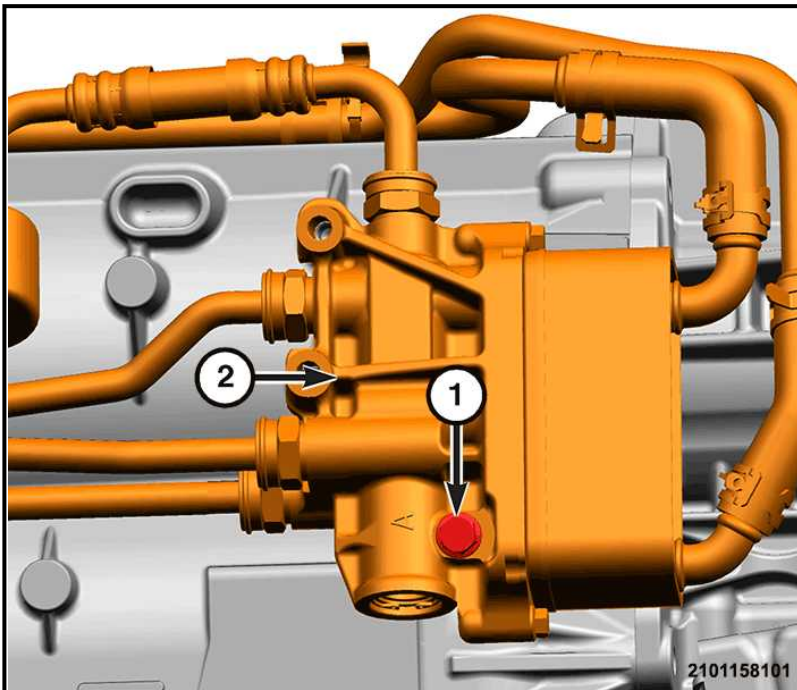
NOTE: Install all torque converter bolts by hand first. There are three sets of two bolts 120B° apart.

12. Install the torque converter to flexplate bolts through the starter pocket.



1 - Transmission Vent Hose

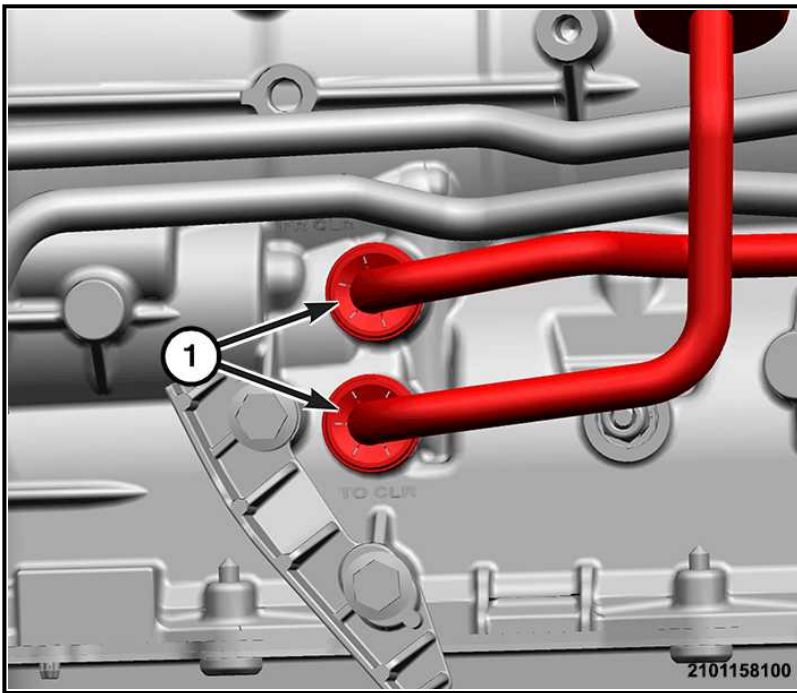
13. Connect the transmission oil heater.



1 - Transmission Oil Heater Bolts

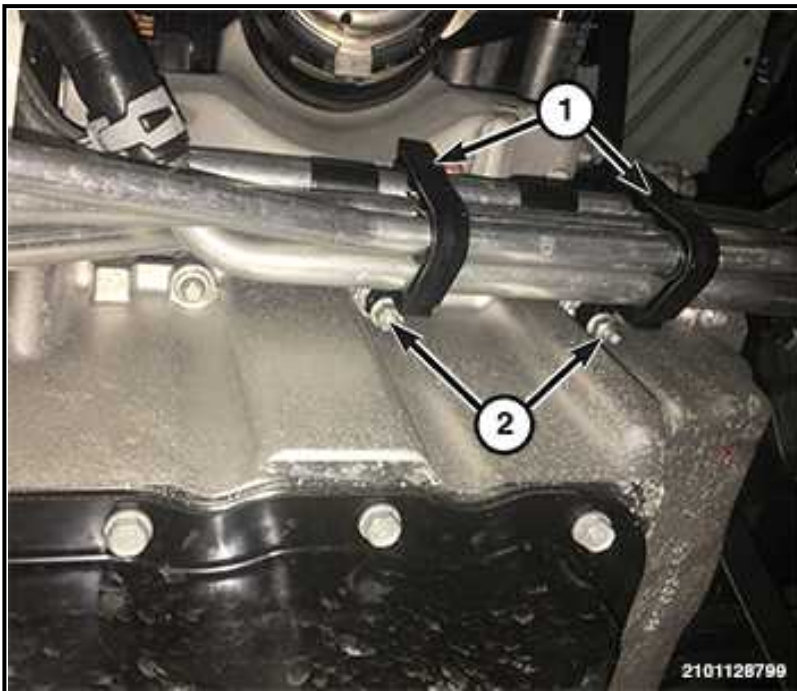
2 - Transmission Oil Heater

14. Install the transmission oil heater and tighten the transmission oil heater bolts.



1 - Transmission Oil Cooler Lines

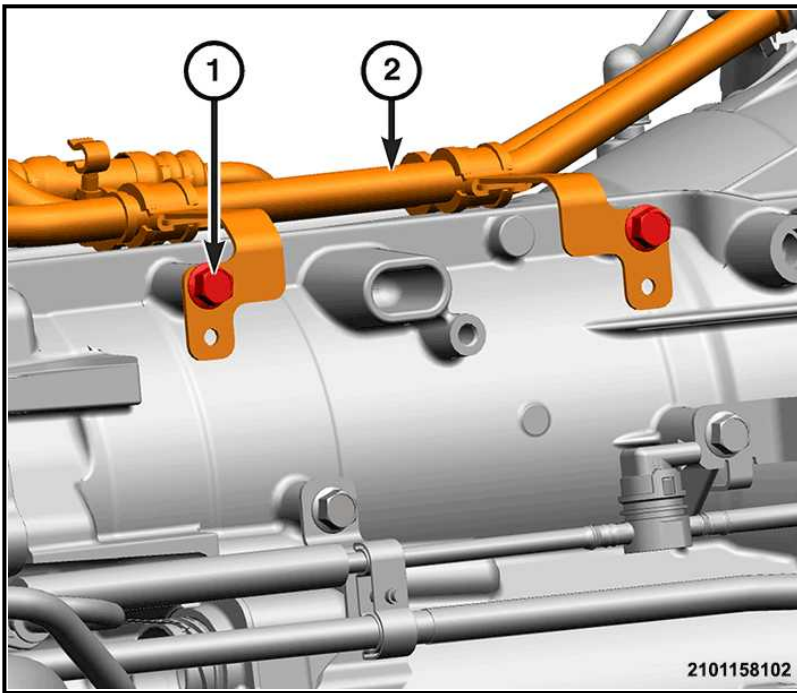
15. Connect the transmission lines to the transmission. Be sure that the lines are fully seated. Snap the lock ring over the line fitting.



1 - Transmission Oil Cooler Line Clip

2 - Transmission Oil Cooler Line Retaining Bolts

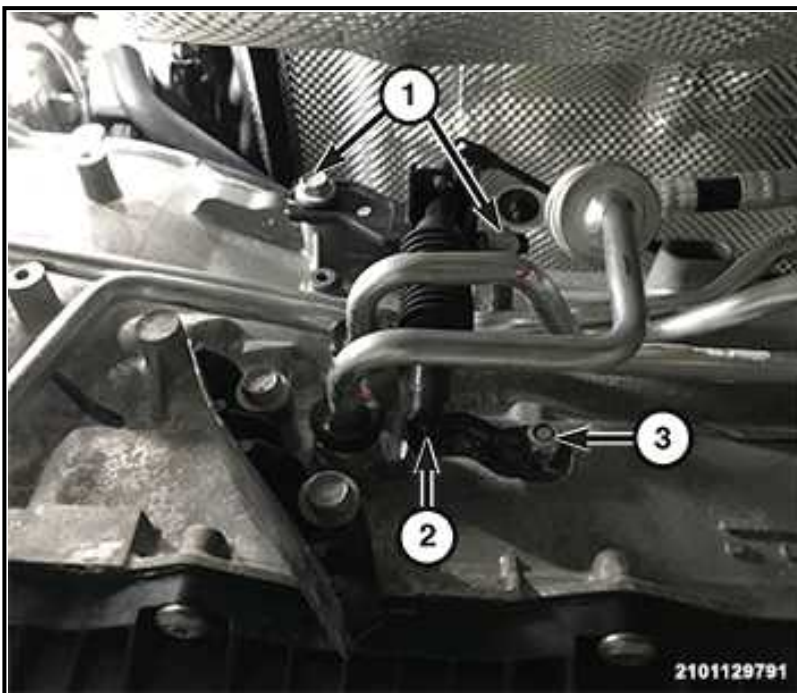
16. Install the two transmission oil cooler line retaining bolts to the transmission, and one transmission oil cooler line retaining bolt to the engine. Connect left front transmission line clip.



1 - Transmission Heater Coolant Hose Bracket Bolts
--

2 - Transmission Heater Coolant Hoses

17. Install the two bolts that hold the transmission heater coolant hoses to the right side of the transmission.



1 - Manual Park Release (MPR) Cable Bracket Bolts

2 - MPR cable

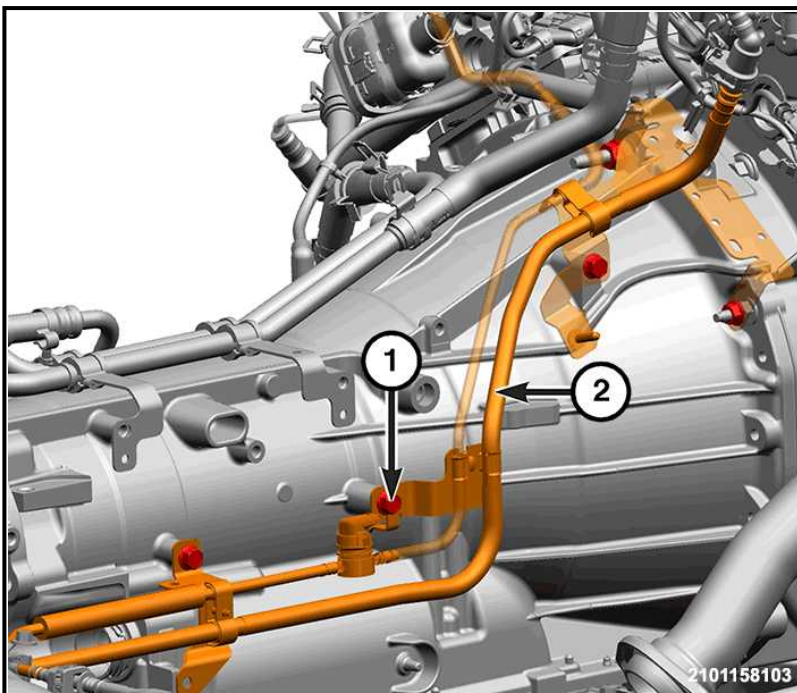
3 - MPR Lever

18. Install the MPR cable bracket and tighten the bolts.



1 - Transmission Wire Harness Connector

19. Connect the 13-pin plug connector. Turn the connector clockwise to lock.



1 - Vapor Line Bracket Bolts

2 - Vapor Line Assembly

20. Install the vapor line bracket bolts.

21. Install the transfer case. Refer to [REMOVAL AND INSTALLATION](#) .

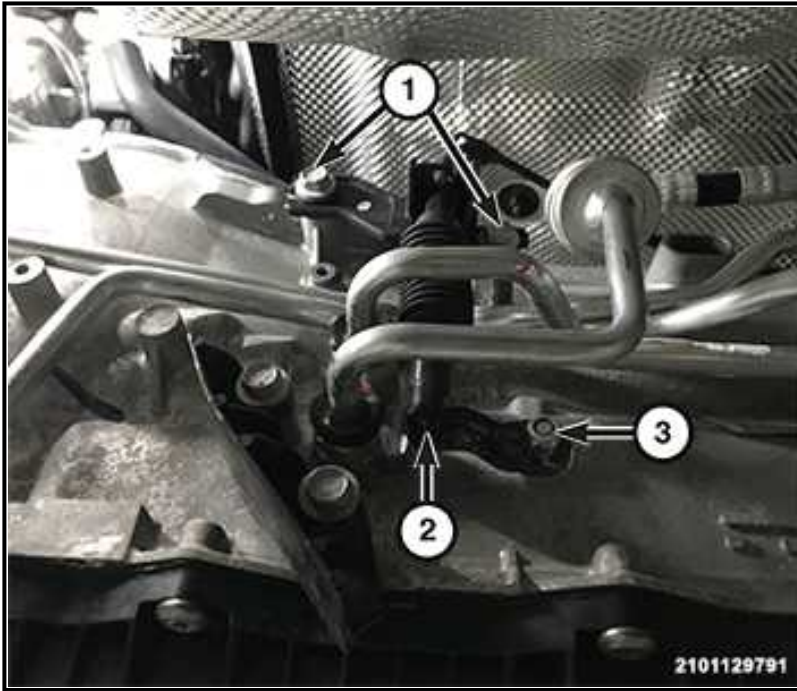
NOTE: Support the front of the front propeller shaft. Do not install the front propeller shaft to axle bolts until the left side catalytic converter is installed.

22. Install the front propeller shaft to the transfer case. Refer to [REMOVAL AND INSTALLATION](#) .

23. Install the transmission mount nuts. Refer to [INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION](#) , and [INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND](#)

INSTALLATION .

24. Install the rear propeller shaft. Refer to REMOVAL AND INSTALLATION .



1 - Manual Park Release (MPR) Cable Bracket Bolts
2 - MPR cable
3 - MPR Lever

25. Connect the MPR cable to the MPR lever.

26. Install the heat shield for the rear propeller shaft/muffler.

27. Install the front propeller shaft. Refer to REMOVAL AND INSTALLATION .

28. Install the exhaust pipe. Refer to Y-PIPE, EXHAUST, REMOVAL AND INSTALLATION .

29. Install the frame cross-member supporting the transmission. Refer to CROSSMEMBER, TRANSMISSION, REMOVAL AND INSTALLATION .

30. Install the starter. Refer to STARTER, REMOVAL AND INSTALLATION .

31. Install the transfer case skid plate. Refer to PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION .

32. Fill the transmission with appropriate fluid. Refer to TRANSMISSION FILL AFTER SERVICE .

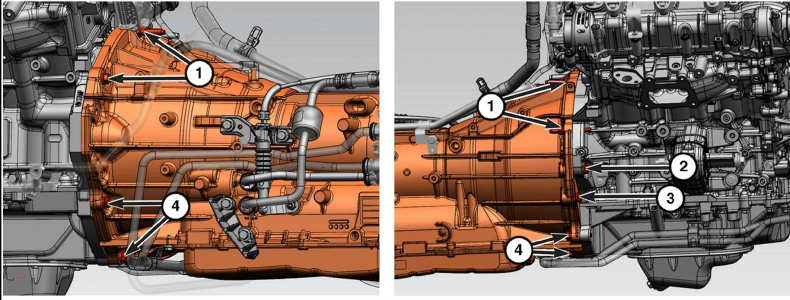
33. Lower the vehicle.

34. Connect the negative battery cable(s). Refer to CABLES, BATTERY .

35. If the valve body is replaced, program the Transmission Control Module (TCM). Refer to MODULE, TRANSMISSION CONTROL (TCM), MODULE PROGRAMMING .

36. Perform the TRANSMISSION VERIFICATION TEST. Refer to TRANSMISSION VERIFICATION TEST .

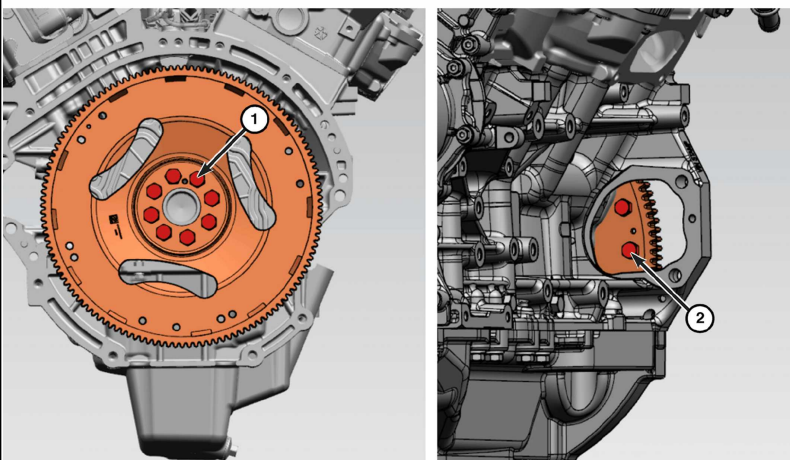
BELLHOUSING AND OIL FILL PLUG



2101191085

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Bolts	- Bolt 50 N.m (37 Ft. Lbs.) - Double Ended Stud 48 N.m (35 Ft. Lbs.)	-
2	Engine Block To Transmission Bellhousing Bolt	50 N.m (37 Ft. Lbs.)	-
3	Dust Shield To Transmission Bellhousing Bolt	12 N.m (9 Ft. Lbs.)	-
4	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
Not Shown	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

FLEXPLATE AND TORQUE CONVERTER

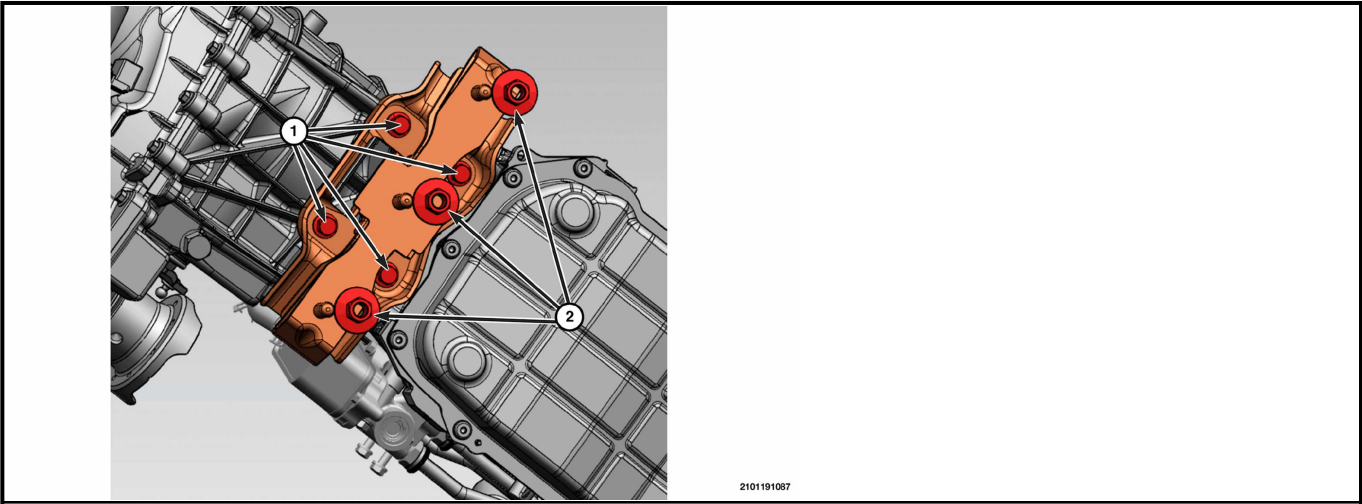


2101191088

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	95 N.m (70 Ft. Lbs.)	Tighten in a crisscross pattern. Do not reuse these fasteners. If removed, a NEW fastener

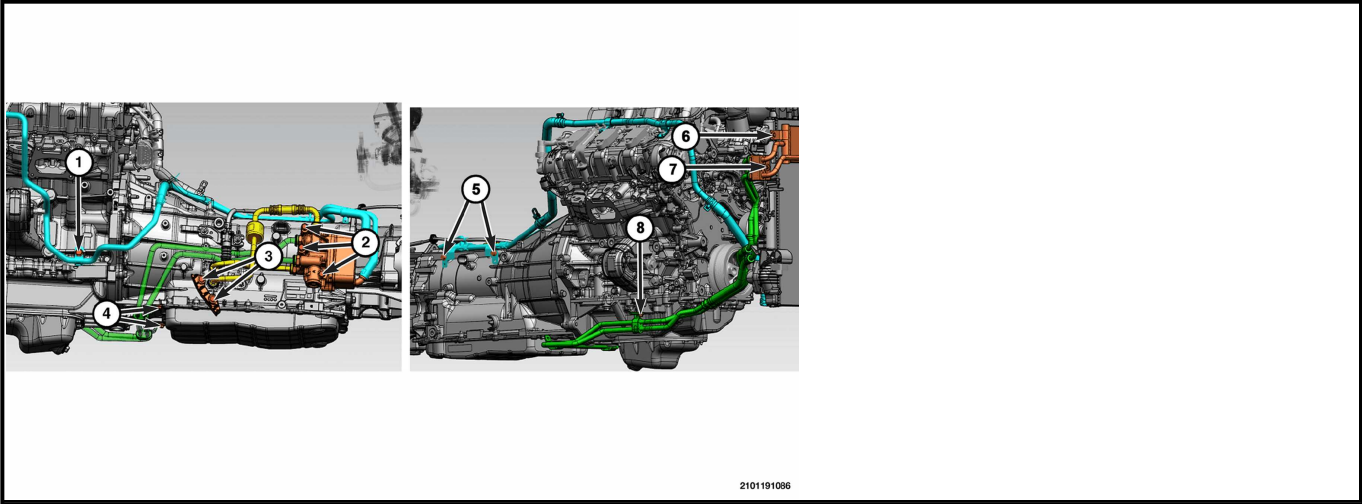
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
			must be installed and tightened to specifications.
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.

TRANSMISSION MOUNT



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

TRANSMISSION OIL COOLER AND HEATER



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket to Engine Bolt	35 N. m (26 Ft. Lbs.)	-
2	Transmission Oil Heater To Case Bolts	23 N. m (17 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Bolt	-	Tighten Securely
7	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
8	Transmission Oil Cooler Line Bracket To Oil Pan	9 N. m (80 In. Lbs.)	-

DISASSEMBLY AND ASSEMBLY

DISASSEMBLY AND ASSEMBLY - TRANSMISSION AND INTERNAL CLUTCHES

The individual clutches listed below provide the following information for each clutch assembly:

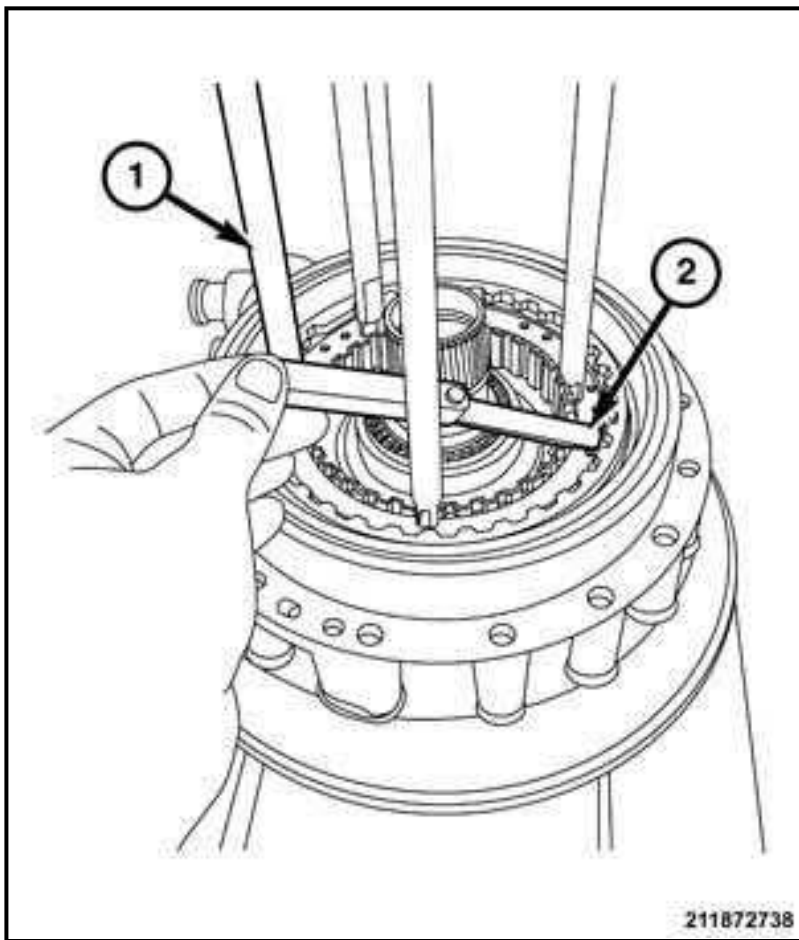
- Disassembly and assembly procedures
- Clutch pack clearance measurements
- Clutch pack clearance specifications
- Adjustments - selectable snap rings and backing plates

It is recommended to measure the clutch pack clearances for evaluation before disassembling a clutch to replace any of the clutch components.

CLUTCH A - DISASSEMBLY AND ADJUSTMENTS

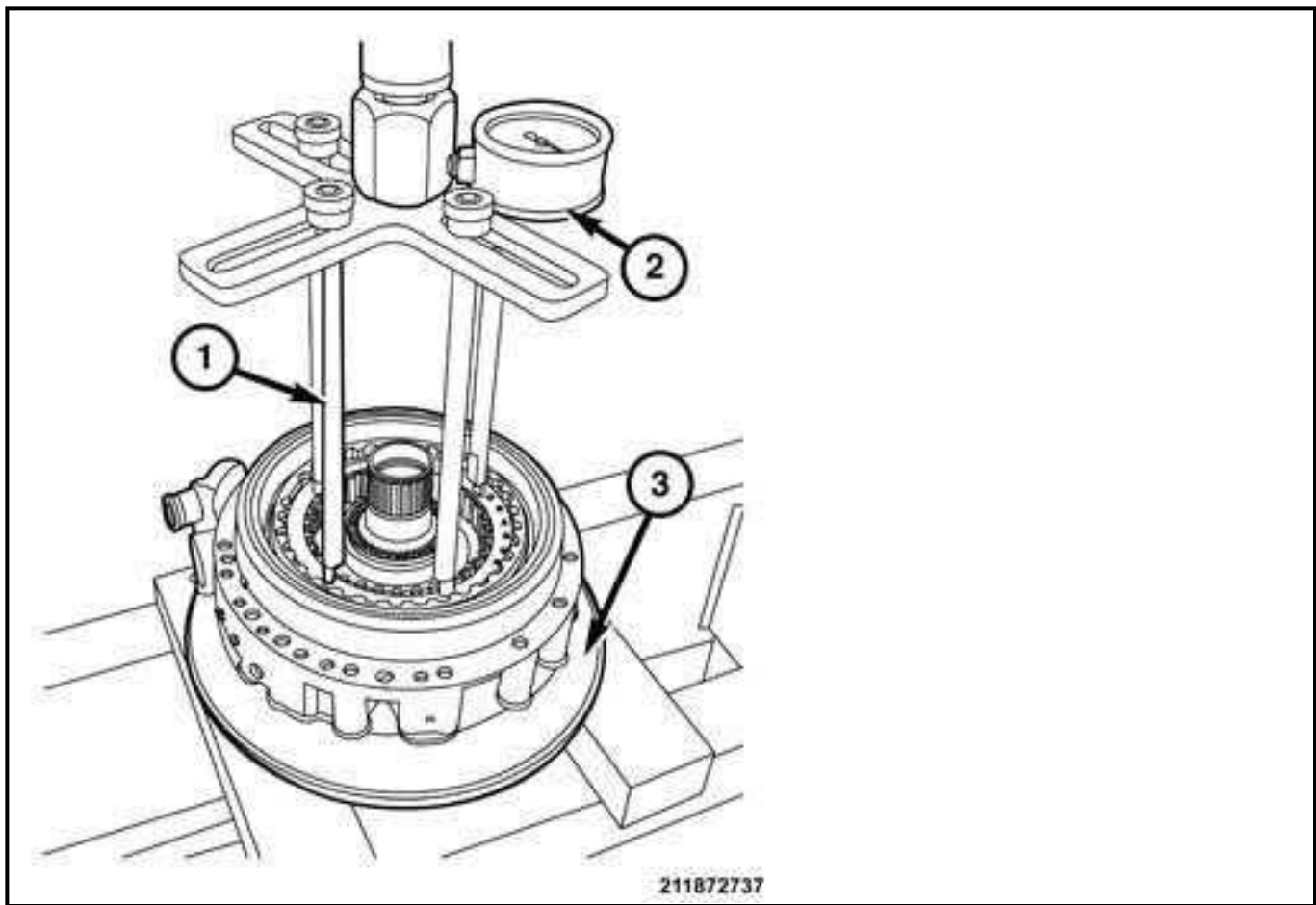
CLUTCH A MEASUREMENT PROCEDURE

1. Using (special tool #10428, Adapter, Pressing Tool) and (special tool #10429, Gauge, Force), place the Clutch A/oil pump assembly in a suitable arbor press.
2. Apply 200 N (45 lbs.) of force to the Clutch A backing plate to compress the wave plate.



1 - Pressing Tool Adapter
2 - Feeler Gauge

3. With a suitable feeler gauge measure the gap between the Clutch A backing plate and the snap ring.
4. Refer to the clutch clearance table for specs. If clearance is not within specification, a thinner or thicker selectable snap ring can be installed for proper clearance.



1 - Pressing Tool Adapter
2 - Force Gauge
3 - Clutch A/Oil Pump Assembly

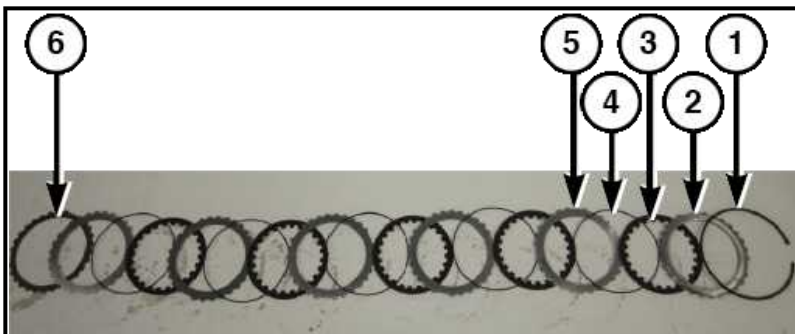
CLUTCH SPECIFICATIONS

B	B	B	B	B
Clutch	Condition	Minimum	Normal	Maximum
A	NEW	1.51 mm	1.665 mm	1.82 mm
		0.059 in	0.066 in	0.072 in
	AFTER OPERATION	1.51 mm	1.765 mm	2.02 mm
		0.059 in	0.069 in	0.080 in

CLUTCH A SELECTABLE SNAP RINGS

3.2 mm	0.125 in.
3.0 mm	0.118 in.
2.8 mm	0.110 in.
2.6 mm	0.102 in.
2.4 mm	0.0944 in.
2.2 mm	0.0866 in.

DISASSEMBLY Clutch A, depending on transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates, five wave springs, five steel plates, one support plate, one snap ring, and one wave plate.



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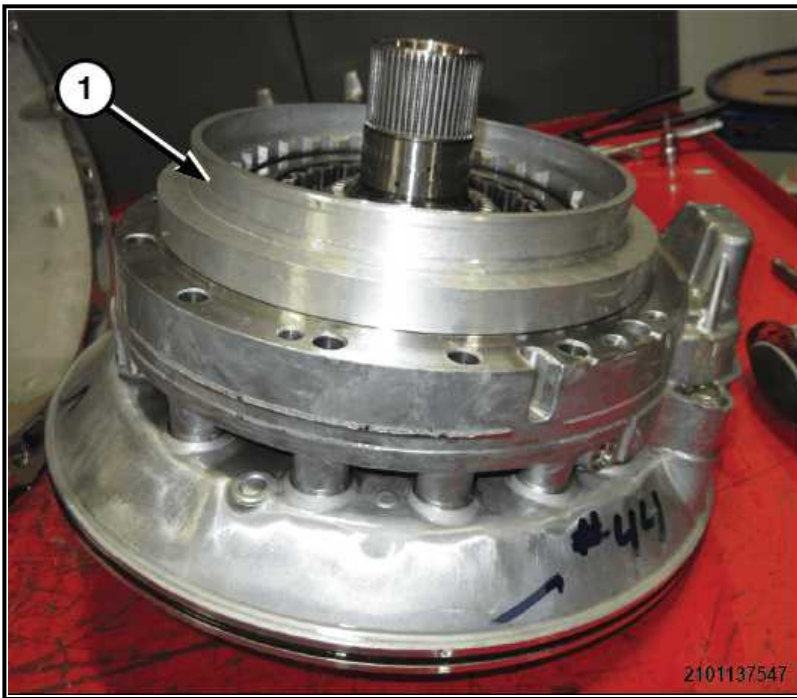
- | |
|---------------------|
| 1 - Snap Ring |
| 2 - Support Plate |
| 3 - Friction Plates |
| 4 - Wave Springs |
| 5 - Steel Plates |
| 6 - Wave Plate |

1. Remove the oil pump from the transmission case. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).



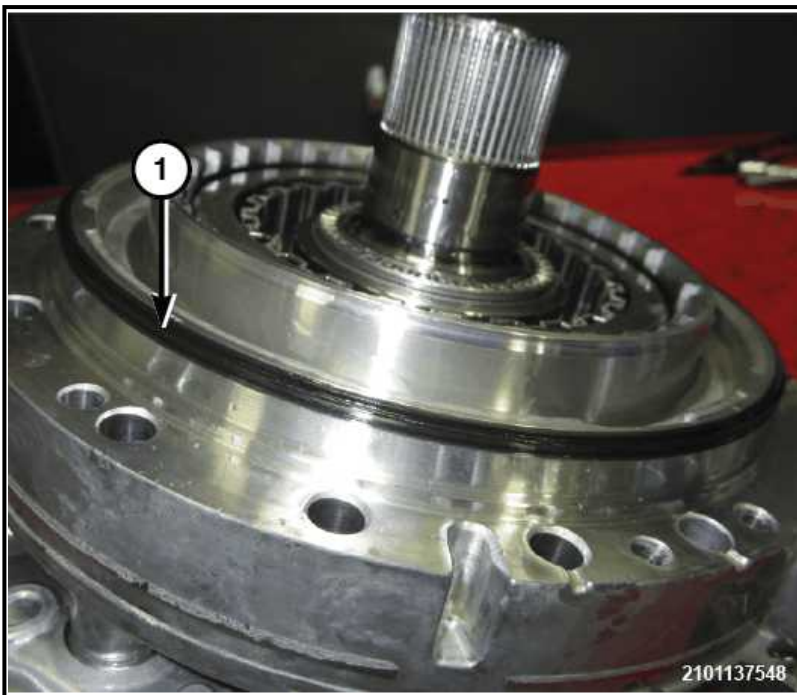
- | |
|----------------------------|
| 1 - Clutch B Damper Spring |
|----------------------------|

2. Remove the Clutch B damper spring.



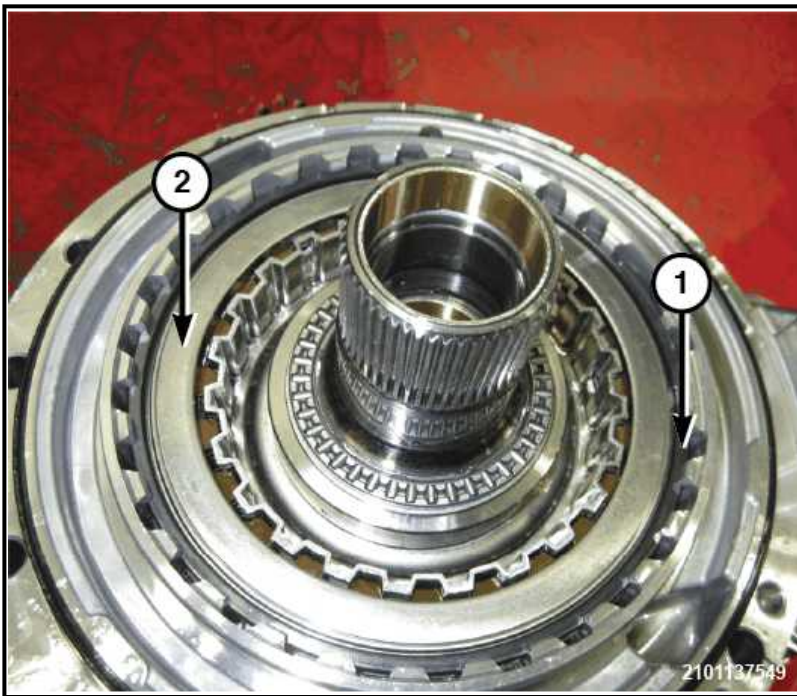
1 - Clutch B Piston

3. Remove the Clutch B piston from the assembly.



1 -Clutch B Piston Seal

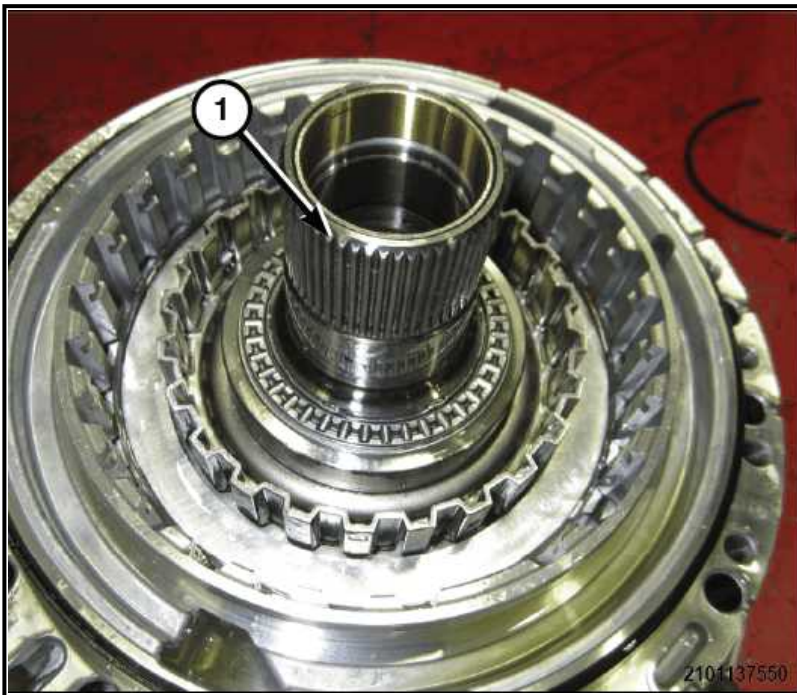
4. Check the Clutch B piston seal for damage or wear and replace if necessary.



1 - Snap Ring

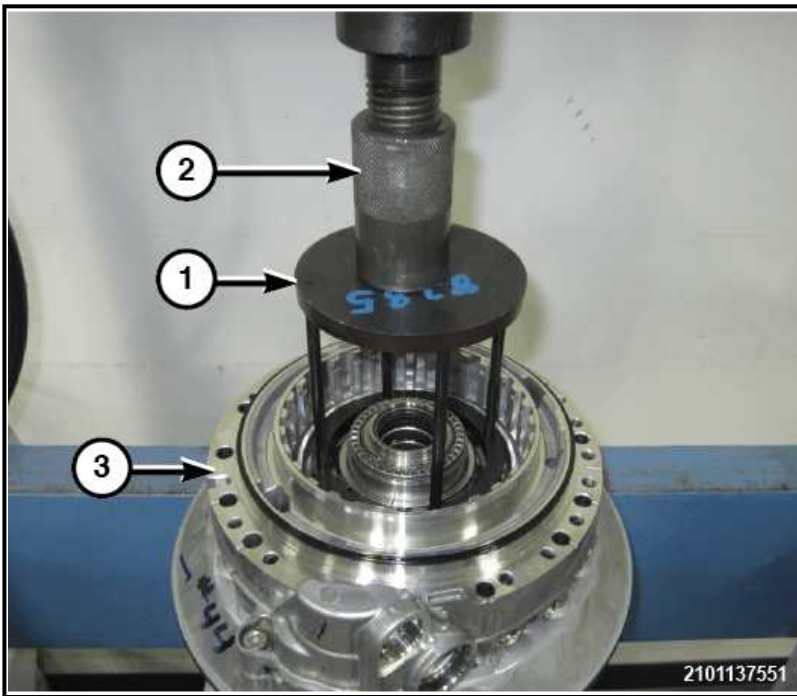
2 - Clutch A Discs and Plates

5. Remove the snap ring.
6. Remove the Clutch A disks and plates.



1 - Hub

7. Remove the hub.



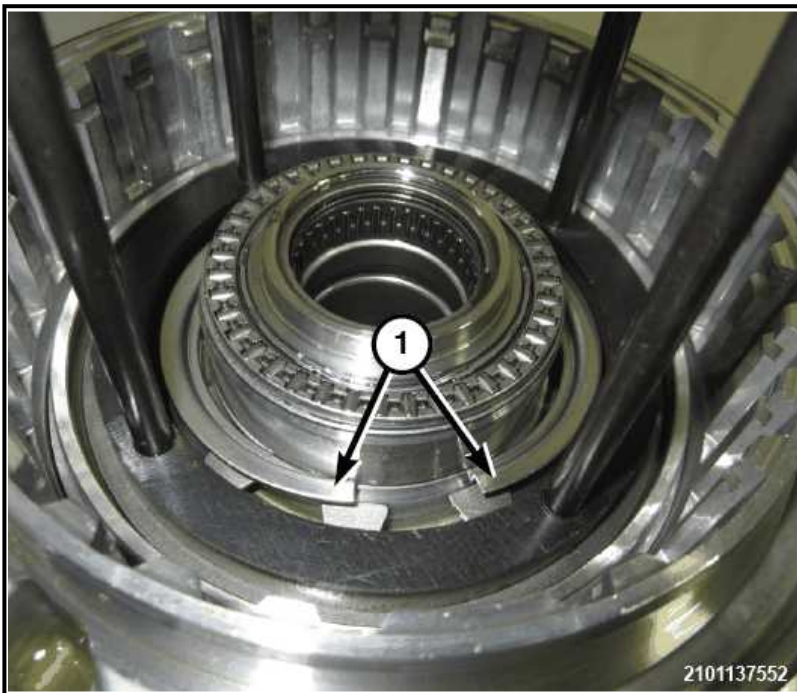
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

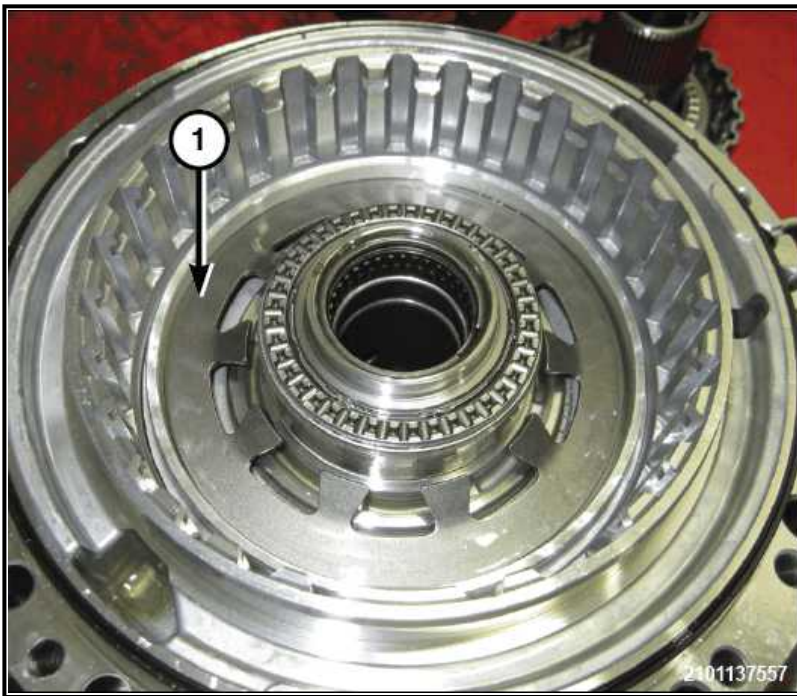
8. Position the oil pump housing assembly in a suitable arbor press.

9. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retaining ring to remove tension.



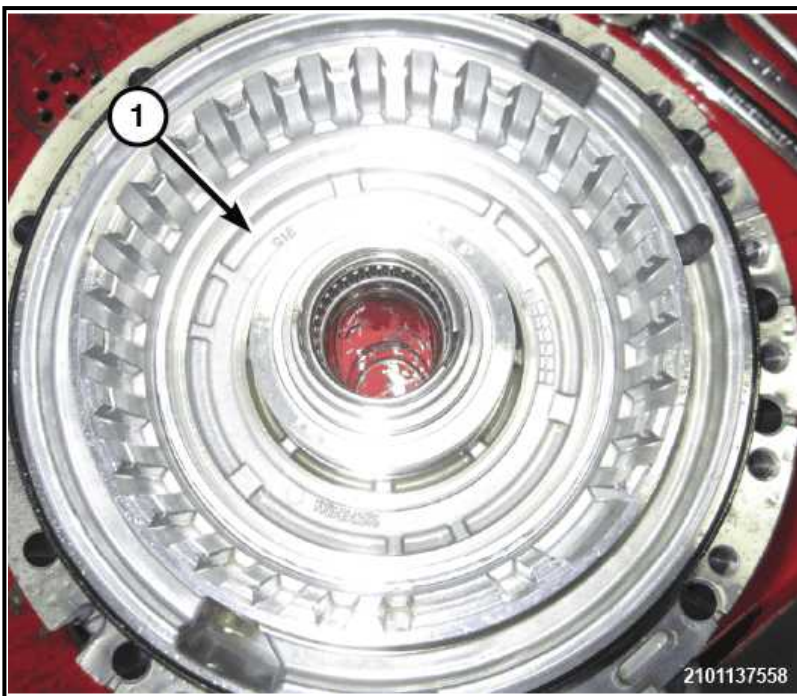
1 - Retaining Ring

10. Remove the two halves of the retaining ring.



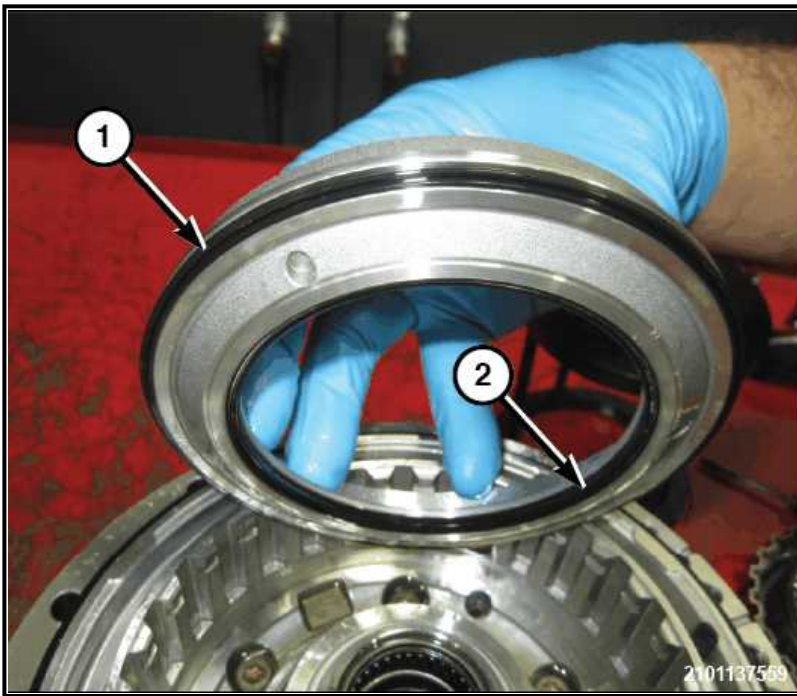
1 - Clutch A Belleville Spring

11. Remove the Clutch A belleville spring.



1 - Clutch A Piston

12. Remove the Clutch A piston (1) by rotating and gently lifting.



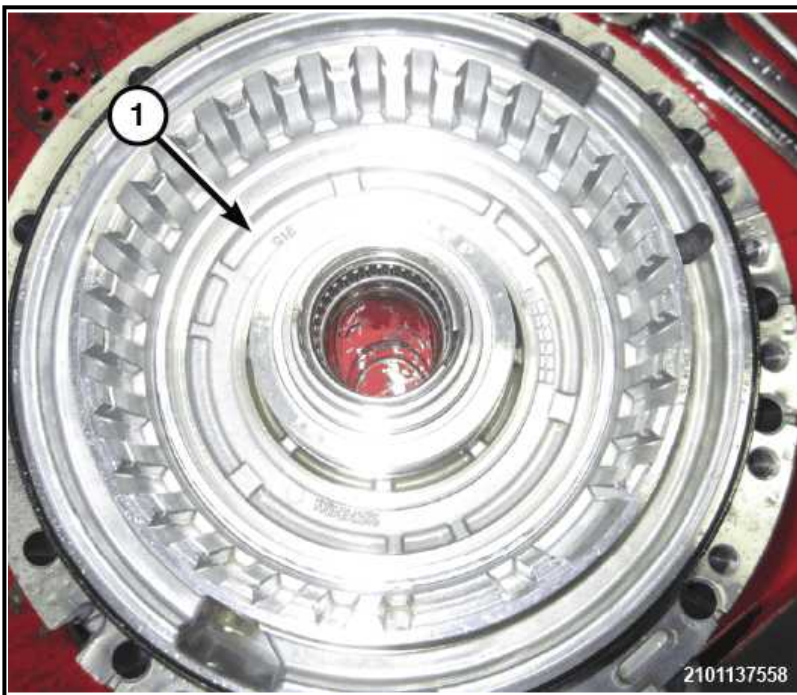
- | |
|--------------------------------|
| 1 - Clutch A Piston Outer Seal |
| 2 - Clutch A Piston Inner Seal |

13. Remove and **DISCARD** the Clutch A Piston inner and outer seals.

ASSEMBLY

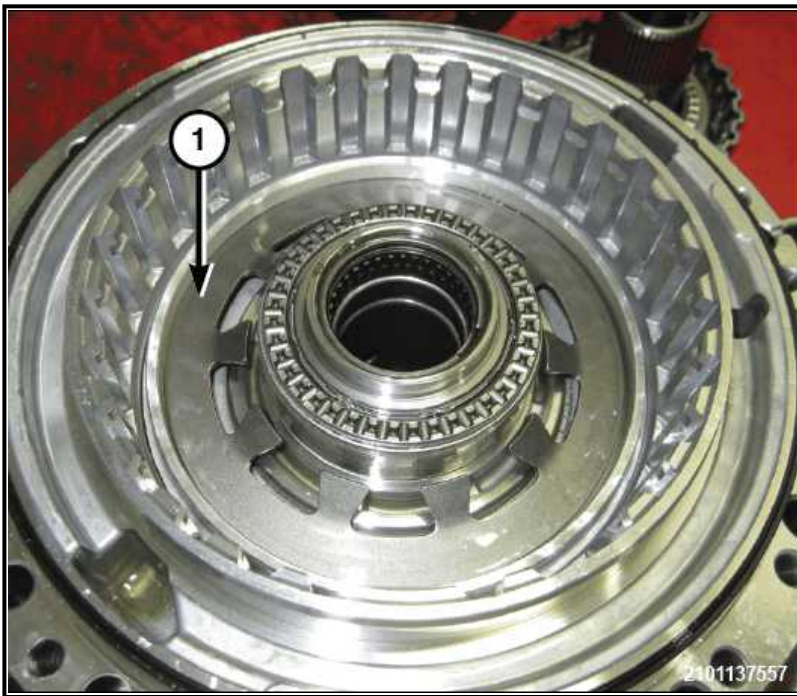
NOTE: If the clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Install new Clutch A inner and outer piston seals.



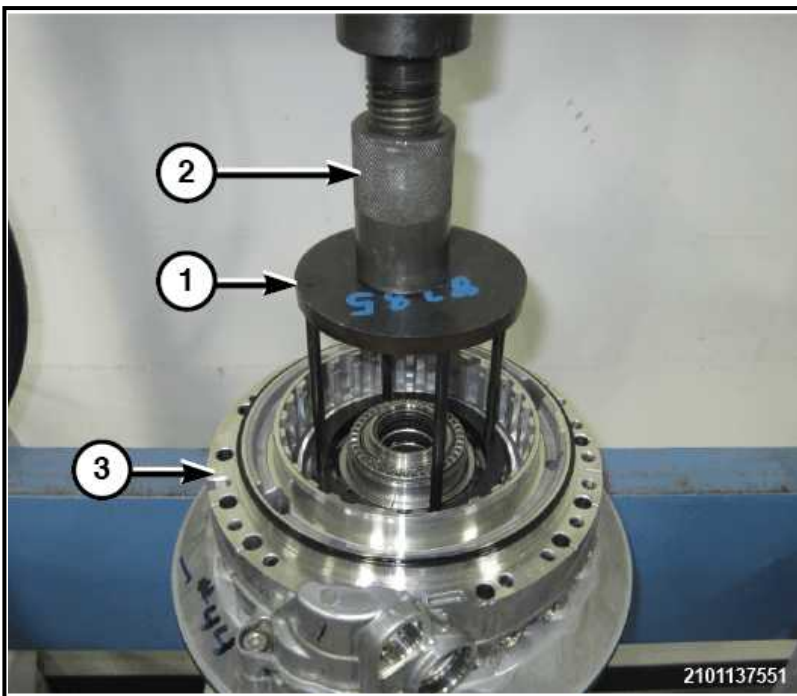
- | |
|---------------------|
| 1 - Clutch A Piston |
|---------------------|

2. Insert the Clutch A piston into the housing. Lubricate the seals with transmission assembly lube prior to installing them into the housing.



1 - Clutch A Belleville Spring

3. Insert the belleville spring.



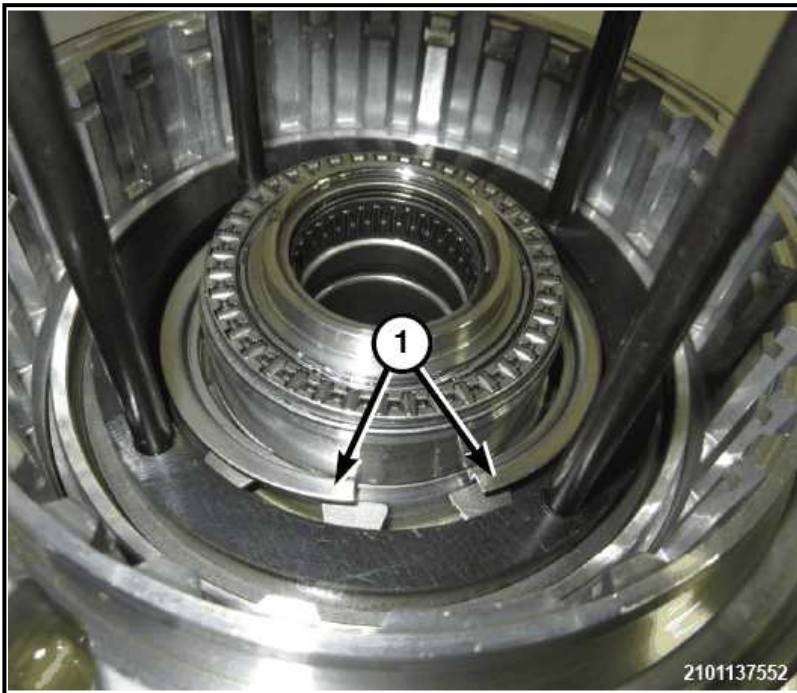
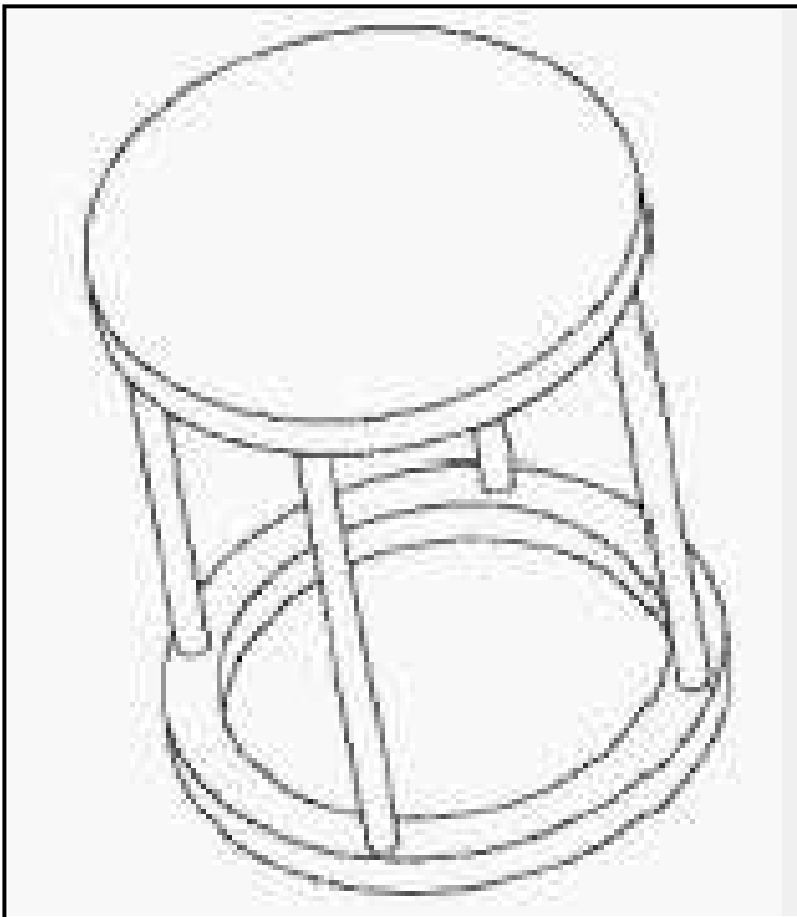
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

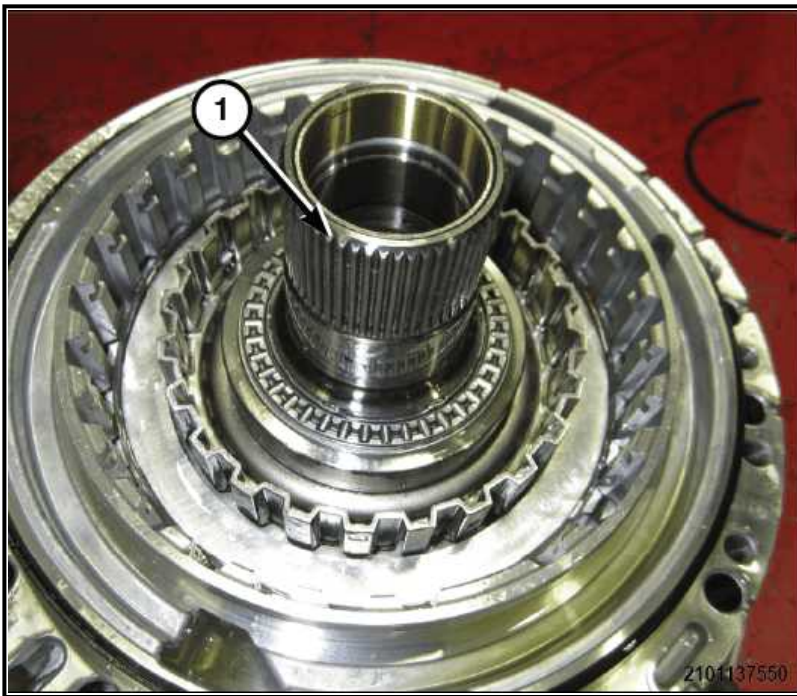
4. Position the oil pump housing assembly in a suitable arbor press.

5. Using (special tool #8285, Compressor, Spring) , press on the fingers of the piston retaining ring to remove tension.



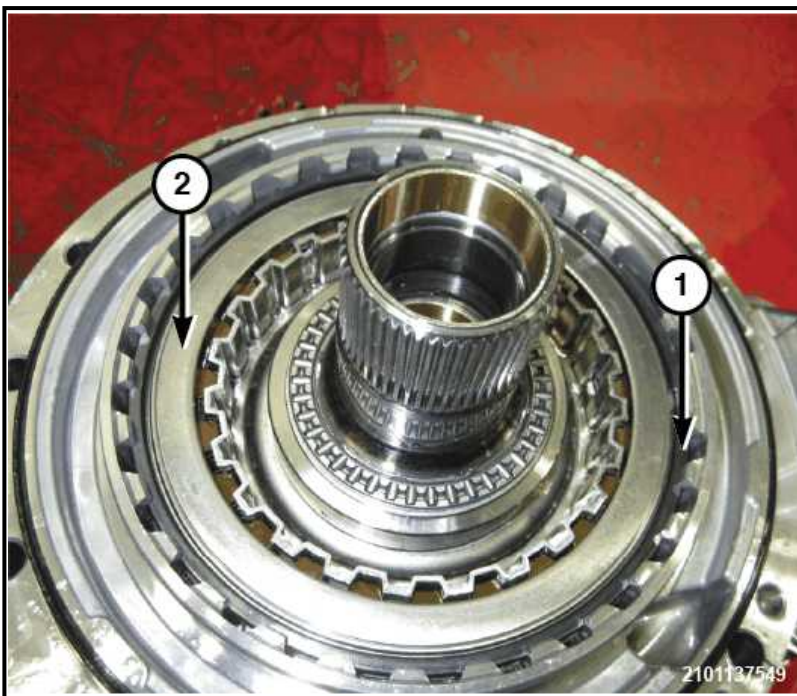
1 - Retaining Ring

6. Install the two retaining ring halves.



1 - Hub

7. Install the hub.

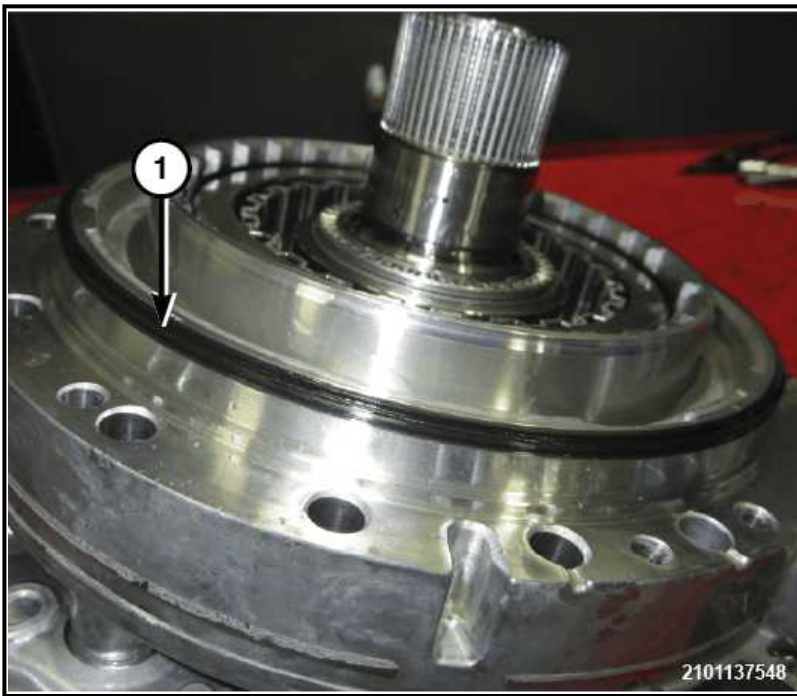


1 - Snap Ring

2 - Clutch A Discs and Plates

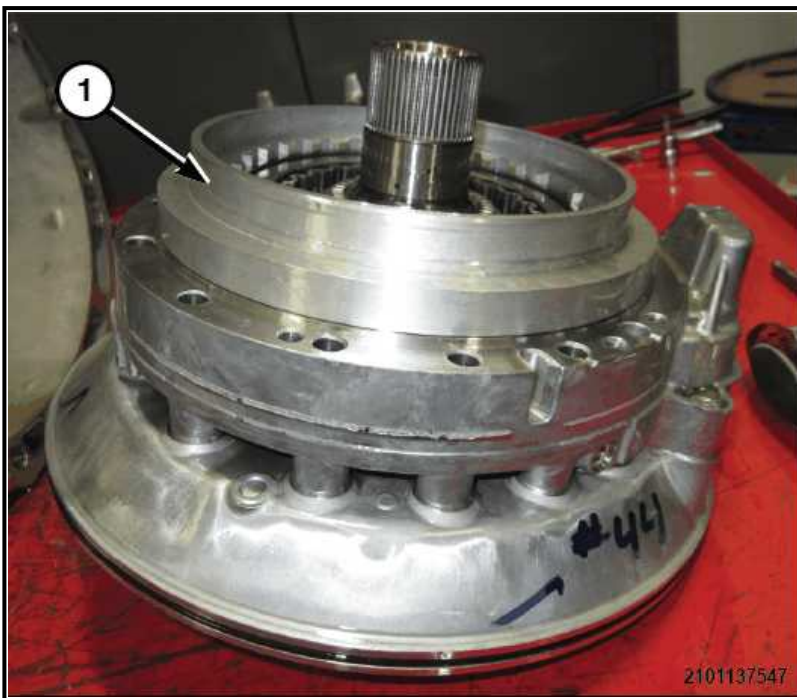
8. Install the Clutch A disks and plates.

9. Install the snap ring.



1 - Clutch B Piston Seal

10. Install a **NEW** Clutch B seal.



1 - Clutch B Piston

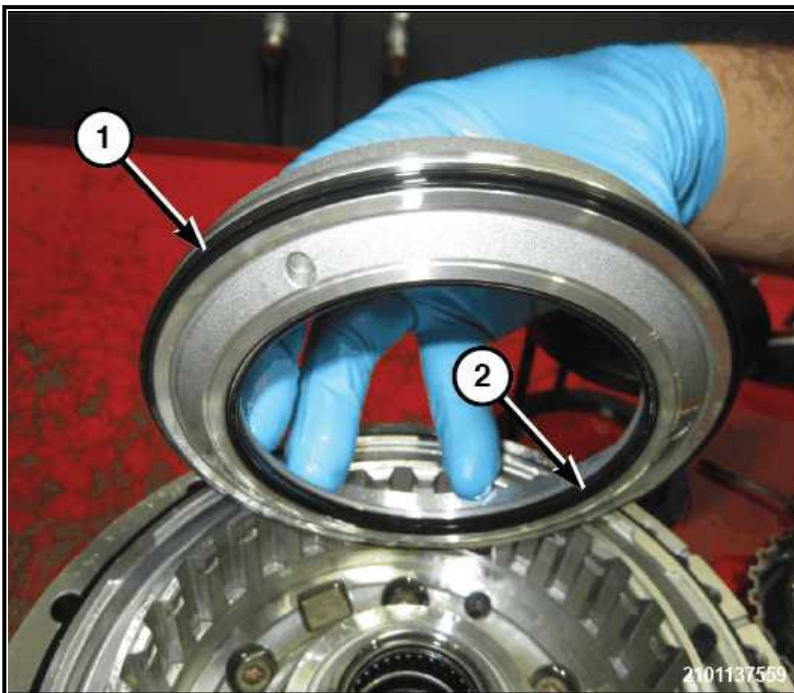
11. Install the Clutch B piston on the assembly.



1 - Clutch B Damper Spring

12. Install the Clutch B damper spring on the Clutch B piston.

13. Install the transmission oil pump. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).

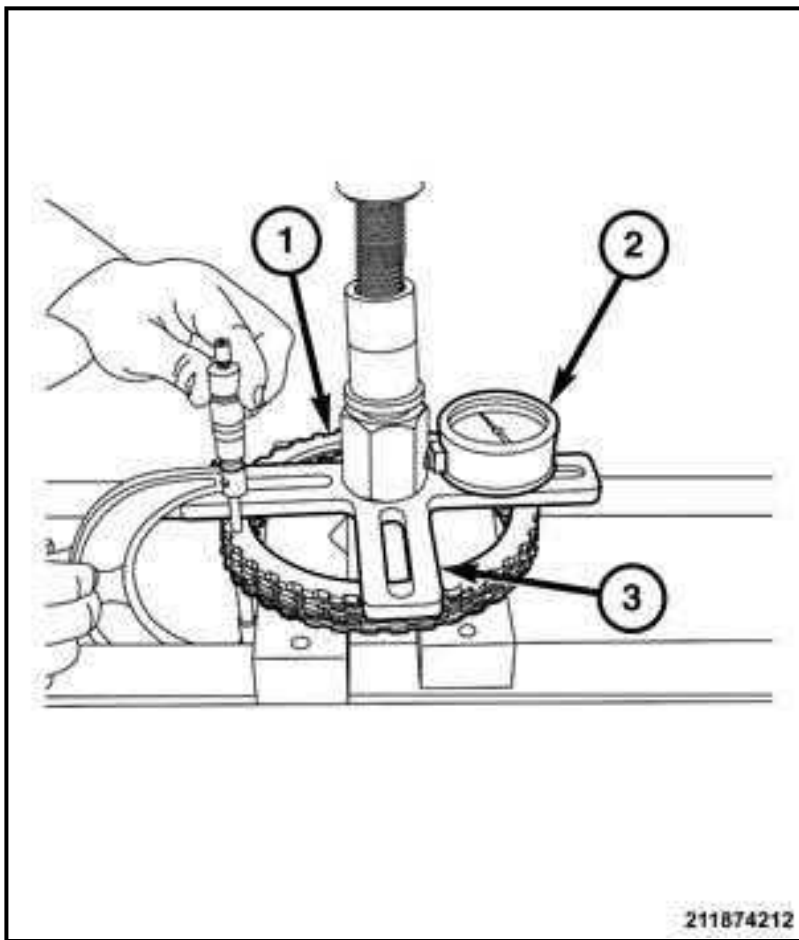


CLUTCH B - DISASSEMBLY AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

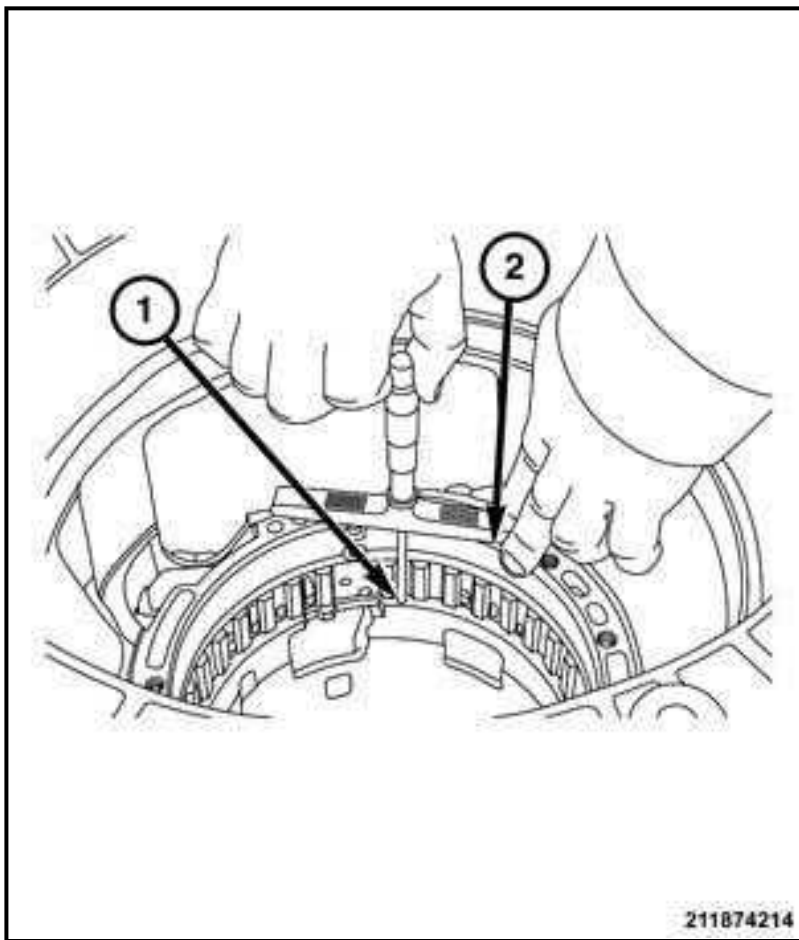
NOTE: When the Clutch B is replaced, the proper selectable shim must be installed to achieve specified clearance.

1. Place the Clutch B, with the wave plate on top, on a suitable arbor press.
2. Position tools (special tool #8901A, Pressing Tool) (using just the cross bar) and (special tool #10429, Gauge, Force) on top of the Clutch B wave plate and under the press ram.



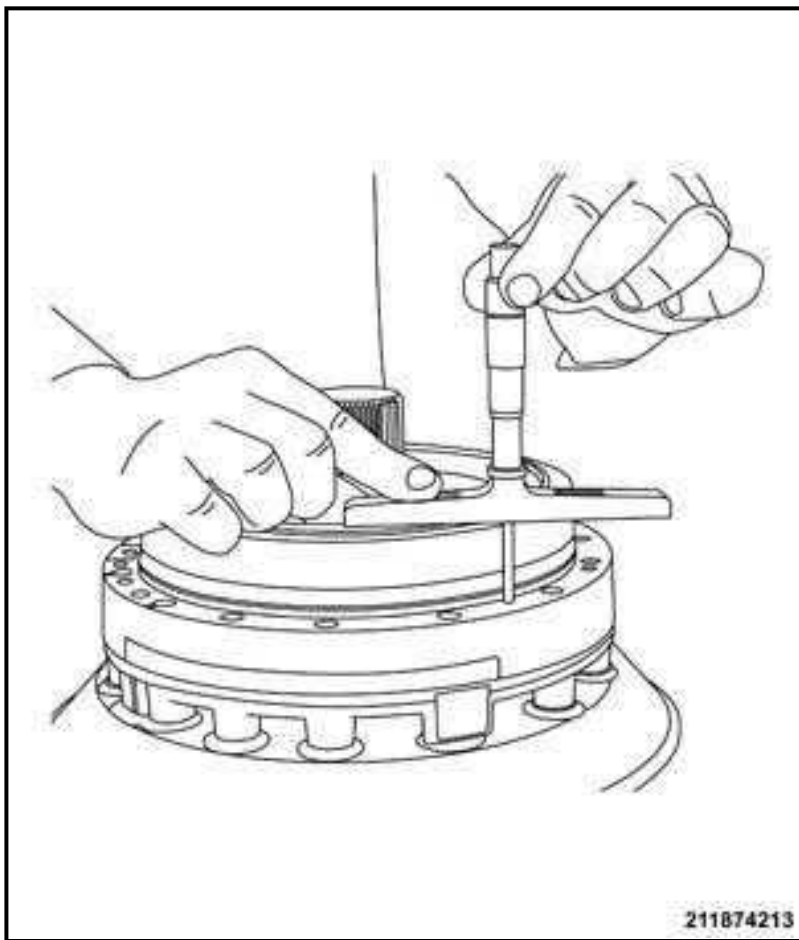
1 - Clutch B Wave Plate
2 - Force Gauge
3 - Compressed Clutch B

3. Apply 500 N (112 lbs.) of downward force on the Clutch B to compress the wave plate.
4. Using a suitable micrometer, measure the thickness of the compressed Clutch B. **Record the measurement as (A)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



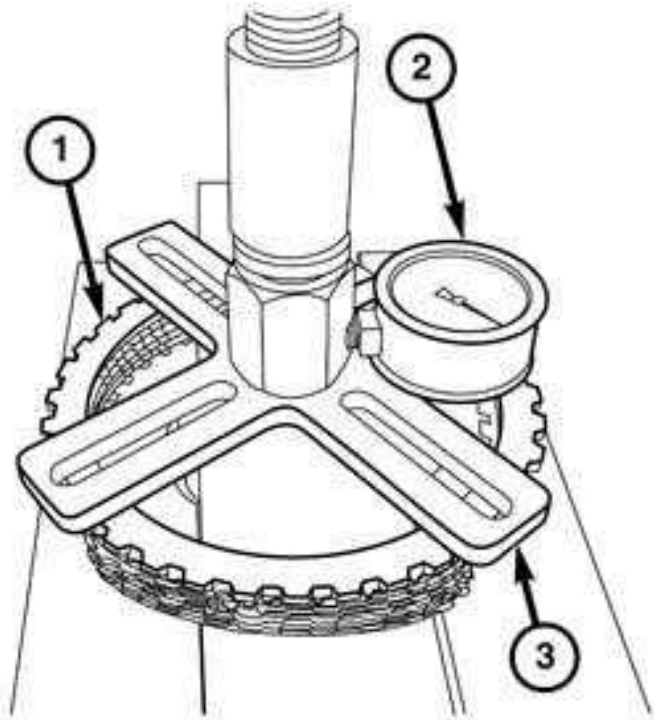
1 - Clutch B Retainer
2 - Transmission Oil Pump

5. With a suitable depth micrometer, place it at the mounting surface of the transmission oil pump and measure to the base of the Clutch B retainer on the case. This measurement should be 61.05 mm. **Record the measurement as (B)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



6. Using a suitable depth micrometer, measure the Clutch B piston.
7. Measure between the fluid pump sealing surface and the bottom of the straight edge. **Record the measurement as (C)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.

Calculation - Take the case depth (B) subtract (C) subtract (A) remainder is the clearance of the Clutch B. If the clearance is not within specification a thinner or thicker reaction plate can be installed to achieve proper clearance.



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1 - Clutch B Wave Plate

2 - Force Gauge

3 - Pressing Tool

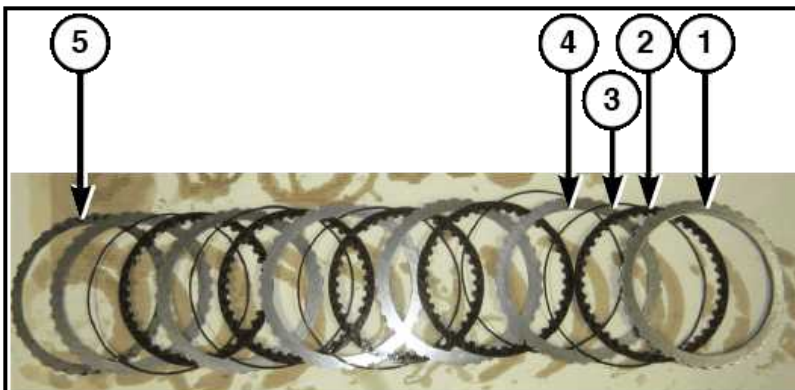
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
B	NEW	1.52 mm	1.725 mm	1.93 mm
		0.060 in.	0.068 in.	0.076 in.
	AFTER OPERATION	1.52 mm	1.825 mm	2.13 mm
		0.060 in.	0.072 in.	0.084 in.

CLUTCH B SELECTABLE BACKING PLATES

6.0 mm	.236 in.
5.8 mm	.228 in.
5.6 mm	.220 in.
5.4 mm	.212 in.
5.2 mm	.204 in.
5.0 mm	.196 in.
4.8 mm	.188 in.

DISASSEMBLY The Clutch B, depending on the transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates (2), five wave springs (3), five steel plates (4), one backing plate (1), and one wave plate (5).



2101137385

1 - Backing Plate

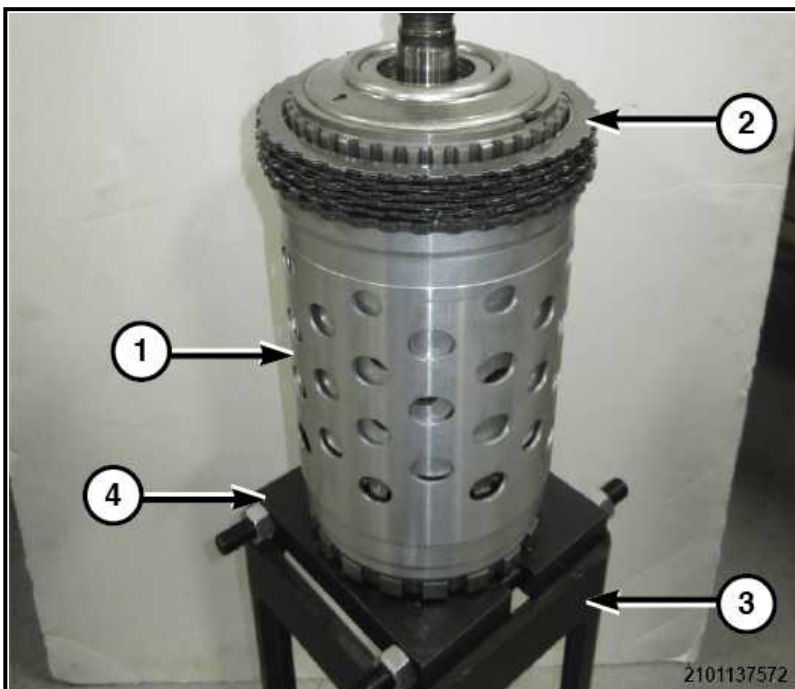
2 - Friction Plates

3 - Wave Springs

4 - Steel Plates

5 - Wave Plate

1. Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear) and remove the Clutch B discs and plates.



2101137572

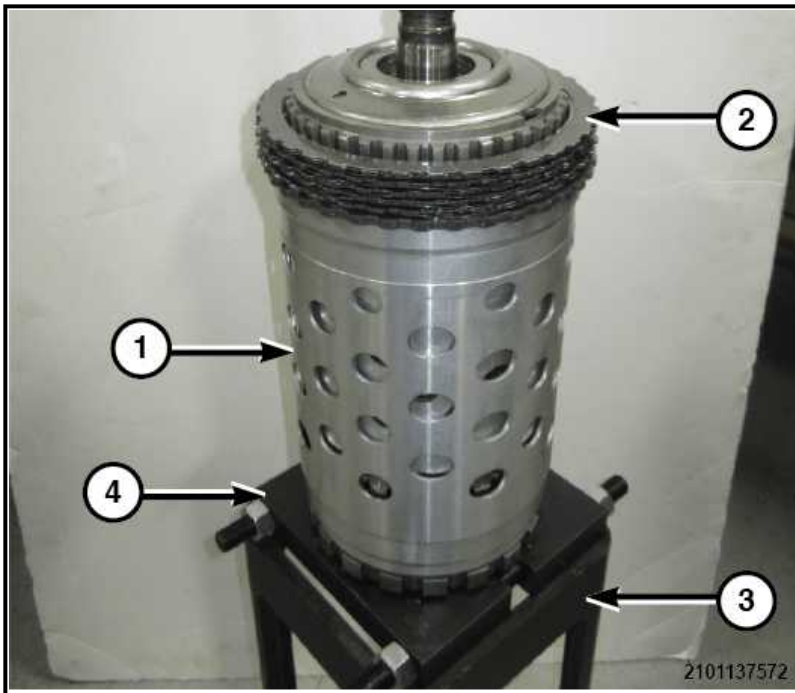
1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

ASSEMBLY



1 - P4 Annulus Drum Assembly

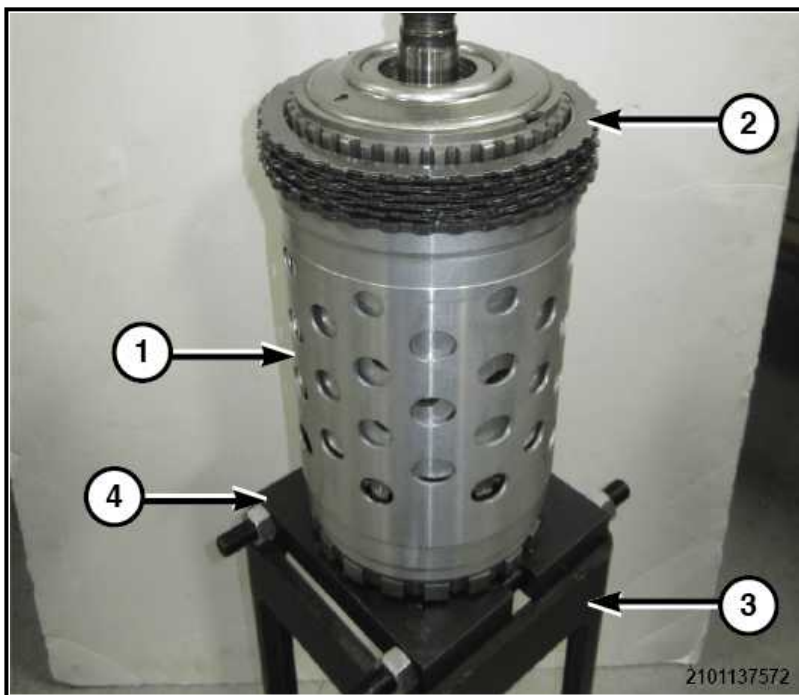
2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Splitter, Bearing/Gear

NOTE: If clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Position the input/output and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) and (special tool #1130, Splitter, Bearing/Gear).



1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

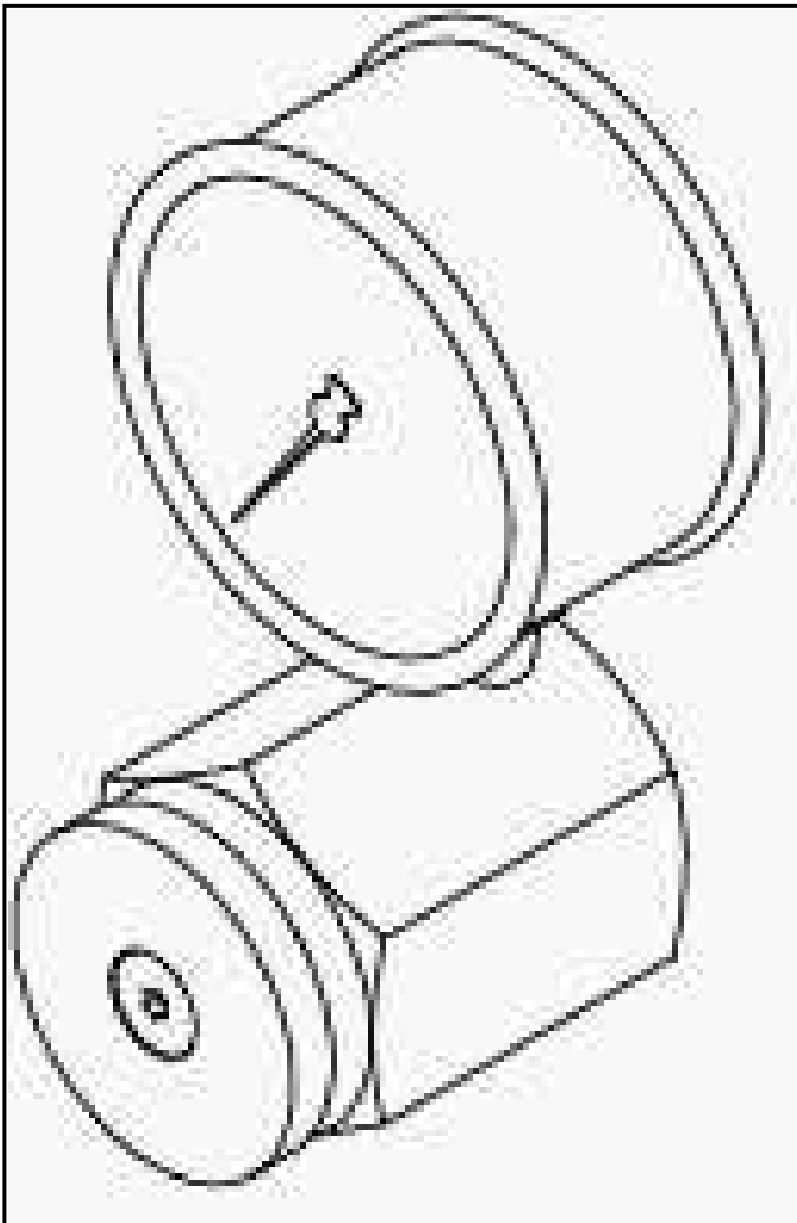
4 - Bearing/Gear Splitter

2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.
5. Install the P1 annulus onto the input/output shaft.
6. Install the correct selectable shim onto the P1 annulus.

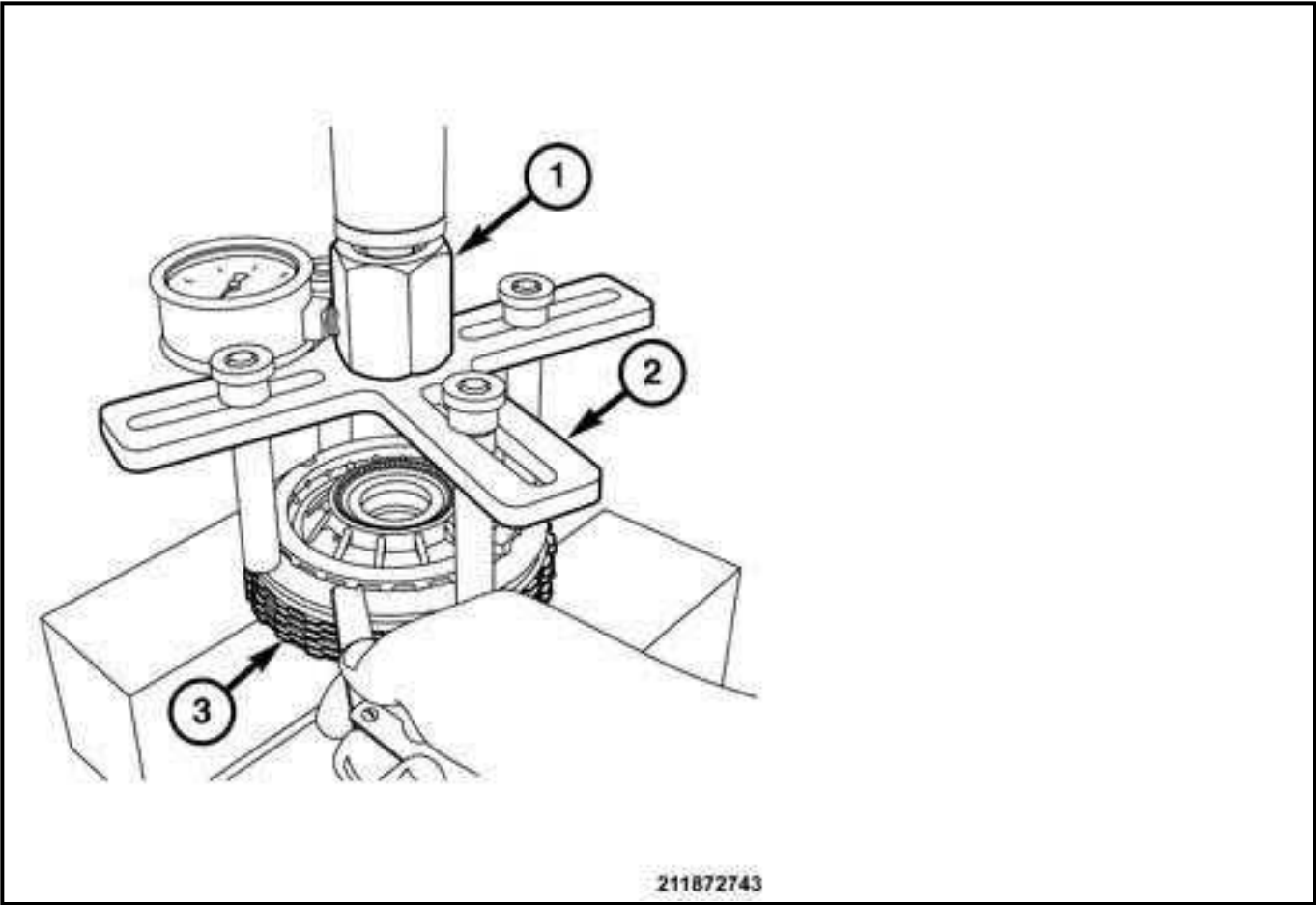
CLUTCH C - DISASSEMBLY AND ADJUSTMENTS

CLUTCH C MEASUREMENT PROCEDURE

1. Using (special tool #8901A, Pressing Tool) and (special tool #10429, Gauge, Force), place Clutch C in a suitable arbor press (with the backing plate facing up).



2. Apply 200 N (45 lbs.) of force to the Clutch C to compress the wave plate.
3. With a suitable feeler gauge, measure the gap between the Clutch C backing plate and the Clutch C retainer.
4. Refer to clutch clearance table for specifications. If clearance is not within specifications, a thinner or thicker selectable backing plate can be installed to achieve proper clearance.



1 - Force Gauge
2 - Pressing Tool
3 - Clutch C

CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
C	NEW	1.71 mm	1.905 mm	2.100 mm
		0.067 in	0.075 in	0.083 in
	AFTER OPERATION	1.71 mm	2.025 mm	2.337 mm
		0.067 in	0.080 in	0.092 in

CLUTCH C SELECTABLE BACKING PLATES

4.8 mm	0.188 in.
4.5 mm	0.177 in.
4.2 mm	0.165 in.
3.9 mm	0.153 in.
3.6 mm	0.141 in.
3.3 mm	0.129 in.
3.0 mm	0.118 in.

DISASSEMBLY Clutch C, depending on transmission Julian date, may contain wave springs that sit around each friction plate.



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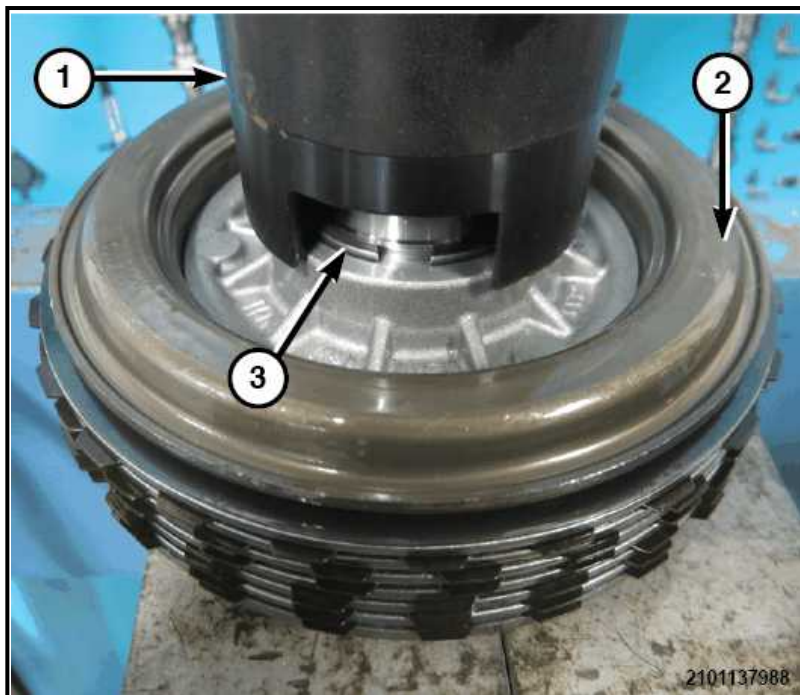
1 - Wave Plate

2 - Friction Plates

3 - Backing Plate

4 - Steel Plates

DISASSEMBLY



2101137988

1 - Damper Installer

2 - Clutch C

3 - Snap Ring

1. Place Clutch C in a suitable press.

2. Using (special tool #8680A, Installer, Damper), compress Clutch C as needed to remove the snap ring.

3. Remove the snap ring.



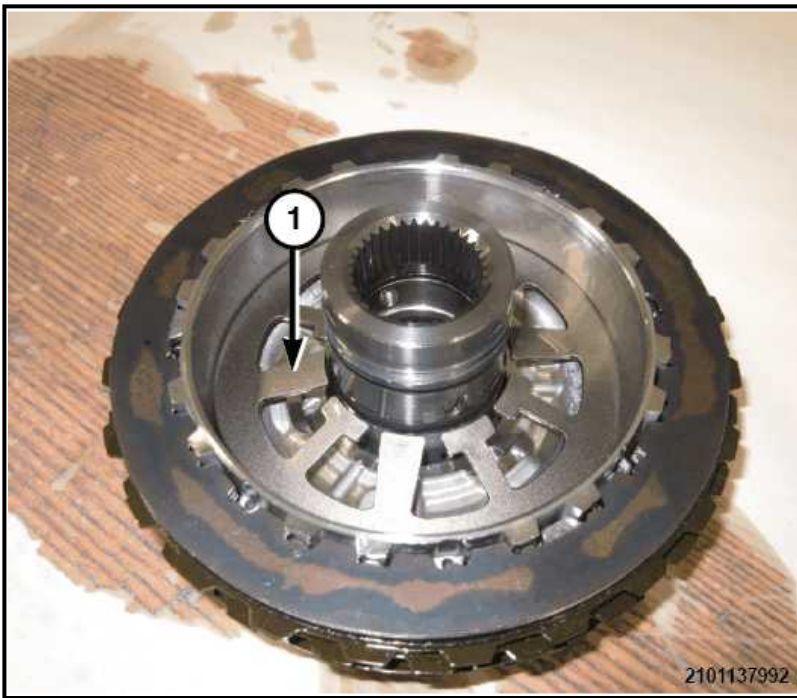
1 - Clutch C Retainer

4. Remove the Clutch C retainer.



1 - Clutch C Piston

5. Remove the Clutch C piston.



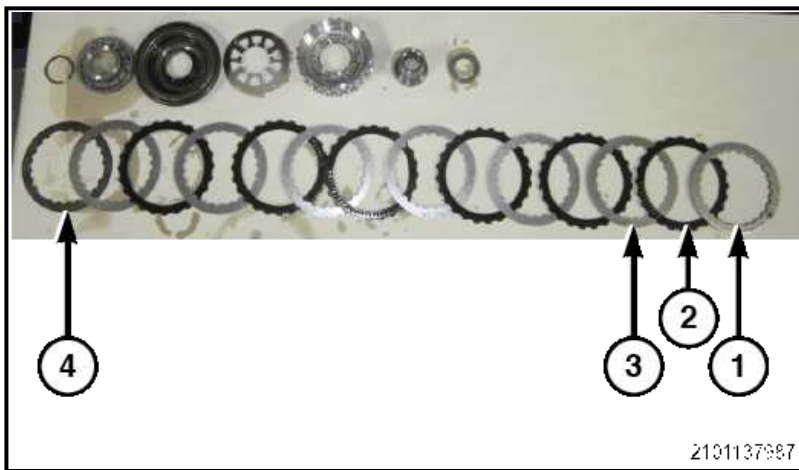
1 - Clutch C Belleville Spring

6. Remove the Clutch C belleville spring.



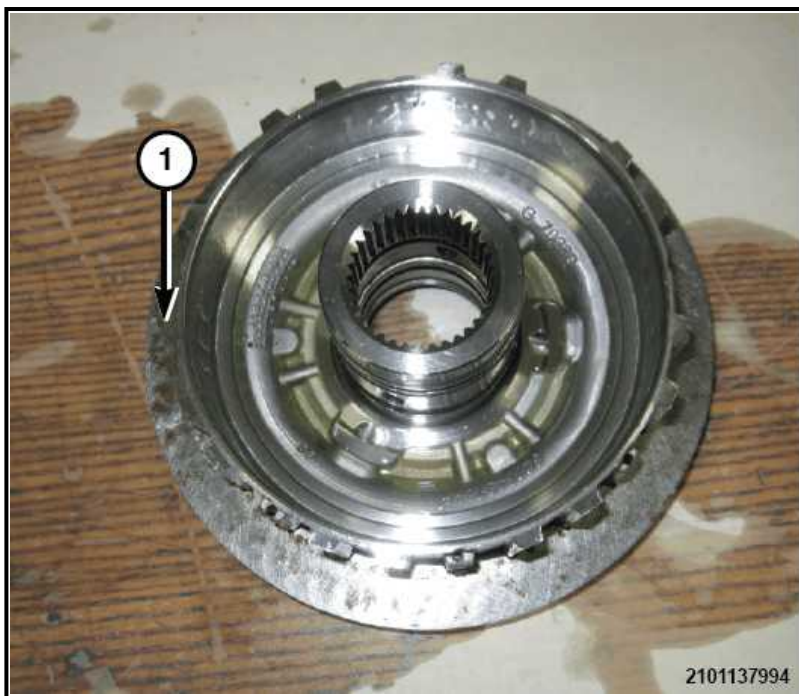
1 - Clutch C Wave Plate

7. Remove the Clutch C wave plate.



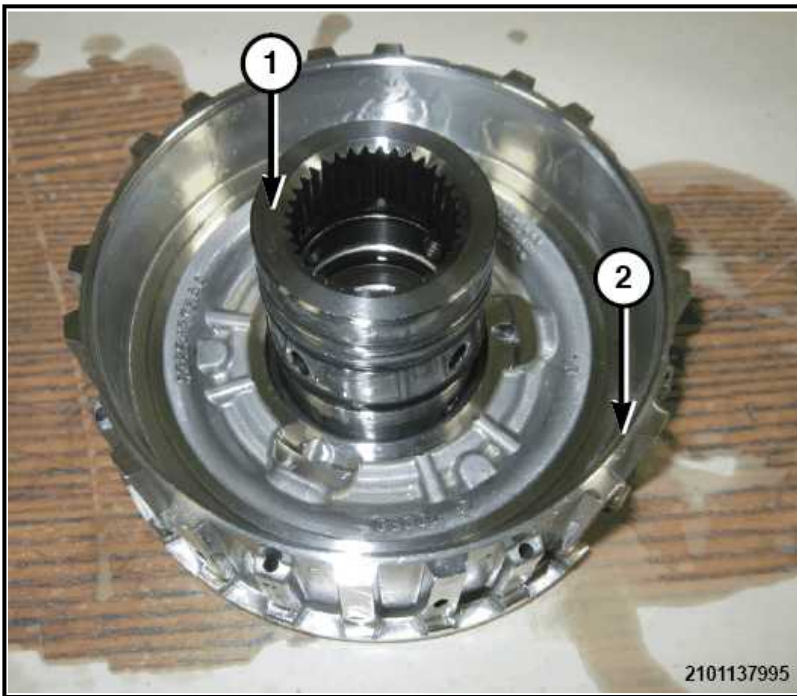
1 - Wave Plate
2 - Friction Plates
3 - Backing Plate
4 - Steel Plates

8. Remove the friction plates and the steel plates.



1 - Backing Plate

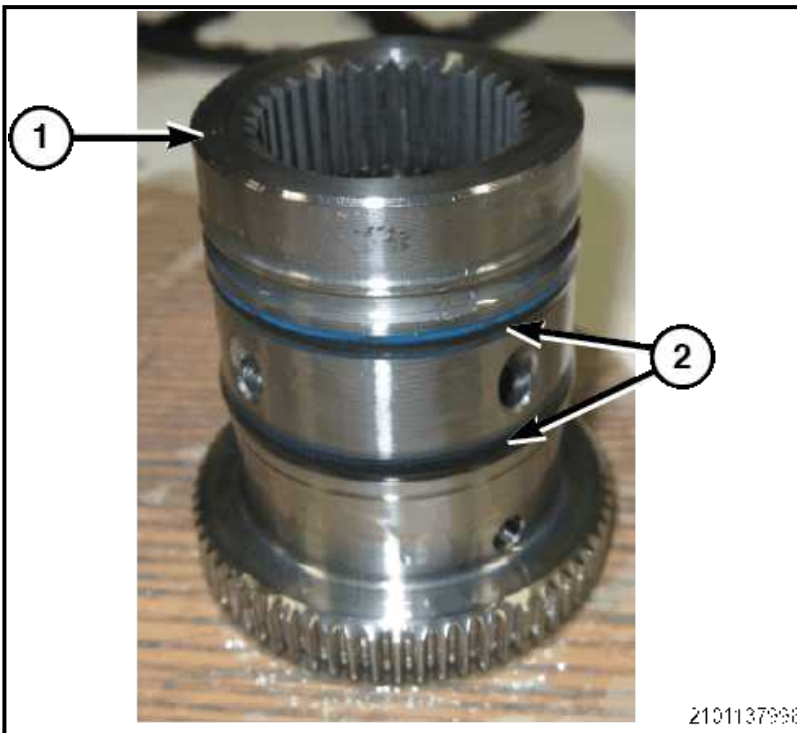
9. Remove the backing plate.



1 - Clutch C Shaft

2 - Clutch C Hub

10. Separate the Clutch C shaft from the Clutch C hub.



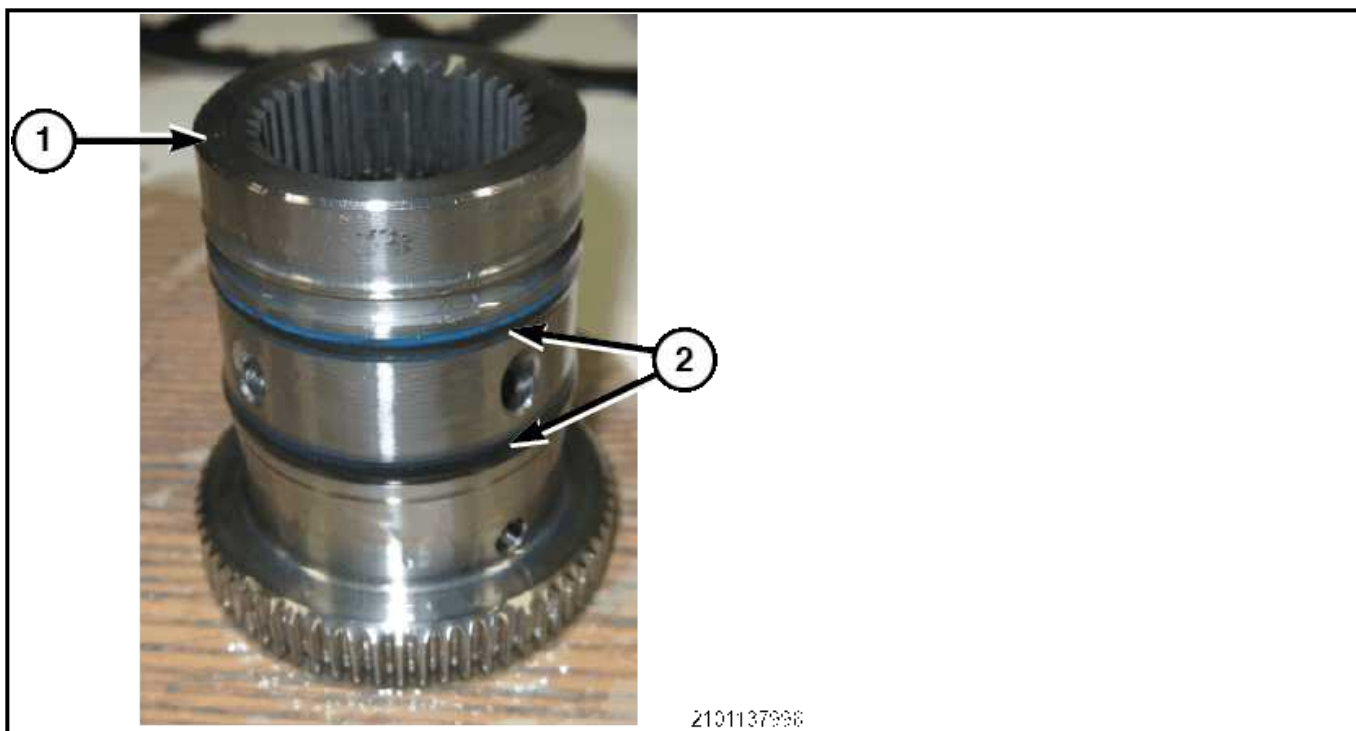
1 - Clutch C Shaft

2 - O-Rings

11. Remove and **DISCARD** the O-rings from the Clutch C shaft.

ASSEMBLY

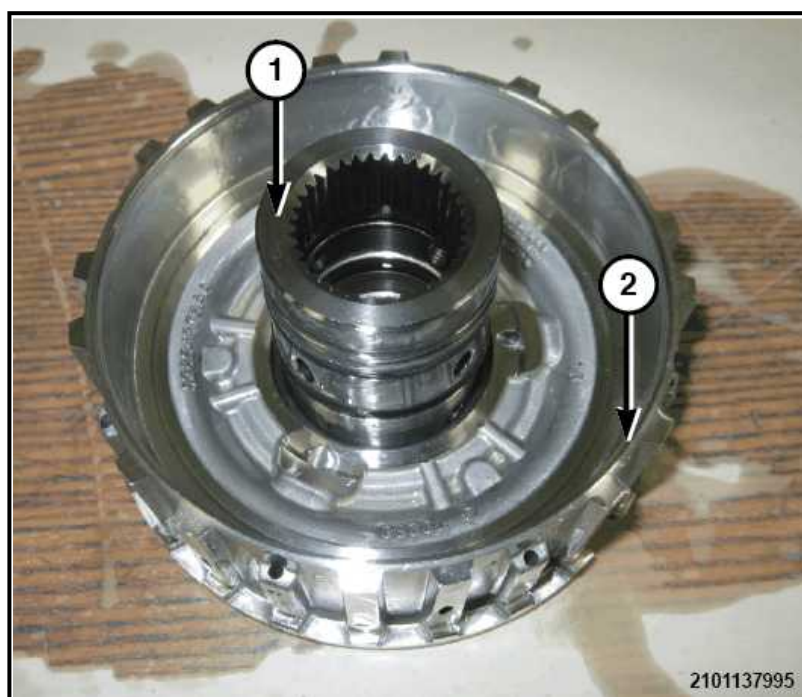
NOTE: If clutch discs are being replaced, soak in 8HP trans fluid before assembly.



1 - Clutch C Shaft

2 - O-Rings

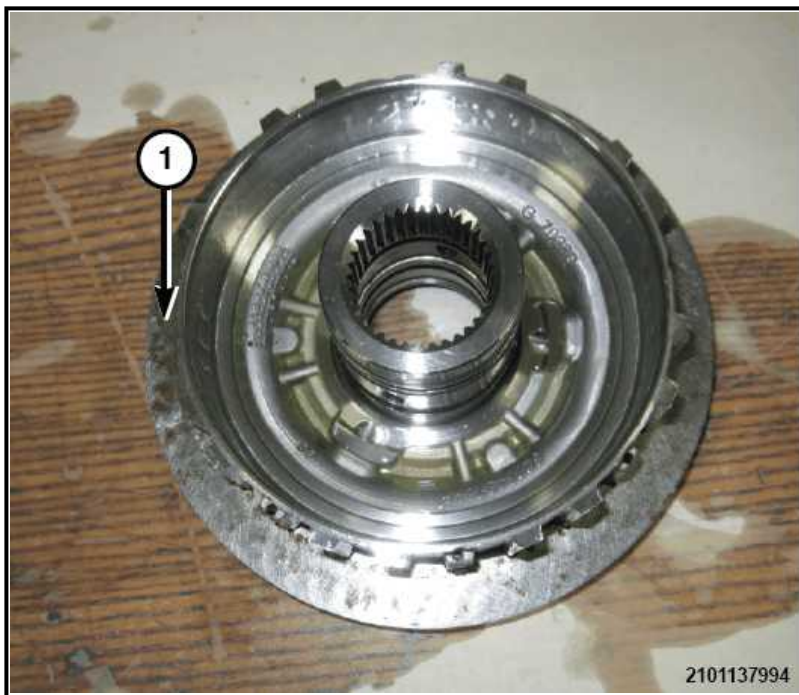
1. Install **NEW** the O-rings on the Clutch C shaft.



1 - Clutch C Shaft

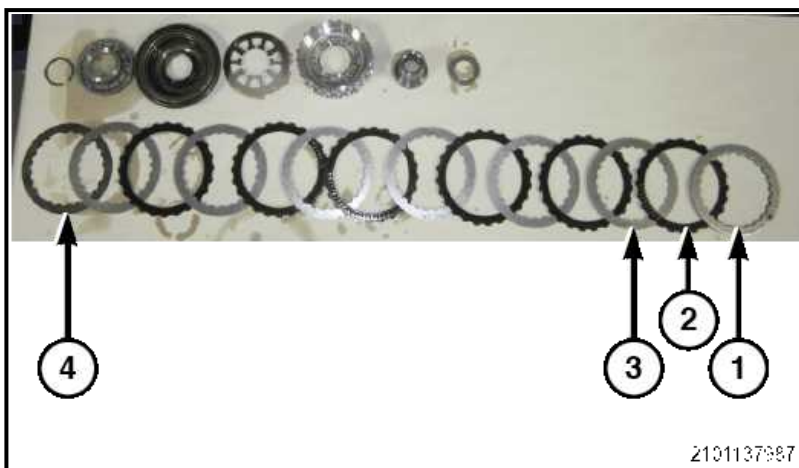
2 - Clutch C Hub

2. Install Clutch C hub onto the Clutch C shaft.



1 - Backing Plate

3. Install the backing plate.



1 - Wave Plate

2 - Friction Plates

3 - Backing Plate

4 - Steel Plates

4. Install friction plates and steel plates.



1 - Clutch C Wave Plate

5. Install the wave plate.



1 - Clutch C Belleville Spring

6. Install the belleville spring.



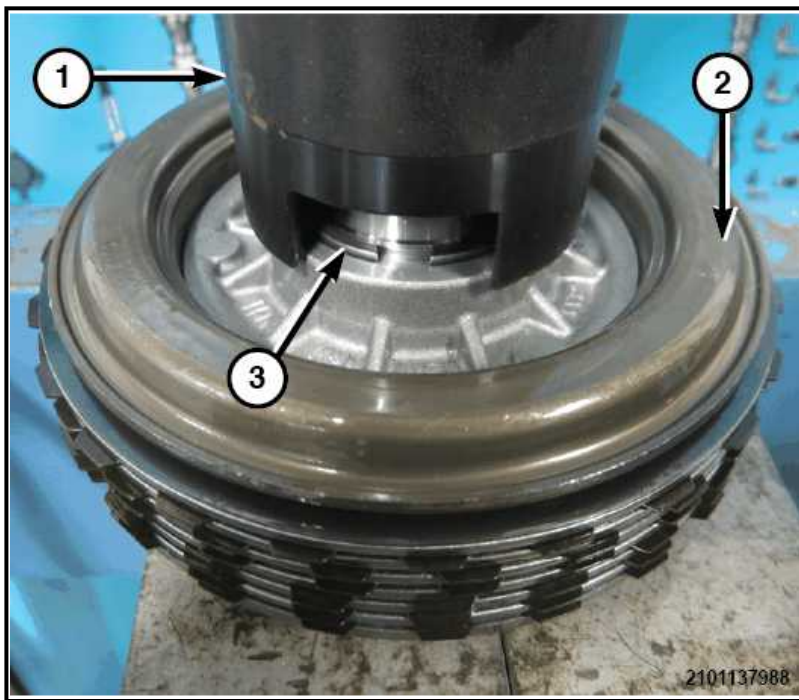
1 - Clutch C Piston

7. Install the Clutch C piston.



1 - Clutch C Retainer

8. Install the Clutch C retainer.



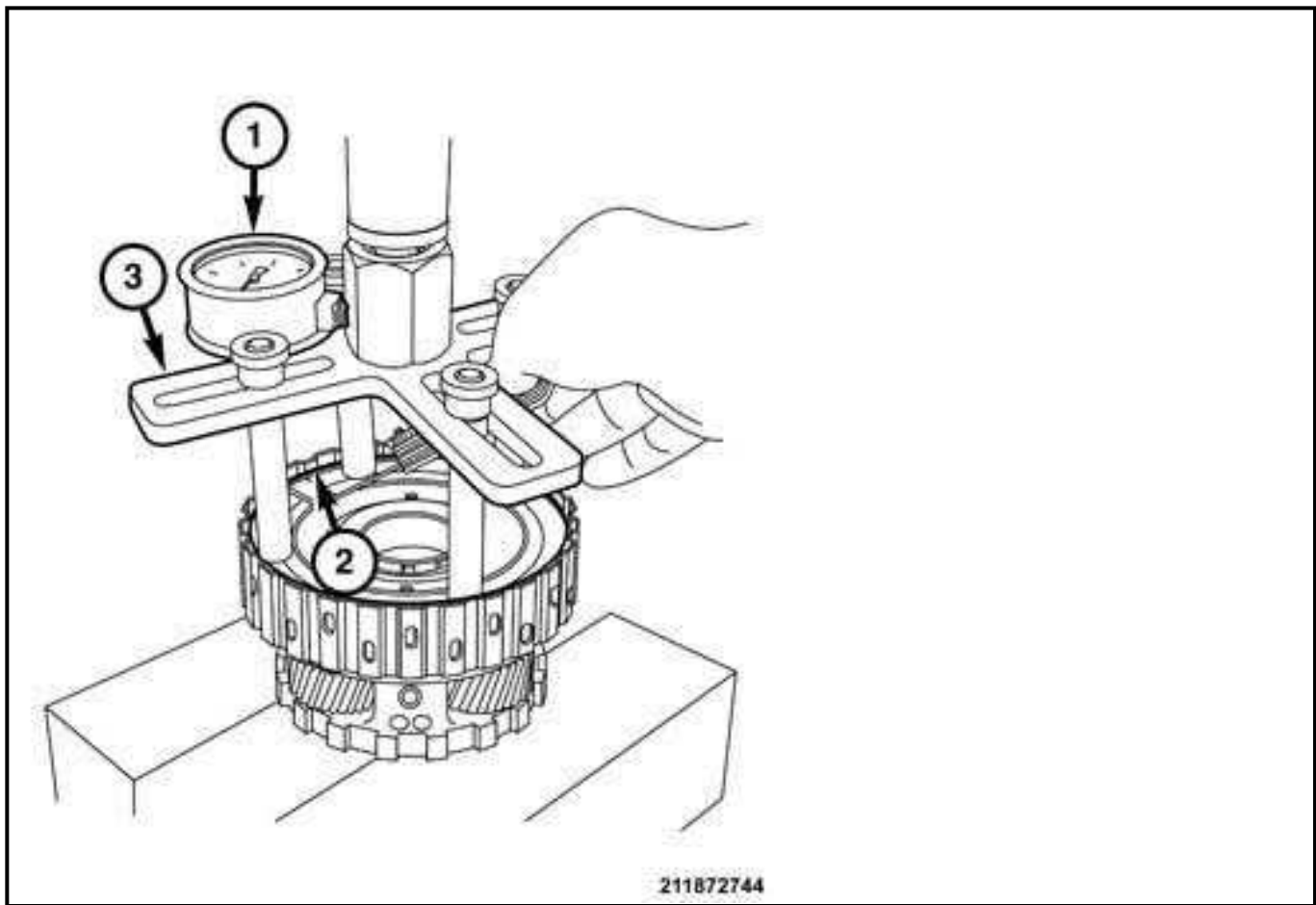
1 - Damper Installer
2 - Clutch C
3 - Snap Ring

9. Place Clutch C in a suitable press.
10. Using (special tool #8680A, Installer, Damper), compress the clutch enough to install the snap ring.
11. Install the snap ring.
12. Using (special tool #8901A, Pressing Tool) and (special tool #10429, Gauge, Force) measure the Clutch C clearance. Refer to clutch clearance chart for specifications.

CLUTCH D - DISASSEMBLY AND ADJUSTMENTS

CLUTCH D MEASUREMENT PROCEDURE

1. Using (special tool #8901A, Pressing Tool) and (special tool #10429, Gauge, Force), place the Clutch D in a suitable arbor press.
2. Apply 200 N (45 lbs.) of force to the Clutch D backing plate to compress the wave plate.
3. With a suitable feeler gauge, measure the gap between the Clutch D backing plate and the Clutch D retainer.
4. Refer to clutch clearance table for specs. If clearance is not within specification a thinner or thicker selectable snap ring can be Installed to achieve proper clearance.



1 - Force Gauge
2 - Pressing Tool
3 - Clutch D

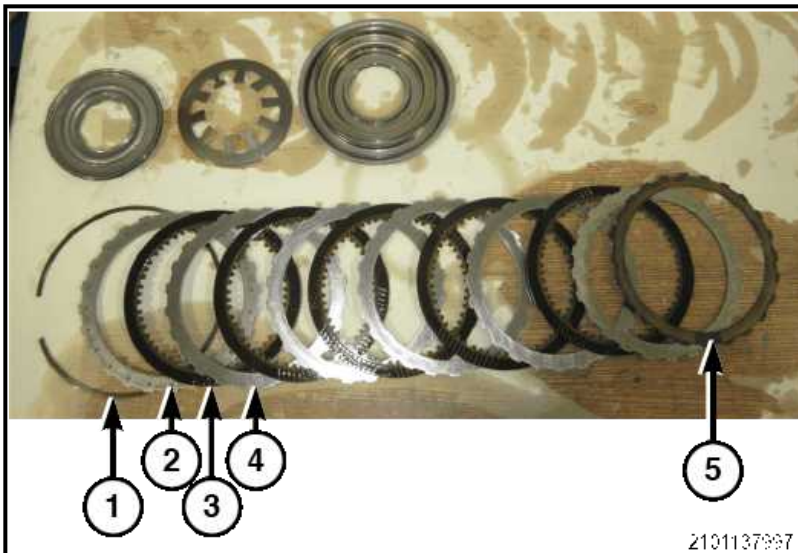
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
D	NEW	1.37 mm	1.515 mm	1.66 mm
		0.054 in.	0.060 in.	0.065 in.
	AFTER OPERATION	1.37 mm	1.615 mm	1.86 mm
		0.054 in.	0.064 in.	0.073 in.

CLUTCH D SELECTABLE SNAP RINGS

3.0 mm	0.118 in.
2.8 mm	0.110 in.
2.6 mm	0.102 in.
2.4 mm	0.0944 in.
2.2 mm	0.0866 in.
2.0 mm	0.0787 in.
1.8 mm	0.0708 in.
1.6 mm	0.0629 in.

DISASSEMBLY Clutch D, depending on transmission Julian date, may contain wave springs that sit around each friction plate.



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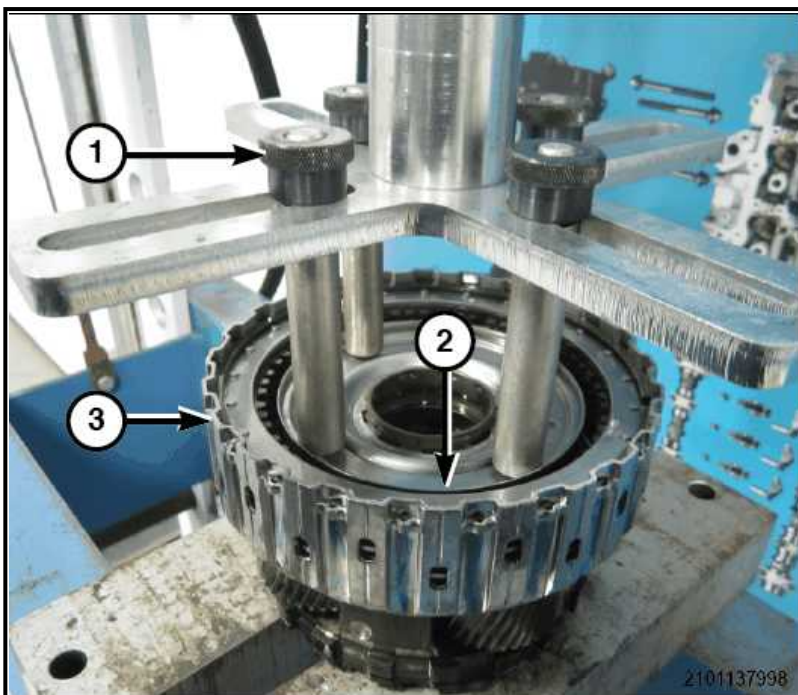
1 - Clutch D Selective Snap Ring

2 - Backing Plate

3 - Friction Plates

4 - Steel Plates

5 - Wave Plate



2101137998

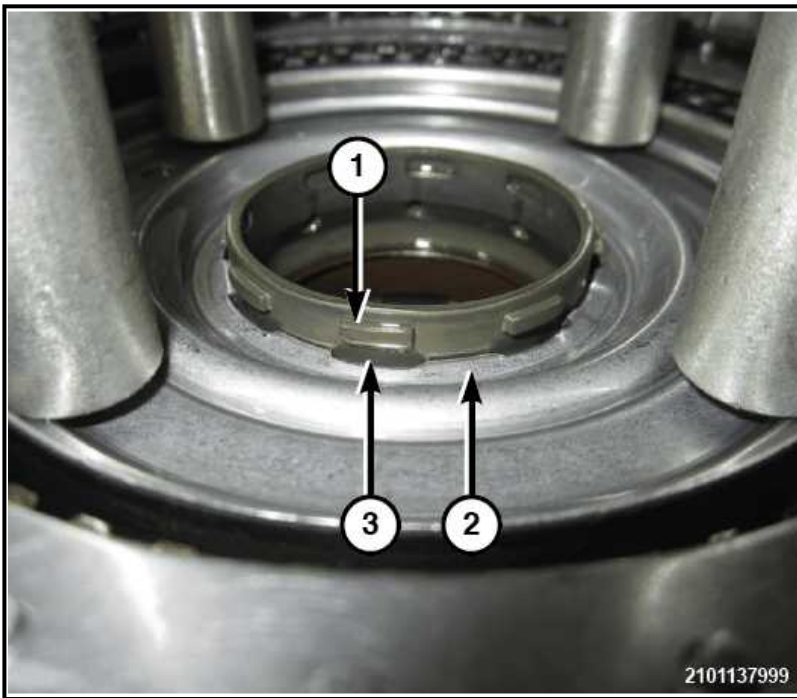
1 - Pressing Tool

2 - Oil Baffle

3 - Clutch D

1. Place Clutch D in a suitable arbor press.

2. Using (special tool #8901A, Pressing Tool), to compress the oil baffle enough to clear the locking tabs.



1 - Clutch D Hub

2 - Oil Baffle

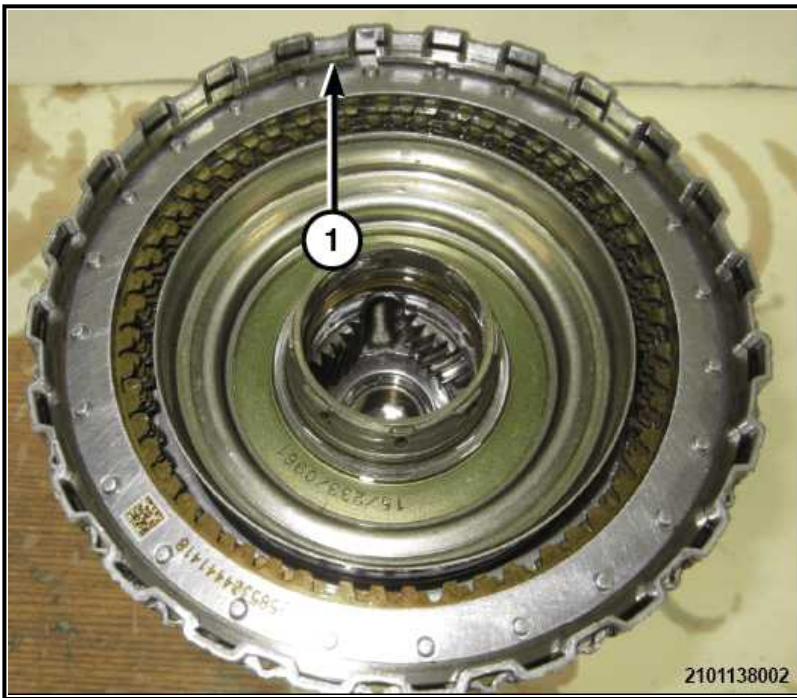
3 - Tabs

3. Rotate the oil baffle slightly until the tabs on the Clutch D hub are clear of the tabs on the baffle.
4. Remove the oil baffle.



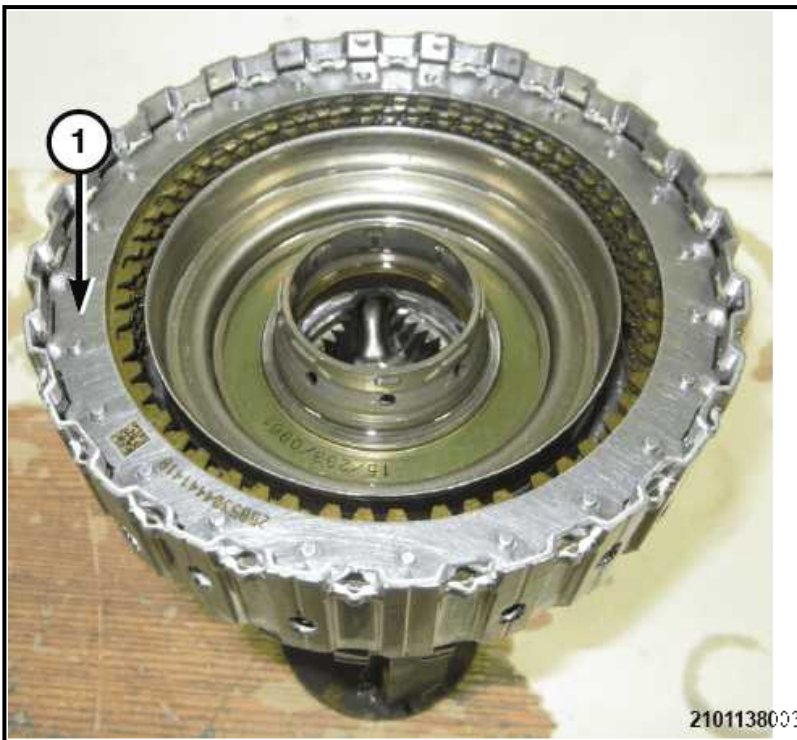
1 - Clutch D Belleville Spring

5. Remove the Clutch D belleville spring.



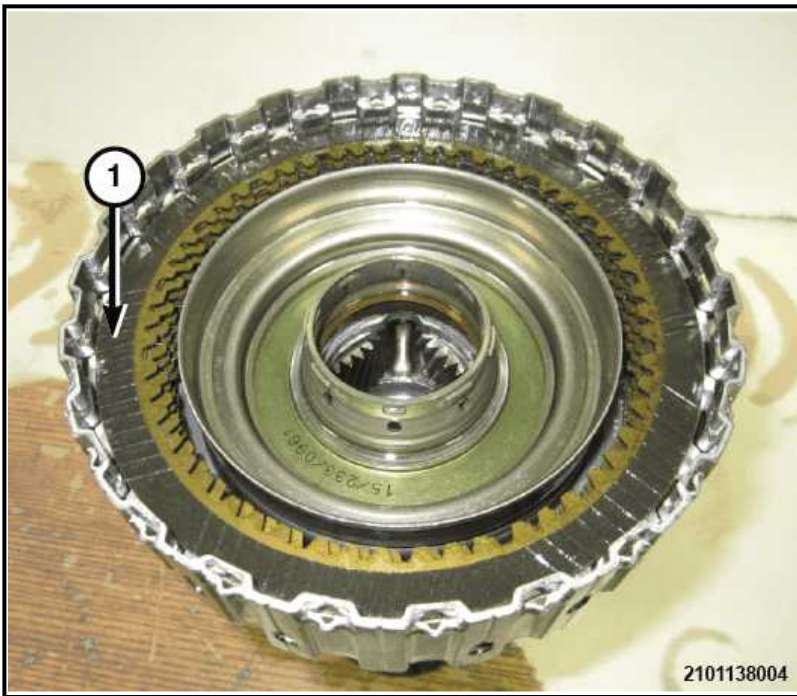
1 - Clutch D Selective Snap Ring

6. Remove the Clutch D selective snap ring.



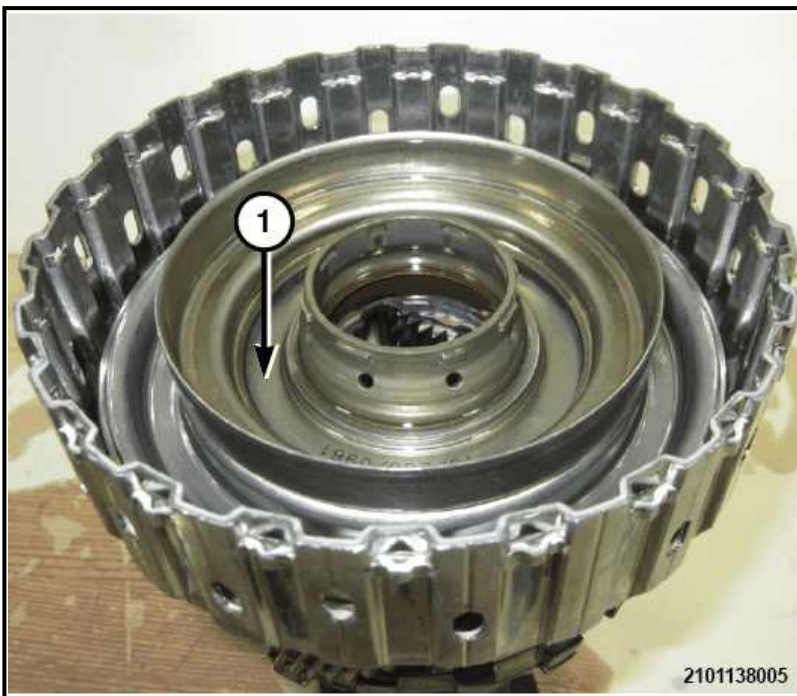
1 - Clutch D Backing Plate

7. Remove the Clutch D backing plate.



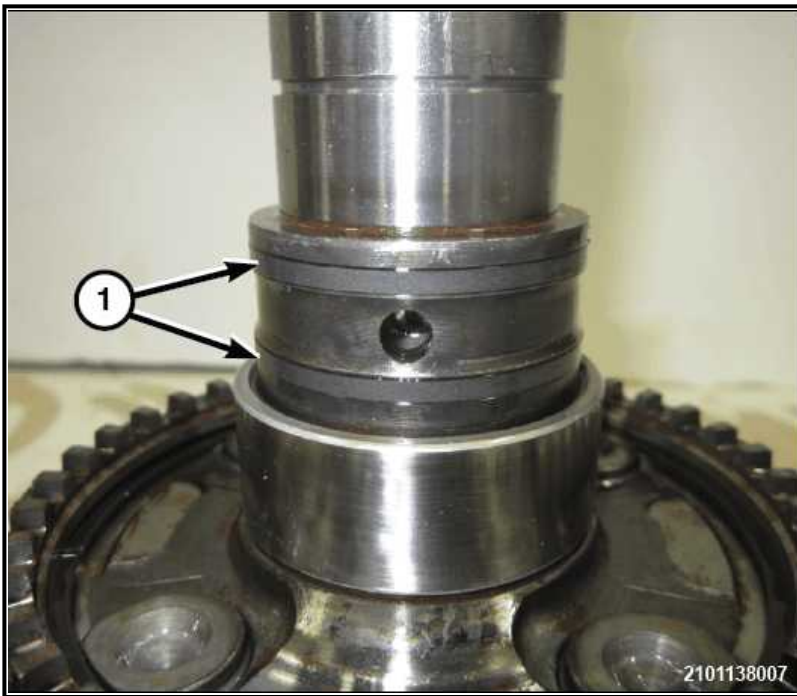
1 - Clutch D Friction Plate

8. Remove the Clutch D friction and steel plate elements, paying attention to the orientation.



1 - Clutch D Piston

9. Remove the Clutch D piston.

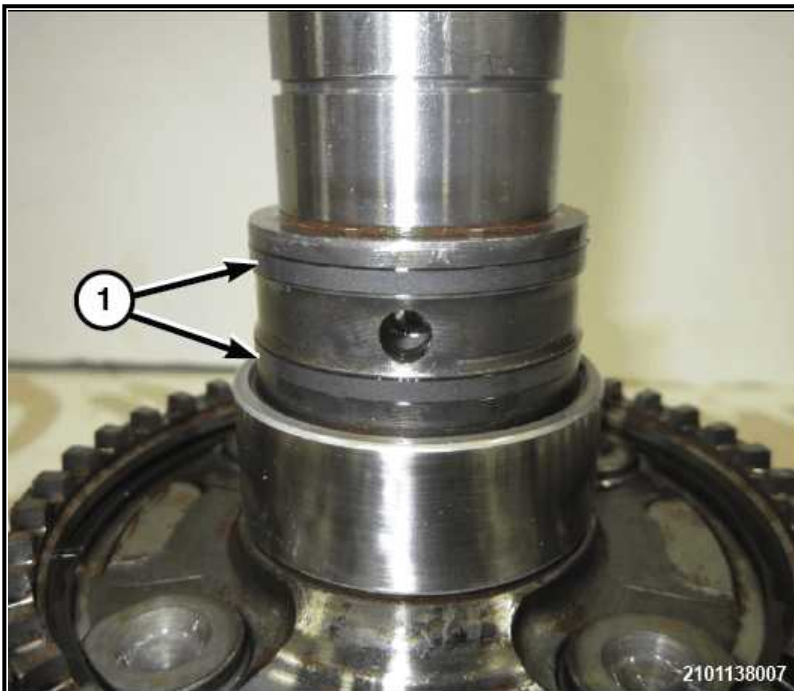


1 - Clutch D Carrier Seal Rings

10. Remove the Clutch D housing seal rings.

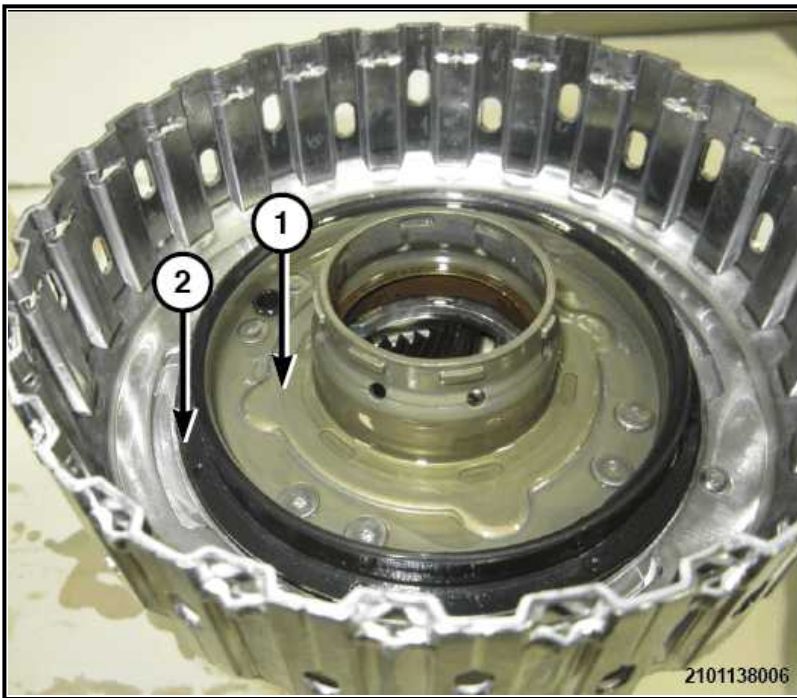
ASSEMBLY

NOTE: If clutch discs are being replaced, soak them in 8HP trans fluid before assembly.



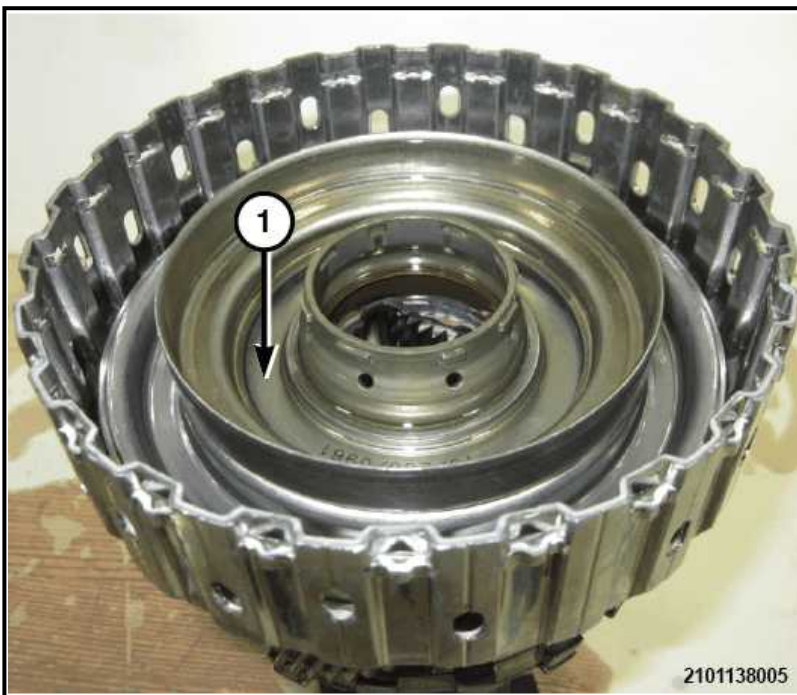
1 - Clutch D Carrier Seal Rings

1. Install the Clutch D housing seal rings.



- | |
|--------------------------|
| 1 - Clutch D Housing |
| 2 - Clutch D Piston Seal |

2. Verify the Clutch D piston seal is in good condition. Replace the Clutch D housing if there are any tears or nicks in the seal.
3. Coat the Clutch D piston seal with 8HP fluid.



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|---------------------|
| 1 - Clutch D Piston |
|---------------------|

4. Install the Clutch D piston (1) in the housing.



1 - Clutch D Selective Snap Ring

2 - Backing Plate

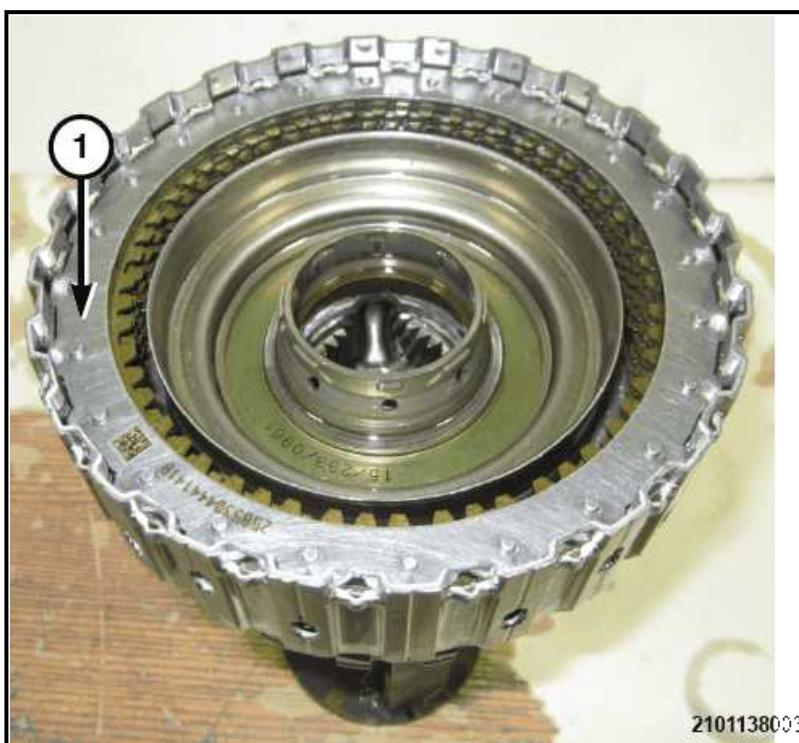
3 - Friction Plates

4 - Steel Plates

5 - Wave Plate

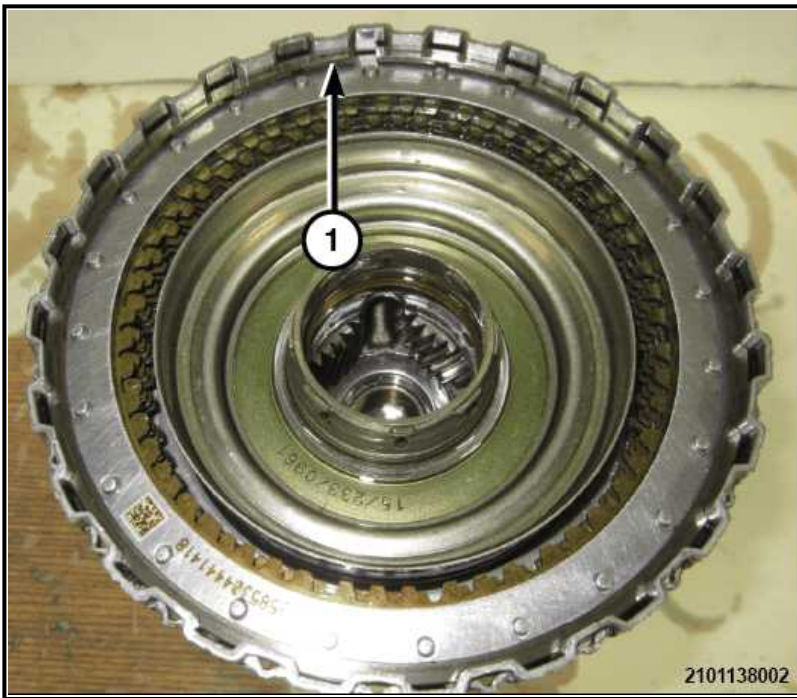
5. Install the wave plate into the housing first.

6. Install the friction plates and steel plates into the housing.



1 - Clutch D Backing Plate

7. Install the backing plate last onto the housing.



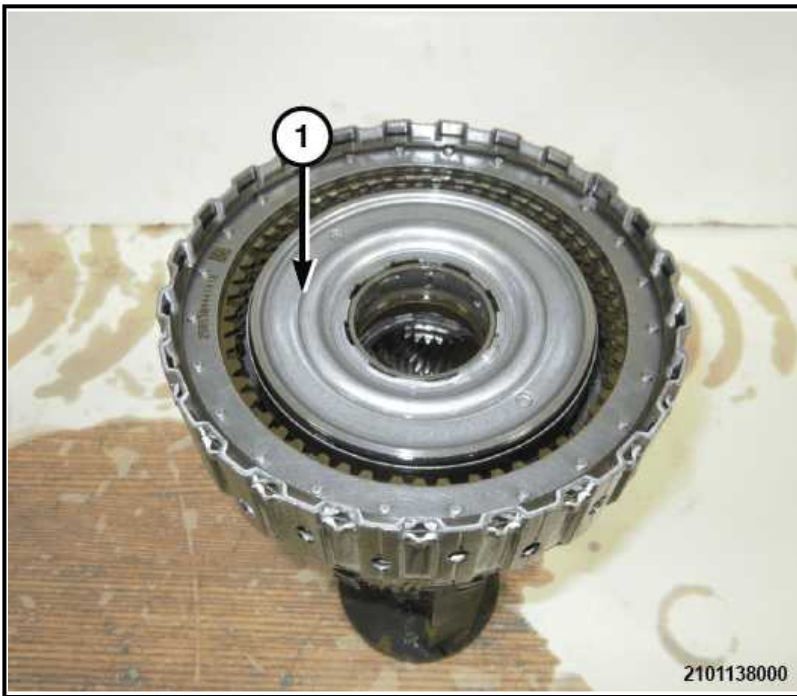
1 - Clutch D Selective Snap Ring

8. Install the proper selective snap ring onto the Clutch D housing.



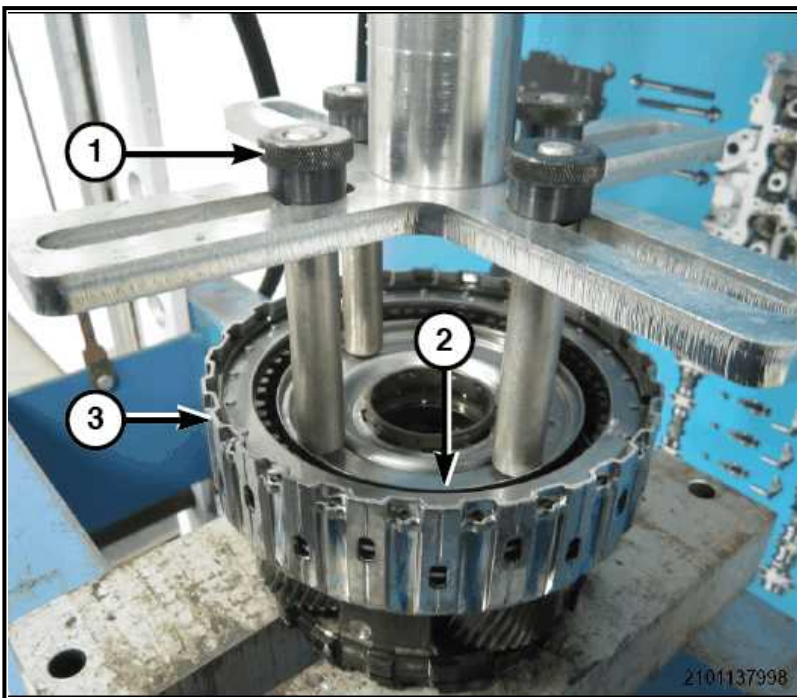
1 - Clutch D Belleville Spring

9. Install the belleville spring.



1 - Oil Baffle

10. Place the oil baffle onto the hub of the Clutch D housing.



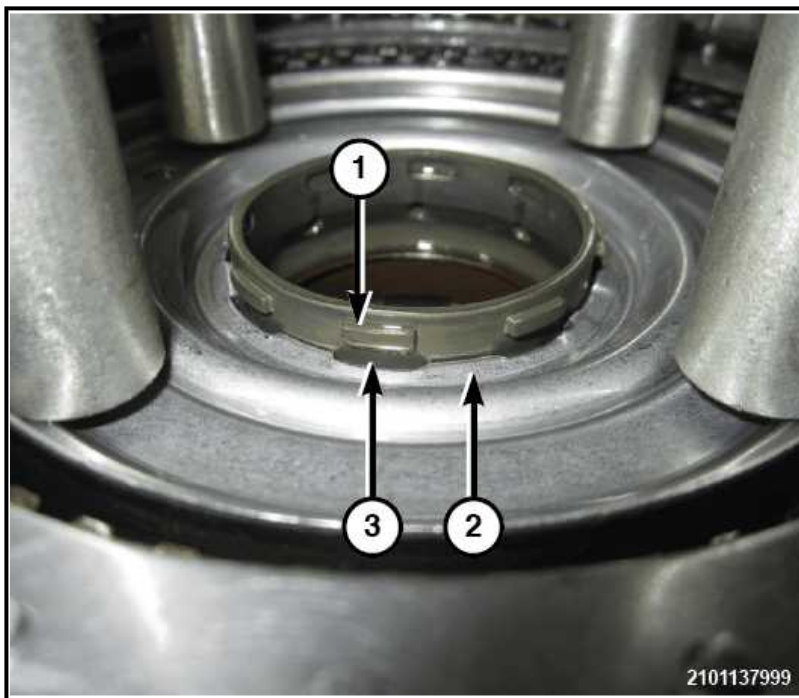
1 - Pressing Tool

2 - Oil Baffle

3 - Clutch D

11. Place the Clutch D in a suitable arbor press.

12. Using (special tool #8901A, Pressing Tool), compress the oil baffle enough to engage the lock tabs.



1 - Clutch D Hub
2 - Oil Baffle
3 - Tabs

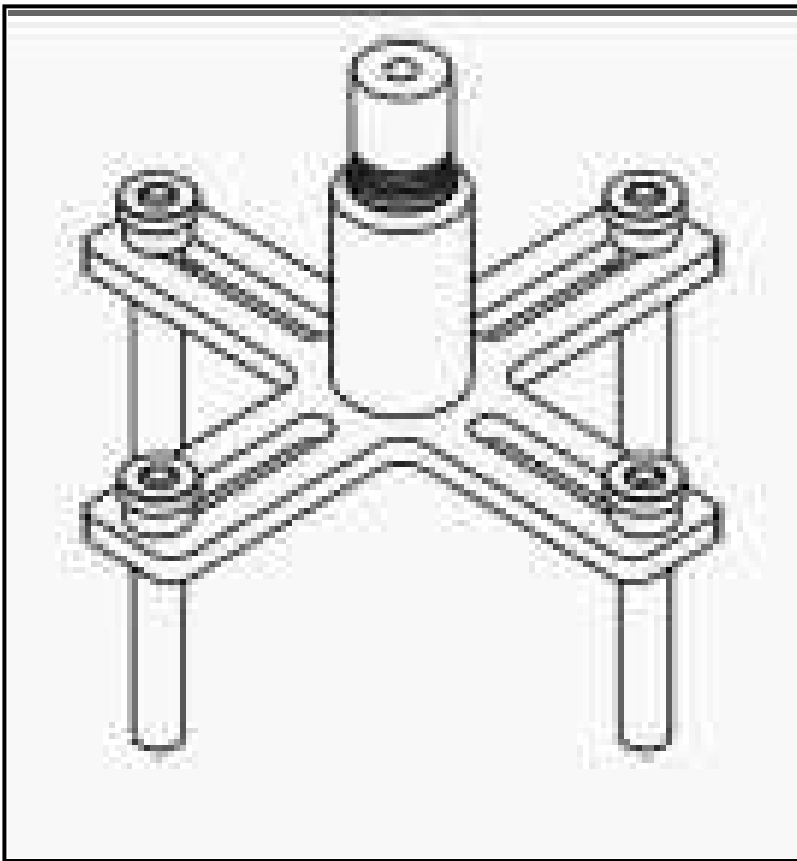
13. Rotate the baffle so the tabs on the Clutch D hub and the tabs on the baffle line up to the locked position.

14. Release the arbor press.

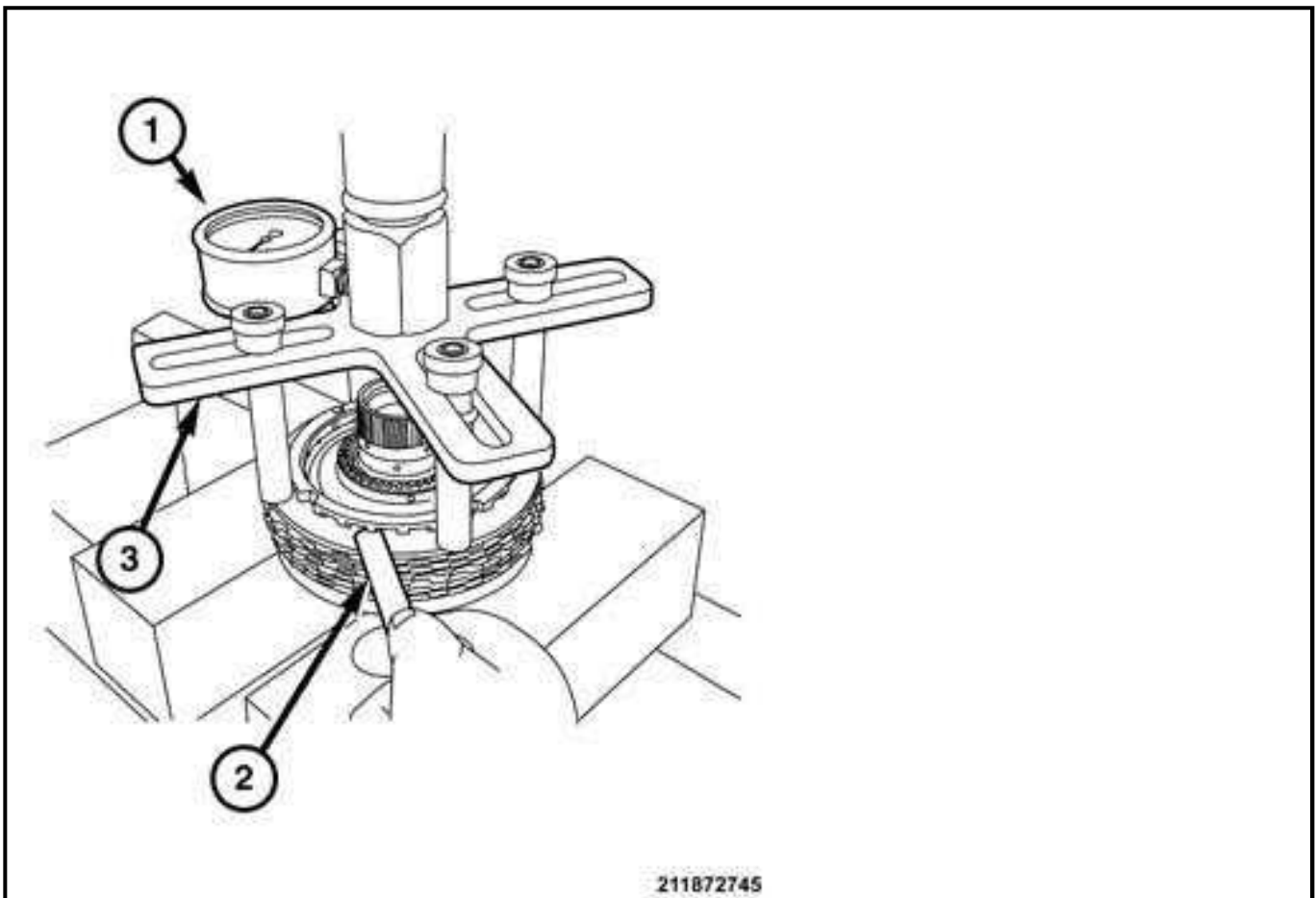
CLUTCH E - DISASSEMBLY AND ADJUSTMENTS

CLUTCH E MEASUREMENT PROCEDURE

1. Place Clutch E in a suitable arbor press.
2. Using (special tool #10429, Gauge, Force) and (special tool #8901A, Pressing Tool), apply 200 N (45 lbs.) to the backing plate of the Clutch E.



3. Using a set of feeler gauges, measure the gap between the backing plate and the retainer of Clutch E.
4. Refer to the clutch measurements table for specifications. If clearance is not within specifications, a thinner or thicker selectable backing plate can be installed to achieve proper clearance.



1 - Force Gauge

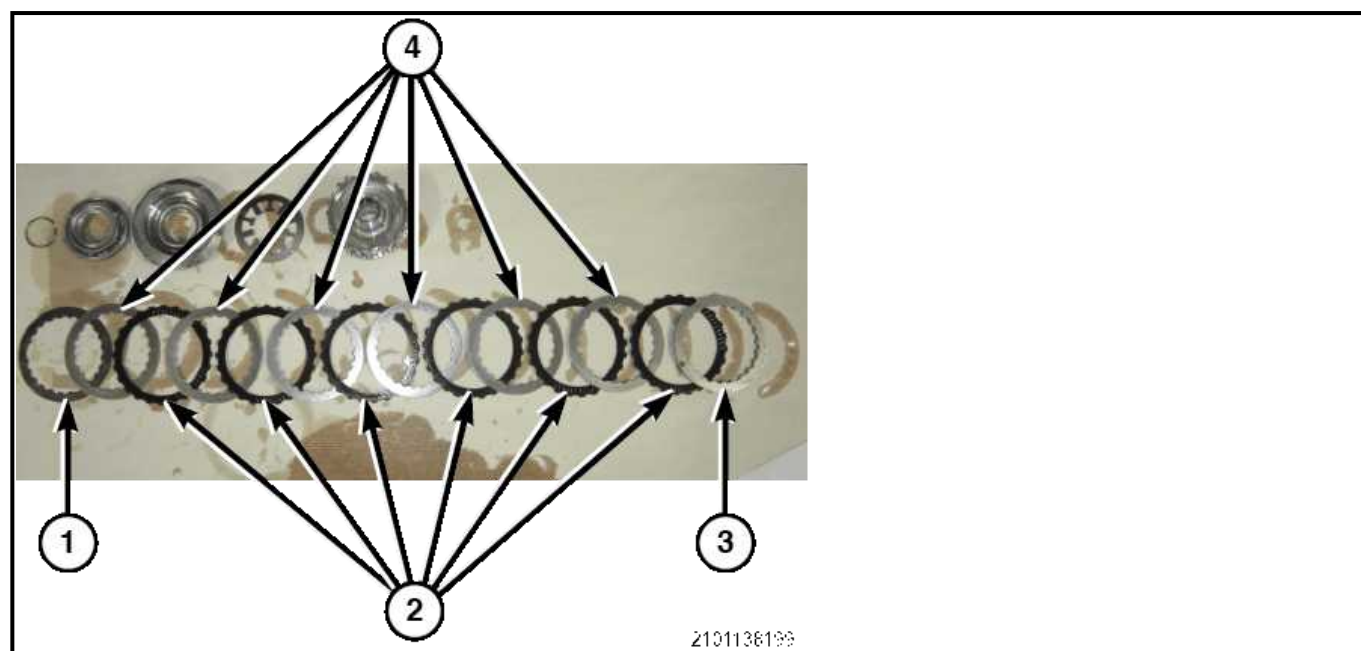
2 - Clutch E

CLUTCH SPECIFICATIONS

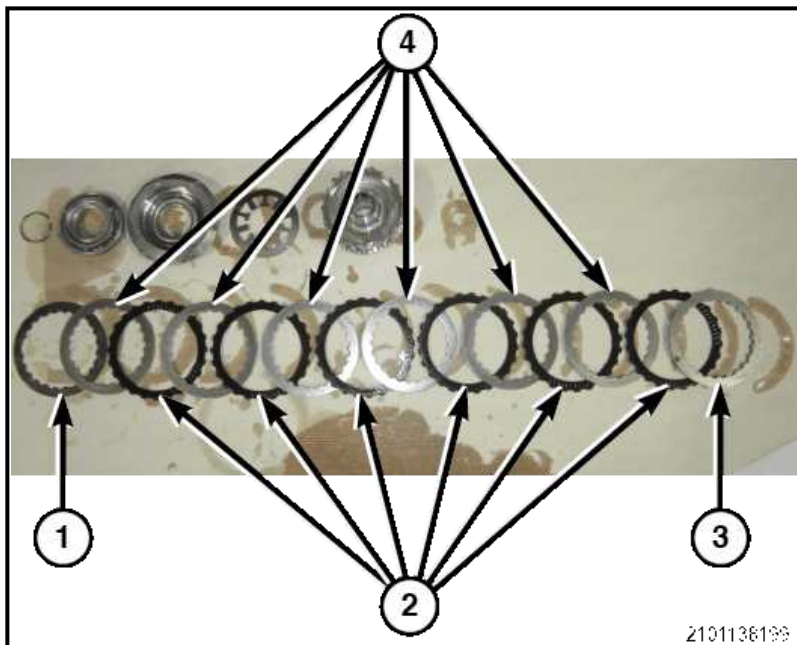
Clutch	Condition	Minimum	Normal	Maximum
E	NEW	1.71 mm	1.905 mm	2.100 mm
		0.067 in	0.075 in	0.083 in
	AFTER OPERATION	1.71 mm	2.025 mm	2.34 mm
		0.067 in	0.080 in	0.092 in

CLUTCH E SELECTABLE BACKING PLATES

4.8 mm	0.188 in.
4.5 mm	0.177 in.
4.2 mm	0.165 in.
3.9 mm	0.153 in.
3.6 mm	0.141 in.
3.3 mm	0.129 in.
3.0 mm	0.118 in.



DISASSEMBLY Clutch E, depending on the transmission Julian date, may contain wave springs that sit around each friction plate.



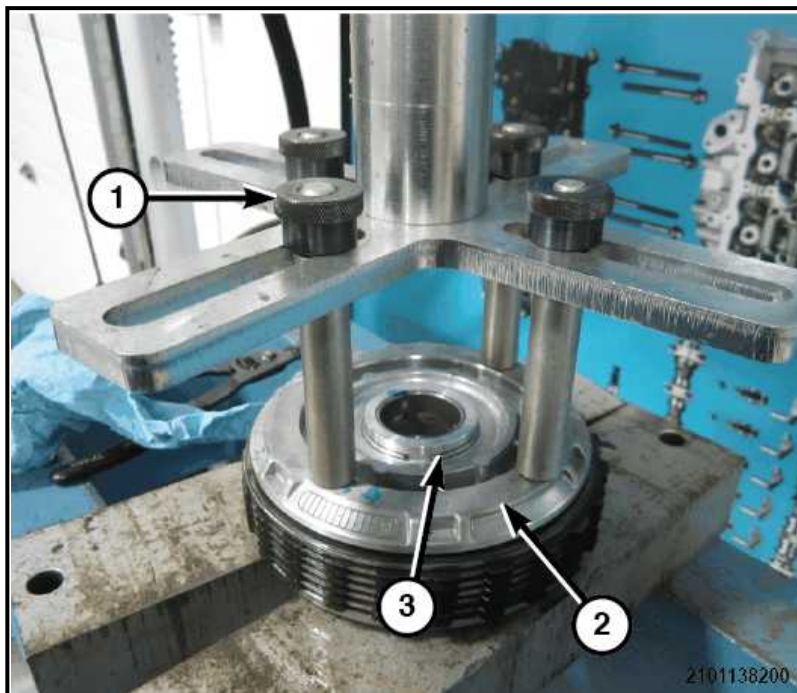
2101136199

1 - Wave Plate

2 - Friction Plates

3 - Backing Plate

4 - Steel Plates



2101138200

1 - Pressing Tool

2 - Clutch E Piston

3 - Snap Ring

1. Place Clutch E in a suitable press.

2. Using (special tool #8901A, Pressing Tool), compress the Clutch E piston enough to remove the snap ring.



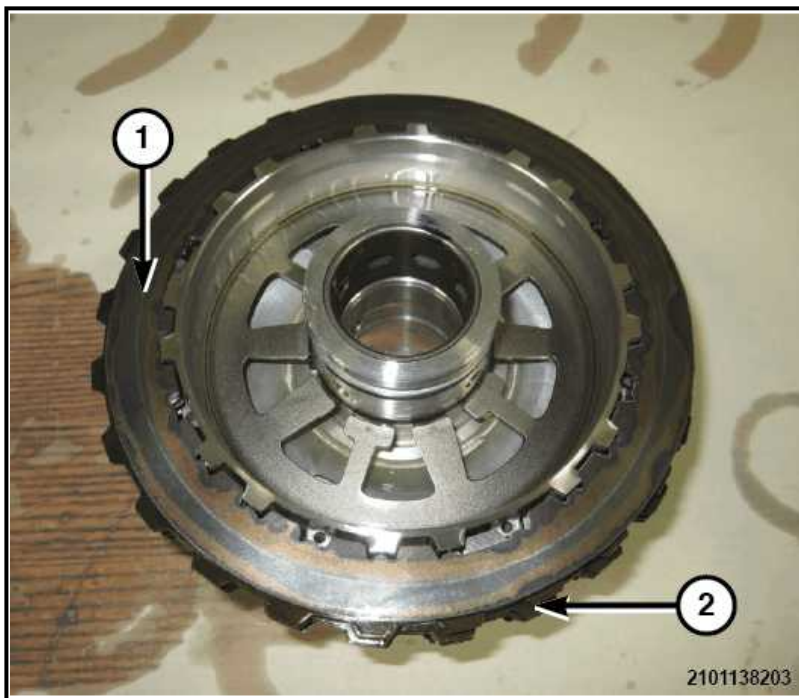
1 - Clutch E Piston Support

3. Remove the Clutch E piston support.



1 - Clutch E Piston

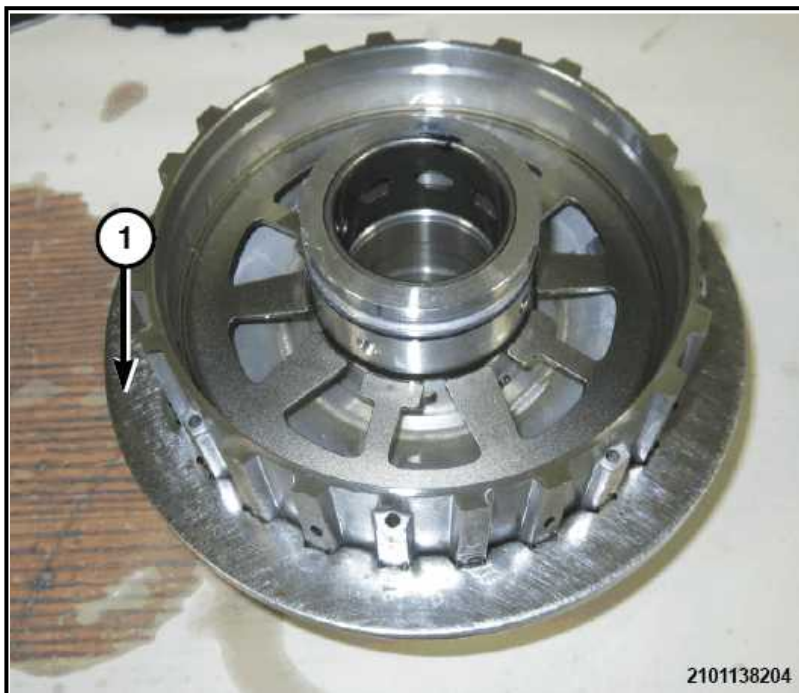
4. Remove the Clutch E piston.



- | |
|--|
| 1 - Clutch E Wave Plate |
| 2 - Clutch E Friction and Steel Plates |

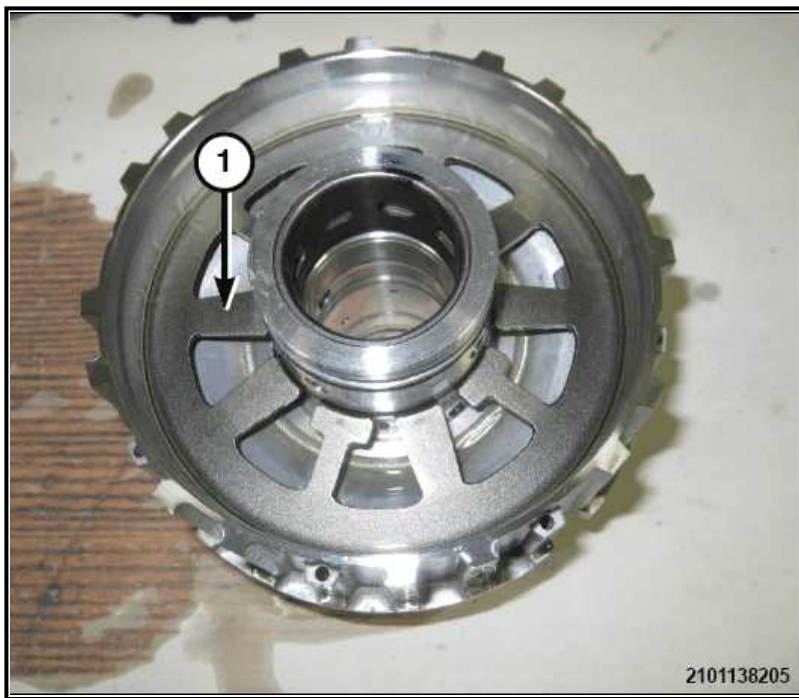
NOTE: Pay attention to the orientation of the plates.

5. Remove the Clutch E wave plate and the friction and steel plates.



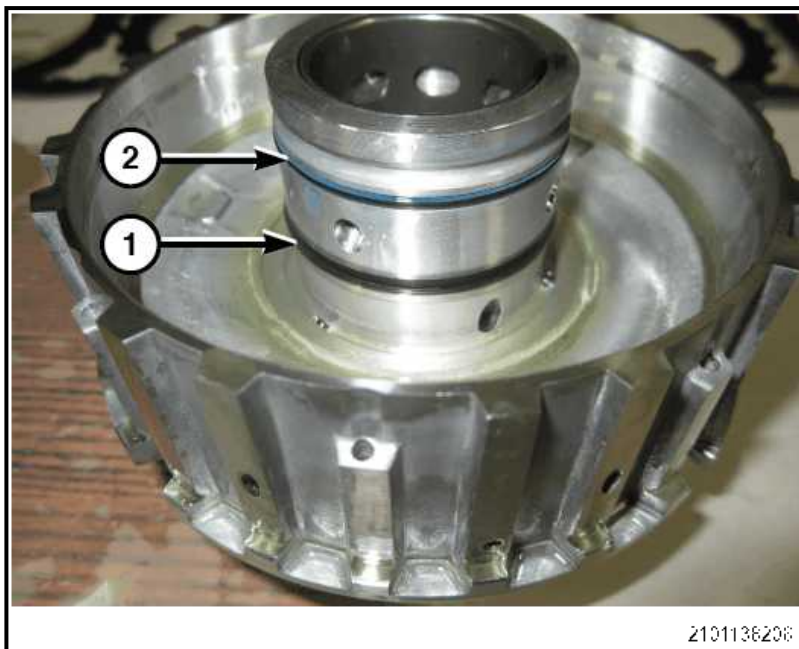
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|----------------------------|
| 1 - Clutch E Backing Plate |
|----------------------------|

6. Remove the Clutch E backing plate.



1 - Belleville Spring

7. Remove the belleville spring.



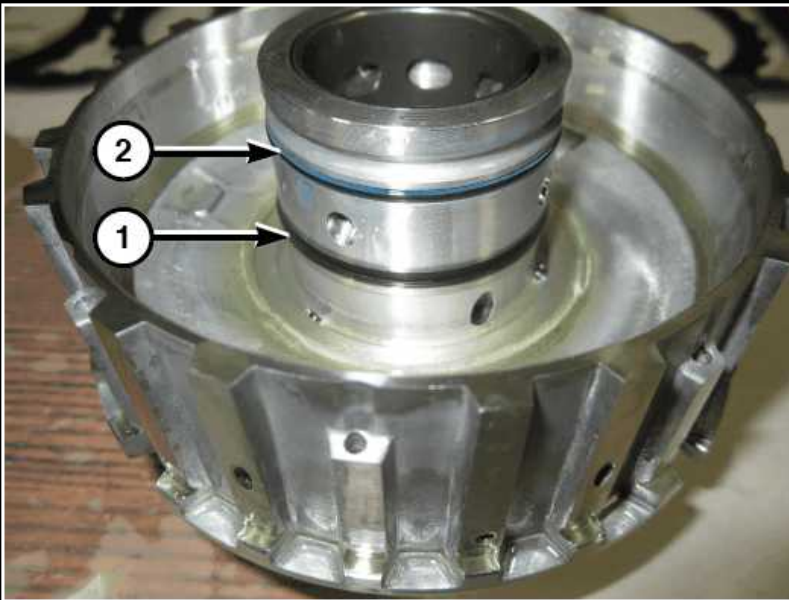
1 - Clutch E Seal

2 - Clutch E O-Ring

8. Remove the Clutch E seal and O-ring.

ASSEMBLY

NOTE: If the clutch discs are being replaced, soak them in 8HP transmission fluid before assembly.



2101136206

1 - Clutch E Seal

2 - Clutch E O-Ring

1. Install the Clutch E seal and O-ring.



2101138205

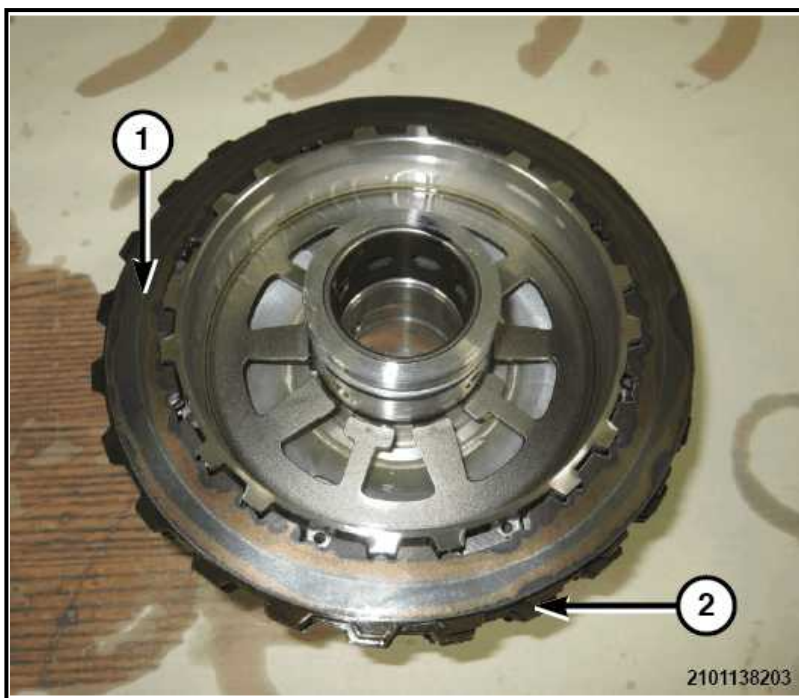
1 - Belleville Spring

2. Install the belleville spring into the Clutch E hub.



1 - Clutch E Backing Plate

3. Install the Clutch E backing plate.



1 - Clutch E Wave Plate

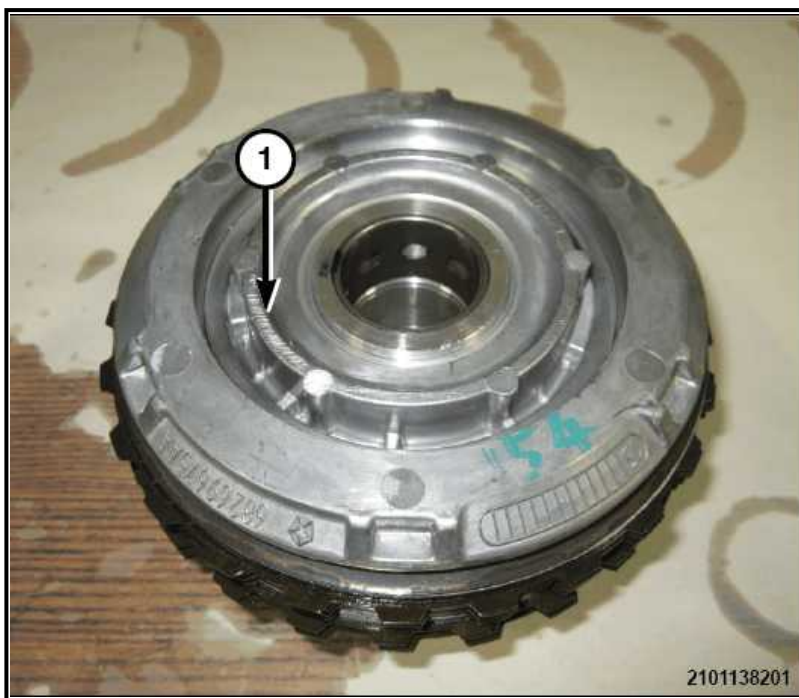
2 - Clutch E Friction and Steel Plates

4. Install the Clutch E friction and steel plates, and install the wave plate.



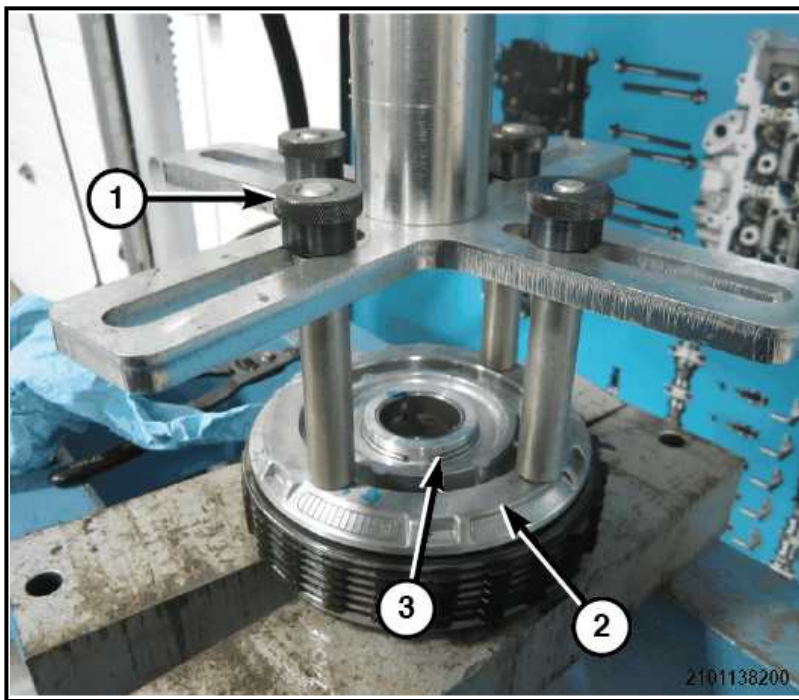
1 - Clutch E Piston

5. Install the Clutch E piston onto the hub.



1 - Clutch E Piston Support

6. Install the Clutch E piston support.



1 - Pressing Tool

2 - Clutch E Piston

3 - Snap Ring

7. Place Clutch E in a suitable arbor press.

8. Using (special tool #8901A, Pressing Tool) compress the Clutch E piston enough to install the snap ring.

CLUTCH AIR PRESSURE TESTS



Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure using (special tool #10383, Plate, Clutch Pressure Test).

The clutches may be tested by applying air pressure to their respective passages. The valve body must be removed. To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 5-8 bar (73-116 psi).

Remove the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#). Install (special tool #10383, Plate, Clutch Pressure Test) and tighten bolts to 6 N.m (50 in. lbs.). When testing is finished install valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#). Fill the transmission. Refer to [TRANSMISSION FILL AFTER SERVICE](#).

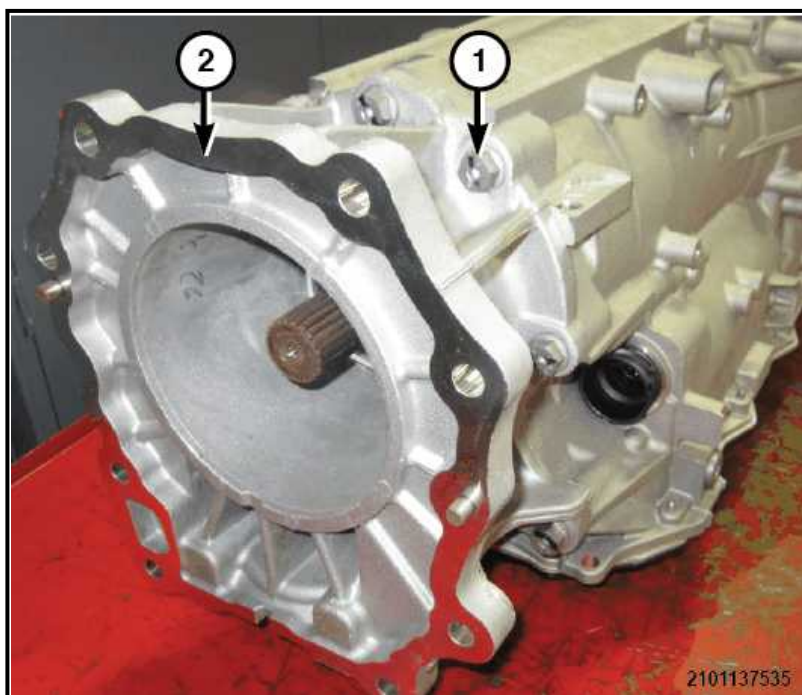
NOTE: If any clutch does not appear to be functioning with the air, add some 8HP transmission fluid and try the test again. Some circuits will not operate without fluid.

END PLAY - MEASUREMENT AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

NOTE: The proper selectable shim must be installed to achieve specified clearance.

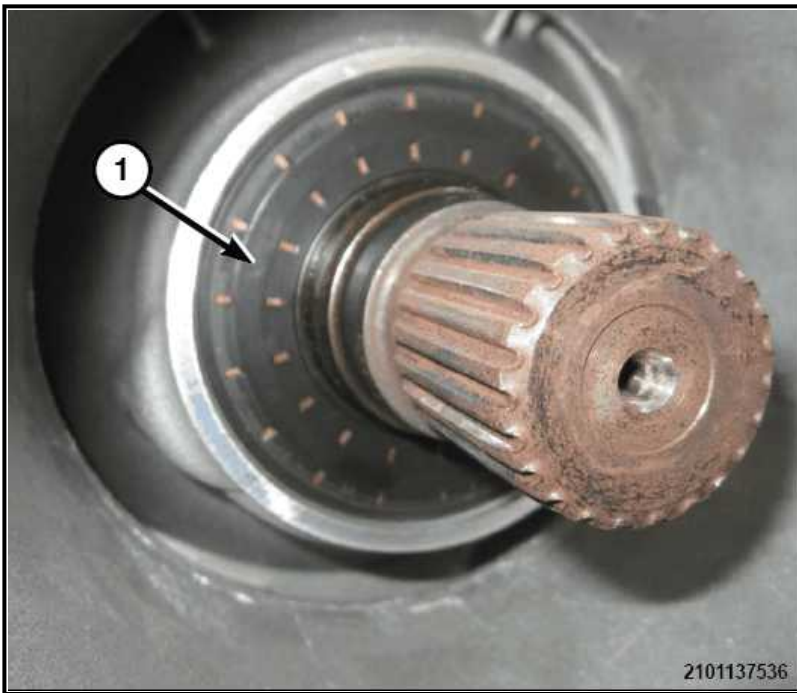
1. Remove the torque converter.



- | |
|-----------------------------|
| 1 - Extension Housing Bolts |
| 2 - Extension Housing |

NOTE: 4WD Only

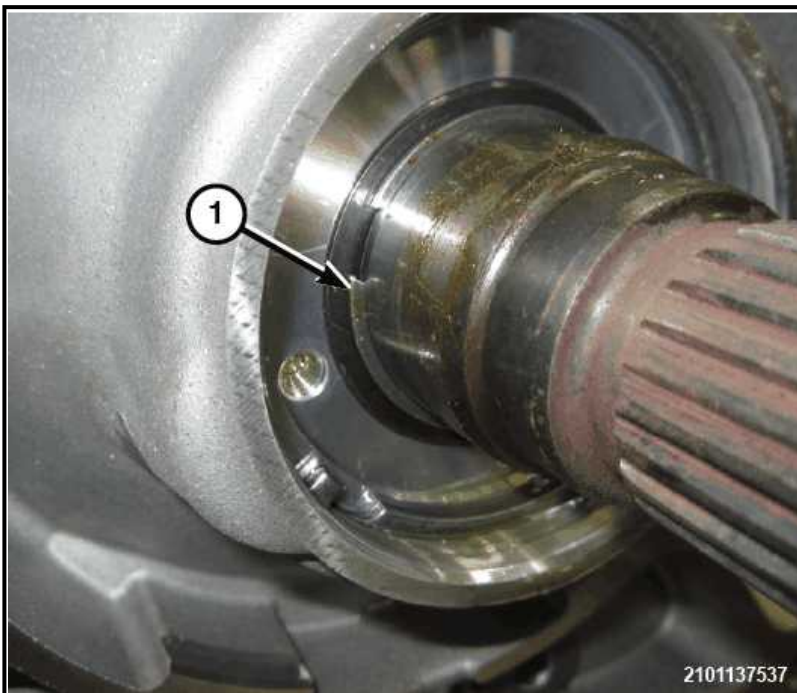
2. If the vehicle is **2WD**, proceed to Step 6. If the vehicle is **4WD** proceed to Step 3.
3. If equipped, remove the transmission housing extension housing bolts and remove the extension housing.



1 - Output Shaft Seal

NOTE: 4WD Only

4. Remove the transmission output shaft seal with a suitable slide hammer and screw.

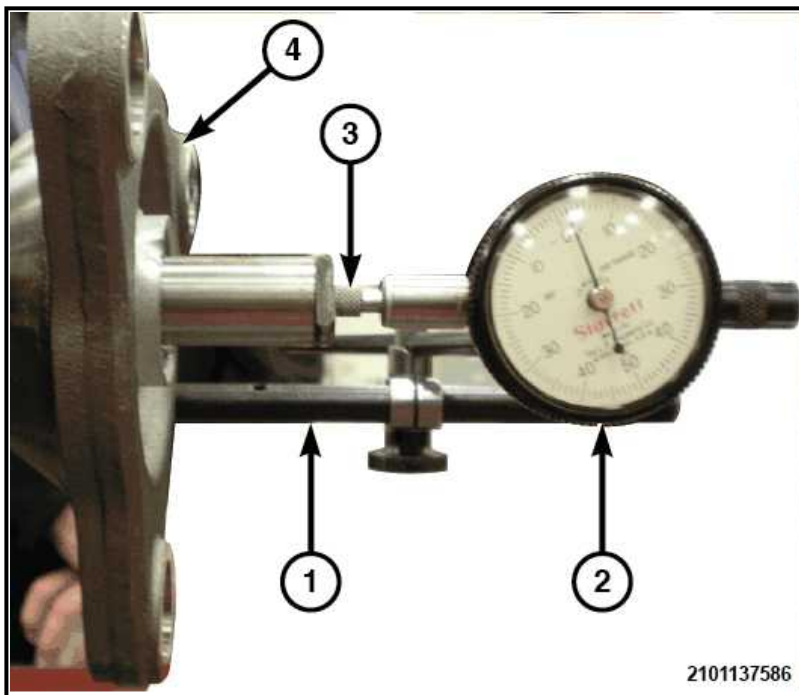


1 - Output Shaft Snap Ring

NOTE: 4WD Only

5. Remove the output shaft snap ring.

NOTE: 2WD shown, 4X4 similar.



1 - Transmission Output Flange
2 - Dial Indicator
3 - Plunger
4 - Transmission Output Flange

6. Measure the output shaft end play as follows:

- Attach a dial indicator and position the plunger against the end of the output shaft.
- Zero the dial indicator.
- Move the output shaft flange in and out, and record the maximum travel on the dial for assembly reference.

If the end play is not within specification a thinner or thicker selectable shim can be installed to achieve proper end play.

END PLAY SPECIFICATIONS

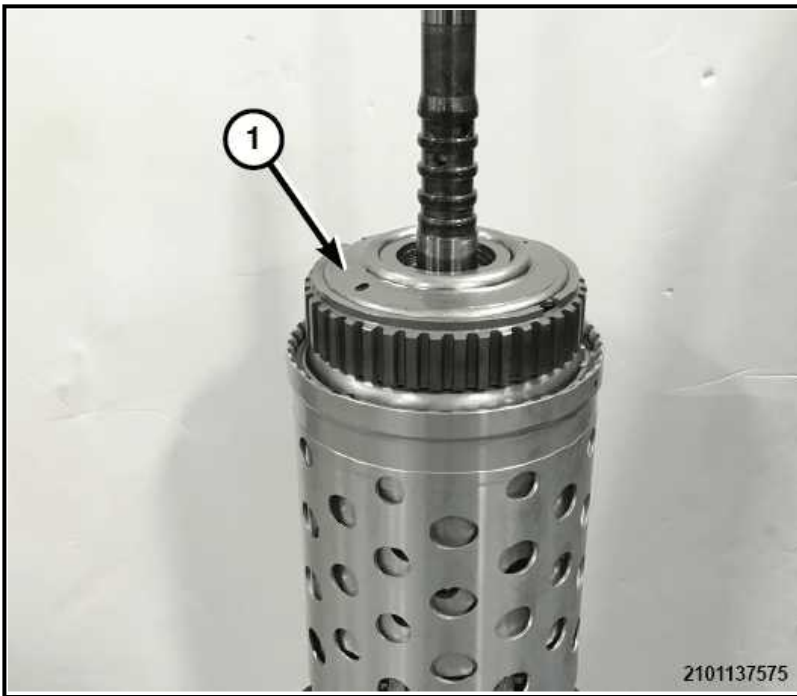
Minimum	Maximum
0.11 mm	0.42 mm
0.0043 in.	0.0165 in.

END PLAY SELECTABLE SHIMS

NOTE: Check with parts for selectable shim thicknesses and availability.

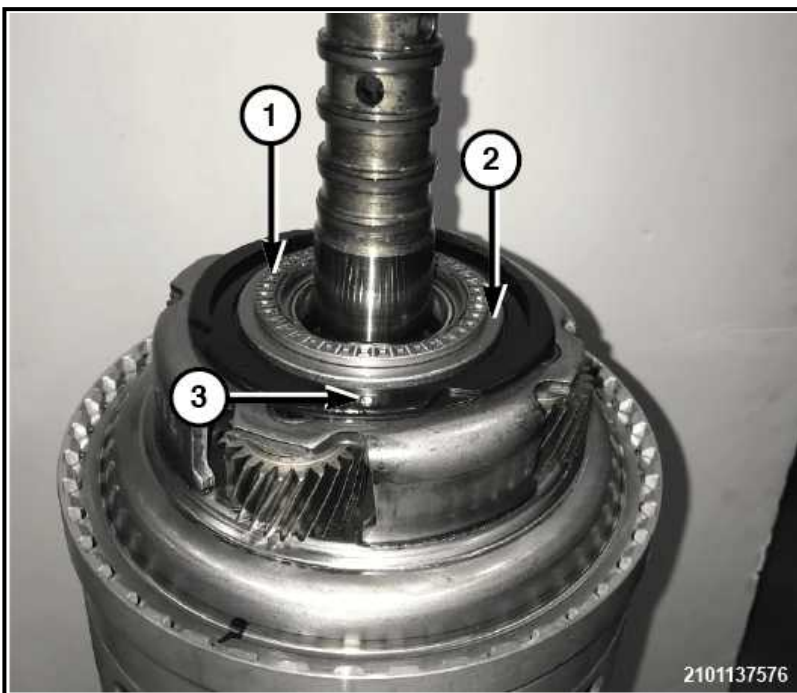
DISASSEMBLY

- Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear).
- Remove the Clutch B discs and plates.



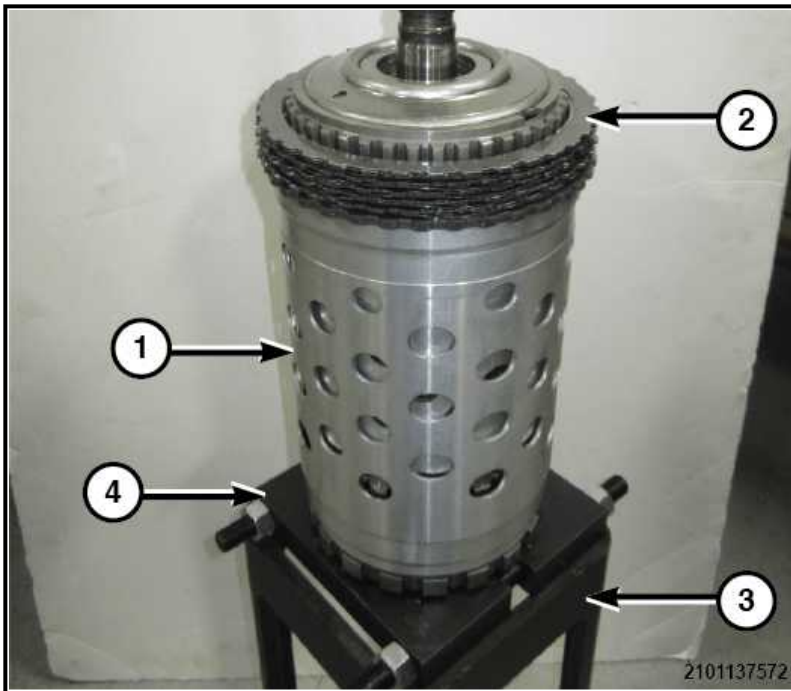
1 - P1 Annulus/Clutch B Hub Assembly

3. Remove the O-ring and five squared O-rings from the input shaft.
4. Remove the P1 annulus/Clutch B hub assembly from the P4 annulus drum.



1 - Thrust Bearing
2 - Holding Plate
3 - Selectable Shim

5. Remove the selectable shim from the P1 planetary carrier.
6. Measure the selectable shim and calculate the thickness of the shim to obtain the correct end play.



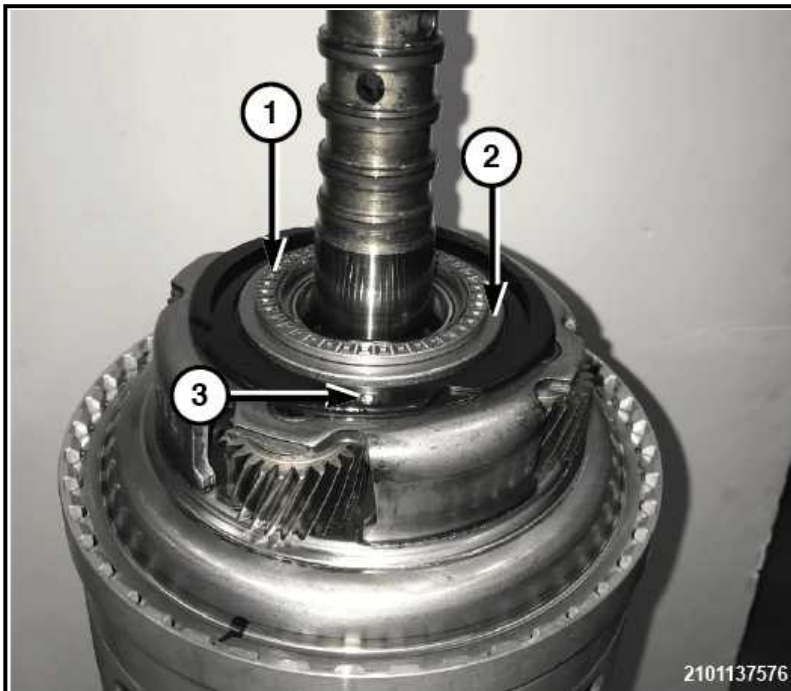
1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

ASSEMBLY

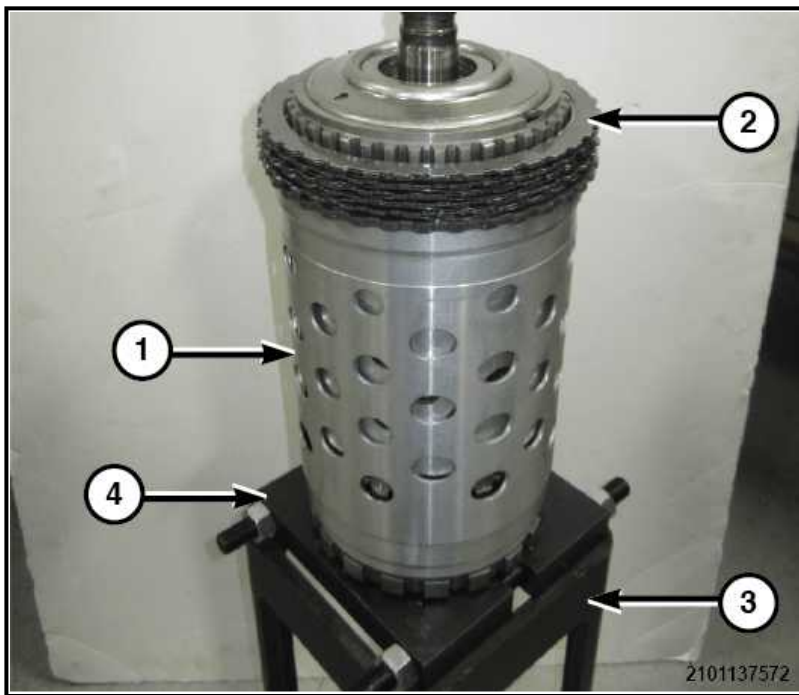


1 - Thrust Bearing

2 - Holding Plate

3 - Selectable Shim

1. Install the selectable shim onto the P1 planetary carrier.



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Bearing/Gear Splitter

2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.
5. Install the P1 annulus onto the input/output shaft.
6. Install the input/output shaft and the P4 annulus drum assembly into the transmission.

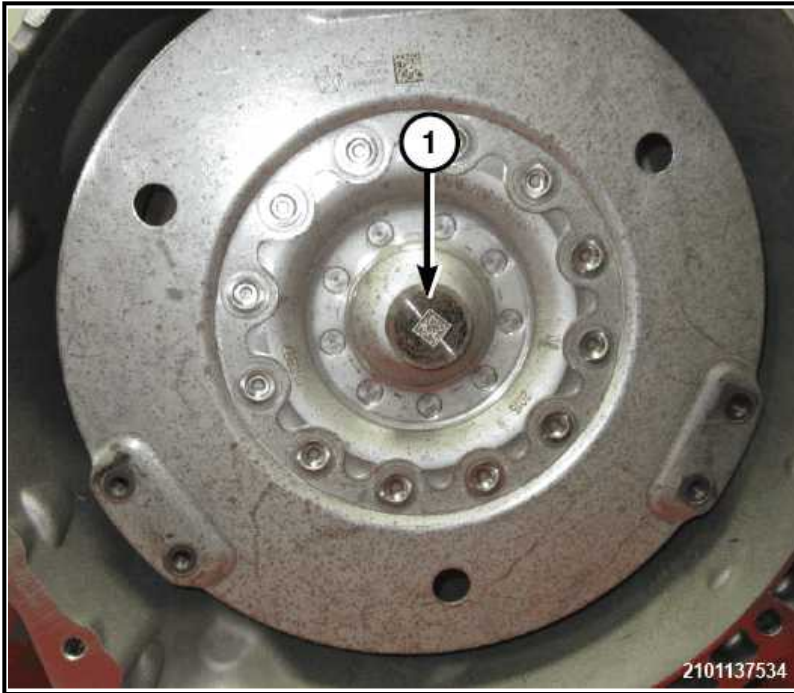
8HP50 - DISASSEMBLY

DISASSEMBLY

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

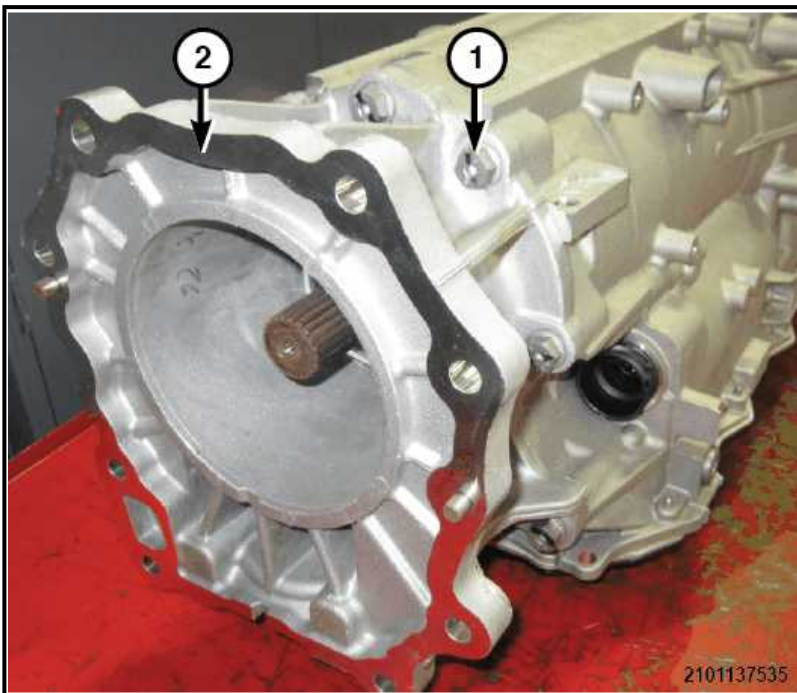
NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TCM Adaptation Procedure. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#).

NOTE: Tag all clutch pack assemblies, as they are removed, for reassembly identification.



1 - Torque Converter

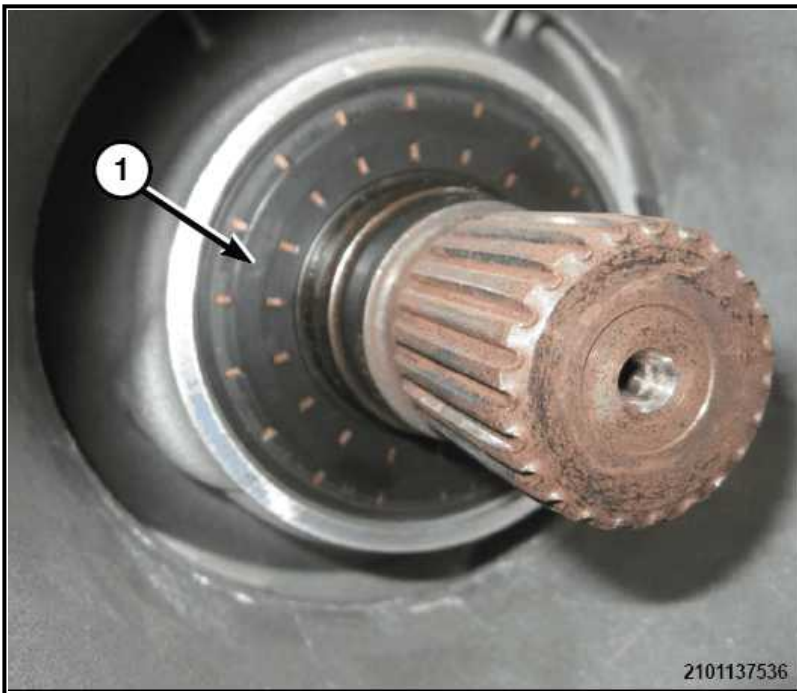
1. Remove the torque converter.



1 - Extension Housing Bolts

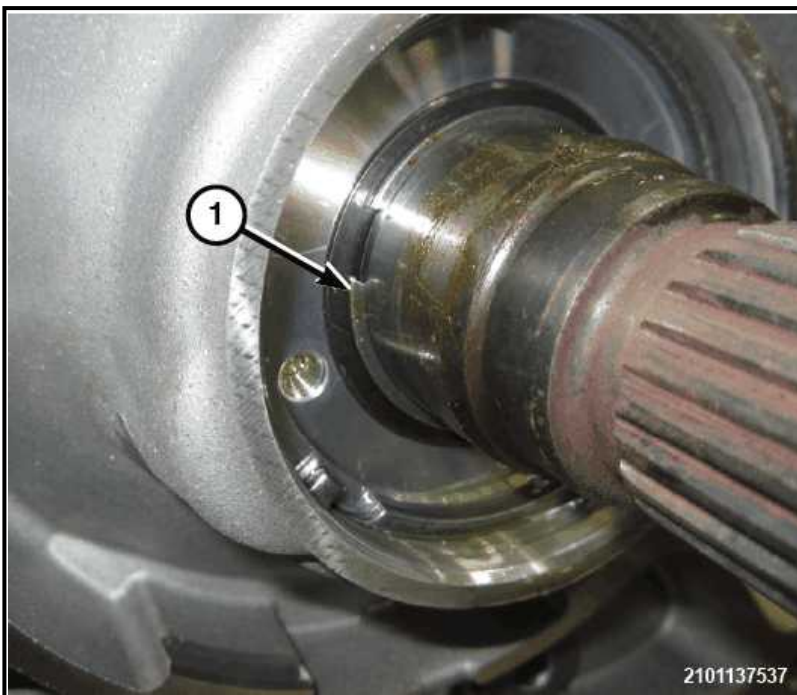
2 - Extension Housing

2. **4X4 ONLY**, If equipped, remove the transmission housing extension bolts and remove the extension housing.



1 - Transmission Output Shaft Seal

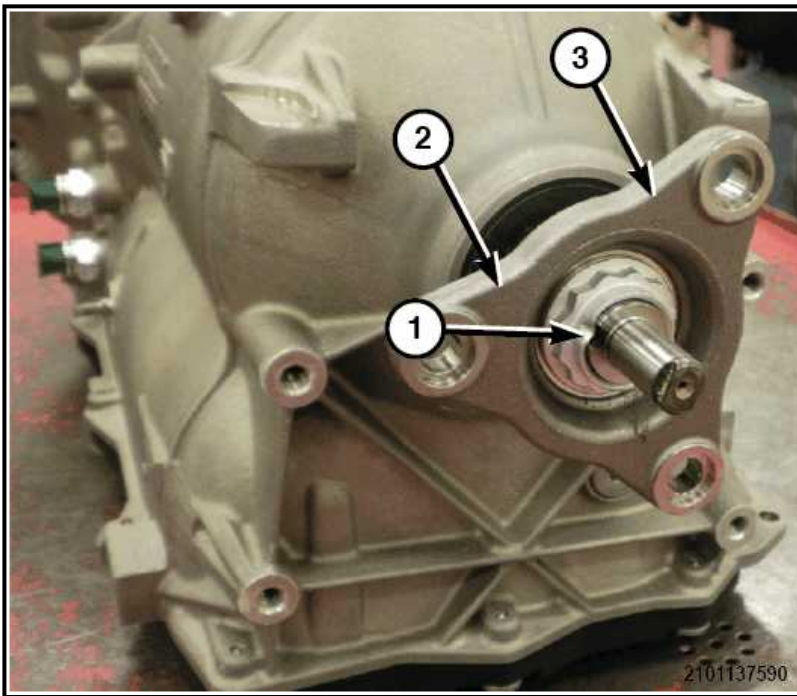
3. Remove the transmission output shaft seal with a suitable slide hammer and screw.



1 - Output Shaft Snap Ring

NOTE: 4X4 only

4. Remove the output shaft snap ring.



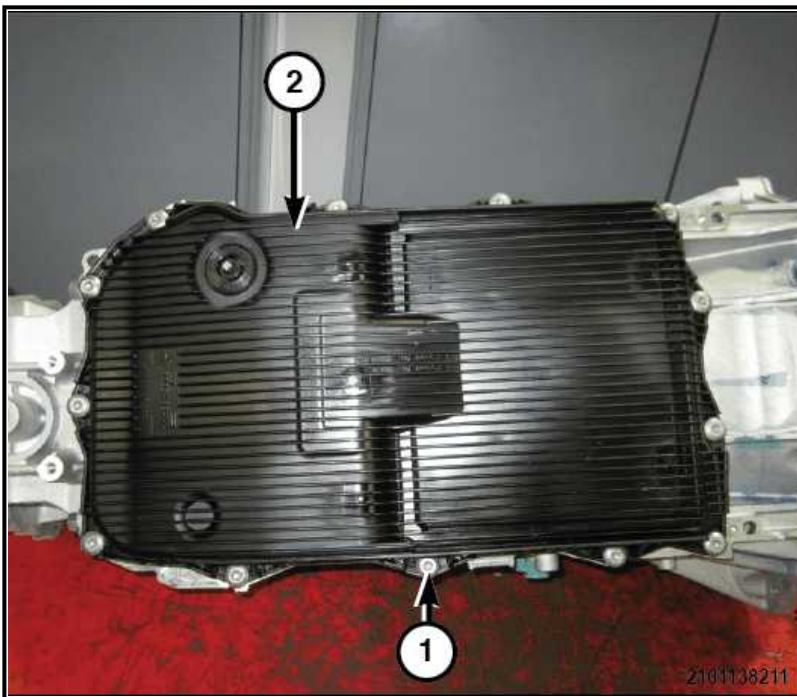
1 - Output Shaft Flange Locknut Staking

2 - Output Shaft Flange

3 - Output Shaft Flange

NOTE: 2WD only.

5. Remove the output shaft flange locknut staking.
6. Using a flange holder (special tool #C-3281, Holder, Flange), remove the output shaft flange nut.
7. Remove the output shaft flange and inspect the output shaft flange sealing surface for damage, replace as needed.



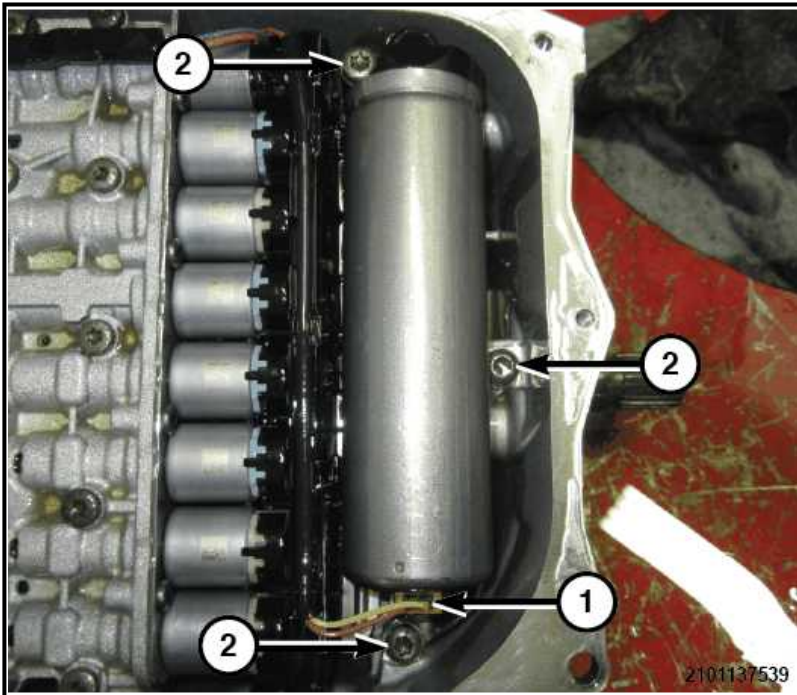
1 - Transmission Oil Pan Bolts

2 - Transmission Oil Pan

8. Remove the transmission oil pan bolts.

NOTE: Inspect the gasket for reuse. If the seal is cut or torn, replace the gasket.

9. Carefully remove the transmission oil pan and gasket.

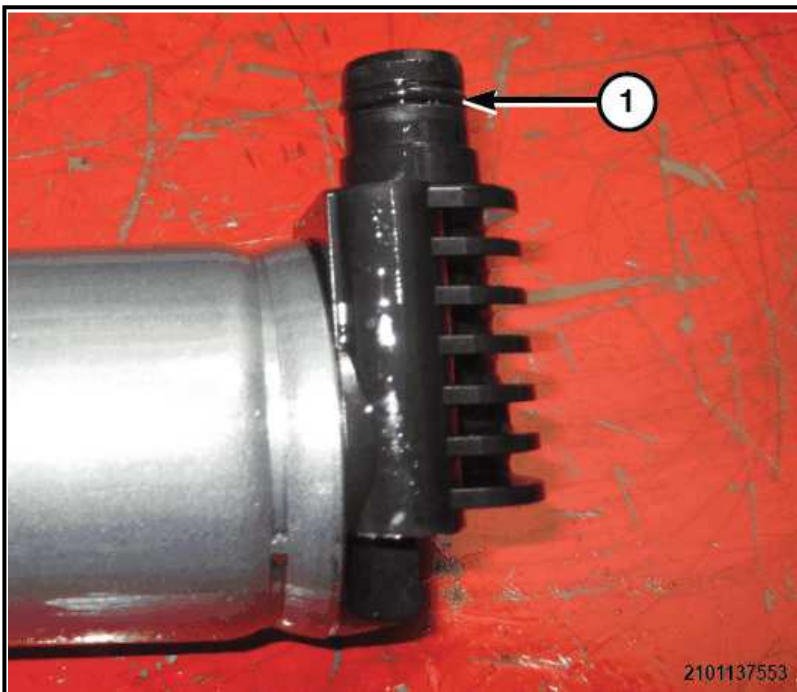


1 - Hydraulic Impulse Oil Storage (H.I.S) Connector

2 - Hydraulic Impulse Oil Storage (H.I.S) Bolts

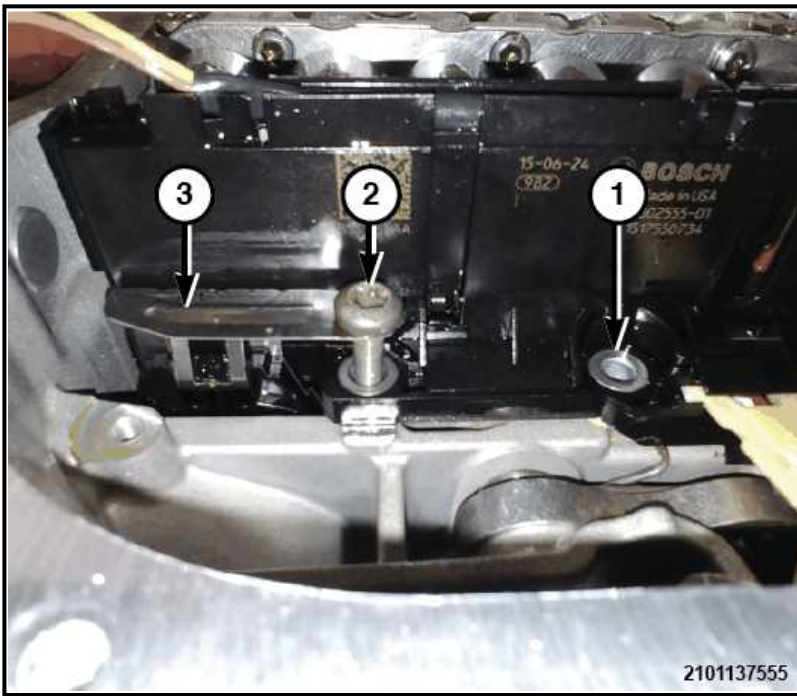
10. If equipped, disconnect the Hydraulic Impulse Oil Storage (H.I.S) connector.

11. If equipped, remove bolts and the H.I.S. accumulator.



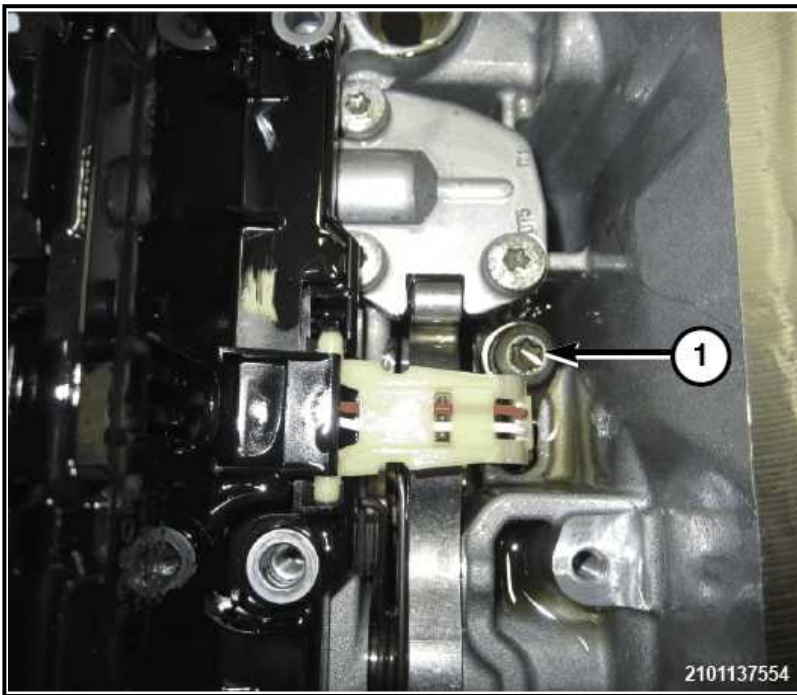
1 - Hydraulic Impulse Oil Storage (H.I.S) Seal

12. Verify the H.I.S. seal is not torn or cut. Replace the seal if it looks worn or damaged,



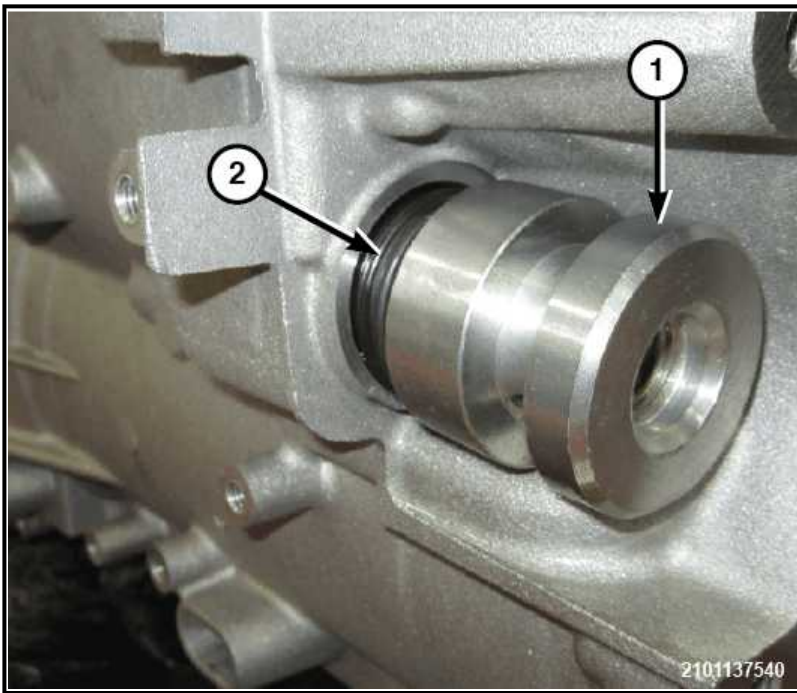
1 - Valve Body Assembly End Retainer Bolt
2 - Valve Body Assembly End Retainer Bolt
3 - Electrical Connector Lock

13. Remove the valve body assembly end retainer bolts.
14. Lift the electrical connector lock to release the internal harness end from inside the transmission for valve body assembly removal.



1 - Output Speed Sensor Bolt

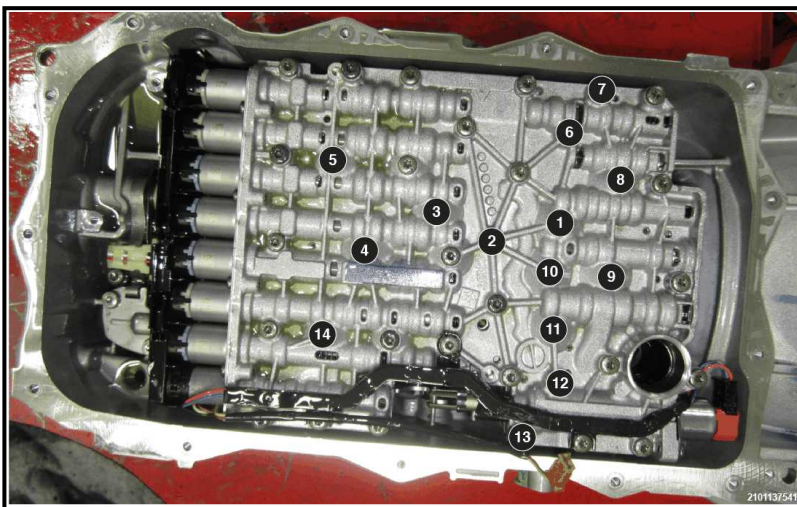
15. Remove the Output Speed Sensor bolt and gently lift the Output Speed Sensor out from the case.



1 - Remover/Installer, Guide Sleeve 10377

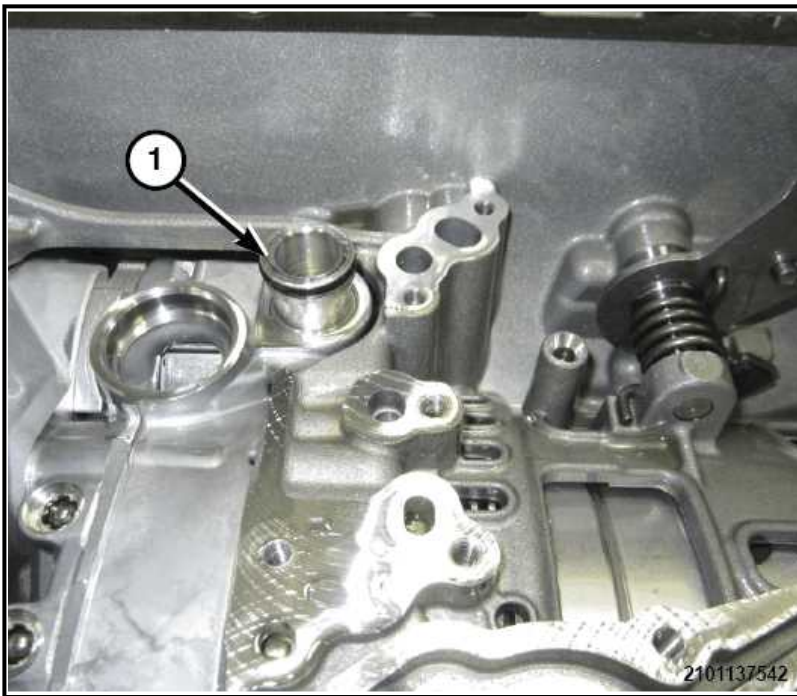
2 - Electrical Harness Insulator

16. Using (special tool #10377, Remover/Installer, Guide Sleeve), carefully pull the electrical harness insulator straight out from the transmission case.



1-14 - Valve Body Assembly Bolts

17. Remove the valve body assembly bolts in the order shown and remove the valve body.



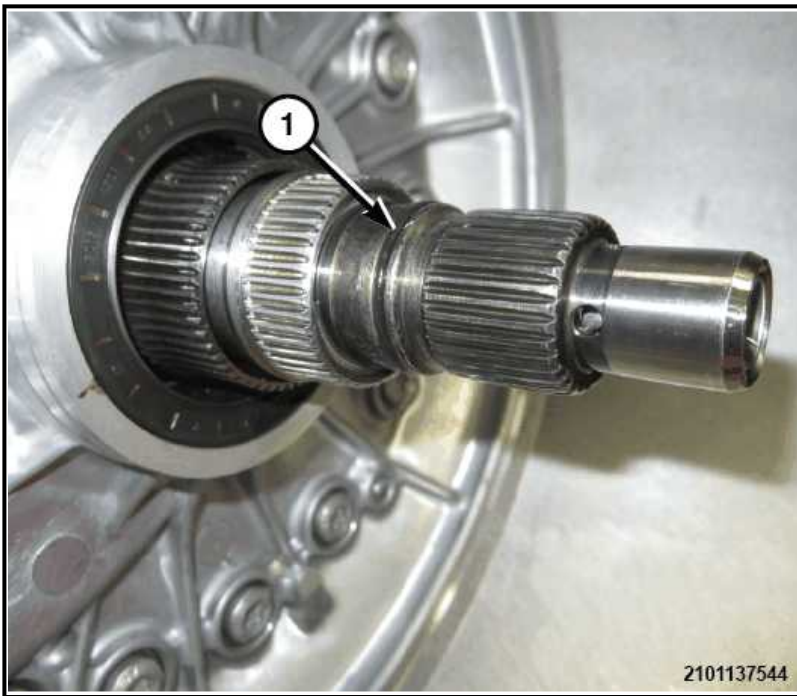
1 - Fluid Port

18. Remove the fluid port from the transmission or valve body assembly (the fluid port may stick in the valve body upon removal).
19. Inspect the fluid port O-rings for damage or wear and replace as necessary.



1 - Oil Pump Housing Bolts

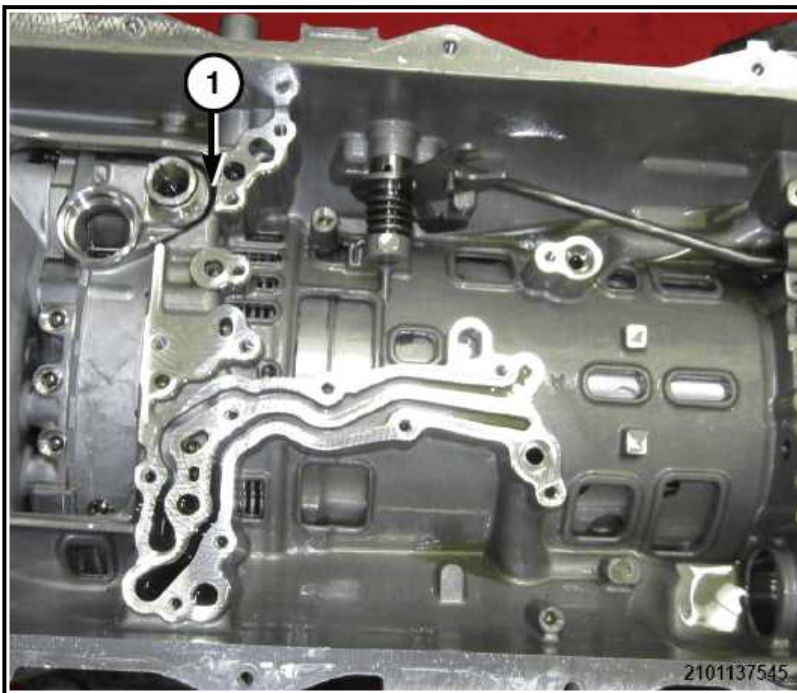
20. Remove and **DISCARD** the oil pump housing bolts.



1 - Input Shaft O-ring

NOTE: Remove the input shaft O-ring before the oil pump is removed.

21. Remove the input shaft O-ring using a small pick or equivalent.



1 - Oil Pump Housing Pry Point

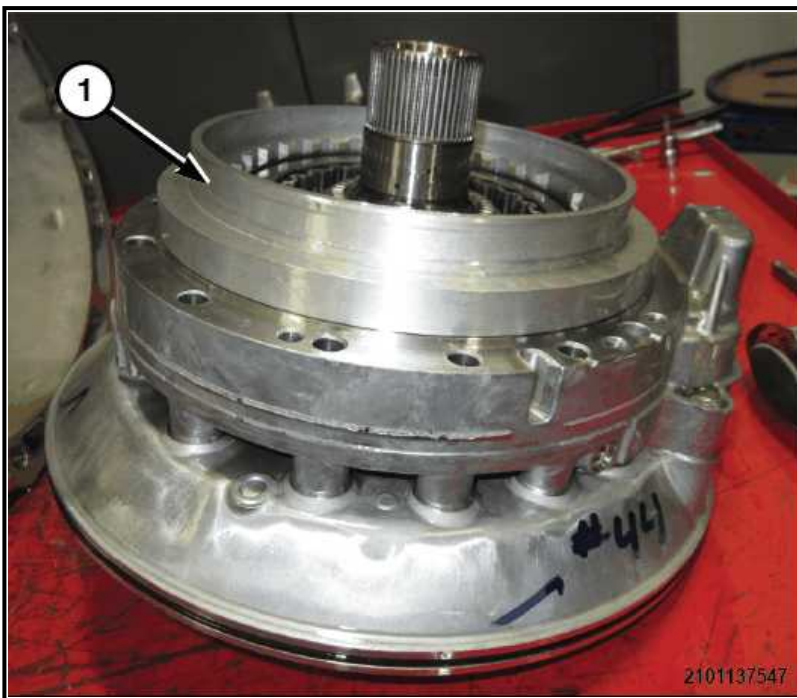
22. Carefully pry the oil pump housing away from the case with a small flat blade screwdriver or equivalent through the case opening.

23. From the front of the transmission, remove the oil pump housing.



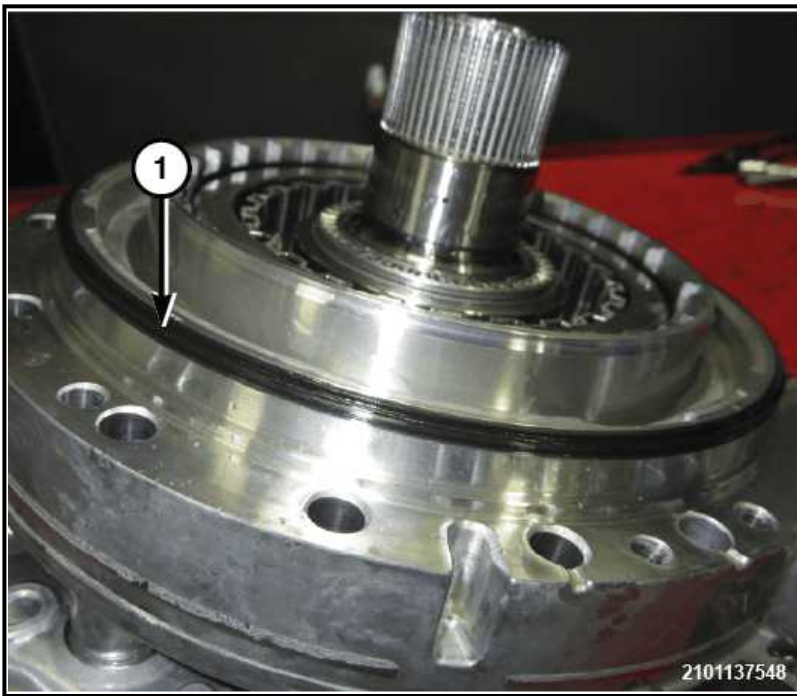
1 - B Clutch Spring Damper

24. Remove the B clutch spring damper.



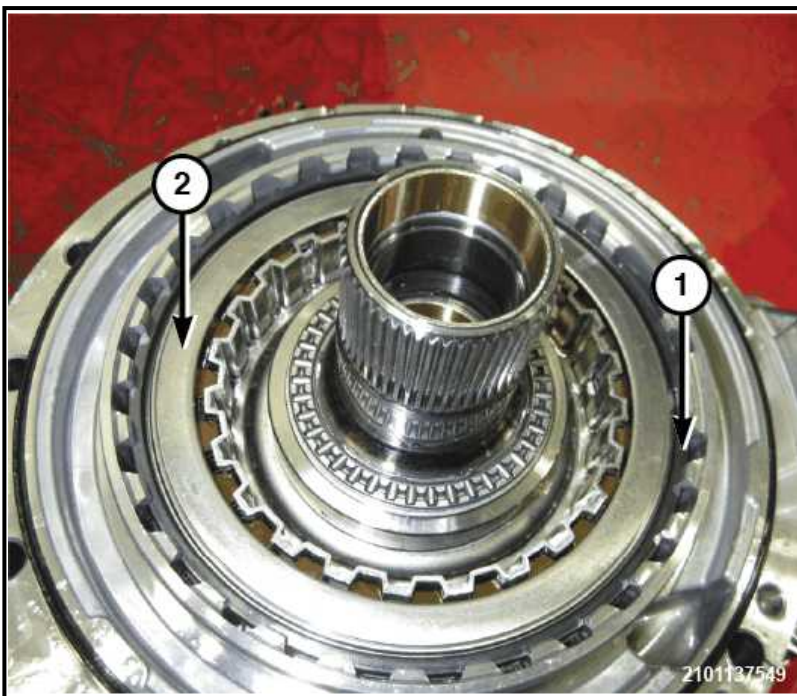
1 - B Clutch Piston

25. Remove the B clutch piston from the assembly.



1 - B Clutch Piston Seal

26. Check the B clutch piston seal for damage or wear and replace if necessary.

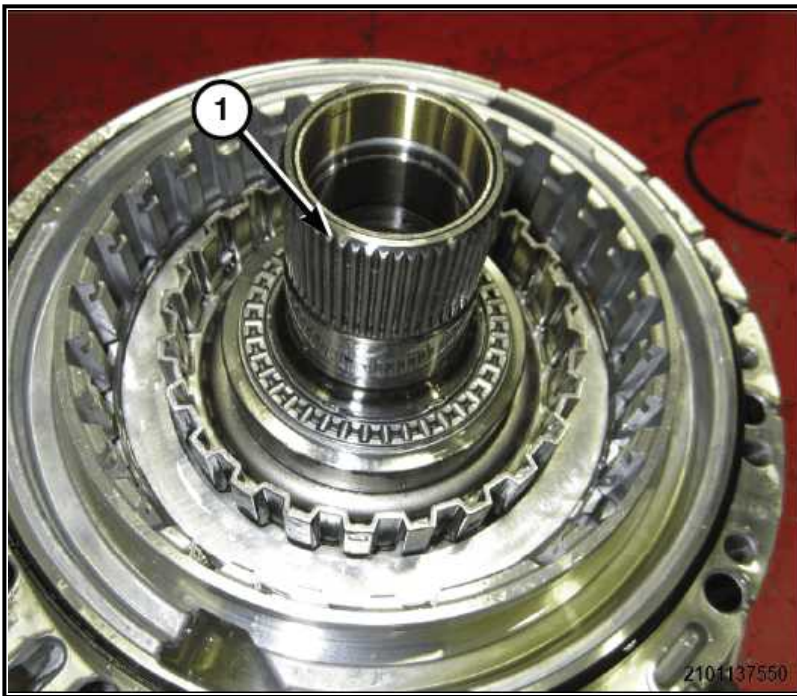


1 - A Clutch Snap Ring

2 - A Clutch Elements

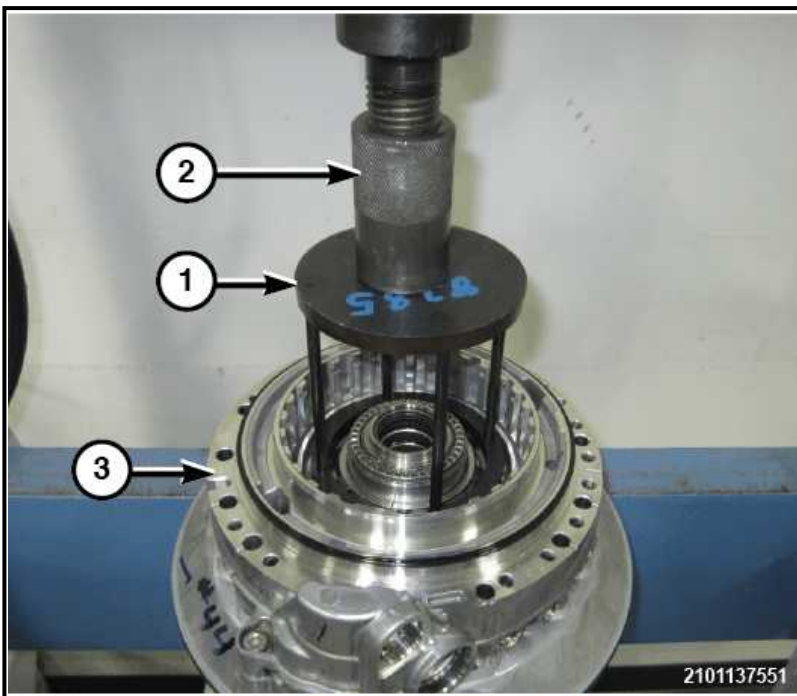
27. Remove the A clutch snap ring.

28. Remove the A clutch elements.



1 - Hub

29. Remove the hub.



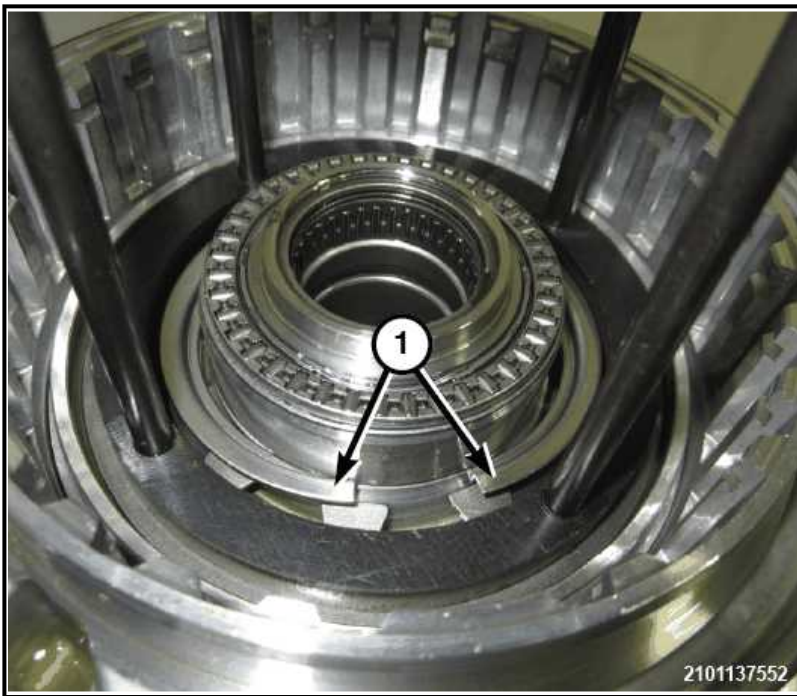
1 - Compressor, Spring 8285

2 - Arbor Press

3 - Oil Pump Housing Assembly

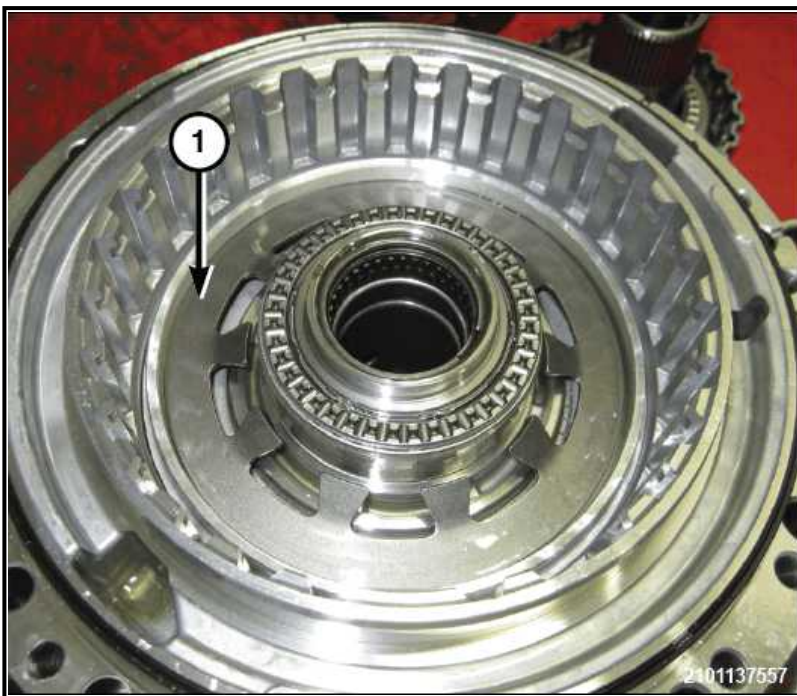
30. Position the oil pump housing assembly in a suitable arbor press.

31. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retaining ring to remove tension.



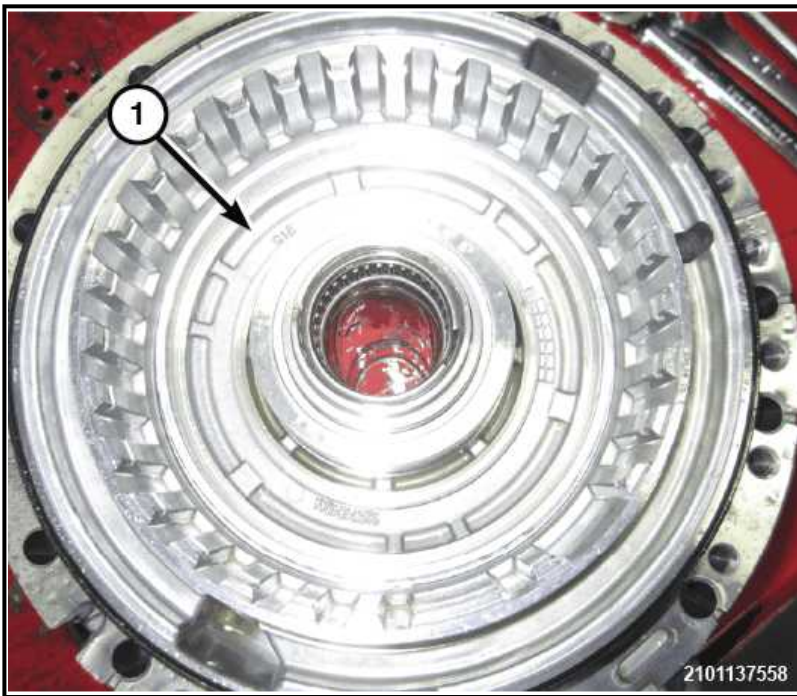
1 - Retainer Halves

32. Remove the retainer halves from the clutch housing.



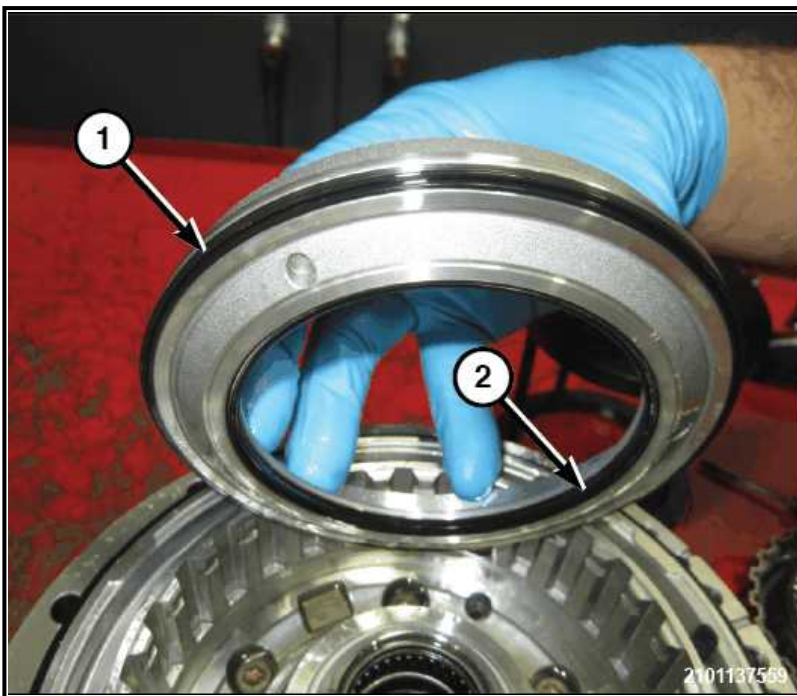
1 - A Clutch Belleville Spring

33. Remove the A clutch belleville spring.



1 - A Clutch Piston

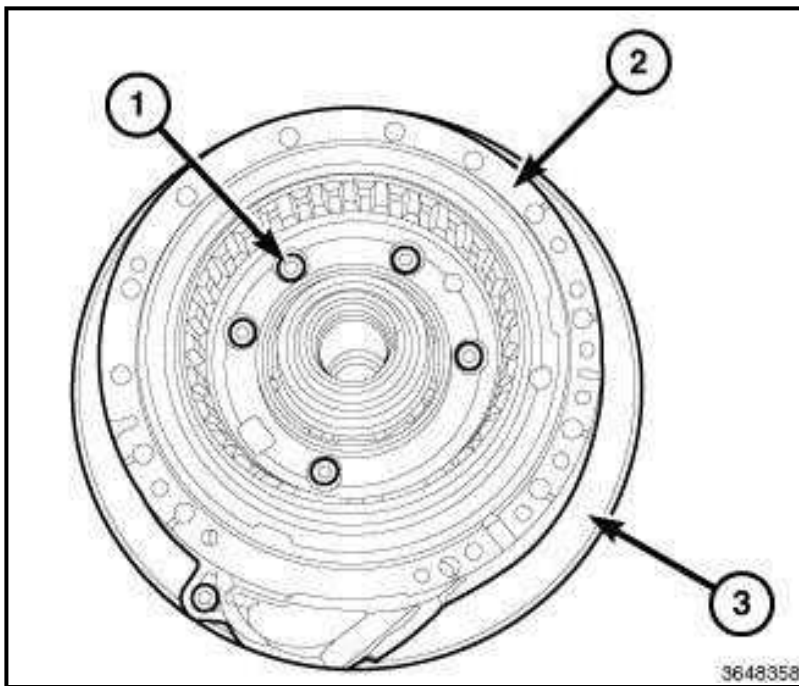
34. Remove the A clutch piston (1) by rotating and gently lifting.



1 - A Clutch Piston Inner Piston Seal

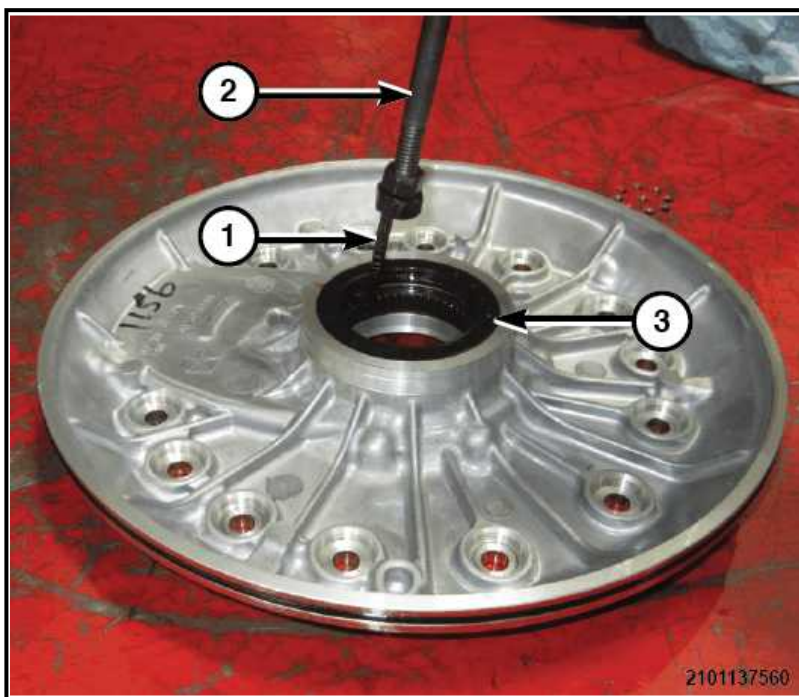
2 - A Clutch Piston Outer Piston Seal

35. Inspect the inner and outer A clutch piston seals for wear or damage and replace as necessary.



1 - Oil Pump Housing Bolts
2 - Oil Pump Housing
3 - Oil Pump Cover

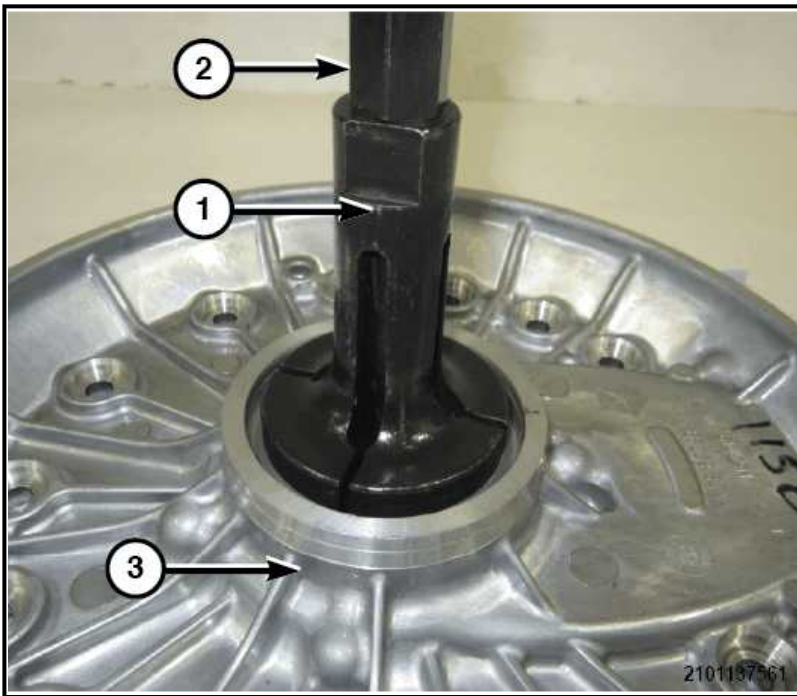
36. Remove the bolts and separate the oil pump housing from the oil pump cover.



1 - Remover, Seal 9667
2 - Slide Hammer C-3752
3 - Torque Converter Oil Seal

37. Using (special tool #9667, Remover, Seal) and (special tool #C-3752, Slide Hammers), remove the torque converter oil seal from the front pump cover.

38. Remove the snap ring.

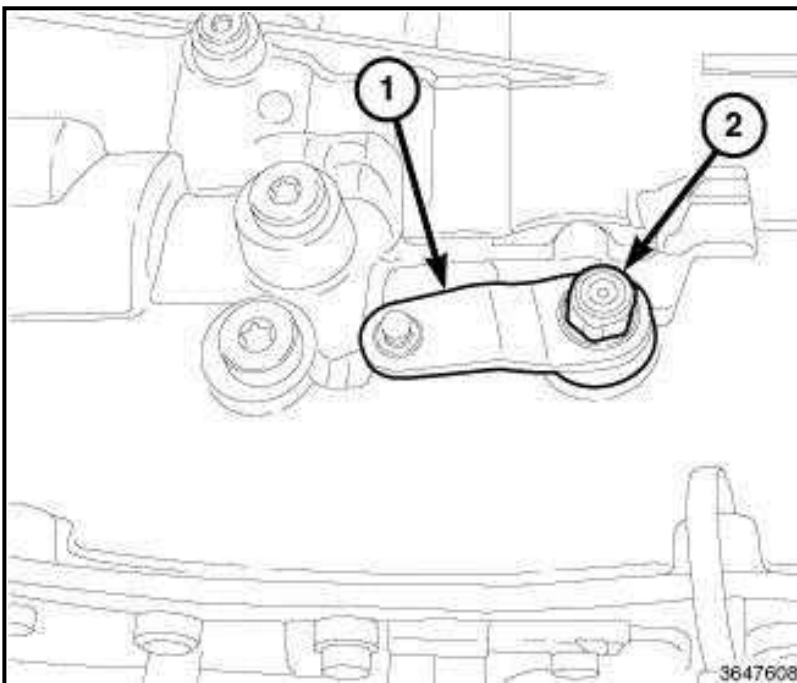


1 - Remover, Bearing Cup 6787A

2 - Slide Hammer C-3752

3 - Needle Bearing

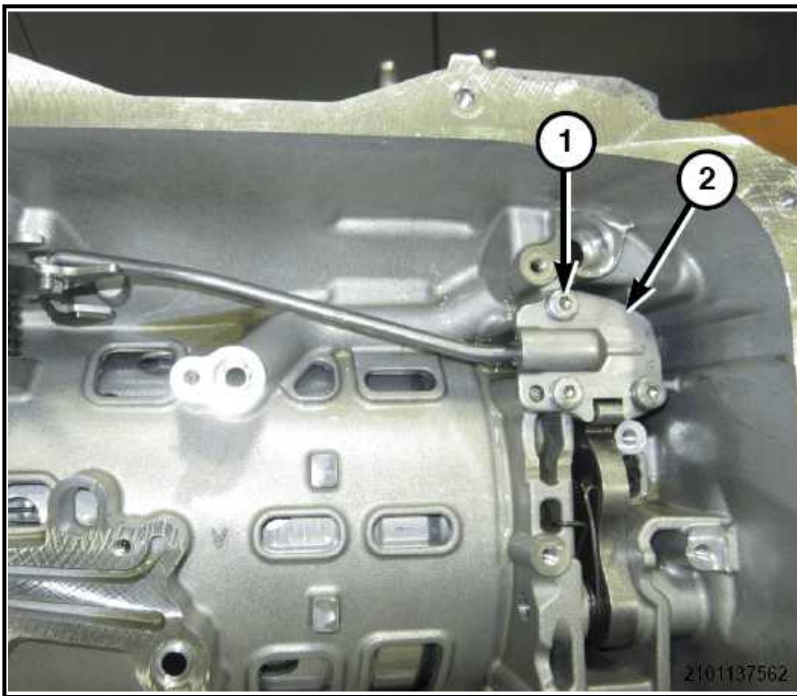
39. Using (special tool #6787A, Remover, Bearing Cup) and (special tool #C-3752, Slide Hammers), remove the needle bearing from the front cover.
40. Remove the front pump needle bearing snap ring.
41. Using (special tool #9585, Remover, Bearing Cup) and (special tool #C-637, Slide Hammer, Universal) remove the front pump needle bearing.



1 - Manual Park Release Lever

2 - Manual Park Release Lever Nut

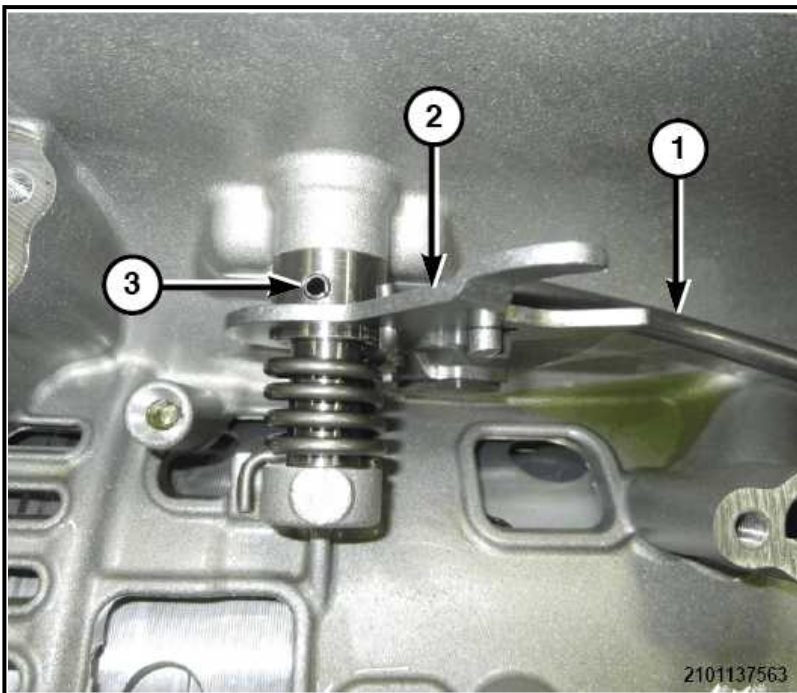
42. Remove the manual park release lever nut and remove the lever.



1 - Pawl Lock Rod Guide Plate Bolts

2 - Pawl Lock Rod Guide Plate

43. Remove the park pawl lock rod guide plate bolts and remove the plate.



1 - Park Pawl Lock Rod

2 - Manual Park Release Lever Assembly
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3 - Manual Park Release Lever Roll Pin
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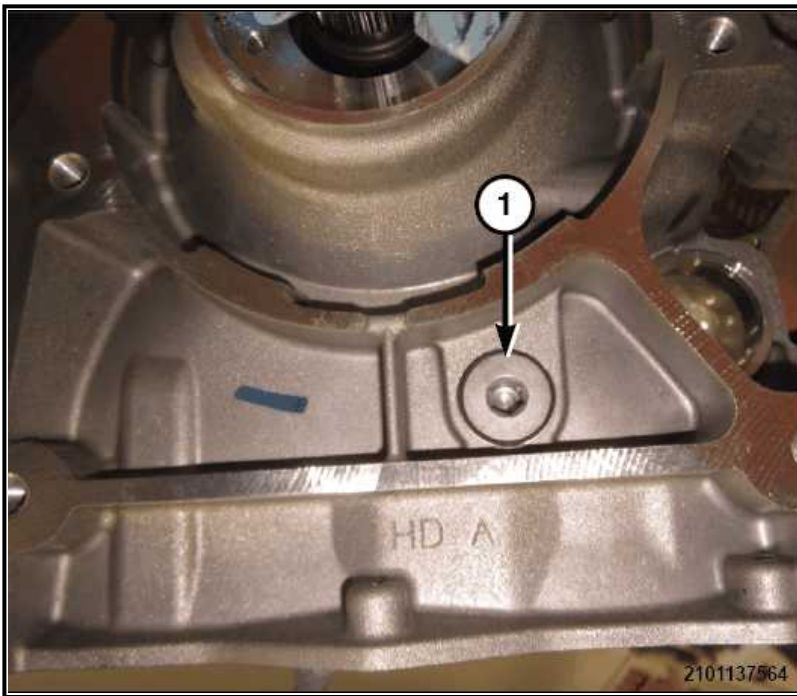
44. Remove the park pawl lock rod from the fork.

NOTE: Pay attention to the spring position for installation.

45. Remove the manual park release lever roll pin using a suitable pin punch.

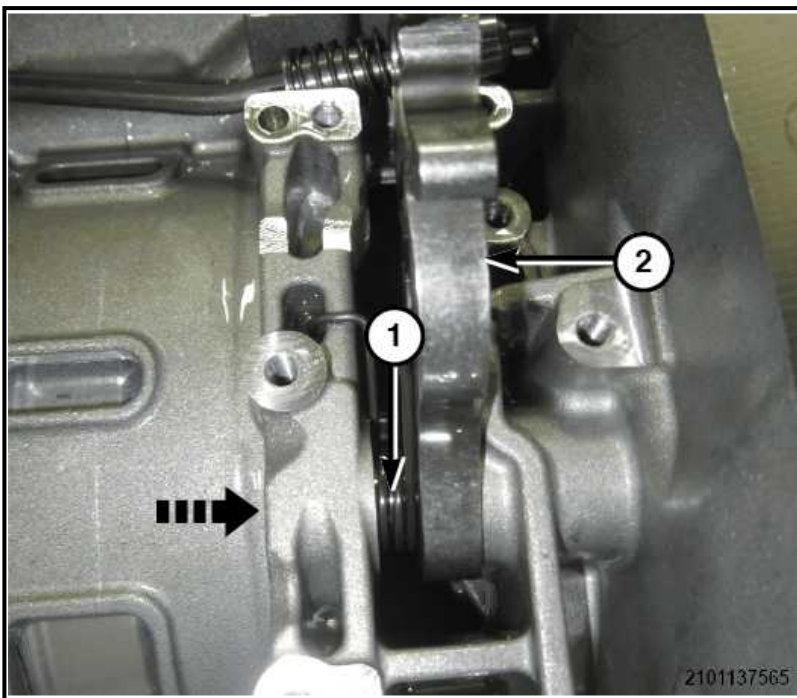
46. Remove the shaft, spring and manual park release lever assembly from the case.

47. Remove the manual park release shaft seal using a small screwdriver or equivalent.



1 - Park Pawl Shaft Plug

48. Remove the park pawl shaft plug from the rear of the case.



1 - Park Pawl Spring

2 - Park Pawl

NOTE: Pay attention to the spring position for installation.

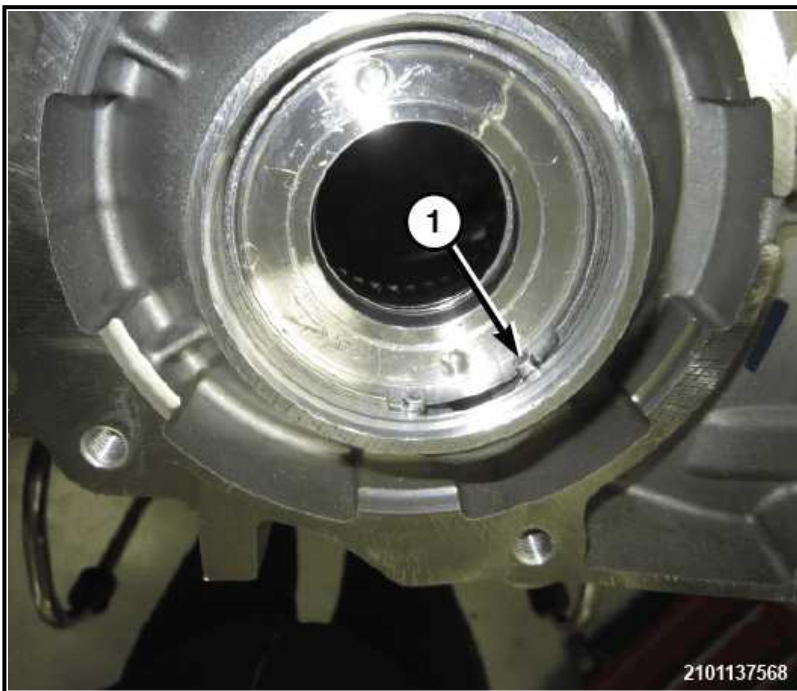
49. Remove the park pawl shaft using a suitable pin punch (Notation arrow for location and drive-out direction), remove the park pawl and park pawl spring.



1 - P4 Annulus Drum Assembly

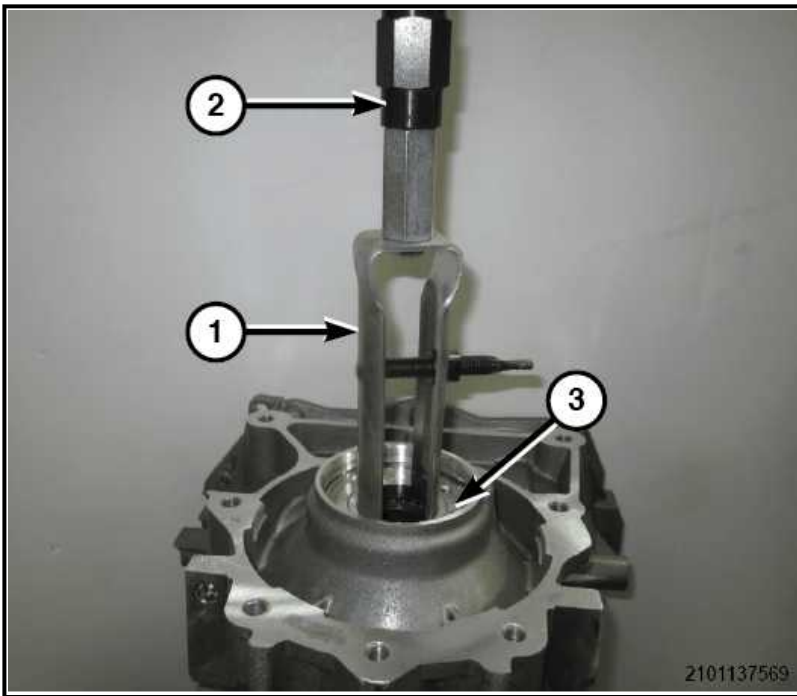
NOTE: The transmission must be in a vertical position before the main stack is removed, so damage to the drums do not occur.

50. Remove the input/output shaft and P4 annulus drum assembly from the case.



1 - Output Shaft Bearing Cup Snap Ring

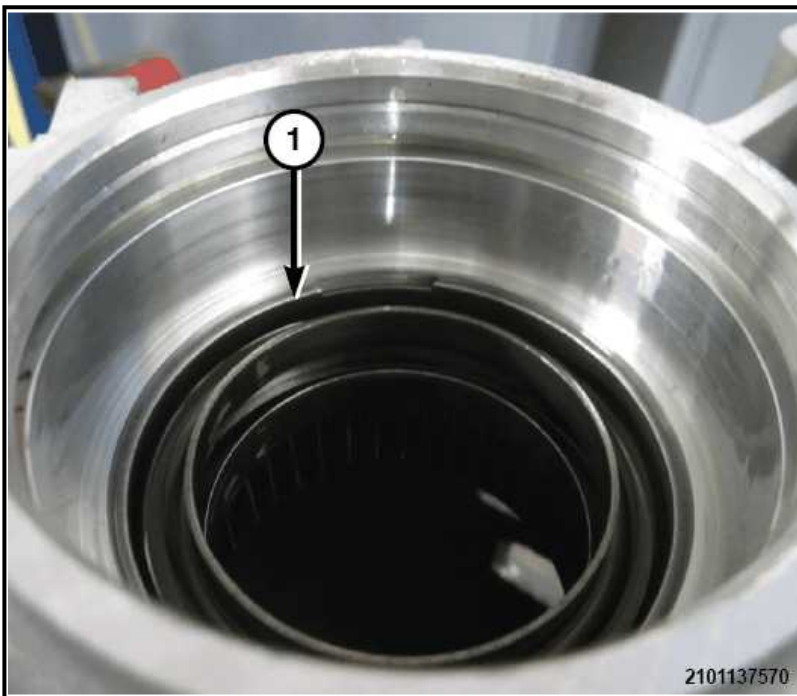
51. Remove the output shaft bearing cup snap ring.



1 - Remover, Bearing Cup 9664
2 - Slide Hammer, Universal C-637
3 - Output Shaft Bearing Cup

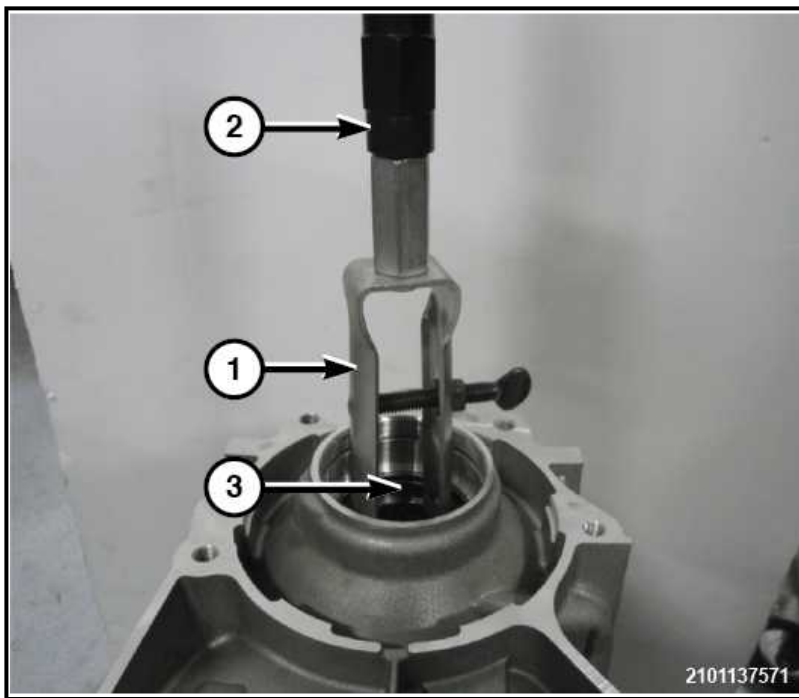
NOTE: 4X4 shown, RWD similar.

52. Using (special tool #9664, Remover, Bearing Cup) and (special tool #C-637, Slide Hammer, Universal), remove the output shaft bearing cup.



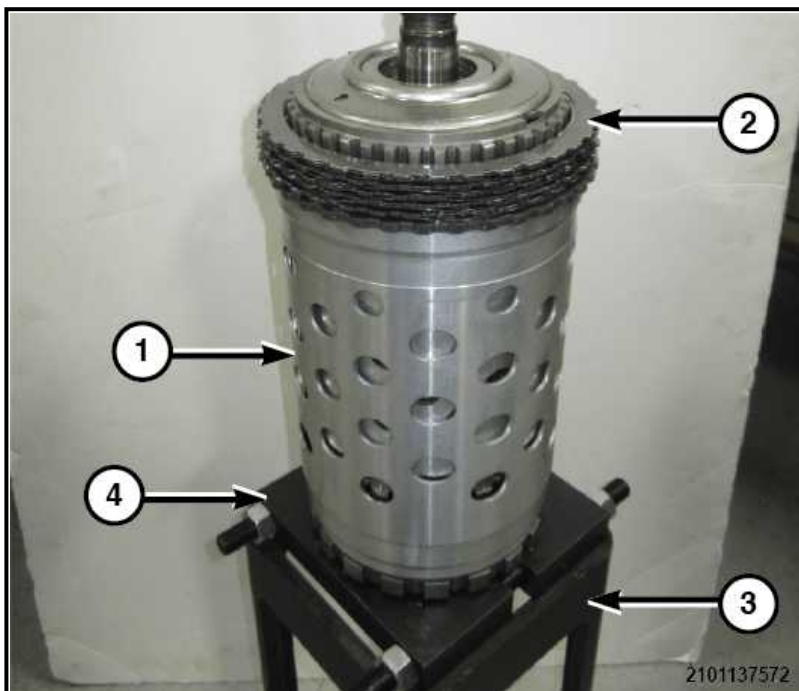
1 - Output Shaft Oil Dam Snap Ring

53. Remove the output shaft oil dam snap ring.



- | |
|-----------------------------------|
| 1 - Remover, Bearing Cup 9664 |
| 2 - Slide Hammer, Universal C-637 |
| 3 - Output Shaft Oil Dam |

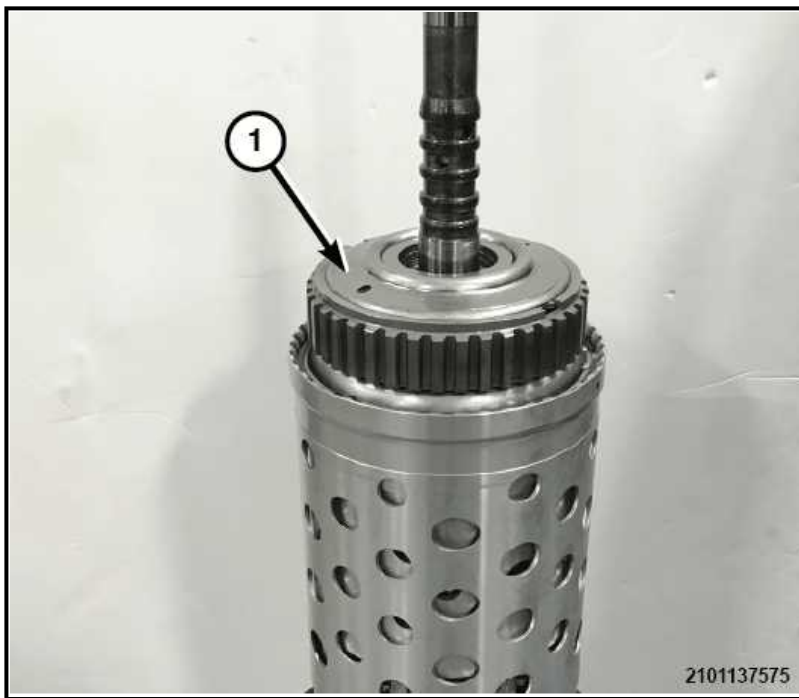
54. Using (special tool #9664, Remover, Bearing Cup) and (special tool #C-637, Slide Hammer, Universal), remove the output shaft oil dam.



- | |
|---|
| 1 - Input/Output Shaft And P4 Annulus Drum Assembly |
| 2 - B Clutch Pack |
| 3 - Assembly, Press Fixture 8925-3 |
| 4 - Splitter, Bearing/Gear 1130 |

55. Position the input/output shaft and P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) and (special tool #1130, Splitter, Bearing/Gear).

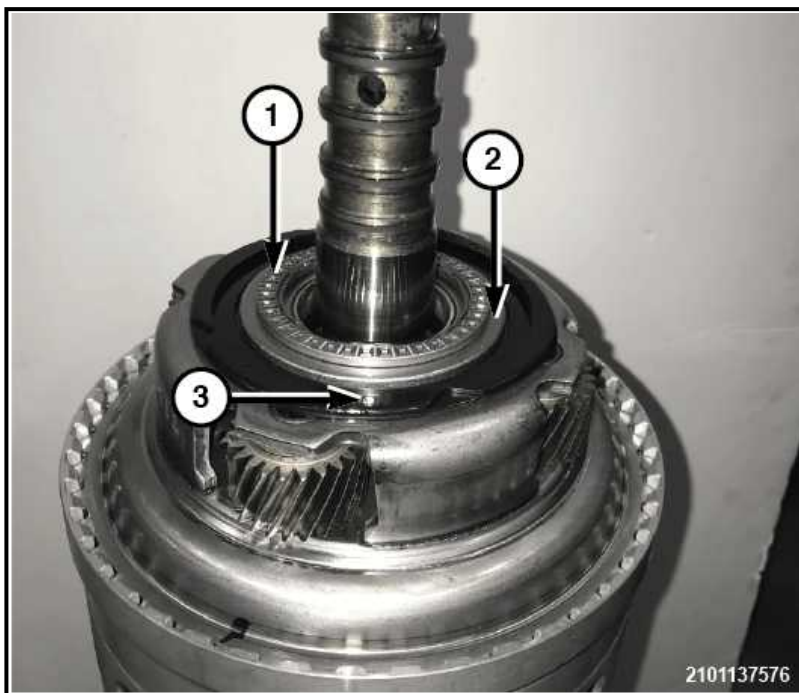
56. Remove the B clutch pack.



1 - P1 Annulus/B Clutch Hub Assembly

57. Remove the O-ring and five squared O-rings from the input shaft.

58. Remove the P1 annulus/B clutch hub assembly from the P4 annulus drum.



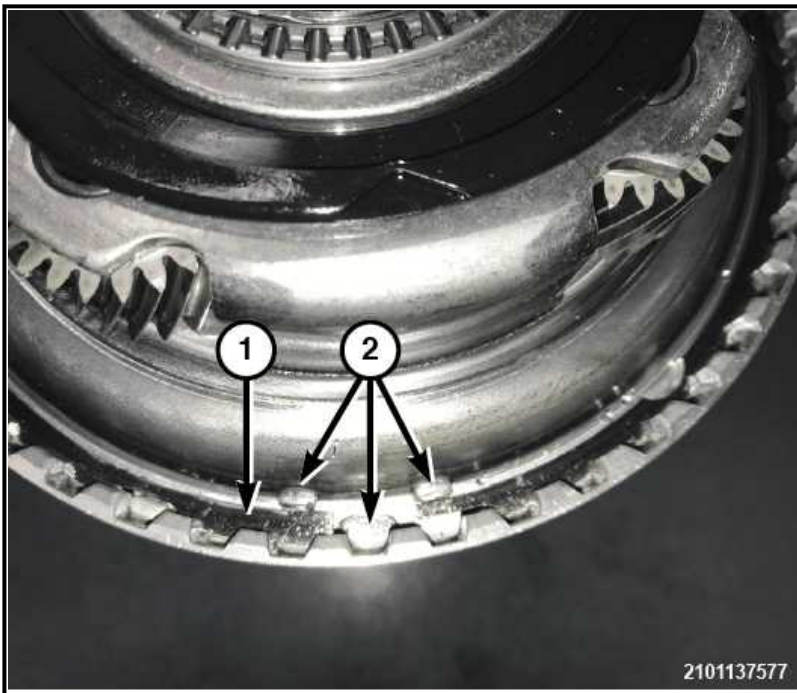
1 - Thrust Bearing

2 - Thrust Bearing Holding Plate

3 - Selectable Shim

59. Remove the selectable shim from the P1 annulus/B clutch hub.

60. Remove the thrust bearing and holding plate from the P1 planetary carrier.



1 - Snap Ring
2 - Snap Ring Openings

NOTE: The (special tool #10378, Rings, Support) are three pieces intended to be used in multiple locations around the drum to prevent damage from prying.

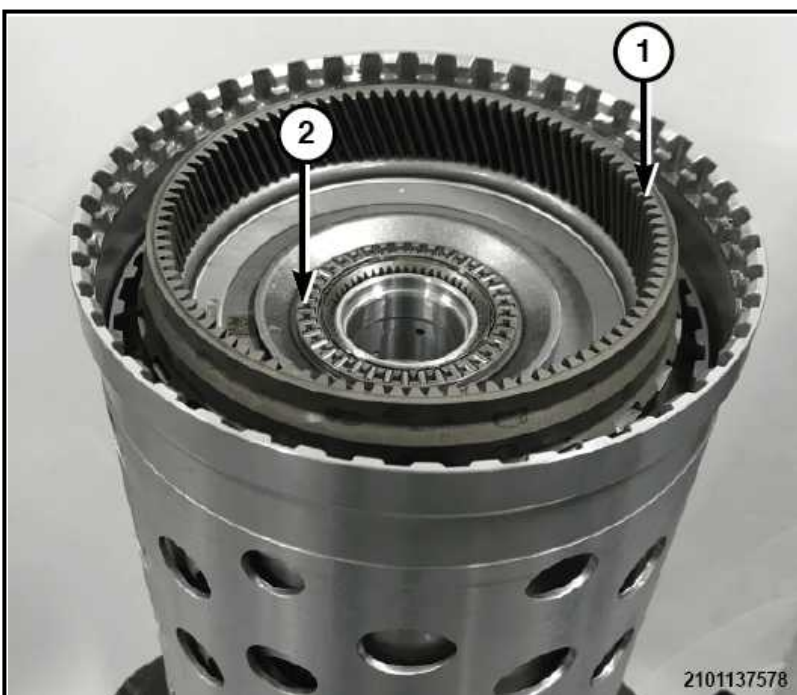
61. Position the (special tool #10378, Rings, Support) on the P4 annulus drum assembly to protect the drum.

NOTE: Pry the snap ring from the opposite side of the snap ring openings to release.

NOTE: When the snap ring is removed the internal clutch drum may drop slightly.

62. Using a suitable tool release the snap ring by prying in and up from the opposite side of the snap ring openings.

63. Remove the P1 planetary carrier.

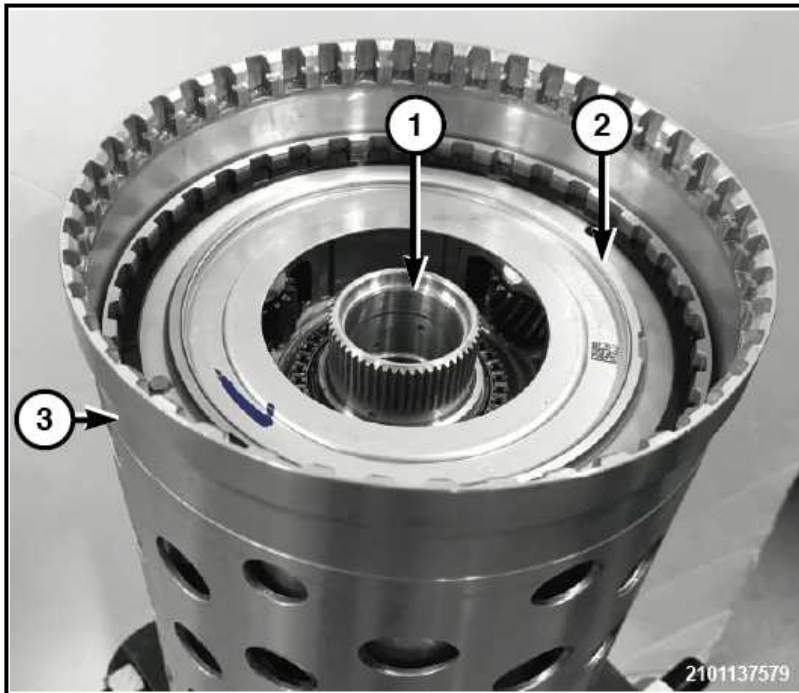


1 - Input Shaft With P2 Planetary Carrier

2 - Thrust Bearing And Washer

64. Remove the input shaft with P2 planetary carrier from the drum assembly.

65. Remove the thrust bearing and washer.



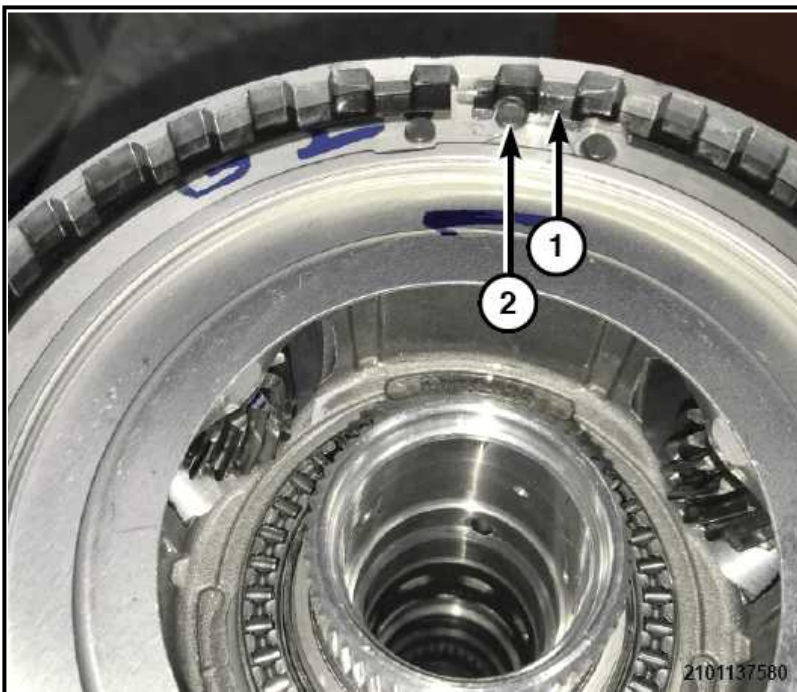
1 - P2 Annulus/P3 Sun Gear

2 - D Clutch Drum

3 - P4 Annulus Drum

66. Remove the P2 annulus/P3 sun gear from the drum assembly.

67. Remove the D clutch drum from the P4 annulus drum.



1 - P3 Planetary Carrier Snap Ring

2 - P3 Planetary Carrier

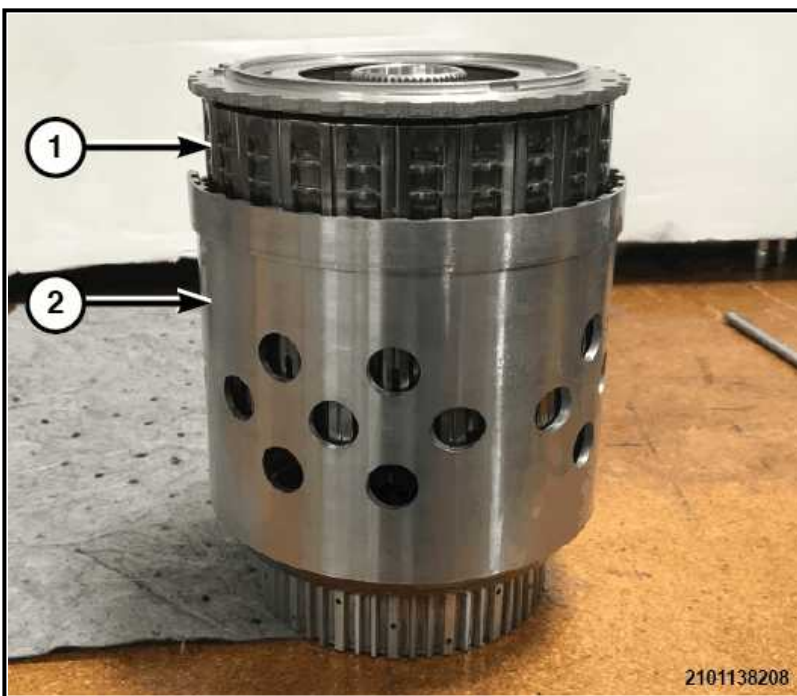
NOTE: The (special tool #10378, Rings, Support) are three pieces intended to be used in multiple locations around the drum to prevent damage from prying.

68. Position the (special tool #10378, Rings, Support) on the P4 annulus drum assembly to protect the drum.
69. Using a suitable tool, release and remove the P3 planetary carrier snap ring holding down the P3 planetary carrier.



1 - P3 Planetary Carrier

70. Remove the P3 planetary carrier.
71. Remove the thrust bearing from the planetary carrier.



1 - P4 Sun Gear/C/E Clutch Retainer

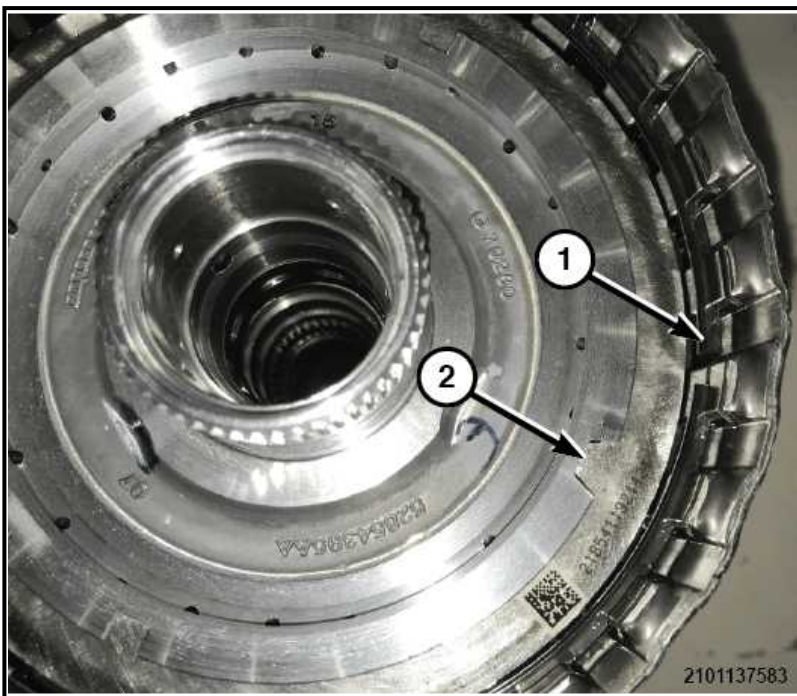
2 - D Clutch Drum

72. Remove the P4 sun gear/C/E clutch retainer from the D clutch drum.



1 - P4 Sun Gear/C/E Clutch Annulus Gear Snap Ring

73. Remove the P4 sun gear/C/E annulus gear snap ring and remove the annulus gear.



1 - P4 Sun Gear/C/E Clutch Retainer Snap Ring

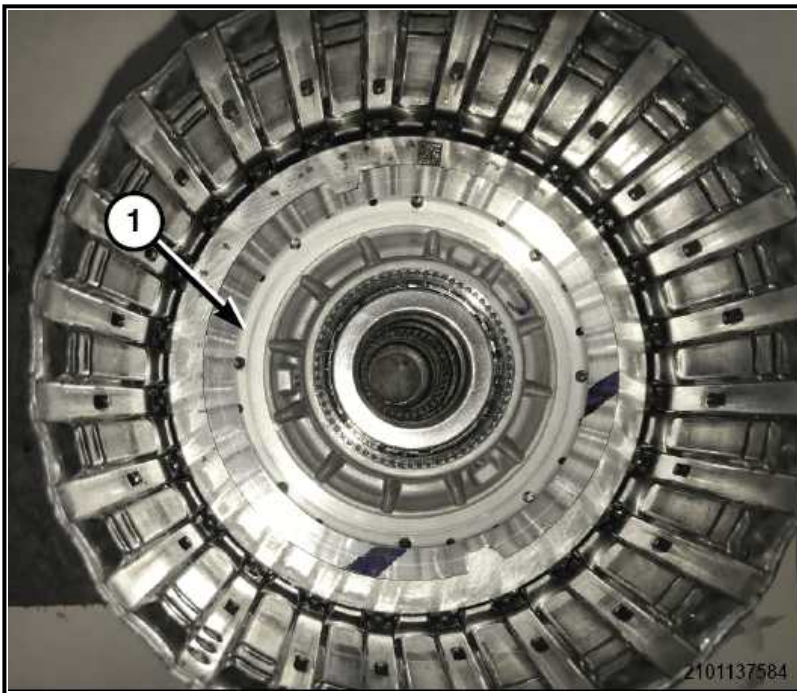
2 - E Clutch

74. Remove the P4 sun gear/C/E clutch retainer snap ring.

75. Remove the E clutch from the P4 sun gear/C/E clutch retainer.

76. Remove the thrust bearing from the E clutch.

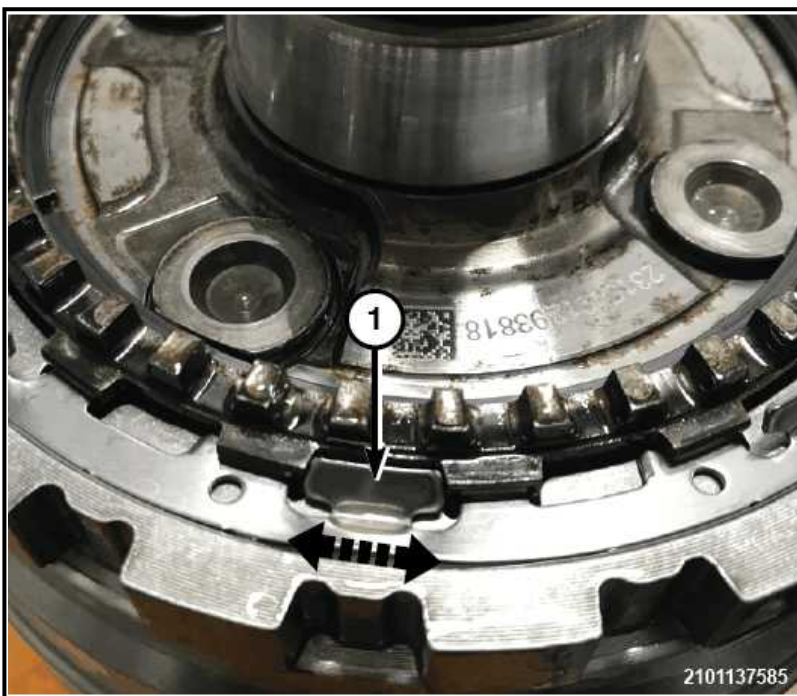
NOTE: Thrust bearing may stick to sun gear upon removal.



1 - C-Clutch

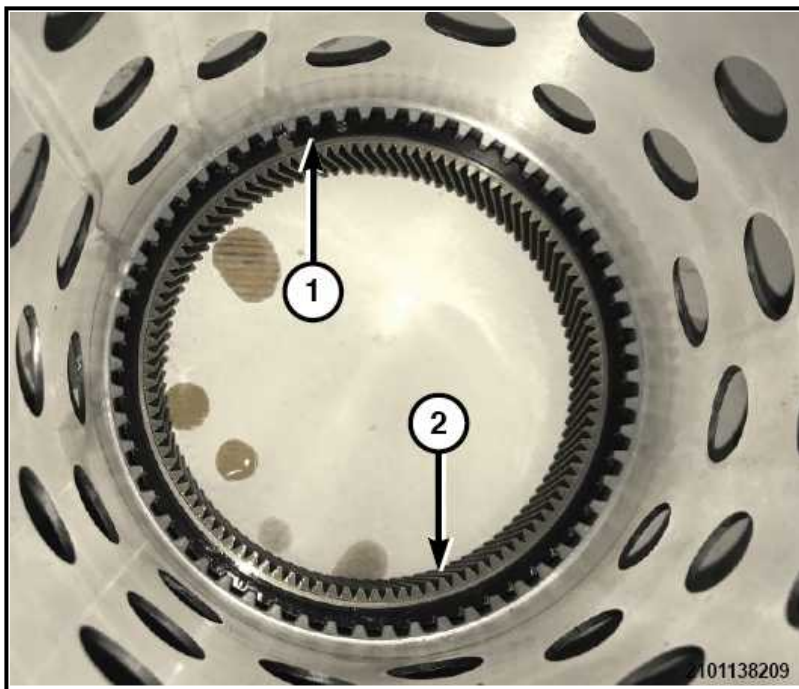
NOTE: The E clutch and C clutch are similar. The C clutch hub is removable and has six friction plates.

- 77. Remove the C clutch from the P4 sun gear/C/E clutch retainer.
- 78. Remove the bearings from the top and bottom of the C clutch.



1 - P4 Planetary Carrier/Output Shaft Lock Ring Locking Tabs

- 79. Remove the P4 planetary carrier/output shaft lock ring from the P4 annulus drum by gently prying the locking tabs open and turning the lock ring to center the locating tabs in the output shaft tab openings. Discard the lock ring and install a **NEW** lock ring during assembly.



1 - Snap Ring
2 P4 Annulus

80. Remove the snap ring from the P4 annulus drum.

81. Remove the P4 annulus from the P4 annulus drum.

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in ELECTROSTATIC DISCHARGE SENSITIVE DEVICES. Failure to follow these instructions may result in damage to the TCM/TCMA.

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TCM Adaptation Procedure. Refer to MODULE, TRANSMISSION CONTROL (TCM), MODULE PROGRAMMING.

8HP50 - ASSEMBLY

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

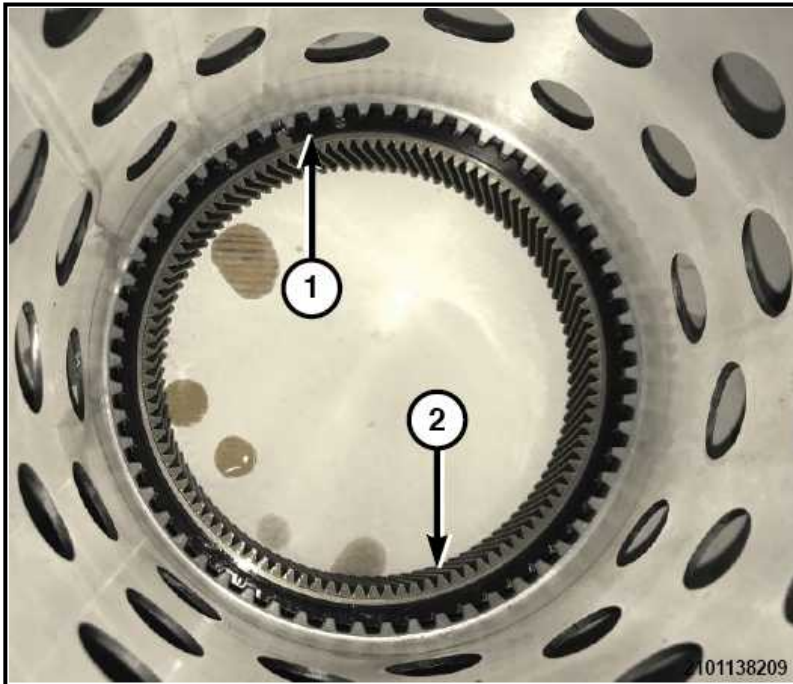
CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in ELECTROSTATIC DISCHARGE SENSITIVE DEVICES. Failure to follow these instructions may result in damage to the TCM/TCMA.

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TCM Adaptation Procedure. Refer to MODULE, TRANSMISSION CONTROL (TCM), MODULE PROGRAMMING.

ASSEMBLY

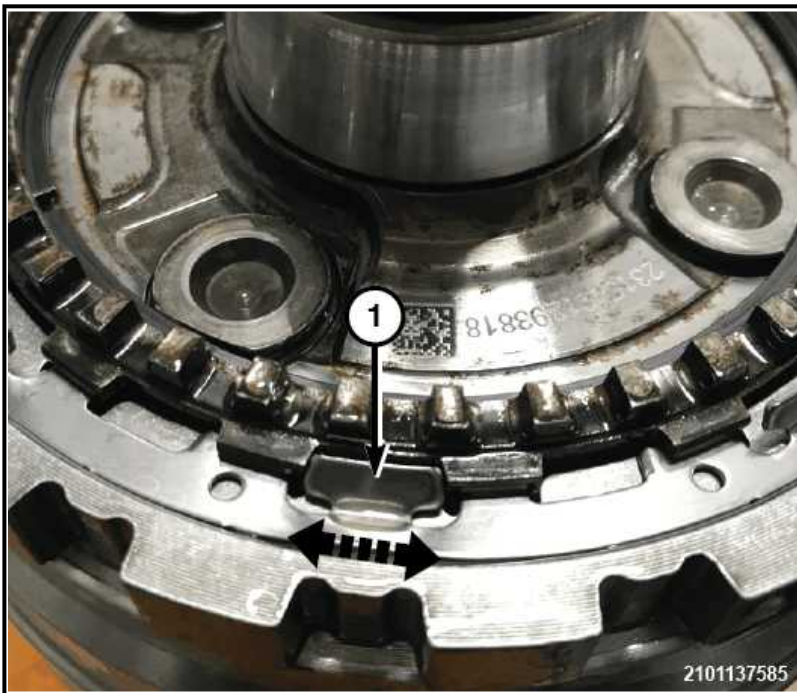
NOTE:

During assembly, torque the fasteners to the specifications in the torque table below.



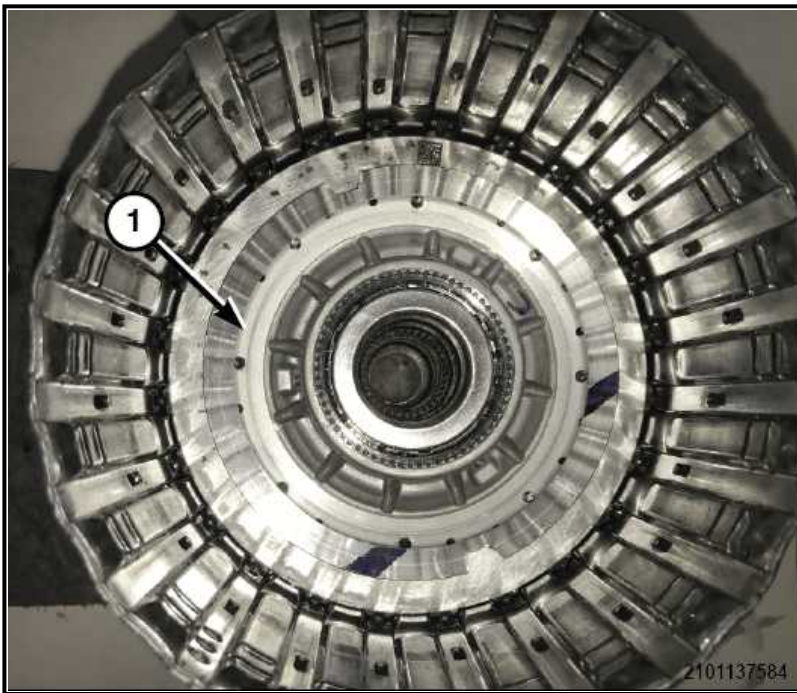
- | |
|----------------|
| 1 - Snap Ring |
| 2 - P4 Annulus |

1. Insert the P4 annulus into the P4 annulus drum.
2. Install the snap ring into the P4 annulus drum.



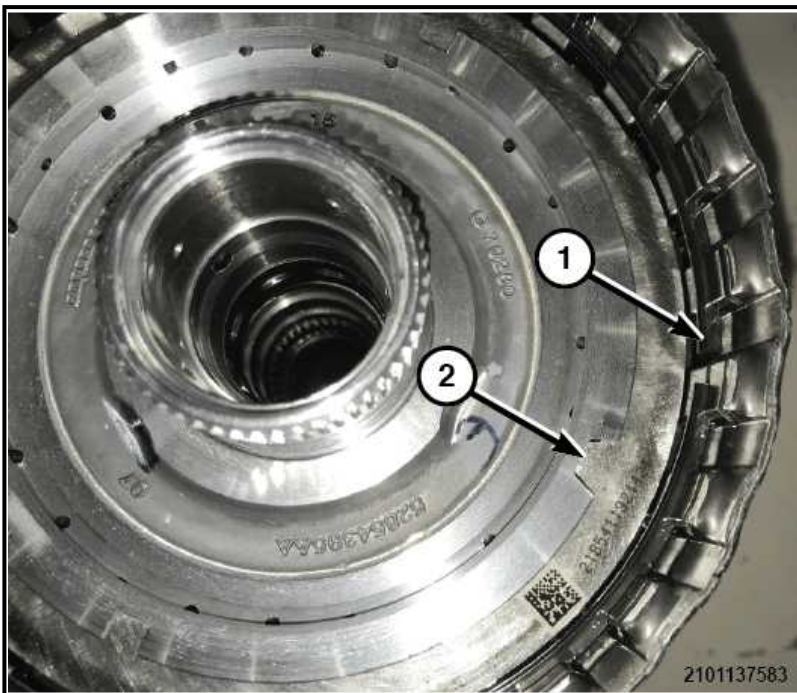
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|---|
| 1 - P4 Planetary Carrier/Output Shaft Lock Ring |
|---|

3. Install the **NEW** P4 planetary carrier/output shaft lock ring from the P4 annulus drum by turning the lock ring to center the lock ring tabs in the output shaft tab openings and gently staking the locking tabs closed.



1 - Clutch C

4. Position the bearings on the top and the bottom of C clutch.
5. Install the C clutch into the P4 sun gear/C/E clutch retainer.



1 - Snap Ring

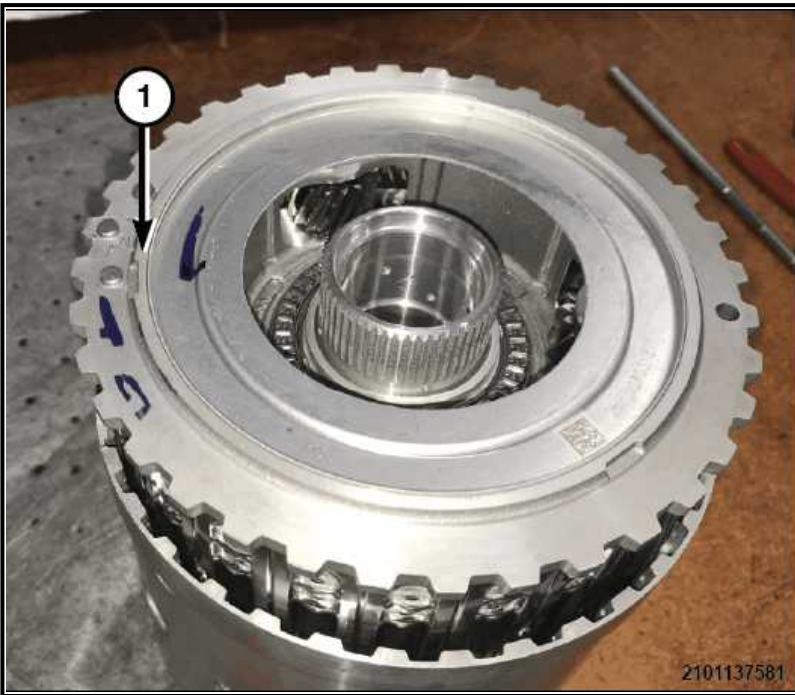
2 - Clutch E

6. Install the needle bearing onto the hub of the E clutch.
7. Install the E clutch into the P4 sun gear/C/E clutch retainer.
8. Install the snap ring into the P4 sun gear/C/E clutch retainer.



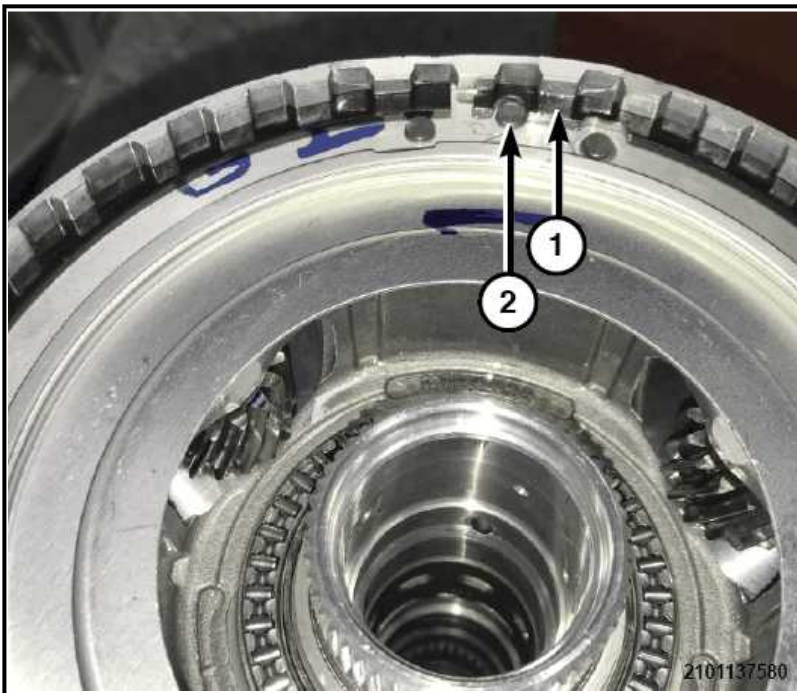
1 - Snap Ring

9. Install the P3 annulus ring into the P4 sun gear/C/E clutch retainer and install the snap ring.



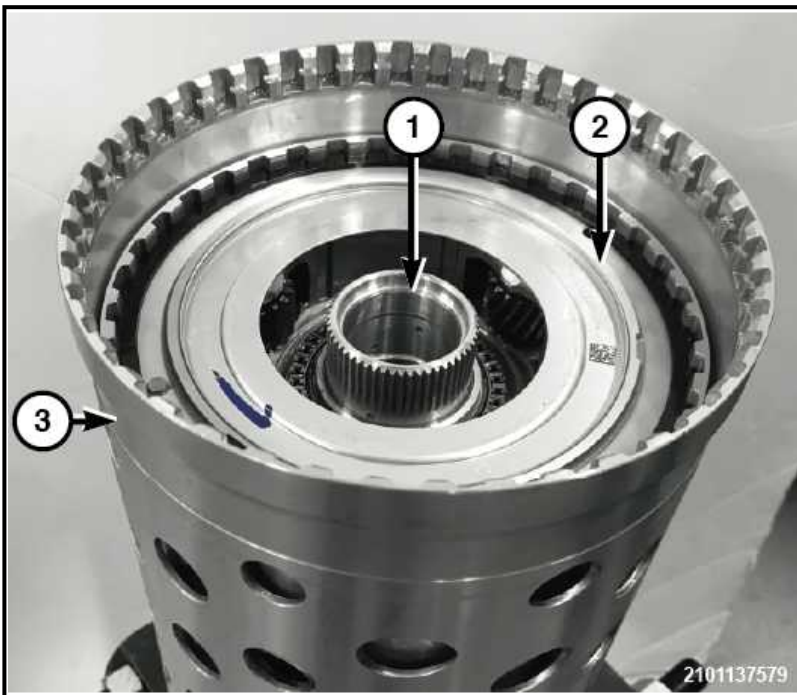
1 - P3 Planetary Carrier

10. Install the P4 sun gear/C/E clutch retainer into the D clutch drum.



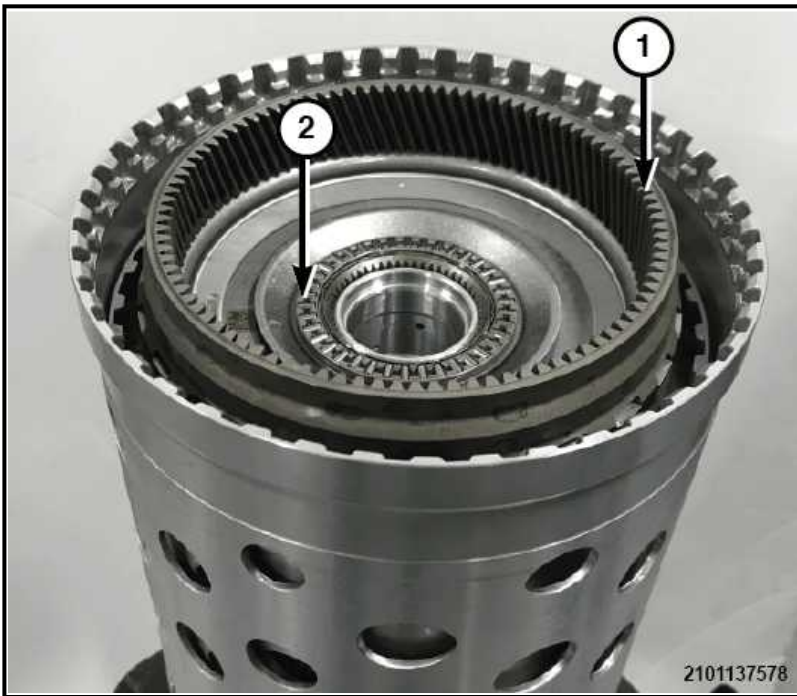
- | |
|--------------------------|
| 1 - Snap Ring |
| 2 - P3 Planetary Carrier |

11. Install the needle bearing onto the planetary carrier.
12. Install the P3 planetary carrier in the D clutch drum.
13. Install the snap ring and verify the relief on the snap ring is set in the locating pin.



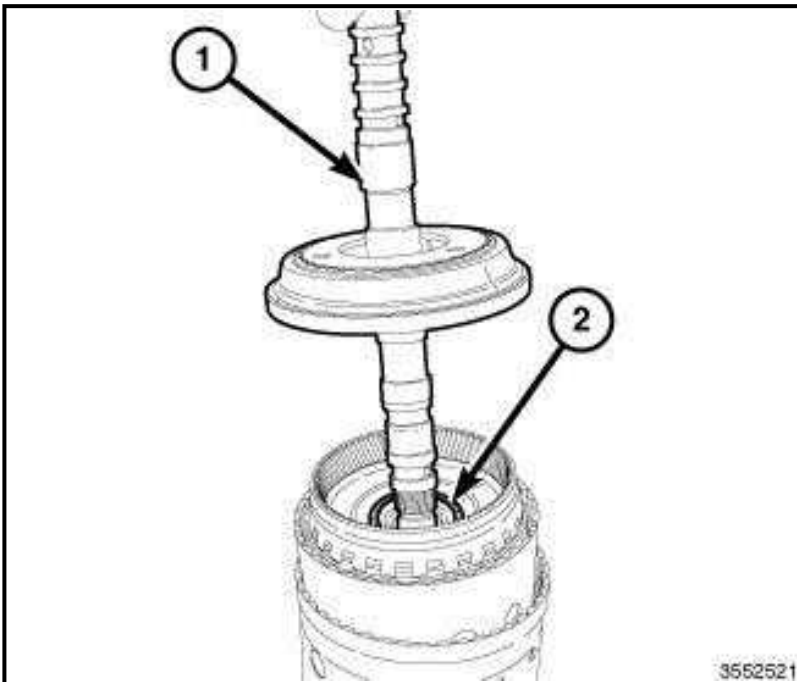
- | |
|----------------------------|
| 1 - P2 Annulus/P3 Sun Gear |
| 2 - Clutch D Drum |
| 3 - P4 Annulus Drum |

14. Install the D clutch drum into the P4 annulus drum.



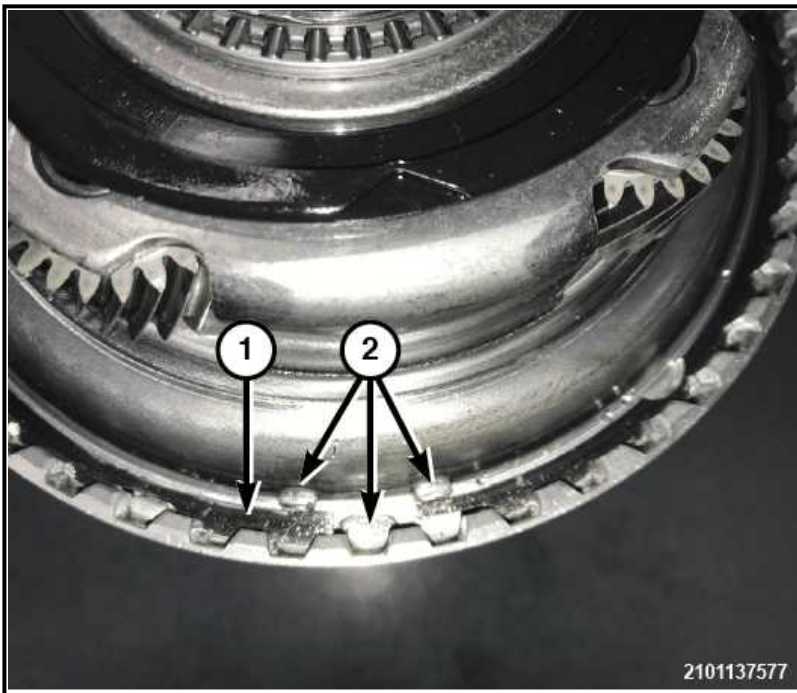
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|-------------------------------|
| 1 - P2 Annulus\P3 Sun Gear |
| 2 - Thrust Bearing and Washer |

15. Install the P2 annulus\P3 sun gear in the drum assembly.
16. Install the thrust bearing and washer.



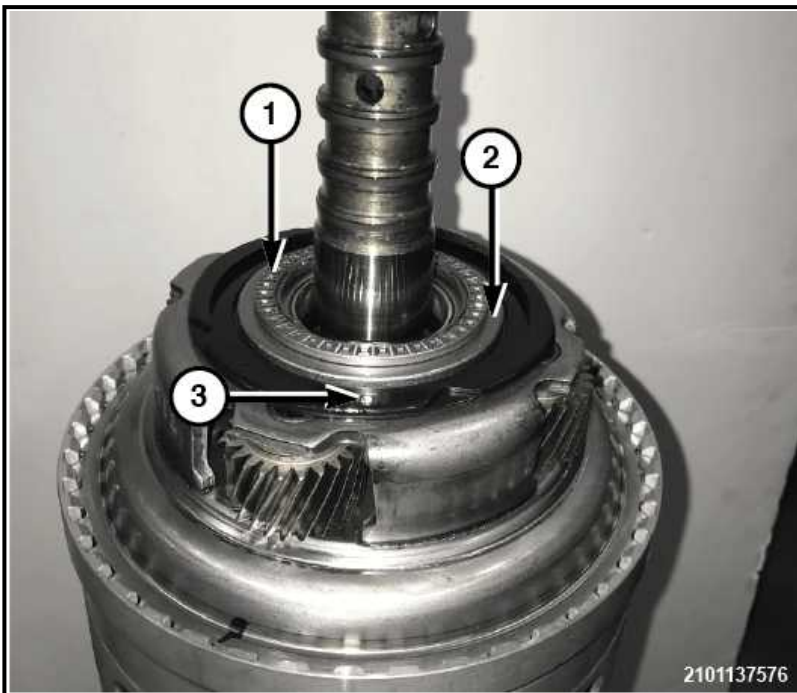
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|--------------------------|
| 1 - Input Shaft |
| 2 - P2 Planetary Carrier |

17. Install the input shaft with P2 planetary carrier into the drum assembly.



- | |
|-----------------------------|
| 1 - Snap Ring |
| 2 - Snap Ring Locating Tabs |

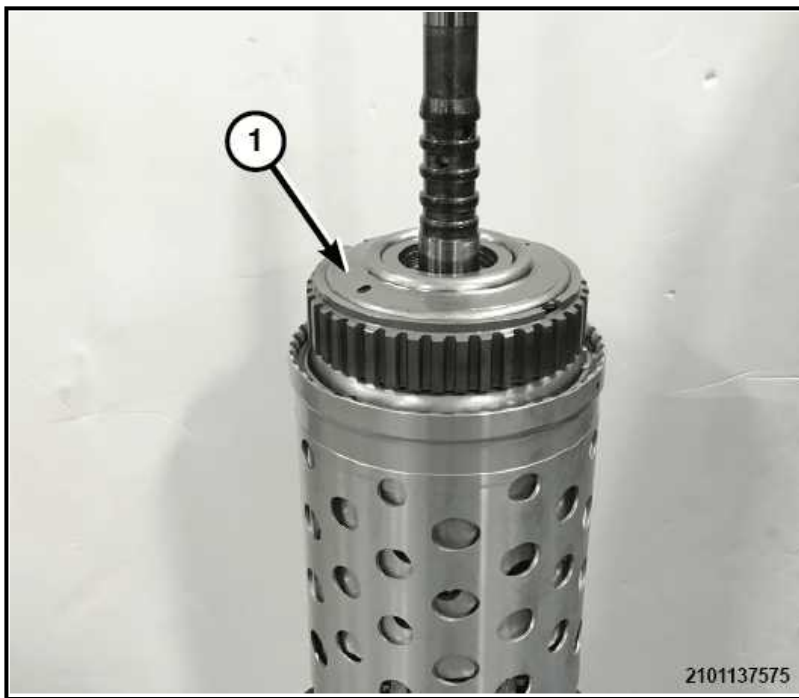
18. Install the snap ring in the orientation shown (snap ring will only install one way) with the locating tabs.



- | |
|---------------------|
| 1 - Thrust Bearing |
| 2 - Holding Plate |
| 3 - Selectable Shim |

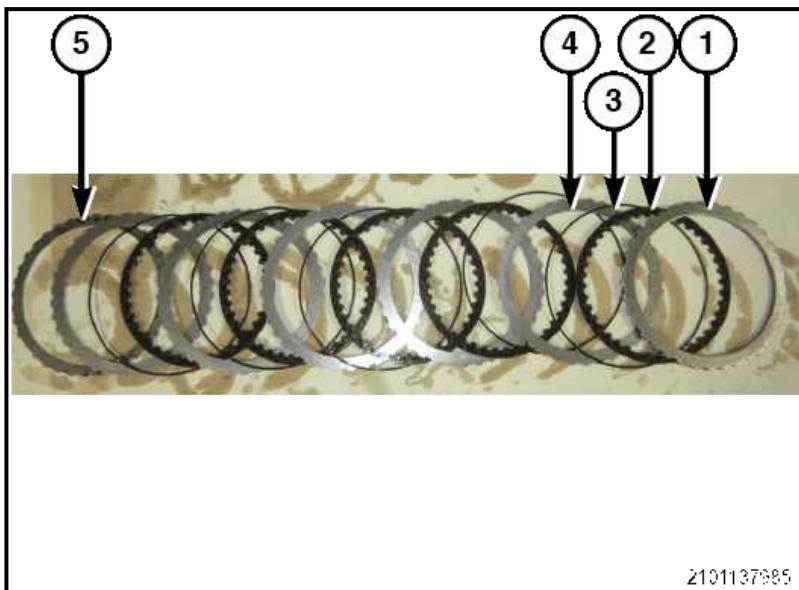
19. Install the thrust bearing and holding plate onto the P1 planetary carrier.

20. Install the selectable shim to the P1 annulus/B clutch hub.



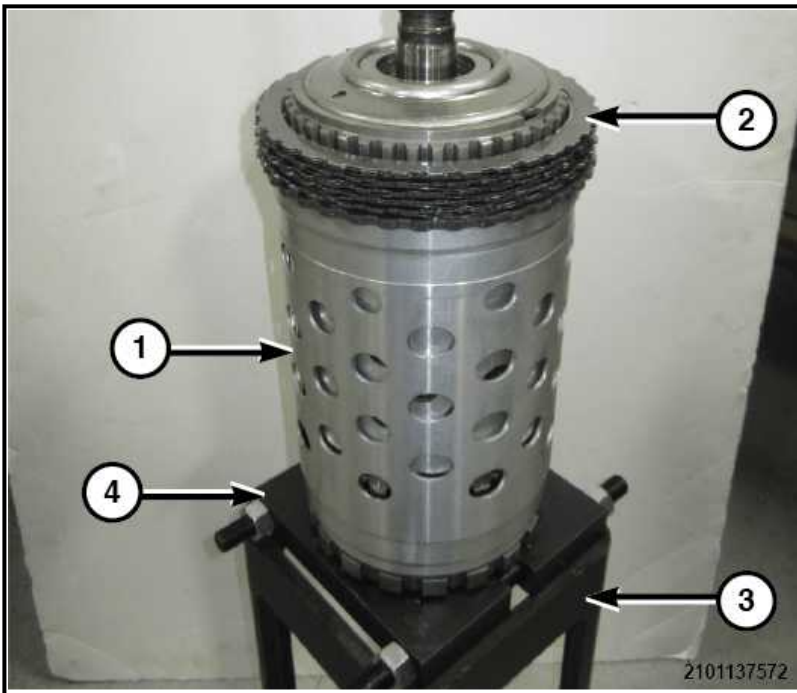
1 - P1 Annulus/Clutch B Hub Assembly

21. Install the P1 annulus\B clutch hub assembly onto the P4 annulus drum.
22. Install the O-ring and five squared O-rings.



- | |
|---------------------|
| 1 - Cover Plate |
| 2 - Friction Plates |
| 3 - Wave Springs |
| 4 - Steel Plates |
| 5 - Wave Plate |

23. The Clutch B, dependent on transmission Julian Date, may contain wave springs that sit around each fiber. There will be five friction plates (discs), five wave springs, five steel plates, one cover plate, one snap ring, and one wave plate (last plate far left in figure).



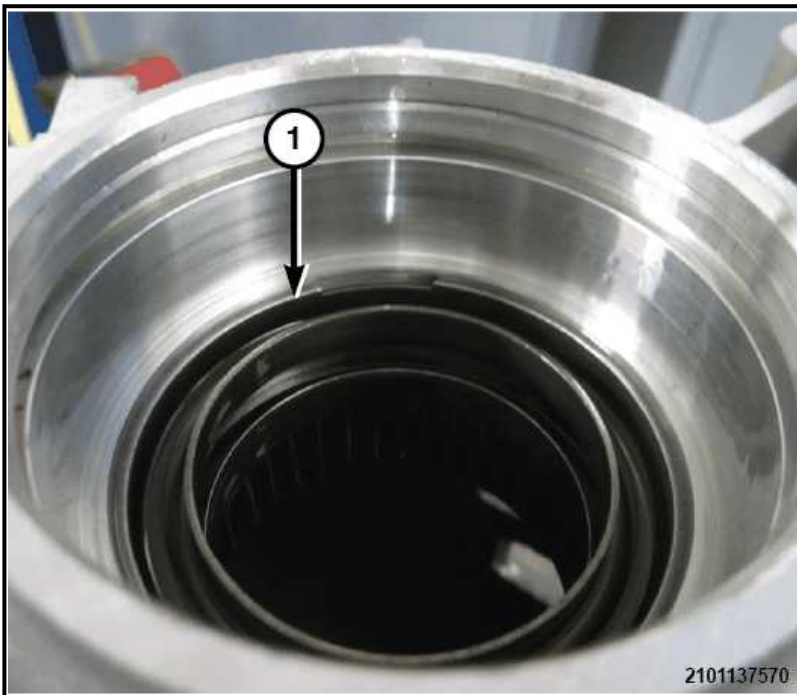
1 - Input/Output Shaft and P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

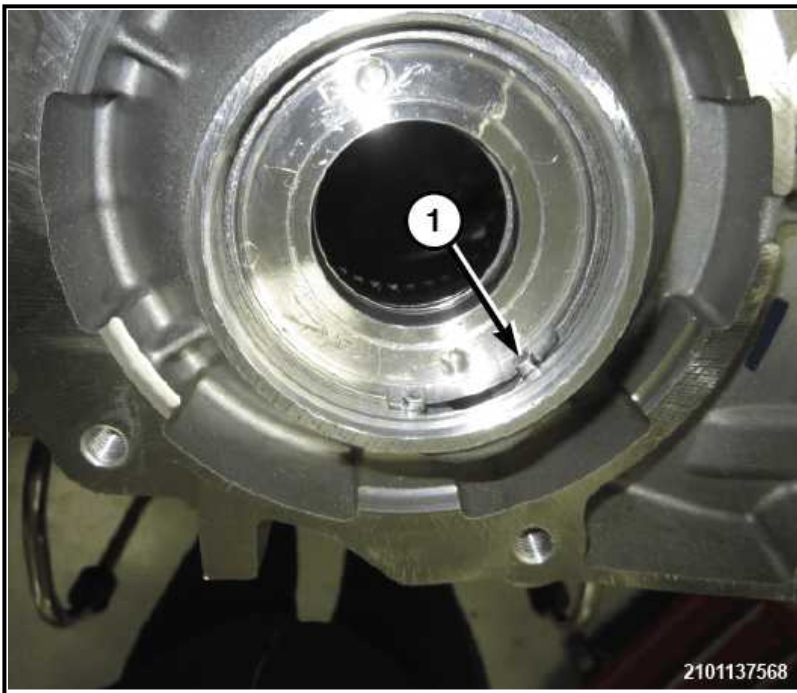
4 - Bearing/Gear Splitter

24. Install the Clutch B discs and plates.



1 - Output Shaft Oil Dam Snap Ring

25. Install the output shaft oil dam and the snap ring.



1 - Outer Bearing Cup Snap Ring

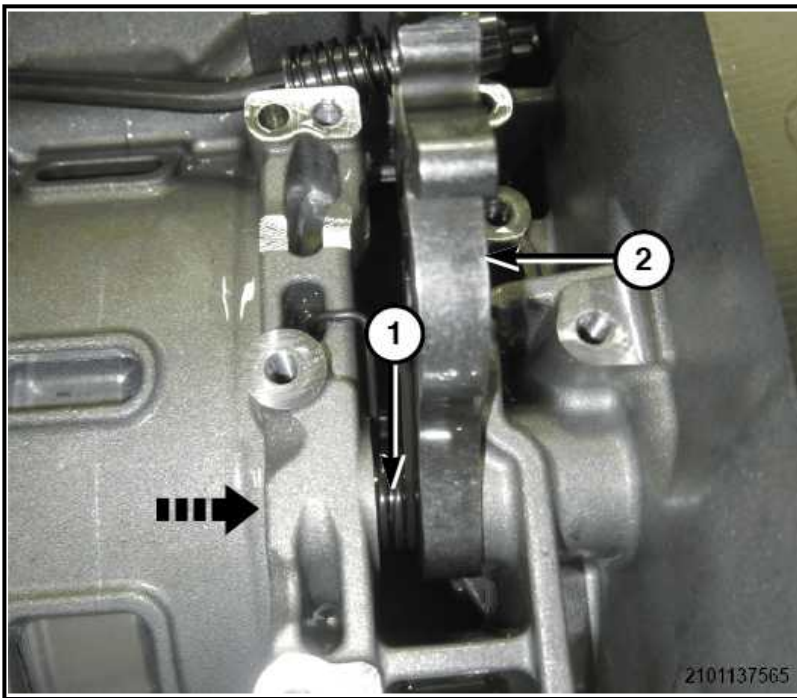
26. Install the needle bearing (AWD) or ball bearing (2WD).
27. Install the snap ring.



1 - Input/Output Shaft and P4 Annulus Drum Assembly

NOTE: The transmission must be in a vertical position when installing the main stack, so damage to the drums does not occur.

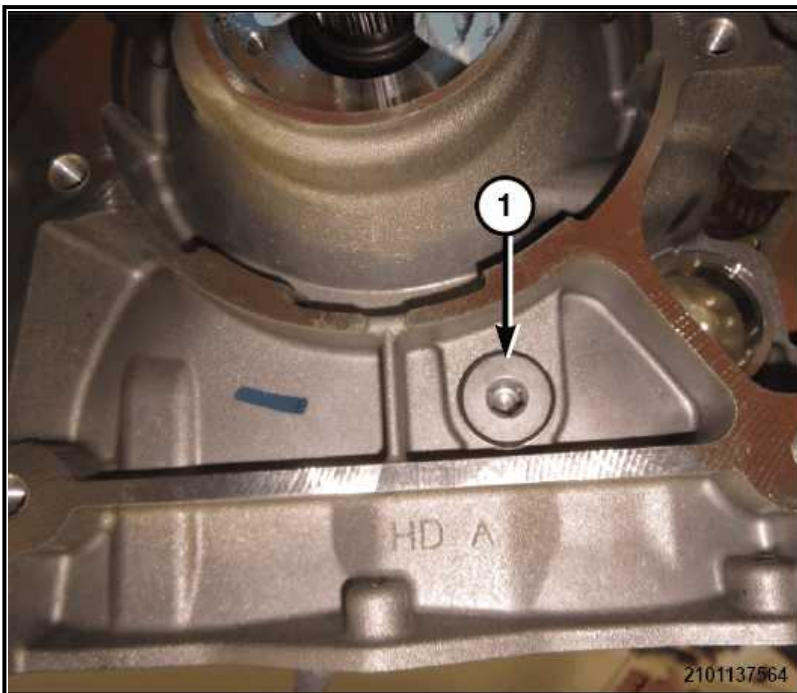
28. Install the input/output shaft and P4 annulus drum assembly into the case.



1 - Park Pawl Spring

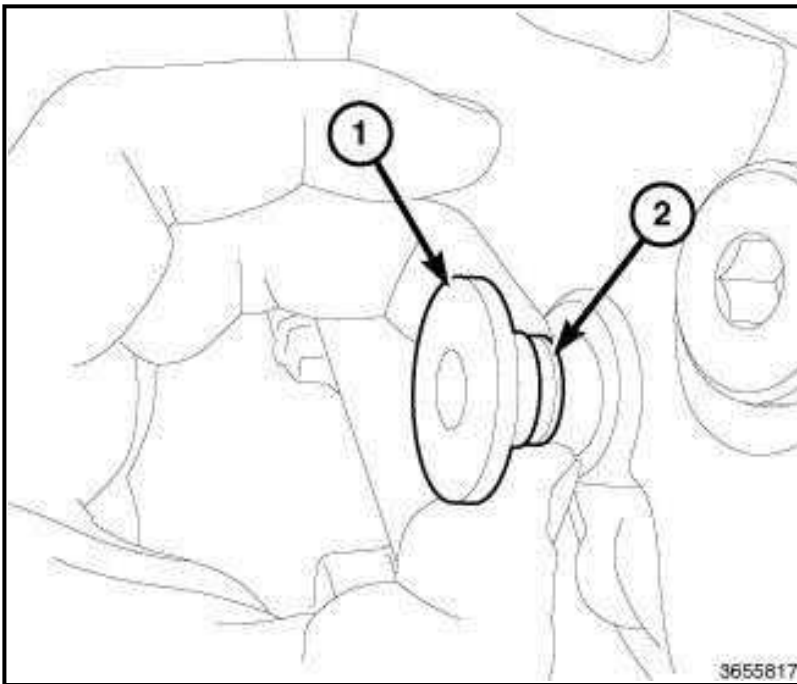
2 - Park Pawl

29. From outside the transmission case, install the park pawl shaft and install the park pawl and spring.



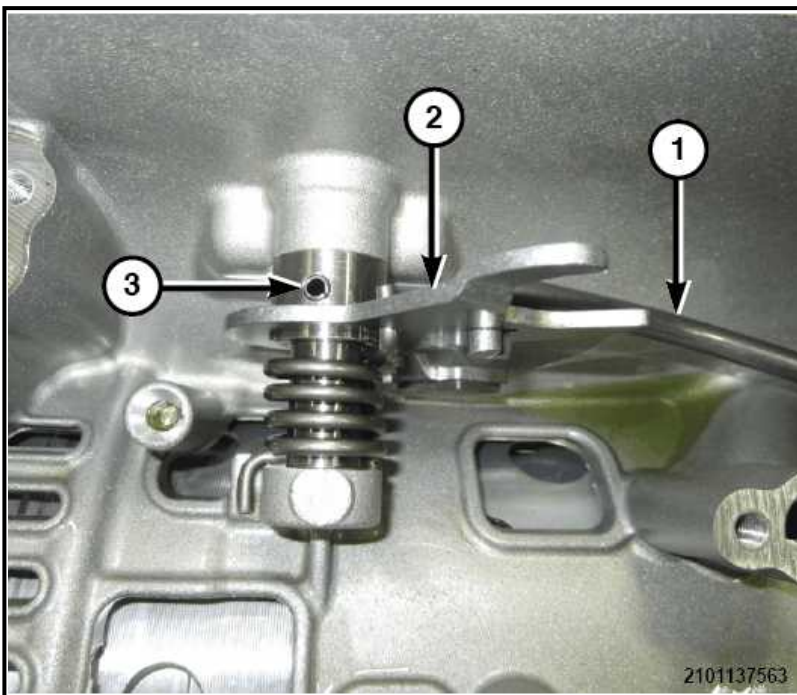
1 - Park Pawl Shaft Plug

30. Install the park pawl shaft plug into the rear of the case and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#) .



1 - Spacer 6936
2 - Manual Park Release Shaft Seal

31. Using (special tool #6936, Spacer), install the selector shaft seal.

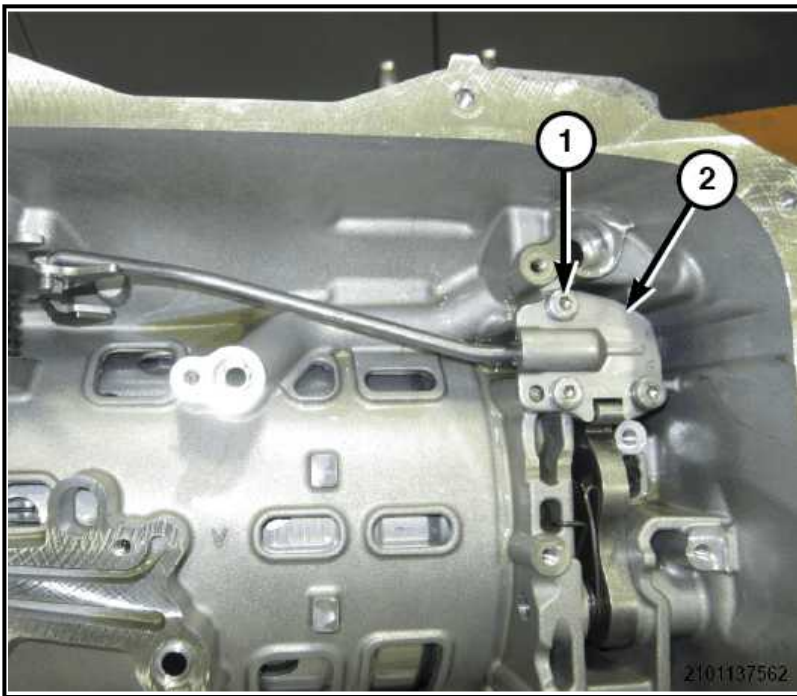


1 - Park Pawl Lock Rod
2 - Fork
3 - Roll Pin

32. Install the shaft, spring, and manual lever assembly into the case.

33. Install the roll pin flush with the manual lever assembly hub using a suitable pin punch.

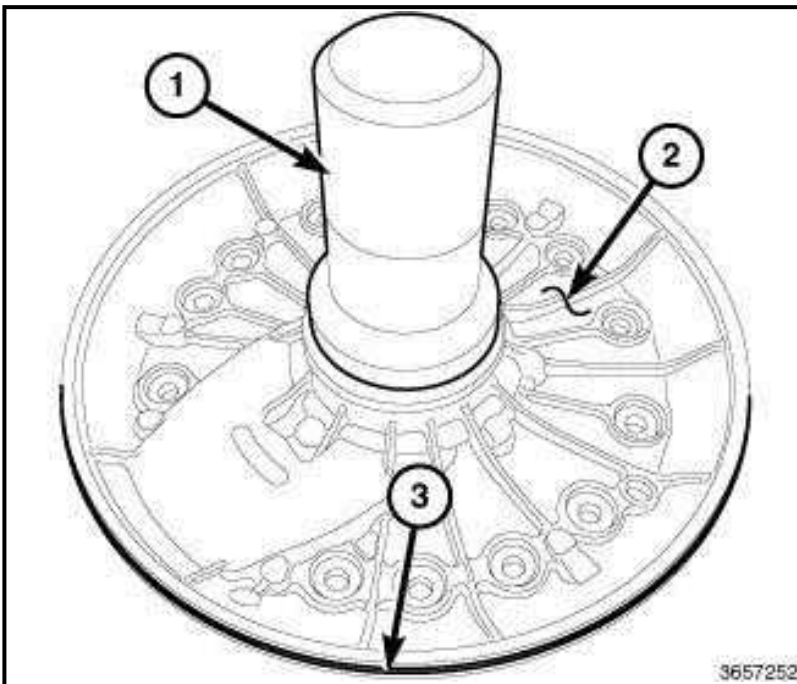
34. Install the park pawl lock rod onto the fork.



1 - Park Pawl Lock Rod Guide Plate Retaining Bolts
--

2 - Park Pawl Lock Rod Guide Plate

35. Position the park pawl lock rod guide plate, install the three park pawl lock rod guide plate retaining bolts.

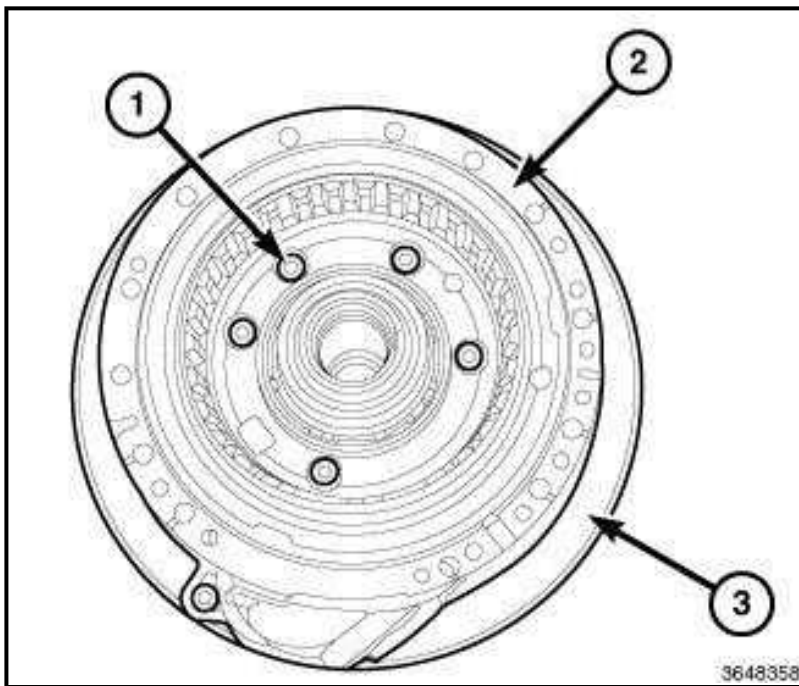


1 - Oil Pump Cover Oil Seal Installer

2 - Oil Pump Cover

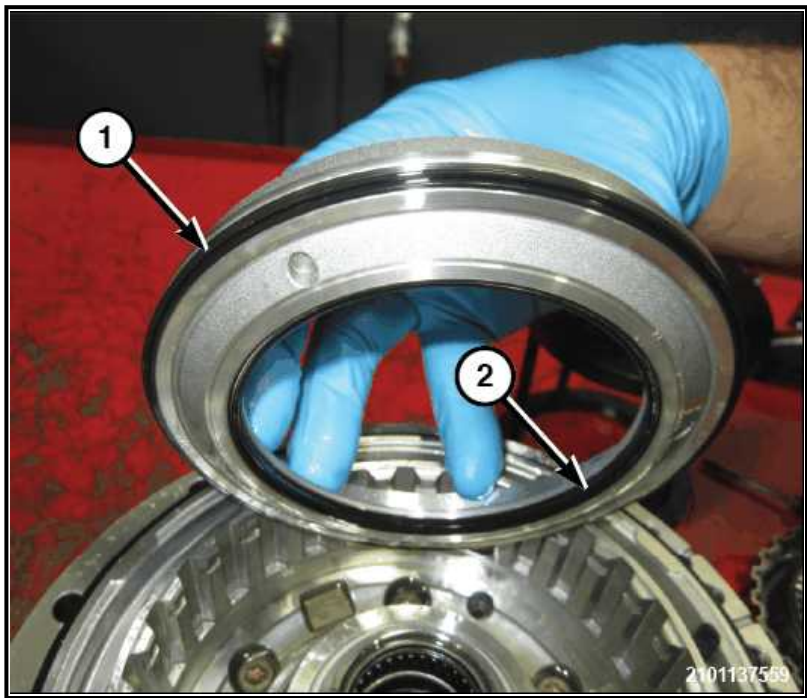
3 - Oil Pump Cover Lip Seal

36. Using (special tool #10375, Installer, Oil Pump Cover Oil Seal), install the input shaft seal in the oil pump cover.



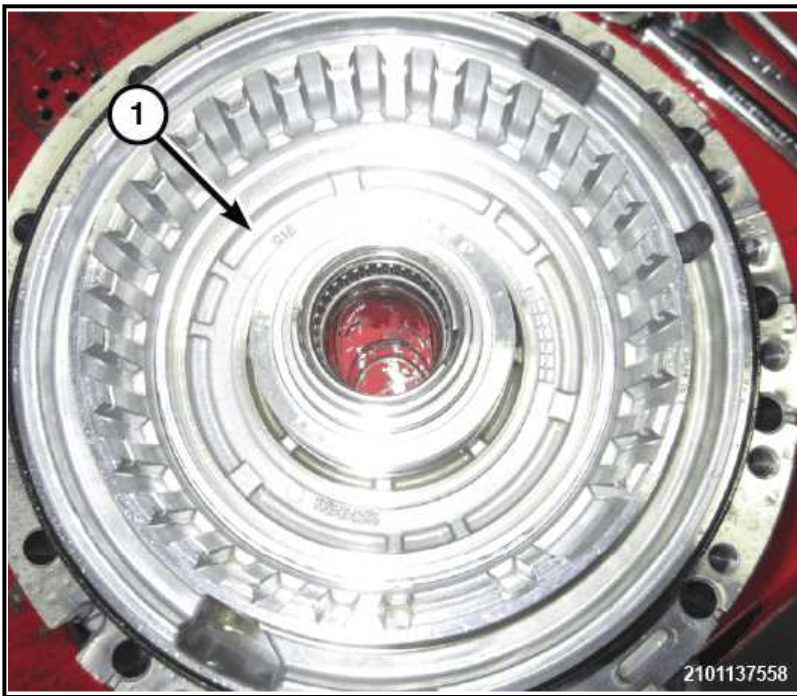
1 - Transmission Oil Pump Housing to Cover Bolts
2 - Transmission Oil Pump Housing
3 - Transmission Oil Pump Front Cover

- 37. Position the oil pump housing and oil pump cover together.
- 38. Install the transmission oil pump housing to cover bolts.



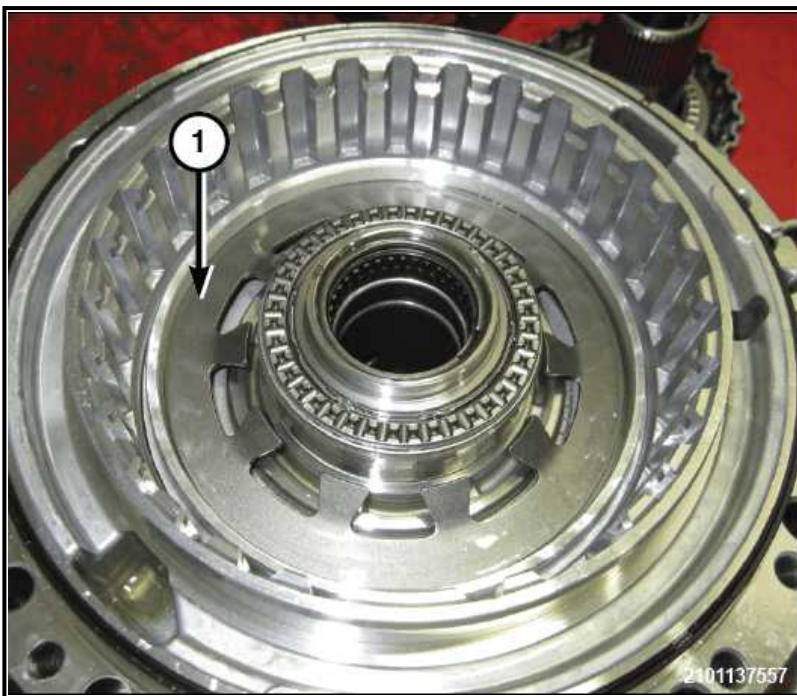
1 - Clutch A Piston Outer Seal
2 - Clutch A Piston Inner Seal

- 39. Lube the Clutch A piston inner and outer seals using transmission assembly lube.



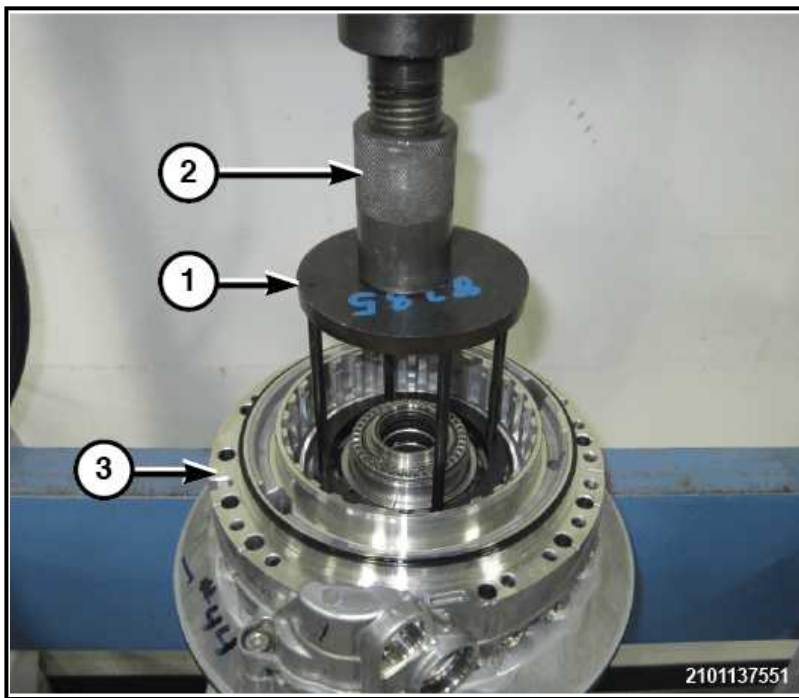
1 - Clutch A Piston

40. Install the Clutch A piston in the housing.



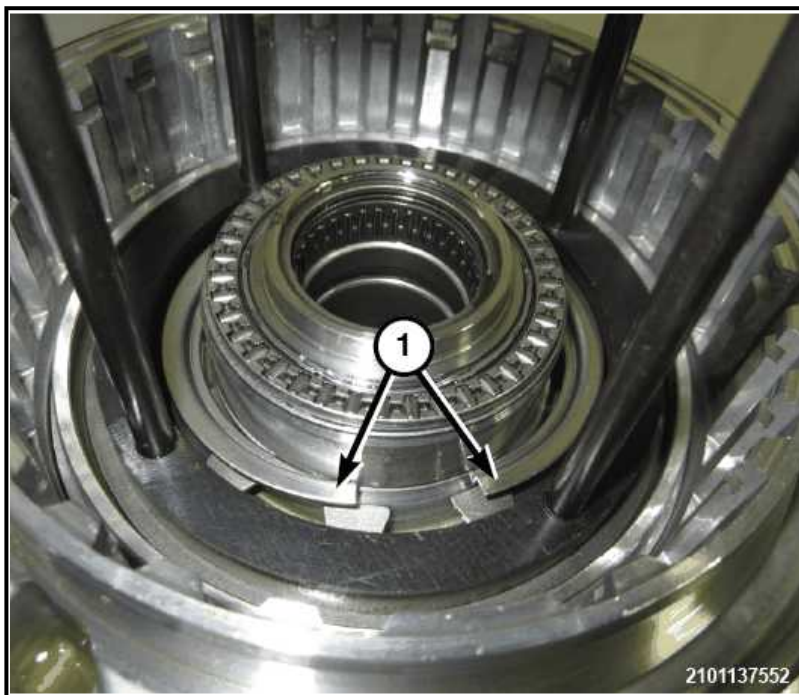
1 - Clutch A Belleville Spring

41. Install the Clutch A belleville spring in the housing.



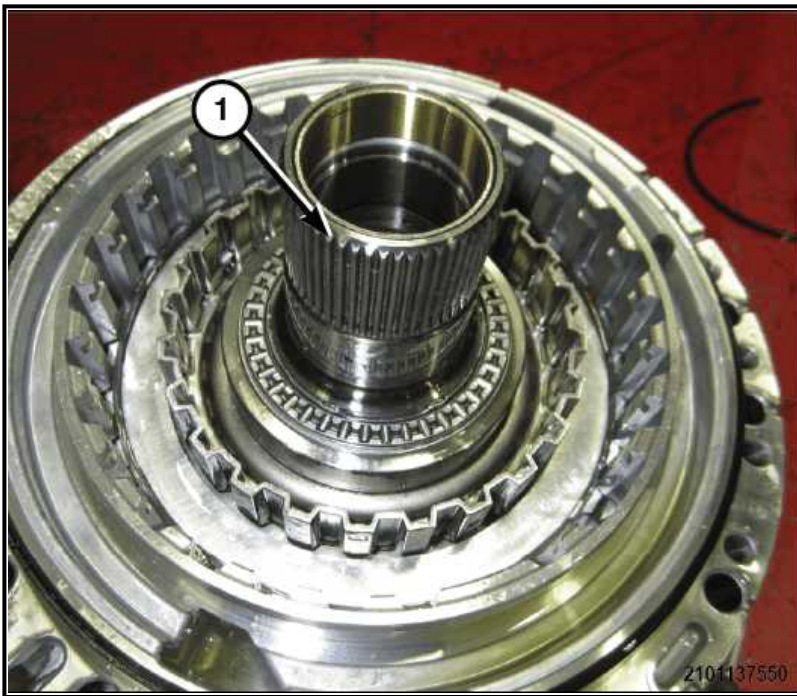
1 - Spring Compressor Tool
2 - Arbor Press
3 - Transmission Oil Pump Assembly

42. Position the oil pump assembly in a suitable arbor press.
43. Using (special tool #8285, Compressor, Spring) (1), press on the fingers of the piston retaining ring to remove tension, and install the two halves of the split retainer ring.



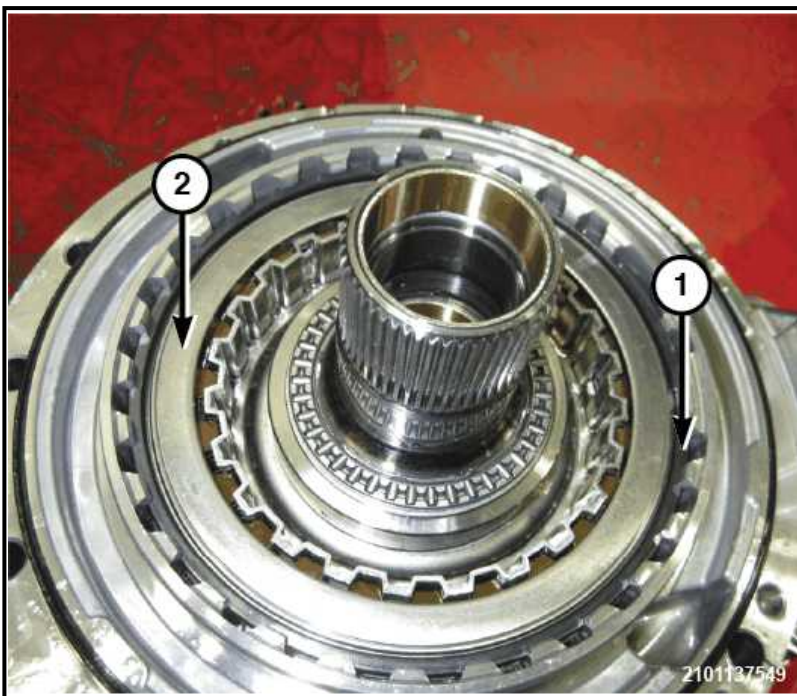
1 - Retaining Ring

44. Verify the split retainer ring halves are seated in the groove.



1 - Hub

45. Install the hub.

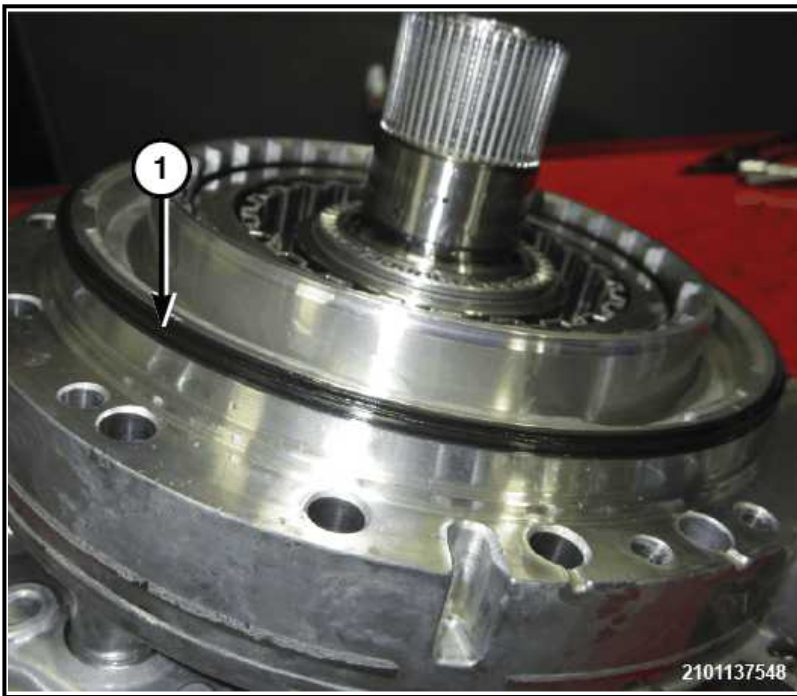


1 - Snap Ring

2 - Clutch A Discs and Plates

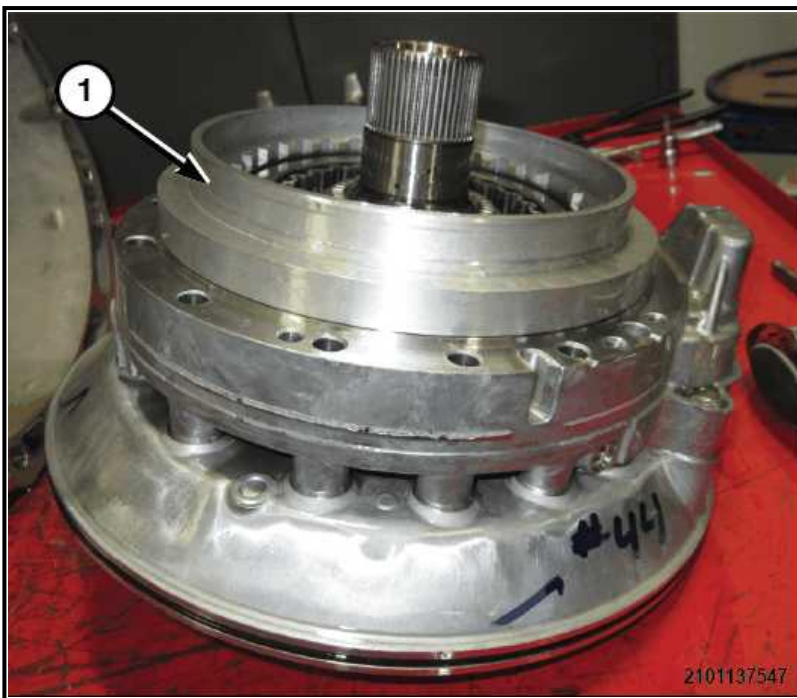
46. Install the Clutch A disks and plates.

47. Install the snap ring.



1 - Clutch B Piston Seal

48. Verify the B piston seal is not worn or damaged, replace if the seal is questionable.



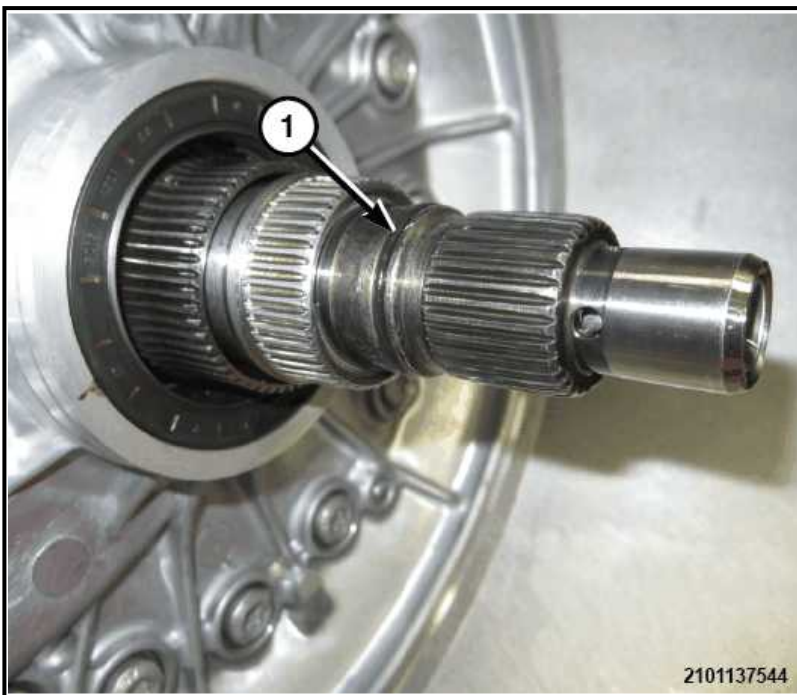
1 - Clutch B Piston

49. Install the Clutch B piston.



1 - Clutch B Damper Spring

50. Install the Clutch B damper spring on the assembly.



1 - Input Shaft O-Ring

51. Carefully position the oil pump housing assembly into the case.

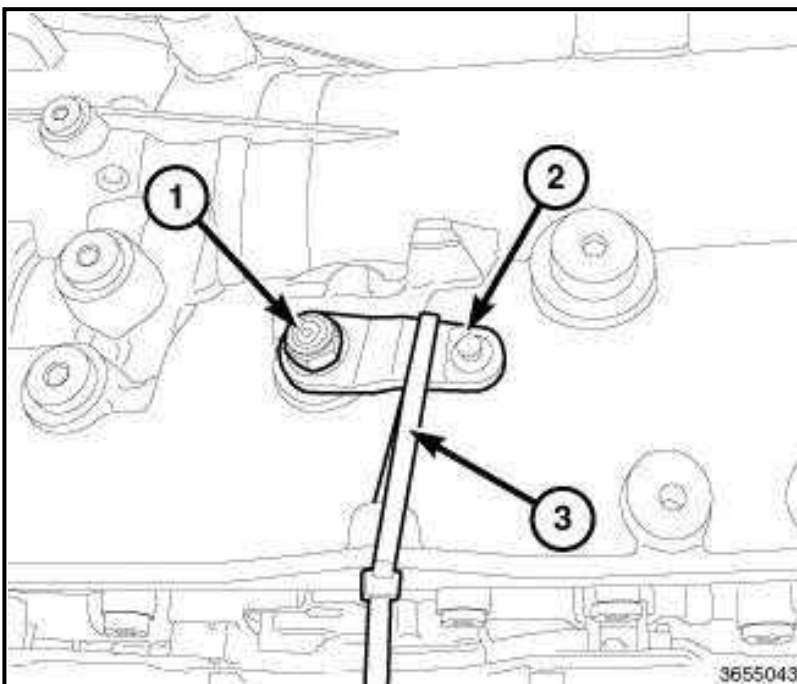
52. Install the **NEW** input shaft O-ring.



1 - Transmission Oil Pump Assembly to Case Bolts

NOTE: Firmly press the oil pump in place before drawing it in with bolts.

53. Install **NEW** transmission oil pump assembly to case bolts.



1 - Manual Park Release (MPR) Lever Retaining Nut

2 - Manual Park Release (MPR) Lever

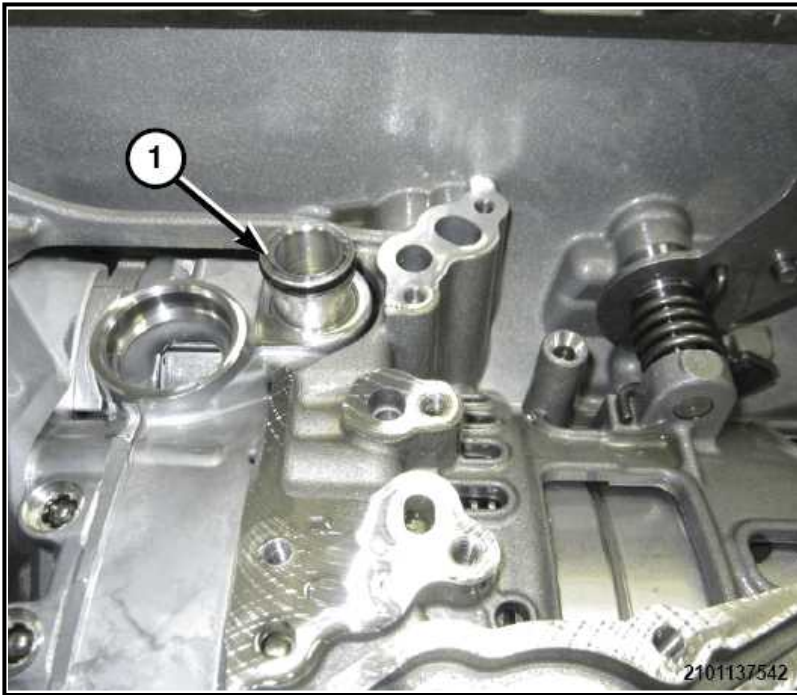
3 - Tie Strap

NOTE: The Manual Park Release (MPR) lever can be reversed to release tension and ease the installation of the valve body assembly.

54. Temporarily install the MPR lever to release tension on the shift fork as follows:

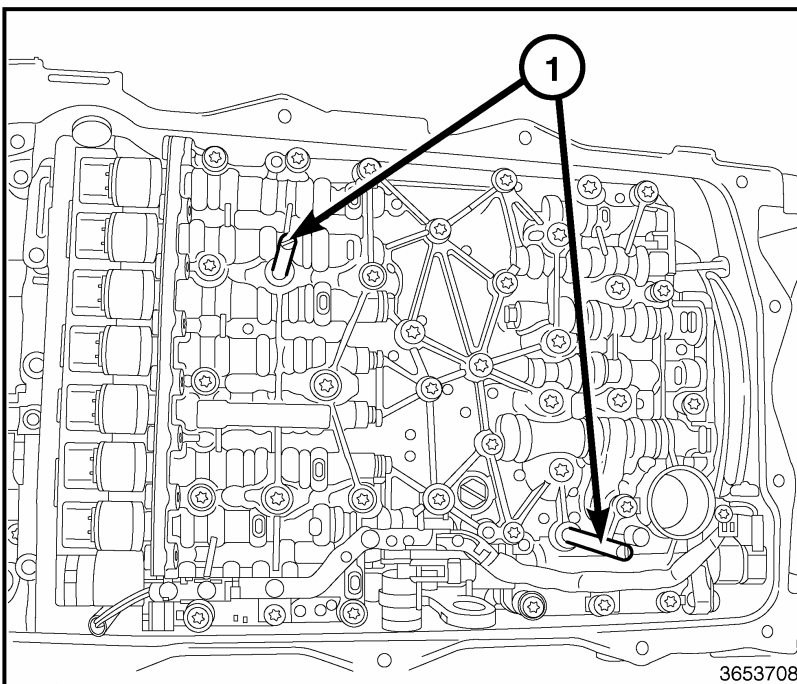
- a. Install the MPR lever 180 degrees offset from its original position.
- b. Install the MPR retaining nut and hand tighten.

- c. Turn the MPR lever and using a tie strap, secure the lever into position so the park release fork is in the same position as it was before valve body assembly removal.



1 - Fluid Transfer Port

55. Install the fluid transfer port with **NEW** O-rings to the transmission case.



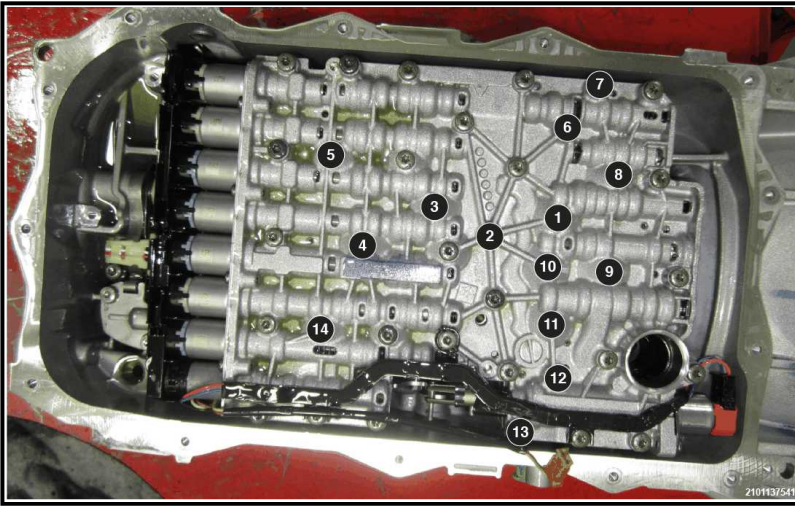
1 - Pins, Valve Body Alignment 10379

56. Install the (special tool #10379, Pins, Valve Body Alignment) in the transmission case as guides for the valve body assembly.

NOTE: Make sure the shift fork lines up properly.

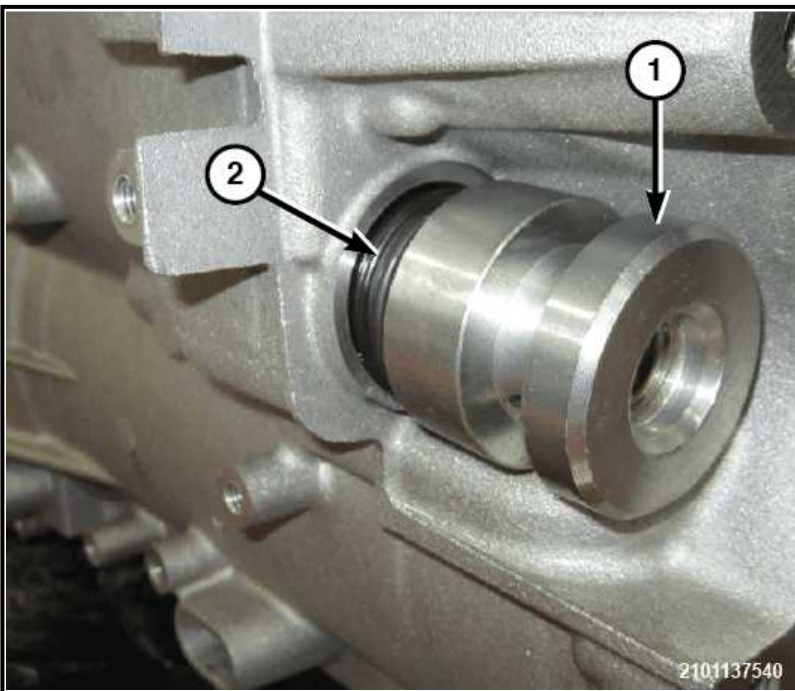
57. Using the valve body alignment pins position the valve body assembly to the transmission.

NOTE: After several bolts have been hand tightened, remove the guide pins.



1-14 - Valve Body Bolt

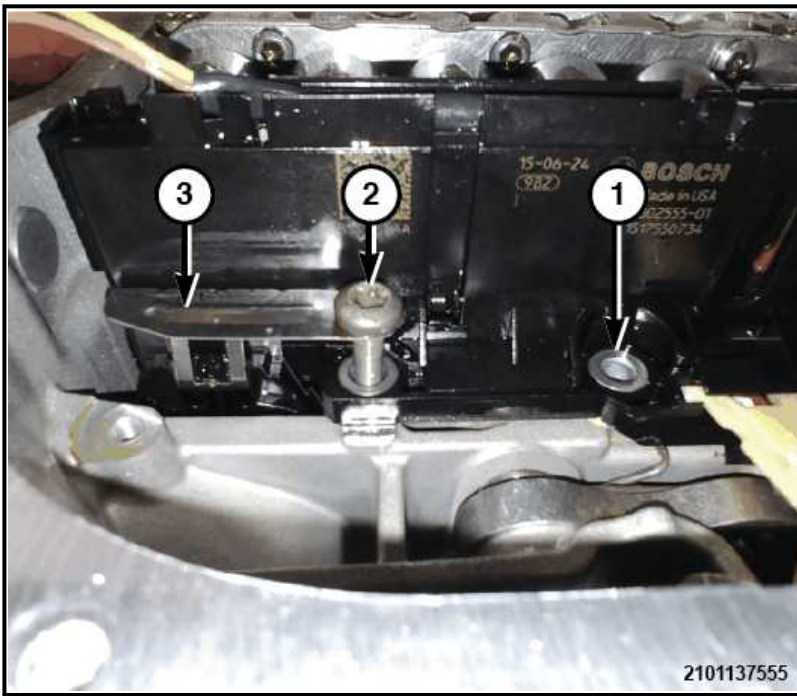
58. Install the valve body assembly bolts.



1 - Guide Sleeve Remover/Installer

2 - Electrical Harness Guide Sleeve

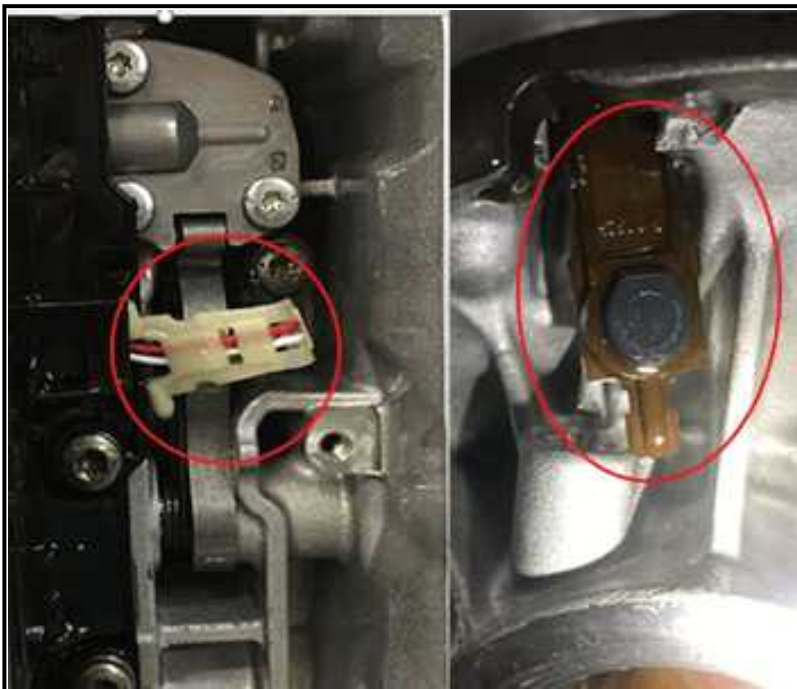
59. Using (special tool #10377, Remover/Installer, Guide Sleeve), carefully install the electrical harness guide sleeve into the transmission case.



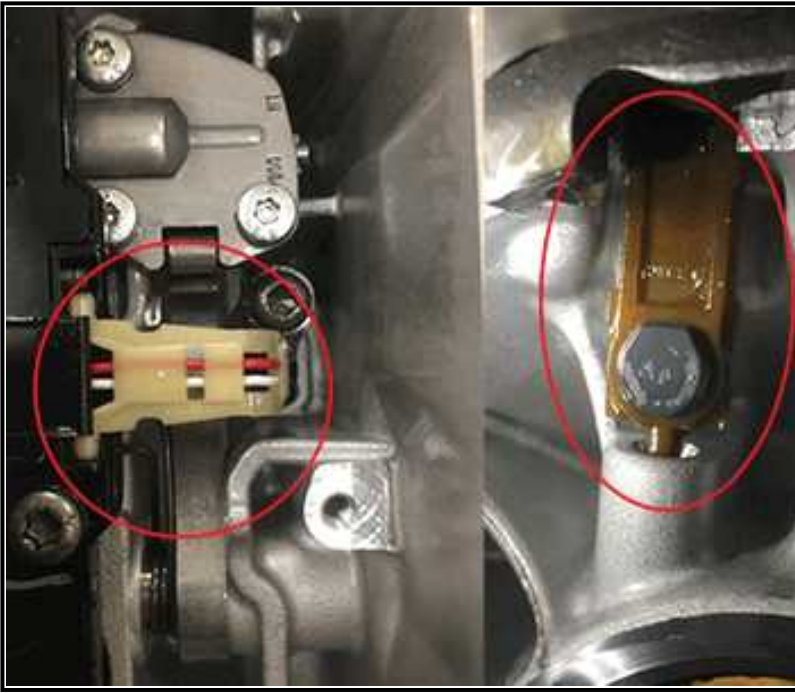
1 - Valve Body End Bolt
2 - Electrical Connector Lock Bolt
3 - Electrical Connector Lock

60. Latch the electrical connector lock by pushing down.

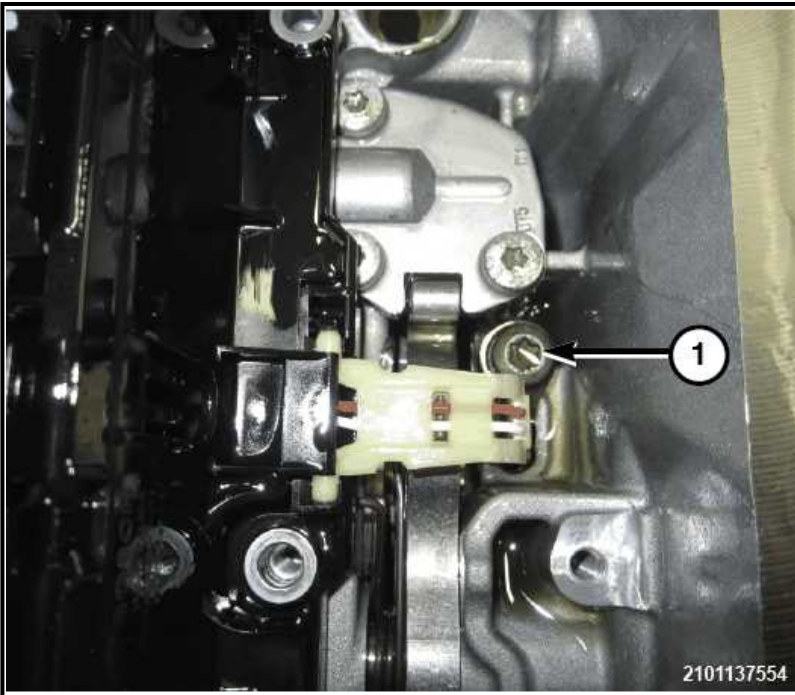
61. Install the valve body end bolt and electrical connector lock bolt.



62. When installing the Output Speed Sensor (OSS) into the case, take care to position the OSS guide pin as shown below or **DAMAGE** to the sensor may result. This is the **INCORRECT** alignment of the pin.

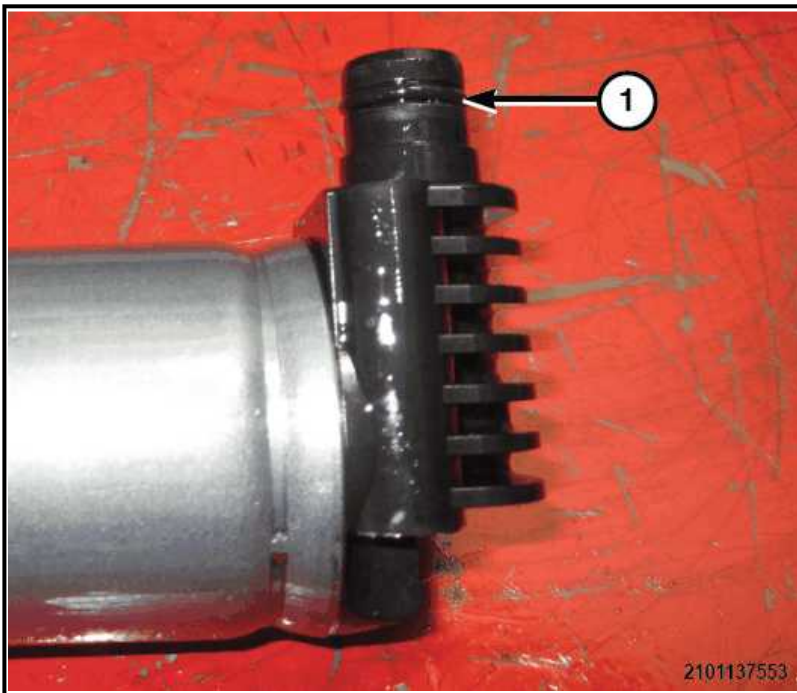


63. This is the **CORRECT** installation and pin alignment.



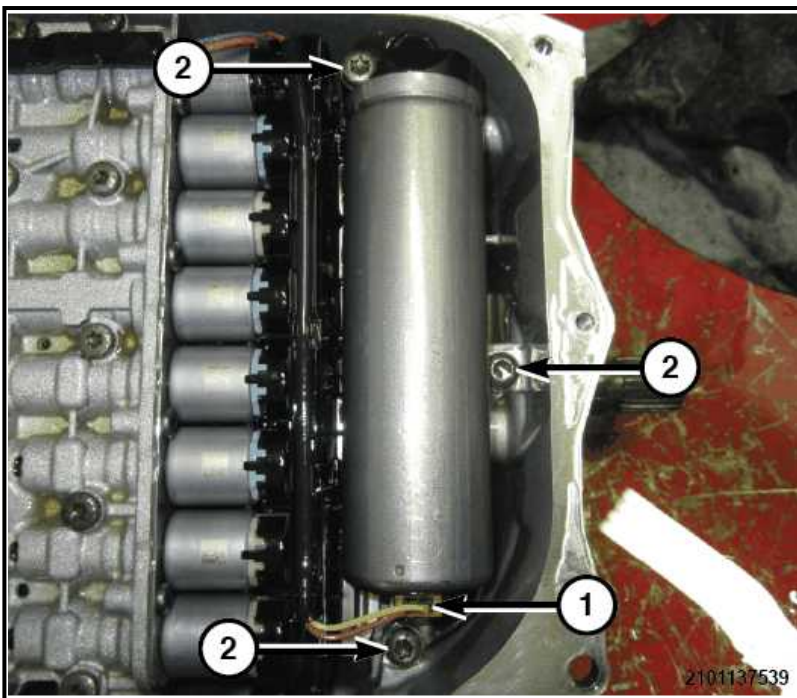
1 - Output Speed Sensor Bolt

64. Install the output speed sensor and the bolt in the case and tighten to.



1 - Hydraulic Impulse Solenoid (H.I.S) O-ring

65. Verify the HIS O-ring is not torn or damaged. Replace if necessary.

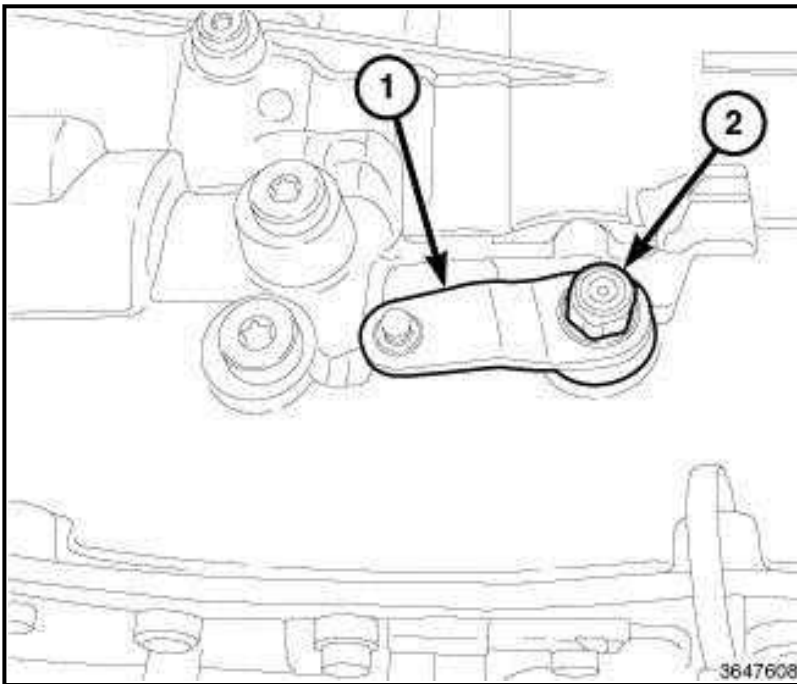


1 - Hydraulic Impulse Solenoid (HIS) Wire Harness Connector

2 - Hydraulic Impulse Solenoid (HIS) Bolts

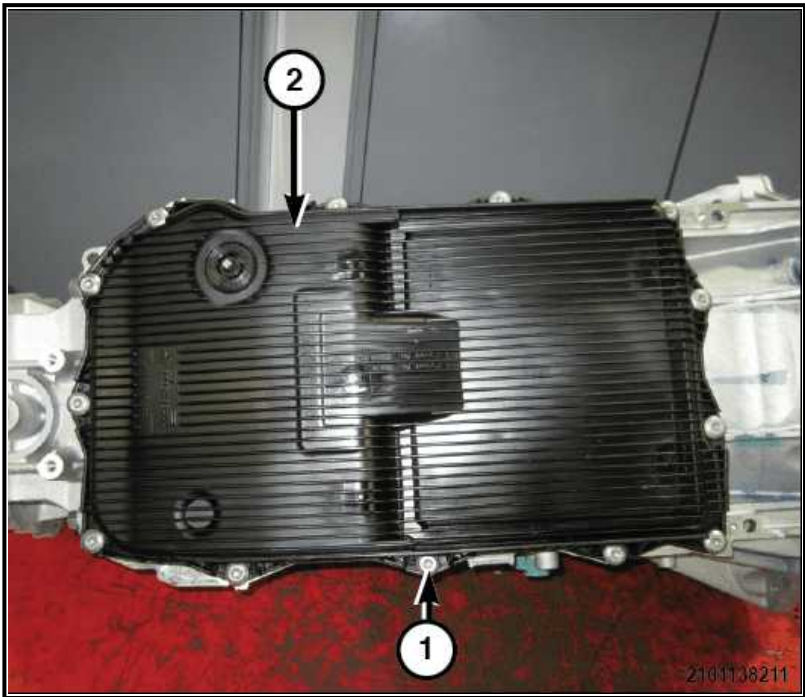
66. If equipped, install the HIS and bolts.

67. Connect the HIS electrical connector.



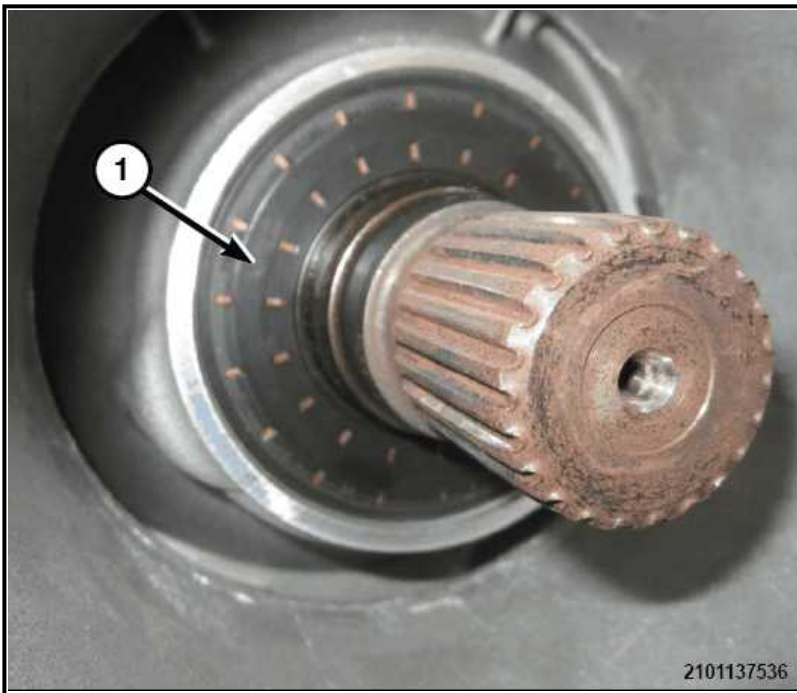
1 - Manual Park Release (MPR) Lever
2 - Manual Park Release (MPR) Lever Retaining Nut

- 68. Remove the tie strap and return the manual release lever to the original position.
- 69. Install the manual release lever nut.



1 - Transmission Oil Pan Bolts
2 - Transmission Oil Pan

- 70. Position the transmission oil pan and gasket.
- 71. Install the transmission oil pan bolts.

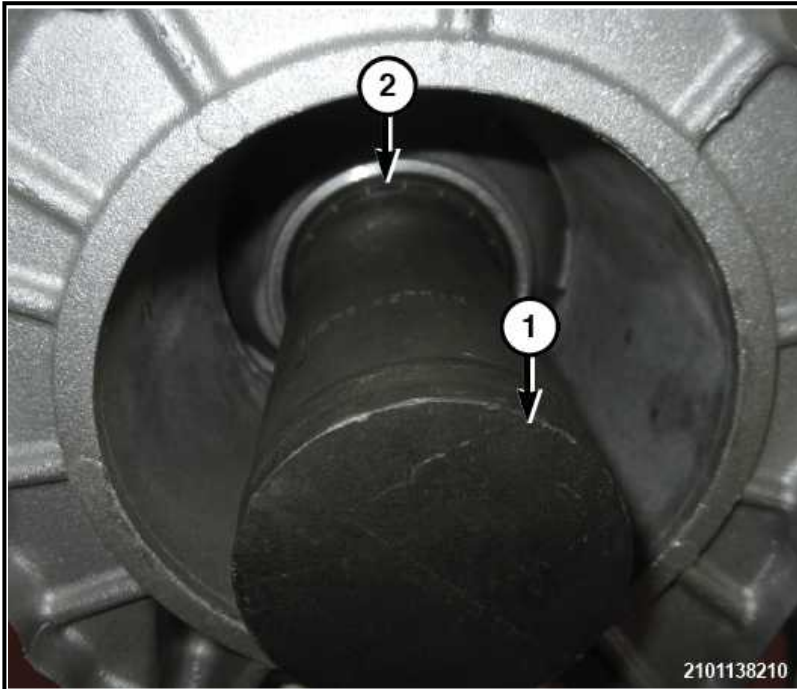


1 - Output Shaft Seal

NOTE: 4X4 only.

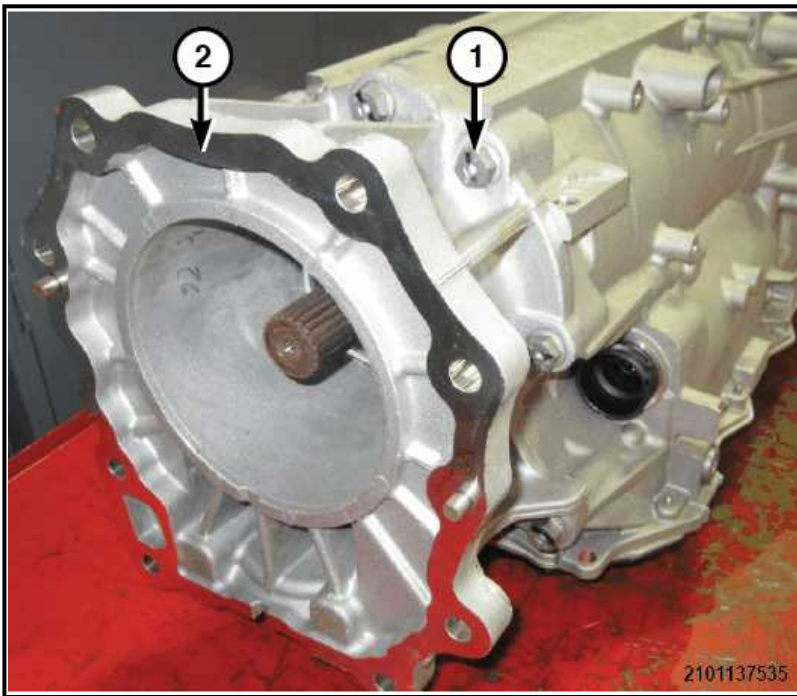
CAUTION: The seal must be installed flush with the case. Driving the seal deeper could damage the seal causing a leak.

72. Position the new output shaft seal over the output shaft and against the transmission case.



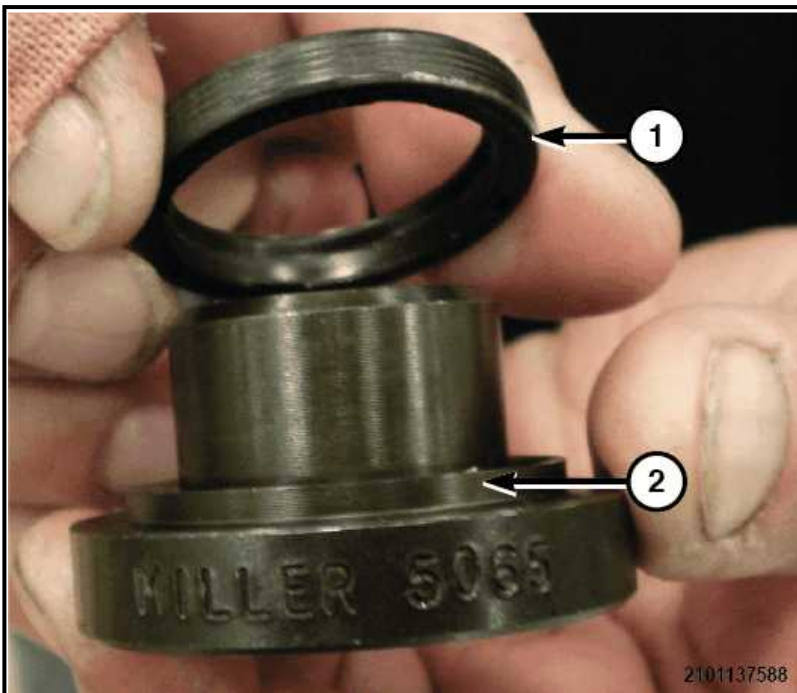
1 - Seal Installer
2 - Output Shaft Seal

73. Using (special tool #9677, Installer, Seal), install the output shaft seal.



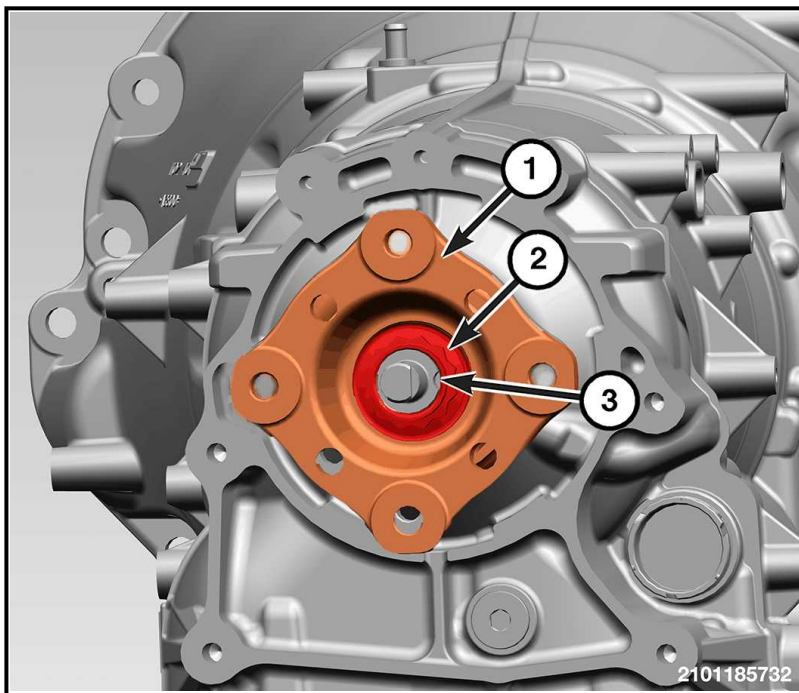
- | |
|-----------------------------|
| 1 - Extension Housing Bolts |
| 2 - Extension Housing |

74. **4X4 ONLY**, If equipped, position the extension housing and install the extension housing bolts.



- | |
|---------------------------|
| 1 - Output Flange Oil Dam |
| 2 - Bearing Installer |

75. For 2WD vehicles, using (special tool #5065, Installer, Bearing) install the **NEW** output flange oil dam into the output flange.



1 - Transmission Output Flange
2 - Transmission Output Flange Nut
3 - Transmission Output Flange Nut Stake

76. For 2WD vehicles, install the output shaft flange.
77. For 2WD vehicles, install a **NEW** output shaft flange nut and washer using a 34 mm 12 point socket and (special tool #C-3281, Holder, Flange) to hold the flange.
78. For 2WD vehicles, stake the nut.



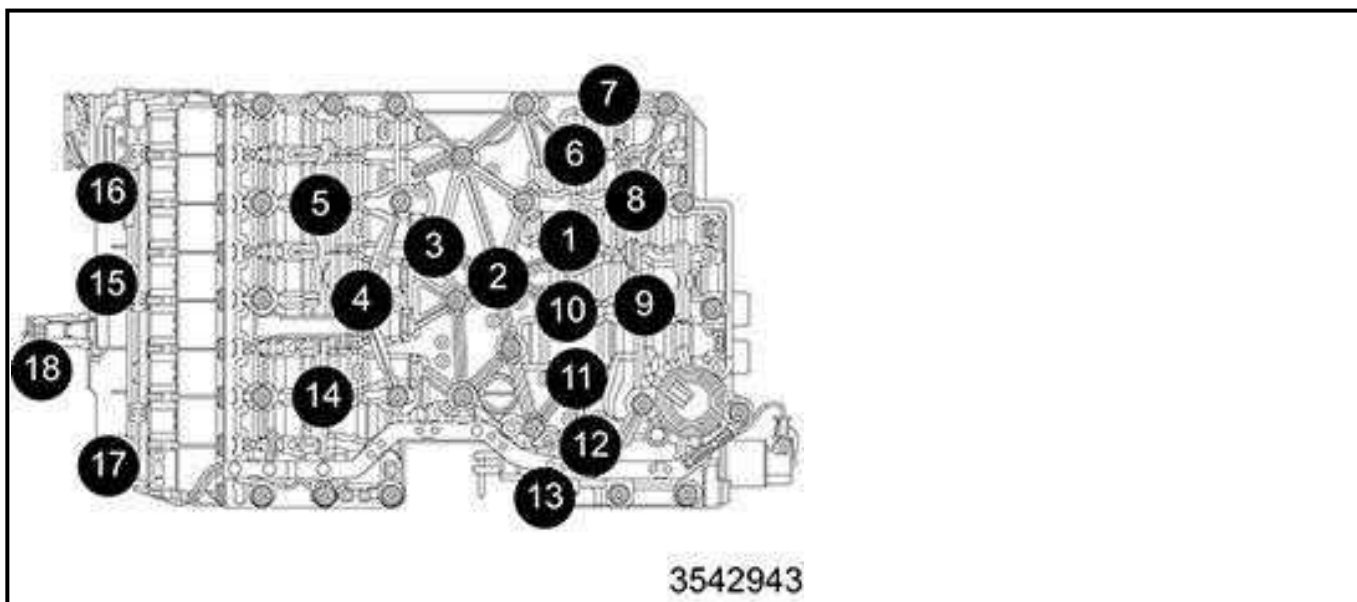
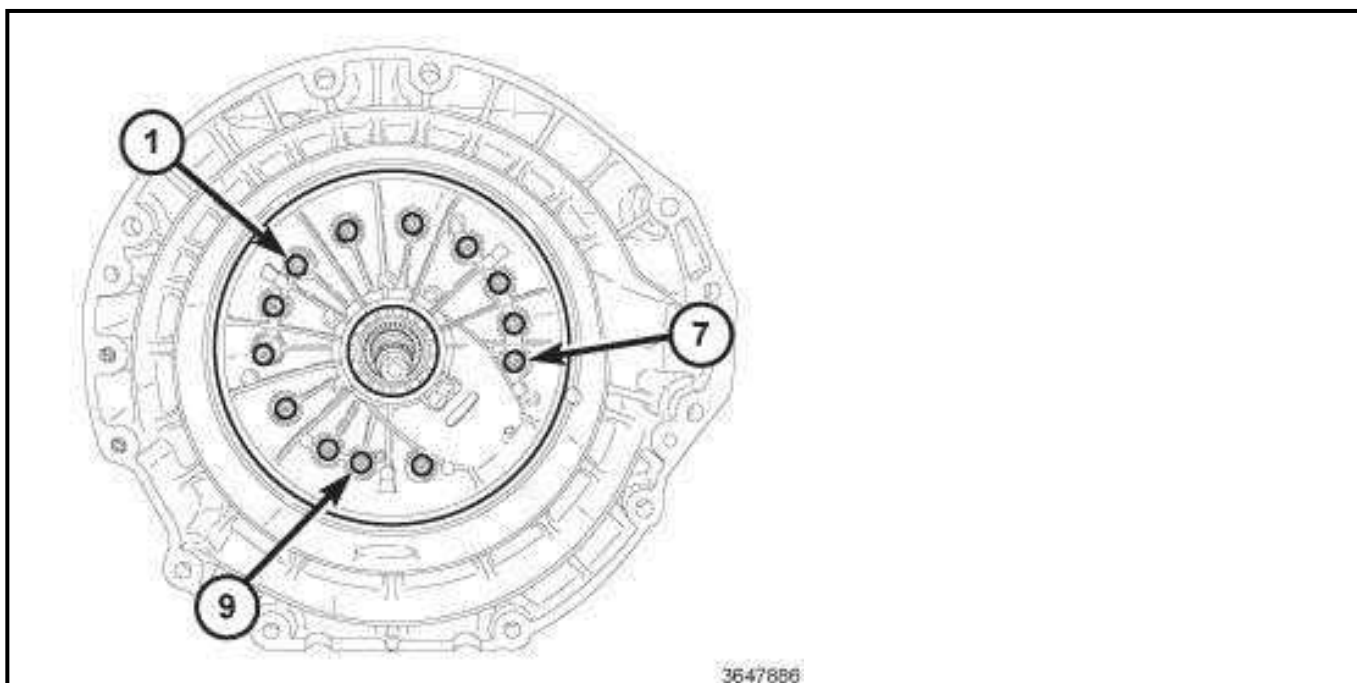
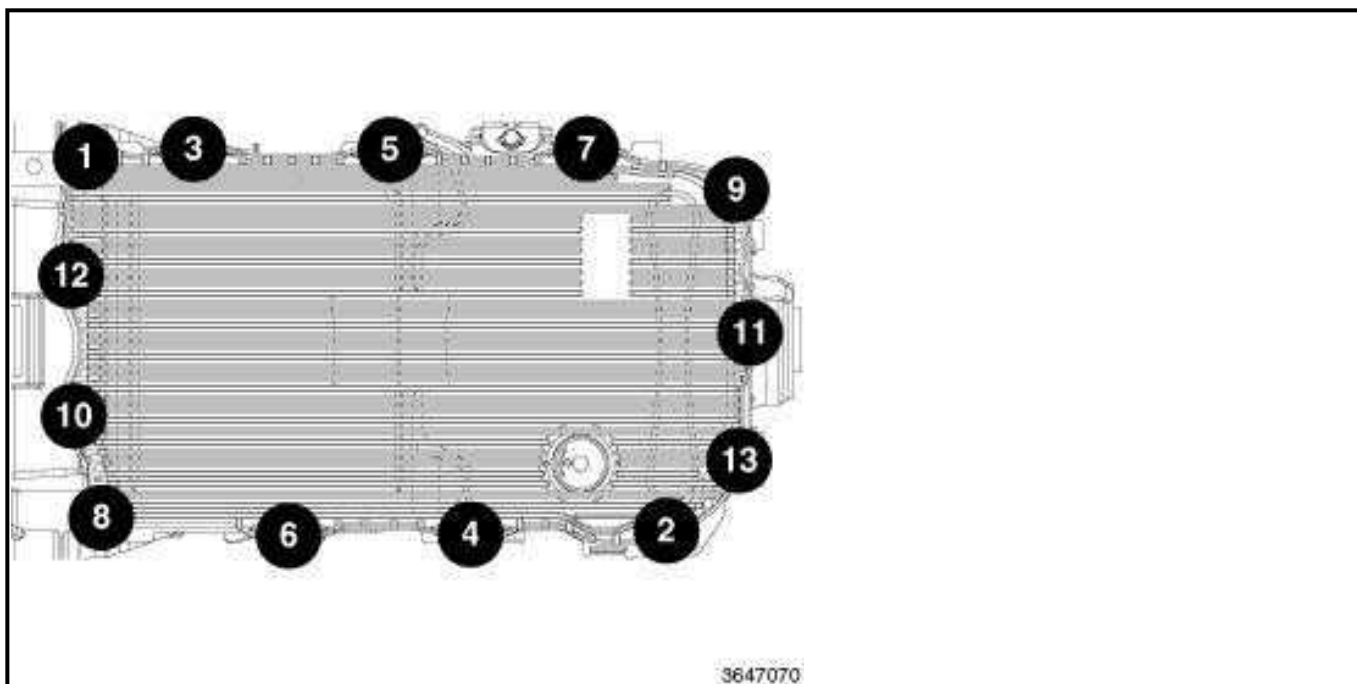
1 - Torque Converter

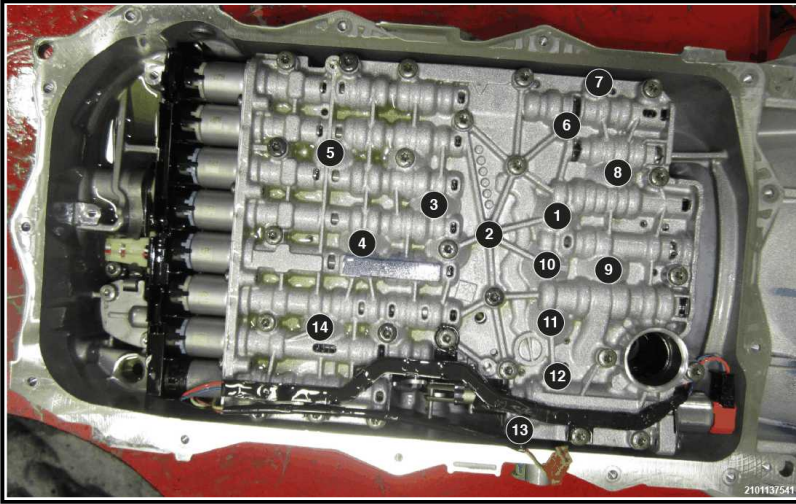
79. Before installing the transmission in the vehicle, pre-fill the transmission as outlined in FILL TRANSMISSION AFTER SERVICE. Refer to [TRANSMISSION FILL AFTER SERVICE](#) .

TORQUE SPECIFICATIONS

8HP50 TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Hydraulic Impulse Solenoid Bolts	8 N.m (71 In. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Lock Solenoid Screw	6 N.m (53 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	13 N.m (10 Ft. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	11 N.m (8 Ft. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Filter to Transmission Oil Pan	6 N.m (53 In. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	Torque Procedure: 1. Install bolts except for the spots where the locating pins are installed and hand tighten 2. Remove the pins and install the remaining bolts 3. Tighten bolts to 8 N.m (71 In. Lbs.)	Tightening Sequence





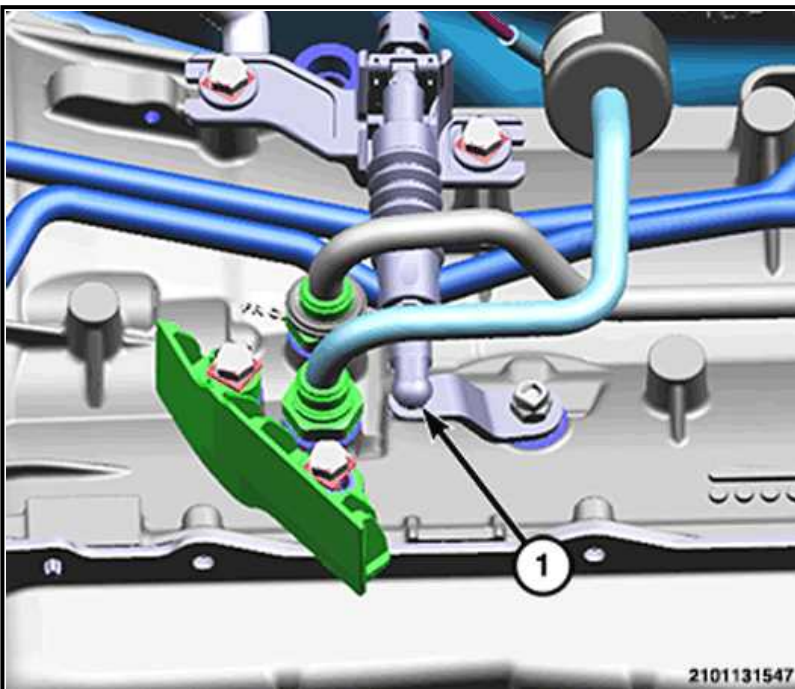
CABLE, MANUAL PARK RELEASE

REMOVAL AND INSTALLATION

MANUAL PARK RELEASE CABLE

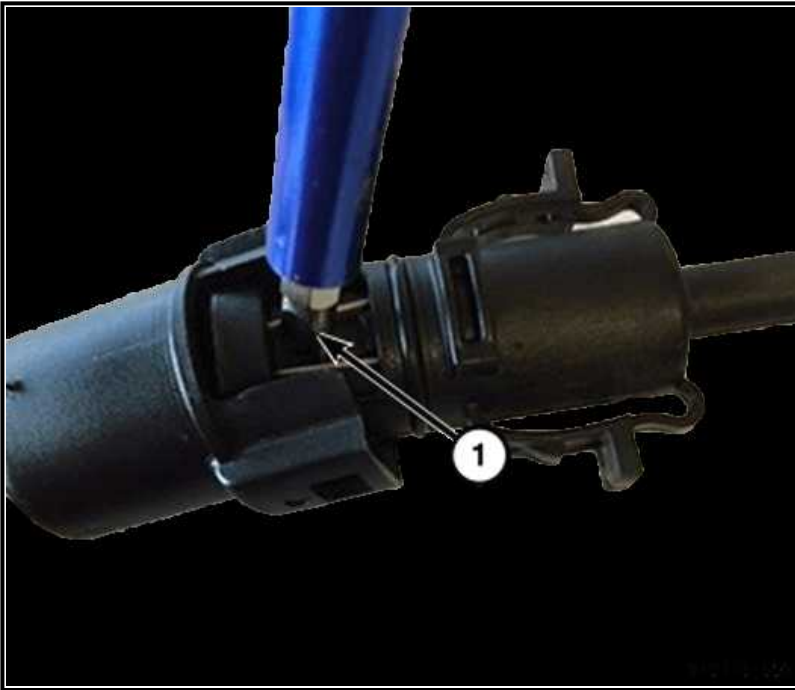
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to [CABLES, BATTERY](#) .
2. Apply the parking brake.
3. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



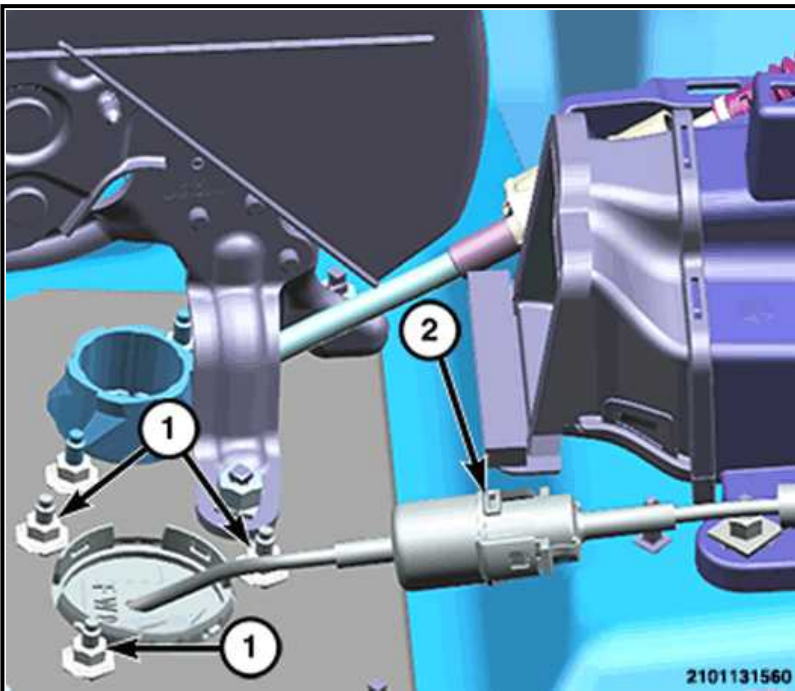
1 - Manual Park Release Cable

4. Disconnect the Manual Park Release (MPR) cable from the lever.
5. Remove the floor console from the vehicle. Refer to [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Cable Retainer

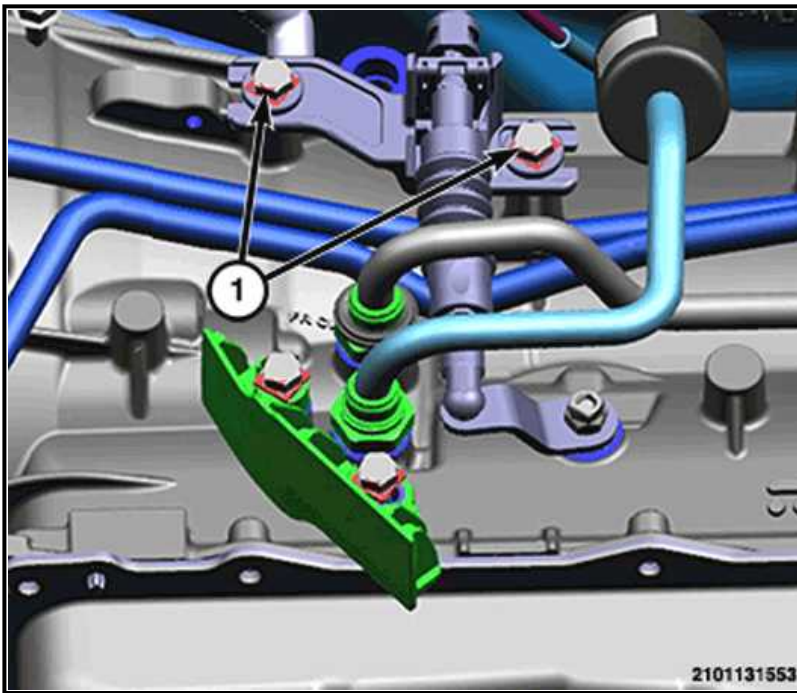
6. Separate the two piece cable by squeezing the side tabs on the barrel and pulling the ends apart. Then pry the retainer apart holding the two-piece cable.



1 - Manual Park Release Cable Body Grommet Nuts

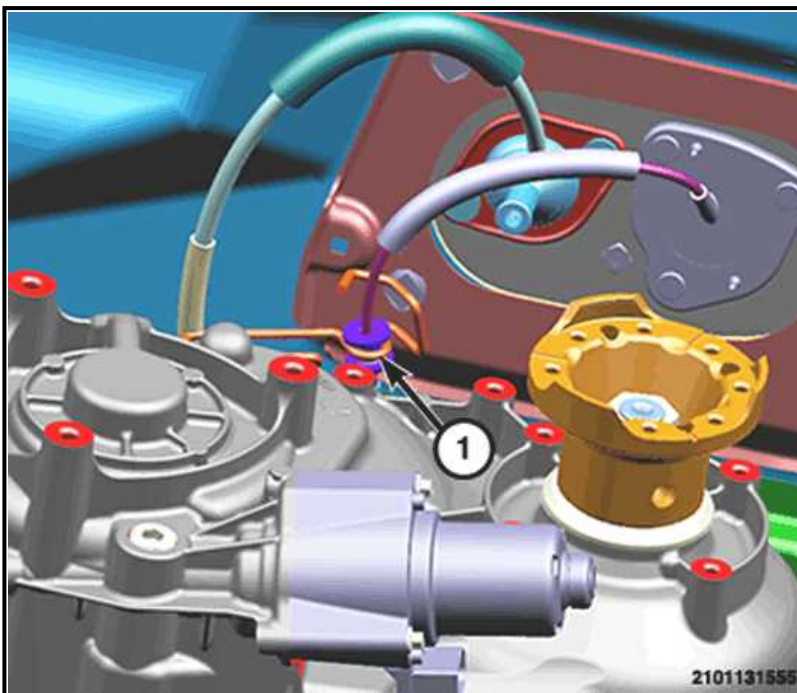
2 - Manual Park Release Cable

7. Remove the body grommet nuts. Push the body grommet through the floor with the remaining end of cable.



1 - Manual Park Release Bracket Bolts

8. Remove the MPR bracket bolts.



1 - Cable Routing Guide

9. Remove the cable from the cable routing guide and remove the cable from under the vehicle.

INSTALLATION

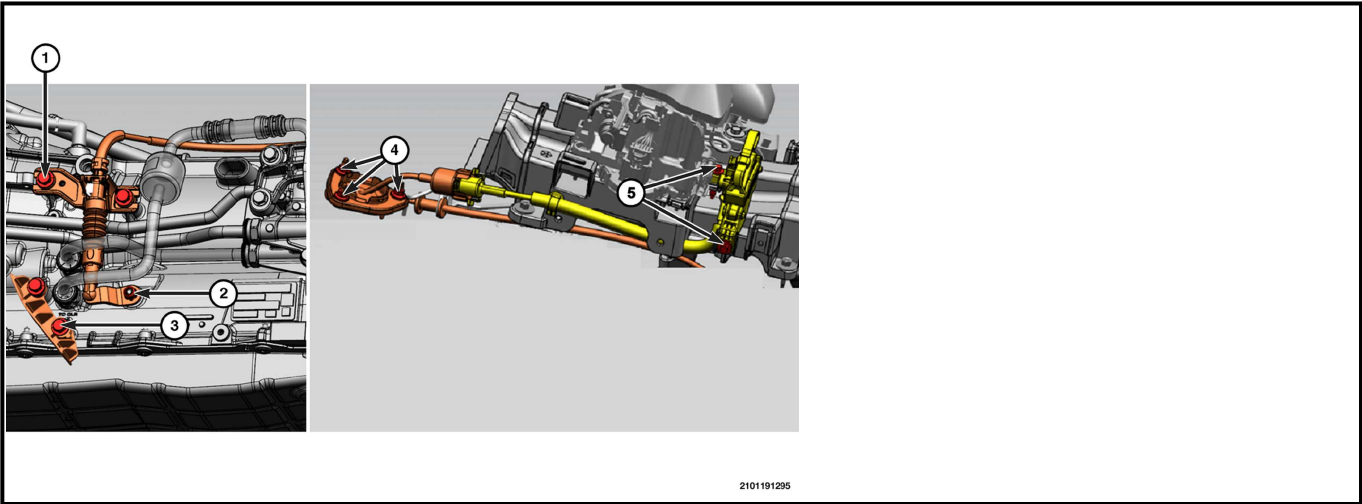
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Route the MPR cable in the same way as the original MPR cable and attach the cable stays to the transmission.

TORQUE SPECIFICATIONS

MANUAL PARK RELEASE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

COOLER, TRANSMISSION OIL

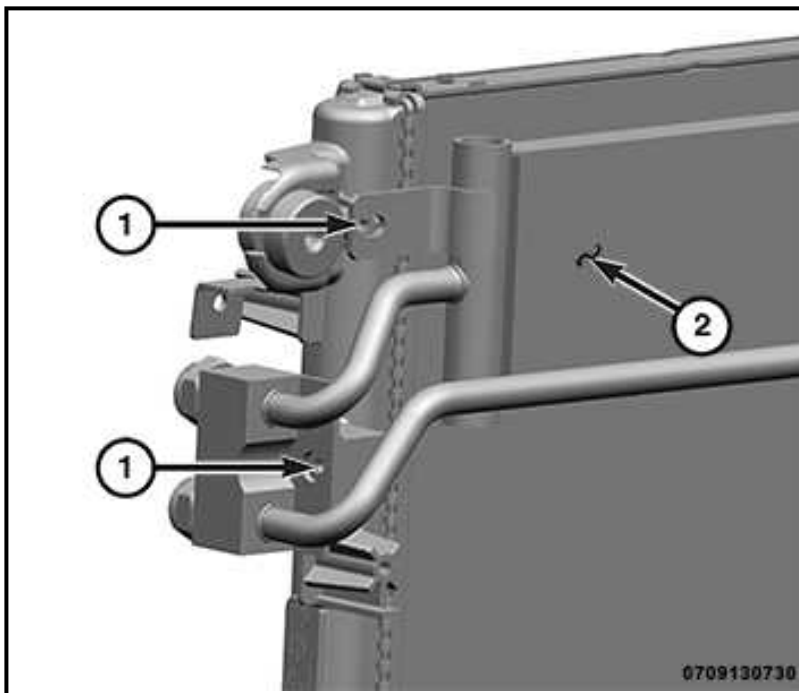
REMOVAL AND INSTALLATION

TRANSMISSION OIL COOLER

REMOVAL

- 1. Disconnect and isolate the negative battery cable. Refer to [CABLES, BATTERY](#) .
- 2. Remove the cooling fan assembly. Refer to [FAN, COOLING, REMOVAL AND INSTALLATION](#) .
- 3. Loosen and move radiator to gain access to transmission cooler. Refer to [RADIATOR, REMOVAL AND INSTALLATION](#) .

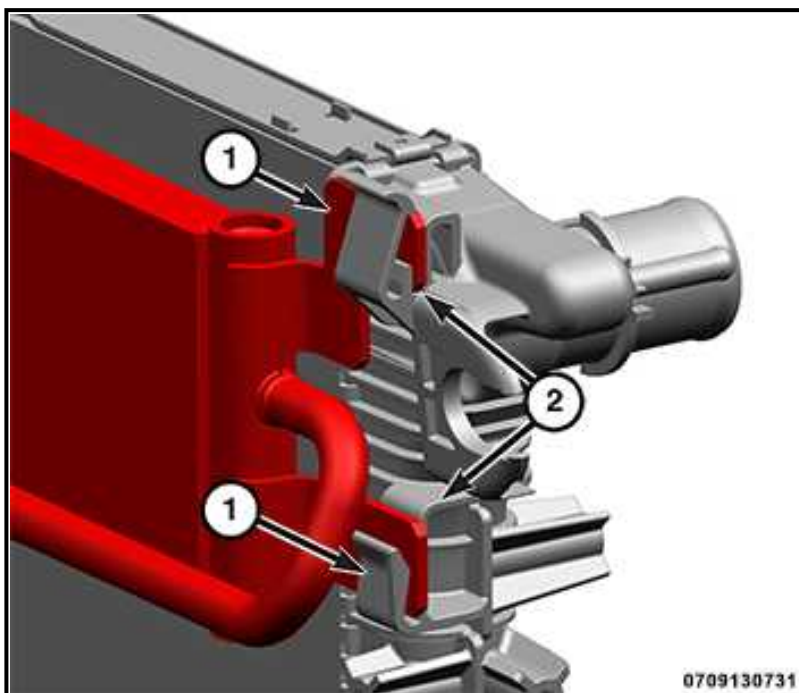
- NOTE:** Plug and seal the ends of the transmission fluid cooler and the transmission fluid cooler lines to prevent leakage of oil, or moisture, contaminates, or impurities from entering into the system.
- NOTE:** It is not necessary to remove the coolant hoses or drain the coolant from the radiator.



1 - Transmission Cooler Bolts

2 - Radiator

4. Remove the two transmission fluid cooler bolts from the radiator.



1 - Transmission Cooler

2 - Radiator

5. Lift and remove the left side transmission fluid cooler from the radiator, and remove the transmission fluid cooler.

INSTALLATION

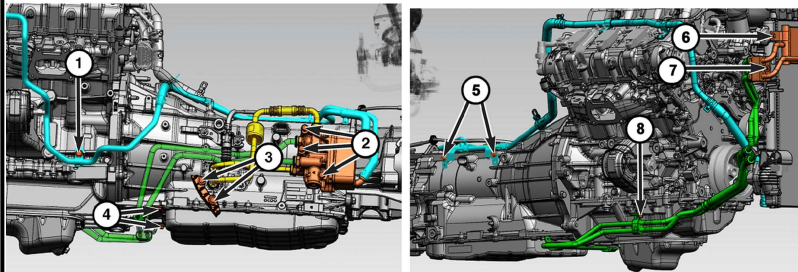
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Use **NEW** seals when installing the transmission cooler lines to the transmission cooler.
- Check transmission fluid level and correct as necessary. Refer to **CHECK FLUID LEVEL** .

TORQUE SPECIFICATIONS

TRANSMISSION OIL COOLER AND HEATER



CalloUT	DEscriPtiOn	SPeCifiCatiOn	COmmenT
1	Transmission Oil Heater Line Bracket to Engine Bolt	35 N. m (26 Ft. Lbs.)	-
2	Transmission Oil Heater To Case Bolts	23 N. m (17 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Bolt	-	Tighten Securely
7	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
8	Transmission Oil Cooler Line Bracket To Oil Pan	9 N. m (80 In. Lbs.)	-

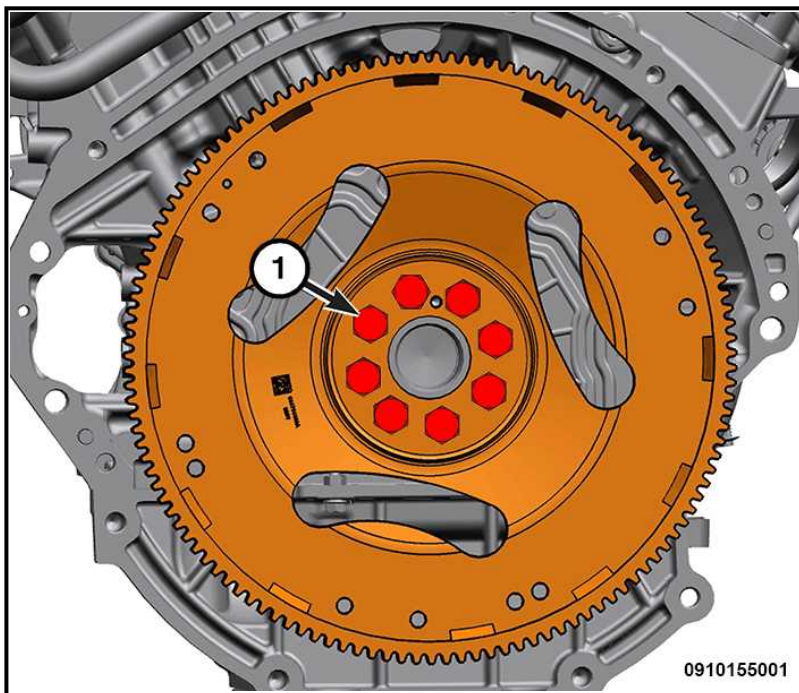
FLEXPLATE

REMOVAL AND INSTALLATION

FLEX PLATE - 3.6L

REMOVAL

1. Remove the transmission. Refer to **REMOVAL AND INSTALLATION**.



1 - Flexplate Bolts

2. Remove flexplate the bolts.

CAUTION: Do not use an impact socket or a thick walled socket when removing or installing the flexplate retaining bolts, damage to the crankshaft, internal engine or the transmission may occur.

3. Remove the flexplate.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

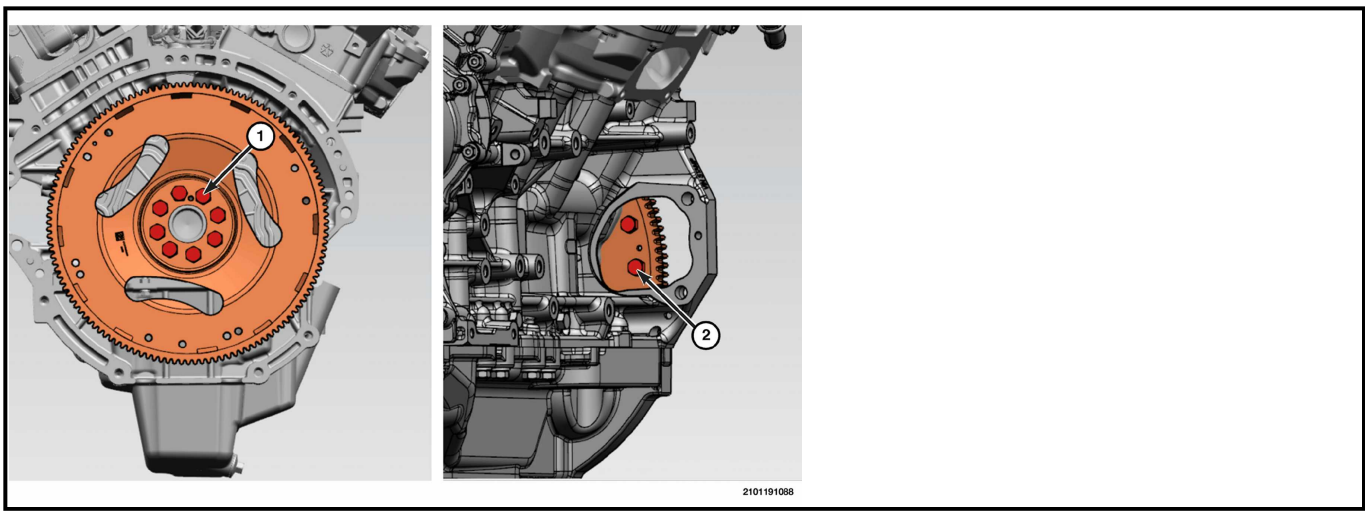
Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Install the spacer and the bolts hand tight.
- Using a criss-cross pattern, tighten the flexplate retaining bolts to the proper torque specification in the torque table.

CAUTION: Do not use an impact socket or a thick walled socket when removing or installing the flexplate retaining bolts, damage to the crankshaft, internal engine or the transmission may occur.

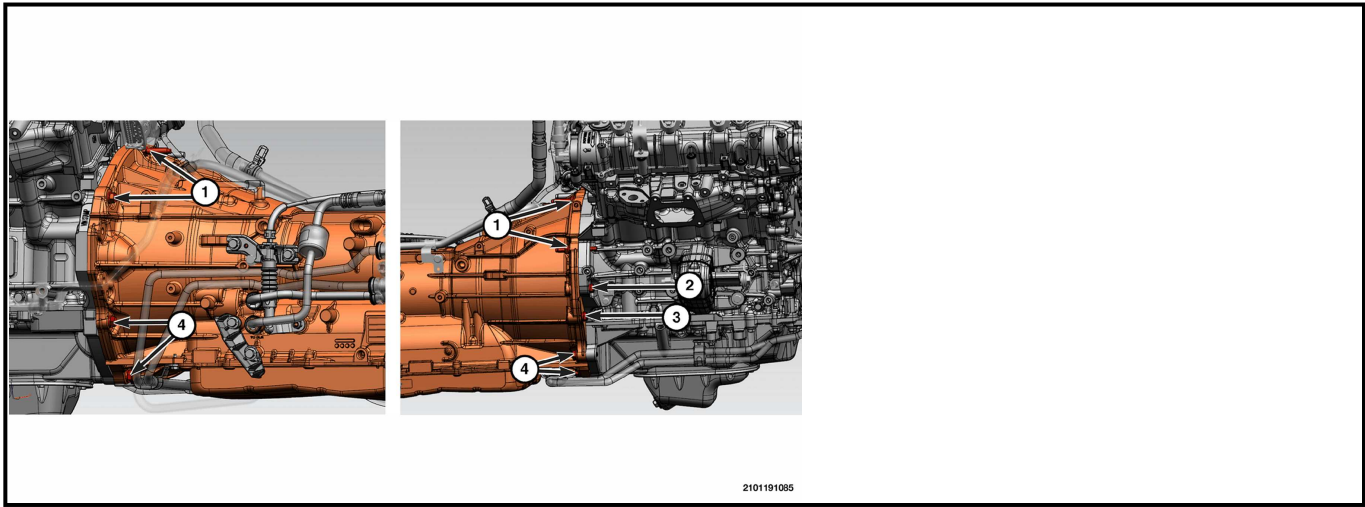
TORQUE SPECIFICATIONS

FLEXPLATE AND TORQUE CONVERTER



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	95 N.m (70 Ft. Lbs.)	Tighten in a crisscross pattern Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.

BELLHOUSING AND OIL FILL PLUG



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Bolts	Bolt 50 N.m (37 Ft. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
		Double Ended Stud 48 N.m (35 Ft. Lbs.)	
2	Engine Block To Transmission Bellhousing Bolt	50 N.m (37 Ft. Lbs.)	-
3	Dust Shield To Transmission Bellhousing Bolt	12 N.m (9 Ft. Lbs.)	-
4	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
Not Shown	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

HEATER, TRANSMISSION

REMOVAL AND INSTALLATION

TRANS FLUID HEATER

REMOVAL

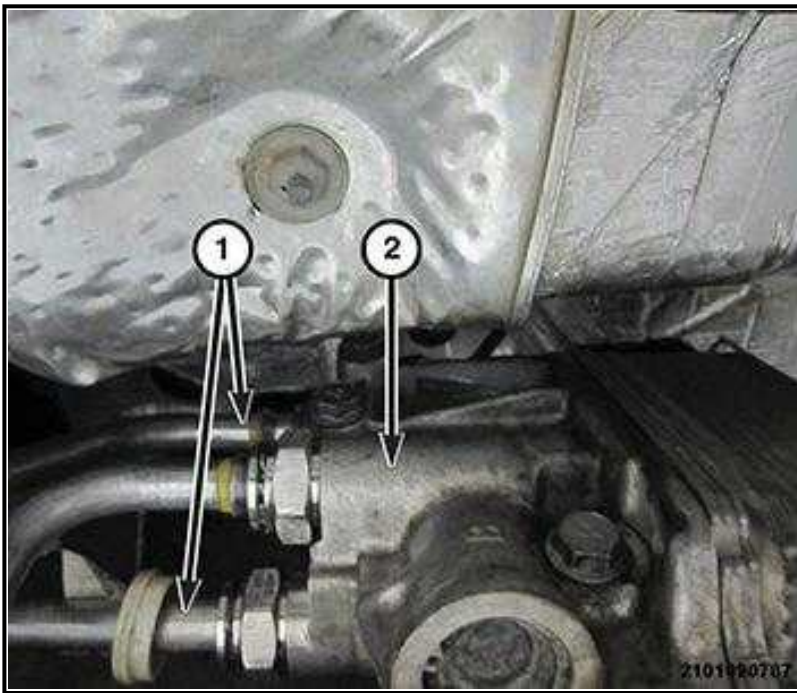
1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Drain the engine cooling system. Refer to [DRAINING](#) .
3. Remove front drive shaft. Refer to [REMOVAL AND INSTALLATION](#) .



1 - Coolant Pipe

2 - Coolant Pipe

4. Remove the spring clamps and disconnect the coolant supply and return pipes from the transmission fluid heat exchanger.



1 - Transmission Fluid Tubes
2 - Transmission Heat Exchanger

5. Disconnect the transmission fluid tubes from the transmission heat exchanger.
6. Remove the transmission fluid heat exchanger bolts and remove the transmission fluid heat exchanger.

INSTALLATION

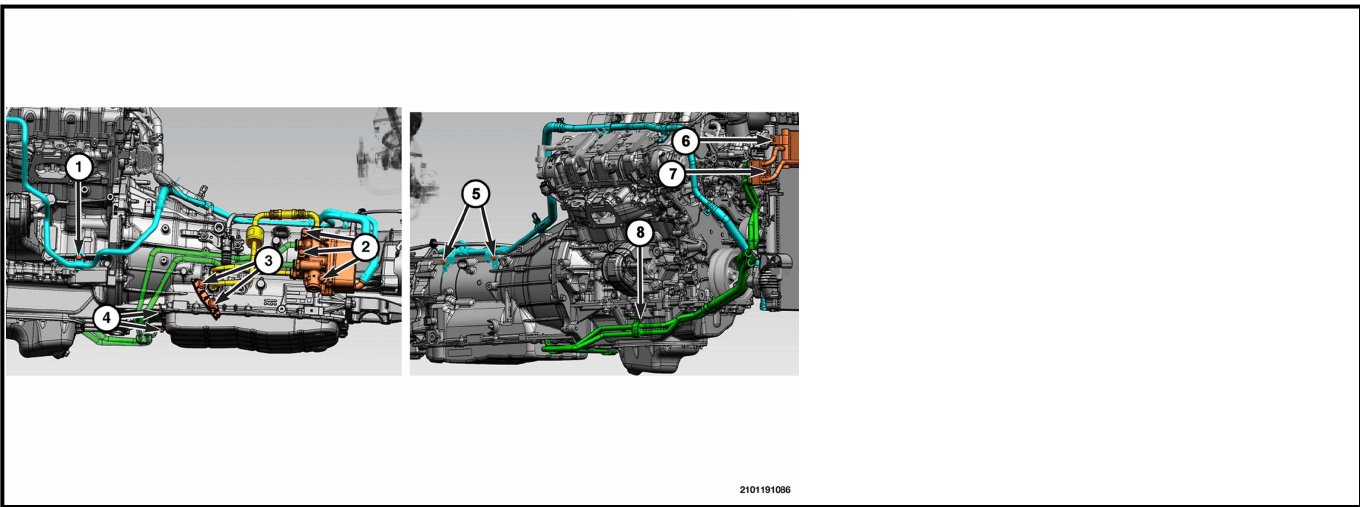
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Check transmission fluid level and correct as necessary. Refer to [CHECK FLUID LEVEL](#) .

TORQUE SPECIFICATIONS

TRANSMISSION OIL COOLER AND HEATER



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket to Engine Bolt	35 N. m (26 Ft. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
2	Transmission Oil Heater To Case Bolts	23 N. m (17 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Bolt	-	Tighten Securely
7	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
8	Transmission Oil Cooler Line Bracket To Oil Pan	9 N. m (80 In. Lbs.)	-

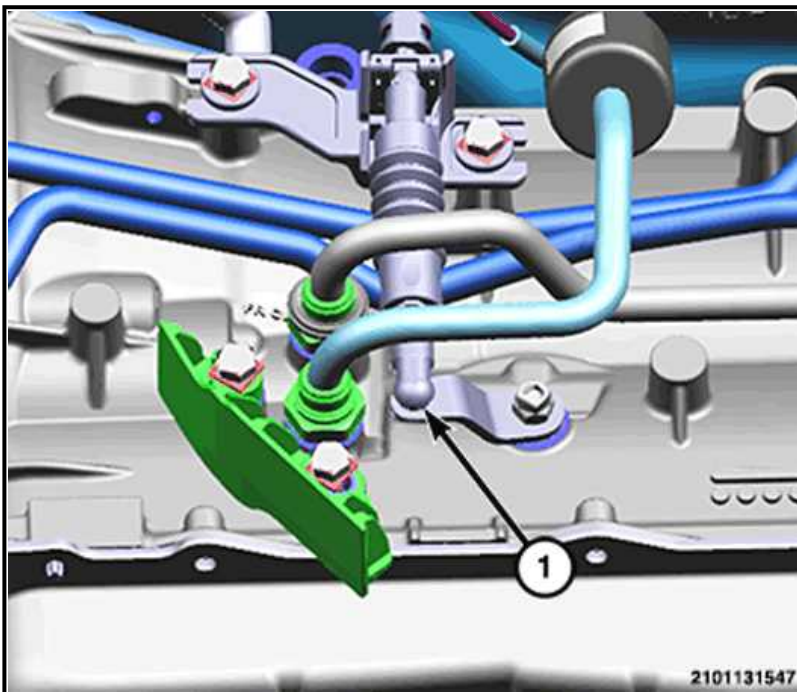
LEVER, MANUAL PARK RELEASE

REMOVAL AND INSTALLATION

MANUAL PARK RELEASE LEVER

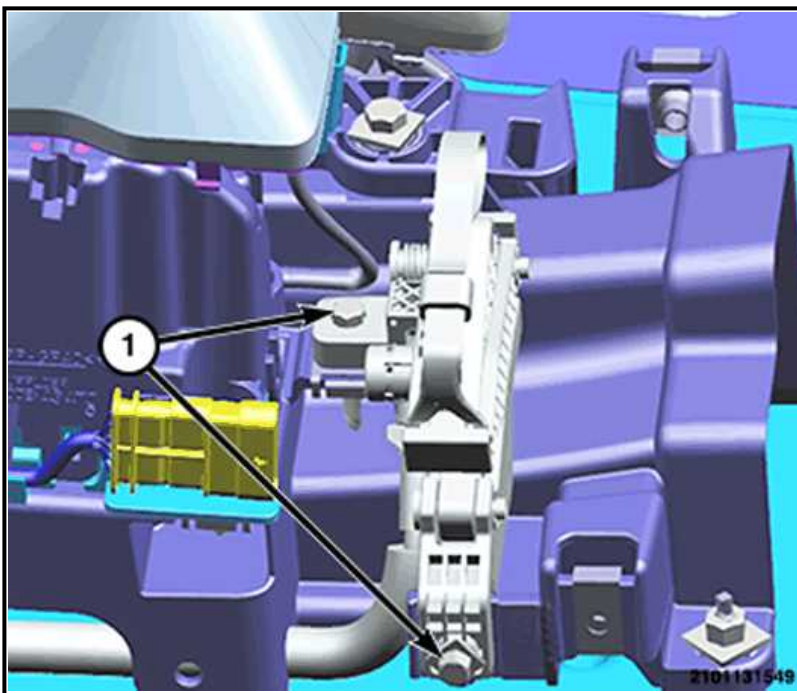
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to [CABLES, BATTERY](#) .
2. Apply the parking brake.
3. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



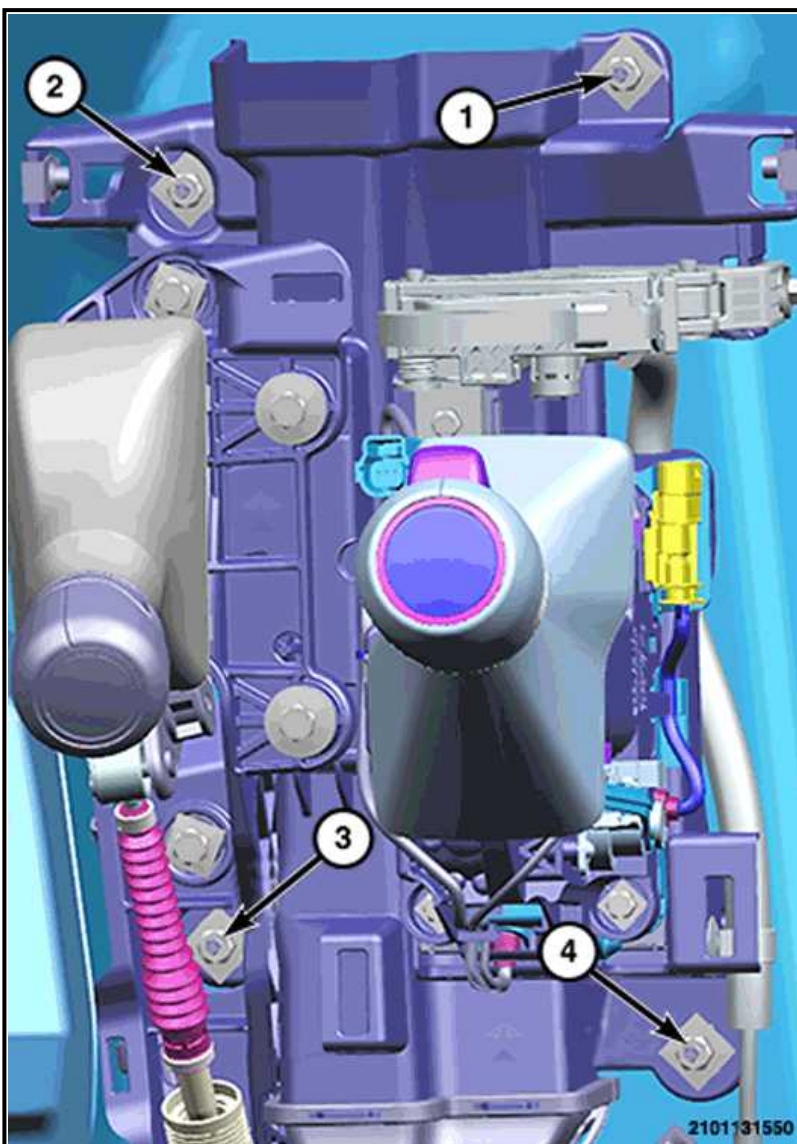
1 - Manual Park Release Cable

4. Disconnect the Manual Park Release (MPR) cable from the lever.
5. Remove the floor console from the vehicle. Refer to [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Shifter Base Bolts

6. Remove the bolts securing the MPR lever to the shifter base.



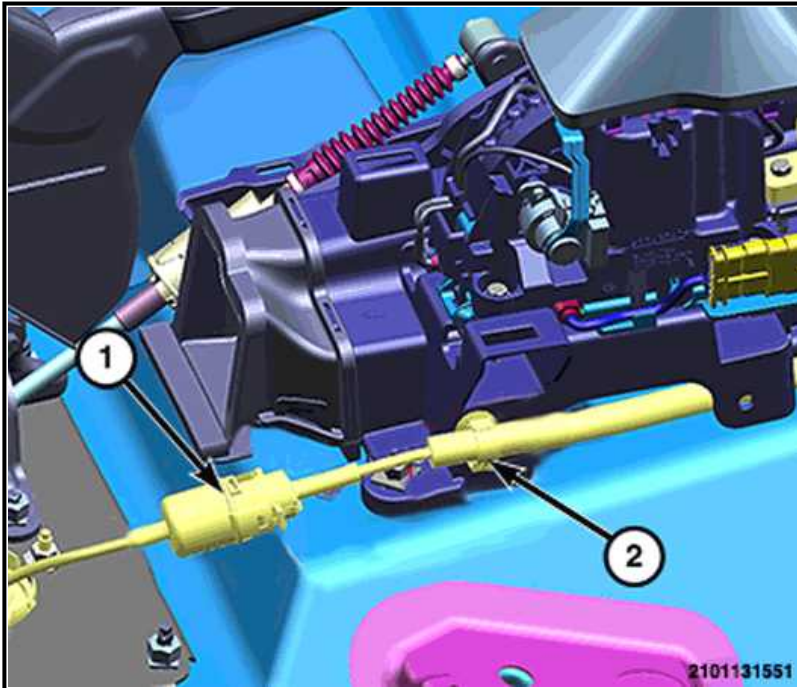
1 - Shifter Base Bolt

2 - Shifter Base Bolt

3 - Shifter Base Bolt

4 - Shifter Base Bolt

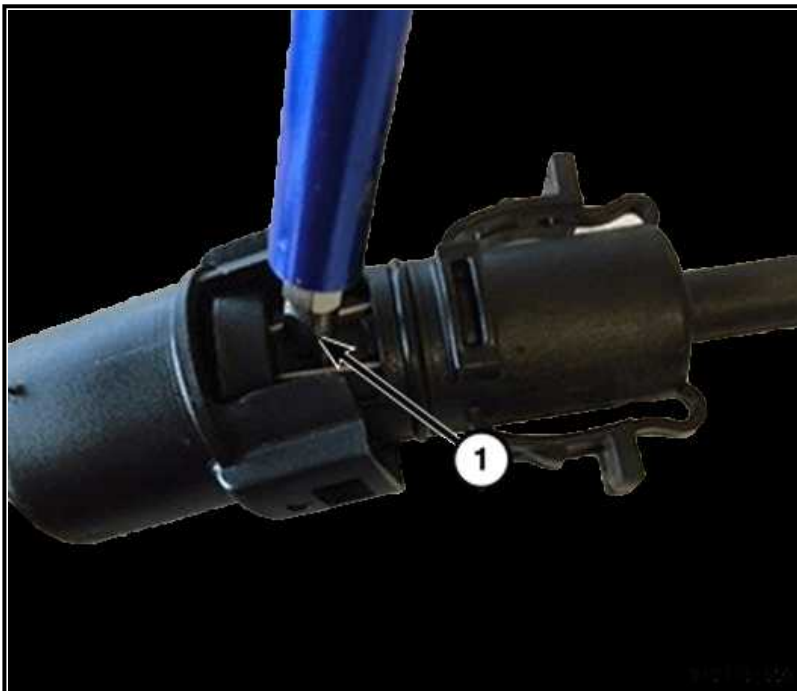
7. Remove the shifter base bolts securing the shifter base.



1 - Manual Park Release Retainer

2 - Manual Park Release Cable Securing Clip

8. Release the two-piece cable securing clip from the shifter base.



1 - Manual Park Release Retainer

9. Separate the two piece cable by squeezing the side tabs on the barrel and pulling the ends apart. Then pry the retainer apart holding the two-piece cable.

10. Remove the cable and the MPR lever from inside the vehicle.

INSTALLATION

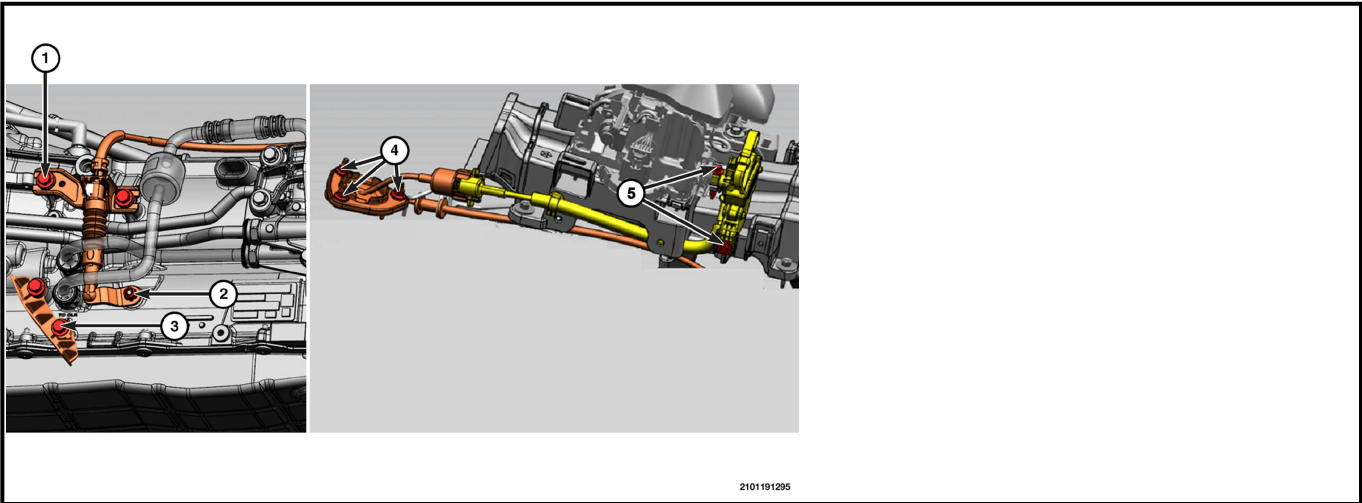
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Route the cables into the bulkhead and install the grommet into the bulkhead. Verify that the grommet is fully seated to prevent leakage.

TORQUE SPECIFICATIONS

MANUAL PARK RELEASE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

MOUNT, TRANSMISSION

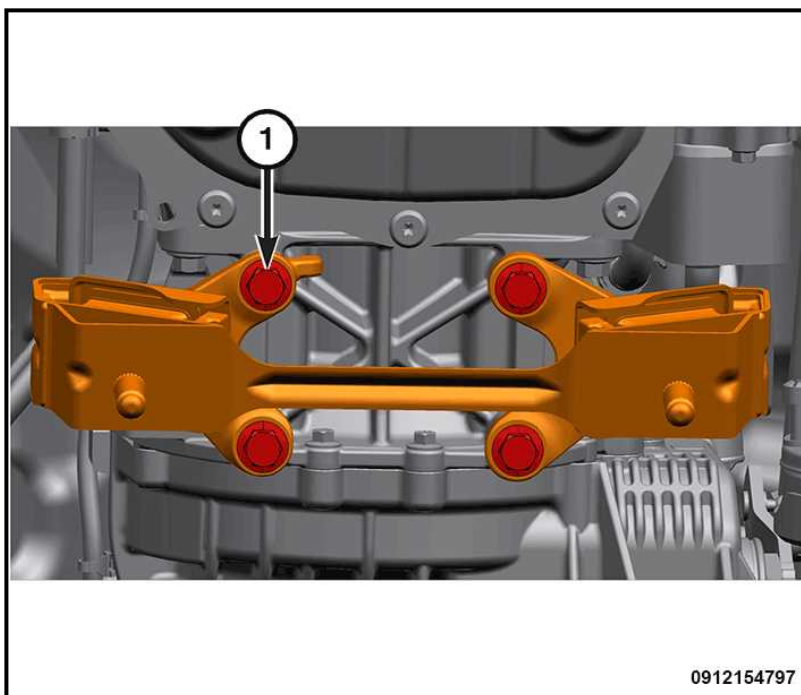
REMOVAL AND INSTALLATION

TRANSMISSION MOUNT

REMOVAL

NOTE: 4X4 with Automatic Transmission shown, other configurations similar.

1. Remove the transmission crossmember. Refer to [CROSSMEMBER, TRANSMISSION, REMOVAL AND INSTALLATION](#) .



1 - Transmission Mount to Transmission Bolts

2. Remove the transmission mount to transmission bolts and remove the rear isolator.

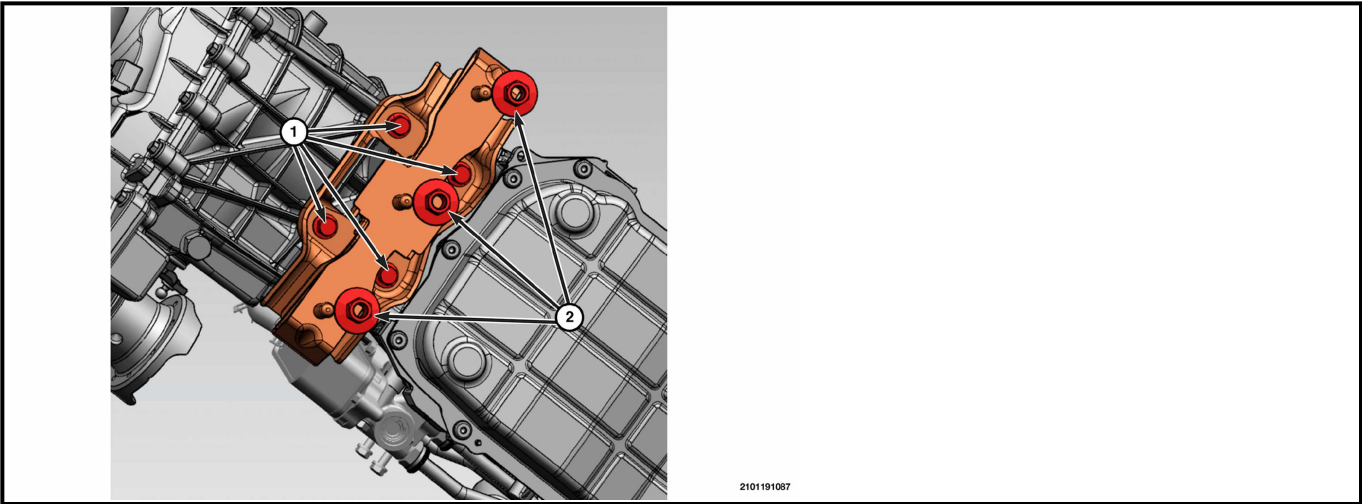
INSTALLATION

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

During installation, torque the fasteners to the specifications in the torque table(s) below.

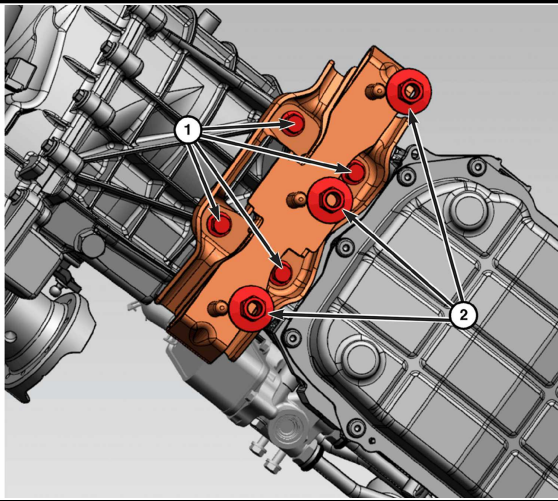
TORQUE SPECIFICATIONS

TRANSMISSION MOUNT



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

TRANSMISSION MOUNT



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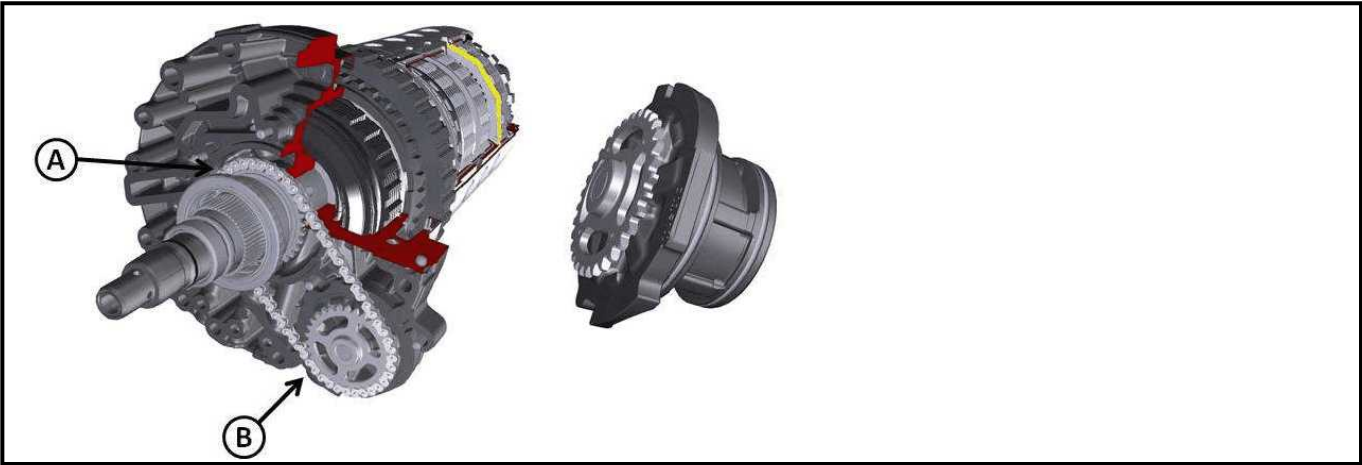
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

PUMP, TRANSMISSION OIL

DESCRIPTION AND OPERATION

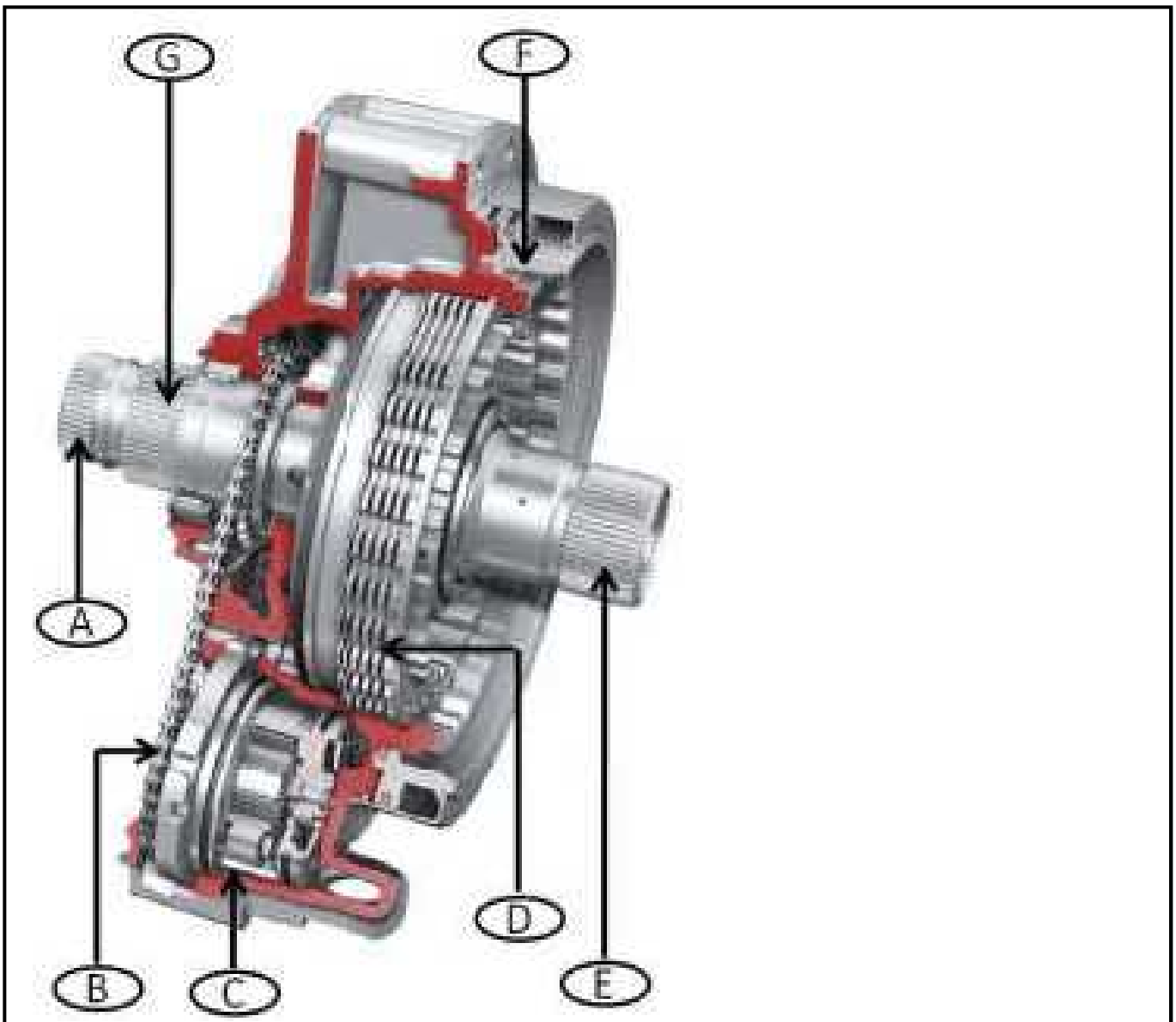
DESCRIPTION AND OPERATION

DESCRIPTION



The transmission oil pump (B) is driven by a chain and sprocket (A). The oil pump is located just behind the torque converter, inside of the pump housing. The pump is a double-stroke vane pump. The pump has dual chambers, two inlet and two outlet ports. The pump provides necessary lubrication and cooling throughout all phases of transmission operation.

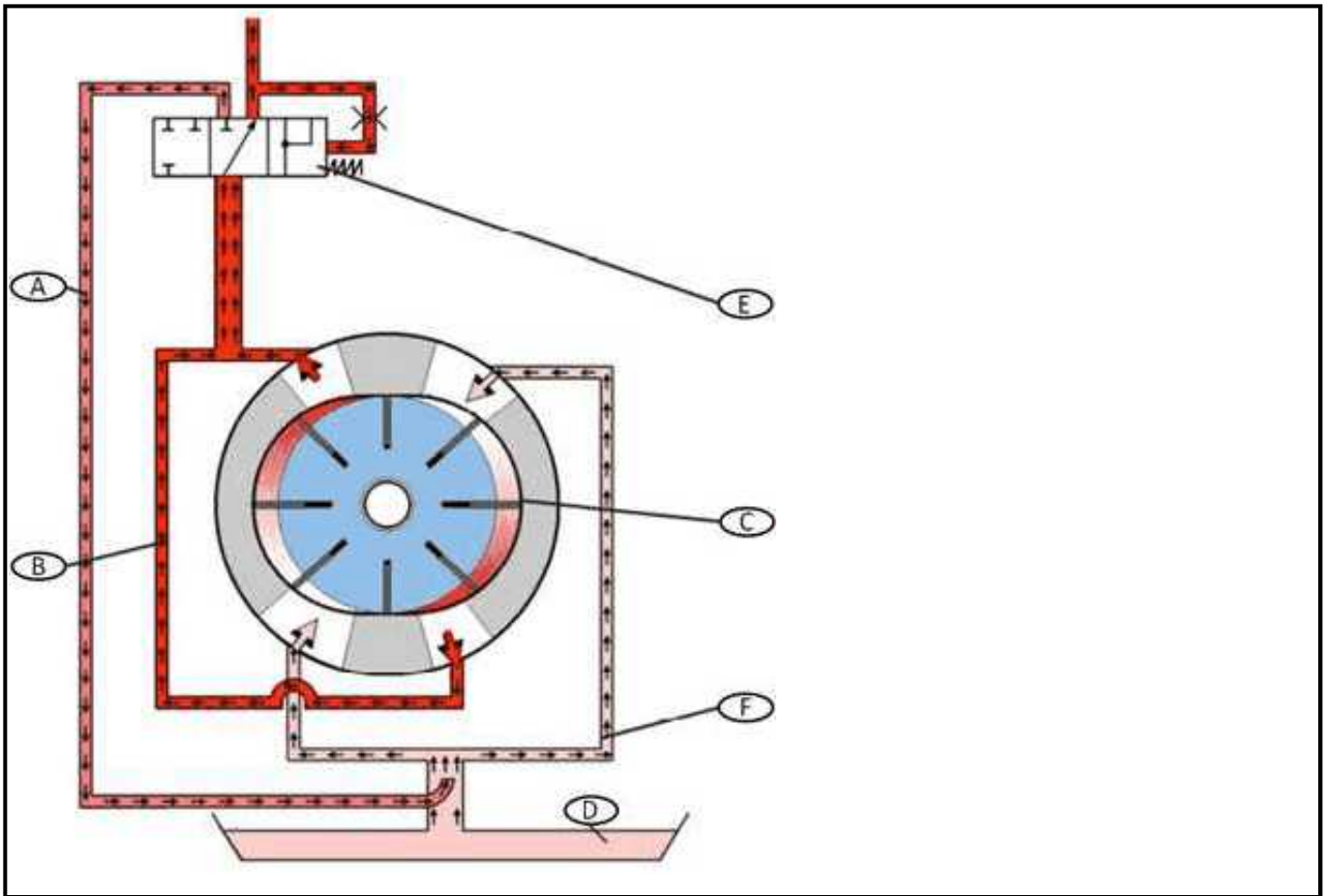
A	Stator Shaft
B	Pump Drive Chain
C	Pump Body
D	Brake A and Housing
E	Central Planetary Shaft for Gear 1 and 2
F	Brake B Piston
G	Pump Drive Hub



OPERATION

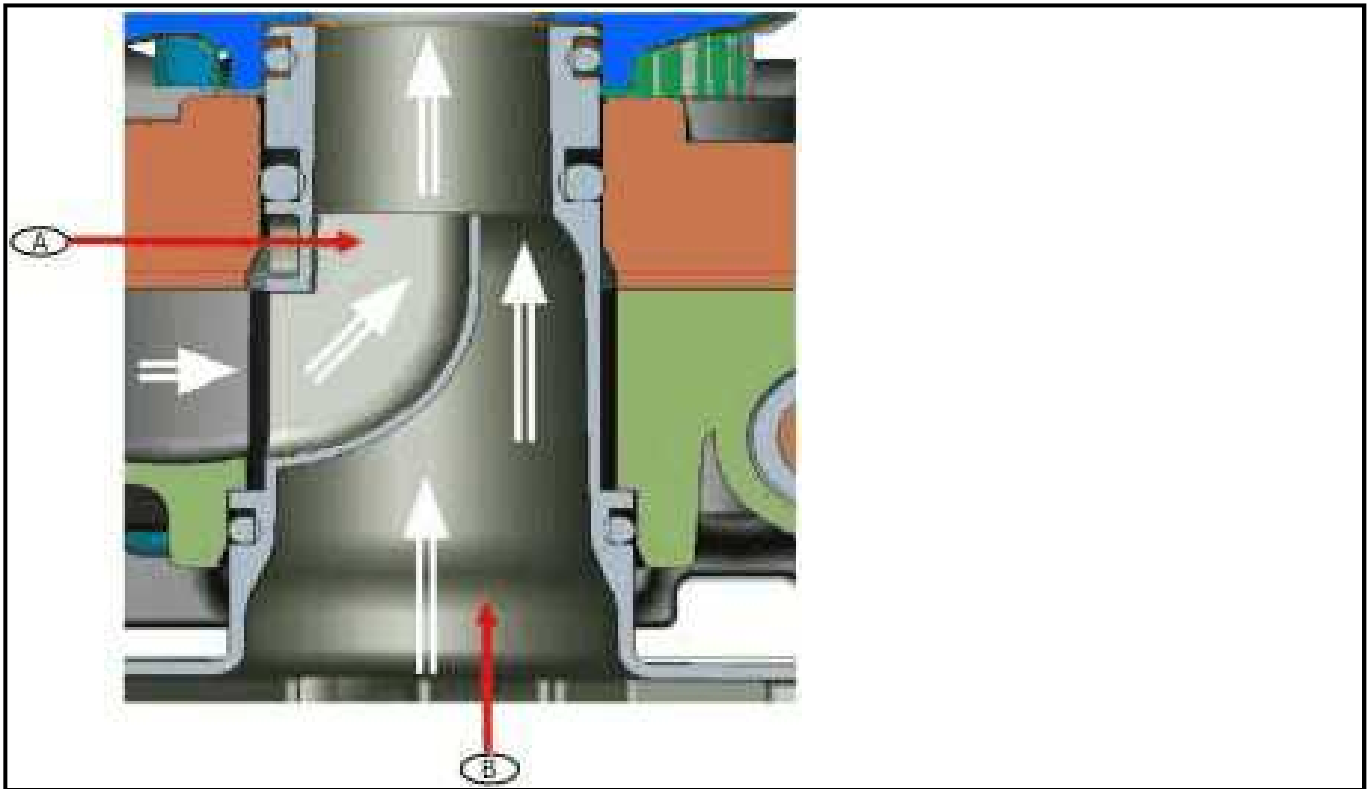
The Automatic Transmission Fluid (ATF) is sucked up from the sump underneath, which has the ATF filter in it, and is sent under pressure to the system delivery valve, to be then sent to the hydraulic valves in the mechatronics unit and to the converter pressure valve. The system delivery valve is managed through the control pressure from the EDS-SYS system pressure control solenoid valve.

A - RETURN OF REDUNDANT OIL	D - SUMP
B - PRESSURE PIPE	E - SYSTEM PRESSURE VALVE
C - PUMP	F - INTAKE PIPE



The excess oil is sent back to the ATF pump in the intake duct. This solution improves the noise, reducing the possibility of cavitation and increasing the pump efficiency by increasing the pressure on the intake side.

A	Charging duct - surplus oil from the system delivery valve
B	Oil from the filter built into the sump



REMOVAL AND INSTALLATION

TRANSMISSION OIL PUMP

Transmission oil pump service will require disassembly and assembly of Clutch A and Clutch B. The individual clutches listed below provide the following information for each clutch assembly:

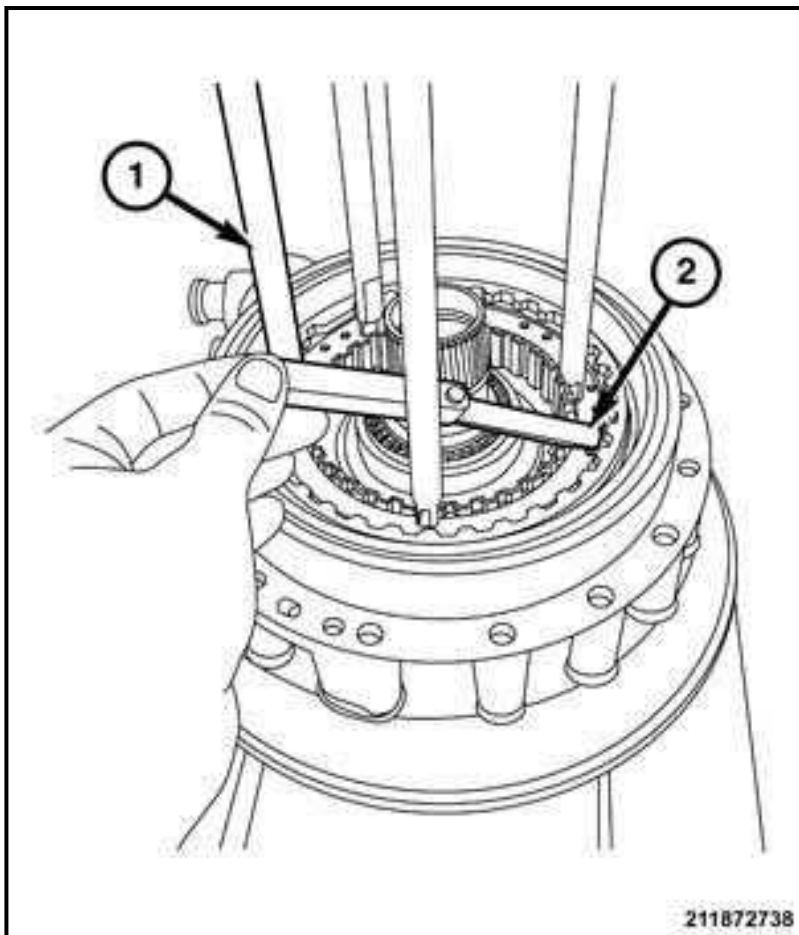
- Disassembly and assembly procedures
- Clutch pack clearance measurements
- Clutch pack clearance specifications
- Adjustments - selectable snap rings and backing plates

It is recommended to measure the clutch pack clearances for evaluation before disassembling the transmission oil pump and making sure they remain in specification after reassembling the transmission oil pump.

CLUTCH A - DISASSEMBLY AND ADJUSTMENTS

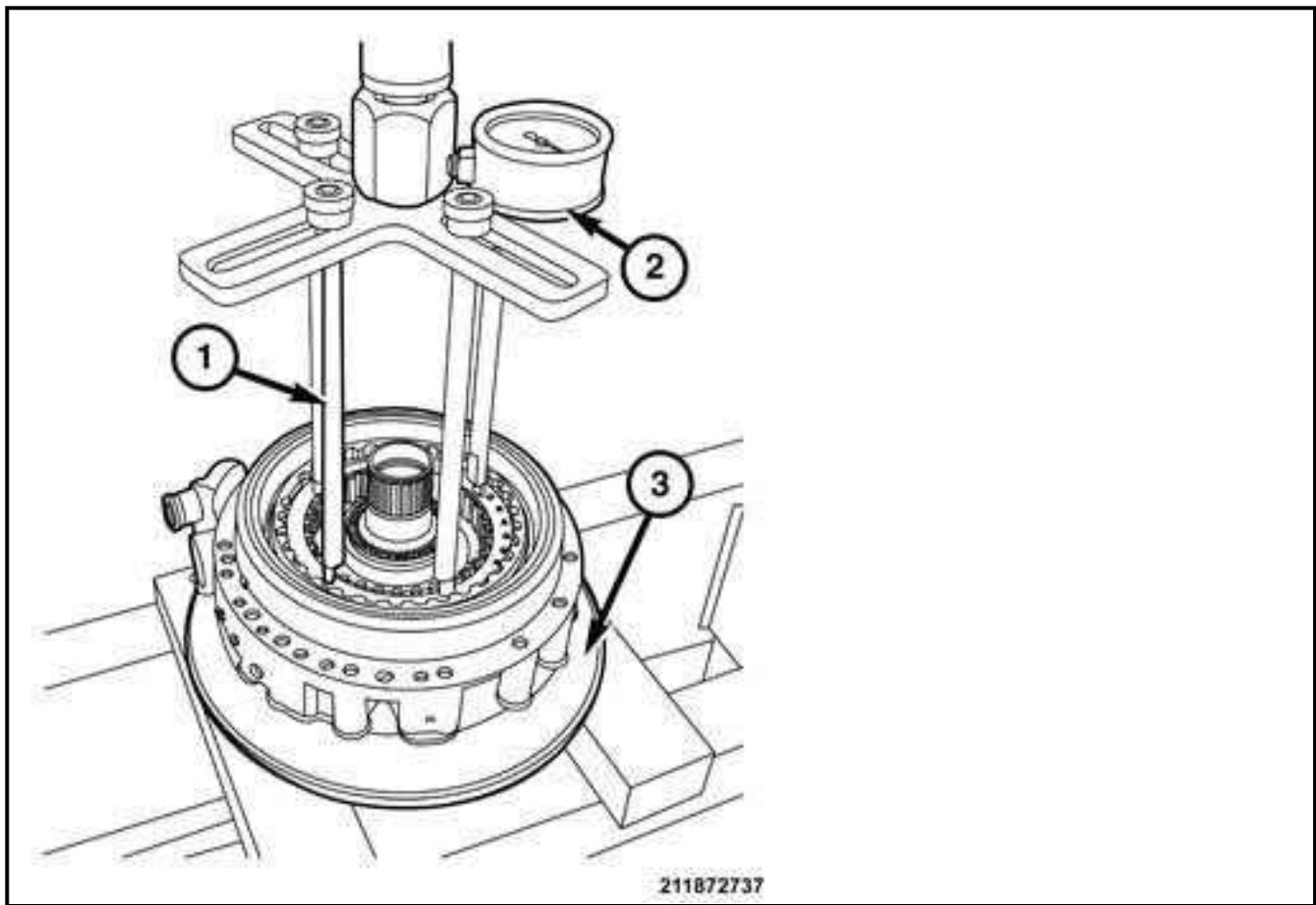
CLUTCH A MEASUREMENT PROCEDURE

1. Using (special tool #10428, Adapter, Pressing Tool) and (special tool #10429, Gauge, Force), place the Clutch A/oil pump assembly in a suitable arbor press.
2. Apply 200 N (45 lbs.) of force to the Clutch A backing plate to compress the wave plate.



1 - Pressing Tool Adapter
2 - Feeler Gauge

3. With a suitable feeler gauge measure the gap between the Clutch A backing plate and the snap ring.
4. Refer to the clutch clearance table for specs. If clearance is not within specification, a thinner or thicker selectable snap ring can be installed for proper clearance.



1 - Pressing Tool Adapter
2 - Force Gauge
3 - Clutch A/Oil Pump Assembly

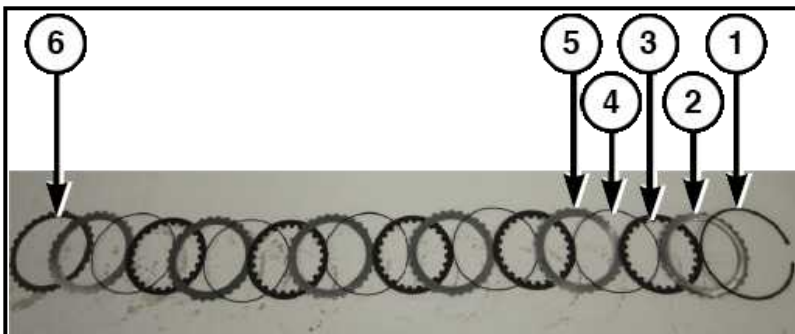
CLUTCH SPECIFICATIONS

B	B	B	B	B
Clutch	Condition	Minimum	Normal	Maximum
A	NEW	1.51 mm	1.665 mm	1.82 mm
		0.059 in	0.066 in	0.072 in
	AFTER OPERATION	1.51 mm	1.765 mm	2.02 mm
		0.059 in	0.069 in	0.080 in

CLUTCH A SELECTABLE SNAP RINGS

3.2 mm	0.125 in.
3.0 mm	0.118 in.
2.8 mm	0.110 in.
2.6 mm	0.102 in.
2.4 mm	0.0944 in.
2.2 mm	0.0866 in.

DISASSEMBLY Clutch A, depending on transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates, five wave springs, five steel plates, one support plate, one snap ring, and one wave plate.



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1 - Snap Ring

2 - Support Plate

3 - Friction Plates

4 - Wave Springs

5 - Steel Plates

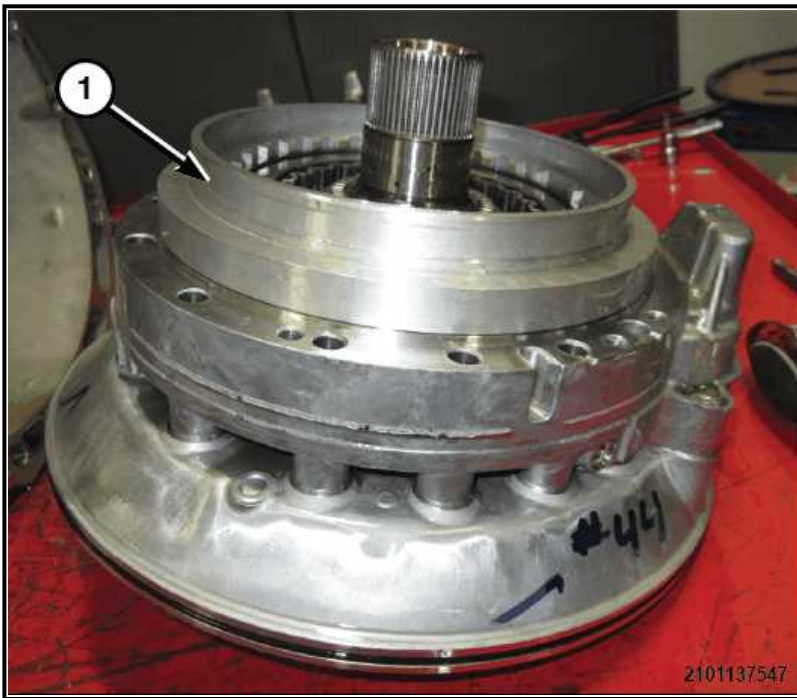
6 - Wave Plate

1. Remove the oil pump from the transmission case. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).



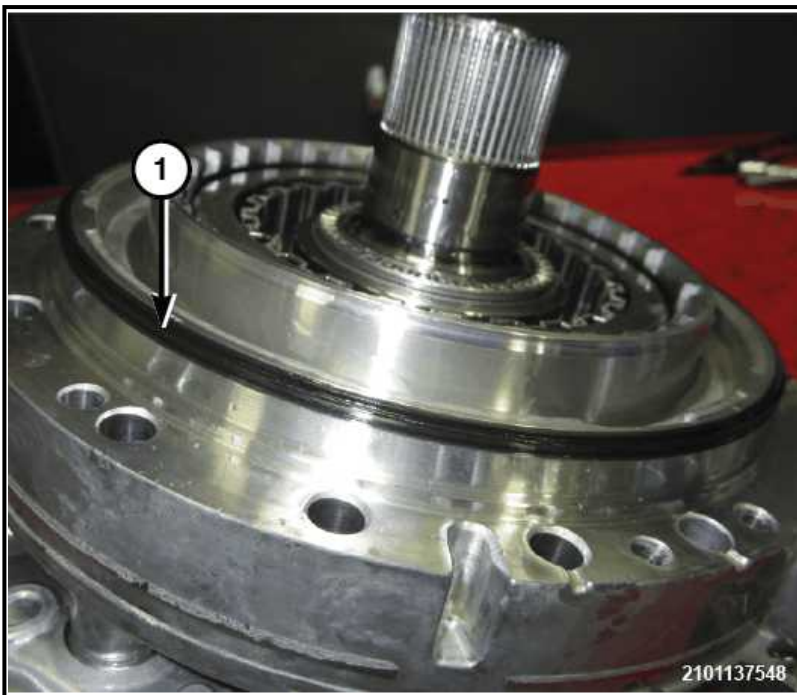
1 - Clutch B Damper Spring

2. Remove the Clutch B damper spring.



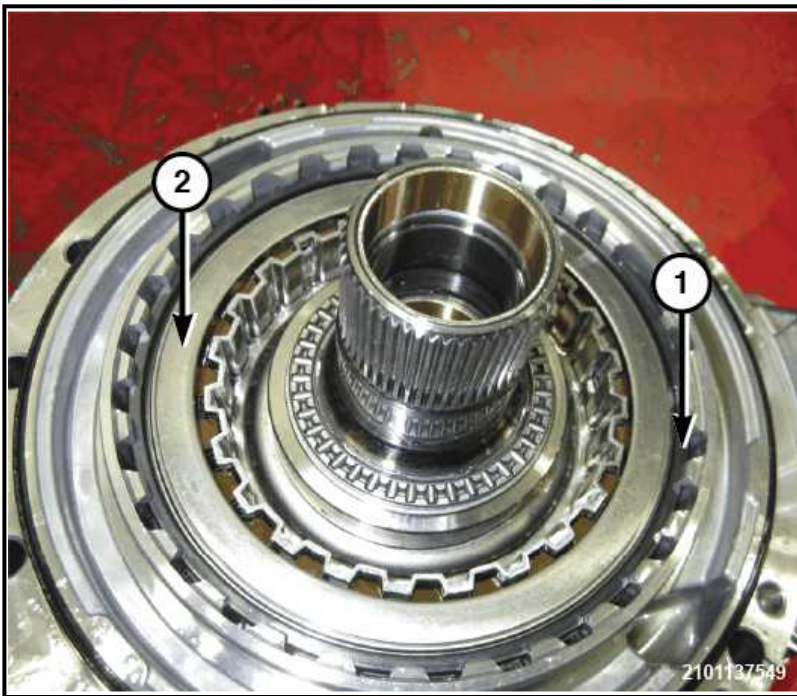
1 - Clutch B Piston

3. Remove the Clutch B piston from the assembly.



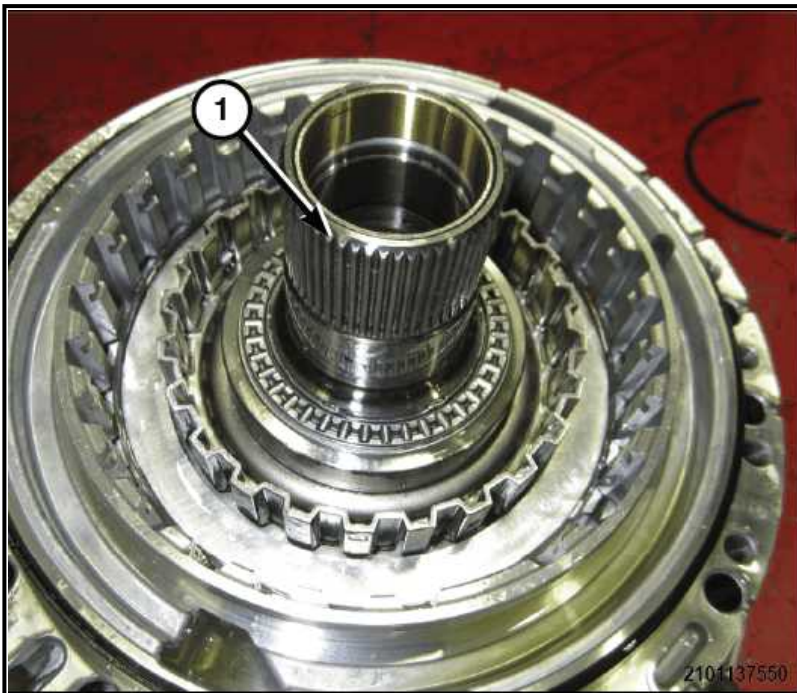
1 -Clutch B Piston Seal

4. Check the Clutch B piston seal for damage or wear and replace if necessary.



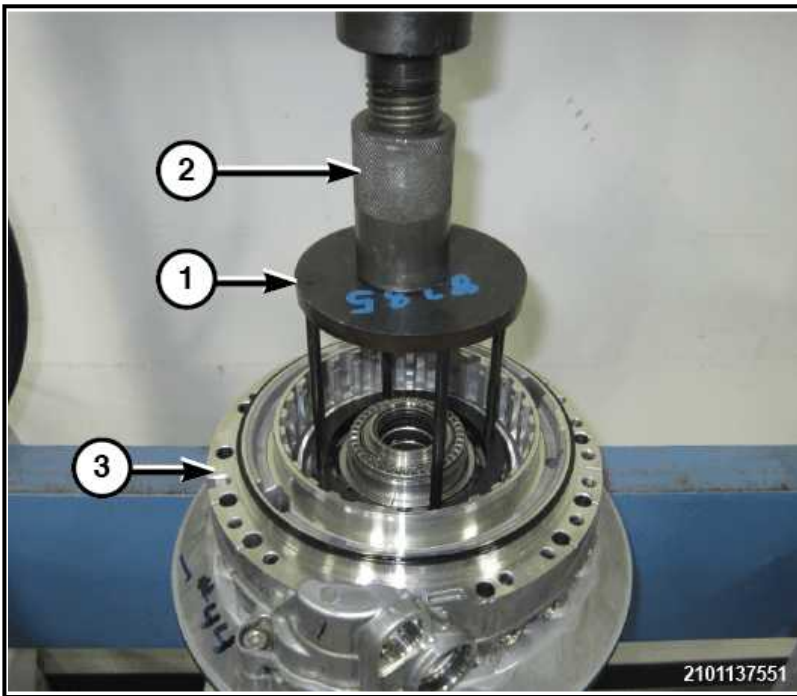
- | |
|-------------------------------|
| 1 - Snap Ring |
| 2 - Clutch A Discs and Plates |

5. Remove the snap ring.
6. Remove the Clutch A disks and plates.



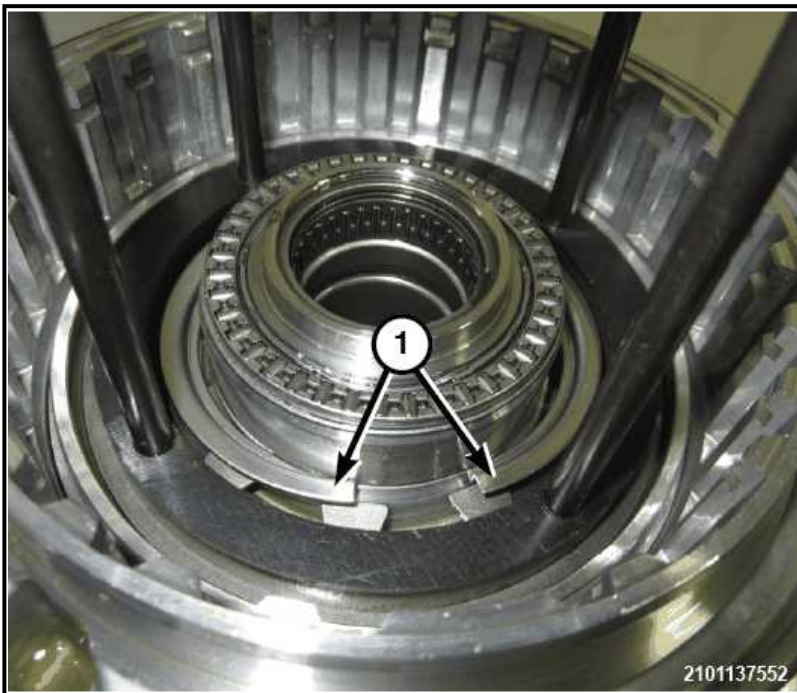
- | |
|---------|
| 1 - Hub |
|---------|

7. Remove the hub.



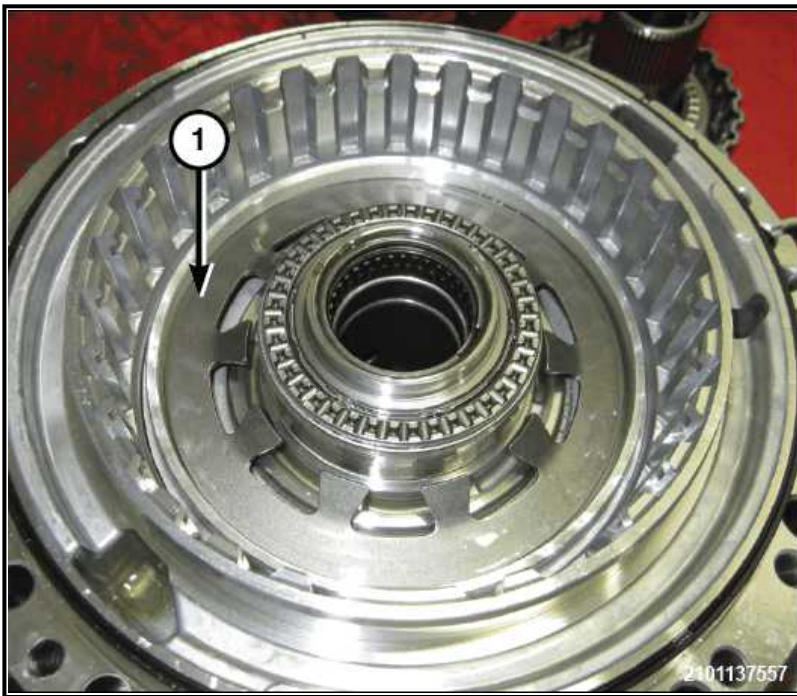
1 - Spring Compressor Tool
2 - Arbor Press
3 - Transmission Oil Pump Assembly

8. Position the oil pump housing assembly in a suitable arbor press.
9. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retaining ring to remove tension.



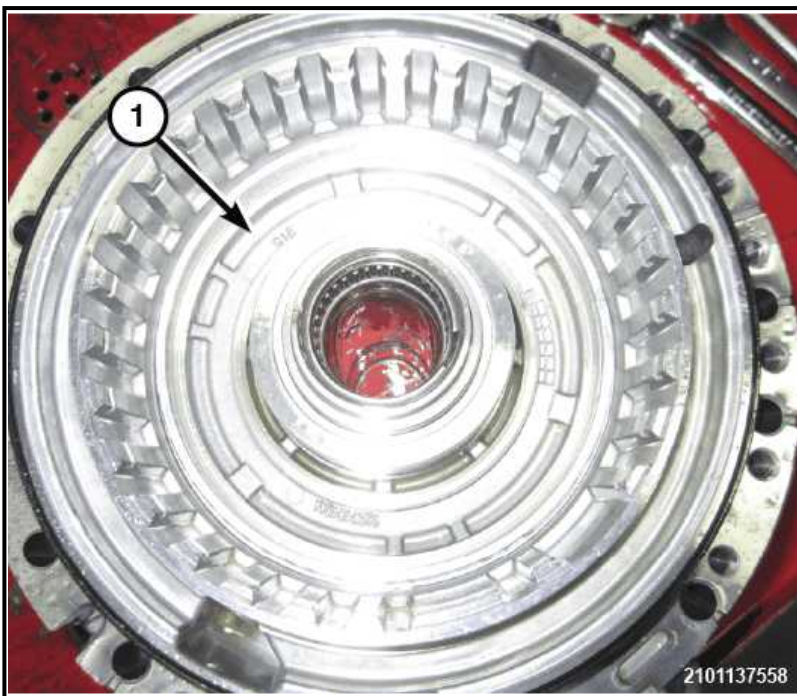
1 - Retaining Ring

10. Remove the two halves of the retaining ring.



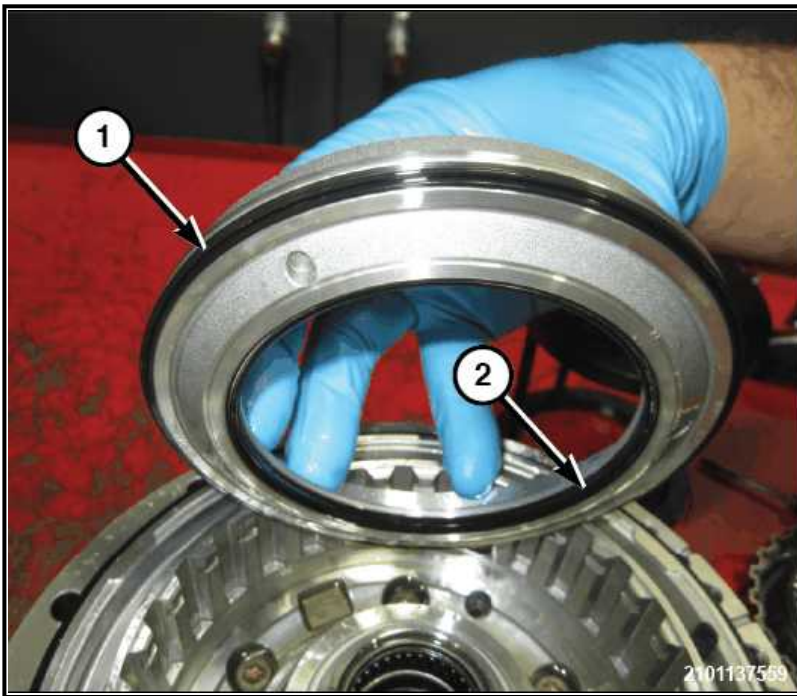
1 - Clutch A Belleville Spring

11. Remove the Clutch A belleville spring.



1 - Clutch A Piston

12. Remove the Clutch A piston (1) by rotating and gently lifting.



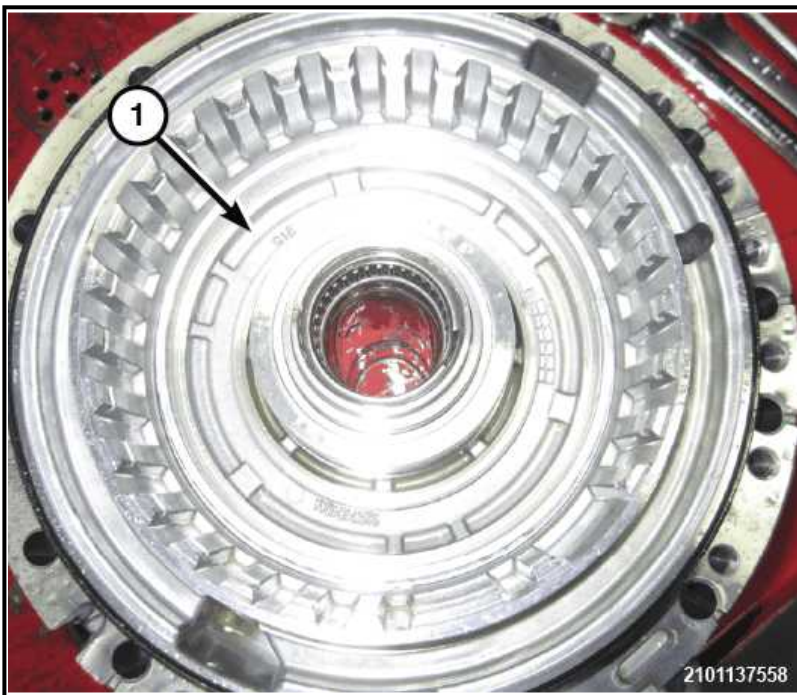
- | |
|--------------------------------|
| 1 - Clutch A Piston Outer Seal |
| 2 - Clutch A Piston Inner Seal |

13. Remove and **DISCARD** the Clutch A Piston inner and outer seals.

ASSEMBLY

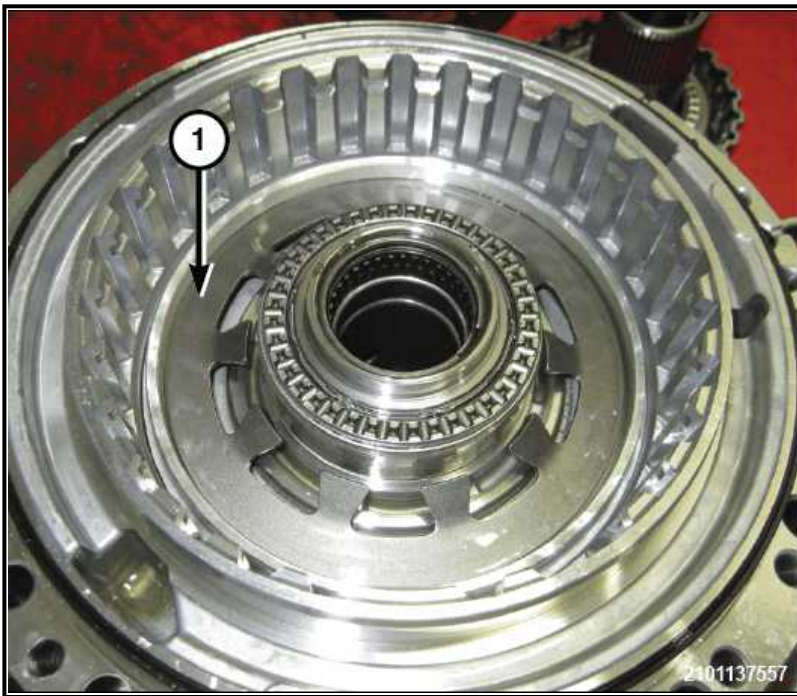
NOTE: If the clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Install new Clutch A inner and outer piston seals.



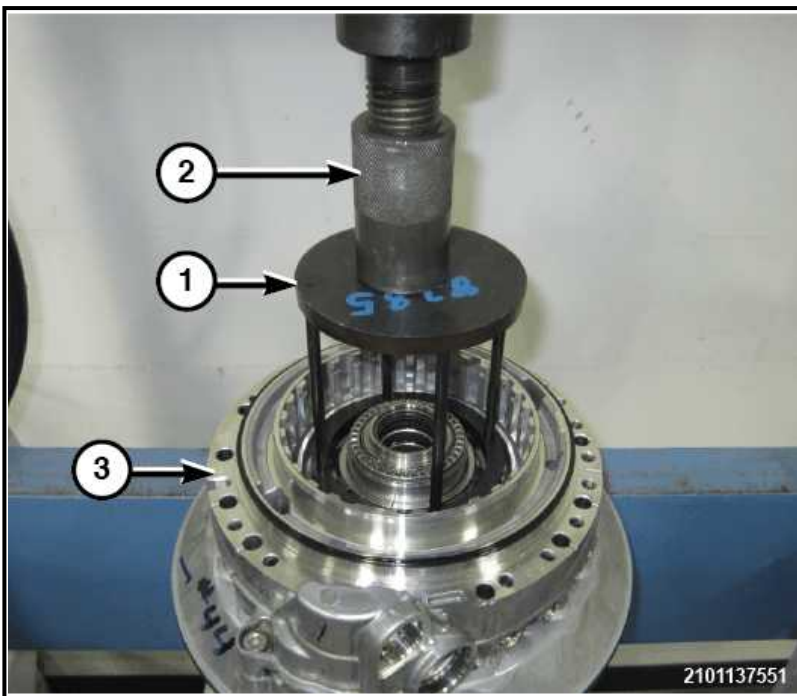
- | |
|---------------------|
| 1 - Clutch A Piston |
|---------------------|

2. Insert the Clutch A piston into the housing. Lubricate the seals with transmission assembly lube prior to installing them into the housing.



1 - Clutch A Belleville Spring

3. Insert the belleville spring.



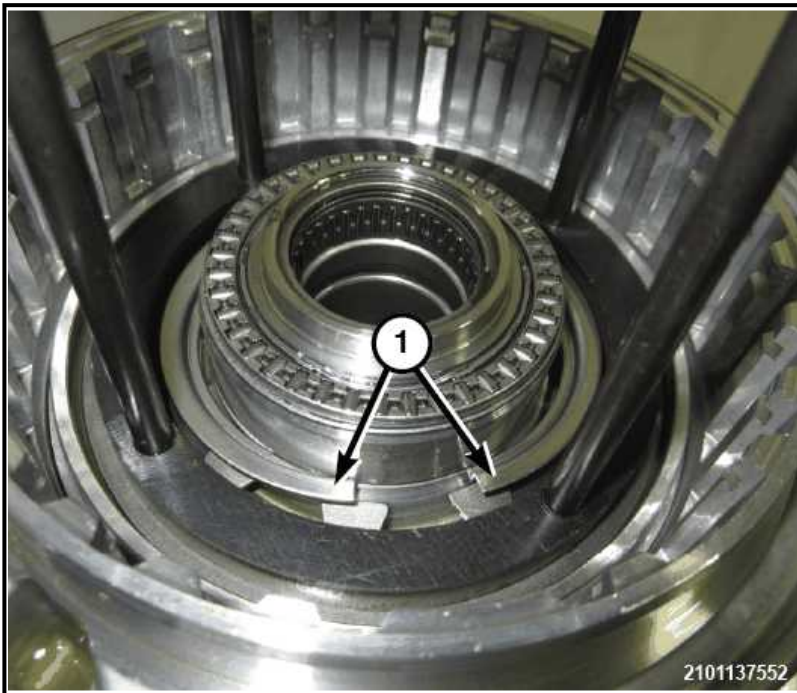
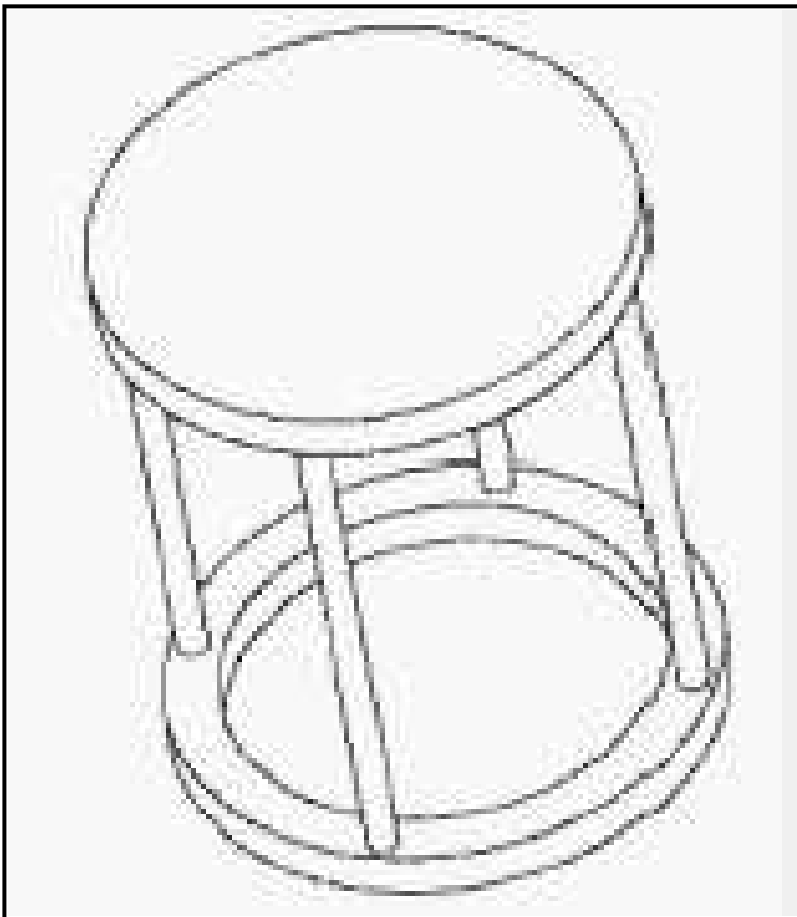
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

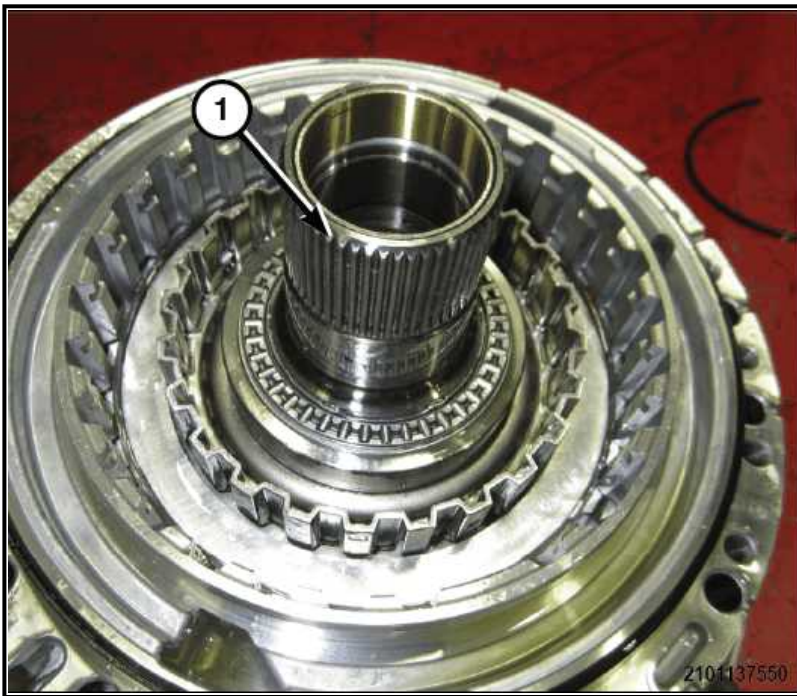
4. Position the oil pump housing assembly in a suitable arbor press.

5. Using (special tool #8285, Compressor, Spring) , press on the fingers of the piston retaining ring to remove tension.



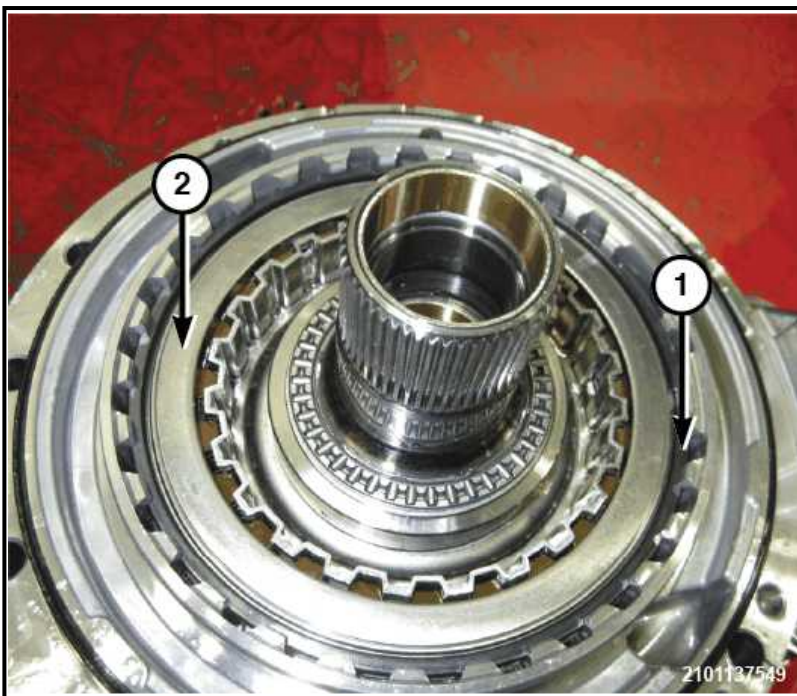
1 - Retaining Ring

6. Install the two retaining ring halves.



1 - Hub

7. Install the hub.

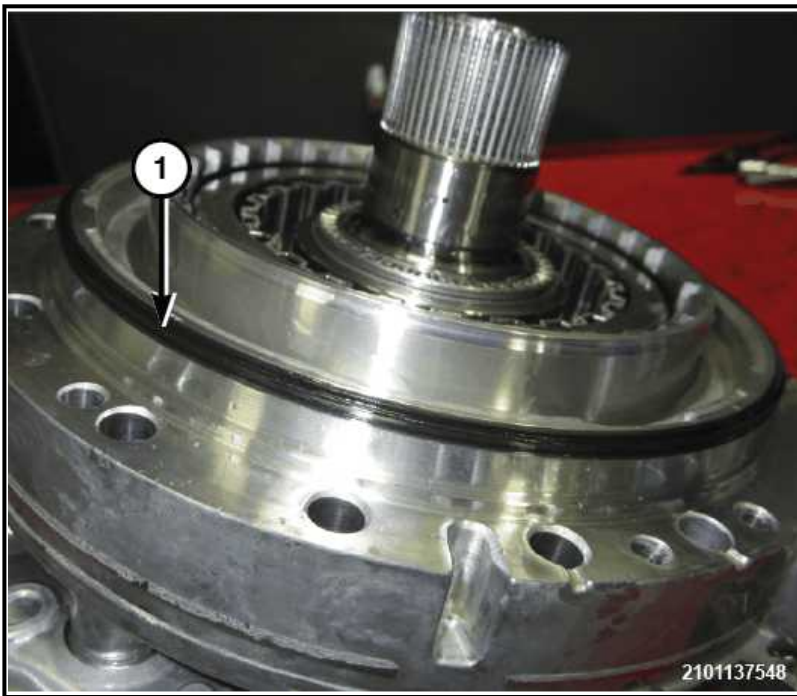


1 - Snap Ring

2 - Clutch A Discs and Plates

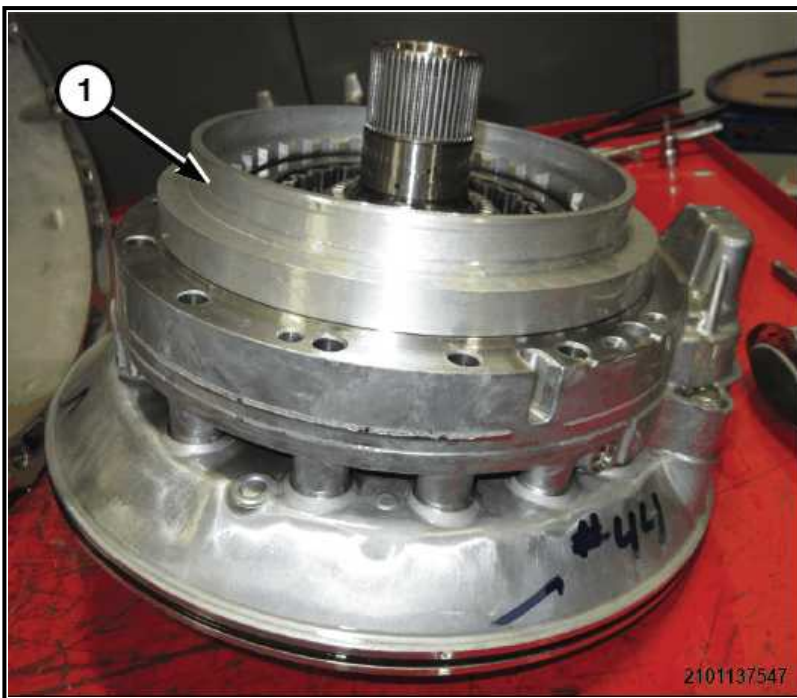
8. Install the Clutch A disks and plates.

9. Install the snap ring.



1 - Clutch B Piston Seal

10. Install a **NEW** Clutch B seal.



1 - Clutch B Piston

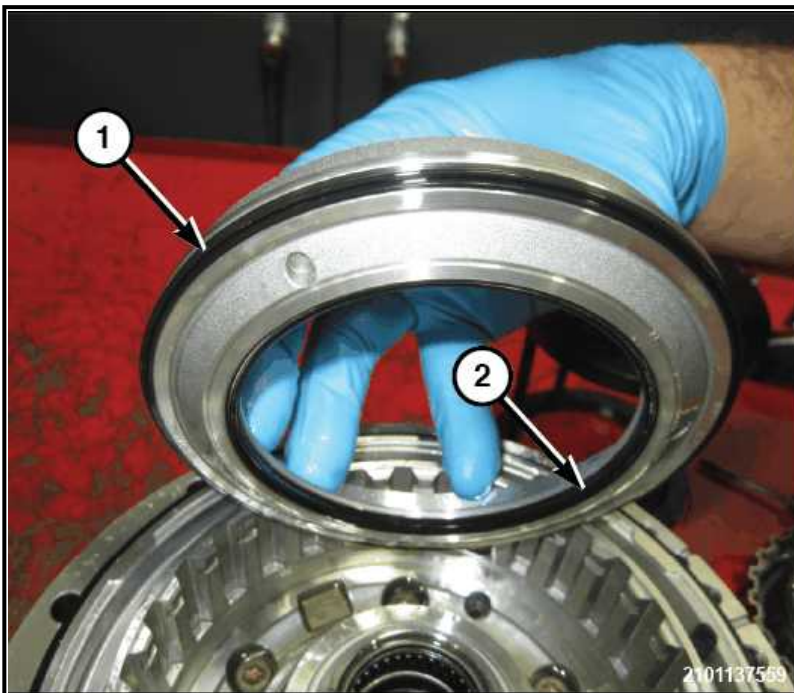
11. Install the Clutch B piston on the assembly.



1 - Clutch B Damper Spring

12. Install the Clutch B damper spring on the Clutch B piston.

13. Install the transmission oil pump. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).

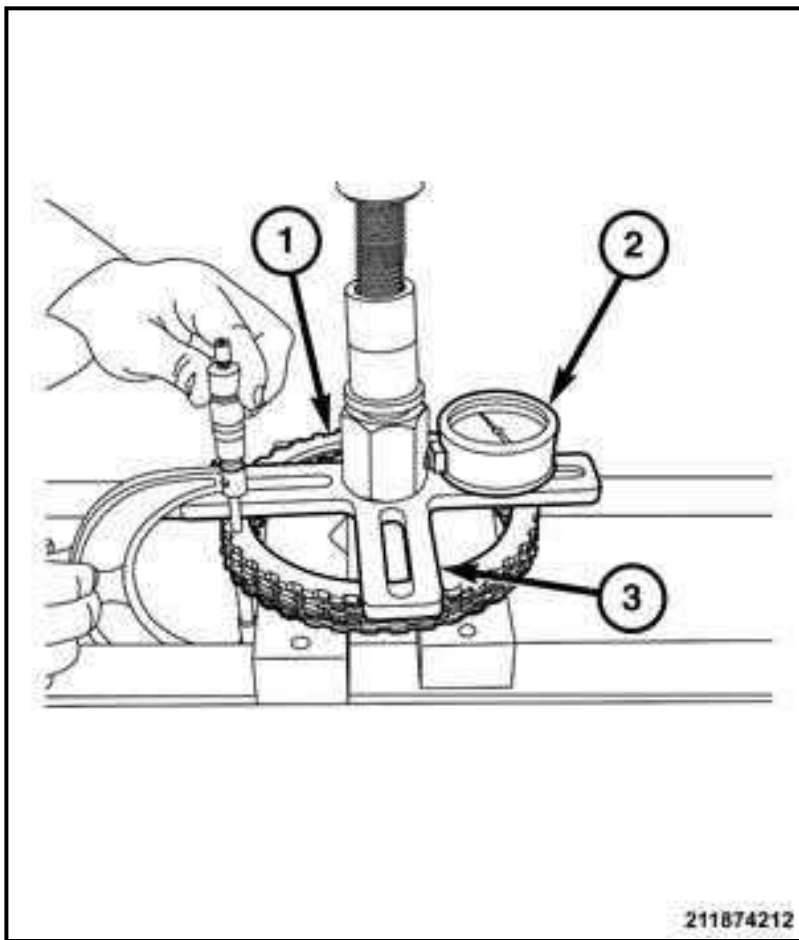


CLUTCH B - DISASSEMBLY AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

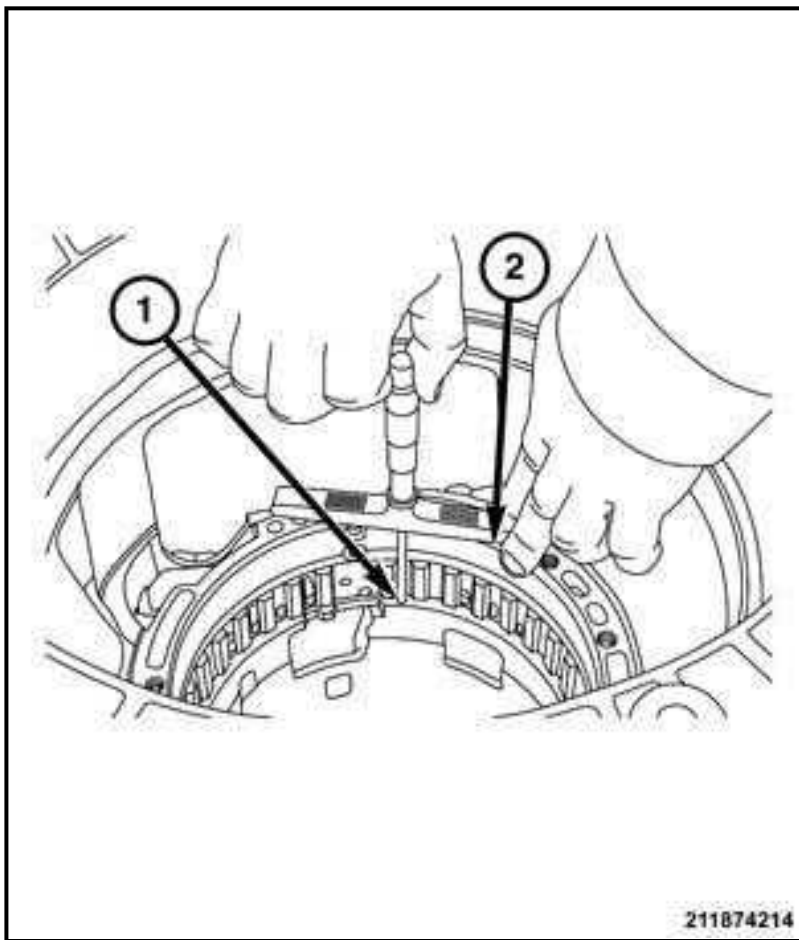
NOTE: When the Clutch B is replaced, the proper selectable shim must be installed to achieve specified clearance.

1. Place the Clutch B, with the wave plate on top, on a suitable arbor press.
2. Position tools (special tool #8901A, Pressing Tool) (using just the cross bar) and (special tool #10429, Gauge, Force) on top of the Clutch B wave plate and under the press ram.



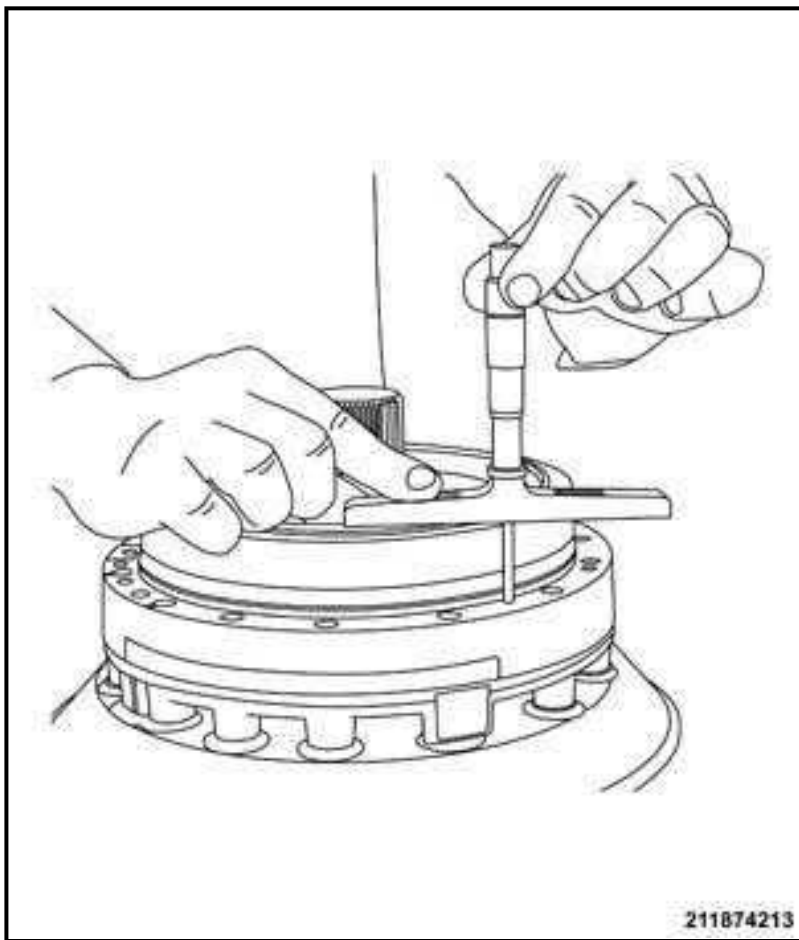
1 - Clutch B Wave Plate
2 - Force Gauge
3 - Compressed Clutch B

3. Apply 500 N (112 lbs.) of downward force on the Clutch B to compress the wave plate.
4. Using a suitable micrometer, measure the thickness of the compressed Clutch B. **Record the measurement as (A)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



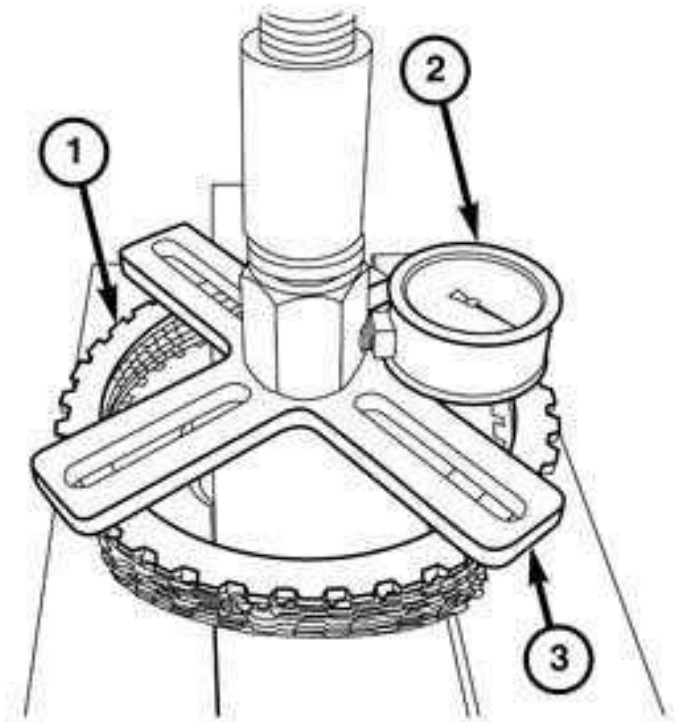
1 - Clutch B Retainer
2 - Transmission Oil Pump

5. With a suitable depth micrometer, place it at the mounting surface of the transmission oil pump and measure to the base of the Clutch B retainer on the case. This measurement should be 61.05 mm. **Record the measurement as (B)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



6. Using a suitable depth micrometer, measure the Clutch B piston.
7. Measure between the fluid pump sealing surface and the bottom of the straight edge. **Record the measurement as (C)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.

Calculation - Take the case depth (B) subtract (C) subtract (A) remainder is the clearance of the Clutch B. If the clearance is not within specification a thinner or thicker reaction plate can be installed to achieve proper clearance.



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1 - Clutch B Wave Plate

2 - Force Gauge

3 - Pressing Tool

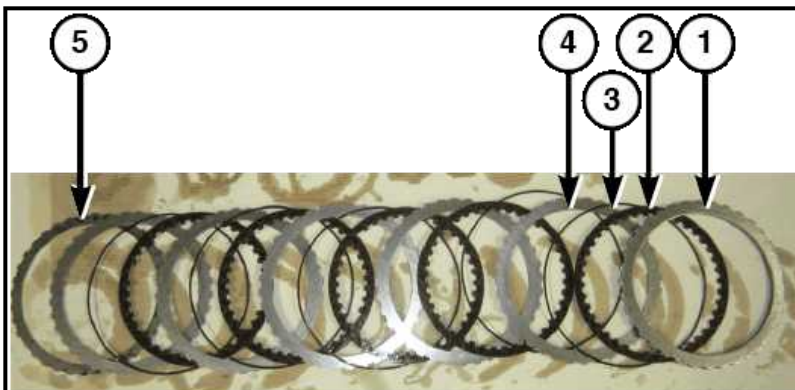
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
B	NEW	1.52 mm	1.725 mm	1.93 mm
		0.060 in.	0.068 in.	0.076 in.
	AFTER OPERATION	1.52 mm	1.825 mm	2.13 mm
		0.060 in.	0.072 in.	0.084 in.

CLUTCH B SELECTABLE BACKING PLATES

6.0 mm	.236 in.
5.8 mm	.228 in.
5.6 mm	.220 in.
5.4 mm	.212 in.
5.2 mm	.204 in.
5.0 mm	.196 in.
4.8 mm	.188 in.

DISASSEMBLY The Clutch B, depending on the transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates (2), five wave springs (3), five steel plates (4), one backing plate (1), and one wave plate (5).



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1 - Backing Plate

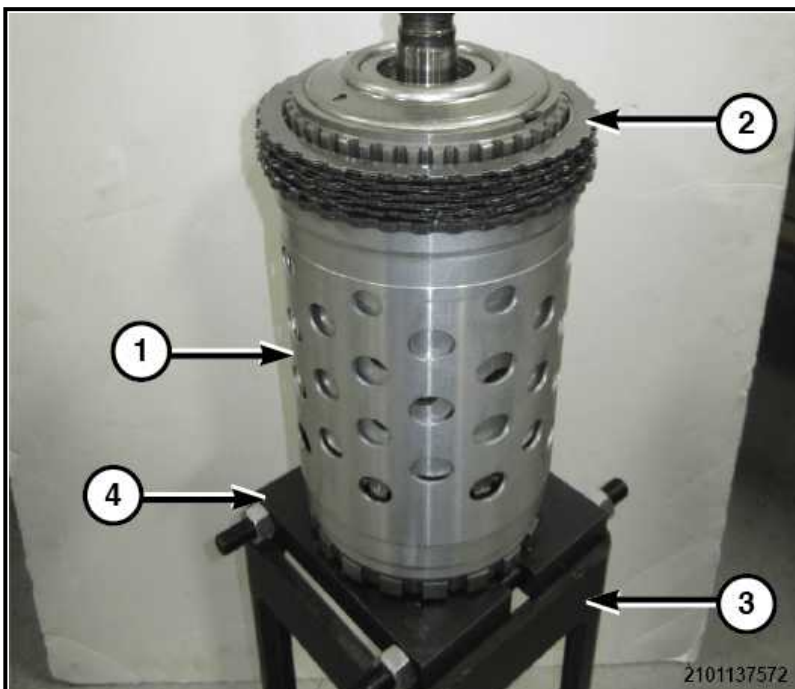
2 - Friction Plates

3 - Wave Springs

4 - Steel Plates

5 - Wave Plate

1. Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear) and remove the Clutch B discs and plates.



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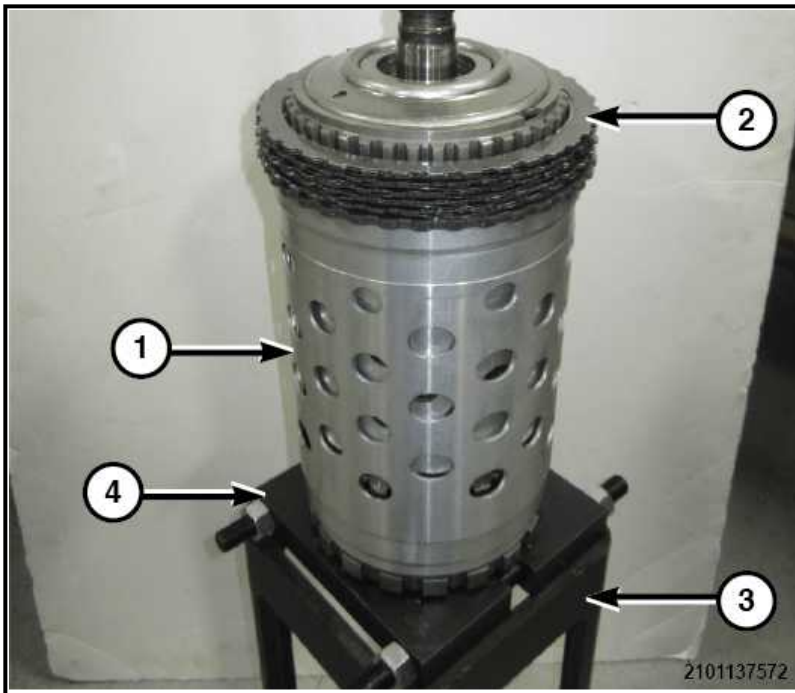
1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

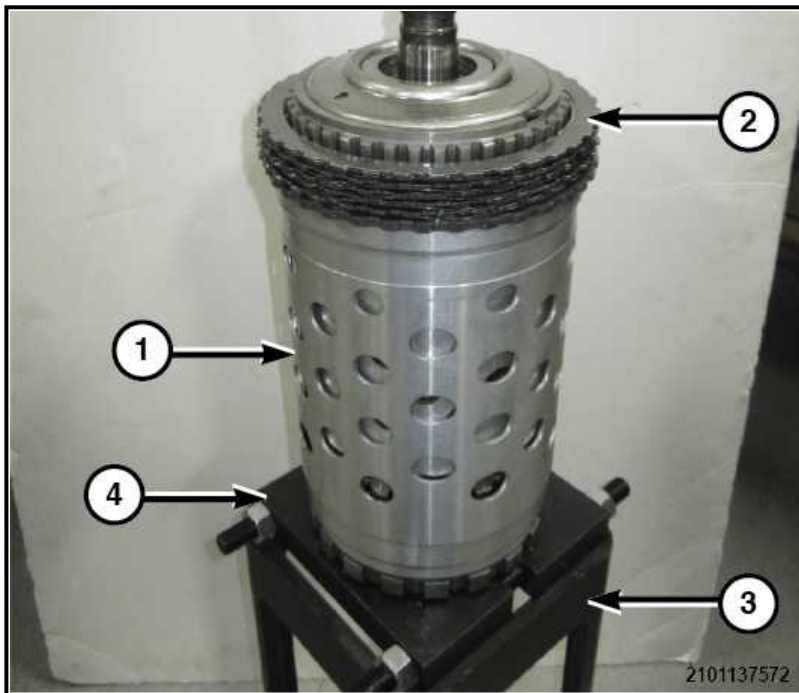
ASSEMBLY



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Splitter, Bearing/Gear

NOTE: If clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Position the input/output and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) and (special tool #1130, Splitter, Bearing/Gear).



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Bearing/Gear Splitter

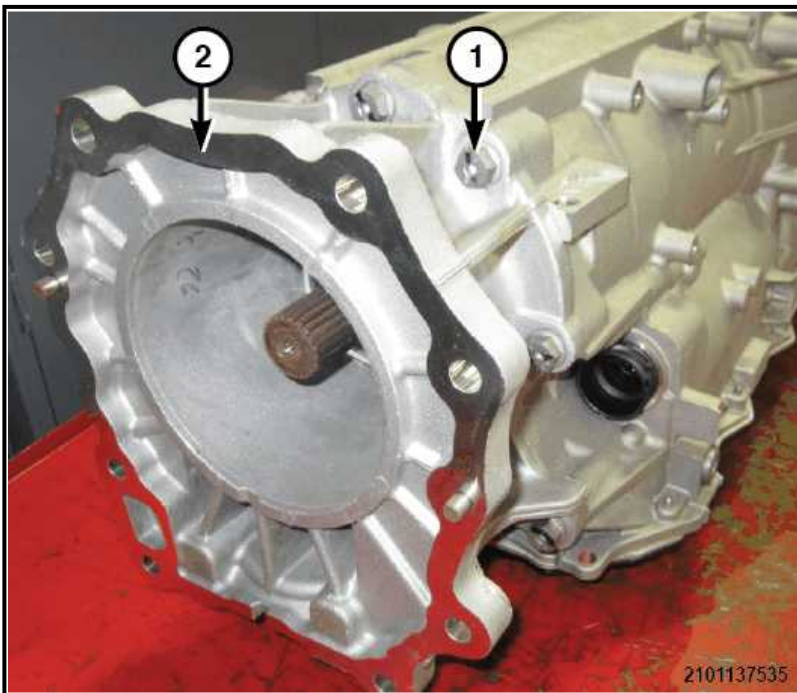
2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.
5. Install the P1 annulus onto the input/output shaft.
6. Install the correct selectable shim onto the P1 annulus.

END PLAY - MEASUREMENT AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

NOTE: The proper selectable shim must be installed to achieve specified clearance.

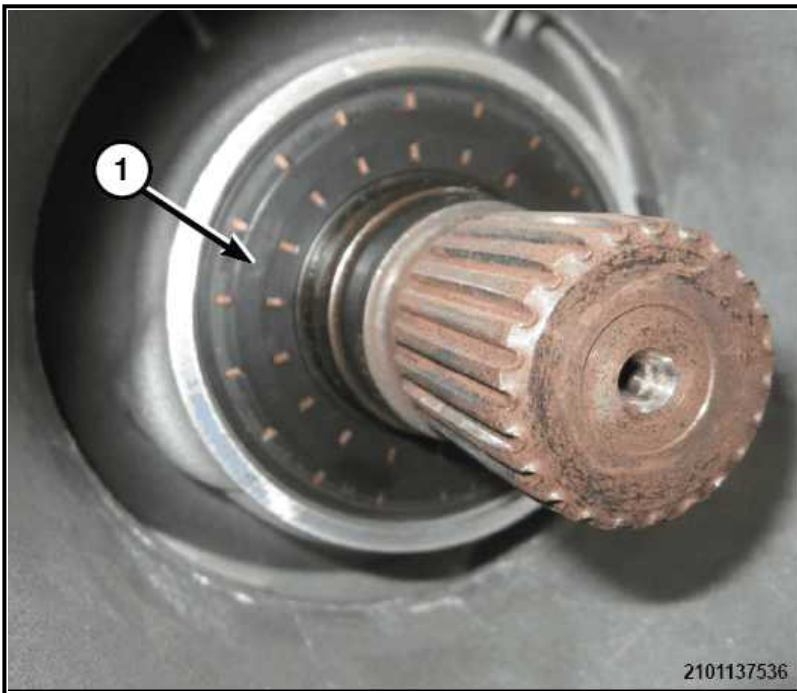
1. Remove the torque converter.



1 - Extension Housing Bolts
2 - Extension Housing

NOTE: 4WD Only

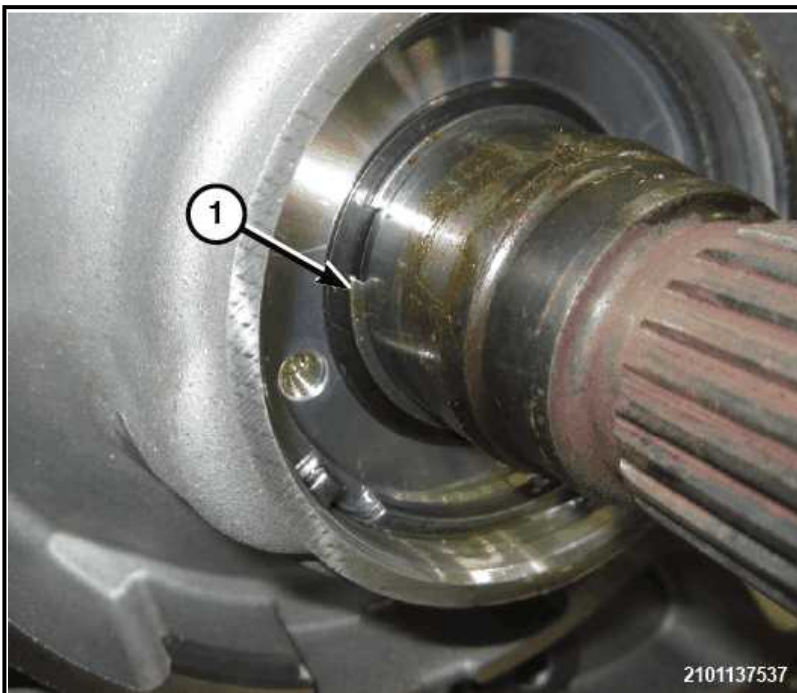
2. If the vehicle is **2WD** , proceed to Step 6. If the vehicle is **4WD** proceed to Step 3.
3. If equipped, remove the transmission housing extension housing bolts and remove the extension housing.



1 - Output Shaft Seal

NOTE: 4WD Only

4. Remove the transmission output shaft seal with a suitable slide hammer and screw.

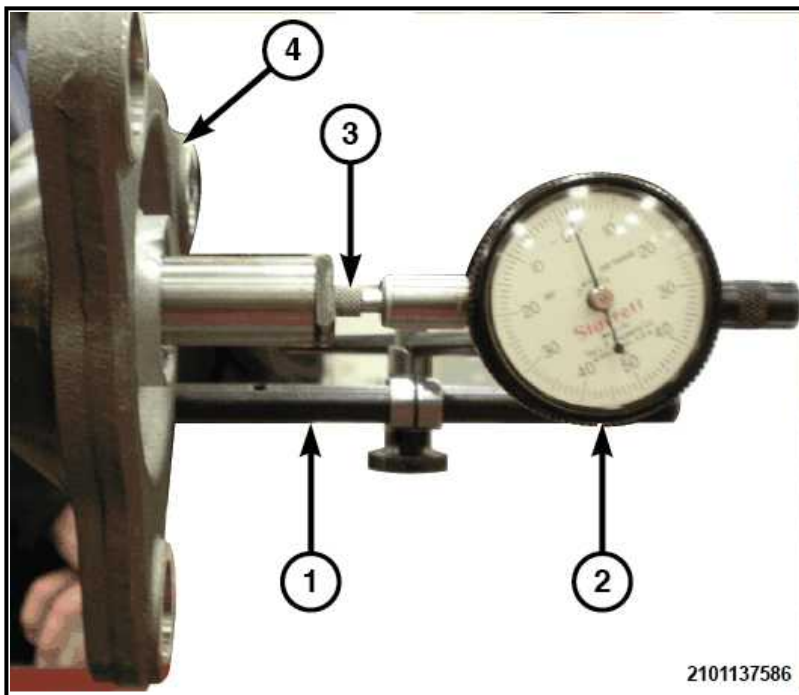


1 - Output Shaft Snap Ring

NOTE: 4WD Only

5. Remove the output shaft snap ring.

NOTE: 2WD shown, 4X4 similar.



1 - Transmission Output Flange
2 - Dial Indicator
3 - Plunger
4 - Transmission Output Flange

6. Measure the output shaft end play as follows:

- Attach a dial indicator and position the plunger against the end of the output shaft.
- Zero the dial indicator.
- Move the output shaft flange in and out, and record the maximum travel on the dial for assembly reference.

If the end play is not within specification a thinner or thicker selectable shim can be installed to achieve proper end play.

END PLAY SPECIFICATIONS

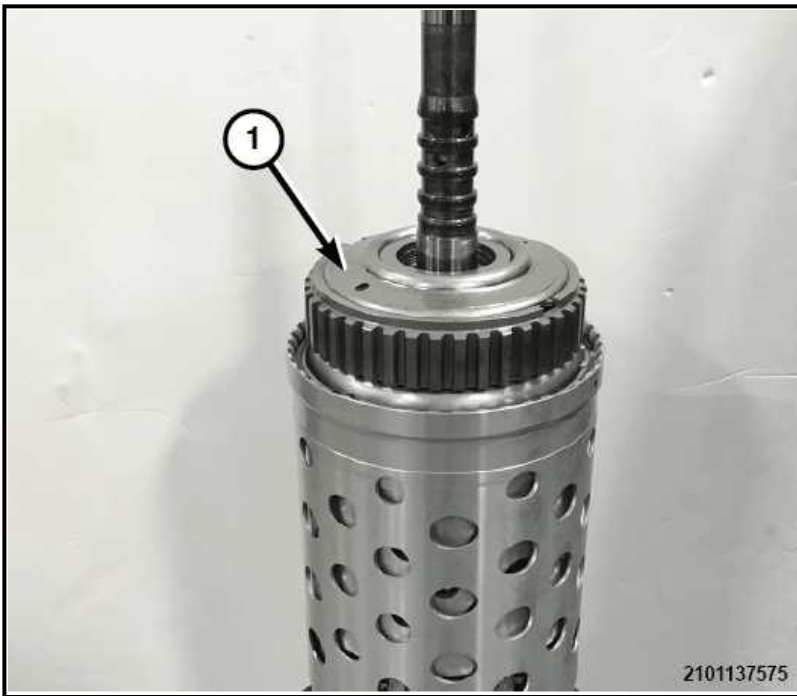
Minimum	Maximum
0.11 mm	0.42 mm
0.0043 in.	0.0165 in.

END PLAY SELECTABLE SHIMS

NOTE: Check with parts for selectable shim thicknesses and availability.

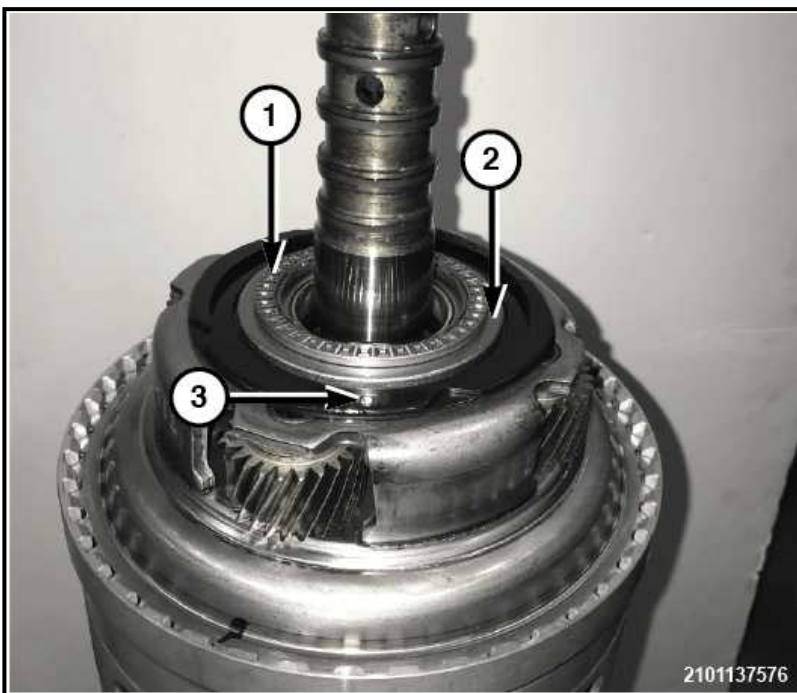
DISASSEMBLY

- Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear).
- Remove the Clutch B discs and plates.



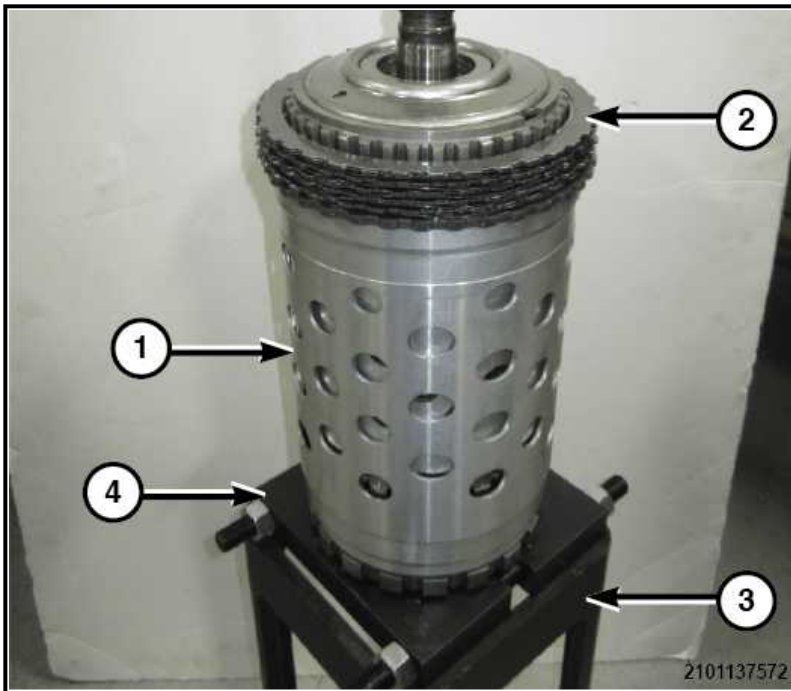
1 - P1 Annulus/Clutch B Hub Assembly

3. Remove the O-ring and five squared O-rings from the input shaft.
4. Remove the P1 annulus/Clutch B hub assembly from the P4 annulus drum.



1 - Thrust Bearing
2 - Holding Plate
3 - Selectable Shim

5. Remove the selectable shim from the P1 planetary carrier.
6. Measure the selectable shim and calculate the thickness of the shim to obtain the correct end play.



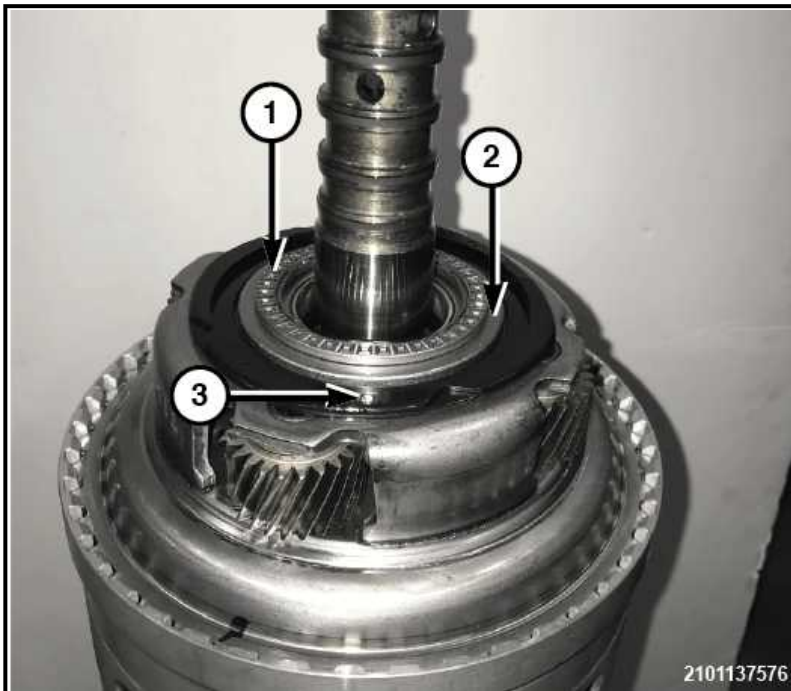
1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

ASSEMBLY

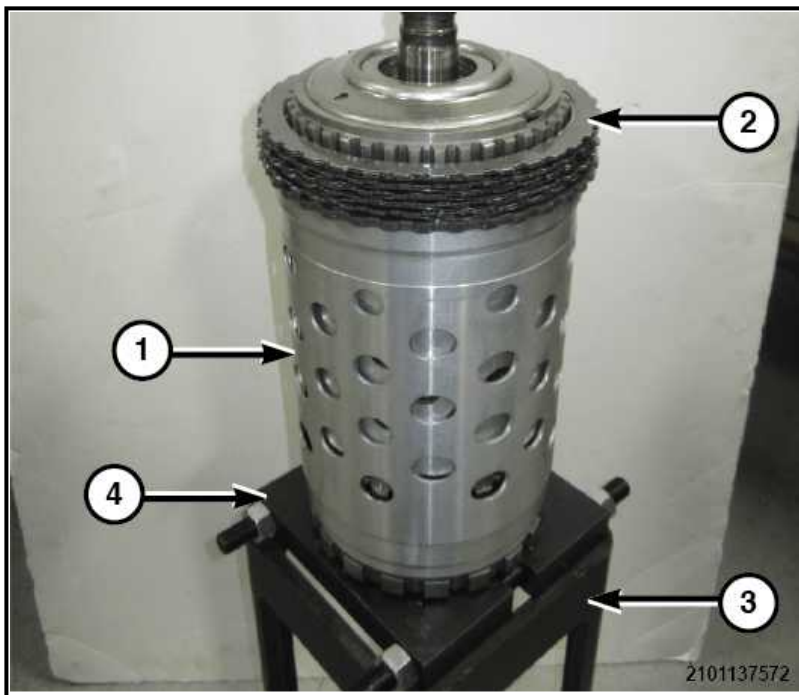


1 - Thrust Bearing

2 - Holding Plate

3 - Selectable Shim

1. Install the selectable shim onto the P1 planetary carrier.



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Bearing/Gear Splitter

2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.
5. Install the P1 annulus onto the input/output shaft.
6. Install the input/output shaft and the P4 annulus drum assembly into the transmission.

TRANSMISSION OIL PUMP

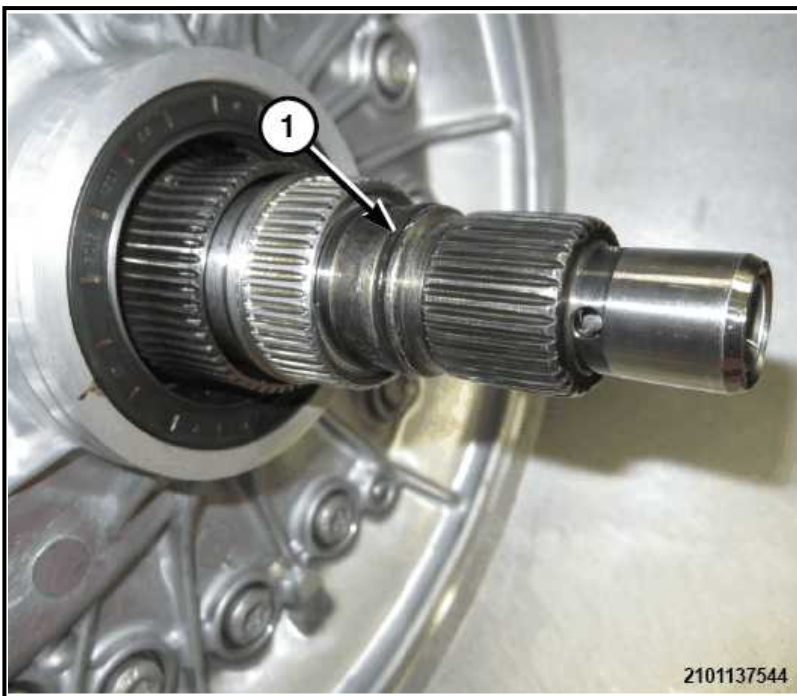
REMOVAL

1. Remove the transmission. Refer to [REMOVAL AND INSTALLATION](#).
2. Remove the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).



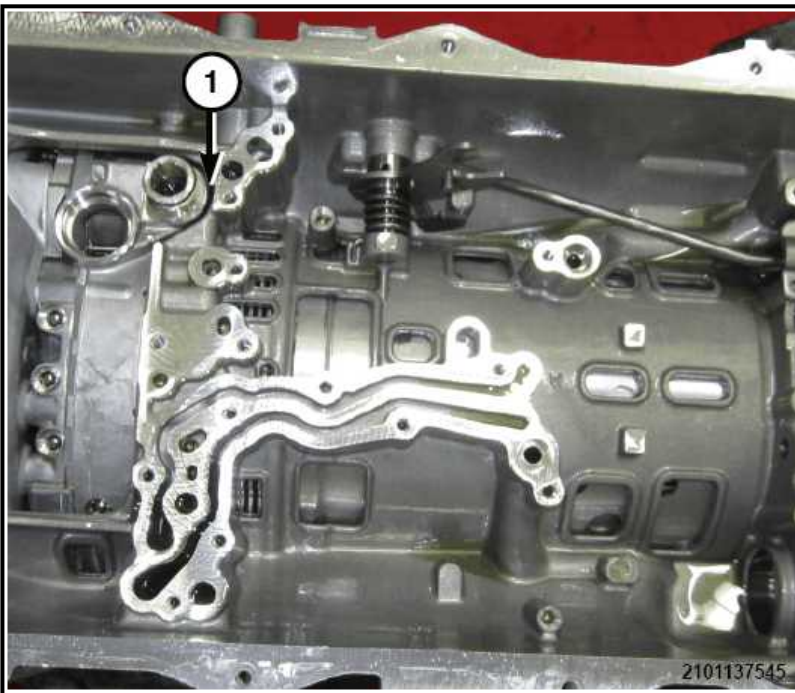
1 - Transmission Oil Pump Assembly To Case Bolts

3. Remove and **DISCARD** the transmission oil pump assembly to case bolts.



1 - Input Shaft O-Ring

4. Remove and **DISCARD** the input shaft O-ring using a small pick or equivalent.



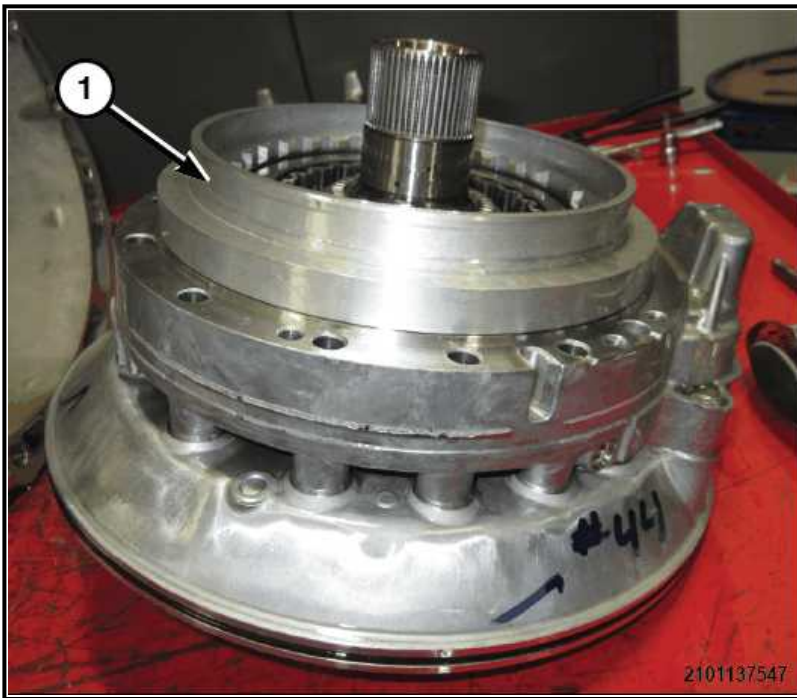
1 - Transmission Oil Pump Assembly

5. Carefully pry the transmission oil pump assembly away from the case with a small flat bladed screwdriver or equivalent through the case opening.
6. From the front of the transmission, remove the transmission oil pump assembly.



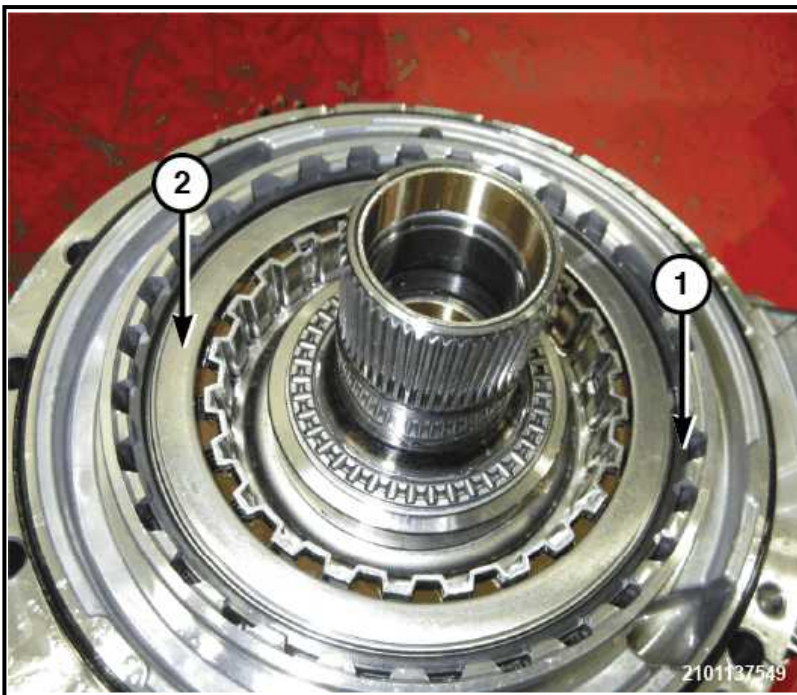
1 - B-Clutch Damper Spring

7. Remove the B-clutch damper spring.



1 - B-Piston

8. Remove the B-piston from the assembly.

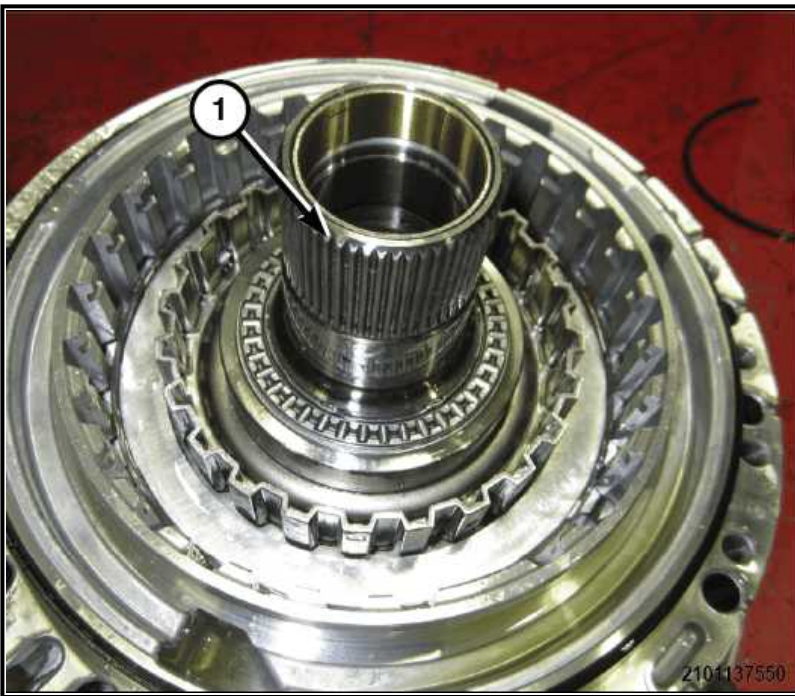


1 - Snap Ring

2 - Clutches and Plates

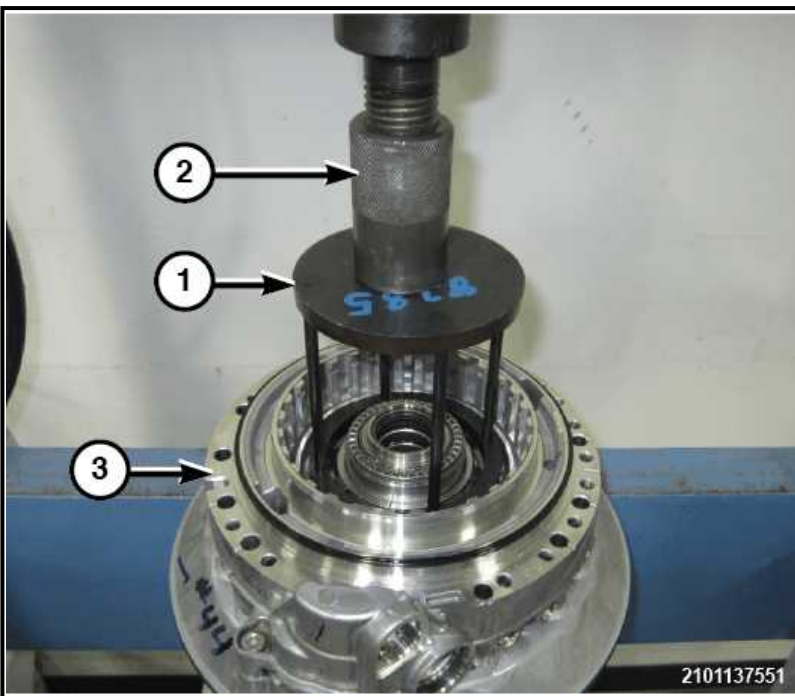
9. Remove the snap ring.

10. Remove the clutches and plates.



1 - Hub

11. Remove the hub.



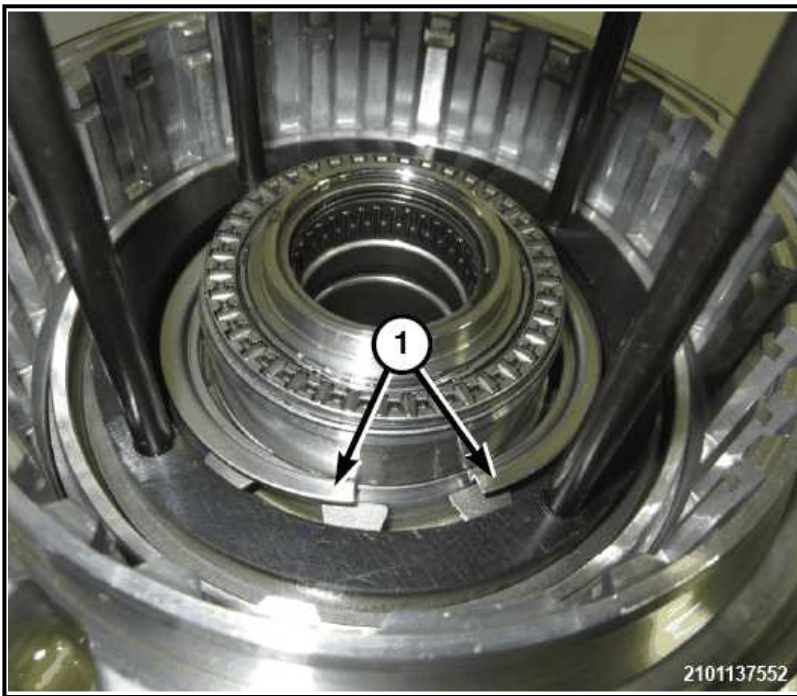
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

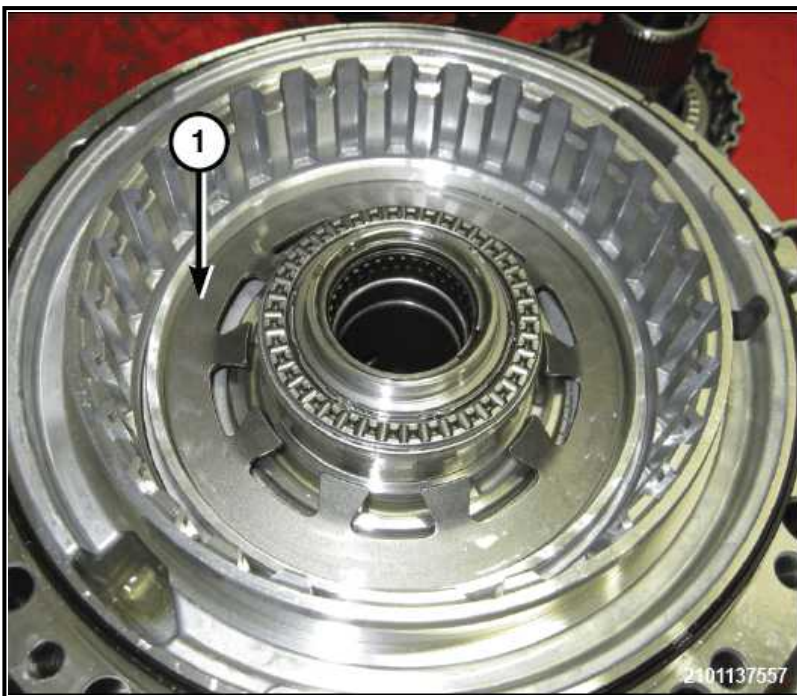
12. Position the transmission oil pump housing assembly in a suitable press.

13. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retainer to remove tension on the split retaining ring.



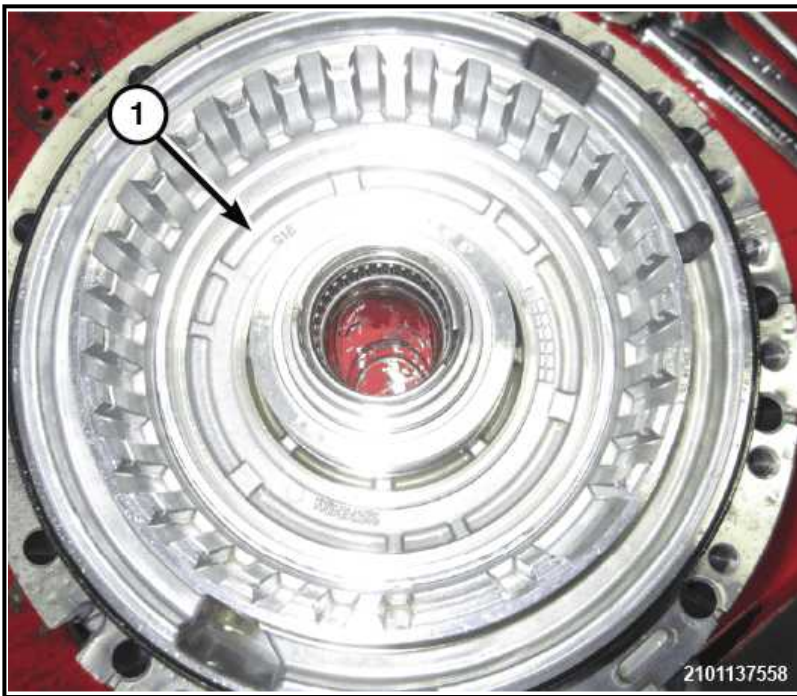
1 - Retaining Ring

14. Remove the two halves of the retaining ring.



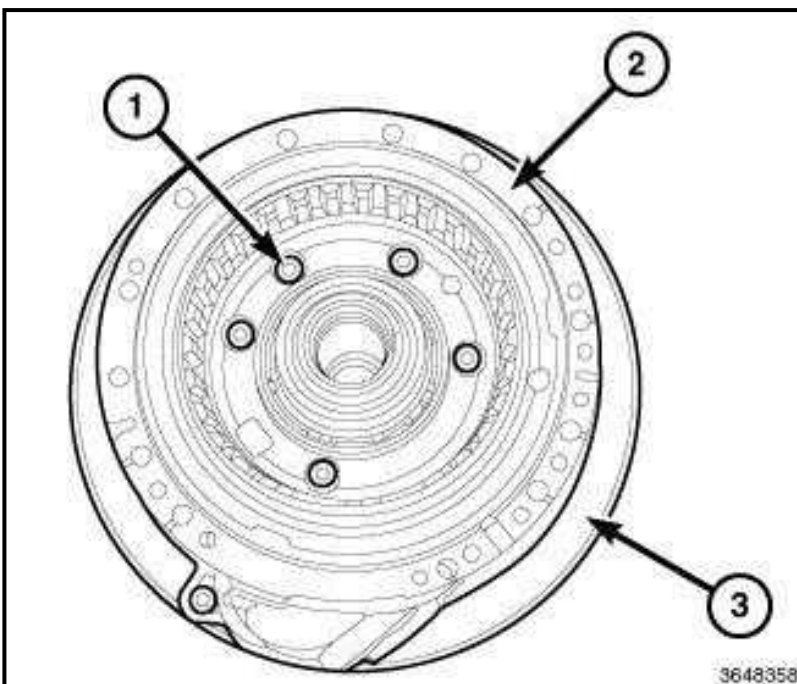
1 - A-Clutch Belleville Spring

15. Remove the A-clutch belleville spring.



1 - A-Clutch Piston

16. Remove the A-clutch piston.



1 - Bolts

2 - Transmission Oil Pump Housing

3 - Transmission Oil Pump Front Cover

17. Remove the bolts and separate the transmission oil pump housing from the transmission oil pump front cover.



1 - Oil Pump Front Cover and O-Ring Seal

18. Separate the transmission oil pump front cover from the transmission oil pump housing and **DISCARD** the oil pump housing O-ring seal.



1 - Drive Sprockets

2 - Chain

19. Remove the drive sprockets, chain and pump body as an assembly.
20. Remove and **DISCARD** all O-rings.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

NOTE: If transmission oil pump was disassembled, replace all O-rings.



1 - Drive Sprockets

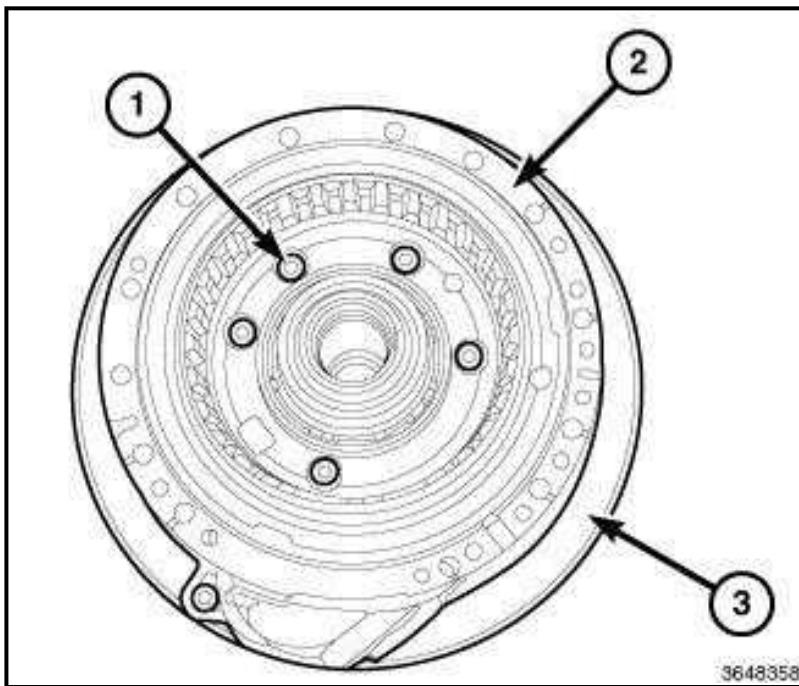
2 - Chain

1. Install the drive sprockets, chain and pump body as an assembly into the transmission oil pump housing.



1 - Oil Pump Front Cover and O-Ring Seal

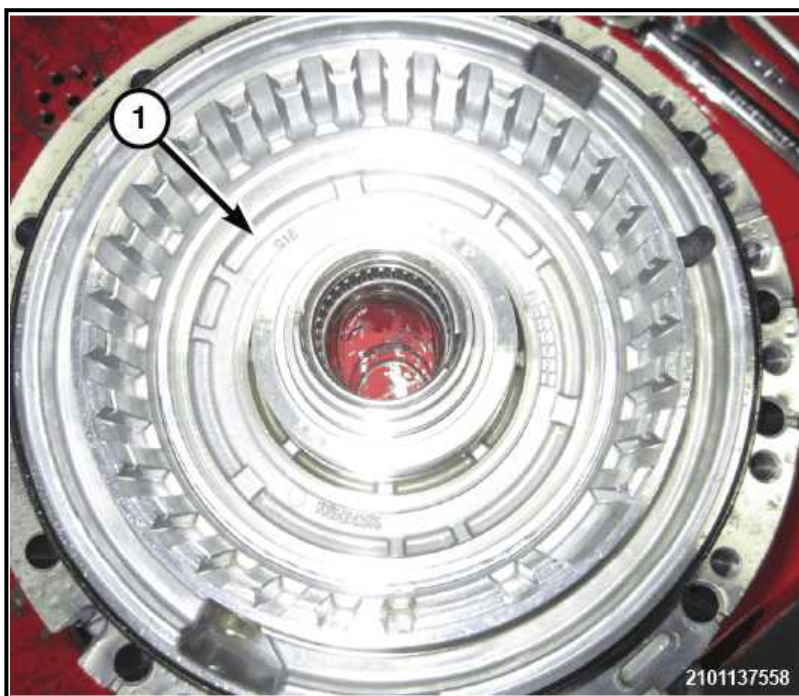
2. Set the transmission oil pump front cover onto the transmission oil pump housing.



1 - Transmission Oil Pump Housing To Cover Bolts
2 - Transmission Oil Pump Housing
3 - Transmission Oil Pump Front Cover

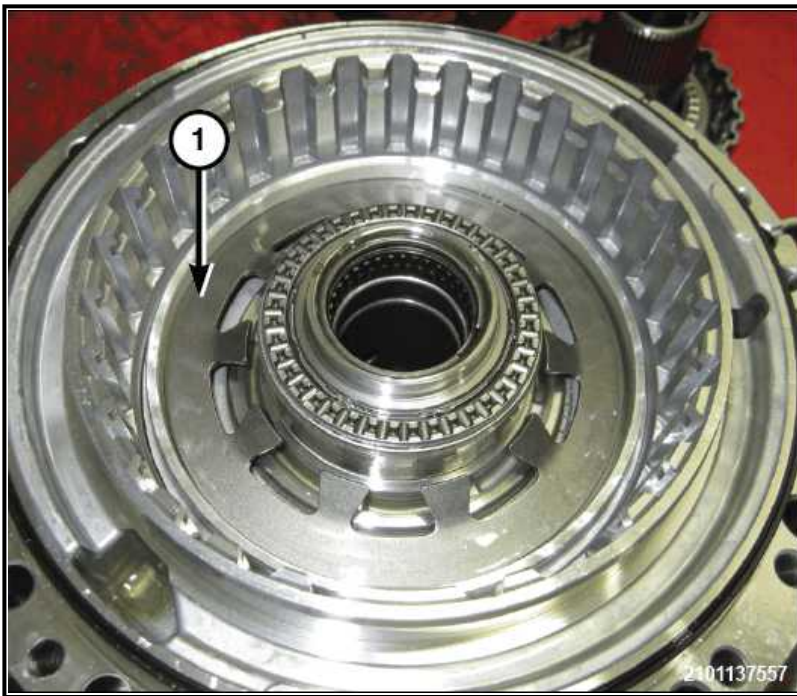
NOTE: The transmission oil pump bolts under the A-clutch must be replaced.

3. Install the **NEW** transmission oil pump housing to cover bolts.



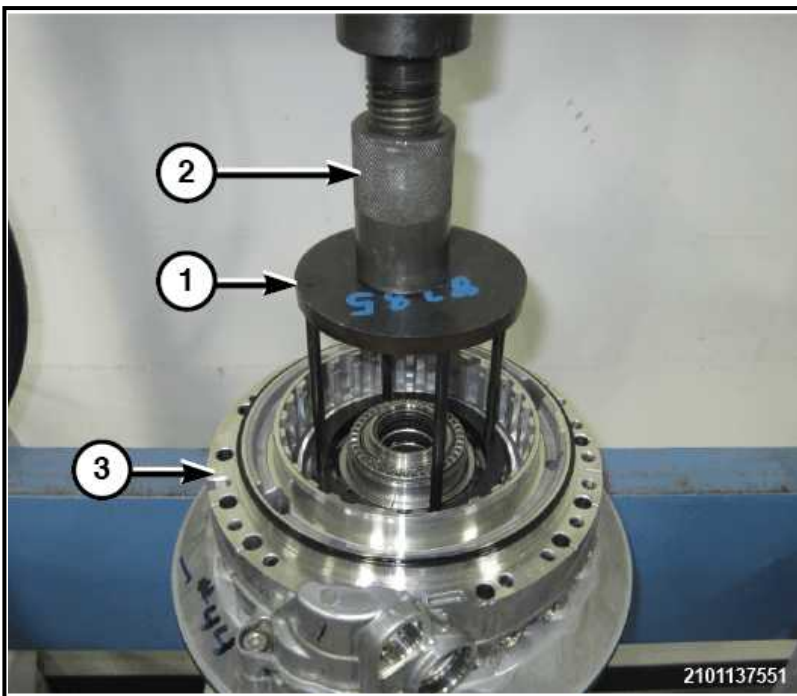
1 - A-Clutch Piston

4. Install the A-clutch piston with **NEW** O-ring seals.



1 - A-Clutch Belleville Spring

5. Install the A-clutch belleville spring.



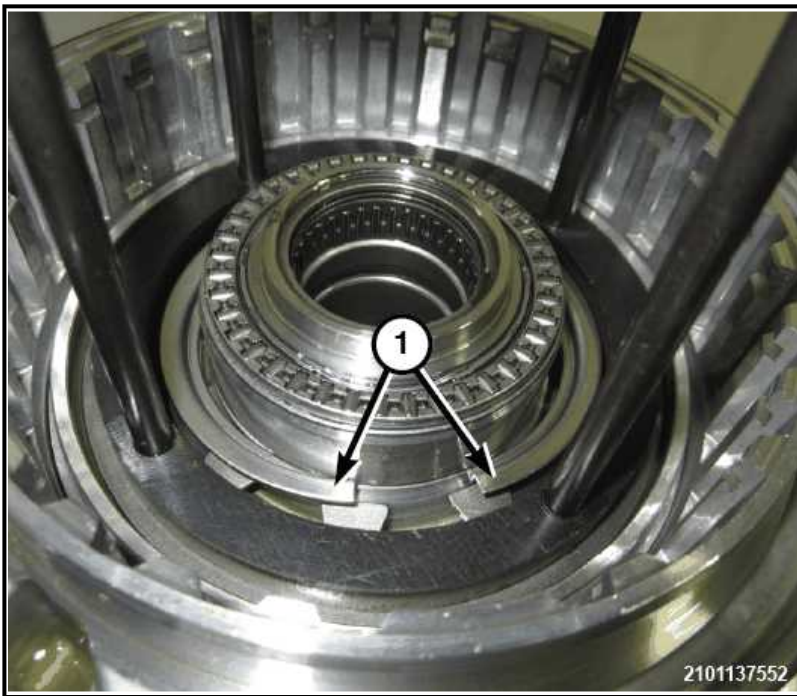
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

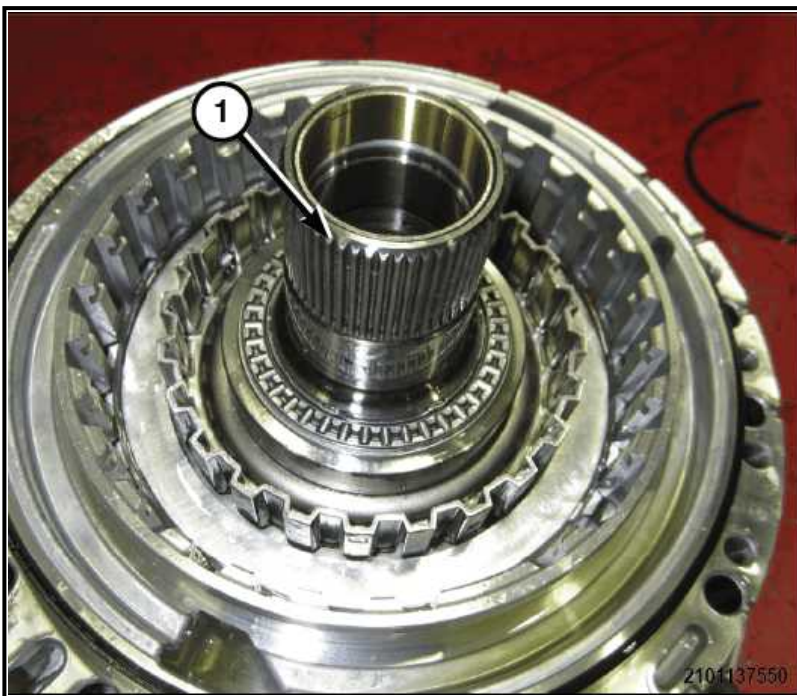
6. Position the transmission oil pump housing assembly in a suitable arbor press.

7. Using (special tool #8285, Compressor, Spring), press down on the fingers of the piston retainer.



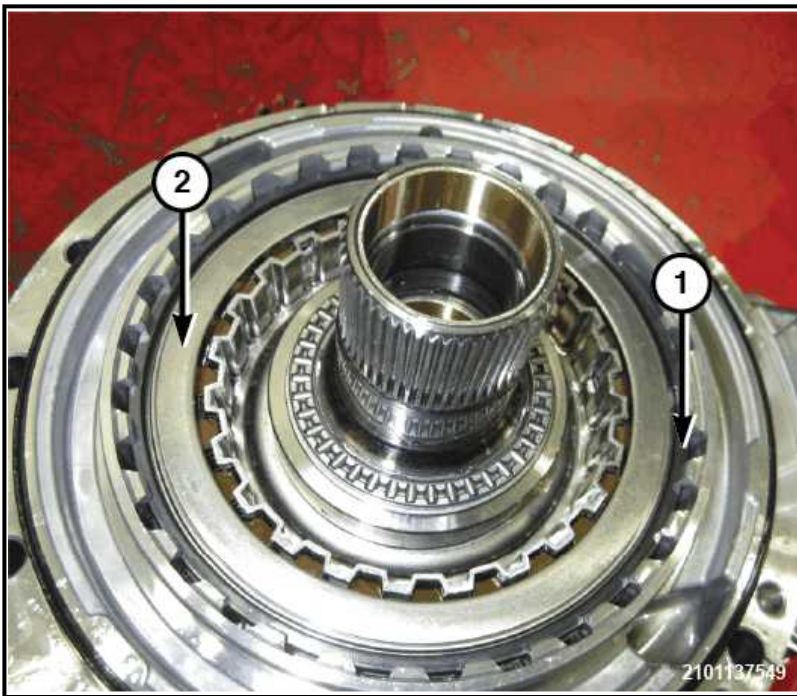
1 - Retaining Ring

8. Install the two retaining ring halves.



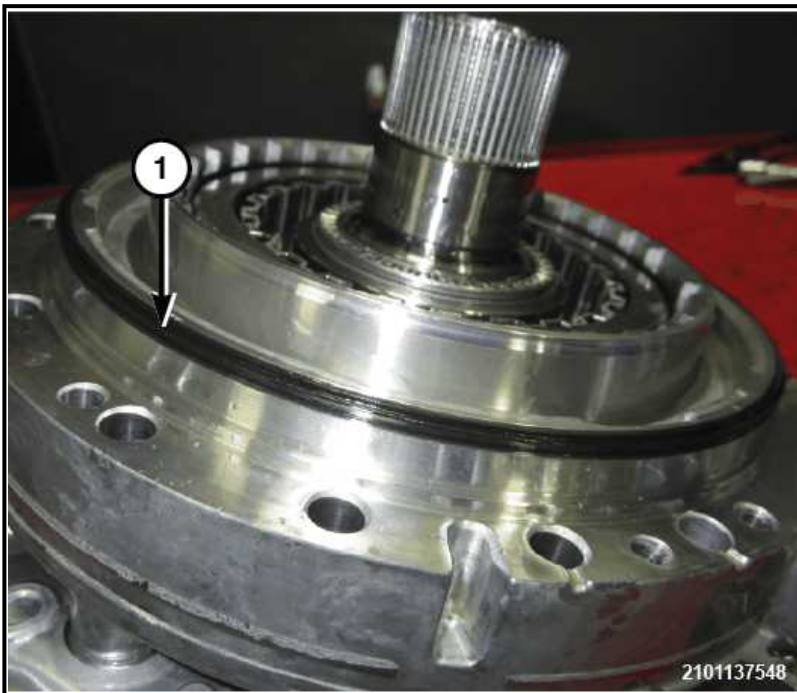
1 - Hub

9. Install the hub.

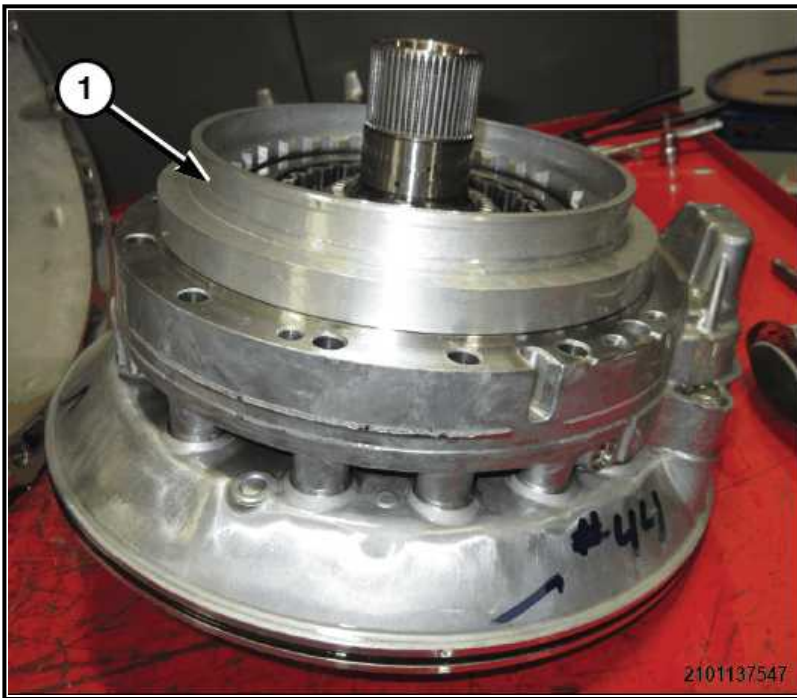


- | |
|-------------------------|
| 1 - Snap Ring |
| 2 - Clutches and Plates |

10. Install the clutches and plates.
11. Install the snap ring.



12. Install a new B-piston seal.



1 - B-Piston

13. Install the B-piston.



1 - B-Clutch Damper Spring

14. Install the B-clutch damper spring.

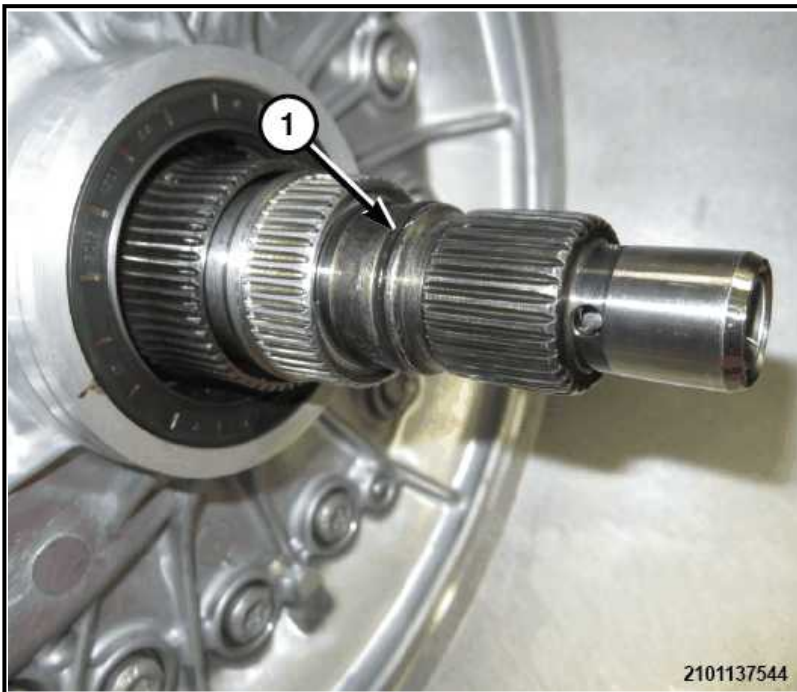
15. Install a **NEW** transmission oil pump front cover seal and install the oil pump in the case.



1 - Transmission Oil Pump Assembly To Case Bolts

16. Firmly press the transmission oil pump in place by hand before drawing it in with the **NEW** transmission oil pump assembly to case bolts.

The transmission oil pump assembly to case bolts must be tightened in the sequence shown in the torque table below.



1 - Input Shaft O-Ring

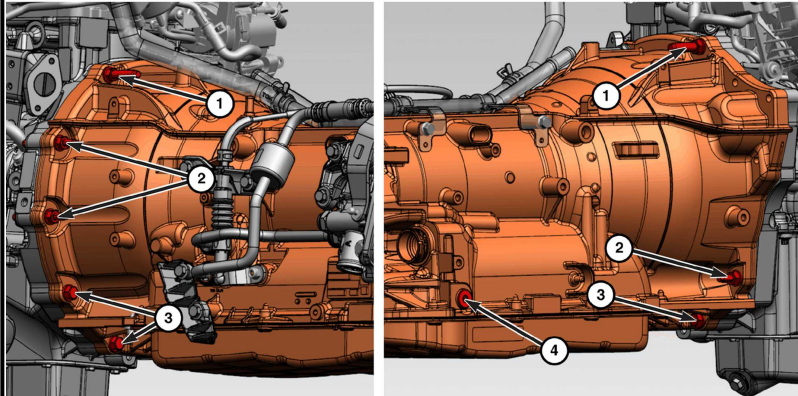
17. Install the **NEW** input shaft O-ring.
18. Install the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
19. Install the transmission. Refer to [REMOVAL AND INSTALLATION](#).

TORQUE SPECIFICATIONS

BELLHOUSING AND OIL FILL PLUG

2.0L GMET

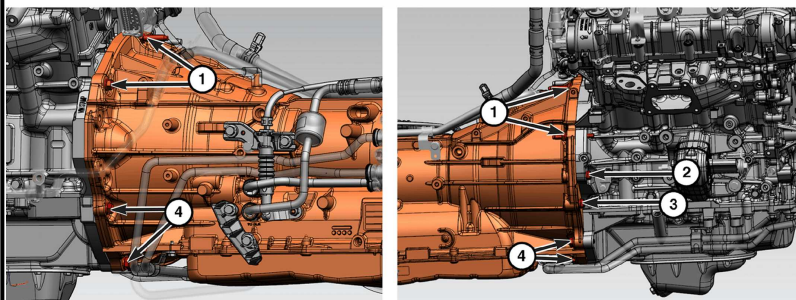
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Double Ended Stud	48 N.m (35 Ft. Lbs.)	-
2	Transmission Bellhousing To Engine Double Ended Stud	49N.m (36 Ft. Lbs.)	-
3	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
4	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	-



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3.6L

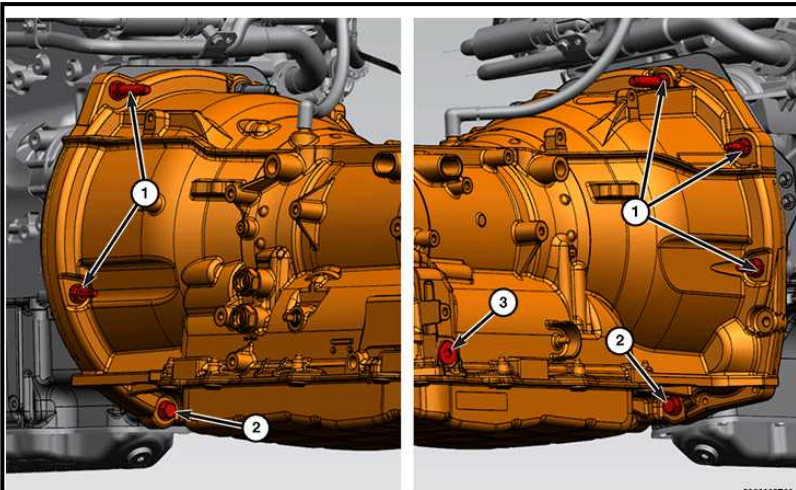
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Bolts	- Bolt 50 N.m (37 Ft. Lbs.) - Double Ended Stud 48 N.m (35 Ft. Lbs.)	-
2	Engine Block To Transmission Bellhousing Bolt	50 N.m (37 Ft. Lbs.)	-
3	Dust Shield To Transmission Bellhousing Bolt	12 N.m (9 Ft. Lbs.)	-
4	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
Not Shown	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	On right side of transmission case.



2101191085

2.2L DIESEL

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Double Ended Stud	49N.m (36 Ft. Lbs.)	-
2	Bellhousing to Engine Oil Pan Bolt	49N.m (36 Ft. Lbs.)	-
3	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	-



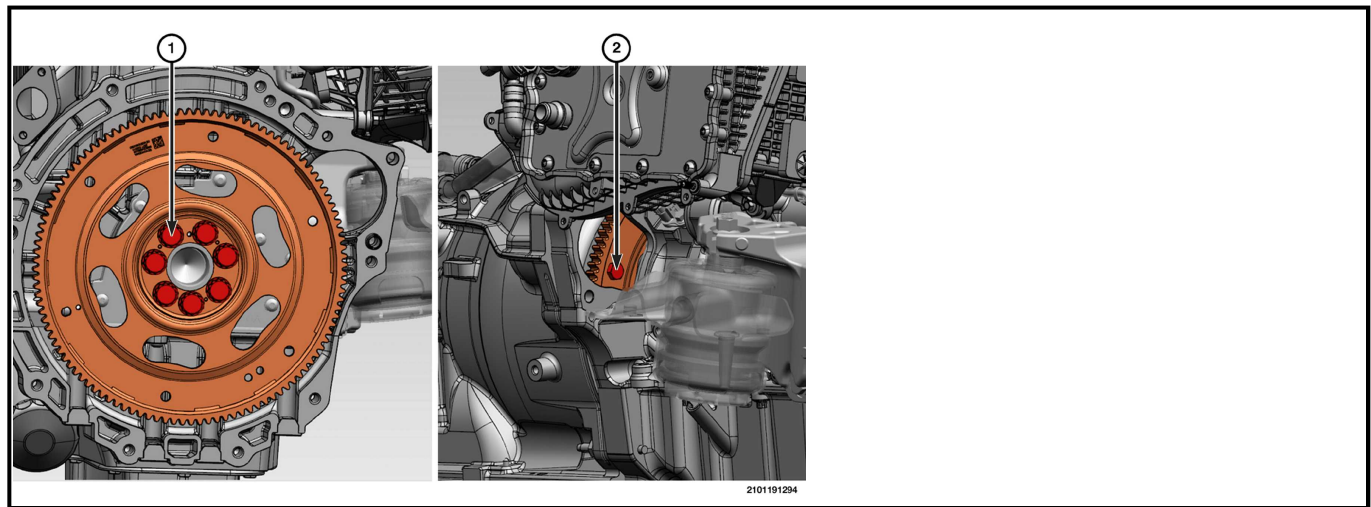
2101193791

FLEXPLATE AND TORQUE CONVERTER

2.0L GMET

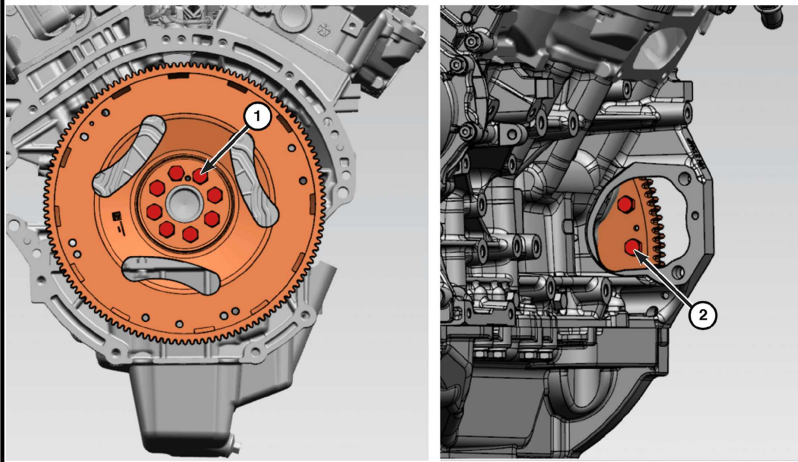
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	110 N.m (81 Ft. Lbs.)	Tighten in a crisscross pattern. Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
			must be re-used, Loc-TiteB® must be applied to the threads.



3.6L

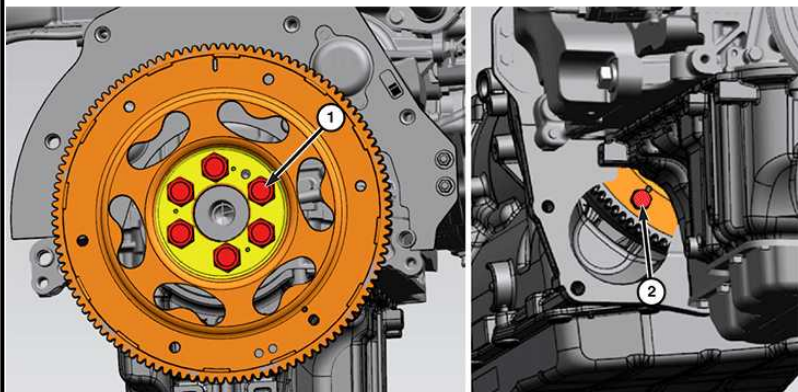
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	95 N.m (70 Ft. Lbs.)	Tighten in a crisscross pattern Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.



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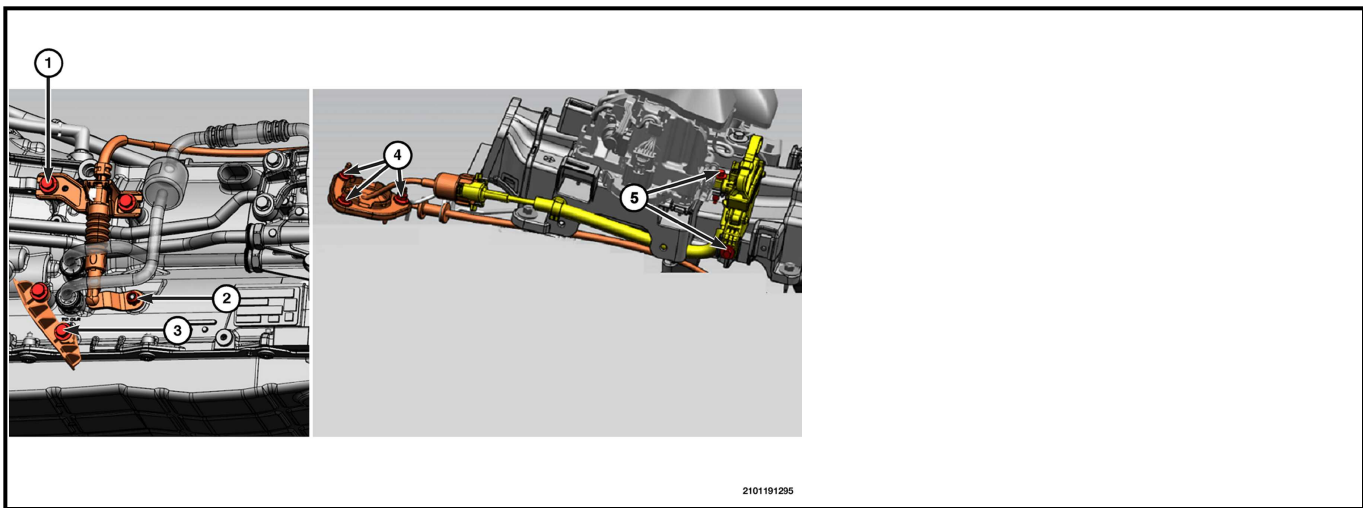
2.2L DIESEL

DESCRIPTION	SPECIFICATION	COMMENT
Flexplate to Crankshaft Bolts	150 N.m (111 Ft. Lbs.)	Tighten in a crisscross pattern Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
Torque Converter to Flex Plate Bolt	37 N.m (27 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.



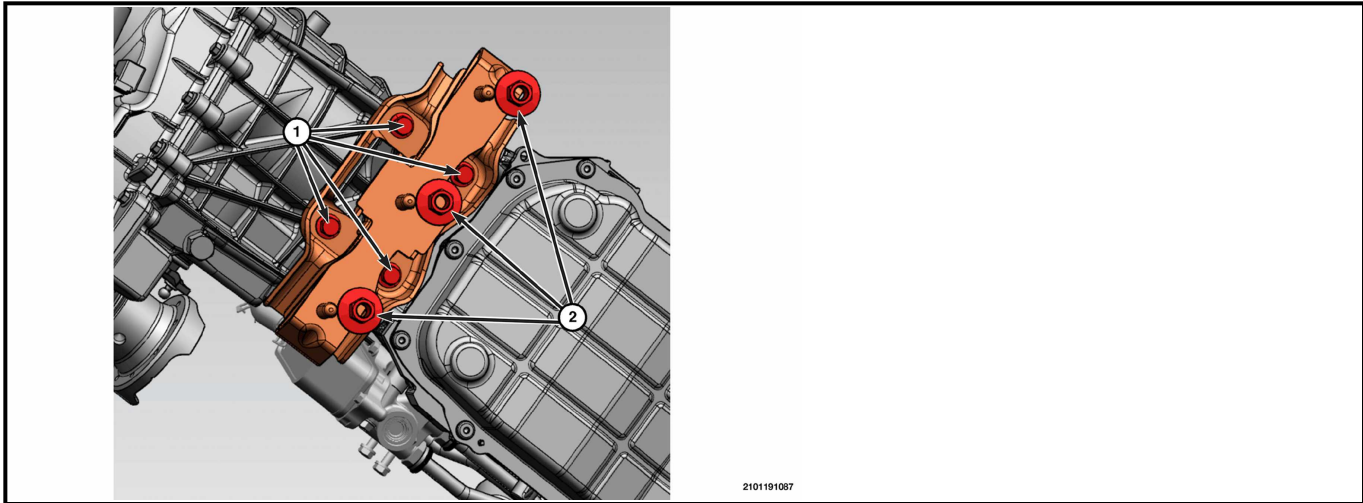
2101193790

MANUAL PARK RELEASE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

TRANSMISSION MOUNT

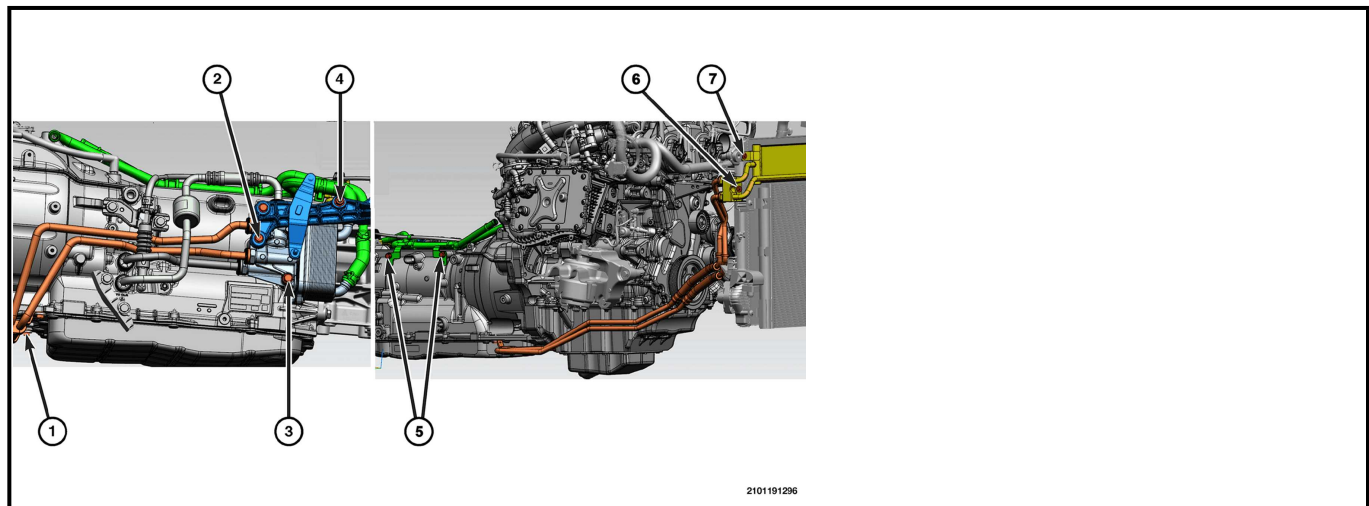


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

TRANSMISSION OIL COOLER AND HEATER

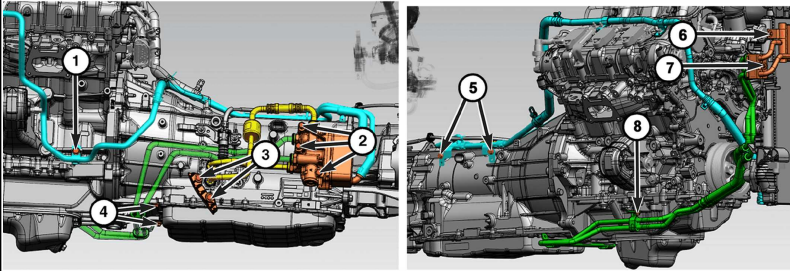
2.0 GMET

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
2	Transfer Case Shifter Cable Bracket To Transmission Bolts (Bolts pass through Transmission Oil Heater	23 N. m (17 Ft. Lbs.)	-
3	Transmission Oil Heater To Case Bolt	23 N. m (17 Ft. Lbs.)	-
4	Transfer Case Shifter Cable Bracket Nut	19 N. m (14 Ft. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
7	Transmission Oil Cooler Bolt	-	Tighten Securely



3.6 L

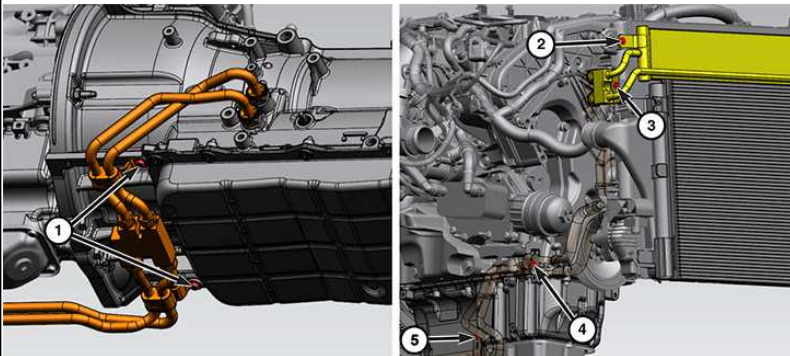
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket to Engine Bolt	35 N. m (26 Ft. Lbs.)	-
2	Transmission Oil Heater To Case Bolts	23 N. m (17 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Bolt	-	Tighten Securely
7	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
8	Transmission Oil Cooler Line Bracket To Oil Pan	9 N. m (80 In. Lbs.)	-



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2.2L DIESEL

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
2	Transmission Oil Cooler Bolt	-	Tighten Securely
3	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
4	Transmission Oil Cooler Line To Engine Bolt	19 N. m (14 Ft. Lbs.)	-
5	Transmission Oil Cooler Line To Engine Oil Pan Bolt	22 N. m (16 Ft. Lbs.)	-

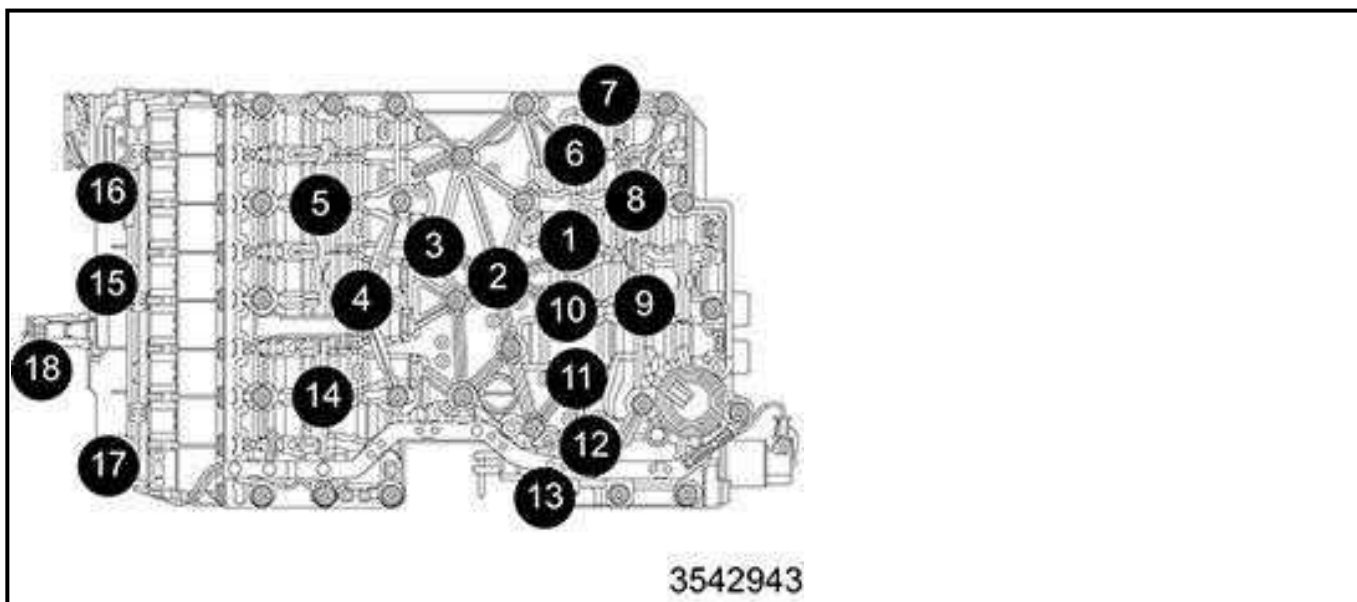
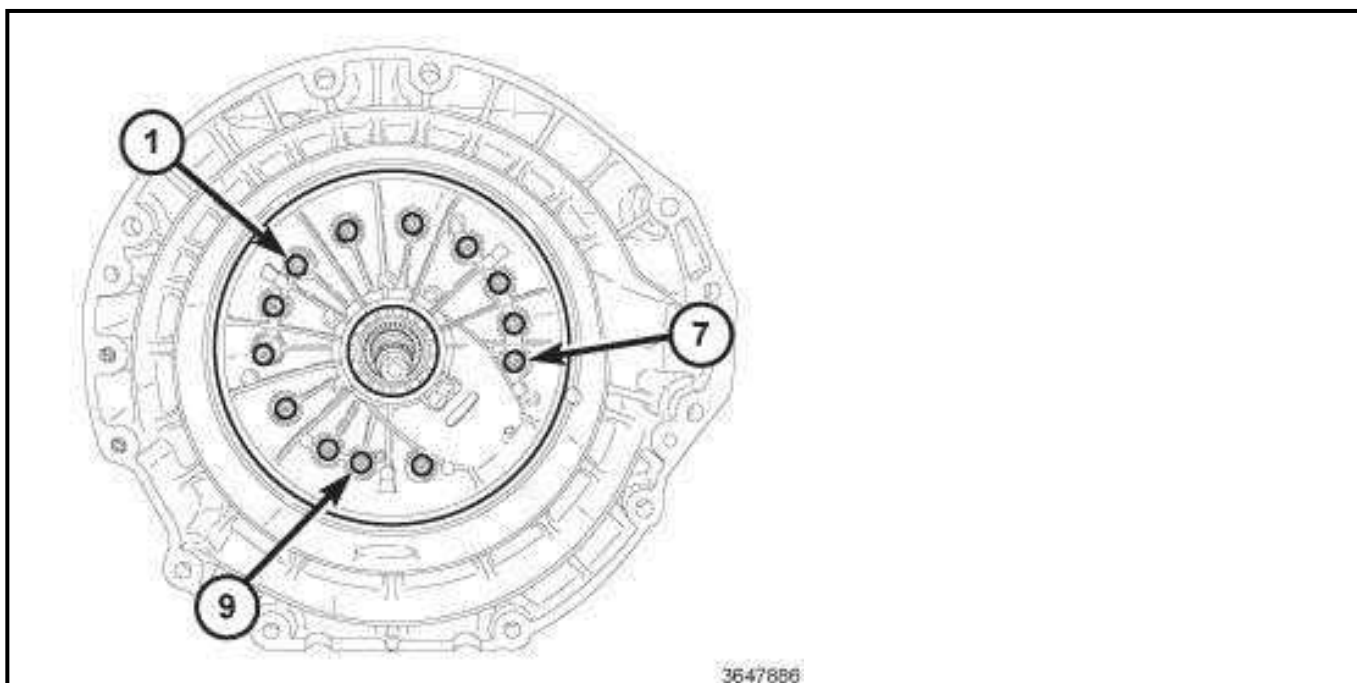
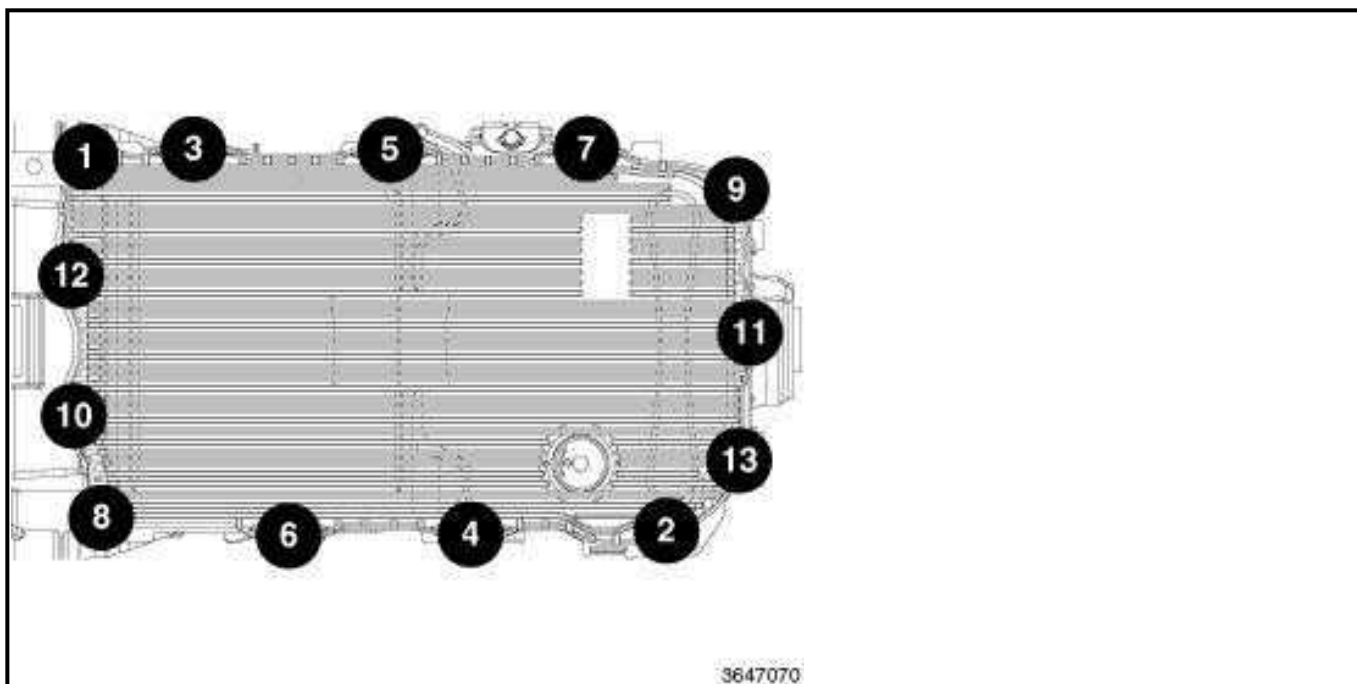


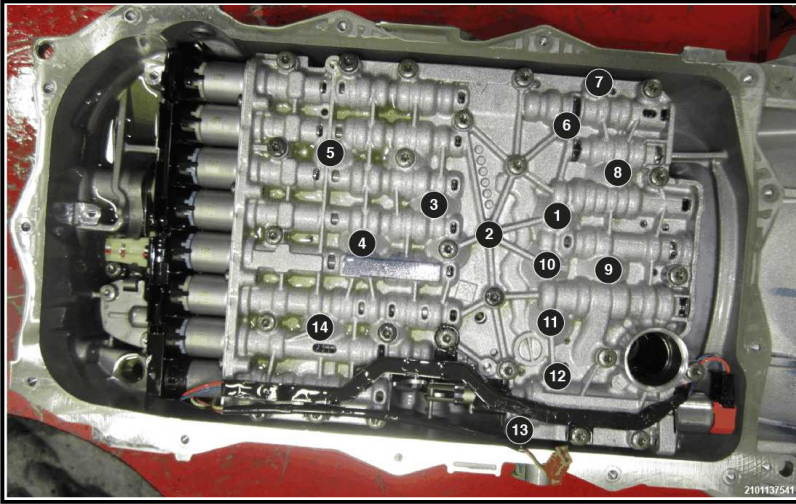
2101193792

8HP50 TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Hydraulic Impulse Solenoid Bolts	8 N.m (71 In. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Lock Solenoid Screw	6 N.m (53 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	13 N.m (10 Ft. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	11 N.m (8 Ft. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-

DESCRIPTION	SPECIFICATION	COMMENTS
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Filter to Transmission Oil Pan	6 N.m (53 In. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	Torque Procedure: 1. Install bolts except for the spots where the locating pins are installed and hand tighten 2. Remove the pins and install the remaining bolts 3. Tighten bolts to 8 N.m (71 In. Lbs.)	Tightening Sequence





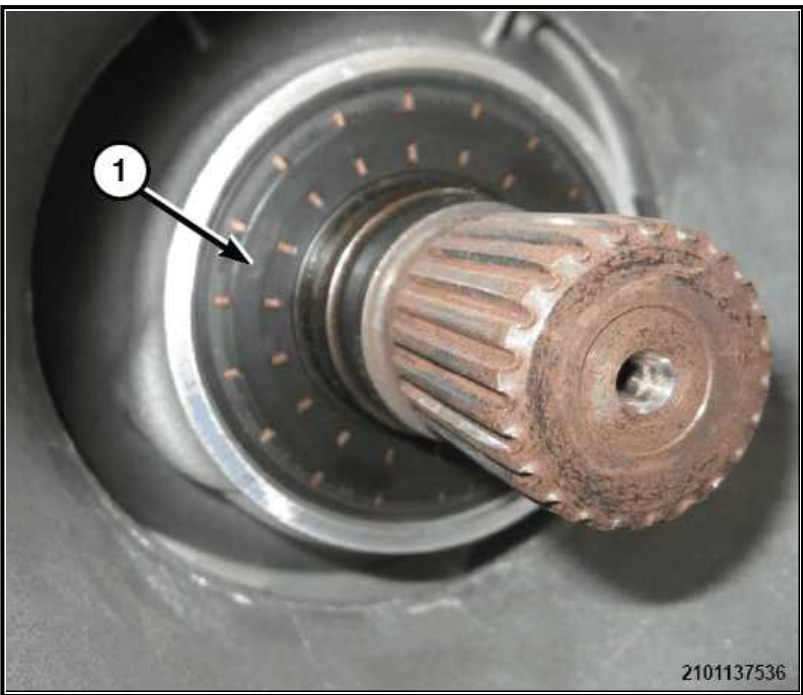
SEAL, OUTPUT SHAFT

REMOVAL AND INSTALLATION

OUTPUT SHAFT SEAL

REMOVAL

1. Remove the transfer case. Refer to [REMOVAL AND INSTALLATION](#) .



1 - Output Shaft Seal

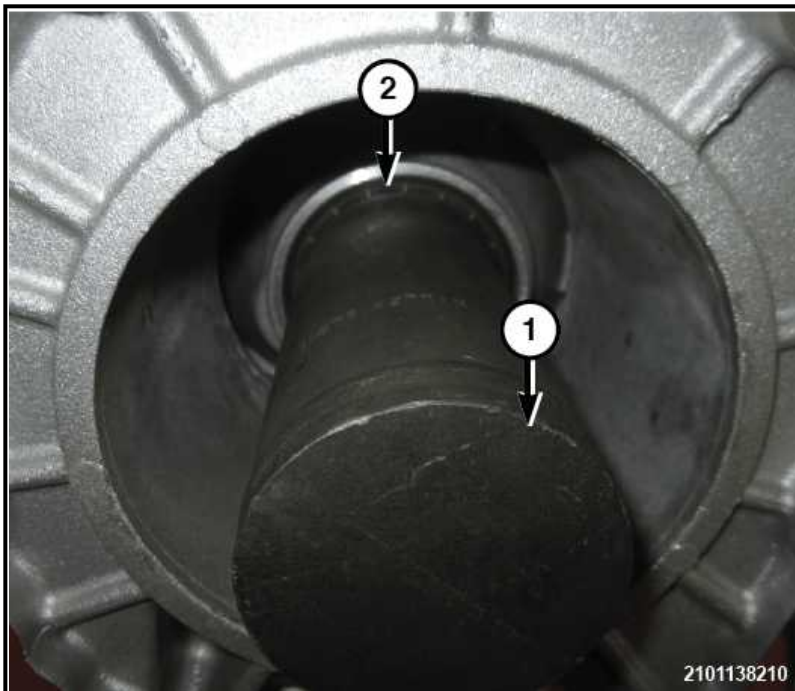
2. Remove and **DISCARD** the output shaft seal with a suitable screw and slide hammer.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Use the (special tool #8481, Installer, Gear) to install the **NEW** output shaft seal.
- Check the transmission fluid level and add as necessary. Refer to [CHECK FLUID LEVEL](#) .

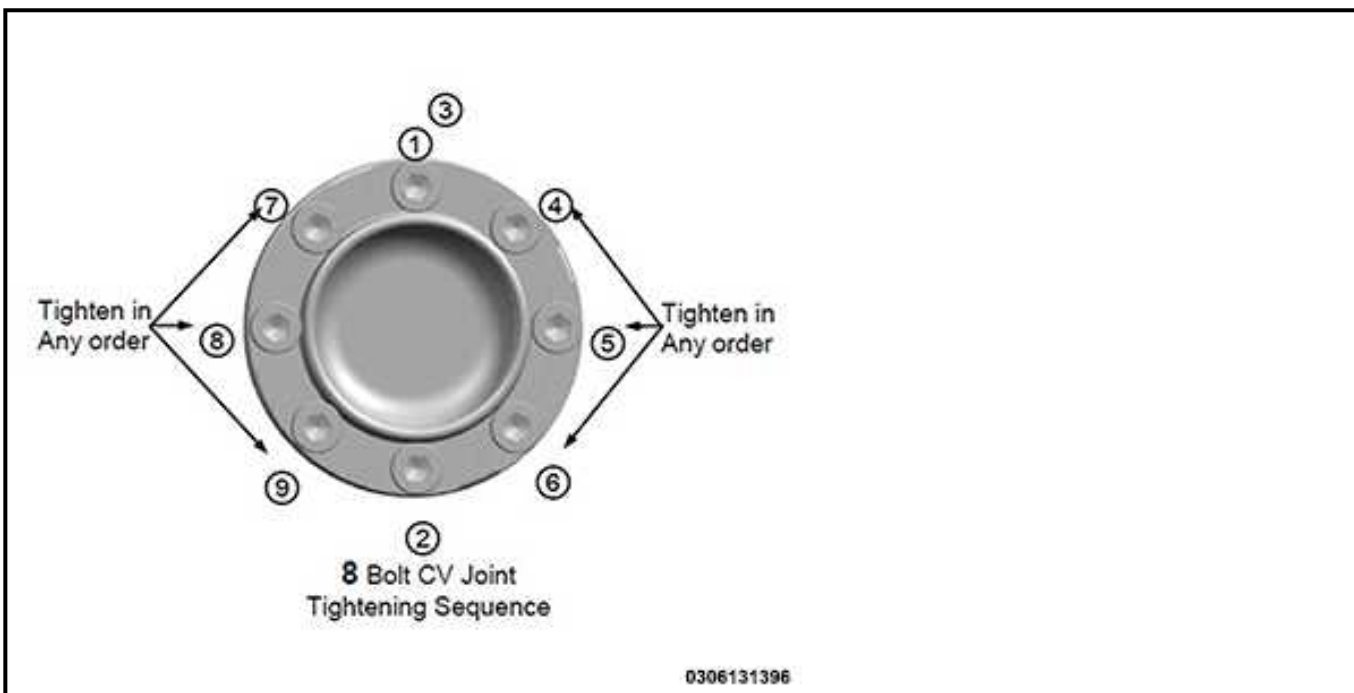


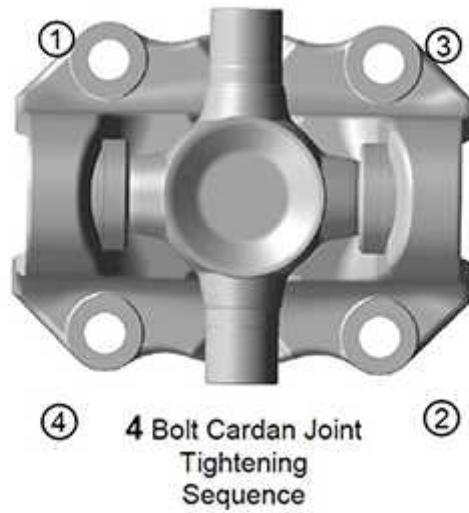
- | |
|-------------------------|
| 1 - Seal Installer Tool |
| 2 - Output Shaft Seal |

TORQUE SPECIFICATIONS

DRIVESHAFTS

Identify the proper CV joint bolt configuration, four or eight bolts, and begin with the first bolt referred to as "1", follow the torque sequence as indicated. In the case where there are two numbers shown for a given bolt it indicates the bolt is to be torqued again within the sequence.



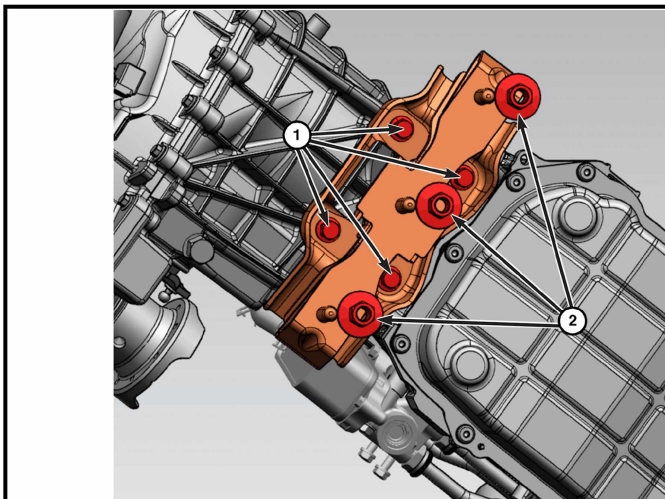


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Fig. 5: Cardan Joint Tightening Sequence (4 Bolt)
 Courtesy of CHRYSLER GROUP, LLC

DESCRIPTION	SPECIFICATION	COMMENT
Front Driveshaft to Front Axle Flange Bolts	121 N.m (89 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Front Driveshaft to Transfer-Case Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft to Transfer-Case Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft to Rear Axle Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft Carrier Bearing to Frame	62 N.m (46 Ft. Lbs.)	-

TRANSMISSION MOUNT



2101191087

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

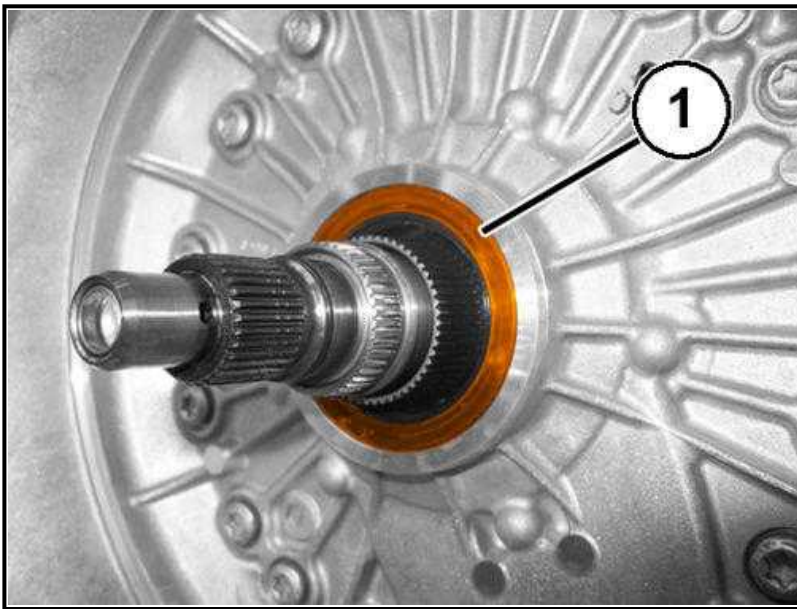
SEAL, TORQUE CONVERTER HUB

REMOVAL AND INSTALLATION

TORQUE CONVERTER HUB SEAL

REMOVAL

1. Remove the transmission and torque converter. Refer to [TORQUE CONVERTER, REMOVAL AND INSTALLATION](#).



1 - Torque Converter Hub Seal

2. Using a suitable tool, remove the torque converter hub seal.

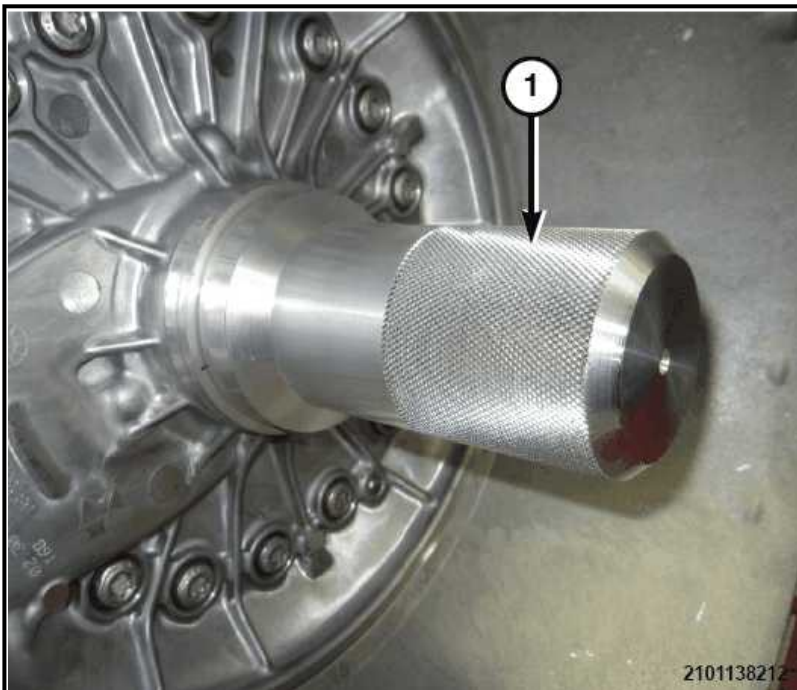
NOTE: Take care not to mar or damage the pump sealing surface during the seal removal.

INSPECTION AND CLEANING

1. Clean and inspect the sealing surface before installing the new seal.

INSTALLATION

1. Position the torque converter hub seal over the input shaft and against the transmission oil pump cover.

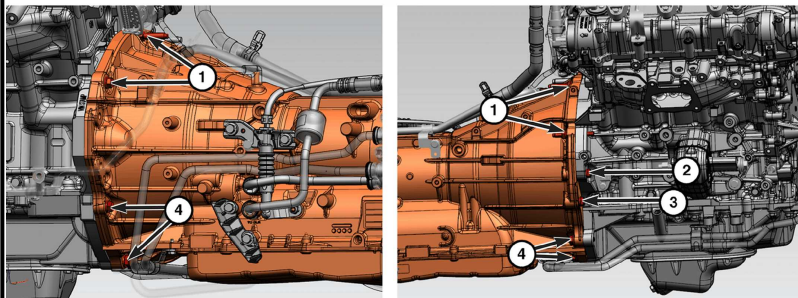


1 - Seal Installer Tool

2. Using (special tool #10375, Installer, Oil Pump Cover Oil Seal) install a new torque converter hub seal.
3. Install the torque converter. Refer to **TORQUE CONVERTER, REMOVAL AND INSTALLATION**.

TORQUE SPECIFICATIONS

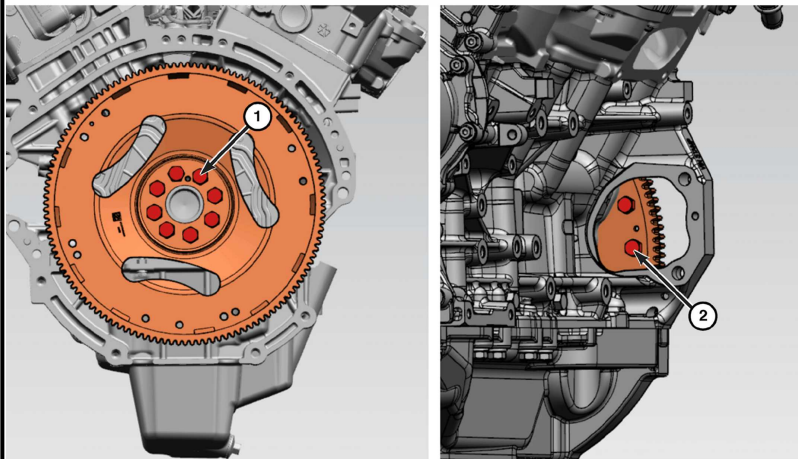
BELLHOUSING AND OIL FILL PLUG



2101191085

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Bolts	- Bolt 50 N.m (37 Ft. Lbs.) - Double Ended Stud 48 N.m (35 Ft. Lbs.)	-
2	Engine Block To Transmission Bellhousing Bolt	50 N.m (37 Ft. Lbs.)	-
3	Dust Shield To Transmission Bellhousing Bolt	12 N.m (9 Ft. Lbs.)	-
4	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
Not Shown	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

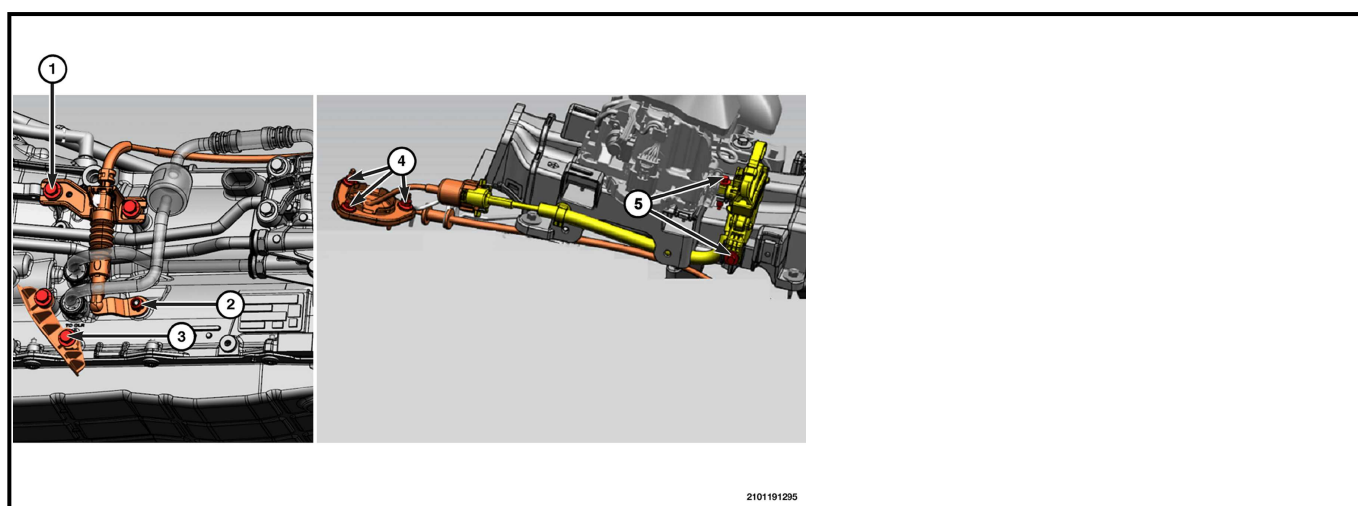
FLEXPLATE AND TORQUE CONVERTER



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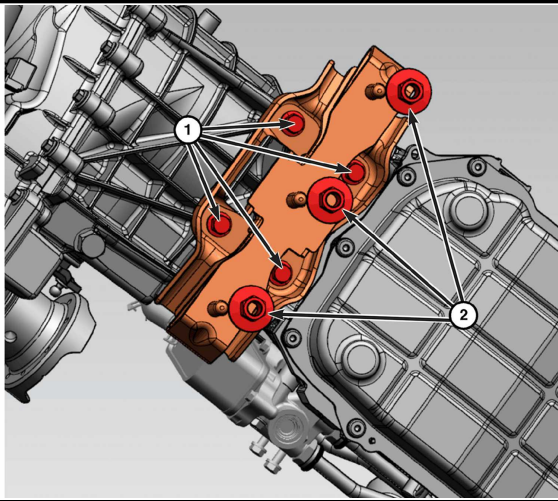
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	95 N.m (70 Ft. Lbs.)	Tighten in a crisscross pattern Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.

MANUAL PARK RELEASE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

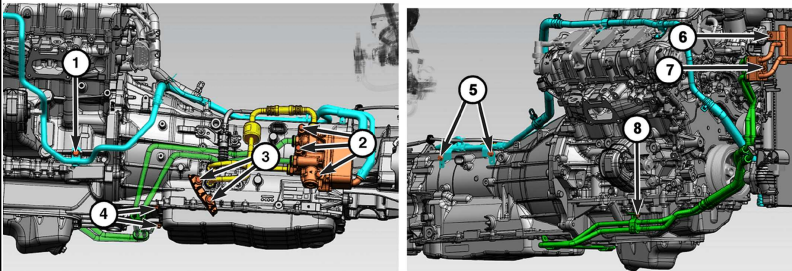
TRANSMISSION MOUNT



2101191087

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

TRANSMISSION OIL COOLER AND HEATER



2101191086

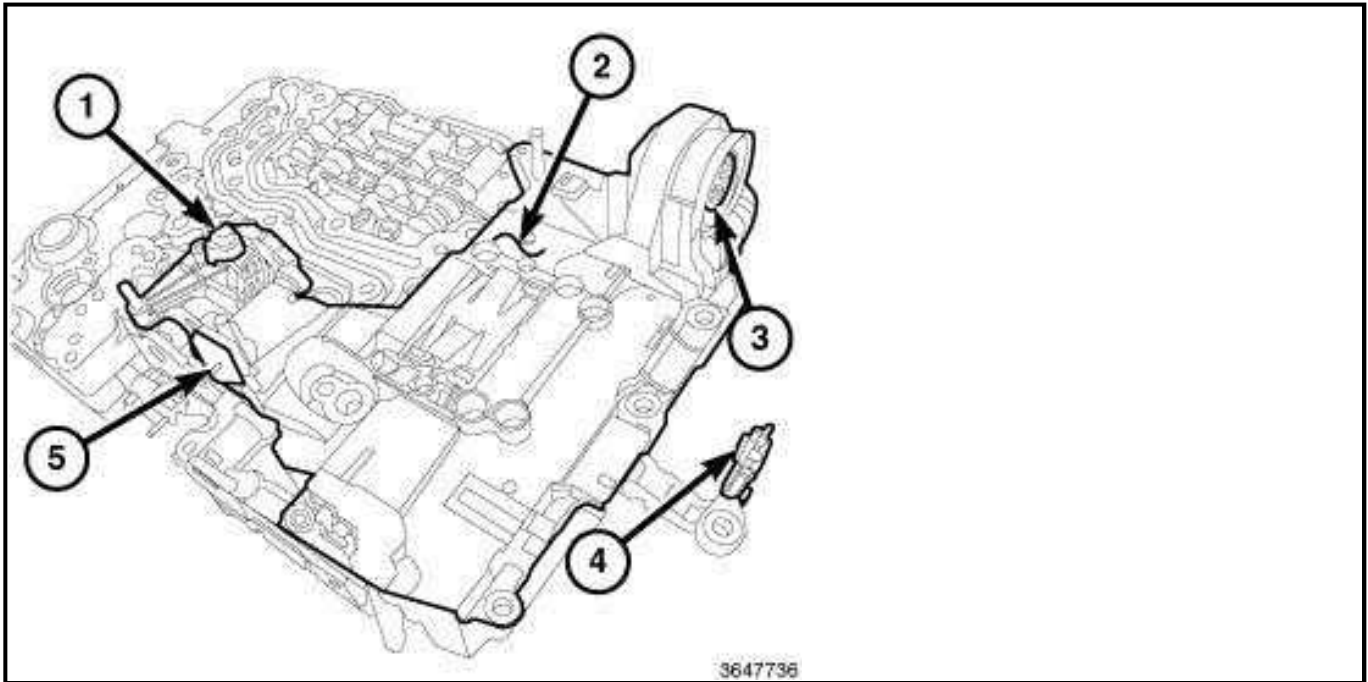
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket to Engine Bolt	35 N. m (26 Ft. Lbs.)	-
2	Transmission Oil Heater To Case Bolts	23 N. m (17 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Bolt	-	Tighten Securely
7	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
8	Transmission Oil Cooler Line Bracket To Oil Pan	9 N. m (80 In. Lbs.)	-

SENSOR, SPEED

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION



- 1 - Input Speed Sensor (ISS)
- 4 - Output Speed Sensor (OSS)
- 2 - Transmission Control Module (TCM) (Includes Transmission Temperature Sensor)
- 5 - Park Position Sensor
- 3 - External Wire Harness Connector

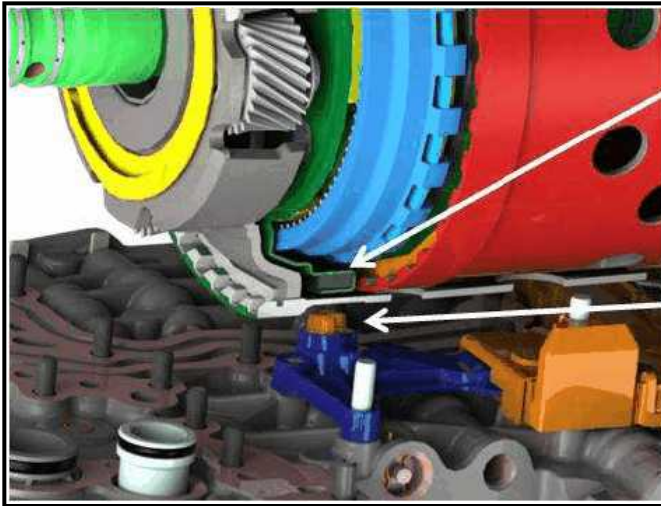
B

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

The ISS (1) and the OSS (4) are integrated components of the TCMA and not serviced individually.

OPERATION

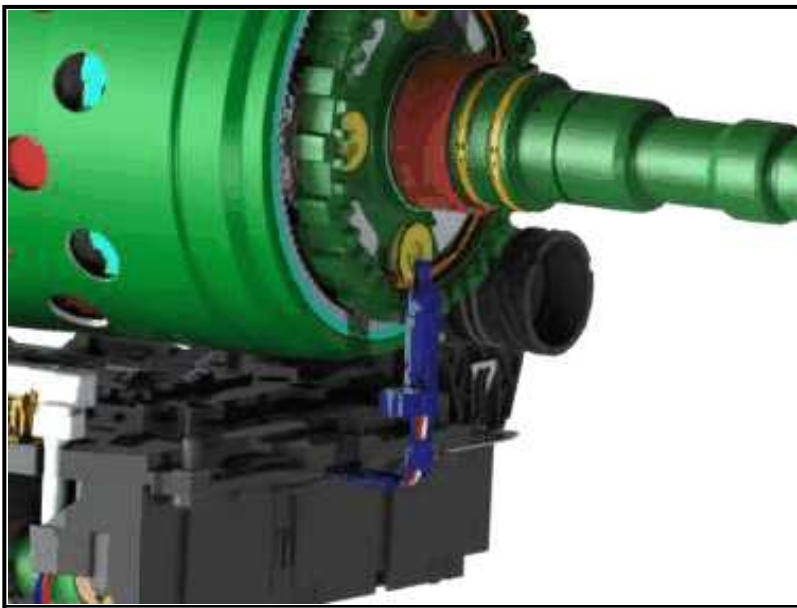
CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.



(B)

(A)

The ISS and OSS are Hall-effect sensors that measure shaft rotational speed. The ISS (A) is located at the front of the TCMA and reads input shaft speed from the magnetic ring (B) on the P2 carrier.



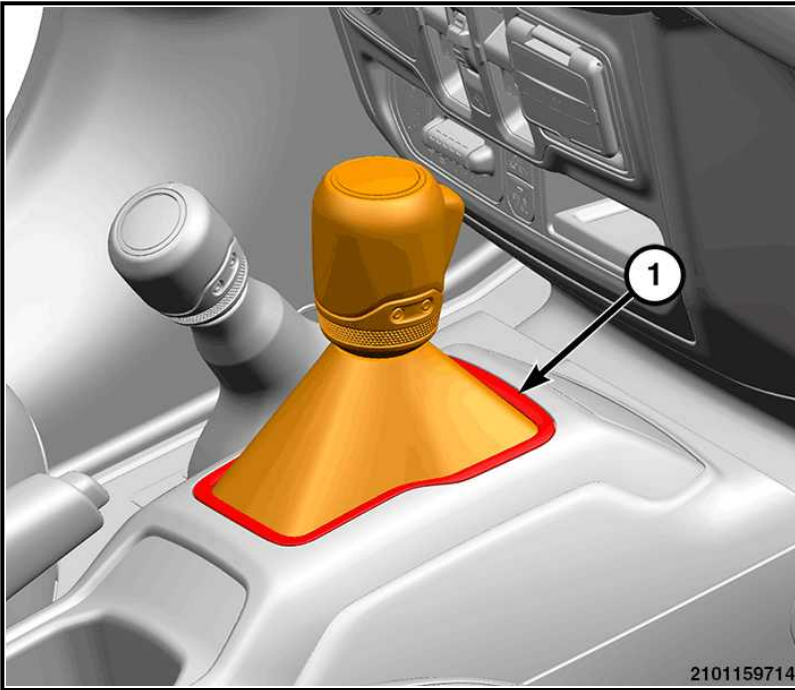
The OSS is located at the back of the TCMA and reads output shaft speed from the P4 carrier.

SHIFTER, TRANSMISSION

REMOVAL AND INSTALLATION

SHIFTER

REMOVAL



1 - Shifter Boot

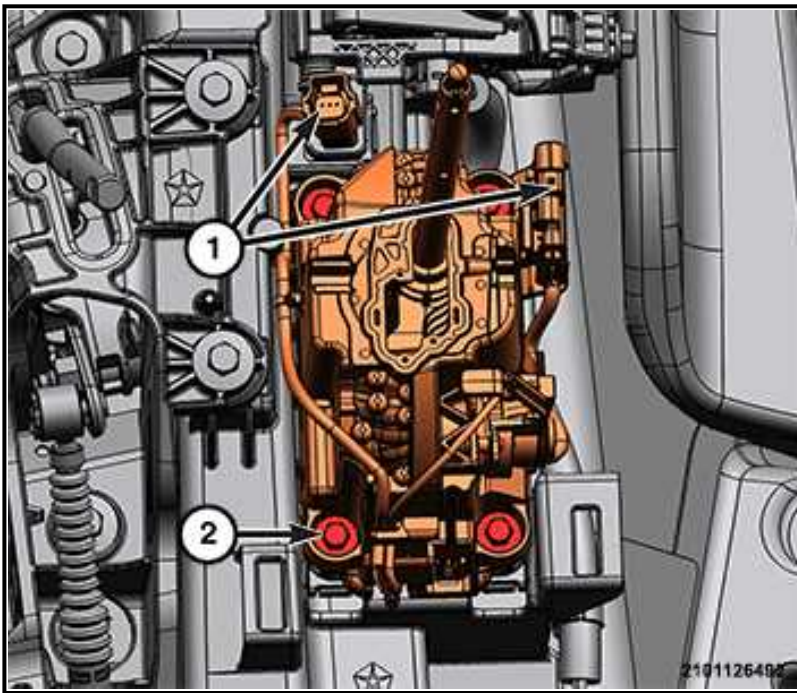
1. Using a plastic trim tool, carefully pry upward on the shifter boot while gently pulling upward on the fabric to release it.

NOTE: Be careful not to damage the trim or boot.



1 - Shifter Knob Bolt

2. Remove the shifter knob bolt and remove the shifter knob.
3. Remove any necessary console parts for access to the Shift Lever Assembly (SLA). Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Wire Harness Connectors
2 - Shifter Bolts

4. Disconnect the wire harness connectors from the SLA.

5. Remove the shifter bolts.

6. Remove the SLA from the vehicle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS

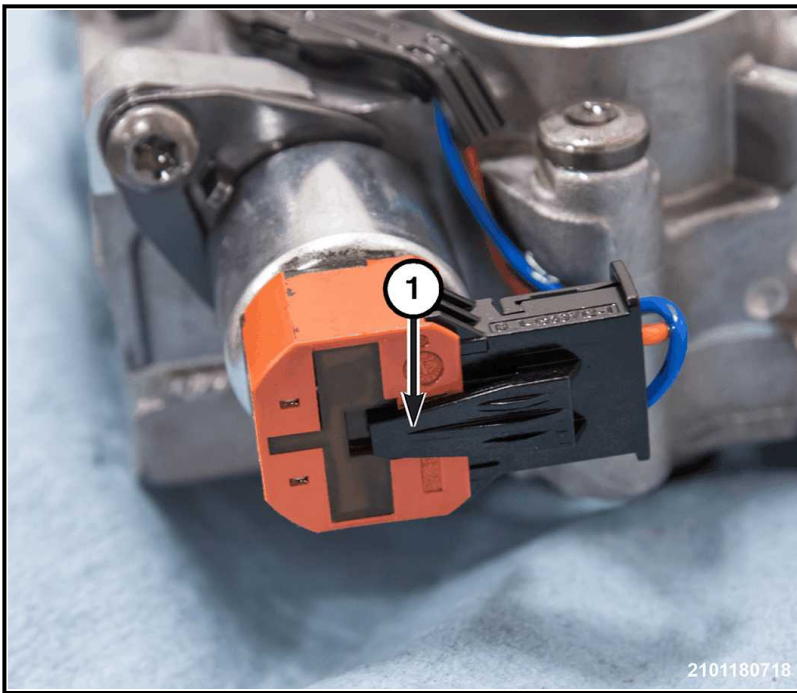
SOLENOID, TRANSMISSION

REMOVAL AND INSTALLATION

PARK LOCK SOLENOID

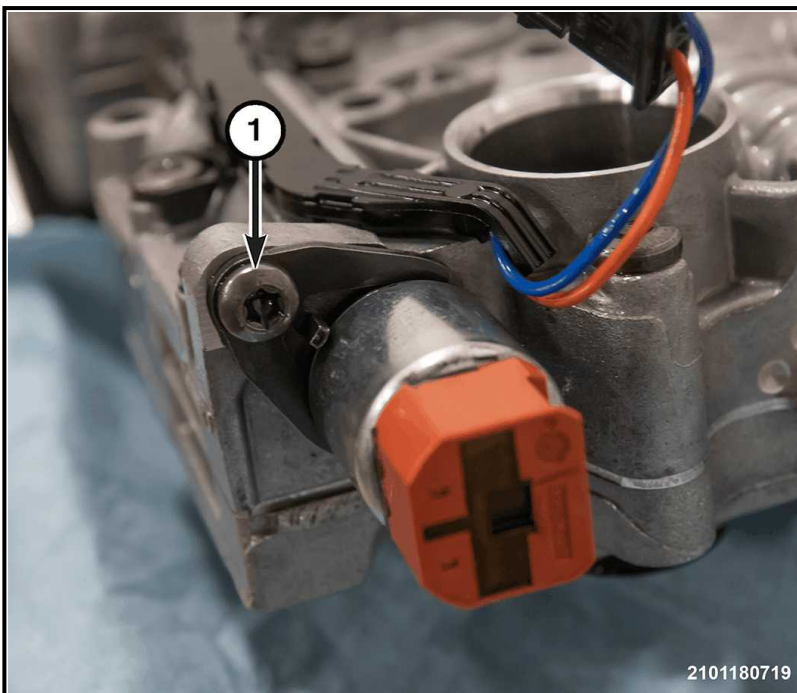
REMOVAL

1. Remove the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).



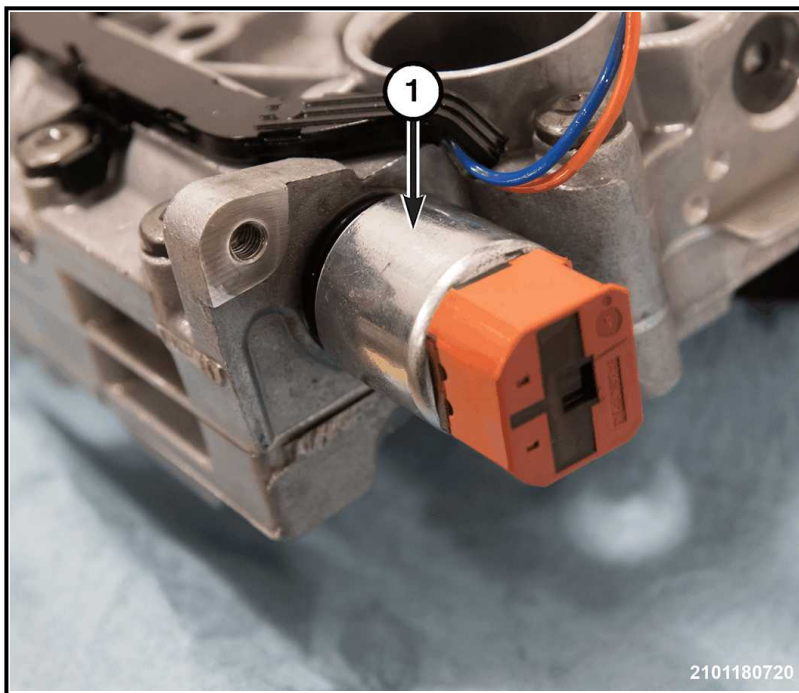
1 - Park Lock Solenoid Wire Harness Connector

2. Disconnect the park lock solenoid wire harness connector.



1 - Park Lock Solenoid Bolt

3. Remove the park lock solenoid bolt and remove the solenoid retainer.



1 - Park Lock Solenoid

4. Remove the park lock solenoid from the valve body.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

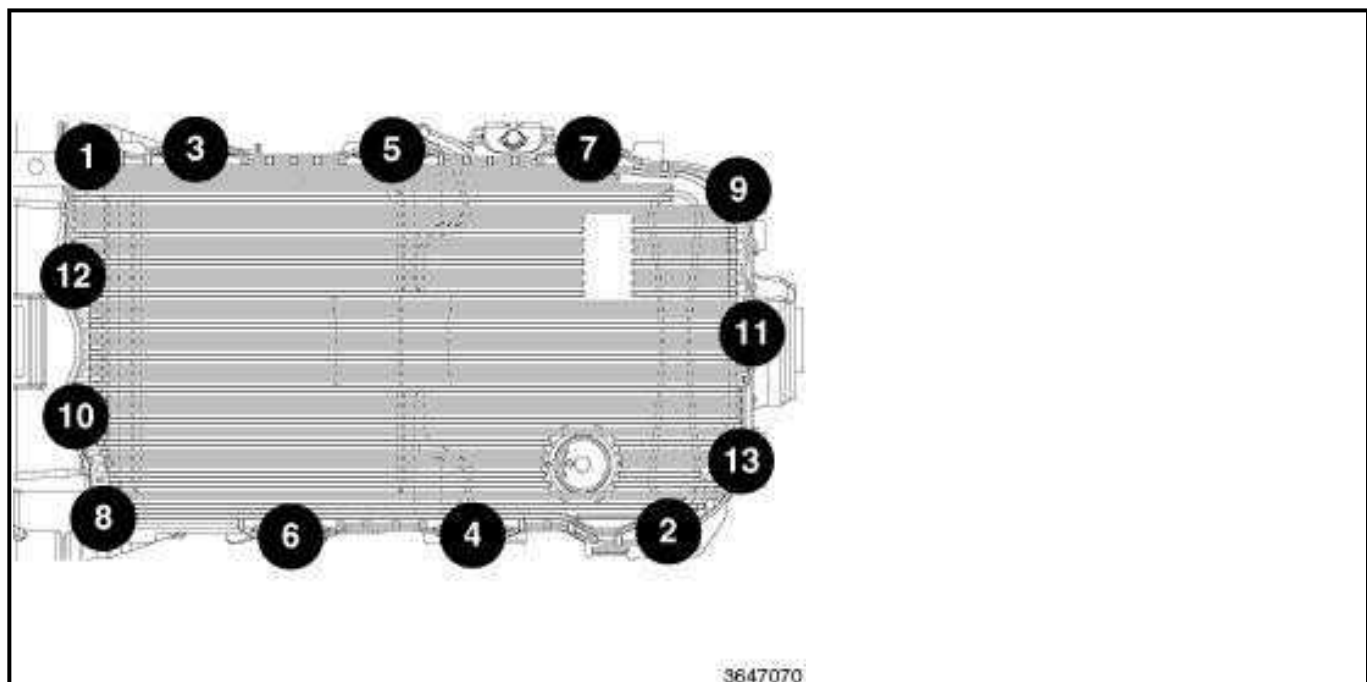
- Check transmission fluid level and correct as necessary. Refer to [CHECK FLUID LEVEL](#) .

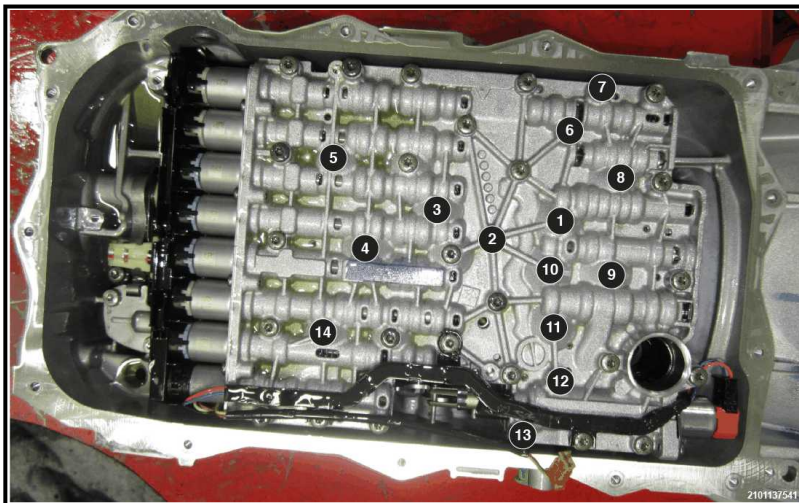
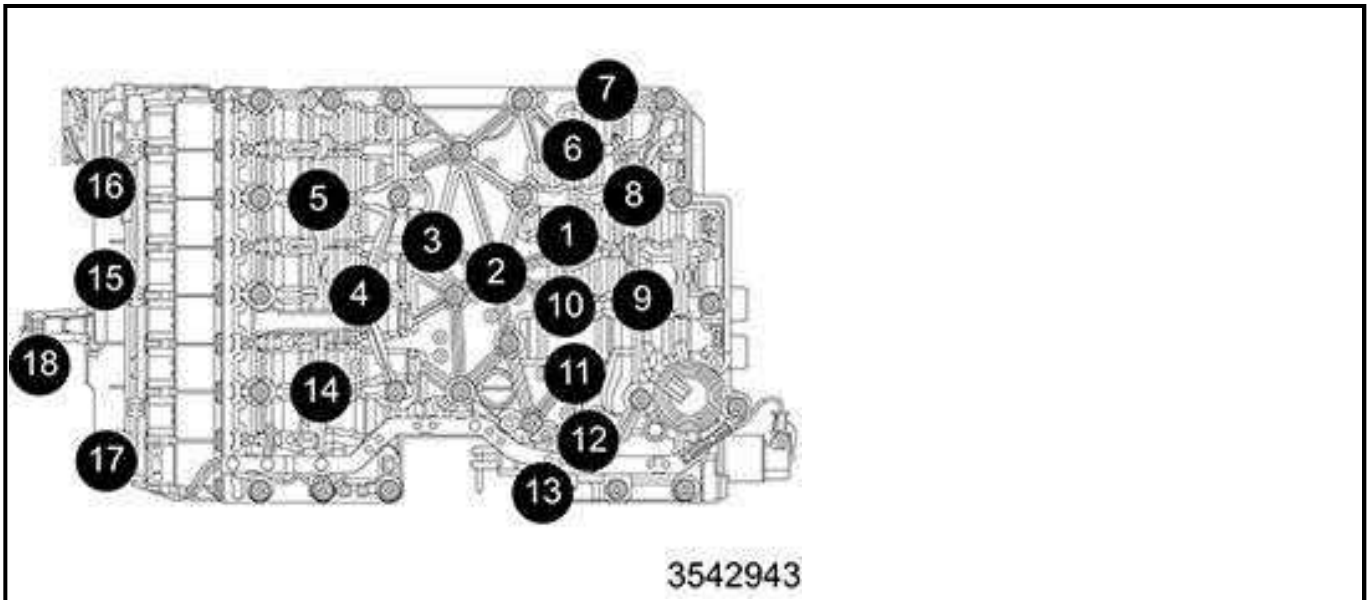
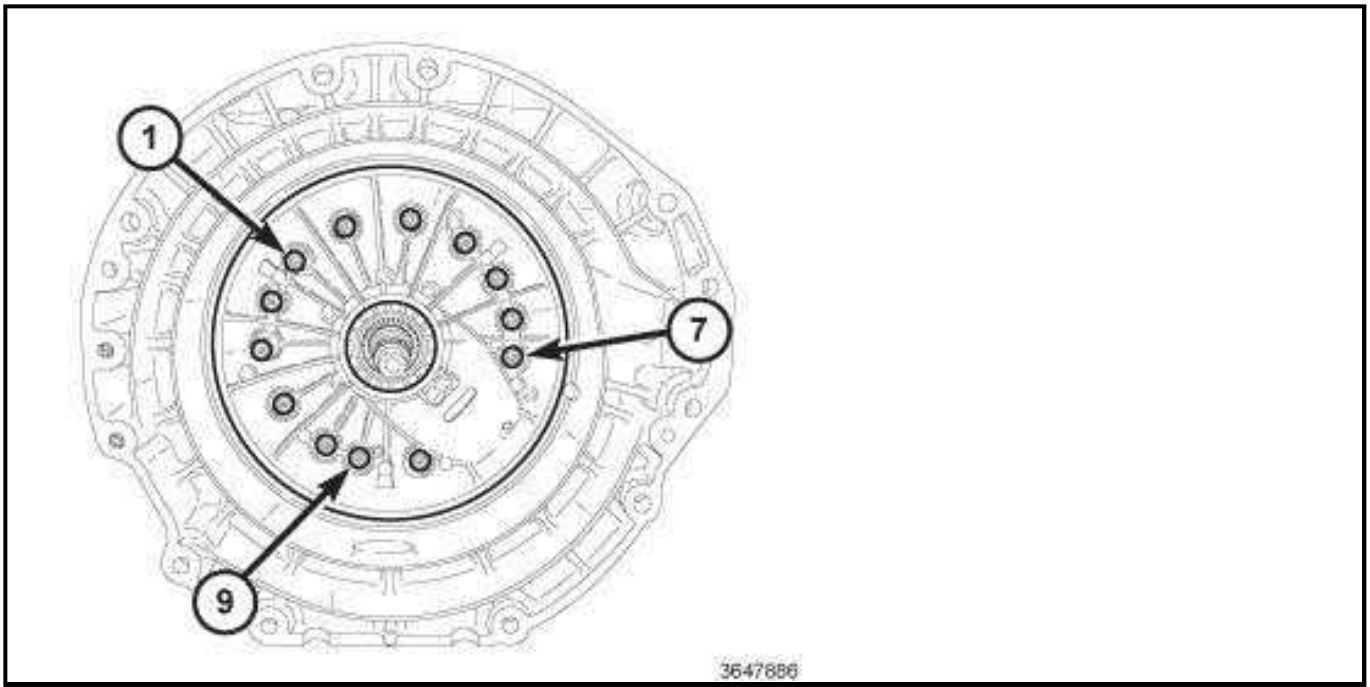
TORQUE SPECIFICATIONS

8HP50 TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Hydraulic Impulse Solenoid Bolts	8 N.m (71 In. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Lock Solenoid Screw	6 N.m (53 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	13 N.m (10 Ft. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	11 N.m (8 Ft. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Filter to Transmission Oil Pan	6 N.m (53 In. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts.	Tightening Sequence

DESCRIPTION	SPECIFICATION	COMMENTS
	2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	Torque Procedure: 1. Install bolts except for the spots where the locating pins are installed and hand tighten 2. Remove the pins and install the remaining bolts 3. Tighten bolts to 8 N.m (71 In. Lbs.)	Tightening Sequence



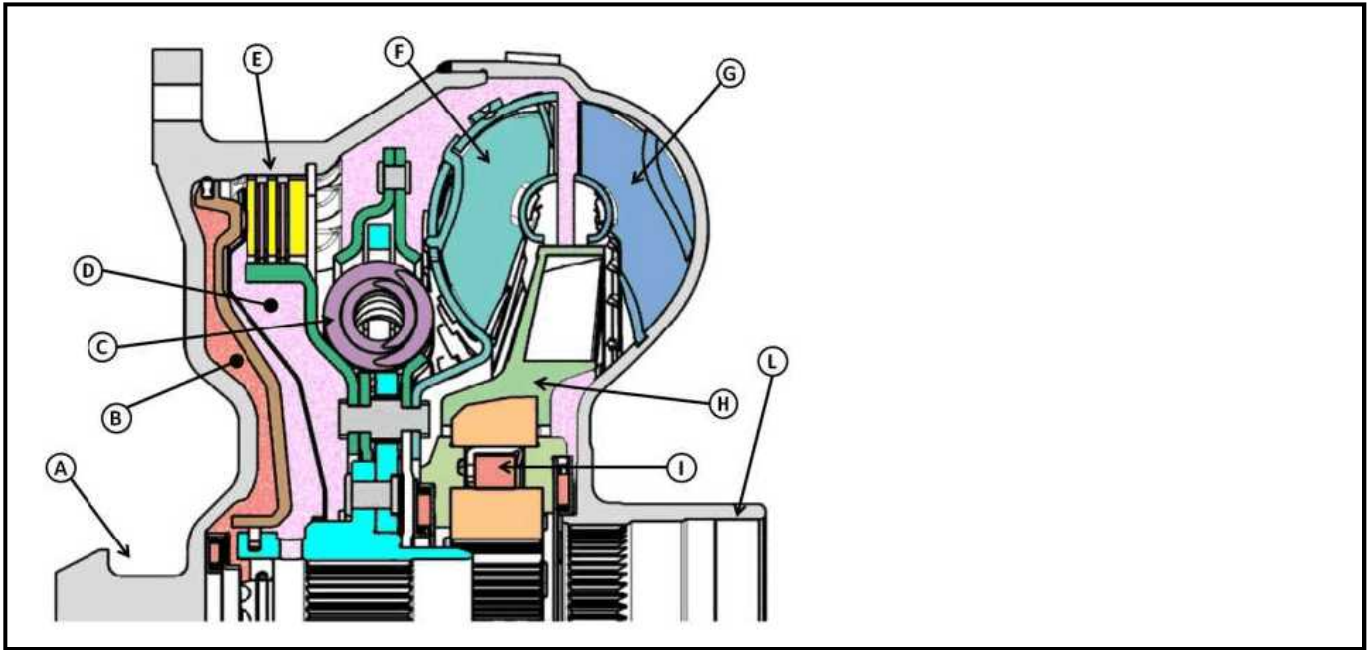


TORQUE CONVERTER

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION



TORQUE CONVERTER

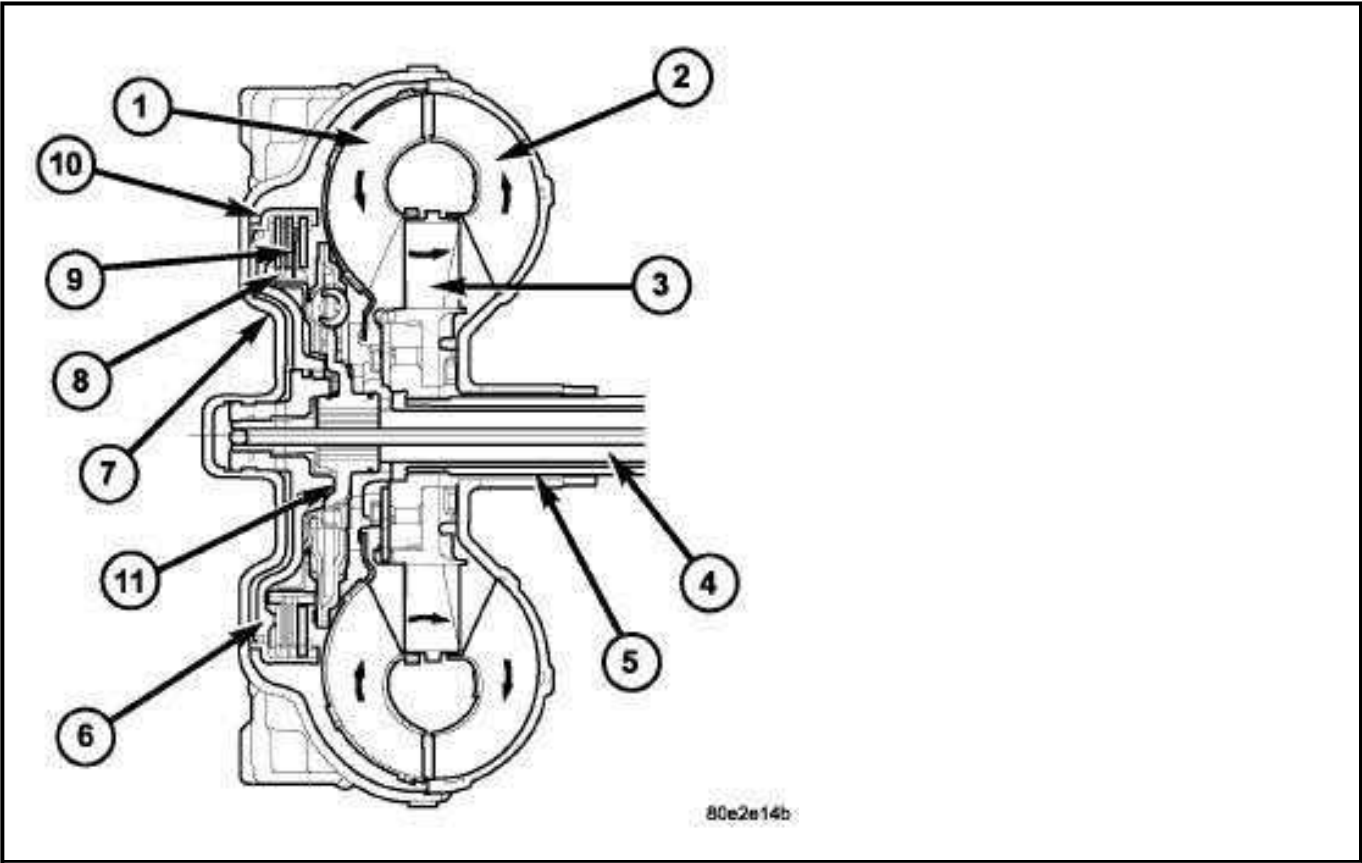
A.	Torque Converter Front Hub
B.	Converter Clutch Chamber
C.	Damper
D.	Turbine and Pump Chamber
E.	Torque Converter Clutch (TCC)
F.	Turbine
G.	Pump
H.	Stator
I.	Stator One-Way Clutch
L.	Transmission Pump Drive Hub Groove

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.

- The torque converter is essential to allow the vehicle to drive off and operates according to the dynamic fluid coupling principle. This means that there is a difference between the rotation speed of the pump and that of the turbine. This difference in rotation speed is called converter slippage and reduces the efficiency of the fluid coupling.
- The torque converter installed is of the so-called "three-duct" type. With this architecture, the turbine area is supplied by two ducts, while the TCC is controlled by a separate third duct.
- The TCC eliminates the converter slippage, thereby reducing fuel consumption. Moreover, opening and closing of the TCC is adjusted according to the desired driving comfort. The TCC is of the multi-plate type and is managed by the Transmission Control Module (TCM). It consists of two clutch plates and three steel discs, thereby creating four friction surfaces. The high friction coefficient and the number of friction surfaces has allowed the operating range of the TCC to be extended considerably, improving the overall efficiency of the kinematic chain. There are turbine torsional dampers inside the torque converter to effectively dampen the engines torsional vibrations when the TCC is activated.
- The TCC opens and closes independently and separately from the turbine area, giving advantages in the TCC control.
- Thanks to the special construction and control characteristics, the TCM is able to open and close the TCC over a wide engine operating range, from first gear up to eighth gear, according to the detected driving conditions and the active shifting strategy.

- The TCC pressure is controlled by the TCM through the EDS-LuK solenoid valve (TCC adjustment solenoid valve) and the corresponding hydraulic control valves.

OPERATION



1.	TURBINE
2.	IMPELLER
3.	STATOR
4.	INPUT SHAFT
5.	STATOR SHAFT
6.	PISTON
7.	COVER SHELL
8.	INTERNALLY TOOTHED DISC CARRIER
9.	CLUTCH PLATE SET
10.	EXTERNALLY TOOTHED DISC CARRIER
11.	TURBINE DAMPER

The torque converter housing has a unique shape to incorporate the TCC and flex plate connection. The torque converter uses the typical turbine, impeller and stator assemblies found in a standard torque converter assembly. The torque converter drives the pump through the splines on the inside of the hub. The torque converter uses a multi-disc torque converter clutch system that improves the durability and the holding pressure in the lock-up circuit. The torque converter incorporates a turbine dampening system. This system suppresses torsional vibrations from the engine to ensure optimal shift quality and reduce noise and vibration concerns.

TCC RELEASE When the TCC is open, the TCC piston is pushed to its default position by torque converter chamber pressure. The Torque Converter Switch Valve (SV-TC) provides pressure for torque converter operation which has been regulated by the Torque Converter Pressure Regulating Valve (TC-V). After exiting the torque converter, fluid moves into the cooling and lubrication circuits. The converter pressure retention valve (TCH1-V) ensures the torque converter pressure is a minimum of 0.35 bar (5 psi) when the TCC is open.

TCC APPLY When the TCC solenoid is energized, fluid is directed to the torque converter switch valve (SV-TC) and TCC lockup valve (TCC-V). The TCC lockup valve directs fluid to the TCC and torque converter chamber. The torque converter switch valve directs fluid exiting the converter chamber to a secondary pressure retention valve (TCH2-V) which is calibrated to retain 1.0 bar (14.5 psi) of pressure in the converter. The torque converter switch valve also directs line pressure to the cooler and lubrication circuit.

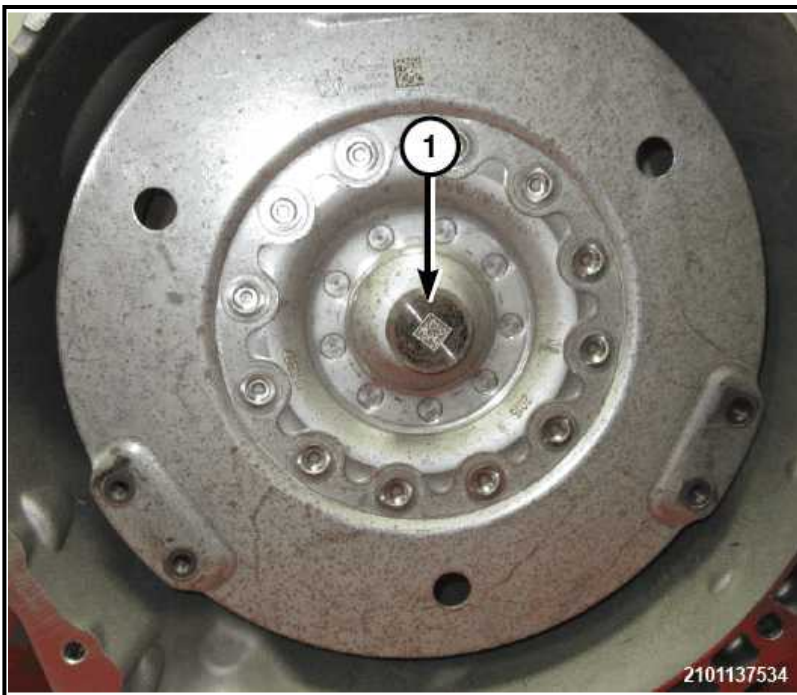
REMOVAL AND INSTALLATION

TORQUE CONVERTER

REMOVAL

1. Remove the transmission from the vehicle. Refer to [REMOVAL AND INSTALLATION](#).
2. Place a suitable drain pan under the torque converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.



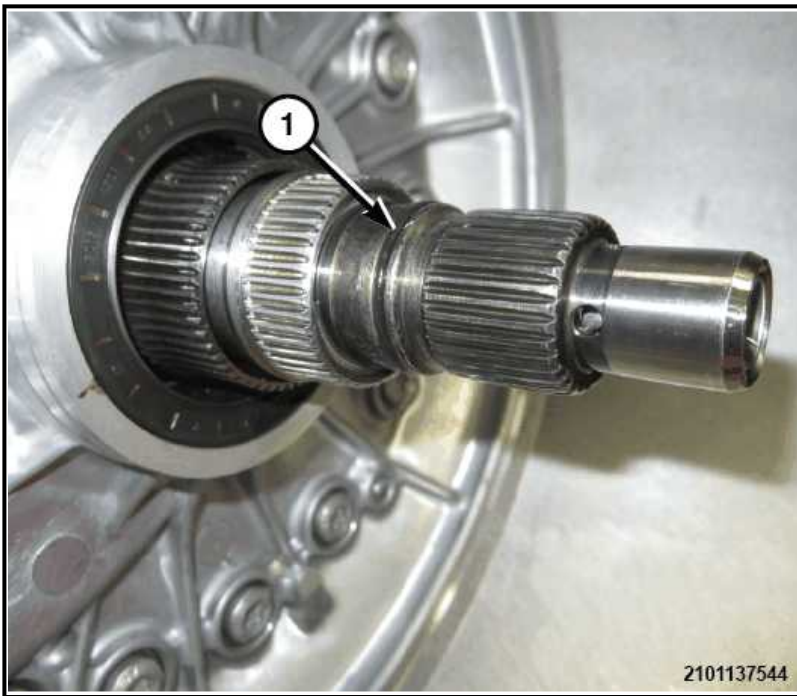
1 - Torque Converter

3. Pull the torque converter forward until the center hub clears the oil pump seal.

INSTALLATION

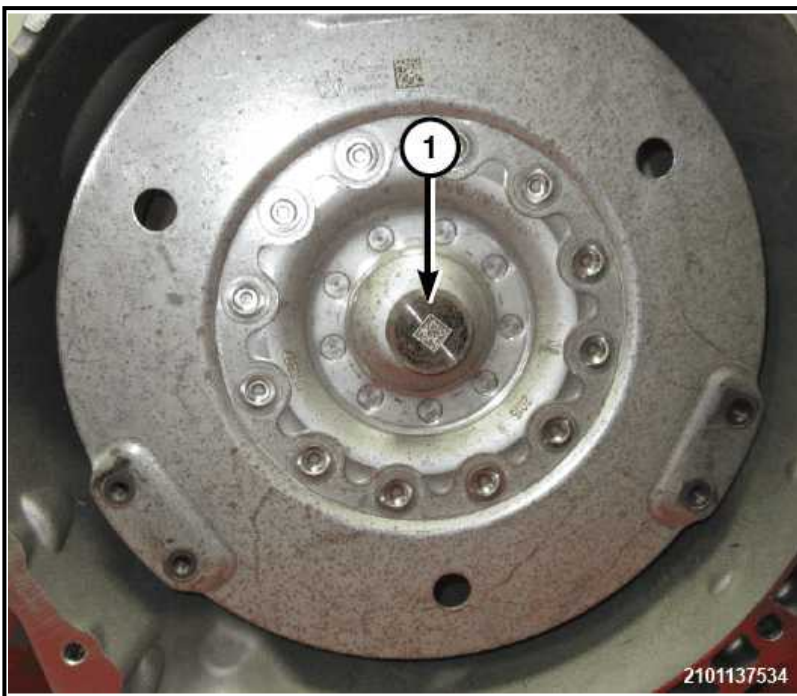
NOTE: Check the torque converter hub for sharp edges, burrs, scratches, or nicks. Polish the hub with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

1. Lubricate the oil pump seal lip with transmission fluid.



1 - Input Shaft O-Ring

2. Check the input shaft O-ring for any damage. Replace if necessary.

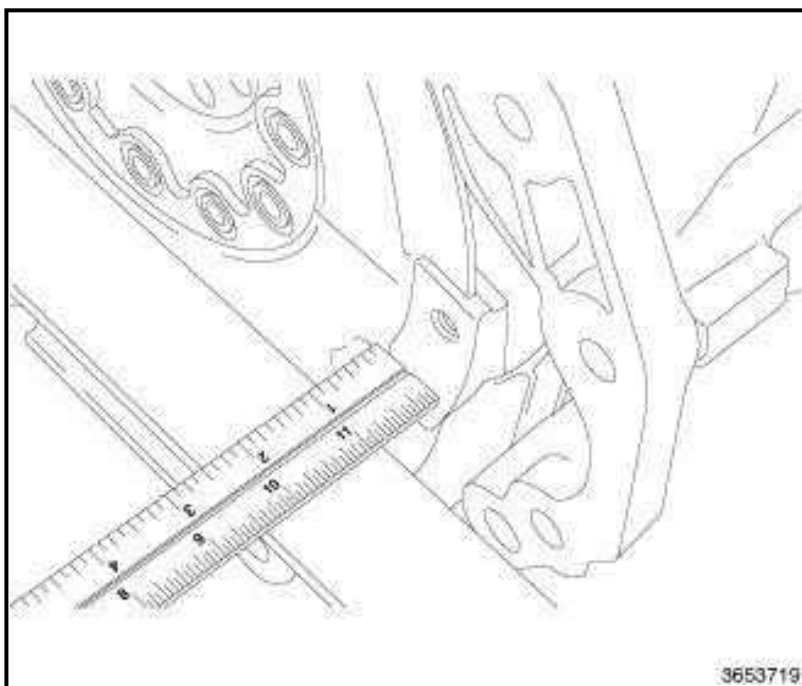


1 - Torque Converter

3. Place the torque converter in position on the transmission.

CAUTION: Do not damage oil pump seal or converter hub while inserting torque converter into the front of the transmission.

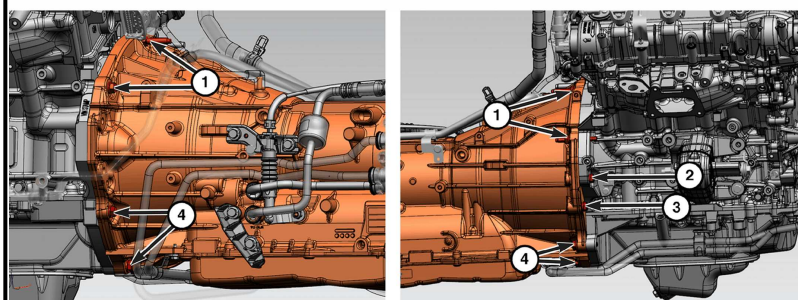
4. Align the torque converter to the oil pump seal opening.
5. Insert the torque converter hub into the oil pump drive gear.
6. While pushing the torque converter inward, rotate the torque converter until the torque converter is fully seated into the oil pump drive gear.



7. Check the torque converter seating with a scale and straightedge. The surface of the torque converter lugs should be at least 19 mm (3/4 in.) to the rear of the straightedge when the torque converter is fully seated.
8. If necessary, temporarily secure the torque converter with a C-clamp attached to the torque converter housing.
9. Install the transmission in the vehicle. Refer to [REMOVAL AND INSTALLATION](#).
10. Fill the transmission. Refer to [TRANSMISSION FILL AFTER SERVICE](#).

TORQUE SPECIFICATIONS

BELLOUSING AND OIL FILL PLUG

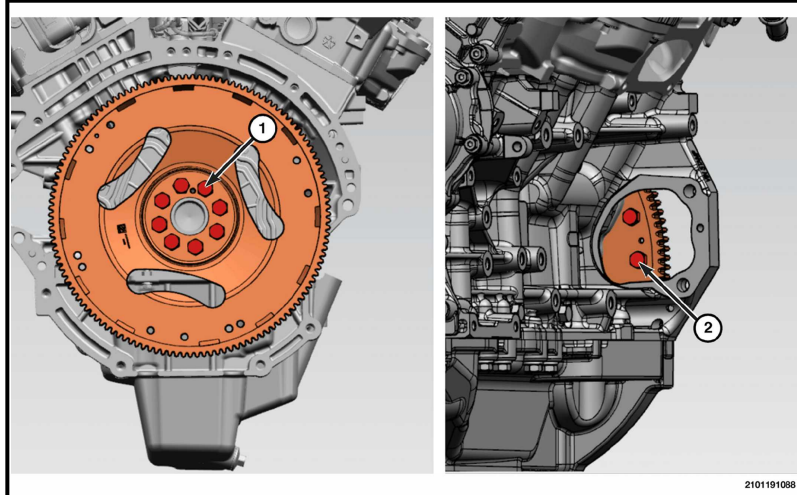


2101191085

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Bolts	- Bolt 50 N.m (37 Ft. Lbs.) - Double Ended Stud 48 N.m (35 Ft. Lbs.)	-
2	Engine Block To Transmission Bellhousing Bolt	50 N.m (37 Ft. Lbs.)	-

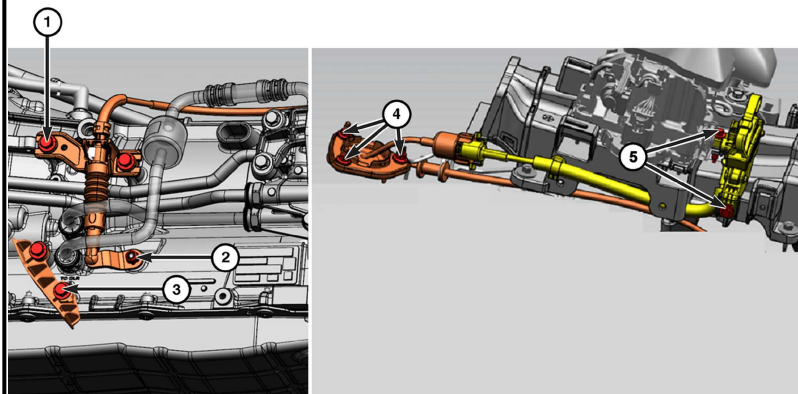
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
3	Dust Shield To Transmission Bellhousing Bolt	12 N.m (9 Ft. Lbs.)	-
4	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
Not Shown	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

FLEXPLATE AND TORQUE CONVERTER



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	95 N.m (70 Ft. Lbs.)	Tighten in a crisscross pattern. Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.

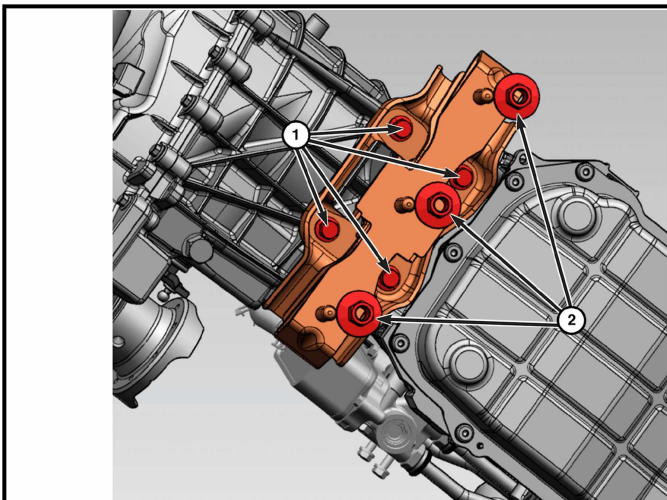
MANUAL PARK RELEASE



2101191295

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

TRANSMISSION MOUNT

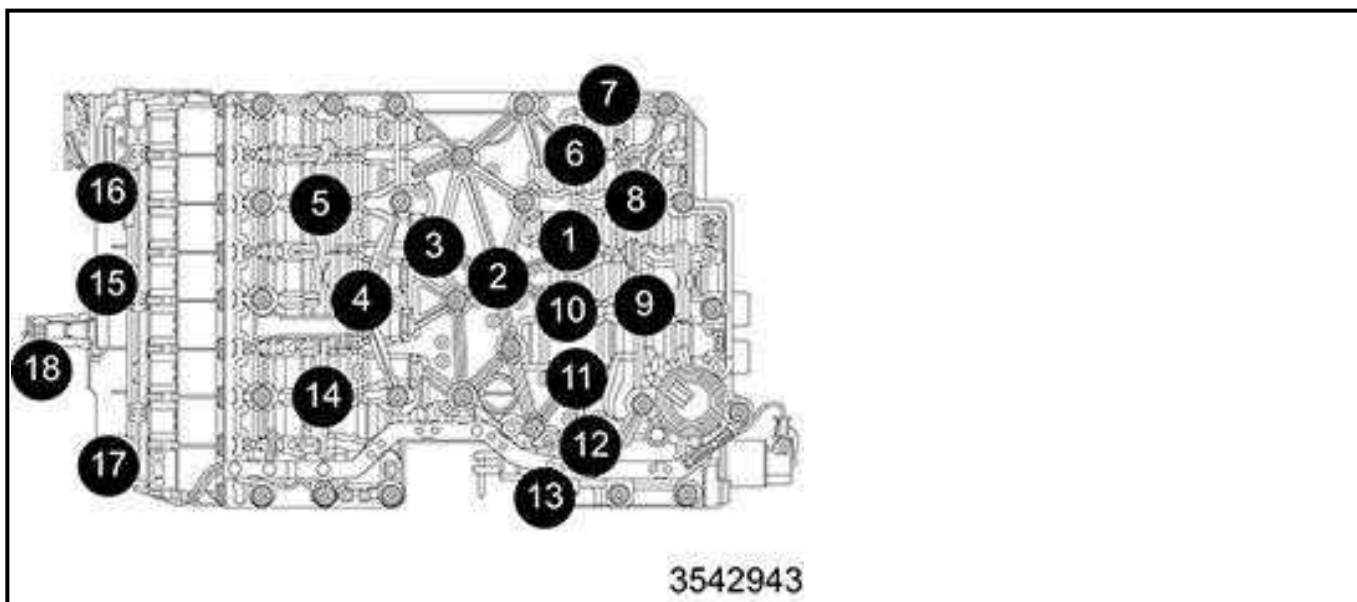
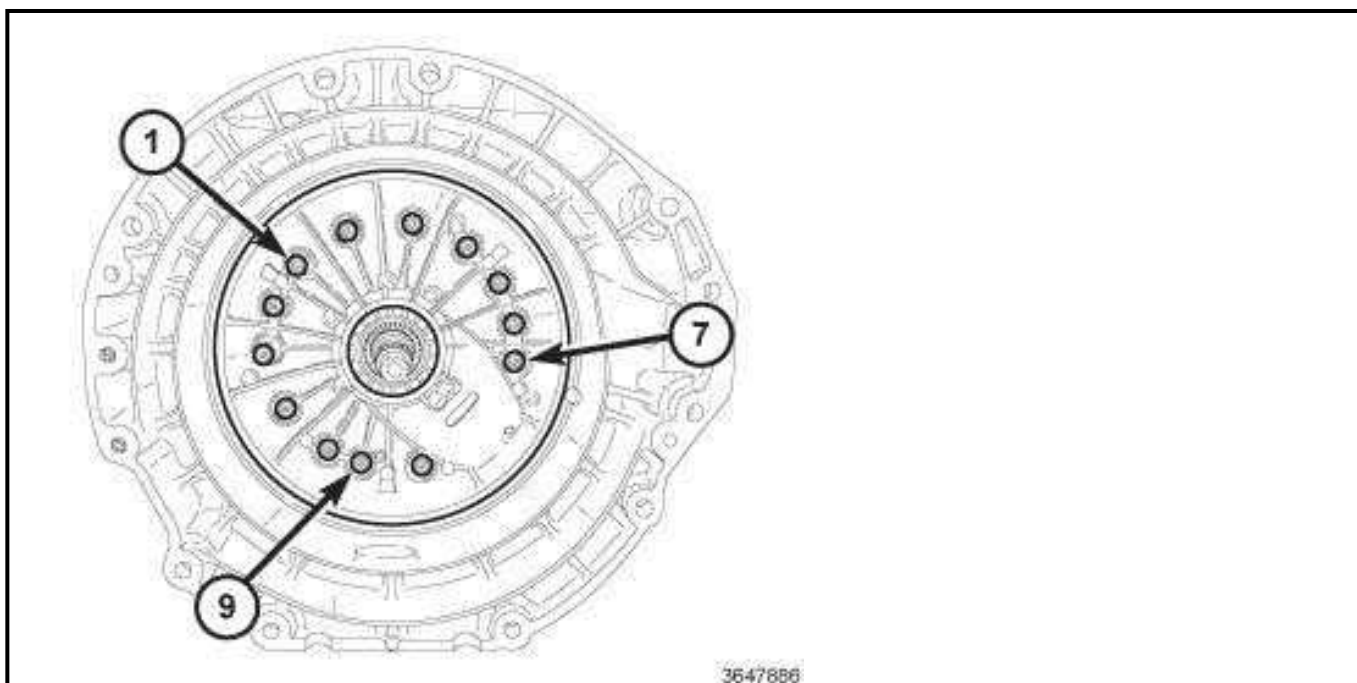
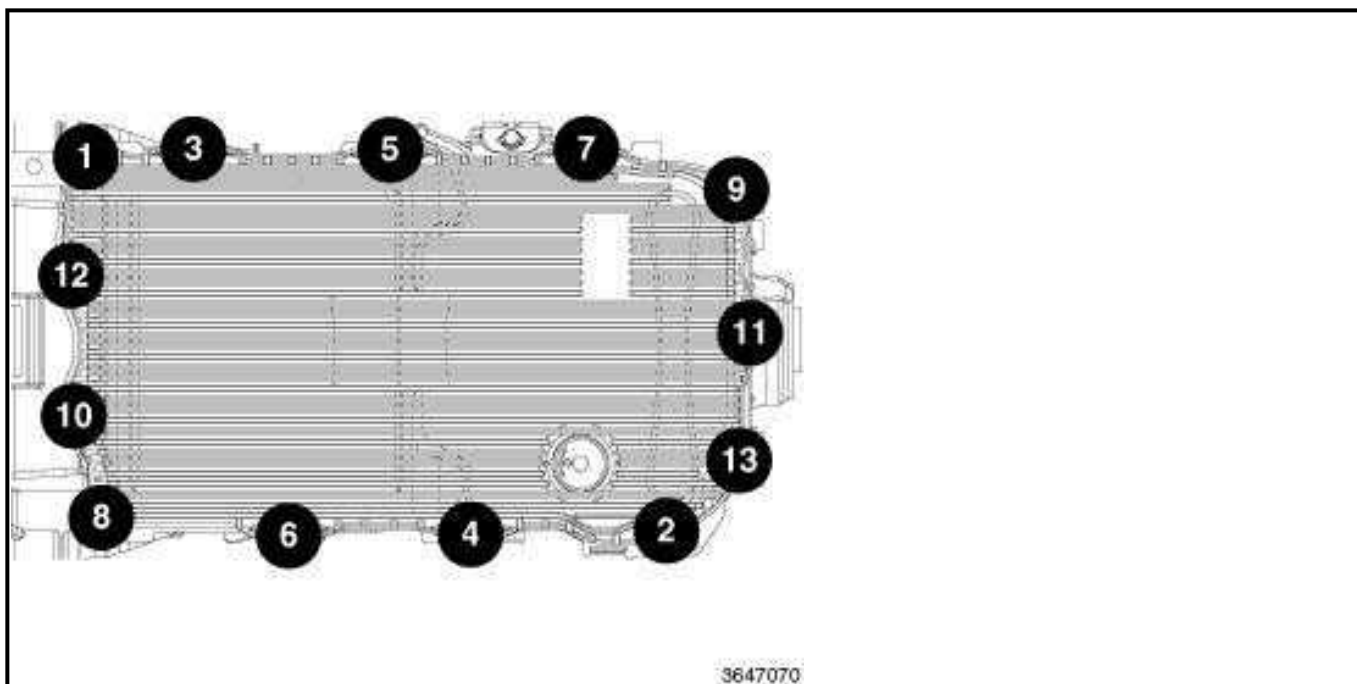


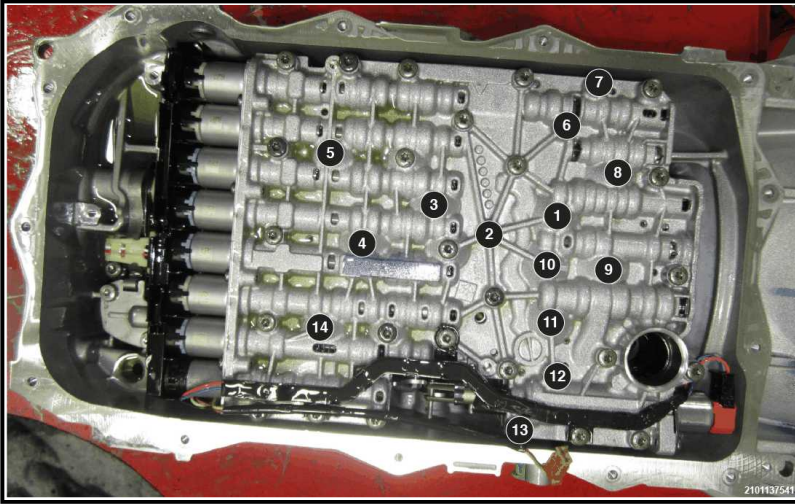
2101191087

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

8HP50 TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Hydraulic Impulse Solenoid Bolts	8 N.m (71 In. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Lock Solenoid Screw	6 N.m (53 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	13 N.m (10 Ft. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	11 N.m (8 Ft. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Filter to Transmission Oil Pan	6 N.m (53 In. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	Torque Procedure: 1. Install bolts except for the spots where the locating pins are installed and hand tighten 2. Remove the pins and install the remaining bolts 3. Tighten bolts to 8 N.m (71 In. Lbs.)	Tightening Sequence





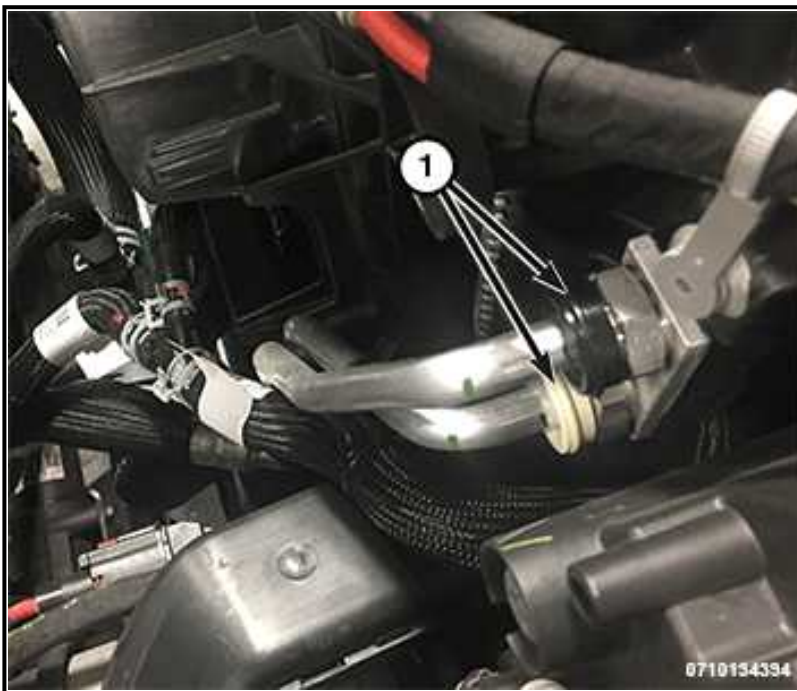
TUBES AND HOSES, TRANSMISSION OIL COOLER

REMOVAL AND INSTALLATION

TRANSMISSION COOLER LINES

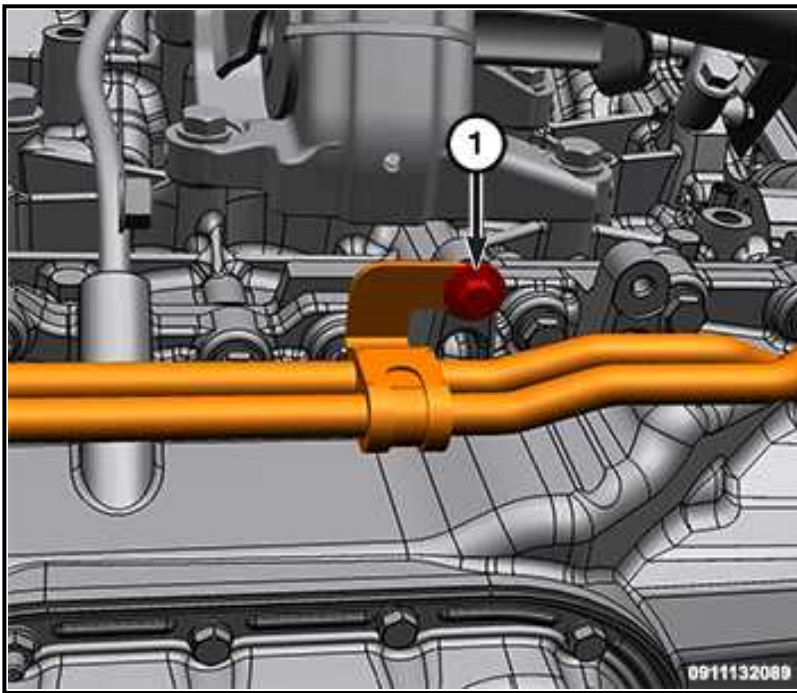
REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the air cleaner assembly Refer to [BODY, AIR CLEANER, REMOVAL AND INSTALLATION](#) .
3. Release the transmission fluid cooler tubes from the routing clip located at the radiator.



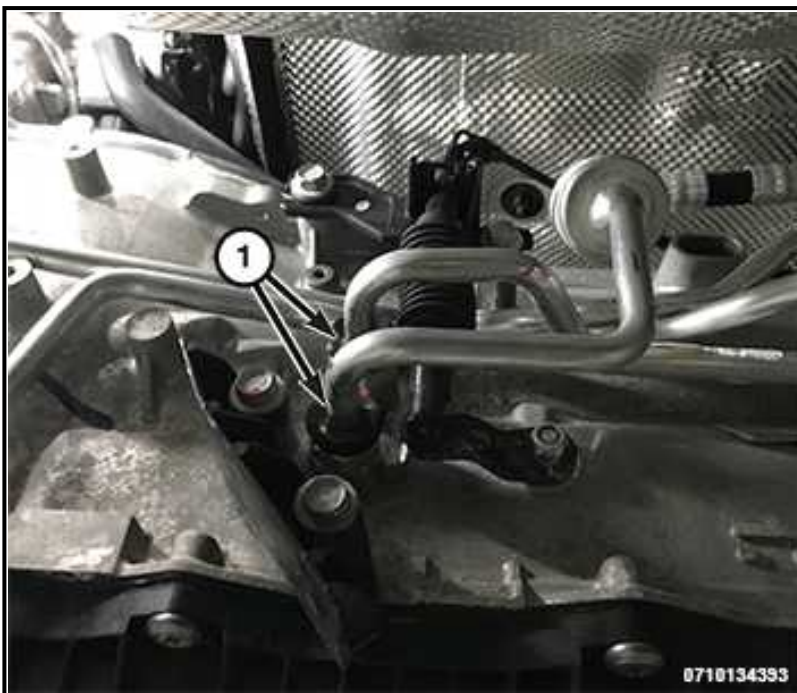
1 - Transmission Cooler Tubes

4. Disconnect the transmission fluid cooler tubes from the transmission fluid cooler.



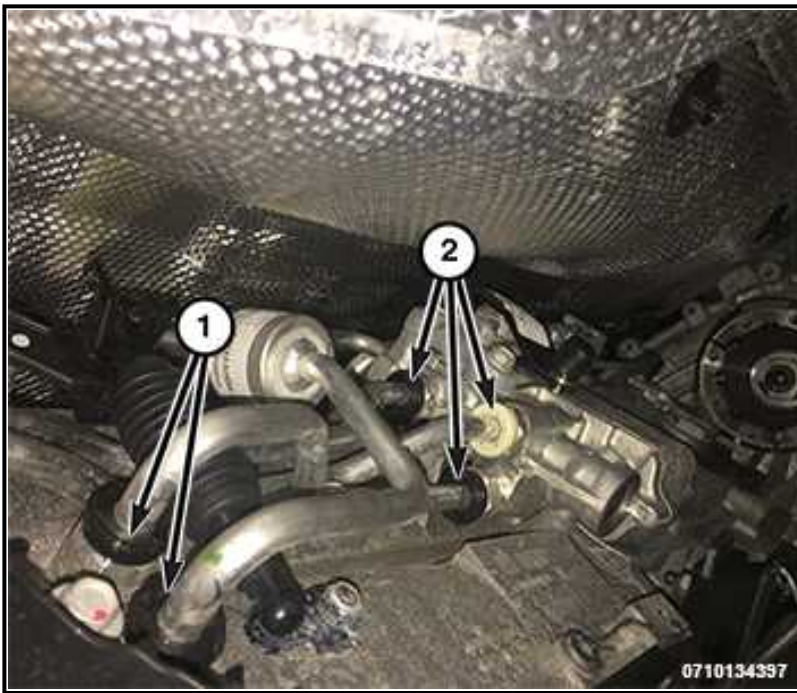
1 - Transmission Cooler Tube Bracket Nut

5. Remove the transmission fluid cooler tube bracket nuts.



1 - Transmission Cooler Tubes

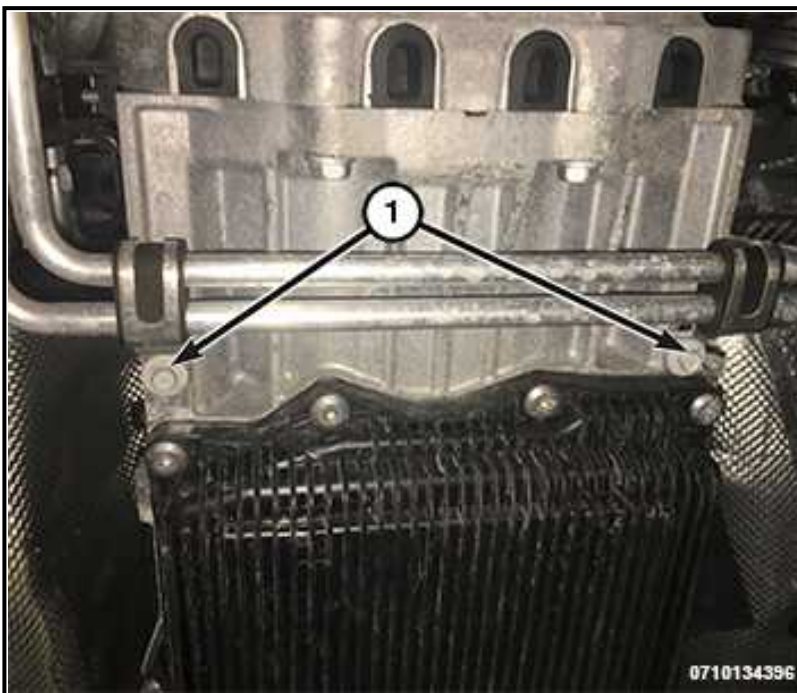
6. Disconnect the transmission fluid cooler tubes from the transmission.



1 - Transmission Cooler Tubes

2 - Transmission Cooler Tubes

7. Remove the transmission fluid cooler tubes from the transmission heater.



1 - Transmission Cooler Tube Bracket Bolts

8. Remove the transmission fluid cooler tube bracket bolts.

9. Remove the transmission fluid cooler lines from the vehicle.

INSTALLATION

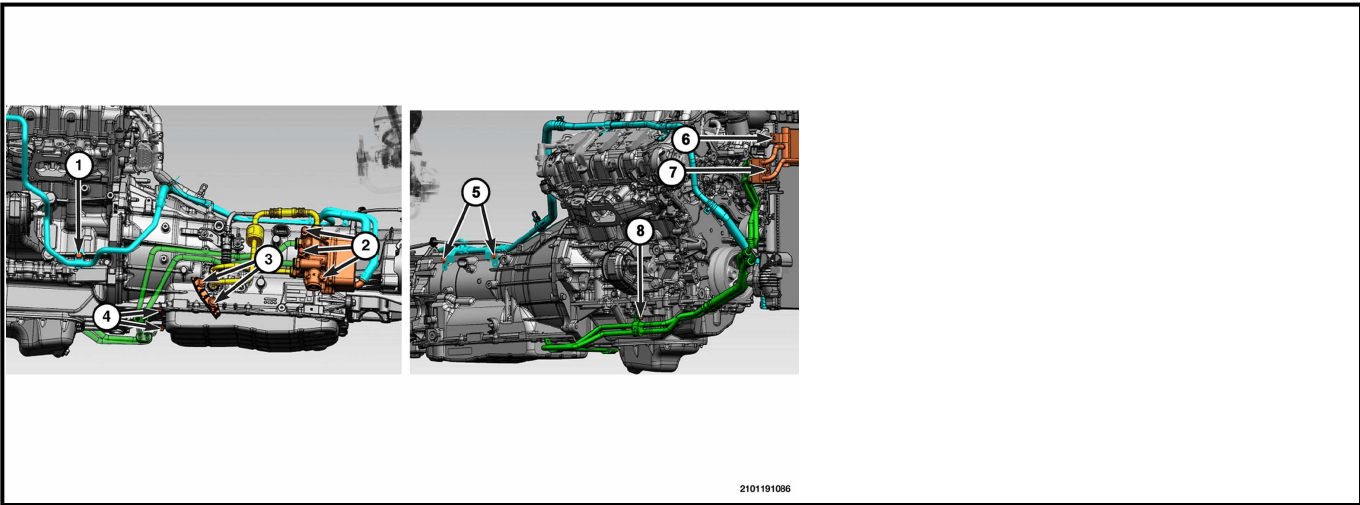
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Verify that the transmission cooler tubes are routed correctly and all of the brackets are fastened properly. Failure to do so can cause the tubes to rub on other components and be damaged.
- Check the transmission fluid level. Refer to [CHECK FLUID LEVEL](#) .

TORQUE SPECIFICATIONS

TRANSMISSION OIL COOLER AND HEATER



CalloUT	DEscriPtion	SPeCifiCation	CoMment
1	Transmission Oil Heater Line Bracket to Engine Bolt	35 N. m (26 Ft. Lbs.)	-
2	Transmission Oil Heater To Case Bolts	23 N. m (17 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Transmission Oil Cooler Line To Transmission Bolts	9 N. m (80 In. Lbs.)	-
5	Transmission Oil Heater Line To Transmission Bolts	22 N. m (16 Ft. Lbs.)	-
6	Transmission Oil Cooler Bolt	-	Tighten Securely
7	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely
8	Transmission Oil Cooler Line Bracket To Oil Pan	9 N. m (80 In. Lbs.)	-

VALVE BODY

REMOVAL AND INSTALLATION

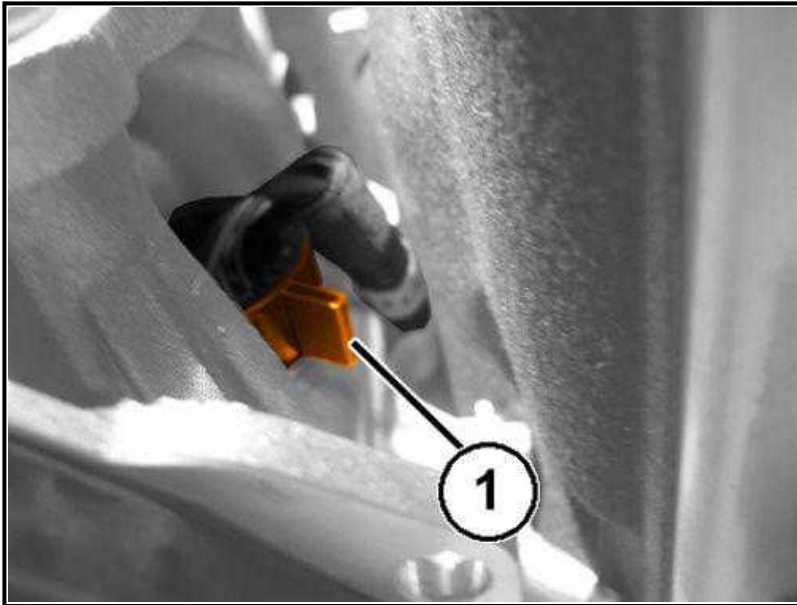
VALVE BODY

REMOVAL

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

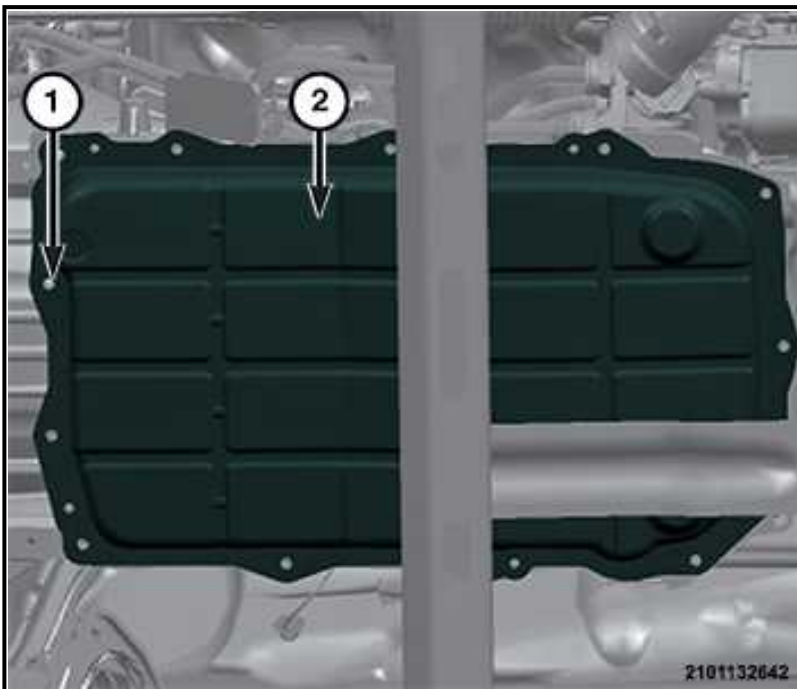
1. Disconnect and isolate the negative battery cable(s). Refer to [CABLES, BATTERY](#) .

2. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
3. Drain the transmission fluid into a clean container. Refer to [FLUID/FILTER SERVICE](#) .



1 - Mechanism Lock

4. Disconnect the transmission solenoid wire harness connector by turning the locking mechanism lock (1) of the adapter plug counter-clockwise and slightly pulling the transmission solenoid wire harness connector.

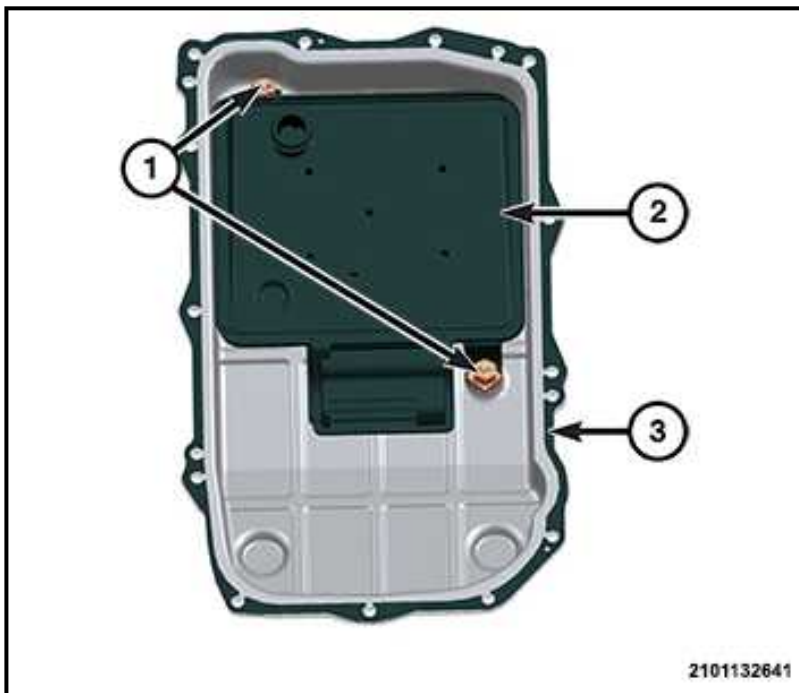


1 - Transmission Fluid Pan Bolts

2 - Transmission Fluid Pan

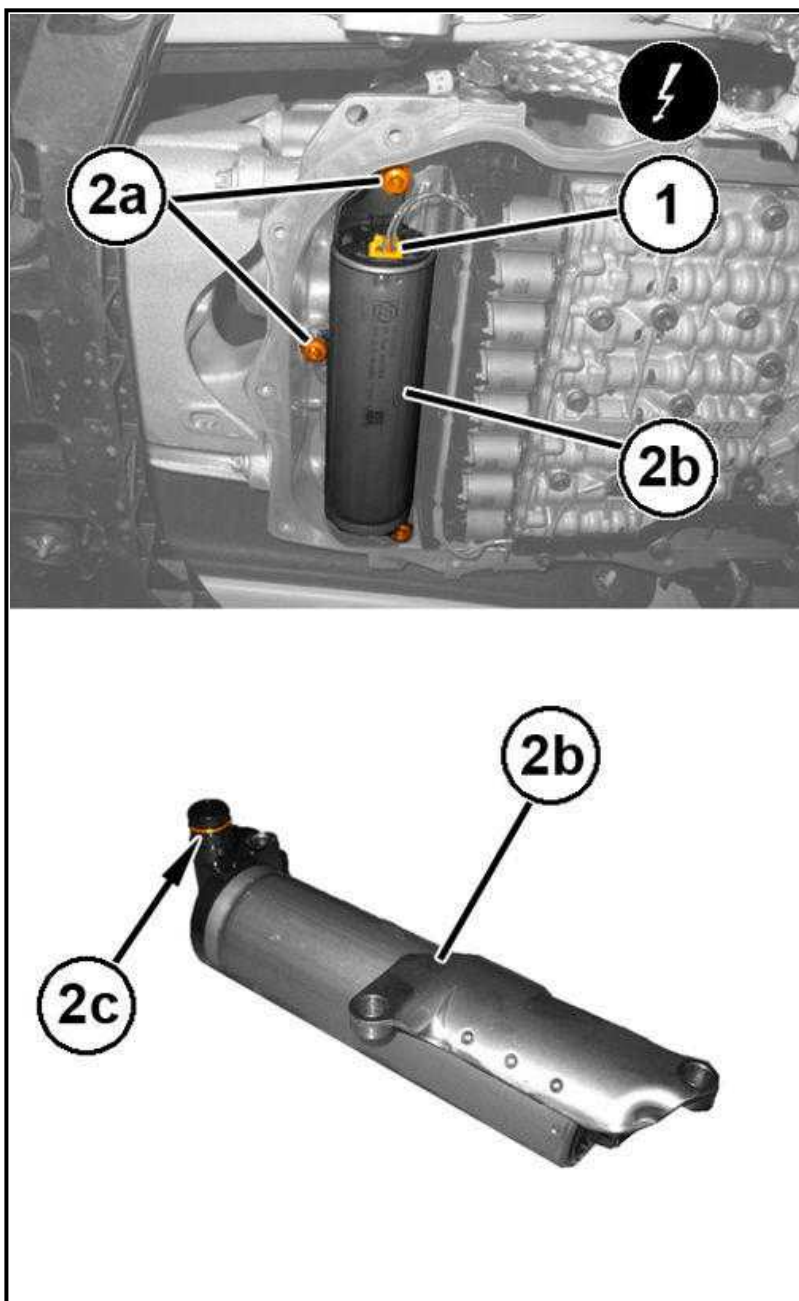
5. Remove the transmission fluid pan bolts and remove the transmission fluid pan.

NOTE: **Inspect the gasket for reuse. If the seal is cut or torn, replace the gasket.**



1 - Transmission Fluid Filter Nuts
2 - Transmission Fluid Filter
3 - Gasket

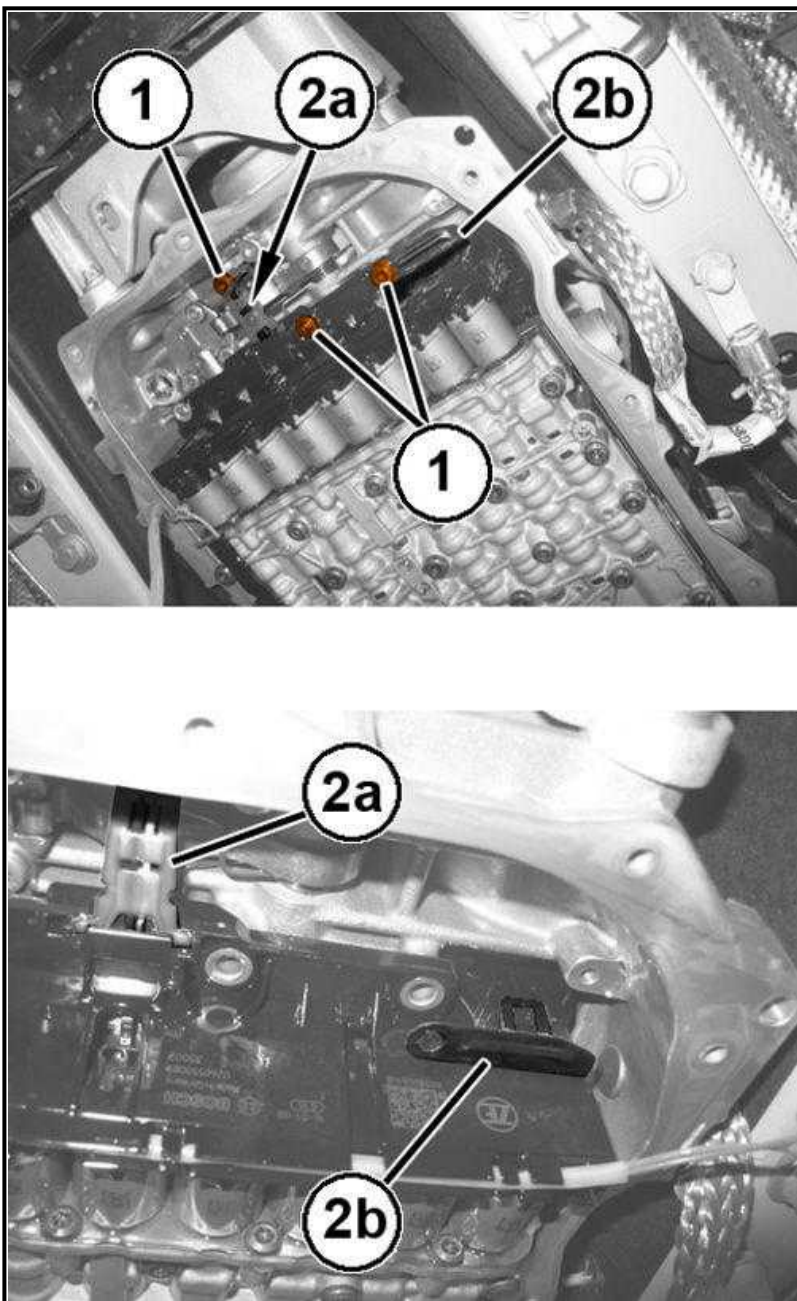
6. Remove the transmission fluid filter nuts, remove the transmission fluid filter and gasket.



1 - Hydraulic Impulse Oil Storage (HIS) connector
2a - Three Bolts
2b - Hydraulic Impulse Oil Storage (HIS) accumulator

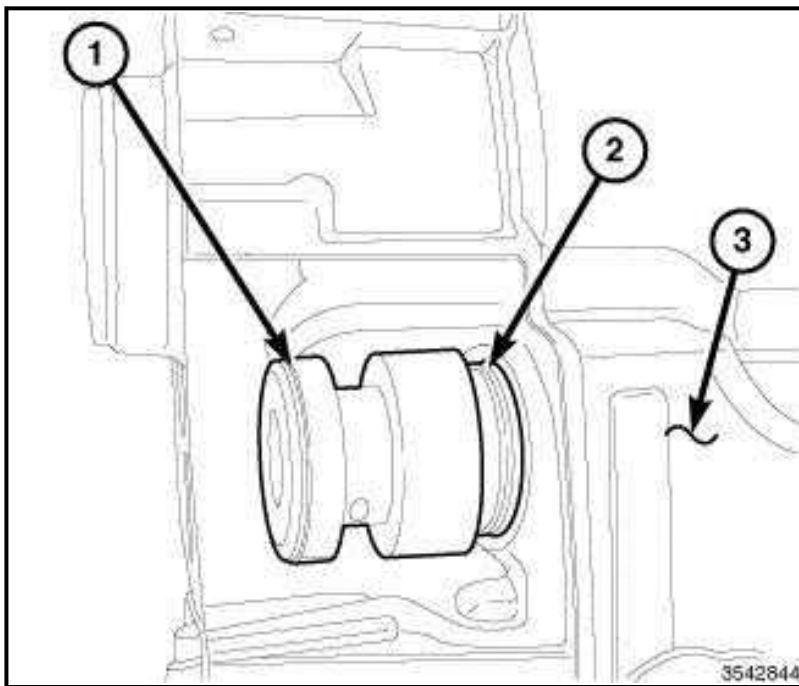
7. If equipped, disconnect the Hydraulic Impulse Oil Storage (HIS) connector.

8. If equipped, remove three bolts and the HIS accumulator.



1 - Valve Body Assembly End Retainer Bolts
2a -Output Speed Sensor (OSS)
2b- Electrical Connector Lock

9. Remove the valve body assembly end retainer bolts.
10. Lift the electrical connector lock to release the internal harness end from inside the transmission for valve body assembly removal.
11. Remove the Output Speed Sensor (OSS) bolt and pull the OSS loose from the case.

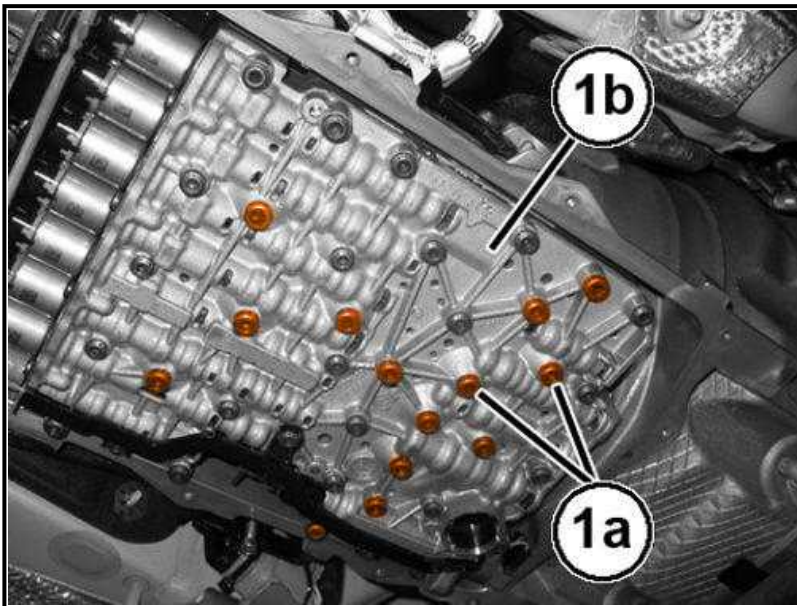


1 - Guide Sleeve Remover/Installer

2 - Electrical Harness Insulator

3 - Transmission Case

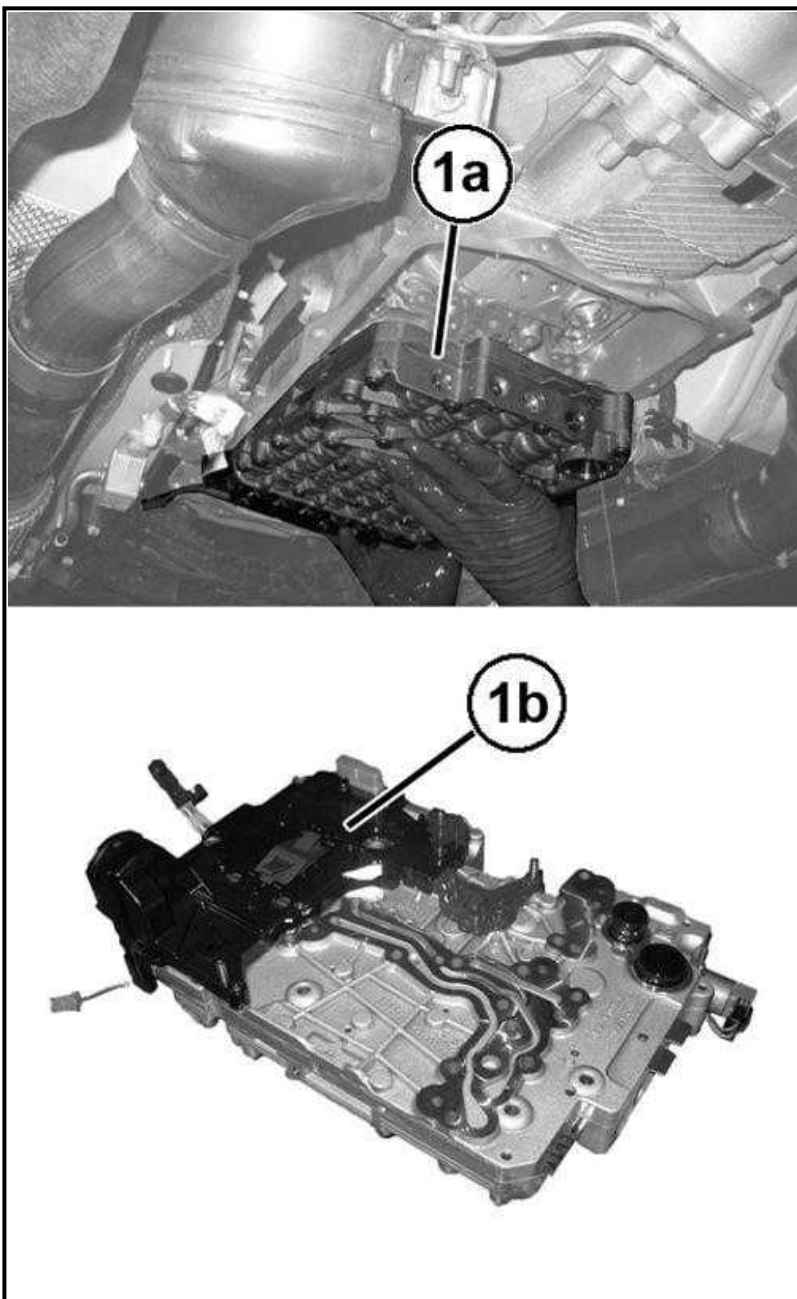
12. Using (special tool #10377, Remover/Installer, Guide Sleeve) carefully pull the electrical harness insulator straight out from the transmission case.



1a - Bolts

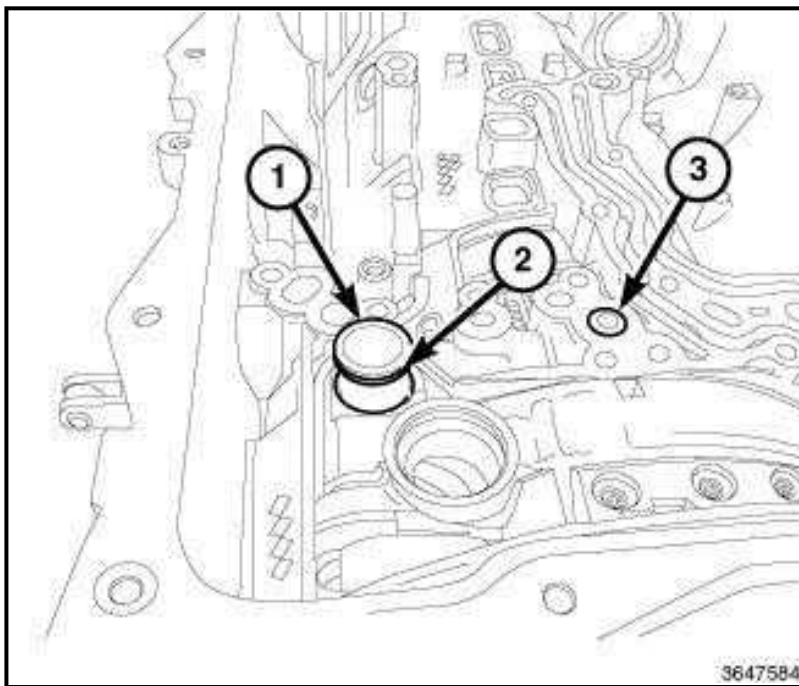
1b - Valve Body Assembly

13. Remove the valve body assembly bolts.



1a - Valve Body Assembly
1b - Transmission Control Module

14. Carefully lower the valve body assembly from the transmission.



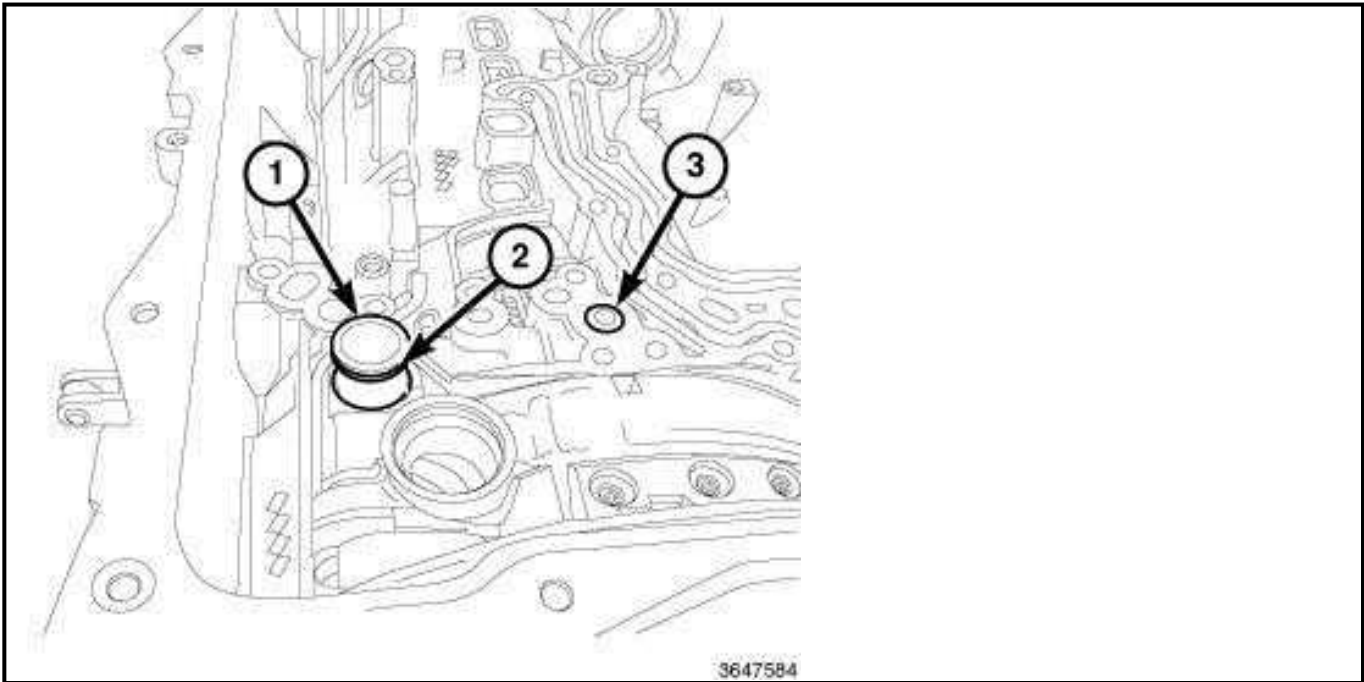
1 - Fluid Transfer Port
2 - O-ring
3 - Seal

NOTE: The fluid port may remain in the valve body upon removal, remove and discard the O-rings.

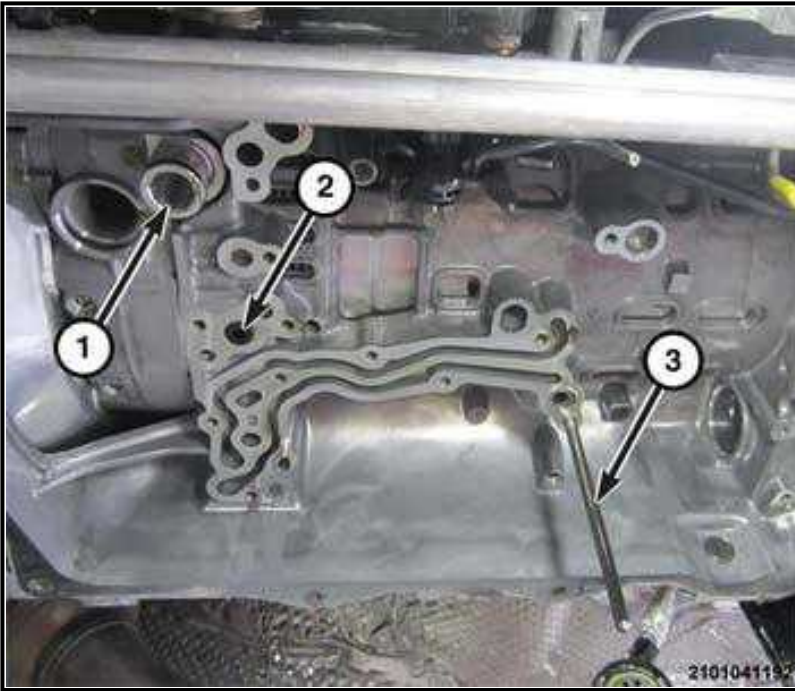
- 15. Remove the fluid transfer port from the transmission.
- 16. Remove and **DISCARD** the O-ring and seal.

INSTALLATION

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.



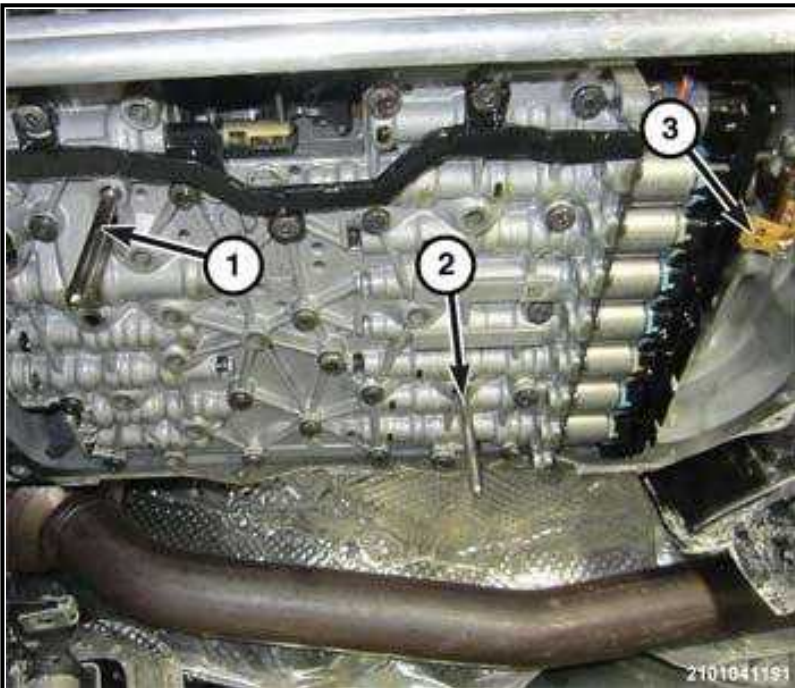
1. Install the fluid port (1) with **NEW** O-rings (2) and seal (3) to the valve body.



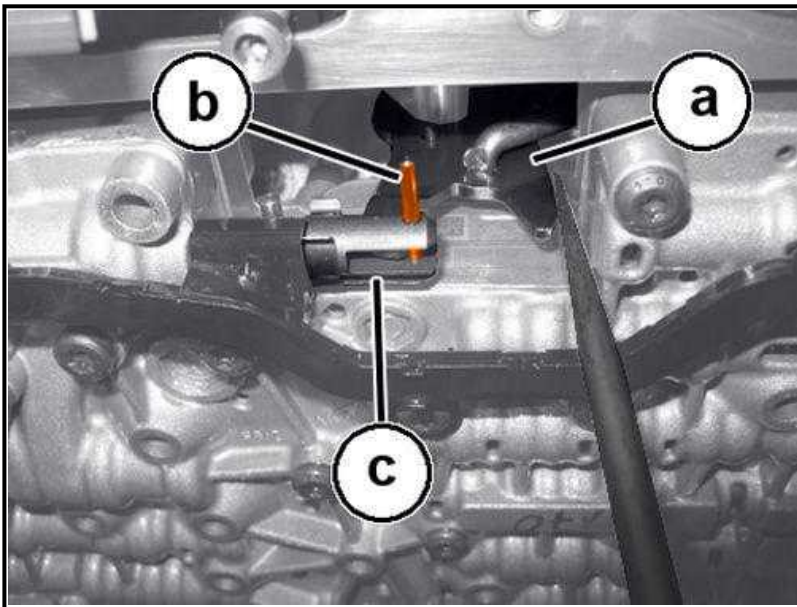
2. Install one of the valve body (special tool #10379, Pins, Valve Body Alignment) (3) in the rear of the transmission as shown as a guide.

NOTE: Make sure the speed sensor at the rear of the valve body does get caught between the valve body and the transmission case when positioning the valve body to the case.

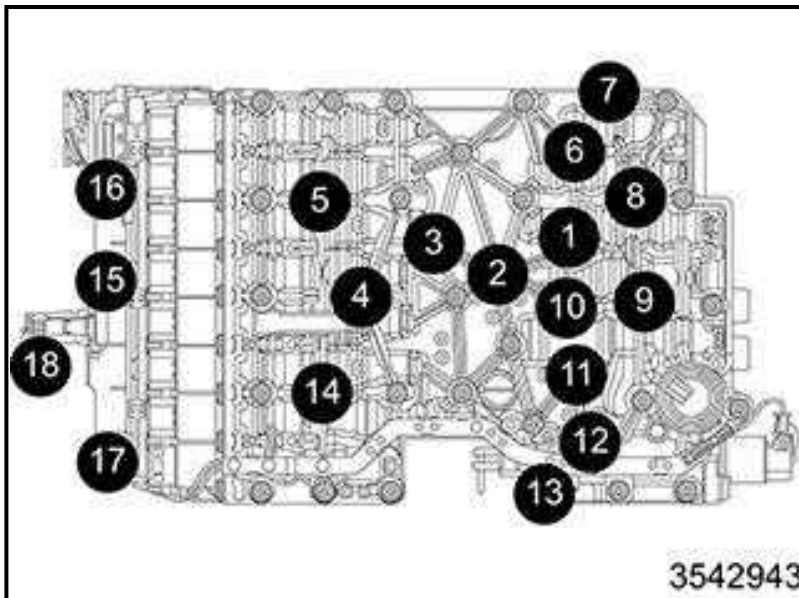
3. Carefully guide the front of the valve body over the cradle while aligning the rear of the valve body with the alignment pin.



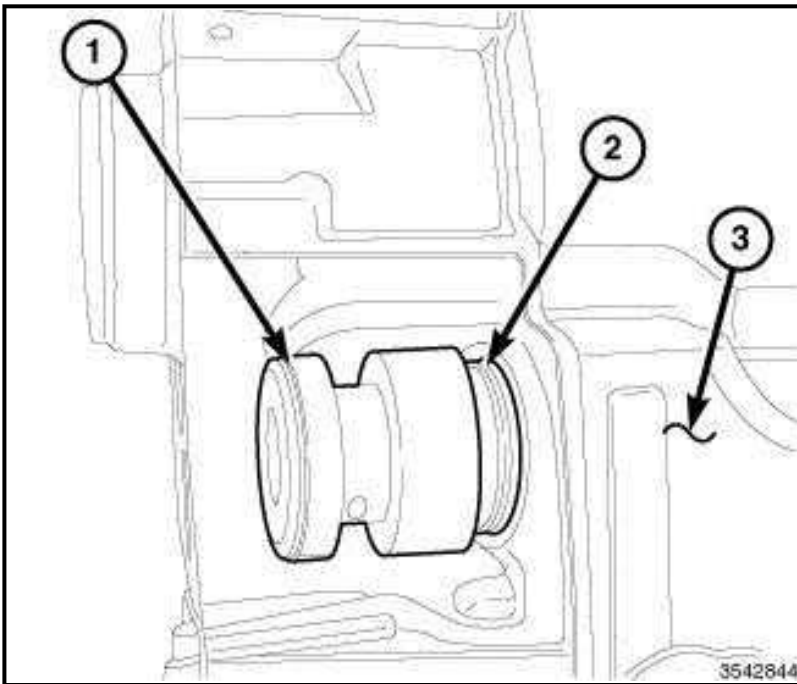
4. Install the front alignment pin (1).



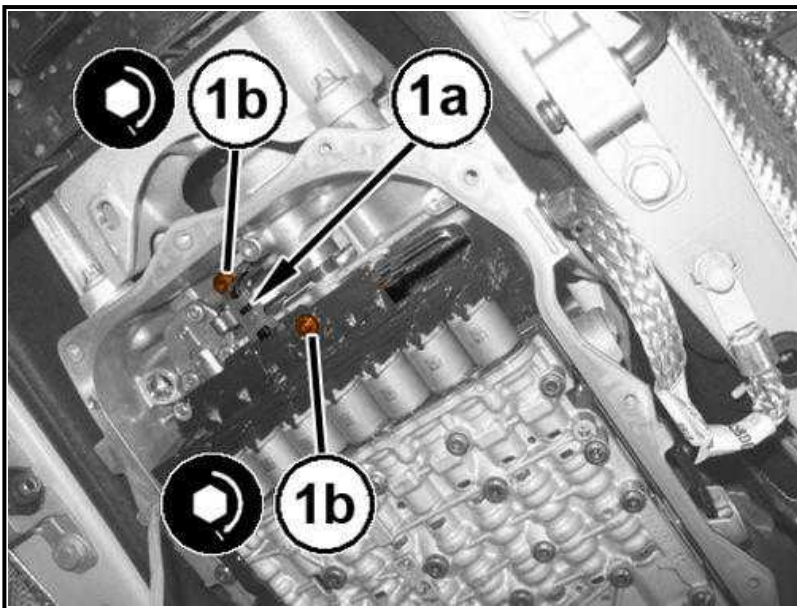
5. When installing the valve body assembly, press the park lever (a) to align (b) in the park control solenoid valve (c).
6. Use an appropriate tool on one of the alignment pins to assist in holding the valve body in position while installing the remaining fasteners.



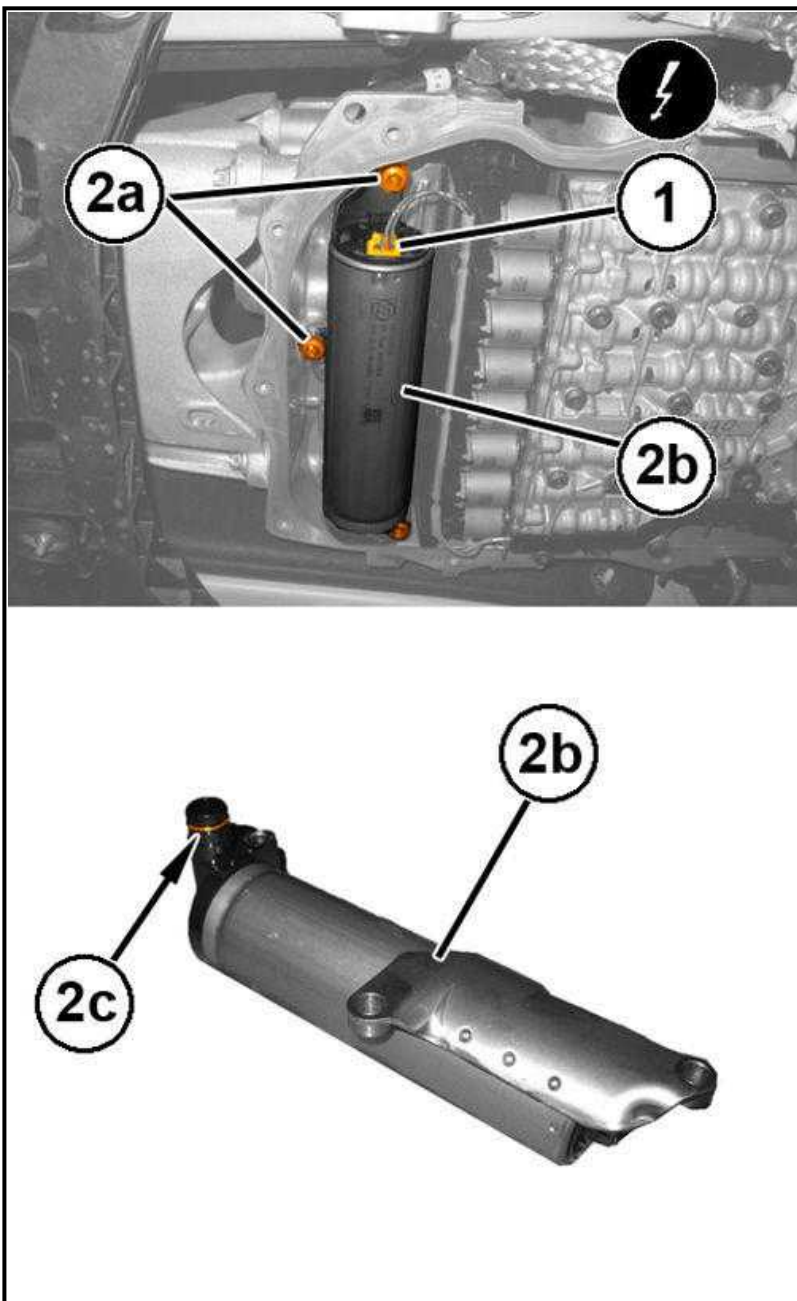
7. Install the valve body assembly retaining bolts not including 16-18 and hand tighten.
8. Tighten the valve body fasteners 1-15 in the sequence shown to proper. Refer to **TORQUE SPECIFICATIONS** .
9. Remove the pins and install the remaining bolts.



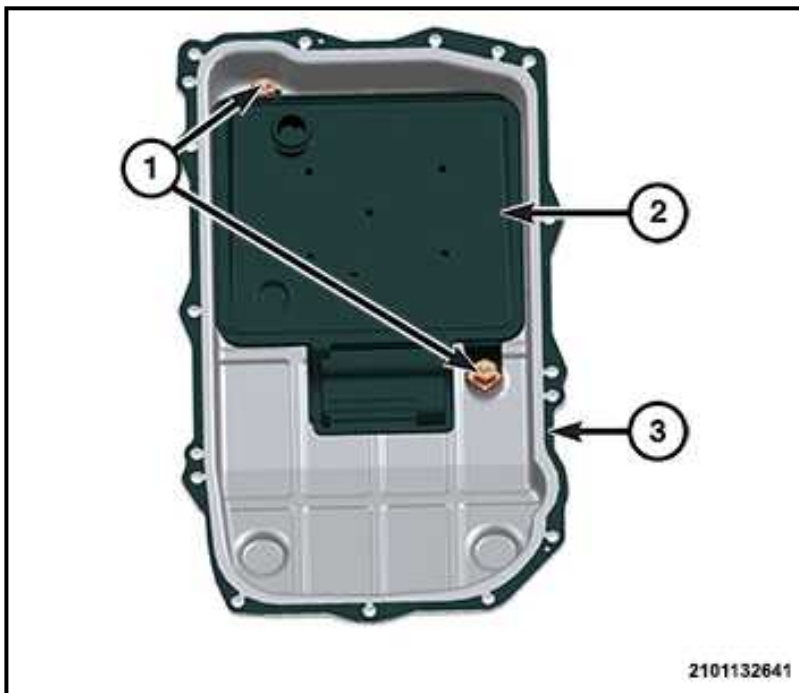
10. Using (special tool #10377, Remover/Installer, Guide Sleeve) (1) carefully install the electrical harness insulator (2) to the transmission case (3).
11. Lock the electrical connector lock (2) to the internal harness end.



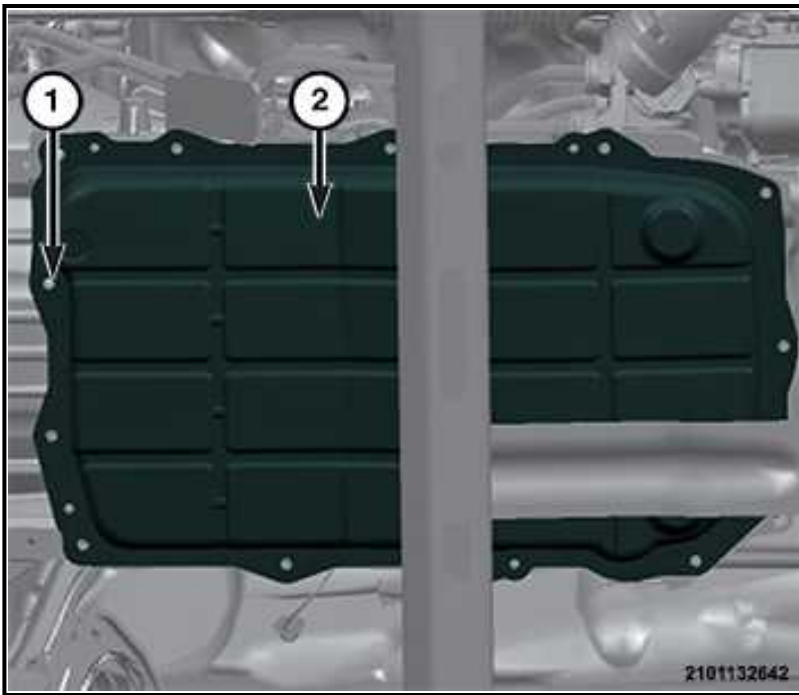
12. Install the OSS (1a) in the case install the OSS bolt (1b) and tighten to the proper. Refer to **TORQUE SPECIFICATIONS** .



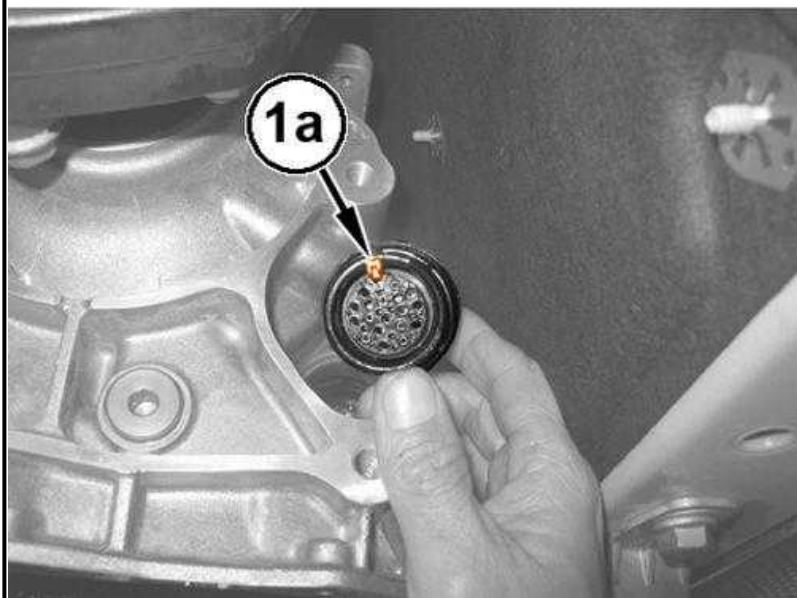
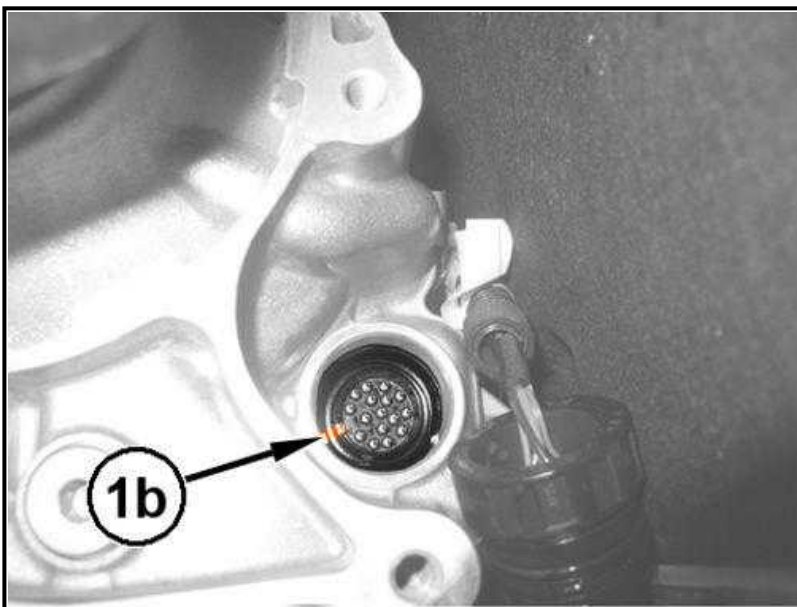
13. If equipped, install the HIS accumulator (2b).
14. Tighten the HIS accumulator bolts (2a) to the proper. Refer to [**TORQUE SPECIFICATIONS**](#) .
15. Connect the HIS wire harness connector (1).



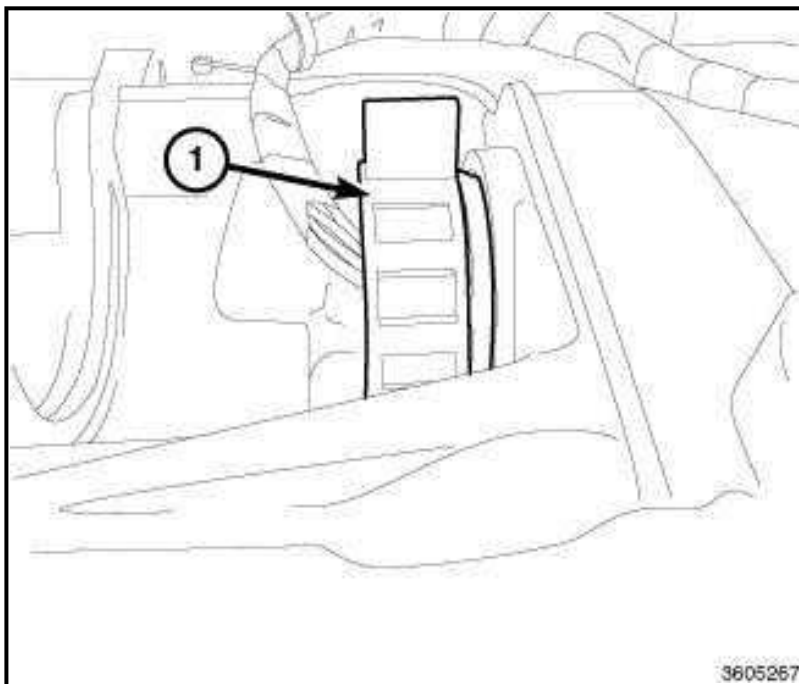
16. Install the transmission fluid filter (2), the transmission fluid filter nuts (1) and gasket (3).



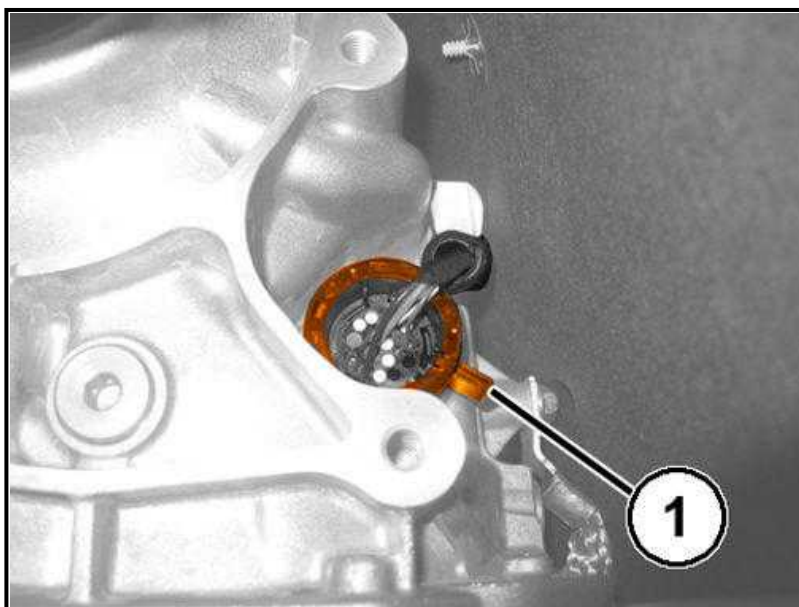
17. Install the transmission fluid pan bolts (1) and tighten to the proper using the sequence given. Refer to [TORQUE SPECIFICATIONS](#) .



18. Install the transmission wire harness connector (1a) back in the transmission case in the correct position (1b).



19. Connect the plug connector (1).



20. Turn the harness plug locking mechanism (1) clockwise and lock in place.

21. Connect the negative battery cable(s). Refer to [CABLES, BATTERY](#) .

22. If the valve body is replaced, program the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#) .

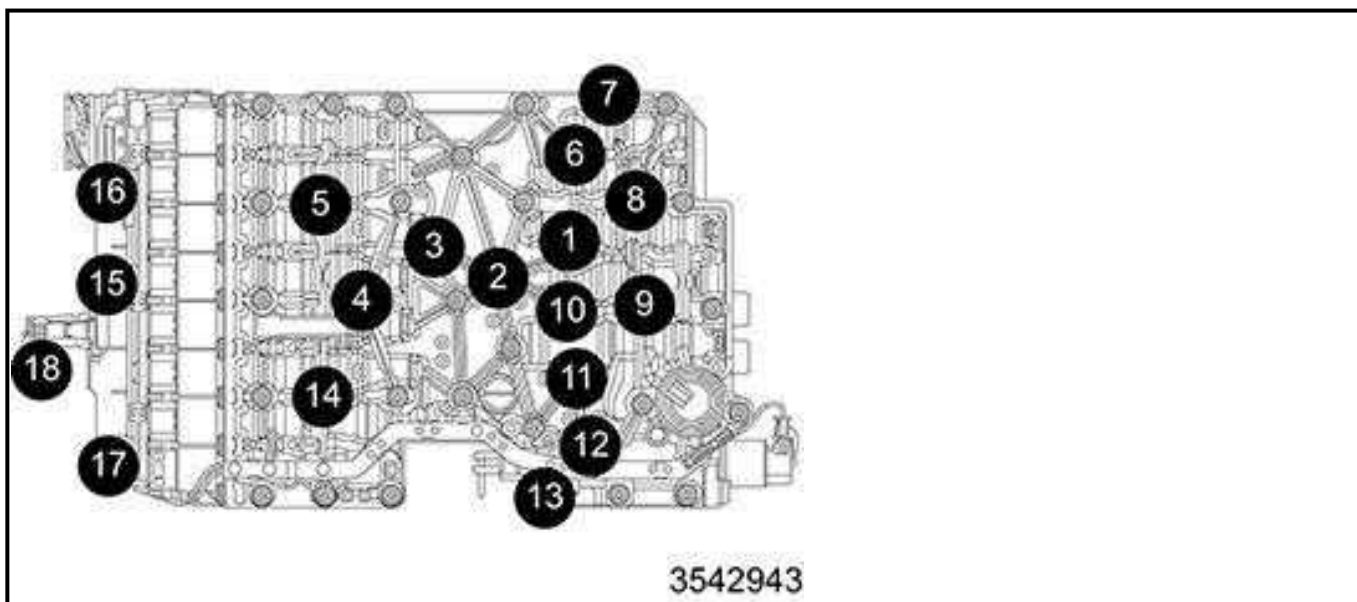
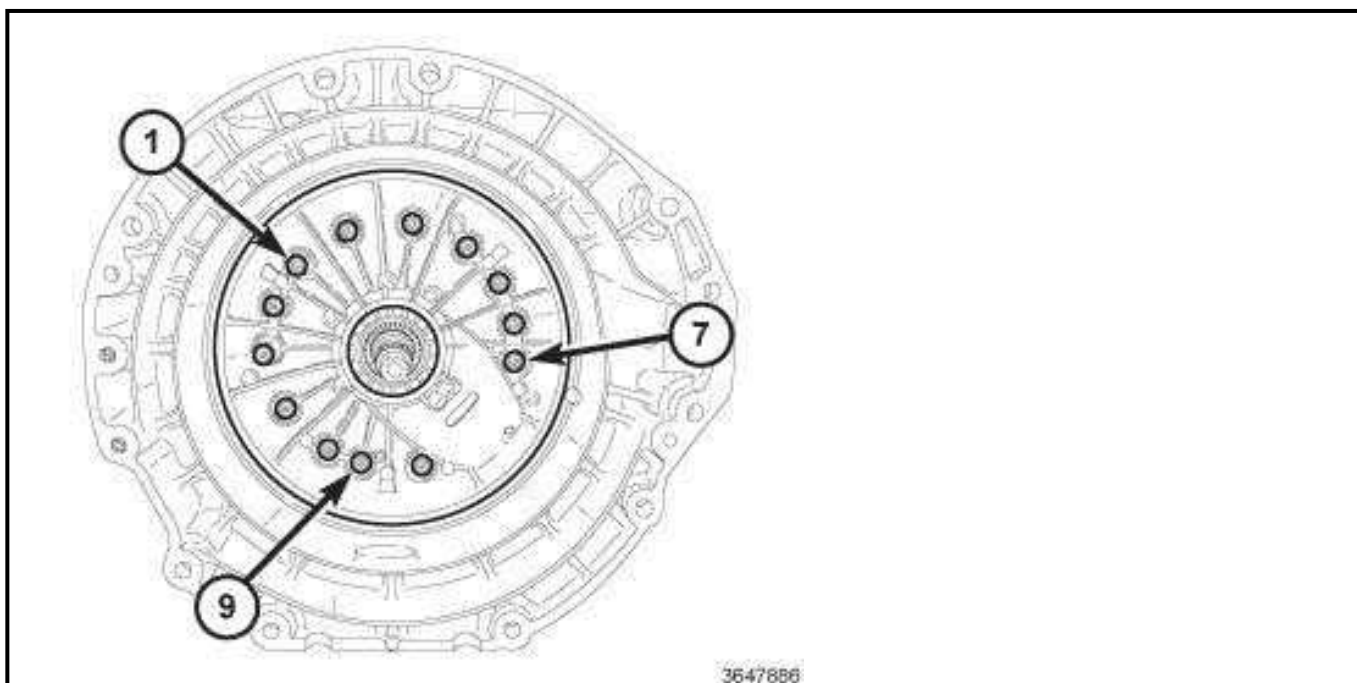
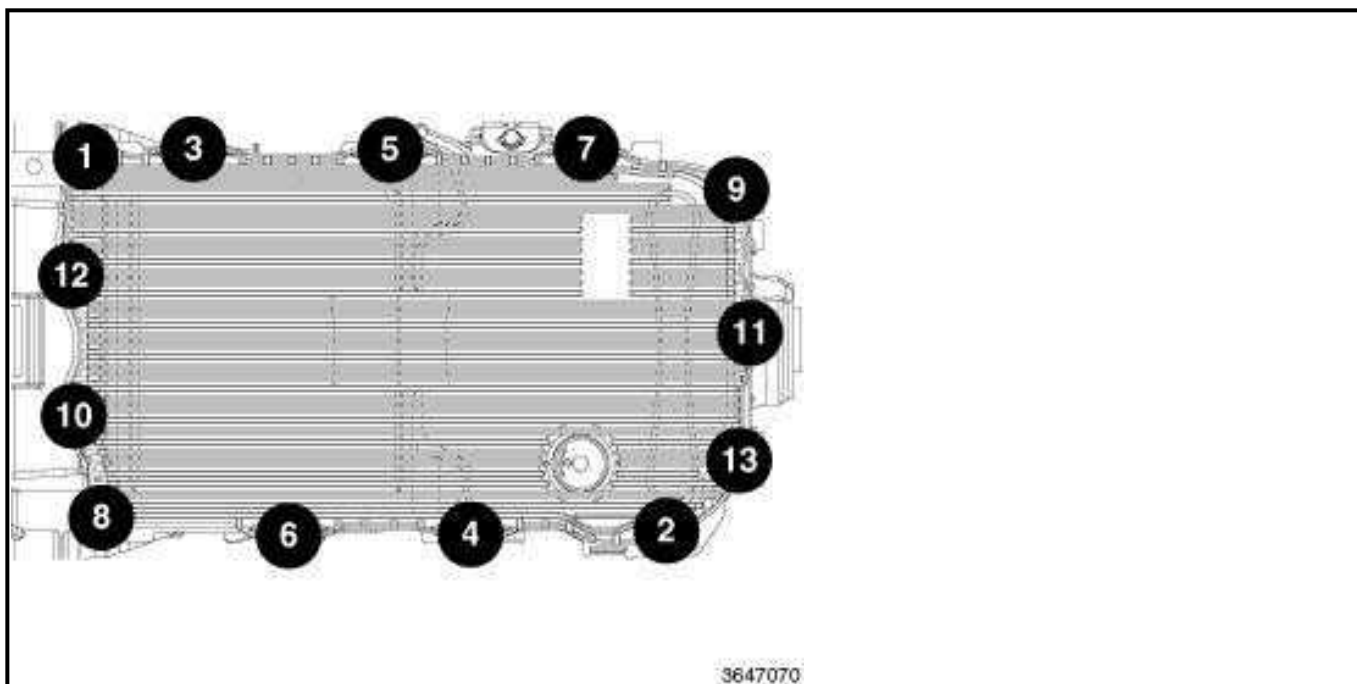
23. Perform the TRANSMISSION FILL AFTER SERVICE procedure. Refer to [TRANSMISSION FILL AFTER SERVICE](#) .

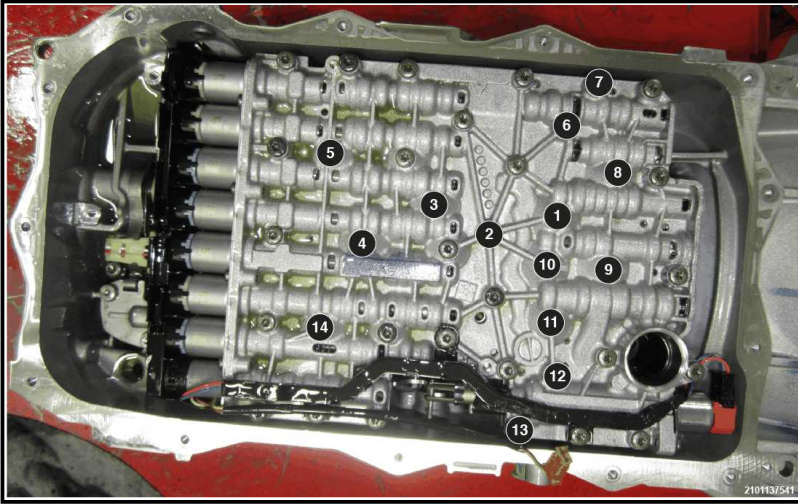
24. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

8HP50 TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Hydraulic Impulse Solenoid Bolts	8 N.m (71 In. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Lock Solenoid Screw	6 N.m (53 In. Lbs.)	-

DESCRIPTION	SPECIFICATION	COMMENTS
Park Pawl Lock Rod Guide Plate Bolt	13 N.m (10 Ft. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	11 N.m (8 Ft. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Filter to Transmission Oil Pan	6 N.m (53 In. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	Torque Procedure: 1. Install bolts except for the spots where the locating pins are installed and hand tighten 2. Remove the pins and install the remaining bolts 3. Tighten bolts to 8 N.m (71 In. Lbs.)	Tightening Sequence





2021 AUTOMATIC TRANSMISSION

8Hp75 Automatic Transmission - Diagnostic Code Index - Gladiator

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>P0219-00</u>	ENGINE OVERSPEED CONDITION
<u>P0562-00</u>	SYSTEM VOLTAGE LOW
<u>P0563-00</u>	SYSTEM VOLTAGE HIGH
<u>P0601-00</u>	INTERNAL CONTROL MODULE MEMORY CHECKSUM ERROR
<u>P0607-00</u>	ECU INTERNAL PERFORMANCE
<u>P0613-00</u>	INTERNAL TRANSMISSION PROCESSOR
<u>P061B-00</u>	INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE
<u>P062F-00</u>	INTERNAL CONTROL MODULE EEPROM ERROR
<u>P0634</u>	PCM/ECM/TCM INTERNAL TEMPERATURE TOO HIGH
<u>P0642-00</u>	SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW
<u>P0643-00</u>	SENSOR REFERENCE VOLTAGE 1 CIRCUIT HIGH
<u>P0667-00</u>	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 PERFORMANCE
<u>P0668-00</u>	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT LOW
<u>P0669-00</u>	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT HIGH
<u>P06AC-00</u>	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 PERFORMANCE
<u>P06AD-00</u>	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT LOW
<u>P06AE-00</u>	PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT HIGH
<u>P0701-00</u>	TRANSMISSION CONTROL SYSTEM RANGE/PERFORMANCE
<u>P0712-00</u>	TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT LOW
<u>P0713-00</u>	TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT HIGH
<u>P0714-00</u>	TRANSMISSION FLUID TEMPERATURE SENSOR A CIRCUIT INTERMITTENT
<u>P0716-00</u>	INPUT SHAFT SPEED SENSOR 1 PERFORMANCE
<u>P0721-00</u>	OUTPUT SHAFT SPEED SENSOR CIRCUIT PERFORMANCE
<u>P0729-00</u>	GEAR 6 SHIFT INCORRECT RATIO
<u>P0731-00</u>	GEAR 1 SHIFT INCORRECT RATIO
<u>P0732-00</u>	GEAR 2 SHIFT INCORRECT RATIO
<u>P0733-00</u>	GEAR 3 SHIFT INCORRECT RATIO
<u>P0734-00</u>	GEAR 4 SHIFT INCORRECT RATIO
<u>P0735-00</u>	GEAR 5 SHIFT INCORRECT RATIO
<u>P0746-00</u>	PRESSURE CONTROL SOLENOID "A" PERFORMANCE
<u>P0750-00</u>	SHIFT SOLENOID 1 CONTROL CIRCUIT - OPEN
<u>P0755-00</u>	SHIFT SOLENOID 2 CONTROL CIRCUIT - OPEN
<u>P076F-00</u>	GEAR 7 SHIFT INCORRECT RATIO
<u>P0776-00</u>	PRESSURE CONTROL SOLENOID "B" PERFORMANCE/STUCK OFF
<u>P077C-00</u>	OUTPUT SHAFT SPEED SENSOR CIRCUIT LOW
<u>P077D-00</u>	OUTPUT SHAFT SPEED SENSOR CIRCUIT HIGH
<u>P077E-00</u>	TRANSMISSION FLUID TEMPERATURE MULTIPLE SENSOR CORRELATION
<u>P07B3-00</u>	TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT LOW
<u>P07B4-00</u>	TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT HIGH
<u>P07B9-00</u>	TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT LOW

DTC	Description
<u>P07BA-00</u>	TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT HIGH
<u>P07BF-00</u>	INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT LOW
<u>P07C0-00</u>	INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT HIGH
<u>P07D9-00</u>	GEAR 8 SHIFT INCORRECT RATIO
<u>P07E4-00</u>	UNABLE TO ENGAGE PARK
<u>P0850-00</u>	PARK-NEUTRAL SWITCH PERFORMANCE
<u>P093A-00</u>	HYDRAULIC ACCUMULATOR SOLENOID OPEN
<u>P093B-00</u>	HYDRAULIC ACCUMULATOR SOLENOID SHORT TO GROUND
<u>P093C-00</u>	HYDRAULIC ACCUMULATOR SOLENOID SHORT TO BATTERY
<u>P0960-00</u>	PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT OPEN
<u>P0962-00</u>	PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT LOW
<u>P0963-00</u>	PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT HIGH
<u>P0972-00</u>	SHIFT SOLENOID 1 CONTROL CIRCUIT PERFORMANCE
<u>P0973-00</u>	SHIFT SOLENOID 1 CONTROL CIRCUIT LOW
<u>P0974-00</u>	SHIFT SOLENOID 1 CONTROL CIRCUIT HIGH
<u>P0975-00</u>	SHIFT SOLENOID B CONTROL CIRCUIT PERFORMANCE
<u>P0976-00</u>	SHIFT SOLENOID 2 CONTROL CIRCUIT LOW
<u>P0977-00</u>	SHIFT SOLENOID 2 CONTROL CIRCUIT HIGH
<u>P0978-00</u>	SHIFT SOLENOID 3 CONTROL CIRCUIT RANGE-PERFORMANCE
<u>P0979-00</u>	SHIFT SOLENOID 3 CONTROL CIRCUIT LOW
<u>P0980-00</u>	SHIFT SOLENOID 3 CONTROL CIRCUIT HIGH
<u>P0981-00</u>	SHIFT SOLENOID 4 CONTROL CIRCUIT RANGE-PERFORMANCE
<u>P0982-00</u>	SHIFT SOLENOID 4 CONTROL CIRCUIT LOW
<u>P0983-00</u>	SHIFT SOLENOID 4 CONTROL CIRCUIT HIGH
<u>P0984-00</u>	SHIFT SOLENOID 5 CONTROL CIRCUIT RANGE-PERFORMANCE
<u>P0985-00</u>	SHIFT SOLENOID 5 CONTROL CIRCUIT LOW
<u>P0986-00</u>	SHIFT SOLENOID 5 CONTROL CIRCUIT HIGH
<u>P1614-00</u>	ECU RESET-RECOVERY OCCURRED
<u>P1634-00</u>	TCM INTERNAL - INTERNAL WATCHDOG PERFORMANCE
<u>P167A-00</u>	CALIBRATION MISMATCH
<u>P1731-00</u>	INCORRECT GEAR ENGAGED
<u>P1778-00</u>	INPUT-TURBINE SHAFT SPEED SENSOR A OUT OF RANGE HIGH
<u>P177E-00</u>	OUTPUT SHAFT SPEED SENSOR OUT OF RANGE HIGH
<u>P1B13-00</u>	PARK BY WIRE UNINTENDED OUT OF PARK POSITION
<u>P1B14-00</u>	PARK BY WIRE UNINTENDED PARK POSITION
<u>P1D25-00</u>	SHIFT CONTROL RATIONALITY
<u>P1D78-00</u>	PARK SOLENOID CIRCUIT LOW
<u>P1D79-00</u>	PARK SOLENOID CIRCUIT HIGH
<u>P1D8A-00</u>	PARK PAWL SOLENOID CIRCUIT LOW
<u>P1D8B-00</u>	PARK PAWL SOLENOID CIRCUIT HIGH
<u>P1D8C-00</u>	PARK PAWL SOLENOID CIRCUIT OPEN
<u>P1D8F-00</u>	INCORRECT GEAR RATIO CLUTCH 1 DEFECTIVE
<u>P1D90-00</u>	INCORRECT GEAR RATIO - CLUTCH 2 DEFECTIVE
<u>P1D91-00</u>	INCORRECT GEAR RATIO - CLUTCH 3 DEFECTIVE
<u>P1D92-00</u>	INCORRECT GEAR RATIO - CLUTCH 4 DEFECTIVE
<u>P1D93-00</u>	INCORRECT GEAR RATIO - CLUTCH 5 DEFECTIVE
<u>P1D94-00</u>	TCM INTERNAL SBW CALIBRATION MISMATCH
<u>P1D95-00</u>	TCM CLUTCH FAILURE UNDETERMINED

DTC	Description
<u>P1D96-00</u>	INCORRECT GEAR RATIO CLUTCH A OR B DEFECTIVE
<u>P1D97-00</u>	INCORRECT GEAR RATIO CLUTCH A OR D DEFECTIVE
<u>P1D98-00</u>	INCORRECT GEAR RATIO CLUTCH B OR D DEFECTIVE
<u>P1D99-00</u>	INCORRECT GEAR RATIO CLUTCH B OR E DEFECTIVE
<u>P1D9A-00</u>	INCORRECT GEAR RATIO CLUTCH C OR D DEFECTIVE
<u>P1D9B-00</u>	INCORRECT GEAR RATIO CLUTCH A OR E DEFECTIVE
<u>P1D9C-00</u>	INCORRECT GEAR RATIO CLUTCH A OR C DEFECTIVE
<u>P1D9D-00</u>	INCORRECT GEAR RATIO CLUTCH B OR C DEFECTIVE
<u>P1D9E-00</u>	INCORRECT GEAR RATIO CLUTCH C OR E DEFECTIVE
<u>P1D9F-00</u>	INCORRECT GEAR RATIO CLUTCH D OR E DEFECTIVE
<u>P1DA0-00</u>	INCORRECT GEAR RATIO CLUTCH A B OR C DEFECTIVE
<u>P1DA1-00</u>	INCORRECT GEAR RATIO CLUTCH A B OR E DEFECTIVE
<u>P1DA2-00</u>	INCORRECT GEAR RATIO CLUTCH B C OR E DEFECTIVE
<u>P1DA3-00</u>	INCORRECT GEAR RATIO CLUTCH B D OR E DEFECTIVE
<u>P1DA4-00</u>	INCORRECT GEAR RATIO CLUTCH B C OR D DEFECTIVE
<u>P1DA5-00</u>	INCORRECT GEAR RATIO CLUTCH C D OR E DEFECTIVE
<u>P1DA6-00</u>	INCORRECT GEAR RATIO CLUTCH A C OR D DEFECTIVE
<u>P1DA7-00</u>	INCORRECT GEAR RATIO CLUTCH A D OR E DEFECTIVE
<u>P1DA8-00</u>	INCORRECT GEAR RATIO CLUTCH A B OR D DEFECTIVE
<u>P1DA9-00</u>	TRANSMISSION FLUID TEMPERATURE RATIONALITY
<u>P1DAA-00</u>	TRANS TEMP UNDETERMINED
<u>P1DAB-00</u>	VEHICLE SPEED UNDETERMINED
<u>P1DAC-00</u>	ENGINE SPEED UNDETERMINED
<u>P1DAD-00</u>	INPUT SHAFT-OUTPUT SHAFT DIRECTION CORRELATION
<u>P1DAF-00</u>	INCOMPATIBLE LIMP IN ACTION REQUESTED
<u>P1DB1-00</u>	TCM SYSTEM VOLTAGE EXCESSIVELY LOW
<u>P1DB2-00</u>	ACTUATOR SUPPLY VOLTAGE A CIRCUIT
<u>P1DB3-00</u>	TCM ECU RESET-RECOVERY OCCURRED
<u>P1DB6-00</u>	VEHICLE SPEED SIGNAL PERFORMANCE
<u>P1DB7-00</u>	TORQUE CONVERTER CLUTCH PERFORMANCE
<u>P1DB8-00</u>	UNINTENDED TORQUE APPLIED WHILE IN NEUTRAL
<u>P1DB9-00</u>	TCM ECU RESET EXTENDED LOW VOLTAGE
<u>P1DC8-00</u>	CLUTCH TEMP THRESHOLD ACHIEVED AUTOSTICK INHIBIT
<u>P1DCD-00</u>	TCM MONITORING PROCESSOR PERFORMANCE MULTIPLE CLUTCHES LOCKED UP
<u>P1DCE-00</u>	TCM MONITORING PROCESSOR PERFORMANCE INCORRECT DRIVING DIRECTION
<u>P1DD0-00</u>	TCM MONITORING PROCESSOR PERFORMANCE UNALLOWED PARK ENGAGEMENT
<u>P1DD2-00</u>	TORQUE REQUEST SIGNAL FROM TCM DENIED
<u>P1DDD-00</u>	TCM MONITORING PERFORMANCE UNABLE TO DISENGAGE DRIVE OR REVERSE
<u>P1DDE-00</u>	IGNITION RUN-START INPUT 1-2 CORRELATION
<u>P1DF3-00</u>	ECU NOT INITIALIZED
<u>P215C-00</u>	OUTPUT SHAFT SPEED WHEEL SPEED CORRELATION
<u>P2761-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT-OPEN
<u>P2762-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT RANGE-PERFORMANCE

DTC	Description
<u>P2763-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT HIGH
<u>P2764-00</u>	TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT LOW
<u>U0001-00</u>	CAN C BUS
<u>U0074-00</u>	DEDICATED POWERTRAIN (DPT) CAN BUS OFF
<u>U0100-00</u>	LOST COMMUNICATION WITH ECM/PCM
<u>U0102-00</u>	LOST COMMUNICATION WITH TRANSFER CASE CONTROL MODULE / AWD
<u>U0103-00</u>	LOST COMMUNICATION WITH ELECTRIC GEAR SHIFT MODULE
<u>U0104-00</u>	LOST COMMUNICATION WITH CRUISE CONTROL MODULE
<u>U0120-00</u>	LOST COMMUNICATION WITH STARTER/GENERATOR CONTROL MODULE
<u>U0121-00</u>	LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE
<u>U0140-00</u>	LOST COMMUNICATION WITH BODY CONTROL MODULE
<u>U0155-00</u>	LOST COMMUNICATION WITH CLUSTER-CCN
<u>U0212-00</u>	LOST COMMUNICATION WITH STEERING COLUMN CONTROL MODULE
<u>U0401-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM
<u>U0403-00</u>	IMPLAUSIBLE DATA RECEIVED FROM TCASE
<u>U0404-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ESM
<u>U0405-00</u>	INVALID DATA RECEIVED FROM CRUISE CONTROL MODULE
<u>U0415-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ABS
<u>U0422-00</u>	IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE
<u>U0423-00</u>	IMPLAUSIBLE DATA RECEIVED FROM CLUSTER-CCN
<u>U0429-00</u>	IMPLAUSIBLE DATA RECEIVED FROM SCM
<u>U0469-00</u>	INVALID DATA RECIEVED FROM STARTER/GENERATOR CONTROL MODULE
<u>U11E3-00</u>	TCM LOST COMMUNICATION WITH ESM ON DPT CAN
<u>U11E4-00</u>	CAN COMMUNICATION MESSAGES MISSING
<u>U1267-00</u>	NO VALID DATA FROM ESM ON CAN-C OR CAN-DPT
<u>U1400-00</u>	IMPLAUSIBLE TPS SIGNAL RECEIVED
<u>U1401-00</u>	IMPLAUSIBLE ENGINE SPEED SIGNAL RECEIVED
<u>U1412-00</u>	IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED
<u>U1424-00</u>	IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED
<u>U1428-00</u>	IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED
<u>U1461-00</u>	IMPLAUSIBLE DATA RECEIVED FROM ESM ON DPT
<u>U1465-00</u>	IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED
<u>U1466-00</u>	IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED ON DPT CAN
<u>U1477-00</u>	IMPLAUSIBLE PADDLE SHIFTER DATA RECEIVED

2021 AUTOMATIC TRANSMISSION

8Hp75 Automatic Transmission - Dtcs P1D91-00 To U1477-00 - Gladiator

DTC TROUBLESHOOTING

P1D91-00-INCORRECT GEAR RATIO - CLUTCH 3 DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.

- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to the appropriate service information .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [**VALVE BODY, REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1D92-00-INCORRECT GEAR RATIO - CLUTCH 4 DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to the appropriate service information .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE:

With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D93-00-INCORRECT GEAR RATIO - CLUTCH 5 DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.

- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1D94-00-TCM INTERNAL SBW CALIBRATION MISMATCH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The purpose of this diagnostic is to detect if the shift by wire stored values in RAM have been corrupted.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- A failure is detected if the calibration data stored in two different locations of the Random Access Memory (RAM) has changed at only one location.
- A failure is detected if the initially determined transmission range (P, R, N or D) after Transmission Control Module (TCM) initialization which is determined with two different methods has unequal results.
- A failure is detected if the calculated transmission range stored in the buffer does not match the current transmission position.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
GENERIC CALIBRATIONS PROGRAMMED IN TRANSMISSION CONTROL MODULE (TCM) TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information.

DIAGNOSTIC TEST

PERFORM TRANSMISSION CONTROL MODULE (TCM) PROGRAMMING PROCEDURE

1. With the scan tool, attempt to program the TCM with the latest calibrations in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#).

Were you able to program the TCM successfully?

Yes

- Test complete.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D95-00-TCM CLUTCH FAILURE UNDETERMINED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- The TCM detects a ratio failure for a single clutch element and then a further symptom is detected in a gear that the clutch element is not involved.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Any driver requests that are not yet honored will be cleared.
- The Transmission will shift into Sixth Gear via Neutral.
- Maintain PARK position if the DTC is detected while in PARK.

- REVERSE gear will not be available.
- DRIVE will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Replace the Transmission in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [**VALVE BODY, REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1D96-00-INCORRECT GEAR RATIO CLUTCH A OR B DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is above a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a

failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCs AND ENVIRONMENTAL DATA - ERASE DTCs AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D97-00-INCORRECT GEAR RATIO CLUTCH A OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is above a calibrated value.
- No clutch slip control functions commanded.

- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
TRANSMISSION - INTERNAL COMPONENTS

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Replace the Valve Body in accordance with the Service information. Refer to **VALVE BODY, REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1D99-00-INCORRECT GEAR RATIO CLUTCH B OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not

involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.

3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D9A-00-INCORRECT GEAR RATIO CLUTCH C OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.

- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2.**

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1D9B-00-INCORRECT GEAR RATIO CLUTCH A OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D9C-00-INCORRECT GEAR RATIO CLUTCH A OR C DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D9D-00-INCORRECT GEAR RATIO CLUTCH B OR C DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.

- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2.**

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D9E-00-INCORRECT GEAR RATIO CLUTCH C OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear

ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or Reverse position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. (Refer to the appropriate service information).

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1D9F-00-INCORRECT GEAR RATIO CLUTCH D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.

- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. (Refer to the appropriate service information).

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA0-00-INCORRECT GEAR RATIO CLUTCH A B OR C DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Second Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2**.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be

needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA1-00-INCORRECT GEAR RATIO CLUTCH A B OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to **VALVE BODY, REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DA2-00-INCORRECT GEAR RATIO CLUTCH B C OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).

- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Replace the Valve Body in accordance with the Service information. Refer to **VALVE BODY, REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DA3-00-INCORRECT GEAR RATIO CLUTCH B D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA4-00-INCORRECT GEAR RATIO CLUTCH B C OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.

- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1DA5-00-INCORRECT GEAR RATIO CLUTCH C D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Seventh Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [**VALVE BODY, REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1DA6-00-INCORRECT GEAR RATIO CLUTCH A C OR D DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a

failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to **2**.

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA7-00-INCORRECT GEAR RATIO CLUTCH A D OR E DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.

- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Seventh Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to **CHECK FLUID LEVEL** .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into First Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DA9-00-TRANSMISSION FLUID TEMPERATURE RATIONALITY

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: **If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.**

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No failures detected in the transmission oil temperature monitoring.

SET CONDITION

- Transmission oil temperature delta between 2 measurements exceeds a calibrated threshold for a calibrated amount of time.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

P1DAA-00-TRANS TEMP UNDETERMINED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- A malfunction is detected by any combination of two transmission temperature sensors indicating a failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID TEMPERATURE SENSOR DTC SET

Possible Causes

TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P1DAB-00-VEHICLE SPEED UNDETERMINED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of this diagnostic is to detect multiple rationality failures of the speed signals. A failure is detected if more than one of the Input Speed Sensor, Output Speed Sensor, or Wheel Speed Sensor signals is not rational.

WHEN MONITORED

When Monitored:

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Engine speed sensor signal is valid.

- Engine speed above 430 RPM.
- Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - Rationality failure is detected for the Input Speed Sensor, Output Speed Sensor and Wheel Speed Sensor.
- Condition Two:
 - With the engine running there is an electrical sensor failure of more than one internal sensor signal used for the rationality monitoring.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- Any driver requests that are not yet honored will be cleared.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
WHEEL SPEED DEVIATION
RELATED VEHICLE SPEED DTC
TRANSFER CASE SHIFT CABLE IMPROPERLY ADJUSTED
OUTPUT SPEED SENSOR IMPROPERLY INSTALLED
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: Diagnose communication DTCs before proceeding. If no communication DTCs are set, diagnose Antilock Brake System (ABS) DTCs before proceeding.

NOTE: This DTC can set due to differences in tire diameter. Check tire diameters to make sure the tires are the same size.

NOTE: This DTC can set due to wheel spin.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. VISUAL INSPECTION

NOTE: This DTC can set due to differences in tire diameter.

NOTE: This DTC may set on a hard acceleration on loose gravel or during other off road driving conditions.

1. Check all of the tires for the correct pressure.
2. Check tire wear on all the tires.
3. Check that all tire sizes are the same.
4. Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes

- Repair as necessary. If the DTC set during a front or rear wheel spin condition, no repair is necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To [3](#)

3. VEHICLE SPEED RELATED DTCS

1. Using the DTC data recorded earlier, check for vehicle speed related DTCs in other modules.
2. Perform any Service Bulletins that may apply.

Were any vehicle speed related DTCs in other modules present?

Yes

- Perform the appropriate diagnostic procedure in accordance with the Service Information.

No

- Go To [4](#)

4. CHECK TRANSFER CASE SHIFT CABLE ADJUSTMENT

1. Check the Transfer Case Shift Cable adjustment in accordance with the Service Information. Refer to [CABLE, SHIFT, REMOVAL AND INSTALLATION](#) [CABLE, SHIFT, REMOVAL AND INSTALLATION](#) .

Is the Transfer Case Shift Cable properly adjusted?

Yes

- Go To [5](#)

No

- Adjust the Transfer Case Shifter Cable in accordance with the Service Information. Refer to [CABLE, SHIFT, REMOVAL AND INSTALLATION](#) [CABLE, SHIFT, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

5. INSPECT THE OUTPUT SPEED SENSOR

1. Remove the Transmission Oil Pan in accordance with the Service Information.

NOTE: If excessive debris is found in the Transmission Oil Pan, correct the cause of the debris before proceeding with this Diagnostic Test.

2. If equipped, remove the Hydraulic Impulse Solenoid (HIS).
3. Inspect the Output Speed Sensor for proper installation.

Is the Output Speed Sensor properly installed?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [6](#)

6. CHECK OUTPUT SPEED SENSOR FOR DAMAGE

1. Carefully remove the Output Speed Sensor from the transmission case.
2. Inspect the Output Speed Sensor for any visible damage.

Is there any damage to the Output Speed Sensor?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Properly install the Output Speed Sensor in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DAC-00-ENGINE SPEED UNDETERMINED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

This diagnostic monitors for a double failure of the Engine Speed signal received via Controller Area Network (CAN) and an electrical or rationality failure of the Input Speed Sensor. If the Transmission Control Module (TCM) detects a failure with both tests this Diagnostic Trouble Code (DTC) will set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No sensor power supply failures detected.

SET CONDITION

- Electrical failure or rationality failure at the Input Speed Signal.
- Controller Area Network (CAN) failure at engine speed signal.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
POWERTRAIN CONTROL MODULE (PCM) DTCS ARE SET
BUSSED SPEED SIGNAL
TRANSMISSION SPEED SENSOR TERMINAL CONTAMINATION
INTERNAL TRANSMISSION FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCS.

Are any engine speed related PCM DTCS set?

Yes

- Repair the PCM DTCS. Refer to the appropriate service information .

No

- Go To [3](#)

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DAD-00-INPUT SHAFT-OUTPUT SHAFT DIRECTION CORRELATION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of the diagnostic is to detect an unwanted driving direction. A rationality check is performed between the measured directions of Input Speed Sensor and Output Speed Sensor signals and the calculated driving direction. The calculated driving direction is based on the commanded currents of the pressure regulators.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Input Speed Sensor or Output Speed Sensor Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal and Output Speed Sensor signal above a calibrated value.
- Shift not in progress.
- No clutch slip control function active.

SET CONDITION

- The failure is detected if the measured directions of input speed and output speed signal do not correspond to the calculated driving direction for a calibrated amount of time.
 - When Calculated Driving Direction is Forward:
 - The measured directions of input speed and output speed signal do not correspond to the calculated driving direction for a calibrated amount of time.
 - When Calculated Driving Direction is Reverse:
 - A failure is detected if the input speed and output speed direction are the same.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Maintain Park position if the DTC detected while in Park.
- Drive will be disabled.
- Reverse will be disabled.
- Torque Converter Clutch (TCC) Low Side Pressure Regulator Switch will be commanded off.
- Clutch adaptation functions will be disabled.
- Any driver requests that are not yet honored will be cleared.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION - INTERNAL

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. With the scan tool, read Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs) and record on the repair order.

2. Record the Event Data and Environmental Data.
3. With the scan tool, erase DTCs.
4. Raise the vehicle on the hoist.
5. Start the Engine.
6. With the scan tool, monitor the Output Speed Sensor rpm.
7. Firmly apply the brakes and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

8. Release the brakes and raise the engine speed to allow the Transmission to upshift to the 1-2 and 2-3 shift schedule.

Did the Output Speed Sensor display an rpm below 1, 000?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of a internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DAF-00-INCOMPATIBLE LIMP IN ACTION REQUESTED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to determine unique failure situations when multiple failures requiring conflicting limp-in actions occur. If conflicting Limp-in actions are commanded, the mechanical Limp-home

mode is activated as the final Limp-in action.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- Multiple failures requiring conflicting limp-in actions occur.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
OTHER TRANSMISSION CONTROL MODULE (TCM) DIAGNOSTIC TROUBLE CODES (DTCS) ARE SET
POWERTRAIN CONTROL MODULE (PCM) DTCS ARE SET

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR OTHER TCM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any other TCM DTCs set?

Yes

- Repair other TCM DTCs. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [2](#)

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCs.

Are any PCM DTCs set?

Yes

- Repair PCM DTCs. Refer to the appropriate service information .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [4](#).

4. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DB1-00-TCM SYSTEM VOLTAGE EXCESSIVELY LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the system voltage level at the TCM supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low
- System Voltage High

If the TCM supply voltage is below a threshold that is lower than the System Voltage Excessively Low threshold, the TCM will not supply power to the solenoid valves and pressure regulators. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- High side switch is activated.
- When Shifter Position is in PARK or NEUTRAL:
 - Solenoid valves and regulators are powered.
 - Engine speed via Controller Area Network (CAN) or input speed signal is above a calibrated value for a calibrated amount of time.
 - Engine Start timer is elapsed.
- When Shifter Position is **not** in PARK or NEUTRAL:
 - Solenoid valves and regulators are powered.
 - Engine speed via CAN or input speed signal is above a calibrated value or a failure is detected in the engine speed monitoring.
- When Shifter Position is **not** in PARK:
 - TCM is powered.

SET CONDITION

- A failure is detected if one of the following occur:
 - The system voltage is less than a calibrated value for a calibrated amount of time.
 - Diagnostic switch is not powered due to undervoltage when **not** in PARK.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.

- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
OPEN FUSE LOW BATTERY VOLTAGE ENGINE CHARGING SYSTEM BATTERY VOLTAGE CIRCUIT HIGH RESISTANCE TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR ENGINE CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Engine Charging System DTCs set?

Yes

- Repair Charging System DTCs. Refer to the appropriate service information .

No

- Go To [2](#)

2. CHECK THE BODY CONTROL MODULE (BCM) FOR VEHICLE VOLTAGE RELATED DTCS

1. With the scan tool, read BCM DTCs.

Are any vehicle voltage related DTCs set?

Yes

- Repair vehicle voltage related DTCs. Refer to the appropriate service information .

No

- Go To [3](#)

3. CHECK TCM SYSTEM VOLTAGE

1. Start the Engine.
2. With the scan tool, under Transmission, check system voltage.

Is the Transmission system voltage above 9.0 volts?

Yes

- Go To [6](#)

No

- Go To [4](#)

4. CHECK THE (A190) 12 VOLT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.

2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

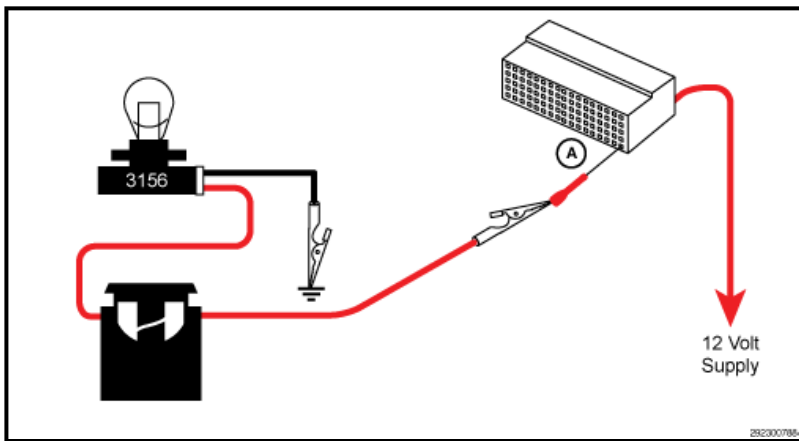
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#) .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#) .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [5](#)

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

5. CHECK THE (Z909) TCM GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the ground circuit.
2. Connect the positive lead of the load test tool to the positive side of the Battery.
3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).

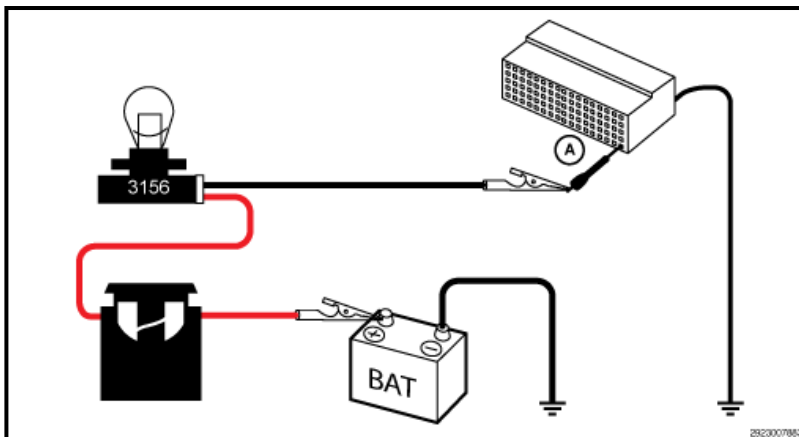
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE:

Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).

**NOTE:**

When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE:

Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Repair the ground circuit for an open or high resistance.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

6. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1DB2-00-ACTUATOR SUPPLY VOLTAGE A CIRCUIT

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The voltage supply circuit(s) for the solenoids and pressure regulators are monitored for open circuits, shorts to ground, and shorts to voltage. If a failure is detected, the Transmission Control Module (TCM) will deactivate the affected power supply circuit and set a corresponding Diagnostic Trouble Code (DTC) relevant to the fault that was detected.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Transmission Control Module (TCM) is in initialization.
- Output power supply is switched off or switched on, battery voltage is greater than or equal to a calibrated value and the time since the last switching of the power supply is greater than a calibrated value.

SET CONDITION

- The failure is detected if the activation of the output stage power supply has not succeeded during TCM initialization.
- The failure is detected if the power supply voltage is greater than a calibrated value after the power supply voltage is either switched on or switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.

- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P1DB3-00-TCM ECU RESET-RECOVERY OCCURRED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of this diagnostic is to determine the reason of a reset after the reset occurred. Some of these are initiated by the Transmission Control Module (TCM) software and others may be caused by an under voltage condition. If the TCM detects a condition for initiating a reset, the reason of the reset is stored in an area of Random Access Memory (RAM) that is not initialized during TCM startup. Upon TCM startup this information is read out to store an appropriate Diagnostic Trouble Code (DTC) indicating the reason for the reset.

This diagnostic detects an under voltage reset of the TCM during normal operation (no engine start present). Under voltage resets during engine start will not be stored within the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Reset monitoring is performed during initialization which occurs at power-up or after a reset.

SET CONDITION

- The following failures can cause resets of the high level software:
 - Monitoring of Shift-By-Wire safety functions indicates a failure.
 - Monitoring of Signal I/O safety functions indicates a failure.
 - Failure to store safety relevant fault in the error handler (Error Reaction Manager).
 - Failure to set safety relevant limp in action in the error handler (Error Reaction Manager).
 - Monitoring of Shift-Control safety functions indicates a failure (electrical current not plausible, inconsistency of actual gear or target gear, power flow implausible, power flow inconsistent to actual gear, implausible combination of valves/clutches).
- If no information about the cause of the reset is stored, it is understood to be an under voltage condition. In this case, the active state (operation mode) of the operating system when the reset occurred is stored during:
 - Initialization
 - Normal operation mode
 - Standby

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the second consecutive trip that the diagnostic fails.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. CHECK THE TRANSMISSION CONTROL MODULE (TCM) SOFTWARE

1. Check for any applicable Service Bulletins or software updates that are applicable.

Were any applicable software updates available?

Yes

- With the scan tool, Program the TCM with the latest calibrations in accordance with the Service Information. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [3](#)

3. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1DB6-00-VEHICLE SPEED SIGNAL PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect rationality failures of the wheel speed signal via Bus. This diagnostic checks if the wheel speed signal is within calculated tolerance bands.

The upper threshold of the first tolerance band is the calculated wheel speed plus a calibrated offset. The calculated wheel speed is based upon the input speed signal multiplied by the gear ratio factor. This factor corresponds to either the target gear or current gear depending on which gear provides the greater ratio.

The lower threshold of the first tolerance band is the calculated wheel speed, minus a calibrated offset. The calculated wheel speed is based upon the input speed signal multiplied by the gear ratio factor. This factor corresponds to either the target gear or current gear depending on which gear provides the lesser ratio.

The thresholds of the second tolerance bands are calculated using the same method described above. In place of the input speed signal, the output speed signal is used for the calculation.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Input or Output Speed Sensor supply voltage Diagnostic Trouble Codes (DTCs) set.
- No Speed Sensor signal DTCs set.
- No Engine Speed or Wheel Speed Controller Area Network (CAN) signal DTCs set.

SET CONDITION

- The failure is detected if the difference between the wheel speed received via CAN and the following signals are both greater than a calibrated value for a calibrated amount of time:
 - The calculated wheel speed from the output speed measured by the Transmission Control Module (TCM).
 - The calculated wheel speed from the input speed measured by the TCM.

POSSIBLE CAUSES

Possible Causes
TRANSFER CASE SHIFT CABLE IMPROPERLY ADJUSTED
ANTI LOCK BRAKE SYSTEM (ABS) DTCS ARE SET
POWERTRAIN CONTROL MODULE (PCM) DTCS ARE SET
OUTPUT SPEED SENSOR IMPROPERLY INSTALLED
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: **Diagnose Powertrain Control Module (PCM) and communication DTCs before proceeding. If no PCM or communication DTCs are set, diagnose Anti-Lock Brake System (ABS) DTCs before proceeding.**

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. VEHICLE SPEED RELATED DTCS

1. Using the DTC data recorded earlier, check for vehicle speed related DTCS in other modules.
2. Perform any Service Bulletins that may apply.

Were any vehicle speed related DTCS in other modules present?

Yes

- Perform the appropriate diagnostic procedure in accordance with the Service Information.

No

- Go To [3](#)

3. CHECK TRANSFER CASE SHIFT CABLE ADJUSTMENT

1. Check the Transfer Case Shift Cable adjustment in accordance with the Service Information. Refer to [**CABLE, SHIFT, REMOVAL AND INSTALLATION CABLE, SHIFT, REMOVAL AND INSTALLATION**](#) .

Is the Transfer Case Shift Cable properly adjusted?

Yes

- Go To [4](#)

No

- Adjust the Transfer Case Shifter Cable in accordance with the Service Information. Refer to [**CABLE, SHIFT, REMOVAL AND INSTALLATION CABLE, SHIFT, REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

4. INSPECT THE OUTPUT SPEED SENSOR

1. Remove the Transmission Oil Pan in accordance with the Service Information.

NOTE: If excessive debris is found in the Transmission Oil Pan, correct the cause of the debris before proceeding with this Diagnostic Test.

2. If equipped, remove the Hydraulic Impulse Solenoid (HIS).
3. Inspect the Output Speed Sensor for proper installation.

Is the Output Speed Sensor properly installed?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [5](#)

5. CHECK OUTPUT SPEED SENSOR FOR DAMAGE

1. Carefully remove the Output Speed Sensor from the transmission case.
2. Inspect the Output Speed Sensor for any visible damage.

Is there any damage to the Output Speed Sensor?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Properly install the Output Speed Sensor in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DB7-00-TORQUE CONVERTER CLUTCH PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the monitoring is to detect a failure in the Torque Converter Clutch (TCC) system. The TCC is used to bypass the torque converter. The TCC can be open, closed or in closed loop control mode where a specific clutch slip is controlled. The actual slip and the target slip are compared to detect a failure.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Torque Converter Clutch (TCC) closed or in closed loop control mode.

SET CONDITION

- The difference between the actual slip and target slip of the TCC is greater than a calibrated threshold for an amount of time.
- Engine torque must be lower than a calibrated threshold.
- Calculated pressure inside the TCC must be greater than a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Torque Converter Clutch (TCC) will be commanded open.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
TORQUE CONVERTER

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. REPLACE THE TORQUE CONVERTER

1. Replace the Torque Converter in accordance with the Service Information. Refer to [TORQUE CONVERTER, REMOVAL AND INSTALLATION](#) .
2. With the scan tool, erase TCM DTCs.
3. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the Transmission in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test Complete.

P1DB8-00-UNINTENDED TORQUE APPLIED WHILE IN NEUTRAL

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect an unwanted power flow in the transmission. A rationality check of the ratio of input speed to engine speed is done while no power flow is requested.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is shifted from Drive to the Neutral or Park position.
- No Input Speed Sensor signal DTCs are set.
- No failure in engine speed signal via CAN detected.
- Engine speed signal via CAN or output speed signal is above a calibrated value.
- No mechanical limp home mode commanded.
- No power flow requested.
- No Output Speed Sensor signal DTCs are set.

SET CONDITION

- The ratio of input speed to engine speed is less than a calibrated value for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Any driver requests that are not yet honored will be cleared.
- The Transmission will shift into Sixth Gear via Neutral
- Maintain Park position if the DTC is detected while in Park.
- Reverse will be disabled.
- Drive will be disabled.
- Clutch adaptation functions will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL INCORRECT
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR INCORRECT GEAR RATIO (DTCS

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any Incorrect Gear Ratio DTCs set?

Yes

- Repair Incorrect Gear Ratio DTCs. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

3. CHECK TRANSMISSION FLUID LEVEL

1. Check the Transmission fluid level. Refer to the appropriate service information .

Was the Transmission fluid level at the correct level?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Check transmission for leaks and repair in accordance with the Service Information.
- Fill Transmission to the proper fluid level. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DB9-00-TCM ECU RESET EXTENDED LOW VOLTAGE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to ensure power flow after a Transmission Control Module (TCM) reset during a mechanical limp-in action or after an under voltage reset due to a low voltage condition of the TCM source voltage.

WHEN MONITORED

SET CONDITION

- Mechanical Limp-In Action was active.
- Reset has occurred during an under voltage condition and the shifter position and driving direction information stored in Random Access Memory (RAM) has been cleared.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM DTCS PRESENT
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Charging System DTCs set?

Yes

- Repair the Charging System DTCs. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK THE (A190) 12 VOLT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE:

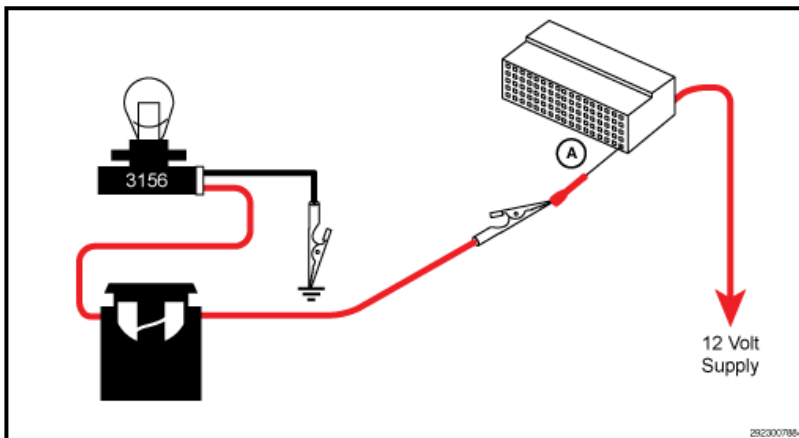
Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [4](#)

No

- Repair the 12.0 volt circuit for an open or high resistance.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

4. ISOLATE AND CHECK THE (A190) 12 VOLT CIRCUIT FOR A SHORT TO GROUND

1. The ignition must be off when checking a circuit for continuity to ground.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the negative lead of the DVOM to a known good ground.
4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: There should be no continuity between ground and the circuit being tested.

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [5](#)

5. CHECK THE (Z909) TCM GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the ground circuit.
2. Connect the positive lead of the load test tool to the positive side of the Battery.
3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a

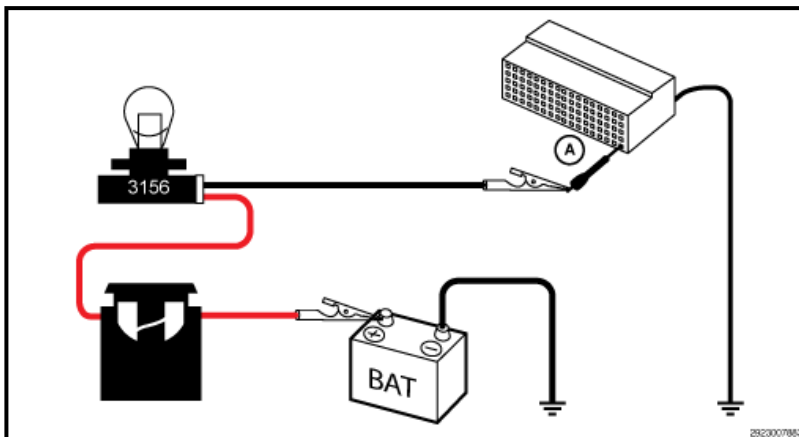
circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE:

Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE:

When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE:

Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [6](#)

No

- Repair the (Z909) TCM ground circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

6. ISOLATE AND CHECK THE (Z909) TCM GROUND CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. The ignition must be off when checking a circuit for continuity to another circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the positive lead of the DVOM to the circuit being tested.
4. With the negative lead of the DVOM, probe all of the other circuits at the component harness connector and check for continuity between the circuit and any other circuit.

NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: There should be no continuity between the circuit being tested and any other circuit.

Is there continuity between the circuit being tested and any other circuit?

Yes

- Repair the circuit for a short to another circuit. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [7](#)

7. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [8](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

8. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DC8-00-CLUTCH TEMP THRESHOLD ACHIEVED AUTOSTICK INHIBIT

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) performs several diagnostic checks to determine whether the temperature of a clutch is above a calibrated temperature value. These diagnostic checks use temperature models which are based upon input speed and output speed, current gear, target gear, calculated effective pressure on engaging clutch and on the disengaging clutch. The Diagnostic Trouble Codes (DTCs) set by these diagnostics are used to protect the durability of the clutches by controlling the shift operation.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- A gear shift or gear engagement is active.

SET CONDITION

- The calculated clutch temperature is above a calibrated value.

DEFAULT ACTION

- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
INCORRECT TRANSMISSION FLUID LEVEL
TRANSMISSION COOLING SYSTEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to [CHECK FLUID LEVEL](#) .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. CHECK THE TRANSMISSION COOLING SYSTEM CONDITION

1. Inspect the transmission cooling system for damage and proper operation.

Were any problems found?

Yes

- Repair the transmission cooling system.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P1DCD-00-TCM MONITORING PROCESSOR PERFORMANCE MULTIPLE CLUTCHES LOCKED UP

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the pressure regulator and solenoid logic to detect a failure in the activation of the pressure regulators and solenoids. The pressure regulators are used to control the pressure to the clutches and the solenoids are used to activate the pressure to the Parking Lock and to the Position Valve. The commanded currents of all regulators and solenoids are monitored. The monitoring consists of several diagnostic strategies:

- Transmission blocking (Multiple clutches locked up)
- Wrong driving direction (Incorrect driving direction)
- Gear engagement of Reverse gear while driving forward (Unallowed Reverse engagement)
- Unwanted engaging or disengaging of Parking Lock (Unallowed Park engagement)

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Limp home mode is not active.
- Position valve monitoring not active.
- Transmission oil temperature must be above a calibrated value.

SET CONDITION

- More than three pressure regulators are activated at the same time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DCE-00-TCM MONITORING PROCESSOR PERFORMANCE INCORRECT DRIVING DIRECTION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect a wrong driving direction.

The failure is detected when:

- When the shifter is in Drive and a pressure regulator combination for Reverse gear is detected (clutches A, B and D are activated).
- When the shifter is in Reverse and a pressure regulator combination other than Reverse gear is detected (clutch C or E is activated).

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Limp home mode is not active.
- Position valve monitoring not active.
- Shifter is in DRIVE or REVERSE position.

SET CONDITION

- When Shifter is in DRIVE:
 - A pressure regulator combination for reverse gear is detected (clutches A, B and D activated).
- When Shifter is in REVERSE:
 - A pressure regulator combination different from reverse gear is detected (clutch C or E activated).

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK THE TRANSMISSION CONTROL MODULE (TCM) SOFTWARE

1. Check for any applicable Service Bulletins or software updates that are applicable.

Were any applicable software updates available?

Yes

- With the scan tool, Program the TCM with the latest calibrations in accordance with the Service Information. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

3. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P1DD0-00-TCM MONITORING PROCESSOR PERFORMANCE UNALLOWED PARK ENGAGEMENT

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect an unwanted disengagement of the Parking Lock.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Limp home mode is not active.
- Position valve monitoring is not active.
- Shifter is in PARK position.

SET CONDITION

- The solenoid for the position valve or the pressure regulator of clutch C is activated for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.

- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1DD2-00-TORQUE REQUEST SIGNAL FROM TCM DENIED

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of this diagnostic is to monitor the accuracy of the engine torque signals by monitoring the engine flag "TCM torque request allowed".

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage within a calibrated range.
- No Controller Area Network (CAN) Bus monitoring Diagnostic Trouble Codes (DTCs) set.

- No CAN Bus message monitoring DTCs set.

SET CONDITION

- Engine signal notifies the TCM that torque interventions are not possible.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The Torque Converter Clutch (TCC) will be commanded open.
- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- The TCM will limit the current to the Torque Converter Clutch (TCC) solenoid to 50mA. The TCC will be open.
- Maximum system hydraulic pressure will be limited.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
BODY CONTROL MODULE (BCM) CAN BUS DTCS SET
POWERTRAIN CONTROL MODULE (PCM) DTCS SET
TRANSMISSION CONTROL MODULE (TCM) DTCS SET
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR BODY CONTROL MODULE (BCM) CONTROLLER AREA NETWORK (CAN) BUS DTCS

1. With the scan tool, read BCM DTCs.

Are any BCM CAN bus DTCs set?

Yes

- Repair BCM CAN Bus DTCs in accordance with the Service Information. If DTC U0002-00 is set, perform that diagnostic first. Refer to [DIAGNOSIS AND TESTING](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [2](#)

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCs.

Are any PCM DTCs set?

Yes

- Repair PCM DTCs. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [3](#)

3. CHECK FOR OTHER TRANSMISSION CONTROL MODULE (TCM) DTCS

1. With the scan tool, read TCM DTCs and record on the repair order.

Are any other TCM DTCs set?

Yes

- Repair other TCM DTC(s). Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1DDD-00-TCM MONITORING PERFORMANCE UNABLE TO DISENGAGE DRIVE OR REVERSE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of the diagnostic is to detect a failure in the activation of the pressure regulators during gear disengagement or while NEUTRAL or PARK position is engaged. This is a rationality check between the activated pressure regulators and the shifter selected gear.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Gear Disengagement:
 - Shifter is in PARK or NEUTRAL.
 - Three pressure regulators are activated.
- Neutral or Park:
 - Shifter is in PARK or NEUTRAL.
 - Since the requested position change to PARK or NEUTRAL, the number of activated pressure regulators has been less than three for more than a calibrated amount of time.

SET CONDITION

- Gear Disengagement:
 - A failure is detected during gear disengagement if three or more pressure regulators are activated at the same time for a calibrated amount of time.

- Neutral or Park:
 - A failure is detected while in Neutral or Park position is engaged if in addition to the two pressure regulators a third pressure regulator is activated at the same time for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [3](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

3. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1DDE-00-IGNITION RUN-START INPUT 1-2 CORRELATION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor if the hard-wired ignition signal state is equal to the ignition signal state received on the Controller Area Network (CAN) Bus. The CAN message is sent by the Body Control Module (BCM) to the Transmission Control Module (TCM).

- A low battery State Of Charge (SOC) or a charging system that is not operating properly can cause many symptoms and DTCs to set.
- If possibly related to the customer complaint, **check the vehicle charging system and battery for proper operation** . Refer to the appropriate Service Information.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No Controller Area Network (CAN) Bus monitoring or CAN message monitoring Diagnostic Trouble Codes (DTCs) set.

SET CONDITION

- The hard wired ignition signal to the Transmission Control Module (TCM) is not equal to the ignition signal that is transmitted on the CAN Bus from the Body Control Module (BCM).

POSSIBLE CAUSES

Possible Causes
IGNITION OFF/RUN/START CONTROL OUTPUT CIRCUIT OPEN OR HIGH RESISTANCE
BODY CONTROL MODULE (BCM)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK THE (F1) IGNITION OFF/RUN/START CONTROL OUTPUT CIRCUIT FOR AN OPEN OR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.

2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

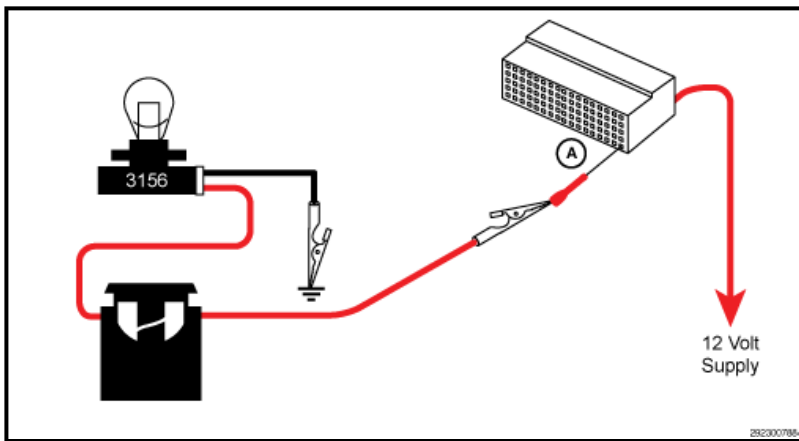
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#).

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [**CIRCUIT LOAD TESTING PROCEDURES**](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [3](#)

No

- Repair the (F1) Ignition Off/Run/Start Control Output circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

3. CHECK FOR BODY CONTROL MODULE (BCM) DTCS

1. With the scan tool, read BCM DTCS.

Are any BCM DTCS set?

Yes

- Repair BCM DTC(s).

Refer to the appropriate service information .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1DF3-00-ECU NOT INITIALIZED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the time period of the Electronic Shift Module (ESM) initialization state. The Transmission Control Module (TCM) receives the status of the initialization state from the ESM on the Controller Area Network (CAN) Bus while evaluating a counter in the TCM to determine if the initialization time is excessive.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No Controller Area Network (CAN) monitoring Diagnostic Trouble Codes (DTCs) set.
- Battery voltage is above a calibrated value.
- No shifter reset requested.

SET CONDITION

- The time period of the Electronic Shift Module (ESM) initialization is greater than a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Maintain Park position if the DTC is detected while in Park.
- Shut off engine to engage Park if there is a lever fault.
- Any driver requests that are not yet honored will be cleared.
- Car wash Neutral hold feature is disabled.
- Reverse will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.

POSSIBLE CAUSES

Possible Causes
ELECTRONIC SHIFT MODULE (ESM)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR TRANSMISSION CONTROL MODULE (TCM) CONTROLLER AREA NETWORK (CAN) BUS DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read TCM DTCs and record on the repair order.

Are any TCM CAN Bus DTCs set?

Yes

- Repair TCM CAN bus DTCs. If DTC U0001-00-CAN C BUS is set, perform that diagnostic first. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To [2](#)

2. CHECK IF ELECTRONIC SHIFT MODULE (ESM) DTCS ARE PRESENT

1. With the scan tool, read ESM DTCs and record on the repair order.

Are any ESM DTCs set?

Yes

- Repair ESM DTC(s). Refer to [DIAGNOSIS AND TESTING](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P215C-00-OUTPUT SHAFT SPEED WHEEL SPEED CORRELATION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect failures of the Wheel Speed Sensor signal via Bus and the Output Speed Sensor signal. The DTC is set when the difference between output speed and wheel speed is greater than a calibrated threshold during shifting, which depends on the axle ratio.

JL, JT and some DJ vehicles that are equipped with oversized tires need to have the proper tire size calibration programmed to the vehicle. Refer to STAR Online Publication, subject "Oversized Tire Calibration For Customized Jeep Wrangler, Gladiator, 2019 Ram Heavy Duty DJ, MVP Update Required, MVP Hotline" for more information.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No Wheel Speed Sensor failures are detected while a gear is engaged.
- No Output Speed Sensor failures are detected while a gear is engaged.
- Engine speed signal is valid.
- Engine speed is greater than a calibrated value.
- Output speed or calculated output speed from the driven wheels is greater than a calibrated threshold.
- Output speed is greater than calibrated threshold.
- Wheel speed is greater than calibrated threshold.
- If equipped, Transfer Case shifting state signal is valid.

SET CONDITION

- A failure is detected if the absolute difference between the output speed measured by the TCM and the output speed calculated from the wheel speed signal via BUS during a shifting operation is greater than a calibrated threshold for a calibrated amount of time.

DEFAULT ACTION

- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).

POSSIBLE CAUSES

Possible Causes
LOSS OF COMMUNICATION WITH THE ANTI LOCK BRAKE SYSTEM (ABS)
INCORRECT TIRE SIZE
MECHANICAL DRIVELINE FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK IF THE VEHICLE WILL DRIVE

1. Attempt to drive the vehicle.

Does the vehicle drive?

Yes

- Go To

Refer to [2](#).

No

- Inspect the driveline for broken components and repair. Items to inspect include:
 - Driveshaft and driveshaft joints.
 - Axle shafts or halfshafts.
 - Ring and pinion or differential gears.
 - If equipped, transfer case or Power Transfer Unit (PTU).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. CHECK FOR PROPER TIRE SIZE

1. Compare the tires on the vehicle to the vehicle placard label typically located in the drivers door opening.

Does the tire size match the vehicle placard?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: If the DTC C0078-86-TIRE DIAMETER - SIGNAL INVALID is present in the ABS module, diagnose this DTC before continuing. Refer to **DIAGNOSIS AND TESTING** .

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [7](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

4. CHECK FOR OVERSIZE TIRES

1. Check the tire size on the vehicle sidewall.

Are the tires on the vehicle 33 inches or greater in diameter?

Yes

- Check for STAR Online cases for Oversized Tire Calibration and perform procedure.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To

Refer to [5](#).

5. CHECK THE BODY CONTROL MODULE (BCM) CONFIGURATION

NOTE: .The Vehicle Identification Number (VIN) of the Body Control Module (BCM) must match the vehicles VIN.

NOTE: There is some variation in tire circumference depending on inflation pressure and amount of tire wear. A properly inflated tire circumference should typically be within 6 mm (0.250 in) of the Dynamic Tire Circumference stored in the BCM.

1. With the scan tool, run a vehicle configuration report.

2. Measure the tire circumference.
3. Compare the measured tire circumference to the Dynamic Tire Circumference stored in the BCM.

Does the tire circumference on the vehicle closely match the Dynamic Tire Circumference stored in the BCM?

Yes

- Go To [6](#)

No

- Install the correct tires for the vehicle.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

6. CHECK THE BODY CONTROL MODULE FOR AVAILABLE PRODUCTION TIRE SIZES

NOTE: A non-production size tire cannot be programmed into the BCM. The production Powertrain, with the production size tires, is the only emissions certified configuration that is available for reprogramming.

1. Check if the tire size installed on the vehicle is an available option for the vehicle configuration for this vehicle.

Is there a production tire size (Dynamic Tire Circumference) option that can be programmed into this BCM?

Yes

- Update the vehicle configuration.

Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Install the correct size tires for this vehicle.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

7. CHECK FOR DTC U0121-00-LOST COMMUNICATION WITH ABS MODULE

1. With the scan tool, read TCM DTCs.

Is DTC U0121-00-LOST COMMUNICATION WITH ABS MODULE present?

Yes

- Repair DTC U0121-00-LOST COMMUNICATION WITH ABS MODULE. Refer to the appropriate service information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in

accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P2761-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT-OPEN

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated.
- Torque Converter Clutch (TCC) Low Side Pressure Regulator Switch will be commanded off.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID

Possible Causes

TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .
- Test complete.

P2762-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

Condition One:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.
- No shifting is in progress.

Condition Two:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.
- No shifting is in progress.
- Clutch involved in shifting.

Condition Three:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.
- No shifting is in progress.

- No clutch involved in shifting.

Condition Four:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

Condition One:

- A current too low failure is detected if the calculated pressure control solenoid feedback current is less than or equal to a calibrated value.
- A current too high failure is detected if the calculated pressure control solenoid feedback current is greater than or equal to a calibrated value.

Condition Two:

- A current too low failure is detected if the calculated pressure control solenoid feedback current is less than or equal to a calibrated value.
- A current too high failure is detected if the calculated pressure control solenoid feedback current is greater than or equal to a calibrated value.

Condition Three:

- A current too low failure is detected if the calculated pressure control solenoid feedback current is less than or equal to a calibrated value.
- A current too high failure is detected if the calculated pressure control solenoid feedback current is greater than or equal to a calibrated value.

Condition Four:

- A Serial Peripheral Interface (SPI) communication failure in the SPI communication between the Central Processing Unit (CPU) and the ASIC is detected based upon the validity of the check-byte, the timing and the feedback signal of the message.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID
TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

- Test complete.

P2763-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated.
- Torque Converter Clutch (TCC) Low Side Pressure Regulator Switch will be commanded off.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID
TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCS.
7. Road test the vehicle and check for DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P2764-00-TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID
TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

U0001-00-CAN C BUS

NOTE: This DTC may not be listed in the Body Control Module (BCM) diagnostic procedures. If this DTC is not found in the BCM diagnostic procedures, perform the comparable CAN C Bus diagnostic test, such as CAN C BUS-NO SIGNAL, CAN C BUS OFF PERFORMANCE or CAN C SIGNAL MISSING.

Perform the comparable CAN C Bus diagnostic tests in the BCM. Refer to [DIAGNOSIS AND TESTING](#) .

U0074-00-DEDICATED POWERTRAIN (DPT) CAN BUS OFF

THEORY OF OPERATION

The purpose of the diagnostic is to detect existing failures on the Dedicated Powertrain Controller Area Network (DPT CAN) Bus. The TCM software monitors the state of the BUS controller(s) and reports any failures.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- System voltage within a valid range.
- CAN bus diagnosis delay timer has elapsed.

SET CONDITION

- The Transmission Control Module (TCM) detects the DPT CAN is in an OFF state.

DEFAULT ACTION

- Any driver requests that are not yet honored will be cleared.

POSSIBLE CAUSES

Possible Causes
DPT CAN BUS (+) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (-) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (+) CIRCUIT SHORT TO GROUND
DPT CAN BUS (-) CIRCUIT SHORT TO GROUND
DPT CAN BUS (+) CIRCUIT SHORT TO ANOTHER CIRCUIT
DPT CAN BUS (-) CIRCUIT SHORT TO ANOTHER CIRCUIT
ELECTRONIC SHIFT MODULE (ESM)
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: For vehicle communication problems, use the scan tool to refer to the **Network Review Screen**. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red. Selecting any of the network components allows access to the source of the problem.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#).

2. CHECK THE DEDICATED POWERTRAIN (DPT) CONTROLLER AREA NETWORK (CAN) CIRCUIT VOLTAGE

1. Turn the ignition off.
2. Disconnect the ESM harness connector.
3. Turn the ignition on.
4. Measure the voltage between ground and the (D441) DPT CAN (+) circuit at the TCM harness connector.
5. Measure the voltage between ground and the (D440) DPT CAN (-) circuit at the TCM harness connector.

Is the voltage between 2.4 and 2.6 volts for each circuit?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information.

No

- Go To [3](#)

3. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.

3. Measure the resistance of the (D441) DPT CAN (+) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms for each circuit?

Yes

- Go To [4](#)

No

- Repair the (D441) DPT CAN (+) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

4. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.
3. Measure the resistance of the (D440) DPT CAN (-) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms for each circuit?

Yes

- Go To [5](#)

No

- Repair the (D440) DPT CAN (-) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

5. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D441) DPT CAN (+) circuit at the TCM harness connector.

Is there continuity between ground and the either of the CAN DPT circuits?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To [6](#)

6. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D440) DPT CAN (-) circuit at the TCM harness connector.
2. Check for continuity between ground and the (D440) CAN DPT (-) circuit at the TCM harness connector.

Is there continuity between ground and the either of the CAN DPT circuits?

Yes

- Repair the (D440) CAN DPT (-) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To [7](#)

7. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D441) DPT CAN (+) circuit and all other circuits at the TCM harness connector.

Is there continuity between either CAN DPT circuit and any other circuit?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To [8](#)

8. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D440) DPT CAN (-) and all other circuits at the TCM harness connector.

Is there continuity between the (D440) DPT CAN (-) and any other circuit?

Yes

- Repair the (D440) DPT CAN (-) for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to **MODULE, ELECTRONIC SHIFT (ESM), REMOVAL AND INSTALLATION** .
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

U0100-00-LOST COMMUNICATION WITH ECM/PCM

NOTE: Perform this diagnostic procedure **ONLY** when the DTC status is "Active". If the DTC status is "Stored" **DO NOT** proceed with this diagnostic procedure. A "Stored" DTC will not affect the performance of the vehicle.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0102-00-LOST COMMUNICATION WITH TRANSFER CASE CONTROL MODULE / AWD

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0103-00-LOST COMMUNICATION WITH ELECTRIC GEAR SHIFT MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to

COMMUNICATION DIAGNOSTIC PROCEDURE .

U0104-00-LOST COMMUNICATION WITH CRUISE CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0120-00-LOST COMMUNICATION WITH STARTER/GENERATOR CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0121-00-LOST COMMUNICATION WITH ANTI-LOCK BRAKE SYSTEM (ABS) CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0140-00-LOST COMMUNICATION WITH BODY CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0155-00-LOST COMMUNICATION WITH CLUSTER-CCN

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0212-00-LOST COMMUNICATION WITH STEERING COLUMN CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0401-00-IMPLAUSIBLE DATA RECEIVED FROM ECM/PCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0403-00-IMPLAUSIBLE DATA RECEIVED FROM TCASE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U0404-00-IMPLAUSIBLE DATA RECEIVED FROM ESM

NOTE: This DTC indicates a communication issue has occurred between the Sending control module (Electronic Shift Module (ESM) and the Reporting control module(s) that set this fault.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to

COMMUNICATION DIAGNOSTIC PROCEDURE

U0405-00-INVALID DATA RECEIVED FROM CRUISE CONTROL MODULE

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE**.

U0415-00-IMPLAUSIBLE DATA RECEIVED FROM ABS

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE**.

U0422-00-IMPLAUSIBLE DATA RECEIVED FROM BODY CONTROL MODULE

NOTE: This DTC indicates a communication issue has occurred between the Sending control module (Body Control Module - BCM) and the Reporting control module(s) that set this DTC.

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE**.

U0423-00-IMPLAUSIBLE DATA RECEIVED FROM CLUSTER-CCN

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE**.

U0429-00-IMPLAUSIBLE DATA RECEIVED FROM SCM

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE**.

U0469-00-INVALID DATA RECIEVED FROM STARTER/GENERATOR CONTROL MODULE

NOTE: Treat this DTC as an IMPLAUSIBLE SIGNAL DTC when performing the COMMUNICATION DIAGNOSTIC PROCEDURE.

Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE**.

U11E3-00-TCM LOST COMMUNICATION WITH ESM ON DPT CAN

THEORY OF OPERATION

The purpose of this diagnostic is to monitor the Dedicated Powertrain (DPT) Controller Area Network (CAN) BUS for message timeout signals from the Electronic Shift Module (ESM).

WHEN MONITORED

- This diagnostic runs continuously when the ignition is switched on.
- Battery voltage is within a calibrated range.
- The Electronic Shifter Module (ESM) is active on the CAN bus.
- A calibrated amount of time has expired after the ignition is switched On.
- No failure is detected in CAN bus monitoring.

SET CONDITION

- DPT CAN Bus messages not received from the Electronic Shift Module (ESM) for a calibrated amount of time.

POSSIBLE CAUSES

Possible Causes
DPT CAN BUS (+) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (-) CIRCUIT OPEN OR HIGH RESISTANCE
DPT CAN BUS (+) CIRCUIT SHORT TO GROUND
DPT CAN BUS (-) CIRCUIT SHORT TO GROUND
DPT CAN BUS (+) CIRCUIT SHORT TO ANOTHER CIRCUIT
DPT CAN BUS (-) CIRCUIT SHORT TO ANOTHER CIRCUIT
ELECTRONIC SHIFT MODULE (ESM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: For vehicle communication problems, use the scan tool to refer to the **Network Review Screen**. The screen depicts a high level view of the vehicle network. Fault and problem areas appear in red. Selecting any of the network components allows access to the source of the problem.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.

3. Measure the resistance of the (D441) DPT CAN (+) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms?

Yes

- Go To [3](#)

No

- Repair the (D441) DPT CAN (+) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

3. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR AN OPEN CIRCUIT OR HIGH RESISTANCE

1. Turn the ignition off.
2. Disconnect the TCM harness connector.
3. Measure the resistance of the (D440) DPT CAN (-) circuit between the ESM harness connector and the TCM harness connector.

Is the resistance below 3.0 Ohms?

Yes

- Go To [4](#)

No

- Repair the (D440) DPT CAN (-) circuit for an open or high resistance.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

4. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D441) DPT CAN (+) circuit at the TCM harness connector.

Is there continuity between ground and the (D441) DPT CAN (+) circuit?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To [5](#)

5. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO GROUND

1. Check for continuity between ground and the (D440) DPT CAN (-) circuit at the TCM harness connector.
2. Check for continuity between ground and the (D440) CAN DPT (-) circuit at the TCM harness connector.

Is there continuity between ground and the (D440) CAN DPT (-) circuit?

Yes

- Repair the (D440) CAN DPT (-) circuit for a short to ground.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To [6](#)

6. CHECK THE (D441) DPT CAN (+) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D441) DPT CAN (+) circuit and all other circuits at the TCM harness connector.

Is there continuity between the (D441) DPT CAN (+) circuit and any other circuit?

Yes

- Repair the (D441) DPT CAN (+) circuit for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To [7](#)

7. CHECK THE (D440) DPT CAN (-) CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT

1. Check for continuity between the (D440) DPT CAN (-) and all other circuits at the TCM harness connector.

Is there continuity between the (D440) DPT CAN (-) and any other circuit?

Yes

- Repair the (D440) DPT CAN (-) for a short to another circuit.
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to [MODULE, ELECTRONIC SHIFT \(ESM\), REMOVAL AND INSTALLATION](#) .
- Perform the TCM VERIFICATION TEST. Refer to the appropriate service information .

U11E4-00-CAN COMMUNICATION MESSAGES MISSING

NOTE: This DTC may not be listed in the Body Control Module (BCM) diagnostic procedures. If this DTC is not found in the BCM diagnostic procedures, perform the comparable CAN C Bus diagnostic test, such as CAN C BUS-NO SIGNAL, CAN C BUS OFF PERFORMANCE or CAN C SIGNAL MISSING.

Perform the comparable CAN C Bus diagnostic tests in the BCM. Refer to [DIAGNOSIS AND TESTING](#) .

U1267-00-NO VALID DATA FROM ESM ON CAN-C OR CAN-DPT

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the Controller Area Network (CAN) C and CAN DPT circuits for failures. This Diagnostic Trouble Code (DTC) sets when there is a problem with both CAN busses and the TCM can not receive data from the Electronic Shift Module (ESM) to determine the shifter position.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- The battery voltage is greater than a calibrated threshold.
- CAN BUS communications are active.
- The delay time since the ignition is switched On has elapsed.

SET CONDITION

- No valid data from Electronic Shift Module (ESM) on CAN C or DPT CAN.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Shut off engine to engage Park if there is a lever fault.
- Maintain Park position if the DTC is detected while in Park.
- Reverse will be disabled.
- Car wash Neutral hold feature is disabled.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.
- Remote Start feature, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
RELATED CAN BUS DTC PRESENT
RELATED ESM DTC PRESENT
ELECTRONIC SHIFT MODULE (ESM)

Always perform the **DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE DTC

1. With the scan tool, read TCM DTCs and record on the repair order.
2. Record the Event Data and Environmental Data.
3. With the scan tool, erase DTCs.
4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
5. With the scan tool, read all DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK FOR TRANSMISSION CONTROL MODULE (TCM) CONTROLLER AREA NETWORK (CAN) BUS DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read TCM DTCs and record on the repair order.

Are any TCM CAN bus DTCs set?

Yes

- Repair TCM CAN bus DTCs. If DTC U0001-00 CAN C BUS or U0074-00 DEDICATED POWERTRAIN (DPT) CAN BUS OFF are set, perform that diagnostic first. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [3](#)

3. CHECK FOR ESM DTCS

1. With the scan tool, read ESM DTCs and record on the repair order.

Are any ESM DTCs set?

Yes

- Repair ESM DTCs. Refer to [DIAGNOSIS AND TESTING](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Electronic Shift Module (ESM) connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace the ESM in accordance with the Service Information. Refer to [MODULE, ELECTRONIC SHIFT \(ESM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

U1400-00-IMPLAUSIBLE TPS SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U1401-00-IMPLAUSIBLE ENGINE SPEED SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U1412-00-IMPLAUSIBLE VEHICLE SPEED SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to [COMMUNICATION DIAGNOSTIC PROCEDURE](#) .

U1424-00-IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE**

U1428-00-IMPLAUSIBLE ENGINE TORQUE SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U1461-00-IMPLAUSIBLE DATA RECEIVED FROM ESM ON DPT

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U1465-00-IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U1466-00-IMPLAUSIBLE DRIVER SHIFT REQUEST SIGNAL RECEIVED ON DPT CAN

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

U1477-00-IMPLAUSIBLE PADDLE SHIFTER DATA RECEIVED

The COMMUNICATION DIAGNOSTIC PROCEDURE **MUST** be performed before replacing any component(s) or module(s). Perform the COMMUNICATION DIAGNOSTIC PROCEDURE. Refer to **COMMUNICATION DIAGNOSTIC PROCEDURE** .

2021 AUTOMATIC TRANSMISSION

8HP75 Automatic Transmission - DTCS P0219-00 To P1D90-00 - Gladiator

DTC TROUBLESHOOTING

P0219-00-ENGINE OVERSPEED CONDITION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of the diagnostic is to detect an engine overspeed using two different methods. First, the actual engine speed is compared to a maximum allowable engine speed threshold. Second, when a gear shift request occurs the calculated input speed of the target gear is compared to the maximum allowable engine speed threshold.

WHEN MONITORED

- When in a fixed gear:
 - The Shifter position is in DRIVE or REVERSE.
 - Not in 7th or 8th gear while in LOW mode.
- When a shift event is in progress:
 - The Shifter position is in DRIVE or REVERSE.

SET CONDITION

- When in a fixed gear:
 - The engine speed is greater than a calibrated value for a calibrated amount of time.
- When a shift event is in progress:
 - The calculated input speed of the target gear is greater than a calibrated value for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
MECHANICAL TRANSMISSION PROBLEM
MECHANICAL ENGINE PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR OTHER DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any Gear Ratio or Speed Sensor DTCs set?

Yes

- Repair the TCM DTCs. Refer to the appropriate service information .

No

- Go To [2](#)

2. CHECK FOR POWERTRAIN CONTROL MODULE (PCM) DTCS

1. With the scan tool, read PCM DTCs.

Are any PCM DTCs set?

Yes

- Repair the PCM DTCs. Refer to the appropriate service information .

No

- Go To [3](#)

3. CHECK FOR ENGINE MECHANICAL PROBLEMS

1. Determine if any Engine mechanical problems are present.

Are any Engine mechanical problems present?

Yes

- Repair Engine in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [4](#)

4. CHECK FOR TRANSMISSION MECHANICAL PROBLEMS

1. Turn the ignition off.
2. Remove the Transmission Oil Pan and inspect for excessive debris or a plugged Transmission Oil Filter.

Is there any debris, plugged Transmission Oil Filter, or signs of an internal Transmission problem?

Yes

- Repair the Transmission in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [5](#)

5. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P0562-00-SYSTEM VOLTAGE LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the system voltage level at the TCM supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low
- System Voltage High

If the TCM supply voltage is below a threshold that is lower than the System Voltage Excessively Low threshold, the TCM will not supply power to the solenoid valves and pressure regulators. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- High side switch is activated.
- When shifter is in PARK or NEUTRAL:
 - Engine speed signal via Controller Area Network (CAN) or Input Speed Sensor signal is above a calibrated value.
- When shifter is in DRIVE or REVERSE:

- Engine speed via CAN is above a calibrated value or engine speed via CAN is invalid.

SET CONDITION

- The Transmission Control Module (TCM) system voltage is less than a calibrated value.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
OPEN FUSE LOW BATTERY VOLTAGE ENGINE CHARGING SYSTEM TCM FUSED B+ (BATTERY VOLTAGE) CIRCUIT OPEN OR HIGH RESISTANCE TCM GROUND CIRCUIT OPEN OR HIGH RESISTANCE TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Charging System DTCs set?

Yes

- Repair the Charging System DTCs. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.

4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK THE (A190) FUSED B+ CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the (A190) Fused B+ circuit.
2. Connect the positive lead of the load test tool to the (A190) Fused B+ circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .

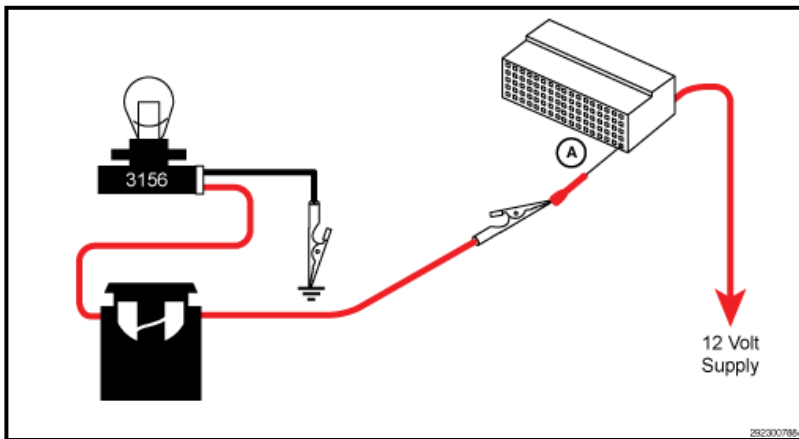
NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.

3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Go To [4](#)

No

- Repair the (A190) Fused B+ circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

4. CHECK THE (Z908) TCM GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the ground circuit.
2. Connect the positive lead of the load test tool to the positive side of the Battery.
3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing

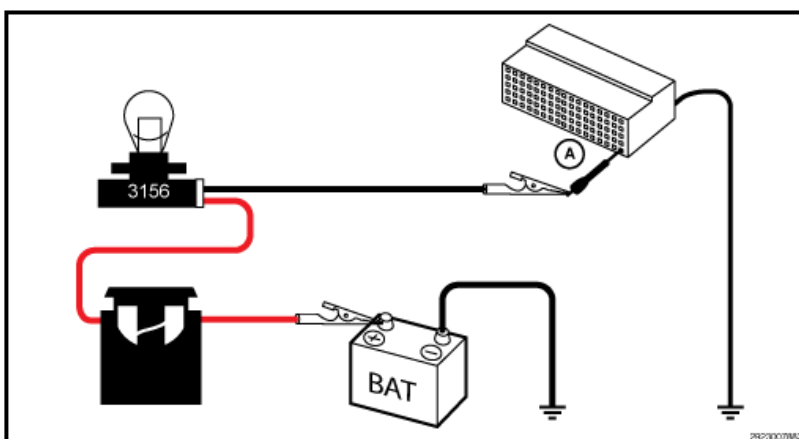
circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test: To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

- 1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
- 2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
- 3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#).



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Repair the (Z908) TCM ground circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0563-00-SYSTEM VOLTAGE HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors the system voltage level at the TCM supply voltage terminal for the following failure conditions:

- System Voltage Excessively Low
- System Voltage Low
- System Voltage High

If the TCM supply voltage is below a threshold that is lower than the System Voltage Excessively Low threshold, the TCM will not supply power to the solenoid valves and pressure regulators. A Diagnostic Trouble Code (DTC) is set when one of the diagnostic voltage thresholds is reached for a calibrated amount of time.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Engine speed via Controller Area Network (CAN) is above a calibrated value or engine speed via CAN is invalid.
- No jump start identified when:
 - Failure detected in Engine speed signal monitoring and no jump start identified.

SET CONDITION

- Battery voltage is above a calibrated value.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.

- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
CHARGING SYSTEM OVERCHARGE CONDITION
JUMP START FROM A 24 VOLT SYSTEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DTCS

1. With the scan tool, read PCM DTCS.

Are any Charging System DTCS set?

Yes

- Repair Charging System DTCS. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST to verify the Transmission and or TCM was not damaged. Refer to the appropriate service information .

No

- Go To [2](#)

2. CHECK IF VEHICLE WAS JUMP STARTED WITH 24-VOLT SYSTEM

NOTE: **Some Recreational Vehicles (RVs), Buses, and Semi Tractors use 24-volt systems.**

1. Check if the vehicle was jump started by a vehicle with a 24-volt charging system.

Was the vehicle jump started by a vehicle with a 24-volt charging system?

Yes

- This is the cause of the DTC. Erase the DTC and return the vehicle to the customer.
- Perform the TRANSMISSION VERIFICATION TEST to verify the Transmission and or TCM was not damaged. Refer to the appropriate service information .

No

- Go To [3](#)

3. CHECK INDICATED TCM BATTERY VOLTAGE

1. Start the Engine and raise the engine speed to 2, 000 rpm.
2. With the scan tool, monitor the TCM Battery Voltage for 60 seconds.

Does the TCM Battery Voltage read above 16 volts at any time during the test?

Yes

- Go To [4](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

4. COMPARE TCM VOLTAGE TO BATTERY VOLTAGE

1. Start the Engine and raise the engine speed to 2, 000 rpm.
2. With the scan tool, read the TCM Battery Voltage.
3. Measure the voltage at the Battery.
4. Compare the readings.

Does the measured voltage reading match the scan tool TCM Battery Voltage reading?

Yes

- Repair the Charging System for an over charging condition in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0601-00-INTERNAL CONTROL MODULE MEMORY CHECKSUM ERROR

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the validity of the Read Only Memory (ROM) flash memory. A Cyclic Redundancy Check (CRC) checksum is calculated for each memory block of the flash memory and compared with the stored reference checksum. There is a different stored reference checksum for each memory block. If the checksum rationality check of the last memory block has finished, the calculation starts all over again beginning with the first memory block.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.

- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE REQUIRES AN UPDATE TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [2](#).

No

- Go To

Refer to [3](#).

2. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P0607-00-ECU INTERNAL PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

This DTC indicates a failure was detected in one or more of the following five monitored internal computing processes:

- Computational failures of the Transmission Control Module (TCM) which are related to the speed signal monitoring. All rationality checks of speed sensor signals are calculated in a complement form. The failure is detected if the complementary signals do not correspond.
- Failures in the measurement of battery voltage. To detect measurement failures, the battery voltage is measured on two separated paths inside the TCM. If the Battery Voltage or Switched Battery Voltage is out of range or the voltage drop of Switched Battery Voltage is too high, an error entry has to be made.
- Detection that the second microprocessor has disabled actuators for the High Side Switch (HSS) and Low Side Switch (LSS) because the second microprocessor has detected a main microprocessor calculation failure. The gradient in transmission output speed monitoring of the second microprocessor may be disabled under certain conditions by the main Central Processing Unit (CPU). To prevent a false calculation of this enable/disable condition, a Level 2 safety calculation is performed by the main microprocessor and is verified by the second microprocessor. If this verification fails, the second microprocessor disables the HSS and LSS by deactivating each independent output line. A failure is detected if results of the Level 2 calculation of main CPU differs from precalculated results in the second CPU or if a driver warning is expected to be sent by the main CPU but second CPU did not receive the acknowledgement.
- Communication failures between the main microprocessor and the second microprocessor. Both microprocessors communicate with each other via a serial link. The failure is detected if the communication between the main microprocessor and the second microprocessor fails.

- The second microprocessor has disabled the HSS and LSS actuator supply because it has detected an internal failure.

WHEN MONITORED

- The ignition is on.

SET CONDITION

- If the TCM has detected the battery voltage or switched voltage is less than 4.0 volts for a calibrated amount of time.
- The redundant signal of the speed sensor signals do not correspond.
- The results of two independently performed calculation within the TCM are not equal.
- A communication problem is detected between the Main Microprocessor (MMP) and the second microprocessor is detected for a calibrated amount of time.
- An internal failure of the second microprocessor has occurred.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- Clutch adaptation functions will be disabled.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSFER CASE SHIFT CABLE IMPROPERLY ADJUSTED
OUTPUT SPEED SENSOR IMPROPERLY INSTALLED
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSFER CASE SHIFT CABLE ADJUSTMENT

Is the Transfer Case Shift Cable properly adjusted?

Yes

- Go To [3](#)

No

- Adjust the Transfer Case Shifter Cable in accordance with the Service Information. Refer to [CABLE, SHIFT, REMOVAL AND INSTALLATION CABLE, SHIFT, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. INSPECT THE OUTPUT SPEED SENSOR

1. Remove the Transmission Oil Pan in accordance with the Service Information.

NOTE: If excessive debris is found in the Transmission Oil Pan, correct the cause of the debris before proceeding with this Diagnostic Test.

2. If equipped, remove the Hydraulic Impulse Solenoid (HIS).
3. Inspect the Output Speed Sensor for proper installation.

Is the Output Speed Sensor properly installed?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [4](#)

4. CHECK OUTPUT SPEED SENSOR FOR DAMAGE

1. Carefully remove the Output Speed Sensor from the transmission case.
2. Inspect the Output Speed Sensor for any visible damage.

Is there any damage to the Output Speed Sensor?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Correctly install the Output Speed Sensor in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0613-00-INTERNAL TRANSMISSION PROCESSOR

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect failures in any of the following microcontroller core functionalities:

Analog to Digital (A/D) converter.

- The A/D converter diagnostic is to ensure the rationality of the signals of both A/D converters in the TCM. The A/D converter monitoring is regularly commanding the A/D converter to convert different reference voltages from the TCM internal voltage regulator Application Specific Integrated Circuits (ASIC). The converted signals are compared to expected values.

Memory management.

- Detection of failures in the Random Access Memory (RAM) or Read Only Memory (ROM) and to check the functionality of the Error Checking and Correction (ECC) algorithm of the memory management unit.

Serial Peripheral Interface Bus (SPI).

- Detection of failures in the SPI communication between the Central Processing Unit (CPU) and the two safety relevant ASICs in the TCM by evaluating the feedback signal of sent SPI data, the control data that the receiving SPI node sends back to the SPI master and the status information of the low level SPI driver.

Failure of Output Coordinator Calculation.

- Detection of failures in the calculation of the output coordinator. The output coordinator software module controls the power stage commands from the upper level application software to the low level hardware routines. A safety function monitors the output coordinator by calculating the same commands using two independent algorithms.

WHEN MONITORED

- The ignition is on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE (TCM)

Repair

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P061B-00-INTERNAL CONTROL MODULE TORQUE CALCULATION PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the positive engine torque request calculation in the Transmission Control Module (TCM) and the engine response resulting from the positive engine torque request. This diagnostic includes, comparison of the calculated torque request versus commanded torque request. The rationality of the actual crankshaft torque signal received from the Powertrain Control Module (PCM). The rationality of the actual input and output speed gradient of the transmission. The comparison of two torque request signals that are managed separately in the software which come after the torque request calculation but before the torque request is sent to the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE (TCM)

Repair

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P062F-00-INTERNAL CONTROL MODULE EEPROM ERROR

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of the diagnostic is to detect if the Electronic Erasable Programmable Read Only Memory (EEPROM) data has been corrupted or access to the data is not possible anymore. If the access is not possible anymore the Flash Control Unit (FCU) Application-Specific Integrated Circuit (ASIC) sets a hardware failure. The corruption of the data is detected by calculating a checksum and comparing it to a reference value. The EEPROM includes all data that can change from transmission to transmission but has to be stored in non-volatile memory (e.g. fault memory, customer specific data such as part numbers, etc). The physical EEPROM emulation memory in flash is sub divided into several sector groups. Each sector group holds one set of data that was stored at the moment of an update. If all sector groups are filled, the sector group with the oldest set of data is used for the update. Updating the sector group results in erasing the entire sector group memory and then programming the current data to it. To always ensure a valid backup of the EEPROM data, at least 2 non-defective sector groups are needed. Each sector group is checksum protected and the validity of the checksum is verified before reading and after writing the data.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- An Electronic Erasable Programmable Read Only Memory (EEPROM) read or write operation has occurred.

SET CONDITION

- The number of sector groups with a valid checksum is less than two.
- The Flash Control Unit is defective.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM) ASSEMBLY

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

CHECK IF TRANSMISSION CONTROL MODULE (TCM) IS PROGRAMMABLE

1. With the scan tool, program the TCM with the latest software. Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .

Were you able to program the TCM successfully?

Yes

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0634-PCM/ECM/TCM INTERNAL TEMPERATURE TOO HIGH

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of the diagnostic is to detect an over temperature shutdown of the Transmission Control Module (TCM) to protect the TCM hardware.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- One of the microchip temperature sensors indicates a temperature that is greater than a calibrated value.
- A failure is detected on either microchip temperature sensor.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.

- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
INCORRECT TRANSMISSION FLUID LEVEL
CASE VENT PLUGGED OR DAMAGED
TRANSMISSION COOLER AIRFLOW IS COMPROMISED
RESTRICTION IN TRANSMISSION COOLING SYSTEM
TORQUE CONVERTER
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR CONDITIONS THAT COULD CAUSE OVERHEATING

1. Check for the following conditions:
 - Incorrect Transmission Fluid level. Refer to the appropriate service information .
 - Case vent plugged or damaged.
 - Transmission Cooler air flow restriction.
 - Fluid restriction in the Transmission Cooler.
 - Bad Torque Converter.

Were any problems found?

Yes

- Repair the condition as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0642-00-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) provides the various sensors in transmission with Supply Voltage circuits. One Supply Voltage circuit can provide power for one or more sensors. This diagnostic monitors one of the sensor voltage supply circuits for faults. This diagnostic also monitors the Input and Output Speed Sensors. If both speed sensors indicate an error at the same time or, if the Voltage Supply circuit voltage is out of normal range, this Diagnostic Trouble Code (DTC) will set.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Transmission Control Module (TCM) voltage is above a calibrated value.

SET CONDITION

- Sensor Voltage Supply circuit voltage is less than a calibrated value.
- Both the Input and Output Speed Sensor signals indicate a short to ground or break failure for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- Remote Start feature, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination. Pay particular attention to power and ground circuits.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

- Test complete.

P0643-00-SENSOR REFERENCE VOLTAGE 1 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The Transmission Control Module (TCM) provides the various sensors in transmission with Supply Voltage circuits. One Supply Voltage circuit can provide power for one or more sensors. This diagnostic monitors one of the sensor voltage supply circuits for faults. This diagnostic also monitors the Input and Output Speed Sensors. If both speed sensors indicate an error at the same time or, if the Voltage Supply circuit voltage is out of normal range, this Diagnostic Trouble Code (DTC) will set.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Transmission Control Module (TCM) voltage is above a calibrated value.

SET CONDITION

- The Sensor Voltage Supply circuit voltage is greater than a calibrated value for a calibrated amount of time.
- Both the Input and Output Speed Sensor signals indicate a short to battery failure for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- The Transmission Control Module (TCM) will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- Remote Start feature, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination. Pay particular attention to power and ground circuits.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0667-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp

(MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No engine speed signal failure detected.
- No turbine speed signal failure detected.
- No monitoring failure of TCM Internal Temperature Sensor 1 detected.
- Engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal is above a calibrated value for five consecutive minutes.

SET CONDITION

- The difference between TCM Internal Temperature Sensor 1 and the TCM Internal Temperature Sensor 2 and Oil Temperature Sensor exceeds a calibrated value when the system is in a steady thermodynamic state.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED

Possible Causes

TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0668-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms

TEMPERATURE vs RESISTANCE

145Â°C (293Â°F)

105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 1 is less than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0669-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 1 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 1 is greater than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P06AC-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No engine speed signal failure detected.
- No turbine speed signal failure detected.
- No monitoring failure of TCM Internal Temperature Sensor 2 detected.
- Engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal is above a calibrated value for five consecutive minutes.

SET CONDITION

- The difference between TCM Internal Temperature Sensor 2 and the TCM Internal Temperature Sensor 1 and Oil Temperature Sensor exceeds a calibrated value when the system is in a steady thermodynamic state.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to TRANSMISSION VERIFICATION TEST .

P06AD-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 2 is less than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P06AE-00-PCM-ECM-TCM INTERNAL TEMPERATURE SENSOR 2 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the

other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- TCM Internal Temperature Sensor 2 is greater than calibrated threshold for a calibrated amount of time.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

TRANSMISSION CONTROL MODULE ASSEMBLY (TCMA)

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
3. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0701-00-TRANSMISSION CONTROL SYSTEM RANGE/PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) performs various internal tests to verify proper controller operation. This Diagnostic Trouble Code (DTC) indicates that the TCMs second microprocessor detected an excessive negative gradient of the Output Speed Sensor.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- An excessive negative gradient of the transmission output speed is detected by the second microprocessor.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Clutch adaptation functions will be disabled.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSFER CASE SHIFT CABLE IMPROPERLY ADJUSTED
OUTPUT SPEED SENSOR IMPROPERLY INSTALLED
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**
 1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
 2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
 3. With the scan tool, erase all DTCs.
 4. Turn the ignition off for a minimum of 10.0 seconds.

5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSFER CASE SHIFT CABLE ADJUSTMENT

Is the Transfer Case Shift Cable properly adjusted?

Yes

- Go To [3](#)

No

- Adjust the Transfer Case Shifter Cable in accordance with the Service Information. Refer to [CABLE, SHIFT, REMOVAL AND INSTALLATION CABLE, SHIFT, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. INSPECT THE OUTPUT SPEED SENSOR

1. Remove the Transmission Oil Pan in accordance with the Service Information.

NOTE: If excessive debris is found in the Transmission Oil Pan, correct the cause of the debris before proceeding with this Diagnostic Test.

2. If equipped, remove the Hydraulic Impulse Solenoid (HIS).
3. Inspect the Output Speed Sensor for proper installation.

Is the Output Speed Sensor properly installed?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [4](#)

4. CHECK OUTPUT SPEED SENSOR FOR DAMAGE

1. Carefully remove the Output Speed Sensor from the transmission case.

2. Inspect the Output Speed Sensor for any visible damage.

Is there any damage to the Output Speed Sensor?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Correctly install the Output Speed Sensor in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

P0712-00-TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: **If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.**

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms

TEMPERATURE vs RESISTANCE

145Â°C (293Â°F)

105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- A short to ground malfunction is detected for the Transmission Fluid Temperature Sensor located in the oil sump.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

CHECK FOR DTCS RELATED TO OTHER INTERNAL TCM TEMPERATURE SENSORS

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any DTCs set for the other internal temperature sensors?

Yes

- Replace the TCM in accordance with the Service information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Repair is not necessary. If only one of the internal TCM temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

P0713-00-TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- A short to battery malfunction is detected for the Transmission Fluid Temperature Sensor located in the oil sump.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

CHECK FOR DTCS RELATED TO OTHER INTERNAL TCM TEMPERATURE SENSORS

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any DTCs set for the other internal temperature sensors?

Yes

- Replace the TCM in accordance with the Service information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Repair is not necessary. If only one of the internal TCM temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

P0714-00-TRANSMISSION FLUID TEMPERATURE SENSOR A CIRCUIT INTERMITTENT

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp (MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: **If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.**

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.

SET CONDITION

- A malfunction is detected on the Transmission Fluid Temperature Sensor located in the oil sump.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

POSSIBLE CAUSES

Possible Causes
NO REPAIRS REQUIRED IF ONLY ONE TEMPERATURE SENSOR HAS FAILED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

CHECK FOR DTCS RELATED TO OTHER INTERNAL TCM TEMPERATURE SENSORS

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.

Are any DTCs set for the other internal temperature sensors?

Yes

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Repair is not necessary. If only one of the internal TCM temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

P0716-00-INPUT SHAFT SPEED SENSOR 1 PERFORMANCE

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Engine speed signal is valid.
- Engine RPM is equal to or greater than a calibrated threshold.

SET CONDITION

- The difference between the input speed measured by the Transmission Control Module (TCM) and both of the following signals are greater than a calibrated value for a calibrated amount of time when there is no electrical or rationality failures of the Output Speed Sensor and no shifting is in progress:
 - The calculated input speed from the wheel speed signal from the CAN.
 - The calculated input speed from the output speed measured by the TCM.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.
- The Torque Converter Clutch (TCC) will be commanded open.
- Clutch adaptation functions will be disabled.
- Maximum system hydraulic pressure will be limited.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
3. Raise the vehicle on the hoist.
4. Start the Engine.
5. With the scan tool, monitor the Input Speed Sensor rpm.
6. Firmly apply the brake pedal and place the gear selector in DRIVE.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

7. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 7, 700 rpm?

Yes

- Go To [2](#)

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of an internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0721-00-OUTPUT SHAFT SPEED SENSOR CIRCUIT PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

NOTE: The transmission needs to be placed into Neutral to perform a 4L to 4H transfer case shift. If the operator is performing a 4L to 4H shift the potential exists for them to shift the transmission from Neutral to Drive and accelerate before the transfer case has actually shifted into 4H. The TCM deems the transfer case is

in 4H since the operator did select 4H, but the transfer case had to stay in 4L because the operator shifted to Drive too early. The TCM will set P0721-00 because of the difference of the output shaft speed compared to the expected wheel speed in this scenario.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Engine speed signal is valid.
- Engine RPM is equal to or greater than a calibrated threshold.

SET CONDITION

- The difference between the output speed measured by the Transmission Control Module (TCM) and both of the following signals are above a calibrated value for a calibrated amount of time with no shifting in progress:
 - Error in driving direction detected.
 - The calculated output speed from the wheel speed signal from the CAN.
 - The calculated output speed from the input speed measured by the TCM.

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [3](#)

No

- Go To [2](#)

2. CHECK IF THE DTC SET DURING A 4L TO 4H SHIFT

NOTE: The P0721-00 can set during a 4L to 4H transfer case shift if the vehicle transmission is shifted from N to D before the transfer case completes its shift to 4H. If the transmission is shifted to D before the transfer case completes the shift to 4H, the transfer case will default back to 4L, causing the TCM to set this DTC.

1. Determine if the P0721-00 set following a failed 4L to 4H transfer case shift.

Did the P0721-00 set during a 4L to 4H transfer case shift?

Yes

- Clear the DTC.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [3](#)

3. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of a internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P0729-00-GEAR 6 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (for example: slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the ratio of input speed to output speed to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Sixth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 6th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH C
CLUTCH D
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to the appropriate service information .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P0731-00-GEAR 1 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from First gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- When in a fixed gear the Transmission Control Module (TCM) did not detect a gear ratio equal to 1st Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into First Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH B
CLUTCH C
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To

Refer to **3**.

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to the appropriate service information .

Did the clutches pass the air pressure tests?

Yes

- Go To **4**

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to the appropriate service information **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0732-00-GEAR 2 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear

ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Second gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 2nd Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Second Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH B
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**
 1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to the appropriate service information .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.

3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [**REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

P0733-00-GEAR 3 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Third gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 3rd Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.

- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH B
CLUTCH C
CLUTCH E

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to the appropriate service information .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Replace the TCM in accordance with the Service information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0734-00-GEAR 4 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Fourth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 4th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH B
CLUTCH D
CLUTCH E

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P0735-00-GEAR 5 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Fifth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 5th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Fifth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH B
CLUTCH C
CLUTCH D

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Replace the TCM in accordance with the Service information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0746-00-PRESSURE CONTROL SOLENOID "A" PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect if one of the two Parking Lock Valves or the Position Valve in the Valve Body is stuck. The first valve is actuated by the Clutch A pressure regulator and the second valve is actuated by the Clutch C pressure regulator. The two Parking Lock Valves control the oil supply in the Valve Body to the Parking Lock. The Parking Lock can only be disengaged if both Parking Lock Valves are supplying hydraulic pressure. The solenoid controlled Position Valve controls the oil supply in the Valve Body to the clutches and to the Parking Lock.

This monitor is a once-per-trip diagnostic that only occurs after an engine start (not during remote start).

- The Parking Lock is engaged during engine off and the Parking Lock Valves are stuck in the supply position, a restart of the engine will cause an unwanted disengaging of the Parking Lock if a separate failure occurs with the second parking lock valve.
- The Parking Lock is engaged during engine off and the Position Valve is stuck in the wrong position, a restart of the engine will cause an unwanted disengaging of the Parking Lock.

WHEN MONITORED

- Once per driving cycle.

- No Controller Area Network (CAN) Engine Speed signal failures via.
- Engine has been off.
- Parking Lock Sensor indicates an engaged parking lock at key on prior to engine restart.
- Brake pressure is above a calibrated threshold.
- Engine has been in Run mode.

Set Condition:

- Parking lock is disengaged.

Default Actions:

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Second Gear via Neutral.
- Remote start feature, if equipped, will be disabled.
- Any driver requests that are not yet honored will be cleared.
- Reverse will be disabled.
- The Torque Converter Clutch (TCC) will be commanded open.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID A TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If

no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P0750-00-SHIFT SOLENOID 1 CONTROL CIRCUIT - OPEN

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- Reverse will be disabled.

- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Shift adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID A
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0755-00-SHIFT SOLENOID 2 CONTROL CIRCUIT - OPEN

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.

- The Transmission will shift into Sixth Gear via Neutral.
- Reverse will be disabled.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Shift adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID B
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P076F-00-GEAR 7 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Seventh gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 7th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Seventh Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.

- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH C
CLUTCH D

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To

Refer to [3](#).

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to **REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Replace the TCM in accordance with the Service information.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P0776-00-PRESSURE CONTROL SOLENOID "B" PERFORMANCE/STUCK OFF

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect if one of the two Parking Lock Valves or the Position Valve in the Valve Body is stuck. The first valve is actuated by the Clutch A pressure regulator and the second valve is actuated by the Clutch C pressure regulator. The two Parking Lock Valves control the oil supply in the Valve Body to the Parking Lock. The Parking Lock can only be disengaged if both Parking Lock Valves are supplying hydraulic pressure. The solenoid controlled Position Valve controls the oil supply in the Valve Body to the clutches and to the Parking Lock.

This monitor is a once-per-trip diagnostic that only occurs after an engine start (not during remote start).

- The Parking Lock is engaged during engine off and the Parking Lock Valves are stuck in the supply position, a restart of the engine will cause an unwanted disengaging of the Parking Lock if a separate failure occurs with the second parking lock valve.

- The Parking Lock is engaged during engine off and the Position Valve is stuck in the wrong position, a restart of the engine will cause an unwanted disengaging of the Parking Lock.

WHEN MONITORED

- Continuously after the ignition switch is turned to the run position.

Set Condition:

- A short to battery failure is detected when the TCM detects a short to battery failure or the PWM feedback signal at the output stage is 0%.
- An open circuit or short to ground failure is detected when the TCM detects a short to ground or open circuit failure or the PWM feedback signal at the output stage is 100%.
- An open circuit failure is detected when the TCM detects an open circuit failure in reaction to the output stage being switch off after an open circuit or short to ground failure detection.
- A short to ground failure is detected when the TCM detects a short to ground failure in reaction to the output stage being switch off after an open circuit or short to ground failure detection.

Default Actions:

DEFAULT ACTION

- Service Transmission lamp will be illuminated.
- Remote Start, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID B TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-Diagnostic Troubleshooting procedure before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .
- Test complete.

P077C-00-OUTPUT SHAFT SPEED SENSOR CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect circuit failures of the Output Speed Sensor. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCs) are set.

SET CONDITION

- The signal acquisition Application-Specific Integrated Circuit (ASIC) reports an open or short to ground condition for the output speed sensor to the main microprocessor.

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME OPEN OR SHORTED TO GROUND
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .

- If no problems are found, replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P077D-00-OUTPUT SHAFT SPEED SENSOR CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect circuit failures of the Output Speed Sensor. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCS) are set.

SET CONDITION

- The signal acquisition Application-Specific Integrated Circuit (ASIC) reports a short to power condition for the output speed sensor to the main microprocessor.

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) - WIRING HARNESS LEADFRAME OPEN OR SHORTED TO POWER
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.

4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the Speed Sensor terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- If no problems are found, replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P077E-00-TRANSMISSION FLUID TEMPERATURE MULTIPLE SENSOR CORRELATION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The transmission monitoring system uses three temperature sensors. If any one of the sensors fail, the other two sensors are used for the control and temperature monitoring calculations and the Malfunction Indicator Lamp

(MIL) will not be illuminated. The MIL will only illuminate when more than one temperature sensor has a failure.

NOTE: If only one of the temperature sensors has failed and the MIL is not illuminated, do not perform any temperature sensor related repairs. The TCM will use the other two sensors to calculate the proper transmission operation.

One of the sensors is located in the oil sump of the transmission and can be monitored with a scan tool under the Oil Temperature Sensor data parameter. This sensor is a 2-wire thermistor with a negative temperature coefficient. This means that as the temperature increases, the resistance of the sensor decreases.

The other two sensors are embedded on the Printed Circuit Board (PCB) in two separate areas of the Transmission Control Module (TCM). The TCM is attached to the valve body and therefore provides the three sensors with a strong temperature correlation. The embedded sensors can not be monitored with the scan tool and cannot be serviced separately.

The oil temperature sensor that is located in the oil sump is normally used exclusively for the transmission control calculations. The embedded sensors located in the TCM are normally used for over-temperature shutdown and temperature sensor rationality monitoring. The following table shows the relationship between temperature and resistance of the Oil Temperature Sensor located in the oil sump.

Because of the three independent signals, it is also possible to detect which sensor caused a rationality failure. As a result the transmission can operate without any restrictions, by using one of the valid sensor signals.

TEMPERATURE vs RESISTANCE	
TEMPERATURE	RESISTANCE
-30Â°C (-22Â°F)	37, 400 - 50, 600 Ohms
10Â°C (50Â°F)	5, 810 - 7, 100 Ohms
110Â°C (230Â°F)	231 - 263 Ohms
145Â°C (293Â°F)	105 - 117 Ohms

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No failure detected in the engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal.
- No failure detected in the Oil Temperature Sensor monitoring.
- Engine speed received via Controller Area Network (CAN) message or Input Speed Sensor signal is above a calibrated value for a calibrated amount of time.

SET CONDITION

- A malfunction is detected on more than one of the three temperature sensors.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID TEMPERATURE SENSOR DTC SET
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to power and ground circuits. Check Service Bulletins for possible causes that may apply. Replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P07B3-00-TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to monitor the Park Pawl Sensor for electrical failures. There are two park position switches that make up the sensor. These electrical failures include short to battery, short to ground, open circuit or if the voltage is outside of a valid range on either of the two pins of the Park Pawl Sensor. The park Pawl Sensor is integrated into the TCM and is serviced by replacing the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Electric Stop/Start function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
SENSOR SUPPLY VOLTAGE CIRCUIT OPEN
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P07B4-00-TRANSMISSION PARK POSITION SENSOR SWITCH A CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of this diagnostic is to monitor the Park Pawl Sensor for electrical failures. There are two park position switches that make up the sensor. These electrical failures include short to battery, short to ground, open circuit or if the voltage is outside of a valid range on either of the two pins of the Park Pawl Sensor. The park Pawl Sensor is integrated into the TCM and is serviced by replacing the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.

- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
PARK POSITION SENSOR SIGNAL CIRCUIT OPEN CIRCUIT
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P07B9-00-TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The purpose of this diagnostic is to monitor the Park Pawl Sensor for electrical failures. There are two park position switches that make up the sensor. These electrical failures include short to battery, short to ground, open circuit or if the voltage is outside of a valid range on either of the two pins of the Park Pawl Sensor. The park Pawl Sensor is integrated into the TCM and is serviced by replacing the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Electric Stop/Start function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
SENSOR SUPPLY VOLTAGE CIRCUIT OPEN
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P07BA-00-TRANSMISSION PARK POSITION SENSOR SWITCH B CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to monitor the Park Pawl Sensor for electrical failures. There are two park position switches that make up the sensor. These electrical failures include short to battery, short to ground, open circuit or if the voltage is outside of a valid range on either of the two pins of the Park Pawl Sensor. The park Pawl Sensor is integrated into the TCM and is serviced by replacing the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition is on.
- Transmission Control Module (TCM) battery supply voltage is within a Calibrated range.

SET CONDITION

- The electrical status signal of the HW supplier is not equal to zero.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) will be illuminated.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
PARK POSITION SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
PARK POSITION SENSOR SIGNAL CIRCUIT OPEN CIRCUIT
PARK POSITION SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Using the schematics as a guide, check TCM connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P07BF-00-INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect Input Speed Sensor circuit failures. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCs) set.

SET CONDITION

- The Transmission Control Module (TCM) detects a short to ground or open circuit condition in the Input Speed Sensor circuit.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- System hydraulic pressure will be set to maximum.
- The Torque Converter Clutch (TCC) will be commanded open.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME OPEN OR SHORTED TO GROUND
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. Read and record all DTCs.
3. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
4. Raise the vehicle on the hoist.
5. Start the Engine.
6. With the scan tool, monitor the Input Speed Sensor rpm.
7. Firmly apply the brake pedal and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

8. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 7, 700 rpm?

Yes

- Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination. Repair Transmission Internal components as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector terminals for corrosion, damage, and pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P07C0-00-INPUT/TURBINE SHAFT SPEED SENSOR 1 CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of this diagnostic is to detect Input Speed Sensor circuit failures. Failures are detected by an Application-Specific Integrated Circuit (ASIC) which communicates with the main microprocessor via a Serial Peripheral Interface (SPI) bus. The ASIC is integrated in the Transmission Control Module (TCM).

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- No sensor supply voltage Diagnostic Trouble Codes (DTCs) set.

SET CONDITION

- The Transmission Control Module (TCM) detects a short to voltage condition in the Input Speed Sensor circuit.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via Controller Area Network (CAN).
- The Torque Converter Clutch (TCC) will be commanded open.
- System hydraulic pressure will be set to maximum.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME SHORTED TO POWER
TRANSMISSION INTERNAL MECHANICAL PROBLEM
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

CHECK FOR AN ACTIVE CONDITION

1. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
2. Raise the vehicle on the hoist.
3. Start the Engine.
4. With the scan tool, monitor the Input Speed Sensor rpm.
5. Firmly apply the brake pedal and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

6. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 7, 700 rpm?

Yes

- Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination. Repair Transmission internal components as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

P07D9-00-GEAR 8 SHIFT INCORRECT RATIO

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Codes (DTCs) set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- A shift from Eighth gear to another gear to be engaged is in progress.
- The output speed and the output speed gradient must be greater than a calibrated value.

SET CONDITION

- The Transmission Control Module (TCM) did not detect a gear ratio equal to 8th Gear when commanded.
- If detected when in the process of a gear shift, the diagnostic system aborts the gear shifting and the gear from which the shifting has been started is engaged. After a calibrated number of symptoms have been detected the failure is stored and the diagnostic system engages a calibrated gear.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated as soon as the diagnostic fails.
- The Transmission will shift into Eighth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Transmission adaptations will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
CLUTCH A
CLUTCH D
CLUTCH E

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [3](#)

3. PERFORM CLUTCH AIR PRESSURE TESTS

1. Perform an air pressure test for the related clutches in accordance with the Service Information. Refer to the appropriate service information .

Did the clutches pass the air pressure tests?

Yes

- Go To [4](#)

No

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

4. CHECK WIRING AND CONNECTORS

1. The conditions necessary to set the DTC are not present at this time.
2. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
3. Wiggle the wires while checking for shorted and open circuits.
4. Check for any Service Bulletins that may apply.

Were any problems found?

Yes

- Repair as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the TCM in accordance with the Service information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P07E4-00-UNABLE TO ENGAGE PARK

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect a disengaged park pawl when the PARK position is commanded and the conditions to engage PARK are met.

A binding or obstructed Manual Park Release (MPR) can cause this DTC to set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Park Lock Sensor circuit Diagnostic Trouble Codes (DTCs) set.
- TCM is commanding PARK position.
- Engine speed is above a calibrated threshold.
- Vehicle speed is below a calibrated threshold.

SET CONDITION

- Park pawl does not engage in the lock position within a calibrated amount of time, or park pawl disengages.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Shut off engine to engage Park if there is a lever fault.
- Remote Start feature, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
MANUAL PARK RELEASE (MPR) ACTIVATED
PARK HOLD SOLENOID
PARK RELEASE SOLENOID
PARK HOLD SOLENOID WIRE HARNESS OR LEADFRAME
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK THE MANUAL PARK RELEASE (MPR) LEVER AT THE TRANSMISSION

1. Have a helper operate the shifter.
2. Raise the vehicle in the air on a suitable frame contact hoist.
3. Set the Parking Brake.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

4. Start the vehicle.
5. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [6](#)

No

- Go To [2](#)

2. DISCONNECT THE MPR CABLE AT THE TRANSMISSION

1. Shut off the vehicle.
2. Disconnect the MPR cable from the lever at the transmission.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

3. Start the vehicle.
4. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [3](#)

No

- Go To

Refer to [5](#).

3. CHECK MPR LEVER IN THE CABIN COMPARTMENT FOR ACTIVATION, OBSTRUCTIONS AND DAMAGE

1. Check the Emergency MPR Lever for activation, obstructions, binding, and damage.

Were any problems found?

Yes

- Deactivate the MPR, remove the obstruction, repair the cause of binding or, if necessary, replace the Emergency MPR Lever in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [4](#)

4. CHECK MPR CABLE FOR BINDING AND DAMAGE

1. Check MPR Cable for binding or damage that could cause this condition.

Is the MPR Cable or Lever causing this condition?

Yes

- Repair or replace the MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [5](#)

5. CHECK MPR LINKAGE ON TRANSMISSION FOR BINDING OR DAMAGE

1. Check MPR linkage on transmission for obstructions, binding, and damage.

Were any problems found?

Yes

- Remove the obstruction, repair the cause of binding or, if necessary, replace the valve body in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [6](#)

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P0850-00-PARK-NEUTRAL SWITCH PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to monitor the rationality of the park pawl sensor signal. The sensor has two pins to determine the position of the park pawl as shown in the table below.

PIN 1 = 0	PIN 2 = 0	Undefined Output
PIN 1 = 1	PIN 2 = 0	Park Pawl Engaged
PIN 1 = 0	PIN 2 = 1	Park Pawl Disengaged
PIN 1 = 1	PIN 2 = 1	Intermediate Position

This diagnostic monitors for two types of faults:

- Undefined output of the sensor
- Sensor too long in intermediate position

If the output of the sensor is undefined or the sensor is in the intermediate position too long, this Diagnostic Trouble Code (DTC) will set.

NOTE: **A binding or obstructed Manual Park Release (MPR) can cause this DTC to set.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- No sensor supply voltage Diagnostic Trouble Codes (DTCs) set.
- No Park Pawl Sensor circuit DTCs set.

SET CONDITION

- A failure is detected if one of the following occurs:
 - Undefined output signal of the park pawl sensor (Pin 1 = 0, Pin 2 = 0).
 - Sensor signal in the intermediate position for longer than a calibrated amount of time (Pin 1 = 1, Pin 2 = 1).

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Car wash Neutral hold feature is disabled.

POSSIBLE CAUSES

Possible Causes
MANUAL PARK RELEASE (MPR) OBSTRUCTION
MANUAL PARK RELEASE (MPR) BINDING
PARK PAWL SENSOR
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK THE MANUAL PARK RELEASE (MPR) LEVER AT THE TRANSMISSION

1. Have a helper operate the shifter.
2. Raise the vehicle in the air on a suitable frame contact hoist.
3. Set the Parking Brake.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

4. Start the vehicle.
5. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [6](#)

No

- Go To [2](#)

2. DISCONNECT THE MPR CABLE AT THE TRANSMISSION

1. Shut off the vehicle.
2. Disconnect the MPR cable from the lever at the transmission.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

3. Start the vehicle.
4. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [3](#)

No

- Go To

Refer to [5](#).

3. CHECK MPR LEVER IN THE CABIN COMPARTMENT FOR ACTIVATION, OBSTRUCTIONS AND DAMAGE

1. Check the Emergency MPR Lever for activation, obstructions, binding, and damage.

Were any problems found?

Yes

- Deactivate the MPR, remove the obstruction, repair the cause of binding or, if necessary, replace the Emergency MPR Lever in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [4](#)

4. CHECK MPR CABLE FOR BINDING AND DAMAGE

1. Check MPR Cable for binding or damage that could cause this condition.

Is the MPR Cable or Lever causing this condition?

Yes

- Repair or replace the MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [5](#)

5. CHECK MPR LINKAGE ON TRANSMISSION FOR BINDING OR DAMAGE

1. Check MPR linkage on transmission for obstructions, binding, and damage.

Were any problems found?

Yes

- Remove the obstruction, repair the cause of binding or, if necessary, replace the valve body in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Go To [6](#)

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P093A-00-HYDRAULIC ACCUMULATOR SOLENOID OPEN

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.
- Condition Two:
 - Ignition on.

- Output stages power supply is activated.
- Output stage is commanded between 5% and 95% PWM.
- Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty or no duty phase.
- Condition Two:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty phase.
 - Voltage of output signal is greater than a calibrated threshold during PWM no duty phase.
 - Voltage of output signal is less than a calibrated threshold during PWM no duty phase.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
HYDRAULIC IMPULSE SOLENOID (HIS) DISCONNECTED TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR DTC P1D8C-00

1. Using the scan tool, check if DTC P1D8C-00 is set in conjunction with P093A-00.

Is the DTC P1D8C-00 set in the TCM also?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Go To [3](#)

3. CHECK THE HYDRAULIC IMPULSE SOLENOID (HIS) HARNESS CONNECTOR

1. Remove the transmission oil pan.
2. Inspect the HIS connector is properly connected at the solenoid.

Is the HIS harness connector properly connected to the solenoid?

Yes

- Go To [4](#)

No

- Properly connect the harness to the HIS.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

4. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

- Cleaning the leadframe corrected the condition.

P093B-00-HYDRAULIC ACCUMULATOR SOLENOID SHORT TO GROUND

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.
- Condition Three:
 - Output stages power supply is activated.
 - Output stage is commanded to 100% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty or no duty phase is less than a calibrated value.
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Two:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Three:
 - A short to ground failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.

- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCS.
7. Road test the vehicle and check for DTCS.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P093C-00-HYDRAULIC ACCUMULATOR SOLENOID SHORT TO BATTERY

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Output stage is commanded above 5% Pulse Width Modulated (PWM).
- Output stages power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the voltage of the output signal during PWM duty phase is greater than or equal to a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Hydraulic Impulse System (HIS) Low Side Switch will be turned off.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0960-00-PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT OPEN

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- An open circuit failure is detected by the Application-Specific Integrated Circuit (ASIC) in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- An open circuit failure is detected by the ASIC in reaction to the output stage being switched off after the Pulse Width Modulated (PWM) feedback is 100% at the output stage.

DEFAULT ACTION

- MIL is illuminated on the first trip that the diagnostic fails.
- System Pressure Regulator Low Side Switch will be turned off.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. **READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN**

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0962-00-PRESSURE CONTROL SOLENOID 1 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the second consecutive trip that the diagnostic fails.
- Low Side System Pressure Regulator Switch will be turned off.

POSSIBLE CAUSES

Possible Causes
PRESSURE CONTROL SOLENOID 1 TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0972-00-SHIFT SOLENOID 1 CONTROL CIRCUIT PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral

Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.
- Output stages power supply is active.
- Power supply voltage is within a calibrated range.

SET CONDITION

- The calculated solenoid current is less than a calibrated value and no shifting is in progress.
- The calculated solenoid current is greater than a calibrated value and no shifting is in progress.
- A Serial Peripheral Interface (SPI) communication failure in the SPI communication between the Central Processing Unit (CPU) and the ASIC is detected based upon the validity of the check-byte, the timing and the feedback signal of the message.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

- Test complete.

P0974-00-SHIFT SOLENOID 1 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Fourth Gear via Neutral.
- Any driver requests that are not yet honored will be cleared.
- Reverse will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 1
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

- Test complete.

P0975-00-SHIFT SOLENOID B CONTROL CIRCUIT PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is active.
- Power supply voltage is within a calibrated range.

SET CONDITION

- The calculated solenoid current is less than a calibrated value and no shifting is in progress.
- The calculated solenoid current is greater than a calibrated value and no shifting is in progress.
- A Serial Peripheral Interface (SPI) communication failure in the SPI communication between the Central Processing Unit (CPU) and the ASIC is detected based upon the validity of the check-byte, the timing and the feedback signal of the message.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID B
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM.. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0976-00-SHIFT SOLENOID 2 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.

- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 2
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0977-00-SHIFT SOLENOID 2 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- Any driver requests that are not yet honored will be cleared.

- Reverse will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Clutch adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 2
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0978-00-SHIFT SOLENOID 3 CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.

- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 3
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0979-00-SHIFT SOLENOID 3 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID C
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.

5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0980-00-SHIFT SOLENOID 3 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Shift adaptation functions will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 3 TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.

3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P0981-00-SHIFT SOLENOID 4 CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.

- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Shut off engine to engage Park if there is a lever fault.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 4
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION**.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST**.
- Test complete.

P0982-00-SHIFT SOLENOID 4 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 4 TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .
- Test complete.

P0983-00-SHIFT SOLENOID 4 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 4
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0984-00-SHIFT SOLENOID 5 CONTROL CIRCUIT RANGE-PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further

evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 5
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCS.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0985-00-SHIFT SOLENOID 5 CONTROL CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery
- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform

rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to ground failure is detected if the ASIC indicates a short to ground failure in reaction to the output stage being switched off after an open circuit or short to ground failure detection.
- A short to ground or open circuit failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 5
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.

4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P0986-00-SHIFT SOLENOID 5 CONTROL CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The current regulator in the Transmission Control Module (TCM) indicates the following circuit failures to the Central Processing Unit (CPU) using an Application Specific Integrated Circuit (ASIC) via Serial Peripheral Interface (SPI) Bus:

- Short to battery

- Short to ground or open circuit (can only be distinguished when the output stage is in idle mode, i.e. commanded current is 0 mA)

In addition to the circuit failure information, the TCM monitoring software uses a Pulse Width Modulated (PWM) feedback signal generated by the current regulator in the output stage to identify failures. To perform rationality monitoring of the output stage current, the TCM software calculates the actual current dependent on the PWM feedback signal, the output stage power supply voltage and the actual transmission oil temperature. The TCM can only distinguish between a short to ground and an open circuit failure if the output stage is deactivated. Depending on the required time to bring the transmission into a Limp Home mode, a further evaluation of the failure is determined after switching off the output stage in order to distinguish between both failure types.

NOTE: **The TCM is integrated with the valve body. This assembly includes all solenoids and circuits from the TCM to the solenoids and sensors. If the TCM requires replacement, the entire valve body is replaced.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the Application-Specific Integrated Circuit (ASIC) indicates a short to battery failure or the PWM feedback signal at the output stage is 0%.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
SHIFT SOLENOID 5
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1614-00-ECU RESET-RECOVERY OCCURRED

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to determine the reason of a reset after the reset occurred. Some of these are initiated by the Transmission Control Module (TCM) software and others may be caused by an under voltage

condition. If the TCM detects a condition for initiating a reset, the reason of the reset is stored in an area of Random Access Memory (RAM) that is not initialized during TCM re-initialization. Upon TCM initialization this information is read out to store an appropriate DTC indicating the reason for the reset.

This diagnostic detects an under voltage reset of the TCM during normal operation (no engine start present). Under voltage resets during engine start will not be stored within the TCM.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- The TCM is powered and the Output Speed Sensor is greater than or equal to 100 RPM or engine speed is greater than or equal to 600 RPM, or ignition is on and no engine start is detected.

SET CONDITION

- A reset code for low level software or under voltage condition has been stored in the non volatile RAM, or startup flag is present in the EEPROM and no shutdown flag present in the EEPROM.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the second consecutive trip that the diagnostic fails.

POSSIBLE CAUSES

Possible Causes
LOW BATTERY VOLTAGE TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCS)

1. With the scan tool, read Powertrain Control Module (PCM) DTCs.

Are any Charging System DTCs set?

Yes

- Repair the Charging System DTCs. Refer to the appropriate service information .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK THE (A190) 12 VOLT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT

1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

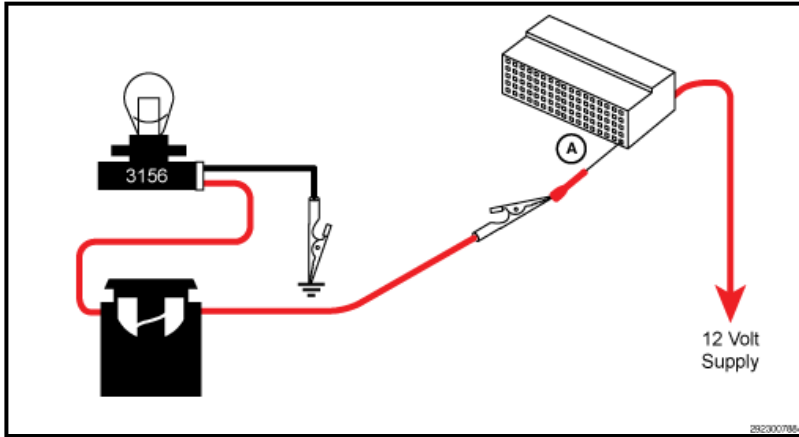
NOTE: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .

NOTE: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.

NOTE: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:

1. Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.
2. Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.
3. The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to [CIRCUIT LOAD TESTING PROCEDURES](#) .



NOTE: When probing a circuit at an Electronic Control Unit (ECU) harness connector, always use an appropriate back probing tool to prevent any possible damage to the ECU terminals.

NOTE: Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.

Is the load test bulb illuminated and bright?

Yes

- Using the schematics as a guide, check the TCM connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Repair the 12.0 volt circuit for an open or high resistance.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1634-00-TCM INTERNAL - INTERNAL WATCHDOG PERFORMANCE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is two fold:

1. To monitor all inhibit path functionalities needed to bring the Transmission Control Module (TCM) to a safe state in case of a failure. Proper inhibit path operation means that the TCM is able to switch off a single output stage and it is able to switch off all output stages by:

- Switching off the output stages power supply (High Side Switch)
- Activating the peripheral reset line
- Deactivating the peripheral clock

Functional Check of Inhibit Path: To ensure that the deactivation of the output stages is working correctly, the functionalities for deactivation of the output stages are tested during initialization of the TCM.

Rationality Check of Peripheral Reset Line: The peripheral reset line is monitored for an unexpected reset during normal operation.

Rationality Check of Peripheral Clock when Peripheral Clock is switched Off or switched On: All actuators are controlled by the peripheral clock. In some cases the peripheral clock is used to deactivate the actuators (e.g. if the SPI communication is disturbed). Therefore the peripheral clock is also monitored by using hardware information from the controlling ASIC.

2. Watchdog monitoring.

Rationality Check between the CPU and the watchdog ASIC: The watchdog ASIC provides a question randomly out of a number of predefined questions, which the CPU receives via the Serial Peripheral Interface (SPI) bus. The CPU must respond correctly within a defined time period. A wrong answer leads to an increment and a correct answer leads to a decrement of the watchdog internal error counter (minimum value: 0, maximum value: 8). Values between 0 and 4 indicate normal behavior because the CPU does not necessarily always answer correctly (see following paragraph). If the value of the error counter reaches 5, the output stages to the solenoids will be switched off by the watchdog ASIC. If the value of the error counter reaches 8, the watchdog ASIC will initiate a TCM reset and the CPU will store a failure.

In order to check the correct behavior of the watchdog ASIC, the CPU purposely does not always answer the questions of the watchdog correctly. The watchdog monitoring software in the TCM occasionally sends wrong answers or sends correct answers too early or too late (failure in timing) to the watchdog ASIC. The CPU then compares the error counter of the watchdog ASIC, which is transmitted in a SPI message, with the expected value calculated in the CPU. If the received watchdog error counter value is unequal to the expected value, the CPU increments its own error counter. A failure is detected if the CPU error counter is greater than a threshold.

Program Flow Control: To ensure that all safety relevant software modules are processed in the correct sequence, the questions transmitted by the watchdog ASIC to the CPU are answered by an algorithm that uses the checksums of all safety relevant software modules. This algorithm responds back to the watchdog ASIC with a correct answer only if all software module checksums are processed in the right order.

WHEN MONITORED

- This diagnostic runs continuously with the ignition on.

SET CONDITION

- The Transmission Control Module (TCM) has detected an internal failure.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [2](#).

No

- Go To

Refer to [3](#).

2. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.

2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P167A-00-CALIBRATION MISMATCH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of this diagnostic is to detect if the programmed Transmission Control Module (TCM) software matches the Hydraulic Identification Number stored in the Electronically Erasable Programmable Read Only Memory (EEPROM) of the TCM which indicates the type of hydraulic hardware is in the transmission. This Hydraulic Identification Number is stored during manufacturing of the Valve Body by the transmission supplier.

This DTC may set if the TCM is replaced without performing the Transmission Adaptation procedure or the incorrect TCM assembly is installed into a vehicle.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The Transmission Control Module (TCM) detects the variables that dictate the vehicle application are not present.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.

- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
GENERIC CALIBRATIONS PROGRAMMED IN TCM TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

PROGRAM THE TRANSMISSION CONTROL MODULE (TCM)

NOTE: Controller is programmed with generic boot and trim calibrations and will not allow the correct vehicle Powertrain management.

1. With the scan tool, attempt to program the TCM with the latest calibrations in accordance with the Service Information. Refer to the appropriate service information .

Were you able to program the TCM successfully?

Yes

- Test complete.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P1731-00-INCORRECT GEAR ENGAGED

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The purpose of this diagnostic is to make sure that the input and output of the Transmission Control Module (TCM) shift by wire software corresponds. The input to the TCM shift by wire software is the driver request, vehicle and transmission conditions.

The following conditions are monitored by this diagnostic:

- A change in transmission position has occurred that was not requested.
- A requested change in transmission position from R/N/D has not occurred.
- The shift by wire stored values in Random Access Memory (RAM) have been corrupted.
- The transmission position transmitted between the shift by wire and the shift control software has been corrupted.
- The engaged transmission position is not displayed to the driver.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- TCM initialization completed.

SET CONDITION

- The TCM has determined a gear position based on input signals that does not correlate with the actual Gear Shift position as determined by the Electronic Shift Module (ESM).
- The TCM does not recognize a request to a change in driving direction from the ESM.
- The TCM determines that one of the conditions for an Auto Neutral is present that does not correlate with the ESM signal.
- The TCM determines that one of the conditions for an Auto Park is present when the vehicle speed is less than or equal to a calibrated value that does not correlate with the ESM signal.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE (TCM) SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

NOTE: Read Service Bulletins to determine if the software update is applicable to the customer complaint.

1. With the scan tool, check if a TCM software update is available that may be related to the customer complaint.

Is an update available?

Yes

- Go To

Refer to [2](#).

No

- Go To

Refer to [3](#).

2. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

P1778-00-INPUT-TURBINE SHAFT SPEED SENSOR A OUT OF RANGE HIGH

For a complete TRANSMISSION wiring diagram, Refer to the appropriate wiring information .

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- The raw value of the turbine speed measured by the Transmission Control Module (TCM) is greater than a calibrated value for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will be placed into Third Gear Limp-in mode.
- The TCM will not request any positive torque interventions from the Powertrain Control Module (PCM) via CAN.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
3. Raise the vehicle on the hoist.
4. Start the Engine.
5. With the scan tool, monitor the Input Speed Sensor rpm.
6. Firmly apply the brake pedal and place the gear selector in DRIVE.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

7. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Input Speed Sensor display an engine speed above 14, 000 rpm?

Yes

- Go To [2](#)

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of an internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

P177F-00-OUTPUT SHAFT SPEED SENSOR OUT OF RANGE HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) can detect rationality failures of the Input (Turbine) Speed Sensor and Output Speed Sensor signals as well as the wheel speed and engine speed signals received through the Controller Area Network (CAN).

The TCM performs three diagnostic checks that include:

- Multi sensor comparisons of up to three speed signals (input, output and wheel speed).
- Monitoring of the gradient of the input speed signal.
- Double failure monitoring to determine unique failure situations which could require unique limp-in functionality.

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Ignition on.

SET CONDITION

- The raw value of the transmission output speed measured by the Transmission Control Module (TCM) is above a calibrated value for a calibrated amount of time:

DEFAULT ACTION

- Service Transmission message will be displayed.
- Clutch adaptation functions will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION INTERNAL FAILURE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, erase Transmission Control Module (TCM) Diagnostic Trouble Codes (DTCs).
3. Raise the vehicle on the hoist.
4. Start the Engine.
5. With the scan tool, monitor the Output Speed Sensor rpm.
6. Firmly apply the brake pedal and place the gear selector in Drive.

WARNING: To avoid personal injury or death, keep hands and feet clear of rotating wheels.

7. Release the brakes and raise the engine speed to allow the Transmission to perform a 2-3 and 3-4 upshift.

Did the Output Speed Sensor display a value above 10, 000 rpm?

Yes

- Go To [2](#)

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. CHECK TRANSMISSION FOR INTERNAL FAILURE

NOTE: This DTC is an indication of a internal Transmission failure.

1. Remove the Transmission Oil Pan and inspect for excessive debris such as clutch friction material or metal contamination.

Is there any indication of an internal Transmission failure?

Yes

- Repair internal Transmission as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1B13-00-PARK BY WIRE UNINTENDED OUT OF PARK POSITION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The purpose of the diagnostic is to detect a disengaged park pawl when the PARK position is commanded and the conditions to engage PARK are met.

A binding or obstructed Manual Park Release (MPR) can cause this DTC to set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- No Park Lock Sensor circuit Diagnostic Trouble Codes (DTCs) set.
- TCM is commanding PARK position.
- Vehicle speed is below a calibrated value.

SET CONDITION

- Park pawl does not engage in the lock position within a calibrated amount of time, or park pawl disengages.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) may be illuminated.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- Remote Start feature, if equipped, will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK RELEASE SOLENOID

Possible Causes

PARK HOLD SOLENOID
MANUAL PARK RELEASE (MPR) ACTIVATED
PARK HOLD SOLENOID WIRE HARNESS OR LEADFRAME
TRANSMISSION CONTROL MODULE (TCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK THE MANUAL PARK RELEASE (MPR) LEVER AT THE TRANSMISSION

1. Have a helper operate the shifter.
2. Raise the vehicle in the air on a suitable frame contact hoist.
3. Set the Parking Brake.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

4. Start the vehicle.
5. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [6](#)

No

- Go To [2](#)

2. DISCONNECT THE MPR CABLE AT THE TRANSMISSION

1. Shut off the vehicle.
2. Disconnect the MPR cable from the lever at the transmission.

WARNING: BE SURE TO KEEP HANDS, FEET AND CLOTHING CLEAR OF ROTATING COMPONENTS.

3. Start the vehicle.
4. With the service brakes applied, have a person slowly shift the transmission from park to Drive and back to Park while you observe the MPR lever at the transmission.

Does the MPR lever move at the transmission when shifting the transmission?

Yes

- Go To [3](#)

No

- Go To

Refer to [5](#).

3. CHECK MPR LEVER IN THE CABIN COMPARTMENT FOR ACTIVATION, OBSTRUCTIONS AND DAMAGE

1. Check the Emergency MPR Lever for activation, obstructions, binding, and damage.

Were any problems found?

Yes

- Deactivate the MPR, remove the obstruction, repair the cause of binding or, if necessary, replace the Emergency MPR Lever in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#).

No

- Go To [4](#)

4. CHECK MPR CABLE FOR BINDING AND DAMAGE

1. Check MPR Cable for binding or damage that could cause this condition.

Is the MPR Cable or Lever causing this condition?

Yes

- Repair or replace the MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#).

No

- Go To [5](#)

5. CHECK MPR LINKAGE ON TRANSMISSION FOR BINDING OR DAMAGE

1. Check MPR linkage on transmission for obstructions, binding, and damage.

Were any problems found?

Yes

- Remove the obstruction, repair the cause of binding or, if necessary, replace the valve body in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#).

No

- Go To [6](#)

6. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.

6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to **TESTING FOR AN INTERMITTENT CONDITION** .

P1B14-00-PARK BY WIRE UNINTENDED PARK POSITION

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The purpose of the diagnostic is to detect an engaged park pawl when the Shifter is in the DRIVE, NEUTRAL, or REVERSE position.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Engine speed is above a calibrated value.
- No Park Lock Sensor circuit Diagnostic Trouble Codes (DTCs) set.
- Shifter is in DRIVE, NEUTRAL or REVERSE position.

SET CONDITION

- The park pawl is engaged for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Electric Stop/Start function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
MANUAL PARK RELEASE (MPR) BINDING OR OBSTRUCTED
LOW LINE PRESSURE ON STARTUP
PARK RELEASE SOLENOID
PARK HOLD SOLENOID
TRANSMISSION

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE DIAGNOSTIC TROUBLE CODE (DTC)

NOTE: If there are any active line pressure, solenoid or gear ratio/clutch DTCs present, diagnose and repair those first before proceeding with this test.

1. With the scan tool, read Transmission Control Module (TCM) DTCs and record on the repair order.
2. Record the Event Data and Environmental Data.
3. With the scan tool, erase DTCs.

NOTE: Stop the vehicle and place shifter into PARK position multiple times during the next step.

4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.
5. With the scan tool, read TCM DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK MANUAL PARK RELEASE (MPR) CABLE AND LEVER

1. Check MPR Cable and Lever for binding, obstruction, or damage that could cause this condition.
 - Check that the system operates smoothly from the lever inside the vehicle.
 - Check that the cable is properly routed with no sharp bends or kinks.
 - Check the levers at the operator end and transmission ends for any obstructions that could prevent full range of movement.
 - If necessary, disconnect the MPR cable from the lever at the transmission to isolate any conditions found.

Is the MPR Cable or Lever binding, obstructed or damaged?

Yes

- Repair MPR Cable or Lever as necessary.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [3](#)

3. CHECK TRANSMISSION FLUID LEVEL AND CONDITION

1. Check the transmission fluid level in accordance with the Service Information. Refer to the appropriate service information .

Is the transmission fluid level correct and appear in good condition?

Yes

- Go To [6](#)

No, transmission fluid level is low but appears in good condition.

- Go To

Refer to [4](#).

Transmission fluid condition is deteriorated.

- Go To [5](#)

4. FILL THE TRANSMISSION FLUID TO THE CORRECT LEVEL

1. Correct the transmission fluid level in accordance with the Service Information. Refer to the appropriate service information .
2. Turn the ignition on.
3. With the scan tool, erase DTCs.

NOTE: Stop the vehicle and place shifter into PARK position multiple times during the next step.

4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.

Did the DTC return?

Yes

- Go To [5](#)

No

- Correcting the transmission fluid level repaired the fault.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

5. REMOVE THE TRANSMISSION OIL PAN FOR INSPECTION

1. Remove the transmission oil pan.
2. Check the transmission oil pan for debris that indicates an internal transmission problem.
3. Inspect the Transmission oil filter for damage or visual indications of flow restriction.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [6](#)

6. REPLACE THE VALVE BODY AND RETEST FOR DTCS

1. Replace the valve body in accordance with the Service Information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
2. Turn the ignition on.
3. With the scan tool, erase DTCs.

NOTE: Stop the vehicle and place shifter into PARK position multiple times during the next step.

4. Using the recorded Event and Environmental Data, along with the When Monitored and Set Conditions above, operate the vehicle in the conditions that set the DTC.

Did the DTC return?

Yes

- Replace the Transmission in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#).
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

No

- Replacing the faulty component repaired the fault.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#).

P1D25-00-SHIFT CONTROL RATIONALITY

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information**.

THEORY OF OPERATION

The purpose of this diagnostic is to detect a faulty position on the interface between the shift by wire software and the shift control software. This diagnostic also compares the target position sent to the shift control software to the read back position from this interface.

WHEN MONITORED

- This diagnostic runs continuously when the ignition is on.

SET CONDITION

- The commanded gear position received by the TCM from the Electronic Shifter Module and the actual gear position of the transmission do not correlate for a calibrated amount of time.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Remote Start feature, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION CONTROL MODULE SOFTWARE
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To

Refer to [2](#).

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK IF TRANSMISSION CONTROL MODULE (TCM) SOFTWARE UPDATE IS AVAILABLE

1. With the scan tool, check if a TCM software update is available.

Is an update available?

Yes

- Go To

Refer to [3](#).

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

3. PROGRAM THE TCM

1. Perform the TCM PROGRAMMING PROCEDURE. Refer to the appropriate service information .
2. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

Were you able to successfully program the TCM and pass the TRANSMISSION VERIFICATION TEST?

Yes

- Test Complete.

No

- Using the schematics as a guide, check the Transmission Control Module (TCM) connector and all related in-line connector terminals for corrosion, damage, or pushed out terminals. Pay particular attention to the power and ground circuits. If no problems are found, replace and program the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

P1D78-00-PARK SOLENOID CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.
- Condition Three:
 - Output stages power supply is activated.
 - Output stage is commanded to 100% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:

- A short to ground failure is detected if the voltage of the output signal during PWM duty or no duty phase is less than a calibrated value.
- A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Two:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Three:
 - A short to ground failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK SOLENOID
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [**TESTING FOR AN INTERMITTENT CONDITION**](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [**MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION**](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [**TRANSMISSION VERIFICATION TEST**](#) .
- Test complete.

P1D79-00-PARK SOLENOID CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Output stage is commanded above 5% Pulse Width Modulated (PWM).
- Output stages power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the voltage of the output signal during PWM duty phase is greater than or equal to a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission lamp will be illuminated.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK SOLENOID TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.

3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P1D8A-00-PARK PAWL SOLENOID CIRCUIT LOW

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
- Condition Two:
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.
- Condition Three:
 - Output stages power supply is activated.

- Output stage is commanded to 100% Pulse Width Modulated (PWM).
- Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty or no duty phase is less than a calibrated value.
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Two:
 - A short to ground failure is detected if the voltage of the output signal during PWM duty phase is less than a calibrated value.
- Condition Three:
 - A short to ground failure is detected if the commanded duty cycle for the solenoid is 100% and the ASIC indicates the output stage is switched off.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Shut off engine to engage Park if there is a lever fault.
- The Transmission will be placed into fixed Sixth Gear Limp-in mode.
- Any driver requests that are not yet honored will be cleared.
- Remote Start feature, if equipped, will be disabled.
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode) will be disabled.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK LOCK SOLENOID
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1D8B-00-PARK PAWL SOLENOID CIRCUIT HIGH

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Ignition on.
- Output stages power supply is activated.
- Output stage is commanded above 5% Pulse Width Modulated (PWM).
- Output stages power supply voltage is within a calibrated range.

SET CONDITION

- A short to battery failure is detected if the voltage of the output signal during PWM duty phase is greater than or equal to a calibrated threshold.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Low Side Switch is turned off to the Park Lock Magnet.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK LOCK SOLENOID
TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.

3. Remove the transmission oil pan and the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to **MODULE, TRANSMISSION CONTROL (TCM), REMOVAL AND INSTALLATION** .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
- Test complete.

P1D8C-00-PARK PAWL SOLENOID CIRCUIT OPEN

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) measures the actual solenoid voltages and compares them to calibrated values to identify the following electrical failures:

- Short to battery
- Open circuit
- Short to ground

When the solenoid is switched on (i.e. commanded control value is 100%), the diagnostic can not distinguish between short to ground and open circuit. In that case, the Application-Specific Integrated Circuit (ASIC) status information is used to detect the failure.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Condition One:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded to 0% Pulse Width Modulated (PWM).
 - Power supply voltage is within a calibrated range.
- Condition Two:
 - Ignition on.
 - Output stages power supply is activated.
 - Output stage is commanded between 5% and 95% PWM.
 - Power supply voltage is within a calibrated range.

SET CONDITION

- Condition One:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty or no duty phase.
- Condition Two:
 - Voltage of output signal is less than or equal to a calibrated threshold during PWM duty phase.
 - Voltage of output signal is greater than a calibrated threshold during PWM no duty phase.
 - Voltage of output signal is less than a calibrated threshold during PWM no duty phase.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- Service Transmission message will be displayed.
- Engine Stop/Start (ESS) function will be disabled.

POSSIBLE CAUSES

Possible Causes
PARK LOCK SOLENOID TRANSMISSION CONTROL MODULE (TCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

2. CHECK FOR DTC P093A-00

1. Using the scan tool, check if DTC P093A-00 is set in conjunction with P1D8C-00.

Is the DTC P093A-00 set in the TCM also?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Go To [3](#)

3. CHECK TRANSMISSION CONTROL MODULE (TCM) WIRING HARNESS LEADFRAME

1. Using the schematics as a guide, check the TCM terminals for corrosion, damage or pushed out terminals.
2. Check Service Information Tune-ups or Service Bulletins for possible causes that may apply.
3. Remove the transmission oil pan and the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
4. Inspect and clean the solenoid terminals at the wiring harness leadframe for metallic contamination.
5. Reinstall the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
6. With the scan tool, erase TCM DTCs.
7. Road test the vehicle and check for DTCs.

Did the DTC return?

Yes

- Replace the TCM in accordance with the Service Information. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
- Test complete.

P1D8F-00-INCORRECT GEAR RATIO CLUTCH 1 DEFECTIVE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information** .

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.

- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Third Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Engine Stop/Start (ESS) function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to the appropriate service information .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

THEORY OF OPERATION

The Transmission Control Module (TCM) monitors for conditions which lead to an unexpected transmission gear ratio (e.g. slipping clutches, hydraulic or mechanical defects, etc.). The TCM compares the actual gear ratio (i.e. the ratio of input speed to output speed) to a minimum and maximum calibrated gear ratio value. The TCM performs this comparison while driving in a fixed gear, during gear engagement, and during shifting from one gear to another.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Shifter is in the DRIVE or REVERSE position.
- Transmission oil temperature is greater than a calibrated value.
- No clutch slip control functions commanded.
- No Input Speed Sensor signal Diagnostic Trouble Code (DTC)s set.
- Input Speed Sensor signal is greater than a calibrated value.
- Output Speed Sensor signal is valid or the output speed can be calculated from the wheel speed Controller Area Network (CAN) signal if the Output Speed Sensor signal is not available.
- Engine speed signal via CAN or output speed signal is greater than a calibrated value.
- During a gear shift:
 - The output speed and the output speed gradient must be greater than a calibrated value.
- When a gear is engaged:
 - The absolute value of the input speed gradient and pedal position must be less than their respective calibrated values.

SET CONDITION

- After a calibrated number of failure symptoms are detected, the DTC is stored and the Transmission Control Module (TCM) commands a calibrated default gear. This gear is monitored as well and if a failure is detected for this gear, an alternative default gear is engaged and so on. The selection of alternative default gears follows a calibrated logic. This logic will detect a damaged clutch and to finally select an alternative gear that consists of a combination of clutches in which the damaged clutch is not involved. If a further failure symptom occurs in this final alternative default gear, a failure for general Transmission ratio malfunction is stored.

DEFAULT ACTION

- Malfunction Indicator Lamp (MIL) is illuminated on the first trip that the diagnostic fails.
- The Transmission will shift into Sixth Gear via Neutral.
- The Torque Converter Clutch (TCC) will be commanded open.
- Disable storage of driver requests for REVERSE and DRIVE.
- REVERSE gear will not be available.
- Electric Stop/Start function, if equipped, will be disabled.
- Disable temporary manual mode input (shift paddles).
- Special shifting modes (Manual Mode, Sport Mode, Tow Mode, ERS) will be disabled.
- Transmission adaptations will be disabled.

POSSIBLE CAUSES

Possible Causes
TRANSMISSION FLUID LEVEL
INTERNAL TRANSMISSION FAILURE

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. CHECK TRANSMISSION FLUID LEVEL

1. Check the transmission fluid level in accordance with the Service Information. Refer to the appropriate service information .

Is the transmission fluid at the correct level?

Yes

- Go To

Refer to [2](#).

No

- Correct the transmission fluid level.
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

NOTE: With the scan tool, read Transmission Control Module (TCM) DTCs and record the Event and Environmental Data on the repair order as it may be needed to determine the root cause of this DTC. It may be very difficult to reset this DTC so this step is very important.

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. With the scan tool, run a vehicle Scan Report, or record the Environmental Data related to the DTCs.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the recorded Environmental Data and the When Monitored Conditions above, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the TESTING FOR AN INTERMITTENT CONDITION procedure. Refer to [TESTING FOR AN INTERMITTENT CONDITION](#) .

3. CHECK TRANSMISSION FLUID CONDITION

1. Check the Transmission fluid condition.

Is the Transmission fluid burnt?

Yes

- Remove the Transmission and perform the appropriate repair for this DTC in accordance with the Service Information. Refer to [REMOVAL AND INSTALLATION](#) .
- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

No

- Replace the Valve Body in accordance with the Service information. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#) .
 - Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .
-

2021 AUTOMATIC TRANSMISSION

8Hp75 Automatic Transmission - Pre-Diagnostic Troubleshooting Procedure, Transmission Verification Test & TCM Adaptation - Gladiator

STANDARD PROCEDURE

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For a complete TRANSMISSION wiring diagram, **Refer to the appropriate wiring information .**

DIAGNOSTIC TROUBLESHOOTING PROCEDURE

The Pre-Diagnostic Troubleshooting Procedure is intended to provide the technician with a common starting point for all DTC troubleshooting procedures. The DTC troubleshooting procedures assume that the following steps have been performed and therefore are not always repeated. Failure to follow the steps in this procedure can lead to misdiagnosis.

If any repairs are performed, perform the appropriate VERIFICATION TEST.

NOTE: **Do not perform repairs not related to the customer complaint.**

1. With the scan tool, **read DTCs and record on the repair order .**
2. With the scan tool, **run a Vehicle Scan Report and a ECU Configuration Report** and save the files for future use.
3. **Check the vehicle repair history** for any recent repairs that may be related to the customer complaint.
4. If possibly related to the customer complaint, **verify the vehicle build configuration** with the OEM Vehicle Build Configuration on Service Library or TechCONNECT. Properly configure the vehicle if necessary.
5. If possibly related to the customer complaint, **verify all Electronic Control Units (ECU)s have the same Original Vehicle Identification Number (VIN) .** If a mismatch is found, this could indicate the source of the problem. Typically, this condition will cause multiple communication DTCs to set however, this is not always the case.
6. With a scan tool, **check all ECUs for available software updates** that are related to the customer complaint.
 - Read Service Bulletins to determine if the software update is applicable to the customer complaint.
 - Update the (ECU)s if necessary.
7. Use the Search function in Service Library or TechCONNECT to **read any related information under SERVICE ACTIONS/TIPS .**
 - Perform any Service Bulletins or other procedures that may apply.
8. **Check for aftermarket electrical accessories .** Be certain they are installed properly and do not interfere with any related power, ground, signal, or communication circuits. Be certain aftermarket wiring harnesses are routed away from vehicle wiring harness to avoid Electromagnetic Interference (EMI) where applicable.

NOTE: **A low battery State Of Charge (SOC) or a charging system that is not operating properly can cause many symptoms and DTCs to set.**

9. If possibly related to the customer complaint, **check the vehicle charging system and battery for proper operation .** Refer to the appropriate Service Information.

NOTE: **Incorrect fluid level, incorrect fluid, fluid contamination, and poor fluid condition can cause many Transmission symptoms.**

10. **Check the Transmission Fluid for proper level and condition** . Visually inspect for external leaks and repair as necessary in accordance with the Service Information.

NOTE: **The Engine must be operating properly for the Transmission to operate properly.**

11. With the scan tool, read Powertrain Control Module (PCM) DTCs. **Repair all PCM DTCs prior to performing Transmission diagnostic procedures.**

12. **Check other ECUs for DTCs** that could cause this DTC to set.

13. If multiple DTCs are set in one ECU, and no detectable pattern is evident (for example, the DTCs are not related to just one or two components or subsystems), **check the applicable ECU ground circuit(s) for proper continuity** . As a general rule, **diagnose the DTCs in the following order** unless instructed otherwise by the specific DTC procedure:

1. ECU Configuration DTCs
2. ECU Voltage DTCs
3. ECU Internal Error DTCs
4. Circuit Fault DTCs (Low voltage, High Voltage, Open Circuit, Short Circuit, Low Current, High Current,)
5. Communication DTCs (See below)
6. Performance / Rationality DTCs
7. Implausible or Invalid Data
8. Missing Message
9. Other

14. If multiple communication DTCs are set, **diagnose the DTCs in the following order** unless instructed otherwise by the specific DTC procedure:

1. CAN Bus Off
2. CAN Bus Off Performance
3. Lost Communication
4. Other

NOTE: **IMPORTANT: Some Control Modules simply pass information from one Control Module to the other. In some cases, a U-code DTC may be set that implicates the "pass-through" module that sent the information. For example, if an Engine Coolant Temperature (ECT) Sensor DTC is set in the Powertrain Control Module (PCM), the HVAC module may set an "Implausible Data from BCM" DTC because the BCM is the module that normally passes that information from the PCM to the HVAC module. However, the BCM may not set any DTCs related to the faulted ECT Sensor because the BCM does not use the ECT information. In this case, the PCM ECT DTC should be diagnosed before the Implausible Data DTC. If you suspect a scenario like this, diagnose the non U-code DTC(s) before diagnosing any Implausible Data, Implausible Signal, Invalid Data, or Missing Message DTCs.**

TRANSMISSION VERIFICATION TEST

Perform the following procedure to verify proper Transmission operation after repairs have been performed.

VERIFICATION-8-SPEED

1. Reinstall any removed components.
2. Reconnect any disconnected electrical connectors.
3. With the scan tool, erase TCM DTCs.

4. With the scan tool, erase ESM DTCs.
5. With the scan tool, erase ABS DTCs.
6. With the scan tool, erase PCM DTCs.

CAUTION: Apply the parking brake.

7. With the scan tool, display the Transmission Temperature.
8. Start the engine and allow the transmission fluid temperature to reach 43B° C (110B° F).
9. Check for Transmission fluid leaks.
10. If internal transmission components were repaired or replaced check the Transmission fluid level and adjust if necessary. Refer to the appropriate service information .
11. If any internal transmission repairs were performed or the Transmission Control Module (TCM) was replaced, perform the TCM ADAPTATION procedure. Refer to the appropriate service information .
12. Perform the ROAD TEST PROCEDURE

ROAD TEST PROCEDURE

1. Operate the vehicle in a manner that will allow 15-20 upshifts through all of the gears.
2. Allow these shifts to occur from 0 kPh (0 mph) to 72 kPh (45 mph) with a constant throttle opening of 20 to 25 degrees.
3. Operate the vehicle below 40 kPh (25 mph) and then perform a throttle kick-down maneuver to 1st gear. Do this several times from below 40 kPh (25 mph).
4. With the scan tool, read TCM DTCs.

Did any TCM DTCs set?

Yes

- Repair TCM DTCs. Refer to the appropriate service information .

No

- Test complete.

TRANSMISSION CONTROL MODULE (TCM) ADAPTATION

The TCM controls the fluid pressure and fill time of each clutch pack to give optimal shift quality. As the clutches wear, the TCM will adapt and make adjustments to keep the shift quality consistent over the life of the vehicle. The initial clutch filling pressure and fill times are set at the factory. When a transmission assembly or transmission component is replaced, or when the adaptation values are reset, the adaptation values must be relearned. This procedure should also be followed when it is suspected that a vehicle has not been driven in a manner that encourages clutch adaptation learning in highway or city driving conditions.

NOTE: The scan tool, for many 8-Speed Transmissions now has a **QUICK LEARN** or **STATIC ADAPTATION (STADA)** routine that should be performed if the customer has any shift quality concerns or after any internal repairs are performed on the transmission. If the **QUICK LEARN** or **STATIC ADAPTATION** routine is not available on the scan tool for the application you are working on or the shift quality concern is not corrected by performing the **QUICK LEARN** or **STATIC ADAPTATION** routine then the **TCM ADAPTATION PROCEDURES** below need to be performed.

QUICK LEARN PROCEDURE

NOTE: The **QUICK LEARN PROCEDURE** requires that the Transmission fluid temperature be at least 55B°C (131B°F).

1. Drive the vehicle briefly to ensure all clutches have been engaged at least twice. Keep the engine running throughout the remainder of this procedure.
2. With the scan tool, activate the RESET ADAPTIVE VALUES routine.
3. With the scan tool, activate the QUICK LEARN routine and follow the on-screen instructions. This procedure requires about 2-5 minutes to complete.

TCM ADAPTATION PROCEDURES

The two procedures to relearn these values are called Fast Filling Adaptation and Standard Clutch Filling Adaptation. Depending on the repair or complaint, one or both procedures must be performed as described below.

NOTE: Performing a reset of the Transmission Adaptation values does not automatically trigger the TCM to relearn the Adaptation values. If a reset is performed, both procedures must be performed to restore optimal shift quality. Do not reset these values unless specifically instructed to do so.

NOTE: This procedure does not need to be performed if the existing TCM is re-flashed and that was the only repair performed.

One or both TCM Adaptation procedures should be performed depending on the situation. Failure to perform these procedures when required could cause shift quality issues.

Fast Filling Adaptation Procedure

Perform the following procedure when the TCM or Transmission assembly has been replaced, or when the adaptation values have been reset. This procedure should be performed before performing the Standard Clutch Filling Adaptation Procedure when these components are replaced.

NOTE: Perform this procedure on a smooth road surface. The TCM will abort the adaptation process if it senses rough road conditions. The road should be clear of traffic due to the start, stop, and slow vehicle speeds required during this procedure.

1. With the Scan Tool, erase Diagnostic Trouble Codes (DTCs).
2. Setup the scan tool to display the Transmission Oil Temperature, Torque, Turbine (Input) Speed Sensor rpm, and Clutch 'X' - Filling Counter for each clutch.
3. Drive the vehicle until the Transmission Oil Temperature is above 30B° C (86B° F).
4. Stop the vehicle.
5. Drive the vehicle to perform upshifts for all gears under the following conditions:
 - Light to medium throttle position
 - Turbine (Input) Speed between 1, 250 - 2, 000 rpm
 - Torque between 100 N.m and 150 N.m (74 ft. lbs. and 111 ft. lbs.)
6. Release the throttle (0% position) to coast and allow a 6-5 down-shift.
7. Perform steps 4-6 until the Filling Counters for each clutch displays 10 counts.

The tables below may be used as an alternate reference for the optimal conditions required to learn the Fast Filling Adaptations.

Fast Filling Adaptation Conditions Table

Conditions Where Fast Filling Adaptations Occur			
Condition	Transmission Temperature	Torque N.m (ft. lbs.)	Input Speed (rpm)
Upshifts	Between 30B° C and 100B° C (86B° F and 212B° F)	Between 100 N.m and 150 N.m (74 ft. lbs. and 111 ft. lbs.)	Between 1250 and 2000 rpm
6-5 Downshifts for B Clutch	Between 30B° C and 100B° C (86B° F and 212B° F)	Between negative (-) 60 N.m and negative (-) 40 N.m (negative (-) 44 ft. lbs. and negative (-) 30 ft. lbs.)	Between 750 and 1100 rpm

Clutch vs Shift Table

Shifts Where Each Clutch Will Fast Adapt					
B	A Clutch	B Clutch	C Clutch	D Clutch	E Clutch
Shift	6 - 7	6 - 5	2 - 3 and 4 - 5	3 - 4	1 - 2 and 5 - 6
Optimal conditions under which adaptation learning occurs.	Best performed at highway speeds in excess of 80 kph (50 mph).	Coasting with throttle at 0% position.	Best performed at light to medium-throttle - normal vehicle launch.	Best performed at light to medium-throttle - normal vehicle launch.	Best performed at light to medium-throttle - normal vehicle launch.

8. Perform the Standard Clutch Filling Adaptation Procedure.

Standard Clutch Filling Adaptation Procedure

Perform the following procedure when a Transmission internal component, Torque Converter, TCM, or Transmission has been replaced, or when the adaptation values have been reset. This procedure should also be performed if it is suspected that the vehicle has not been driven in a manner that encourages clutch adaptation learning in highway or city driving conditions.

NOTE: Perform this procedure on a smooth road surface. The TCM will abort the adaptation process if it senses rough road conditions. The road should be clear of traffic due to the start, stop, and slow vehicle speeds required during the procedure.

NOTE: The TCM learns the Standard Clutch Filling Adaptation values when the applicable clutch is not applied.

1. With the Scan Tool, erase DTCs.
2. Setup the scan tool to display the Transmission Oil Temperature, Torque, Turbine (Input) Speed Sensor rpm, and Clutch 'X' - Fast Filling Counter for each clutch.
3. Drive the vehicle until the Transmission Oil Temperature is above 50B° C (122B° F).

NOTE: Adaptation learning will be aborted if the Transmission Oil Temperature is above 100B° C (212B° F).

4. Stop the vehicle.
5. Drive the vehicle using the paddle shifters or Gear +/- buttons on steering wheel in order to hold the transmission in the desired gear.

NOTE: First and second gears do not require a Standard Clutch Filling Adaptation procedure.

NOTE: If attempting to resolve a specific shift quality issue, use the Gear vs Clutch Table below to see which clutches require further adaptation. For instance, if a rough 2-1 downshift is noted, note that clutch C and clutch E are applying and releasing. Then use the Clutch vs Shift Table above to note that clutch C and clutch E require the adaptation procedure performed in 4th and 7th gear.

6. In 3rd gear, drive the vehicle within the following conditions until the Clutch D - Fast Filling Counter increments by one count:
 - Vehicle speed between 32-56 kph (20-35 mph)
 - Turbine (Input) speed between 950 - 1750 rpm
 - Torque between 25 N.m - 180 N.m (18 ft. lbs. - 133 ft. lbs.)
7. In fourth gear, drive the vehicle within the following conditions until the Clutch C - Fast Filling Counter increments by one count:
 - Vehicle speed between 32-56 kph (20-35 mph)
 - Turbine (Input) speed between 950 - 1750 rpm
 - Torque between 25 N.m - 120 N.m (18 ft. lbs. - 89ft. lbs.)

NOTE: Fifth gear does not require a Standard Clutch Filling Adaptation procedure.

8. In sixth gear, drive the vehicle within the following conditions until the Clutch A - Fast Filling Counter increments by one count:
 - Vehicle speed between 73-81 kph (45-50 mph)
 - Turbine (Input) speed between 950 - 1750 rpm
 - Torque between 50 N.m - 120 N.m (37 ft. lbs. - 89ft. lbs.)
9. In seventh gear, drive the vehicle within the following conditions until the Clutch B- Filling Counter and Clutch E Fast Filling Counter each increment by one count:
 - Vehicle speed between 73-81 kph (45-50 mph)
 - Turbine (Input) speed between 950-1750 rpm
 - Torque between 50 N.m-120 N.m (37 ft. lbs.-89ft. lbs.)

The **Standard Clutch Filling Adaptation Conditions Table** below may be used as an alternate reference for the optimal conditions required to learn the Standard Clutch Filling Adaptations.

Standard Clutch Filling Adaptation Conditions Table

Steady State Gears And Conditions Where Each Clutch Will Adapt					
Clutch	Gear	Optimal Vehicle Speed	Input Speed (rpm)	Torque N.m (ft. lbs.)	Transmission Temperature
A Clutch	6th	73-81 kph (45-50 mph).	Between 950 and 1750 rpm	Between 50 N.m and 120 N.m (37 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)
B Clutch	7th	73-81 kph (45-50 mph).	Between 950 and 1750 rpm	Between 50 N.m and 120 N.m (37 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)
C Clutch	4th	32-56 kph (20-35 mph).	Between 950 and 1750 rpm	Between 25 N.m and 120 N.m (18 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)
D Clutch	3rd	32-56 kph (20-35 mph).	Between 950 and 1750 rpm	Between 25 N.m and 180 N.m (18	Between 50B° C and 100B° C (122B° F

Steady State Gears And Conditions Where Each Clutch Will Adapt					
Clutch	Gear	Optimal Vehicle Speed	Input Speed (rpm)	Torque N.m (ft. lbs.)	Transmission Temperature
				ft. lbs. and 133 ft. lbs.)	and 212B° F)
E Clutch	7th	73-81 kph (45-50 mph).	Between 950 and 1750 rpm	Between 50 N.m and 120 N.m (37 ft. lbs. and 89 ft. lbs.)	Between 50B° C and 100B° C (122B° F and 212B° F)

10. Perform steps 4-9 until the Fast Filling Counters for each clutch has incremented by at least five counts.
11. Evaluate shift performance for all gears. If the shift quality for any gear is insufficient, execute the appropriate driving conditions until shift quality improves. Incrementing the Fast Filling Counters by 12 counts for each clutch may be necessary to properly learn the adaptation values.

The following table Controller Area Network (CAN) be used to determine which clutches are involved in a specific up-shift or down-shift quality issue. 'X' indicates when a clutch is applied. The Standard Clutch Filling Adaptation learning occurs when the applicable clutch is not applied and the transmission is in a steady state (not shifting).

Gear vs Clutch Table

Gear	Clutch A	Clutch B	Clutch C	Clutch D	Clutch E
1st	X	X	X	B	B
2nd	X	X	B	B	X
3rd	B	X	X	B	X
4th	B	X	B	X	X
5th	B	X	X	X	B
6th	B	B	X	X	X
7th	X	B	X	X	B
8th	X	B	B	X	X
Reverse	X	X	B	X	B

Read the information below for details regarding this procedure.

Reading Clutch Adaptation Data

The Clutch Packs will each have 4 scan tool data labels to observe under the TCM section. Using Clutch A as an example, the data labels are:

- **Clutch A- Fast Filling Counter:** This data label displays the number of Clutch Filling Pressure adaptations that have been performed. These adaptations are the first learned values on a new transmission or after clutch adaptation values are reset. You will need to allow 5 to 12 fast filling counts per clutch to properly learn the clutch adaptations. If the shift quality is sufficient after 5 counts, no further adaptation learns for that clutch are necessary.
- **Clutch A- Filling Counter:** This data label displays the number of Clutch Filling Time adaptations that have been performed. You will need to allow 5 to 12 filling counts per clutch to properly learn the clutch adaptations. If the shift quality is sufficient after 5 counts, no further adaptation learns for that clutch are necessary.
- **Clutch A- Filling Pressure:** This data label displays the clutch filling pressure value that is learned during the TCM Adaptation procedure. The TCM adaptation software will increase or decrease the clutch fluid filling pressure to improve shift performance. The clutch Filling Pressure value will change over the life of the transmission based first on initial transmission build variation and then due to normal clutch wear.
- **Clutch A- Filling Time:** This data label displays the clutch filling time value that is learned during the TCM Adaptation procedure. The TCM adaptation software will increase or decrease the Clutch Filling

Time to improve shift performance. The clutch Filling Time value will change over the life of the transmission based first on initial transmission build variation and then due to normal clutch wear.

MODULE PROGRAMMING

PROGRAMMING THE TRANSMISSION CONTROL MODULE (TCM)

NOTE: New TCMs are supplied with generic software. When replacing a TCM, it must be programmed with vehicle specific software.

NOTE: Failure to properly program the TCM will cause Diagnostic Trouble Codes (DTCs) to be set.

1. The following conditions must be met during the reprogramming procedure:
 - Battery must be maintained between 10 and 16 volts. Connect a battery charger if necessary.
 - Ambient temperature must be between 0B°C (32B°F) 60B°C (140B°F).
 - Gear Selector must be in PARK.
2. With the scan tool, download the appropriate TCM flash file to the scan tool.
3. Turn the ignition on.
4. Following the menu on the scan tool, program the TCM.
5. Perform the TCM ADAPTATION procedure. Refer to the appropriate service information .
6. Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .

Is the Programming Procedure and TCM Adaptation Procedure complete?

Yes

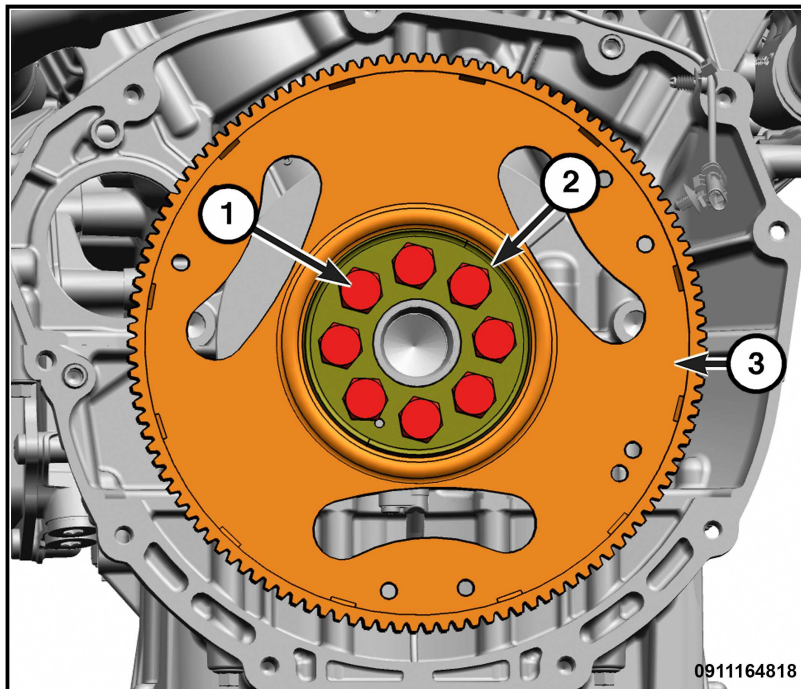
- Perform the TRANSMISSION VERIFICATION TEST. Refer to **TRANSMISSION VERIFICATION TEST** .
-

2021 AUTOMATIC TRANSMISSION

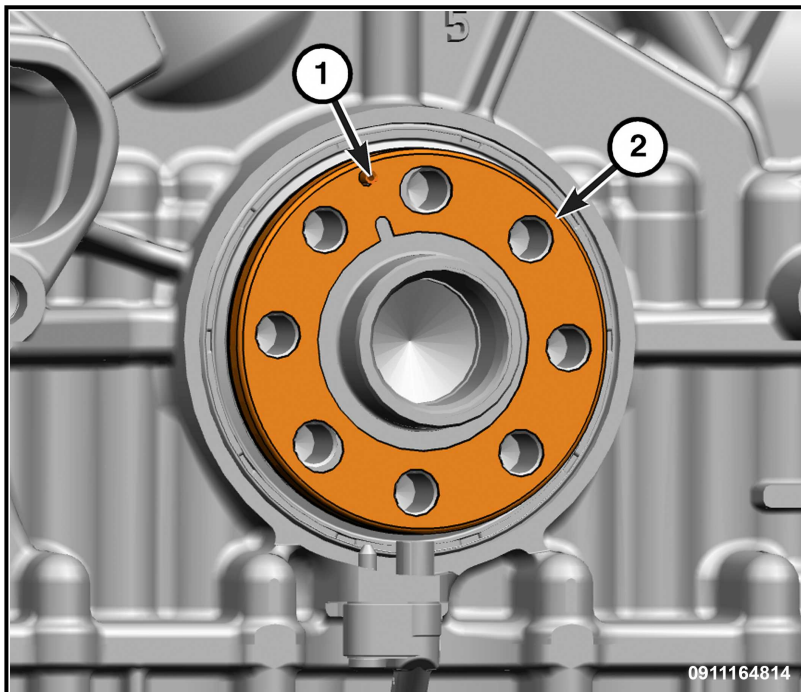
8HP75 Automatic Transmission (Service Information) - Gladiator [EXJ]

DESCRIPTION AND OPERATION

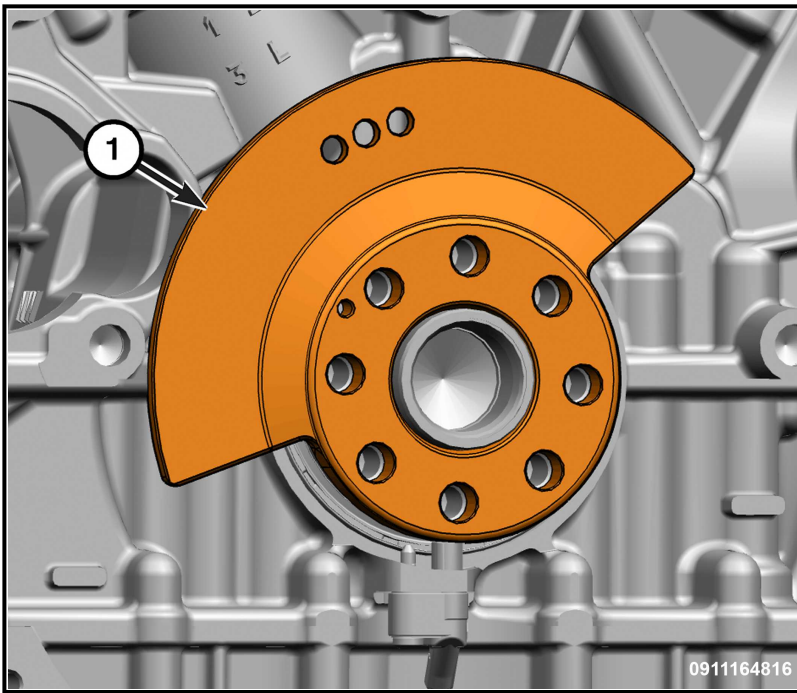
FLEXPLATE - 3.0L DIESEL



- The stamped-steel flex plate (3) is fastened to the crankshaft and can only be installed one way.



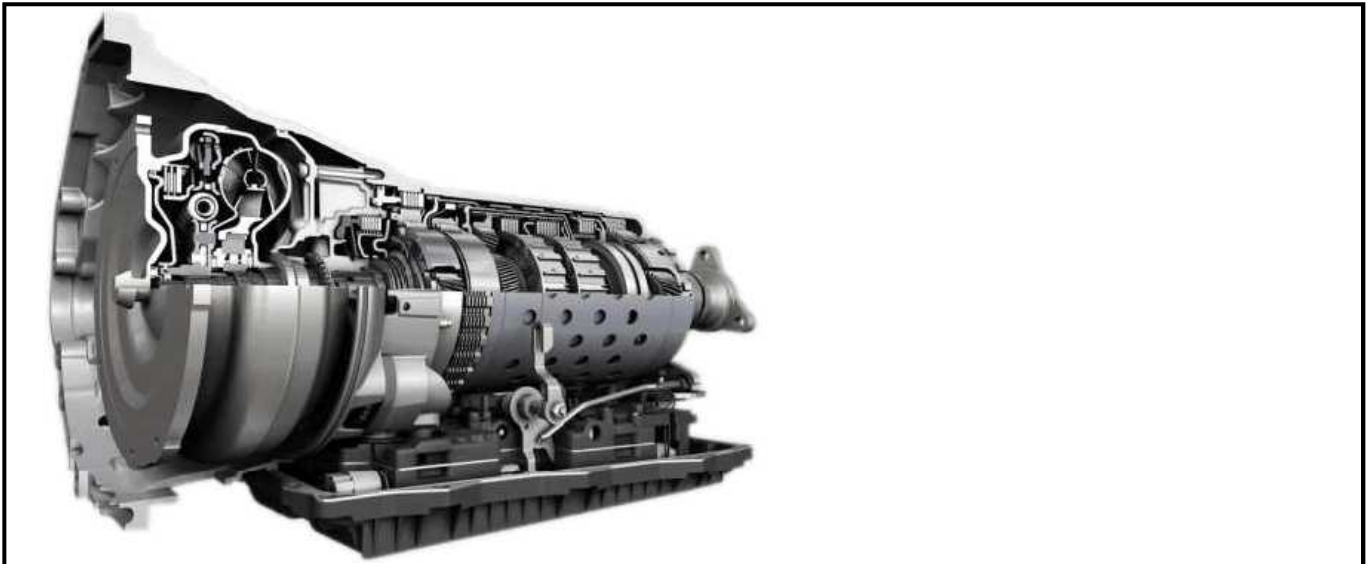
- The crankshaft has a dowel locating pin that is used to align the magnetic tone wheel and the counter weight.

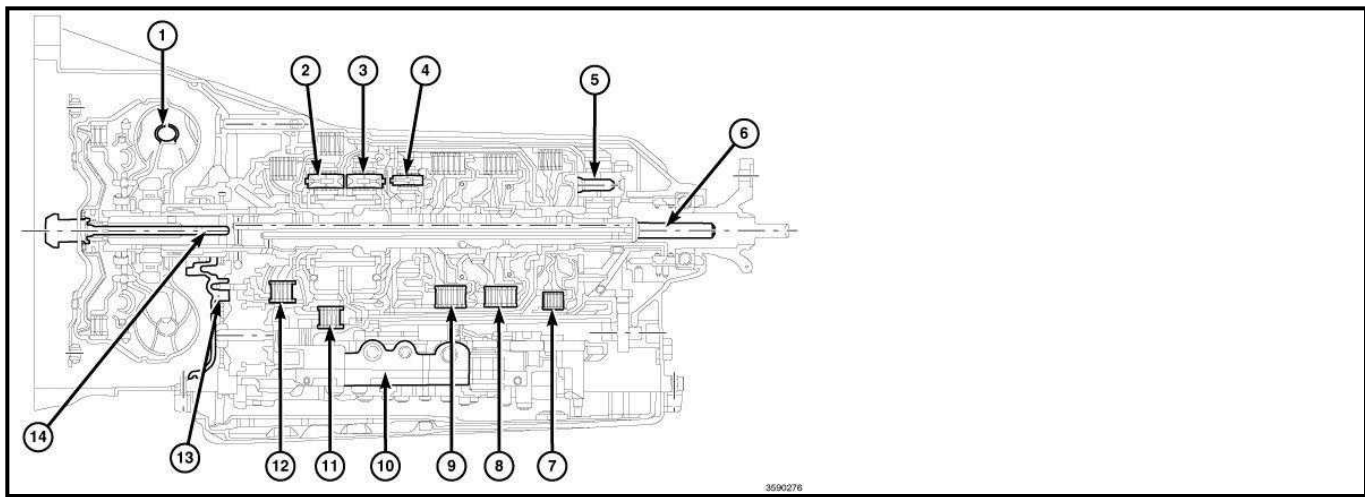


- The counter weight can only be installed one way. The dead hole on the back side of the counter weight is for the dowel pin. The other hole is a through hole that is not to be used.
- The stamped-steel flex plate has a segment ring to provide engine speed and crankshaft position information to the Power Control Module (PCM). The crankshaft position sensor is mounted next to the segment ring and sends electrical pulses to the PCM.

TRANSMISSION ASSEMBLY - 8HP75

DESCRIPTION





1 - Torque Converter	8 - C Clutch
2 - P1 Planetary	9 - E Clutch
3 - P2 Planetary	10 - Valve Body
4 - P3 Planetary	11 - B Clutch
5 - P4 Planetary	12 - A Clutch
6 - Output Shaft	13 - Oil Pump
7 - D Clutch	14 - Input Shaft

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

Listed below are the features and components of the 8HP75 transmission:

- The 8HP75 is an electronic eight-speed automatic transmission. Eight speeds allow the engine to maintain its optimal rpm range, increasing fuel economy and performance.
- The transmission case is a single-piece unit.
- The starter pocket, cooler line fittings, and manual park release lever are located on the driver's side of the case.
- The transmission wire harness connector and oil fill plug are located on the passenger side of the case.
- The two-wheel drive model uses a flanged output shaft connection while the four-wheel drive model uses a sealed, externally splined output shaft to form a dry connection between the adapter plate and the transfer case.
- Transmission control is performed by the TCM based on hard-wired and Controller Area Network (CAN) bus signals from sensors and modules.
- The Transmission Control Module Assembly (TCMA), which is integrated into the valve body, provides fully synchronized clutch-to-clutch shifting through four planetary gear sets.
- The TCMA includes a mounting plate that holds the Transmission Control Module (TCM) and a molded wiring harness for connection to various transmission sensors and solenoids.
- The valve body assembly contains all the sensors and solenoids required for operation, completely inside the transmission.
- The TCM receives driveability data from the Powertrain Control Module (PCM) and other modules over the CAN-Chassis (CAN-C) bus.
- The TCM also receives shift lever position information from the Electronic Shift Module (ESM) over a dedicated transmission CAN bus.
- The TCM processes this input data and controls operation of the torque converter clutch, park lock system, solenoid valves, and pressure regulating valve.

- The input and output speed sensors are Hall-effect sensors that measure shaft rotational speed.
- The input speed sensor is located at the top, near the center, of the TCMA and reads input shaft speed from the magnetic ring on the P2 carrier.
- The output speed sensor is located at the back of the TCMA and reads output shaft speed from the P4 carrier.

IDENTIFICATION In the area of location (A) there are two barcodes and their corresponding alphanumeric codes. The top code identifies the COMPONENT TRACKING NUMBER. The bottom code identifies the PART NUMBER.

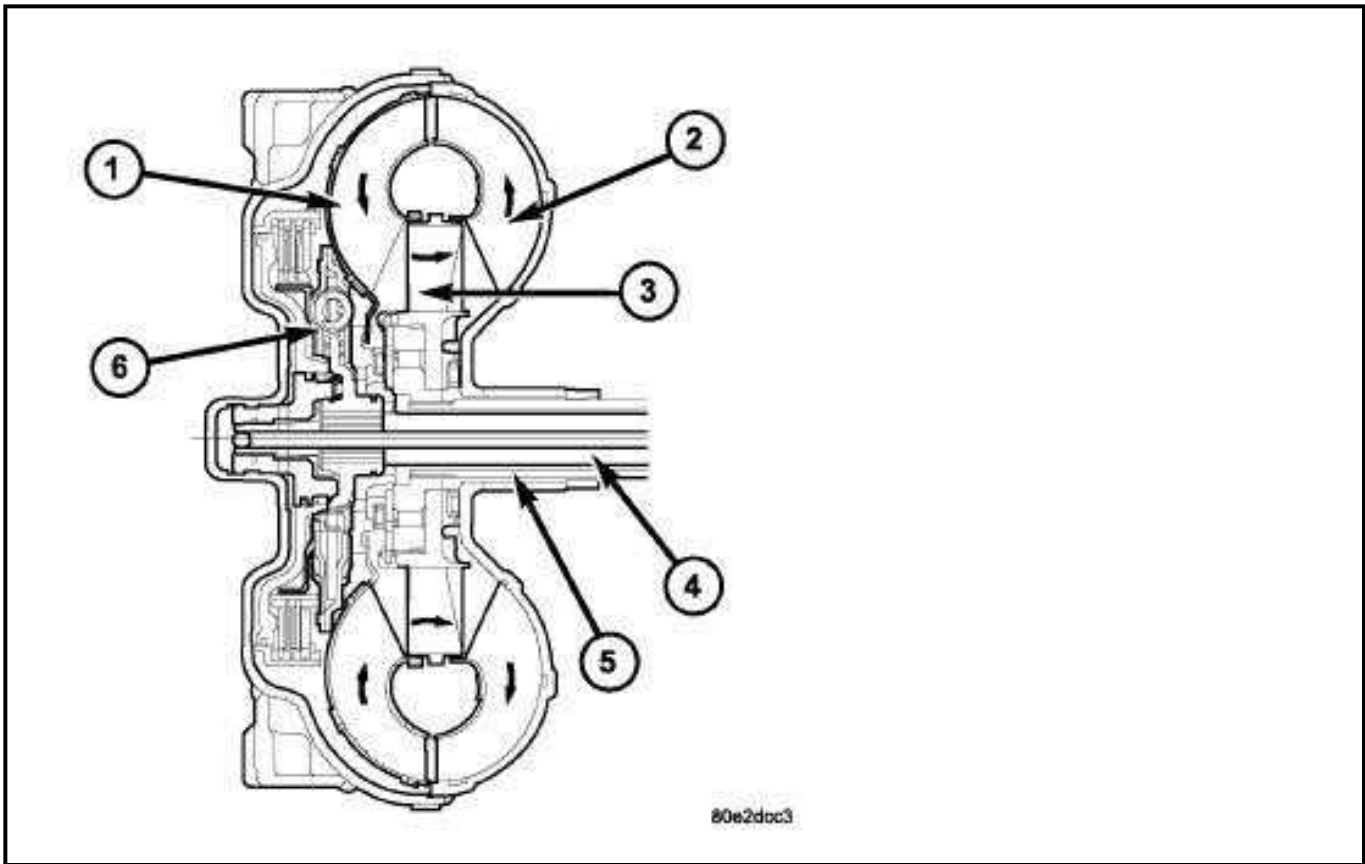


The table below shows the gear ratio for each transmission gear range.

GEAR	RATIO
1st	4.714
2nd	3.143
3rd	2.106
4th	1.667
5th	1.285
6th	1.00
7th	0.839
8th	0.667
Reverse	3.317

FUNCTIONAL DESCRIPTION - TORQUE CONVERTER

DESCRIPTION



TORQUE CONVERTER

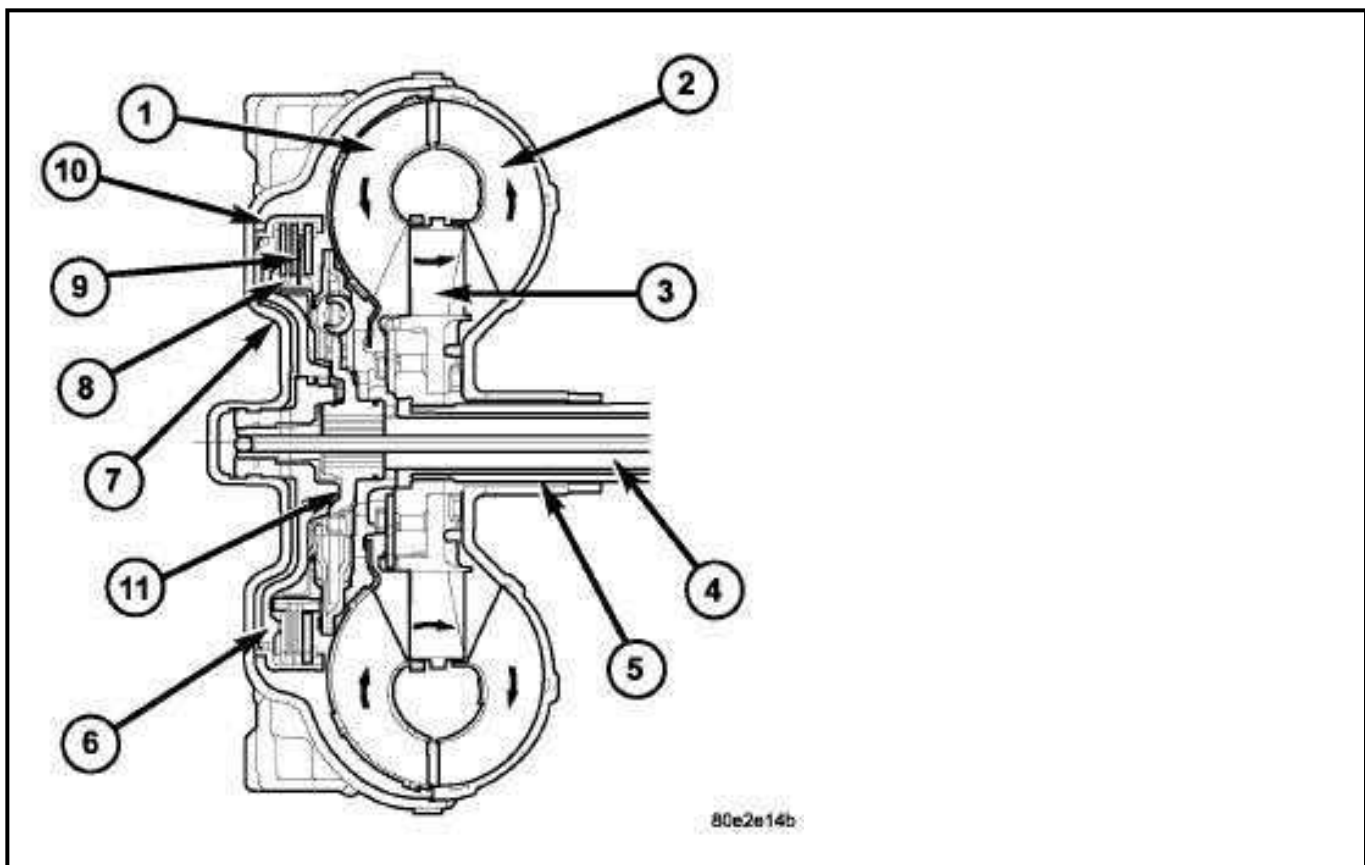
1 - Turbine	4 - Input Shaft
2 - Impeller	5 - Stator Shaft
3 - Stator	6 - Turbine Damper

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.

The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller (2), and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The Torque Converter Clutch (TCC) activates in third through fifth gears.

A turbine damper has been added for some applications to help improve vehicle Noise, Vibration, and Harshness (NVH) characteristics.

OPERATION



1 - Turbine	7 - Cover Shell
2 - Impeller	8 - Internally Toothed Disc Carrier
3 - Stator	9 - Clutch Plate Set
4 - Input Shaft	10 - Externally Toothed Disc Carrier
5 - Stator Shaft	11 - Turbine Damper
6 - Piston	B

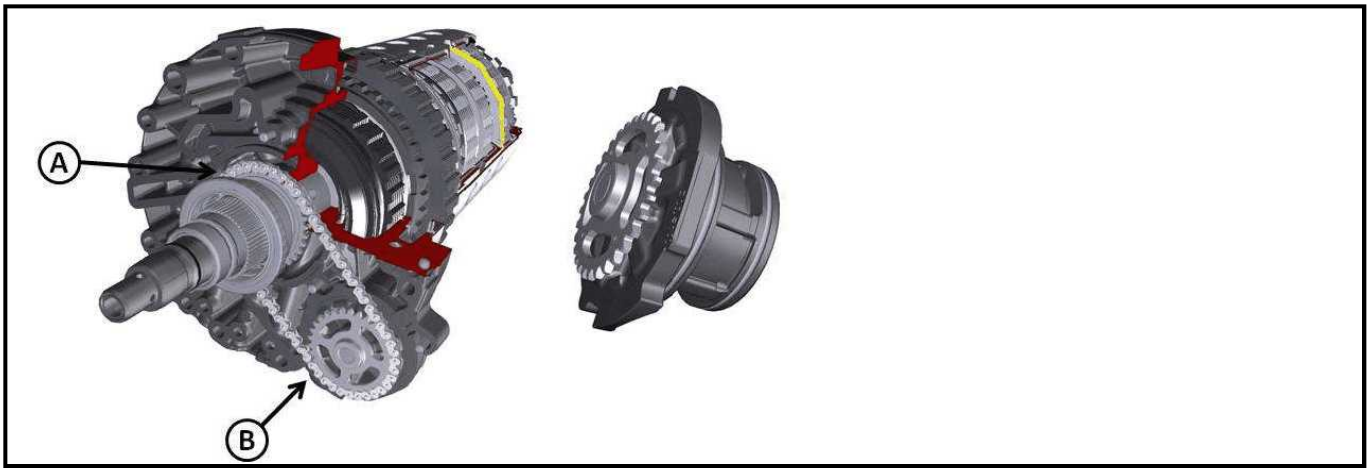
The torque converter housing has a unique shape to incorporate the TCC and flex plate connection. The torque converter uses the typical turbine, impeller and stator assemblies found in a standard torque converter assembly. The torque converter drives the pump through the splines on the inside of the hub. The torque converter uses a multi-disc torque converter clutch system that improves the durability and the holding pressure in the lock-up circuit. The torque converter incorporates a turbine dampening system. This system suppresses torsional vibrations from the engine to ensure optimal shift quality and reduce noise and vibration concerns.

TCC RELEASE - When the TCC is open, the TCC piston is pushed to its default position by torque converter chamber pressure. The Torque Converter Switch Valve (SV-TC) provides pressure for torque converter operation which has been regulated by the Torque Converter Pressure Regulating Valve (TC-V). After exiting the torque converter, fluid moves into the cooling and lubrication circuits. The converter pressure retention valve (TCH1-V) ensures the torque converter pressure is a minimum of 0.35 bar (5 psi) when the TCC is open.

TCC APPLY - When the TCC solenoid is energized, fluid is directed to the torque converter switch valve (SV-TC) and TCC lockup valve (TCC-V). The TCC lockup valve directs fluid to the TCC and torque converter chamber. The torque converter switch valve directs fluid exiting the converter chamber to a secondary pressure retention valve (TCH2-V) which is calibrated to retain 1.0 bar (14.5 psi) of pressure in the converter. The torque converter switch valve also directs line pressure to the cooler and lubrication circuit.

FUNCTIONAL DESCRIPTION - TRANSMISSION OIL PUMP

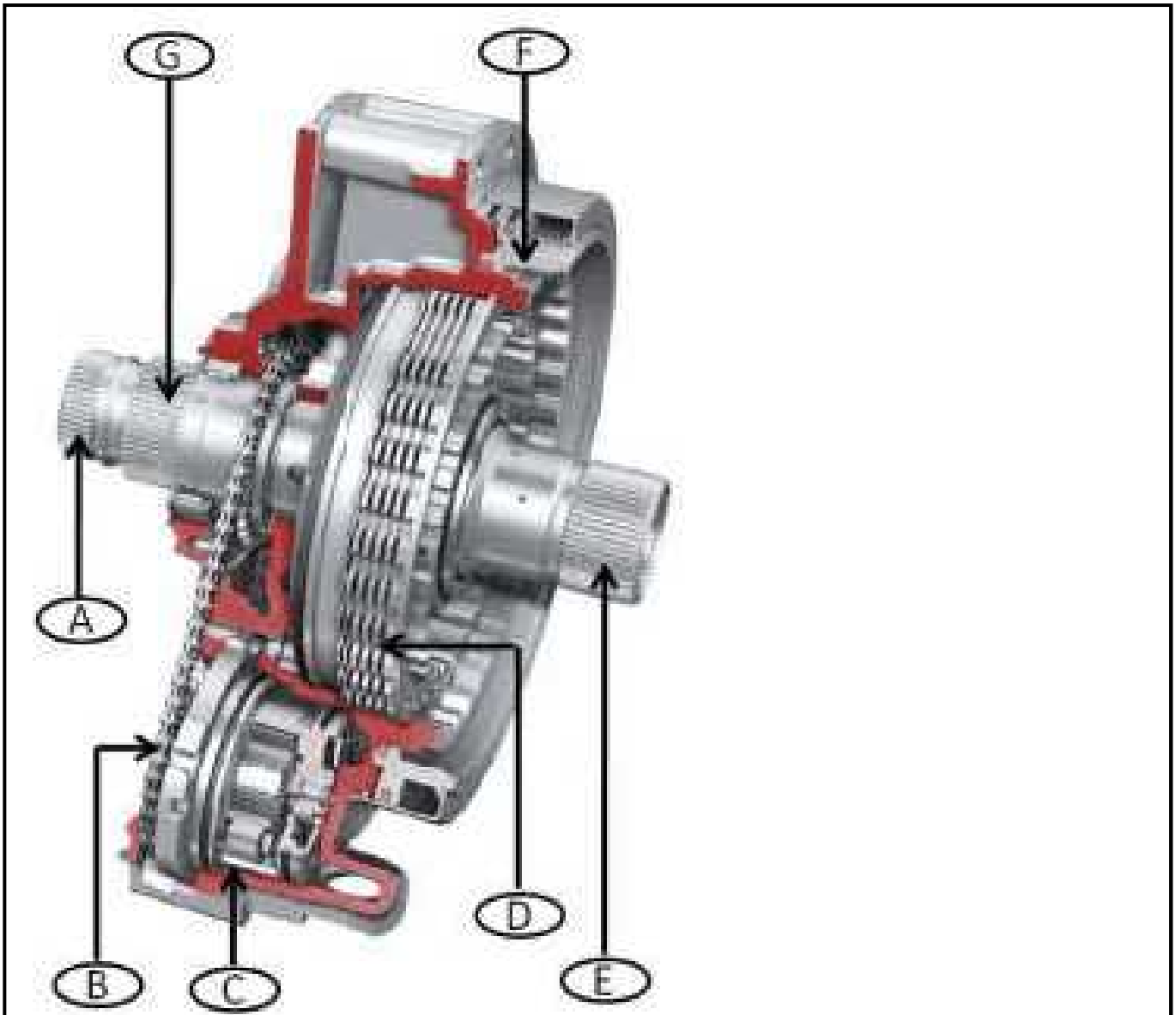
DESCRIPTION



A - Transmission Oil Pump

B - Chain and Sprocket

The transmission oil pump is driven by a chain and sprocket. The oil pump is located just behind the torque converter, inside of the pump housing. The pump is a double-stroke vane pump. The pump has dual chambers, two inlet and two outlet ports. The pump provides necessary lubrication and cooling throughout all phases of transmission operation.



A - Stator Shaft

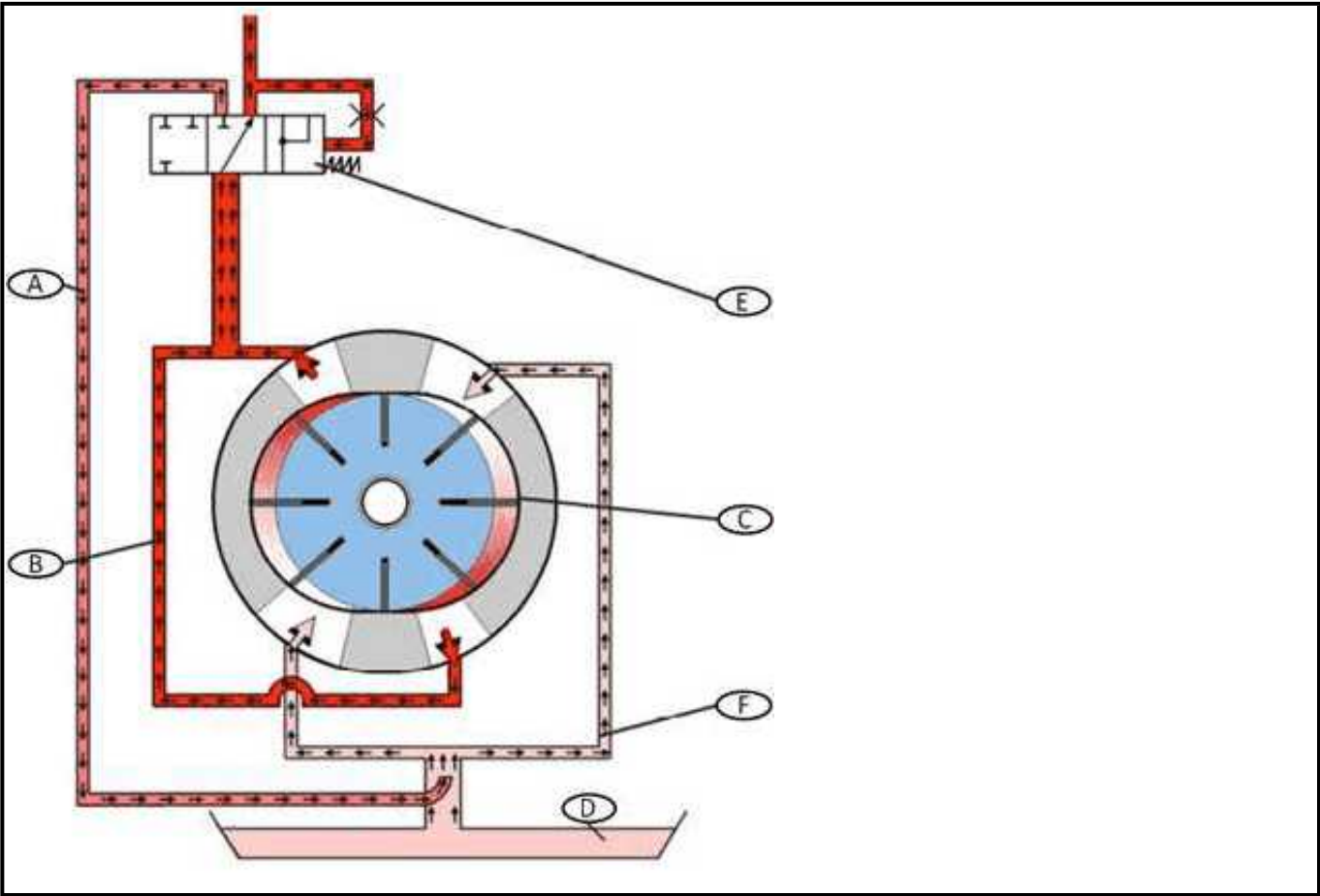
E - Central Planetary Shaft for Gear 1 and 2

B - Pump Drive Chain	F - Brake "B" Piston
C - Pump Body	G - Pump Drive Hub
D - Brake "A" and Housing	B

OPERATION

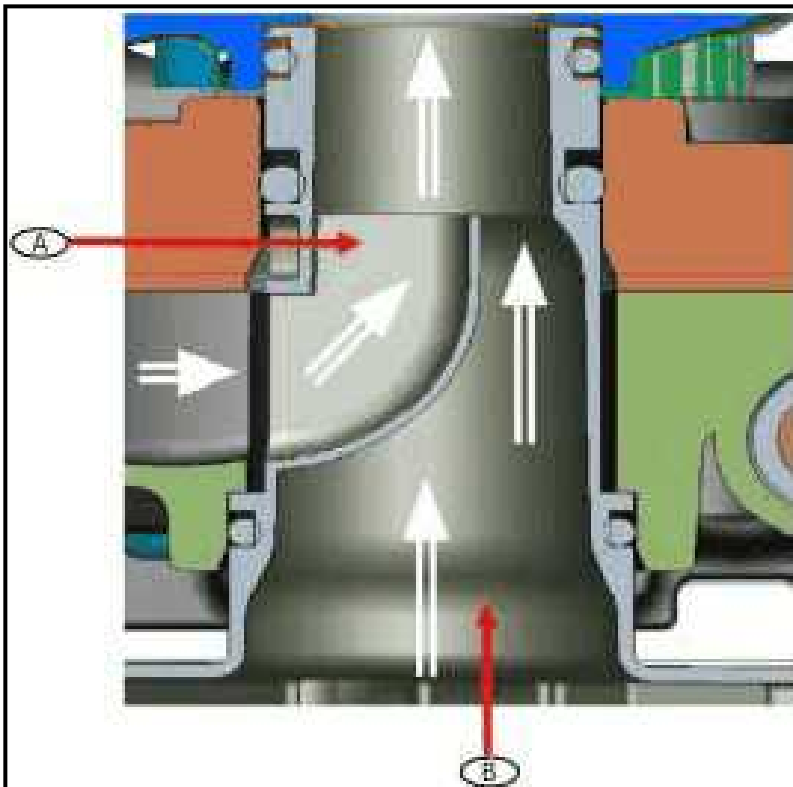
NOTE: The two graphics to the right show the flow of Automatic Transmission Fluid (ATF) through the pump. The bottom graphic is showing the flow of fluid through the valve that controls the fluid pickup where the redundant return oil (A) meets the passage above the sump (D) in the top graphic.

The Automatic Transmission Fluid (ATF) is drawn from the sump underneath, which has the ATF filter in it. The fluid travels through the intake passage to the mechatronics unit in the pump. The excess oil is diverted through the system pressure valve and low pressure passage back to the ATF pump in the intake duct.



A - Return of Redundant Oil	D - Sump
B - Pressure Pipe	E - System Pressure Valve (In the Valve Body)
C - Pump	F - Intake Pipe

The system delivery valve is managed through the control pressure from the system pressure control solenoid valve. This solution improves the noise, reducing the possibility of cavitation and increasing the pump efficiency by increasing the pressure on the intake side.



A - Surplus Oil (Charge Duct) from the System Delivery Valve

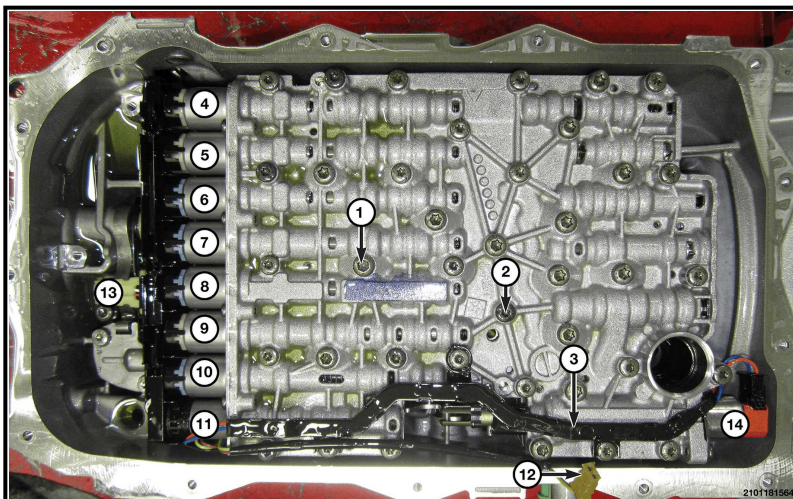
B - Oil from the Filter Built into the Sump

FUNCTIONAL DESCRIPTION - VALVE BODY

DESCRIPTION

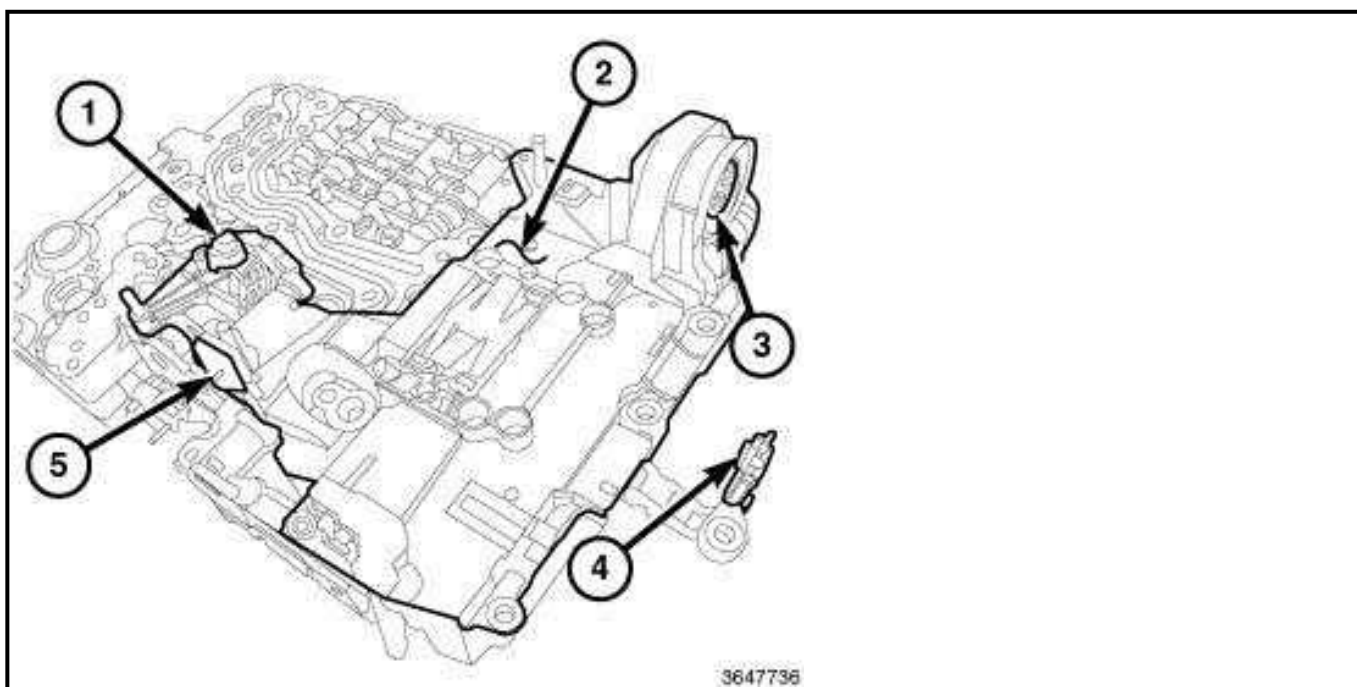
CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

The valve body includes the TCM, all solenoids and sensors, and can be referred to as the TCMA. The TCM is attached to the valve body between the transmission case and the valve body. If any component of the valve body **including the TCM**, sensors or solenoids need replaced, the complete TCMA (valve body) must be replaced. For replacement of the TCMA (valve body). Refer to **VALVE BODY, REMOVAL AND INSTALLATION**.



1 - M6 Valve Body Bolt Hole	8 - Solenoid C
2 - M5 Valve Body to Solenoid Body Bolt Hole	9 - Torque Converter Clutch (TCC) Solenoid
3 - Wiring Harness for Park Hold Solenoid & HIS Solenoids	10 - Line Pressure Solenoid
4 - Solenoid A	11 - Park Release Solenoid
5 - Solenoid B	12 - High Impulse Solenoid (HIS) Wire Harness Connector
6 - Solenoid D	13 - Output Shaft Speed (OSS) Sensor
7 - Solenoid E	14 - Park Hold Solenoid

OPERATION



1 - Input Speed Sensor (ISS)
2 - Transmission Control Module (TCM) (Includes Transmission Temperature Sensor)
3 - External Wire Harness Connector
4 - Output Speed Sensor (OSS)
5 - Park Position Sensor

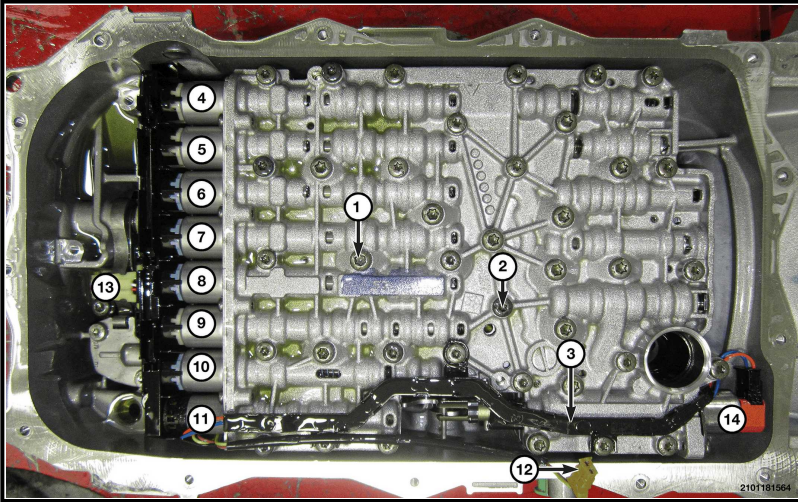
CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

The valve body, which includes the TCM, controls the delivery and pressure of transmission fluid. The TCM is integrated into the valve body. The TCM regulates the amount of hydraulic pressure used to engage the clutches and the TCC, in addition to directing hydraulic pressure to engage or release any given clutch for any given required gear. The TCM will actuate the valves via solenoids based on the position of the shifter, transmission fluid temperature, engine operating conditions, traction conditions and driver demands. During a shift, the TCM will actuate the solenoids to match the gear ranges to the optimal torque range of the engine based on the position of the accelerator pedal, shifter and vehicle speed as determined by the Powertrain Control Module (PCM) based on input from the Vehicle Speed Sensor (VSS) and Anti-lock Brake System (ABS) module. Due to the complexity of the 8HP transmission control system, always refer to the transmission electrical/electronic diagnostics in this information when attempting to diagnose transmission problems.

FUNCTIONAL DESCRIPTION - VALVE BODY SOLENOIDS

DESCRIPTION

The solenoids are integrated into the Transmission Control Module Assembly (TCMA) of the 8HP transmission. The solenoids are not serviced or replaced individually.



1 - M6 Valve Body Bolt Hole	8 - Solenoid C
2 - M5 Valve Body to Solenoid Body Bolt Hole	9 - Torque Converter Clutch (TCC) Solenoid
3 - Wiring Harness for Park Hold & HIS Solenoids	10 - Line Pressure Solenoid
4 - Solenoid A	11 - Park Release Solenoid
5 - Solenoid B	12 - High Impulse Solenoid (HIS) Wire Harness Connector
6 - Solenoid D	13 - Output Shaft Speed (OSS) Sensor
7 - Solenoid E	14 - Park Hold Solenoid

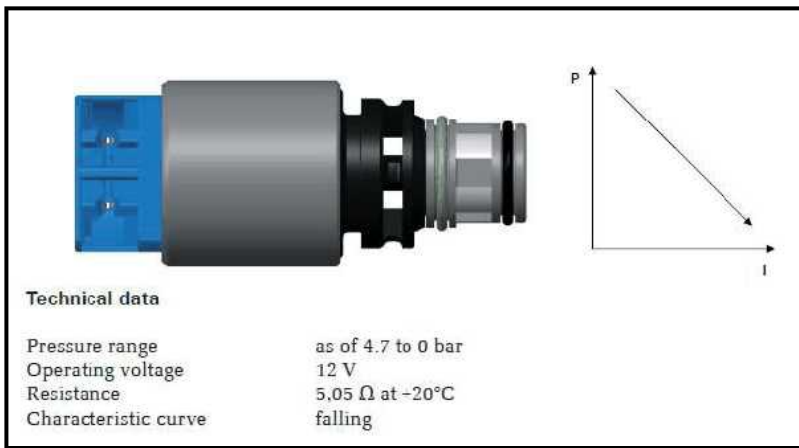
OPERATION

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES. Failure to follow these instructions may result in damage to the TCM/TCMA.

The TCM will actuate the valves via solenoids based on the position of the shifter, transmission fluid temperature, engine operating conditions, traction conditions, and driver demands. During a shift, the TCM will actuate the solenoids to match the gear ranges to the optimal torque range of the engine. This is based on input signals from the accelerator pedal, shifter position, Input Speed Sensor (ISS), Output Speed Sensor (OSS) and vehicle speed as determined by the Powertrain Control Module (PCM) and Anti-lock Brake System (ABS) module.

SOLENOID FUNCTIONALITY: There are two types of transmission solenoids designed for regulating pressure. The transmission solenoids are identified by two distinct colors to help differentiate their characteristics and function:

- Blue/Green transmission solenoids - these transmission solenoids have a falling characteristic curve (the maximum control pressure is obtained when the solenoid valves are not powered).



- White/Orange transmission solenoids - These transmission solenoids have a rising characteristic curve (there is no control pressure when they are not powered).

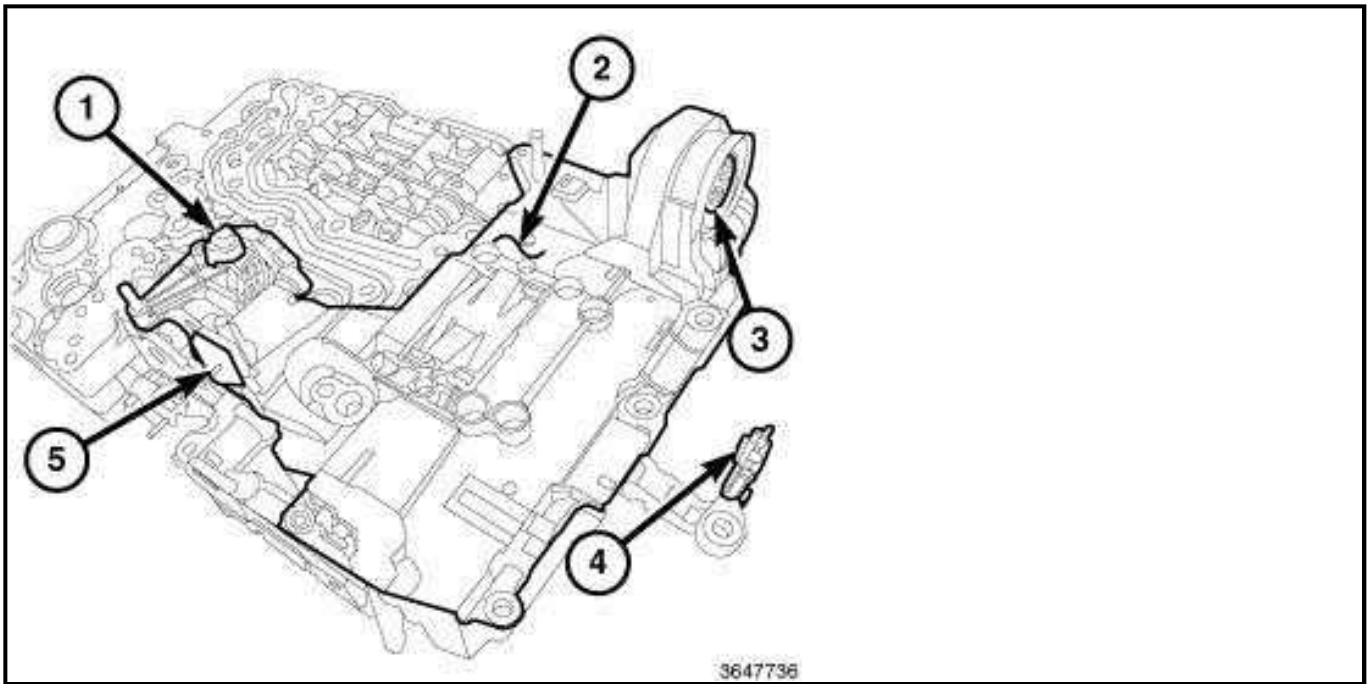


FUNCTIONAL DESCRIPTION - TRANSMISSION SPEED SENSOR

DESCRIPTION

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

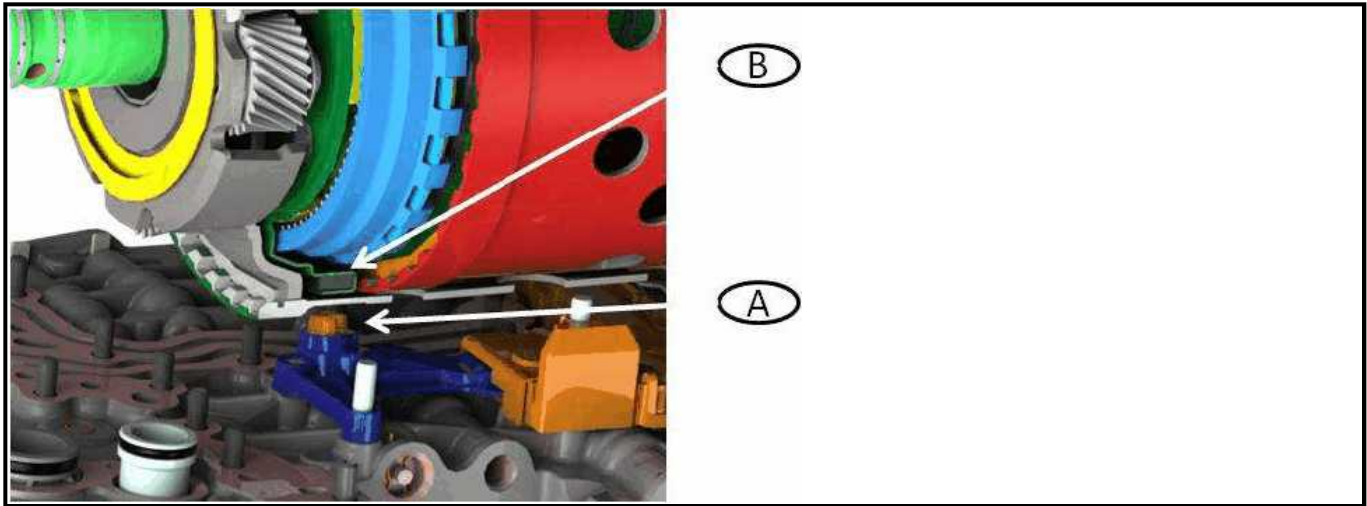
The Input Speed Sensor (ISS) and the Output Speed Sensor (OSS) are integrated components of the Transmission Control Module (TCMA) and not serviced individually.



1 - Input Speed Sensor (ISS)
2 - Transmission Control Module (TCM) (Includes Transmission Temperature Sensor)
3 - External Wire Harness Connector
4 - Output Speed Sensor (OSS)
5 - Park Position Sensor

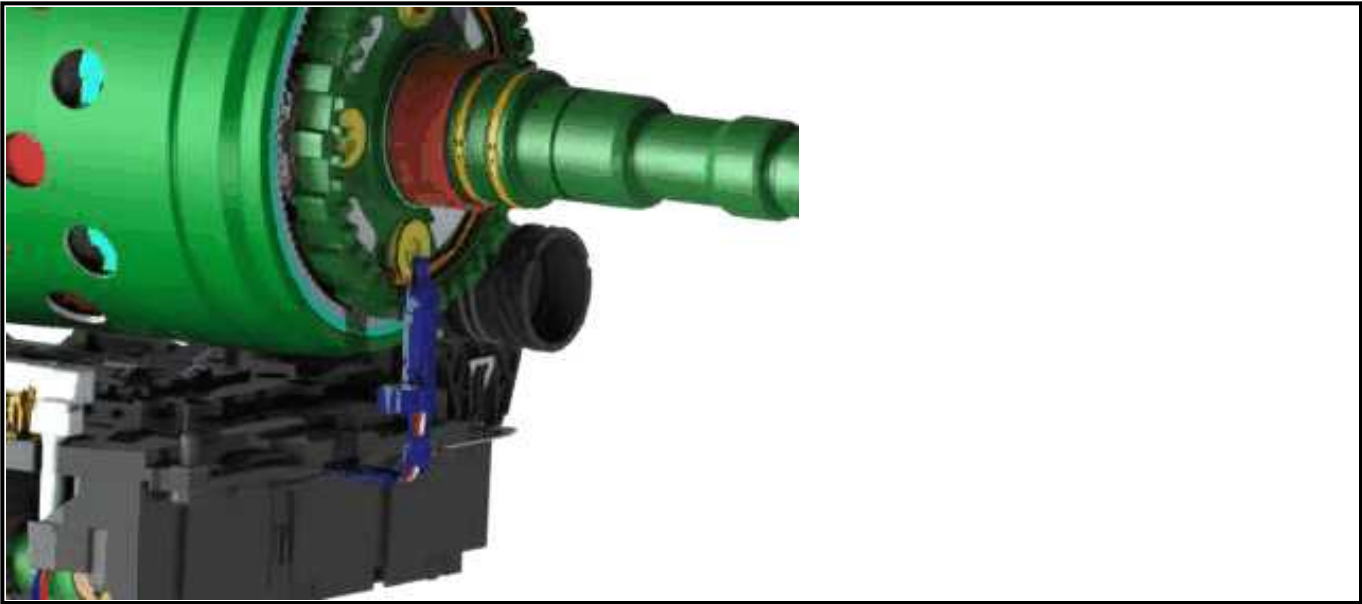
OPERATION

The ISS and OSS are Hall-effect sensors that measure shaft rotational speed. The ISS is located at the front of the TCMA and reads input shaft speed from the magnetic ring on the P2 carrier.

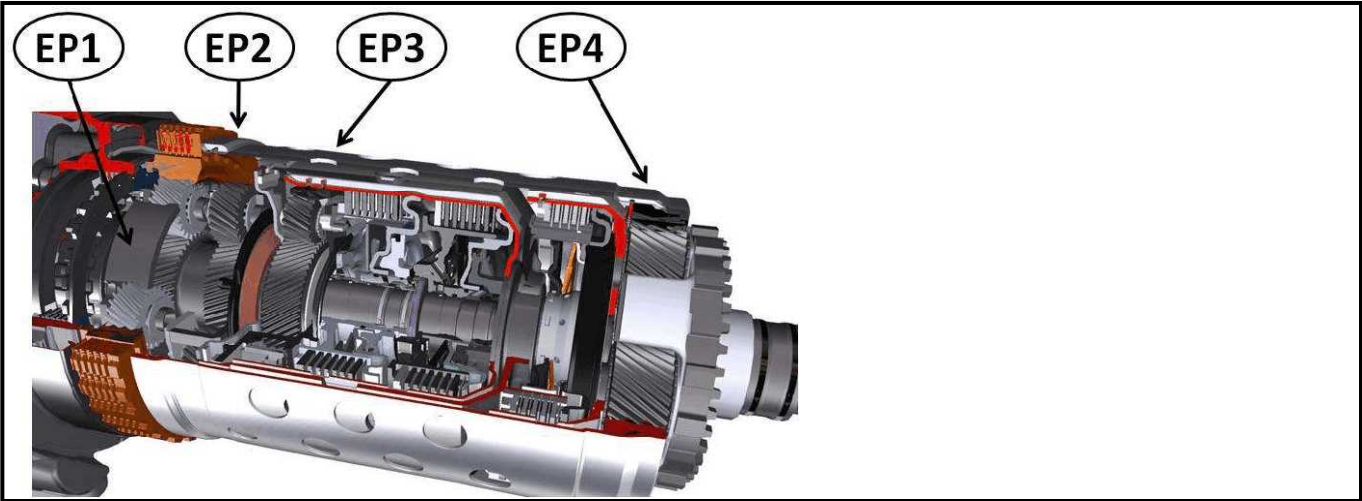


A - Input Speed Sensor
B - Magnetic Ring

The OSS is located at the back of the TCMA and reads output shaft speed from the P4 carrier.



FUNCTIONAL DESCRIPTION - EPICYCLIC GEAR SETS



EP1, EP2, EP3, EP4 = Epicyclic gear train.

The 8 forward gears, and reverse are implemented by connecting four single-arm epicyclic gear trains. The two front gear trains have a common sun gear, while the power is always output through the fourth epicyclic gear train planet carrier.

FUNCTIONAL DESCRIPTION - ENGAGEMENT ELEMENTS (BRAKES AND CLUTCHES)

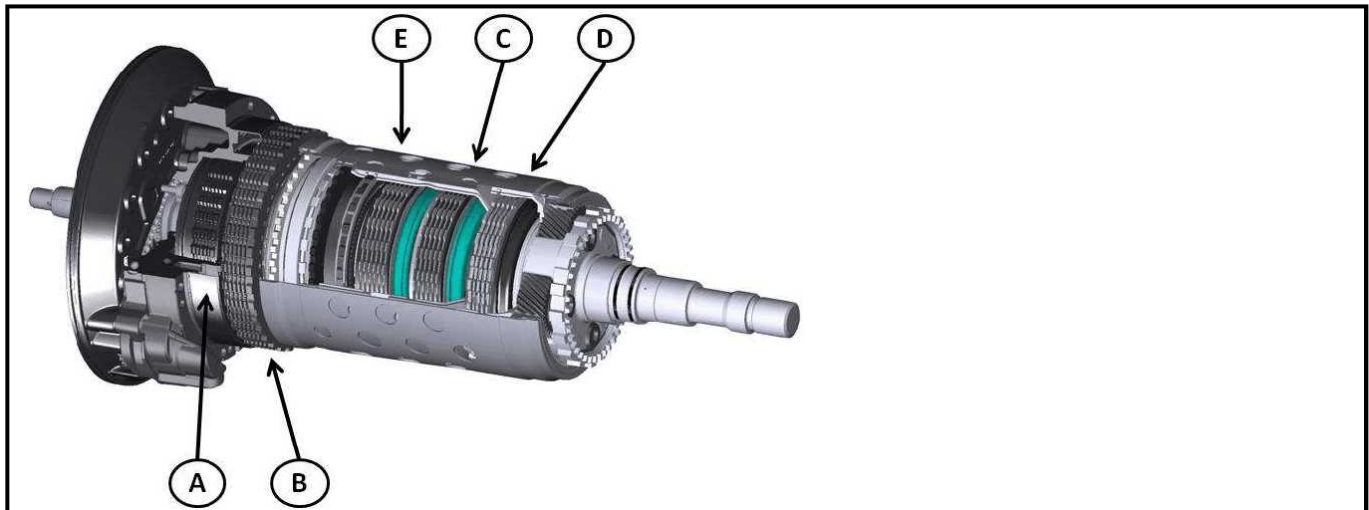
There are five engagement elements divided as follows:

Brakes	A	B	B
Clutches	C	D	E

The clutches and brakes operate as follows:

- Multiple-disc clutches C, D and E transmit the engine torque to the epicyclic gear train while brakes A and B off-load the engine torque to the transmission housing.
- The engagement elements are hydraulically closed. The fluid pressure compresses the disc pack to engage the clutch. When the hydraulic pressure decreases, the diaphragm spring pushes the piston into its rest position.
- The engagement elements serve to engage the gears under load without interrupting the traction force.
- For each gear, three engagement elements are always closed while two engagement elements will always remain open. Each open engagement element creates drag torque which allows an increase in

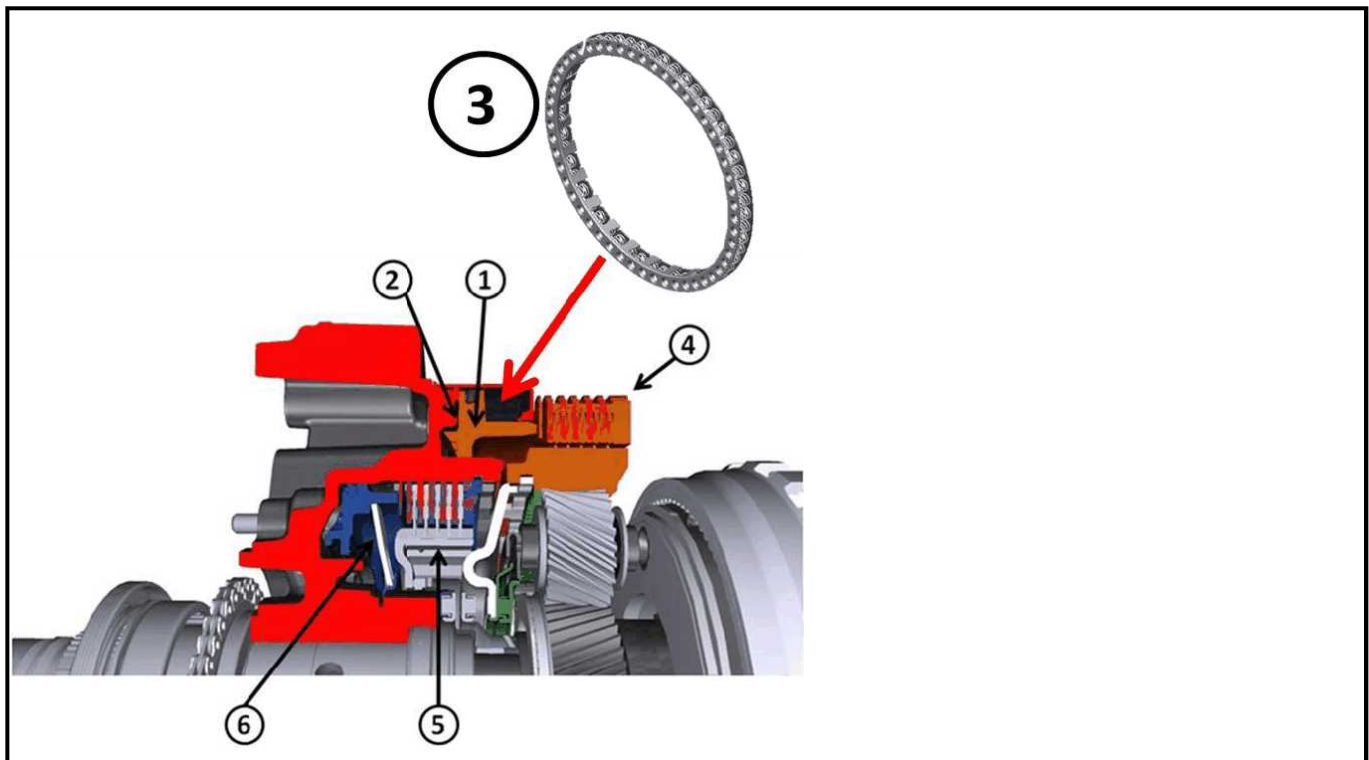
transmission efficiency.



BRAKES

1	Brake B Piston
2	B1 Chamber
3	Return Spring
4	Brake B
5	Brake A
6	Return Spring

- Brake B has a spring pack to return the piston into position.
- Brake A has a diaphragm return spring.



CLUTCHES

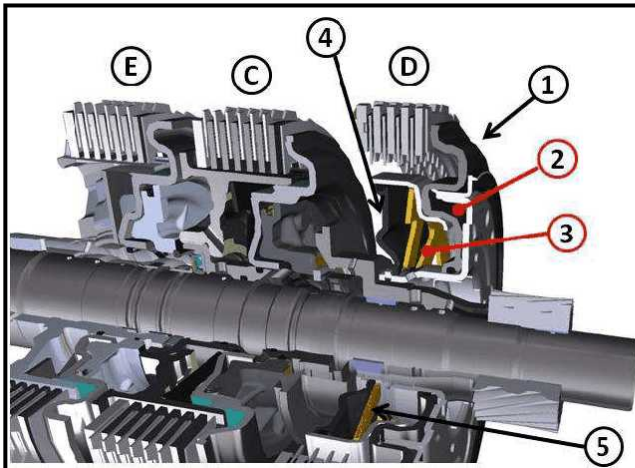
1	Piston
2	Pressure chamber
3	Hydraulic compensation chamber

4

Diaphragm

5

Diaphragm spring



The dynamic pressure of clutches C, D and E is compensated. The increase in dynamic hydraulic pressure at high speeds is due to the fact that the transmission fluid in the clutch cylinder is subject to considerable centrifugal forces created by the rotation. As a result, the pressure in the clutch cylinder increases in the direction of the maximum radius. This "dynamic pressure generation" is undesirable because it increases the pressure and obstructs the defined increase or decrease in the pressure chamber. For the best clutch control, even at high speeds, oil is supplied to both sides of the clutch piston creating a pressure chamber and a pressure compensation chamber. The transmission fluid in the pressure compensation chamber comes from the lubrication ducts and is therefore at low pressure. However, it is subject to the same dynamic pressure increase during rotation due to the centrifugal forces. In this way, the clutch piston contact pressure is balanced, the shift comfort is significantly improved and safe opening and closing of the clutch is ensured at all speeds.

BRAKE CLUTCH ENGAGEMENT MATRIX TABLES

All the gear shifts from first to the eighth speed in either direction are called overlapping engagement/disengagement because during the shift, one clutch must maintain the ability to transmit torque with a reduced pressure, until the other clutch is able to take on the torque.

The gear shift is supported by a brief reduction in torque when shifting up, or a brief increase in torque when shifting down. Thanks to the crossed movements, we can say that the freewheel clutches have been replaced by hydraulic clutch control, with a saving in weight and size.

GEAR	Brake A	Brake B	Clutch C	Clutch D	Clutch E
REVERSE	X	X	B	X	B
1st	X	X	X	B	B
2nd	X	X	B	B	X
3rd	B	X	X	B	X
4th	B	X	B	X	X
5th	B	X	X	X	B
6th	B	B	X	X	X
7th	X	B	X	X	B
8th	X	B	B	X	X
PARK/NEUTRAL	X	X	B	B	B

Engaged = X

Brake/Clutch Engagement Control Solenoid Valves

GEAR	Brake A	Brake B	Clutch C	Clutch D	Clutch E
NEUTRAL	B	B	X	X	X

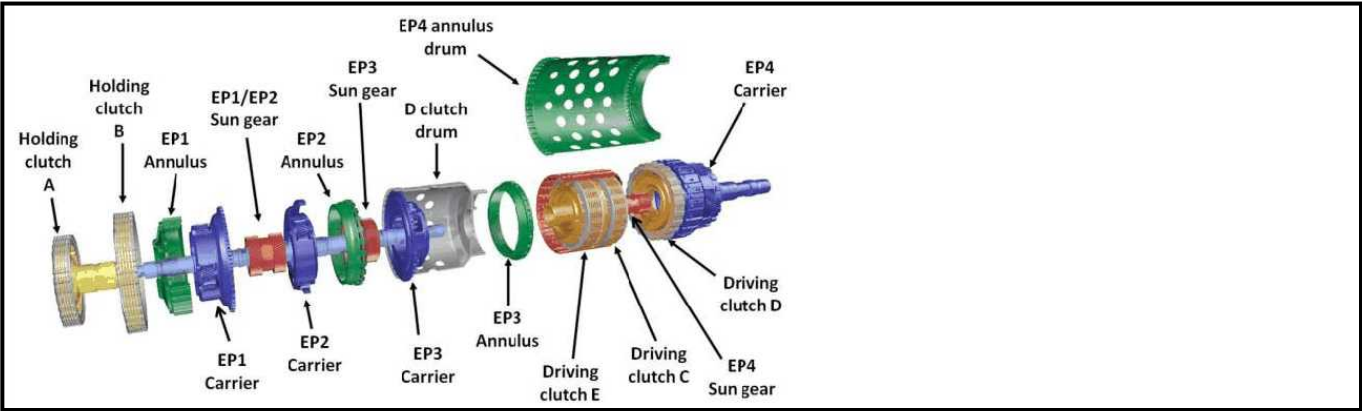
GEAR	Brake A	Brake B	Clutch C	Clutch D	Clutch E
REVERSE	X	X	X	B	X
1st	X	X	B	X	X
2nd	X	X	X	X	B
3rd	B	X	B	X	B
4th	B	X	X	B	B
5th	B	X	B	B	X
6th	B	B	B	B	B
7th	X	B	B	B	X
8th	X	B	X	B	B

Engaged = X

FUNCTIONAL DESCRIPTION - PLANETARY GEAR COMPONENTS

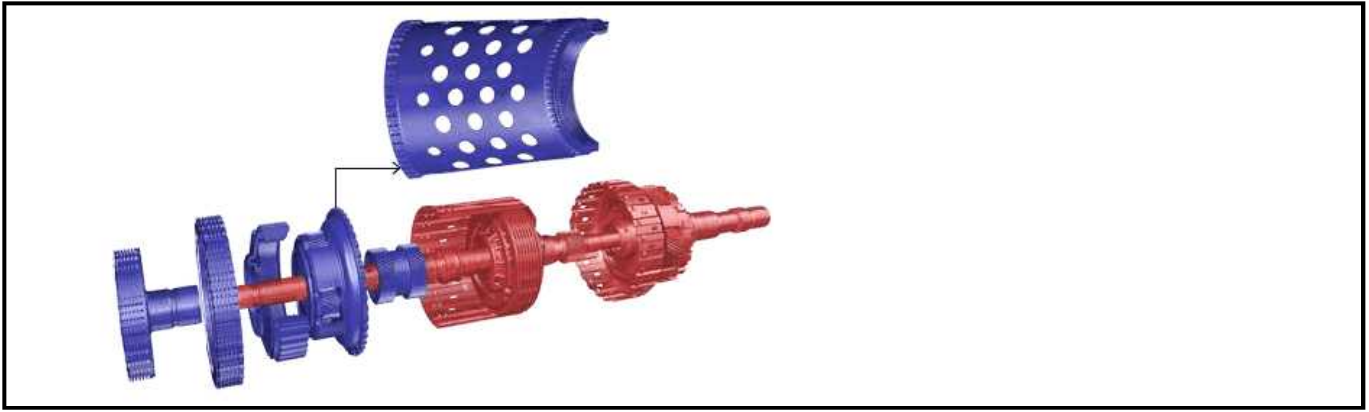
Transmission Components

Holding Clutch
:
Brake (Engagement Element)
Driving Clutch
:
Clutch (Engagement Element)
Annulus
:
Internal Crown Gear
Sun Gear
:
Sun Gear
Carrier
:
Planetary Carrier
Drum
:
Drum



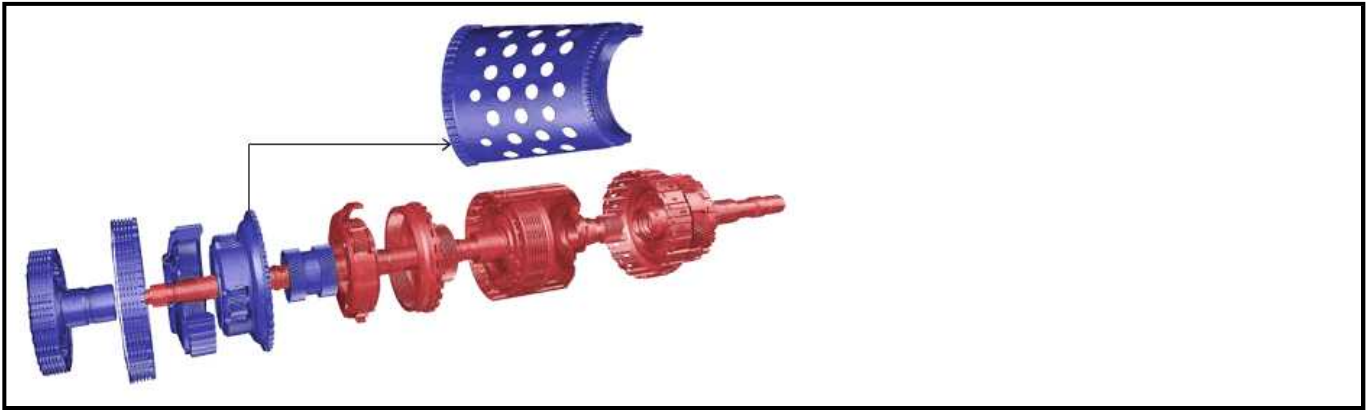
1st GEAR

Engagement elements activated: A, B and C Turbine shaft → clutch C → sun gear 4 → planet gears 4 → planet carrier 4.



2nd GEAR

Engagement elements activated: A, B and E Turbine shaft → planet carrier 2 → planet gears 2 → crown gear 2 → clutch E → sun gear 4 → planet gears 4 → planet carrier 4.

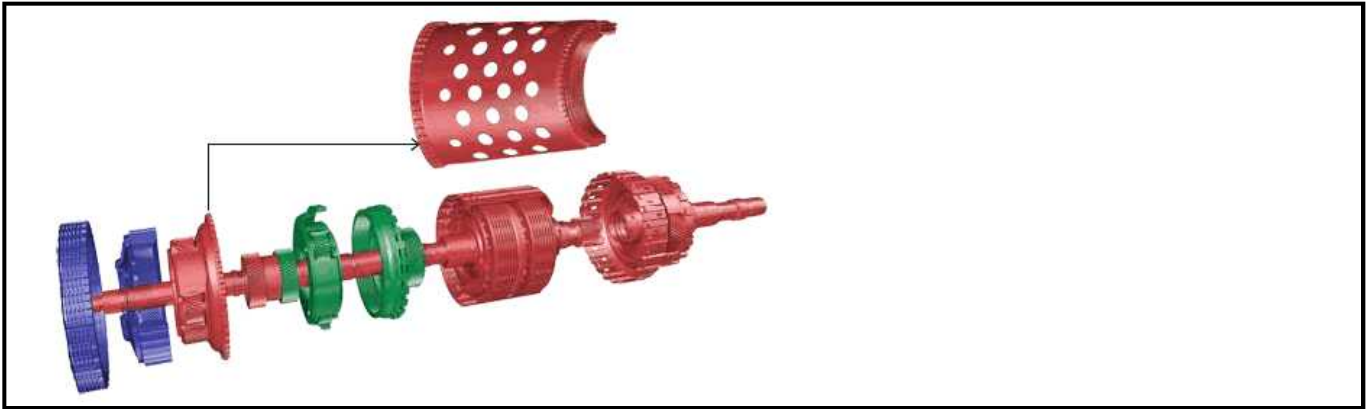


3rd GEAR

Engagement elements activated: B, C and E.

- Turbine shaft → clutch C → sun gear 4 → planet gears 4 → epicyclic gear train 4.
- Clutch C → clutch E → internal crown gear C2 → planet gears 2 (EP2 is blocked since C2 and PT2 are connected through clutches C and E).
- Turbine shaft → planet carrier 2 (EP2 blocked) → sun gear 1 → planet gear 1 → planet carrier 1 → internal crown gear 4.

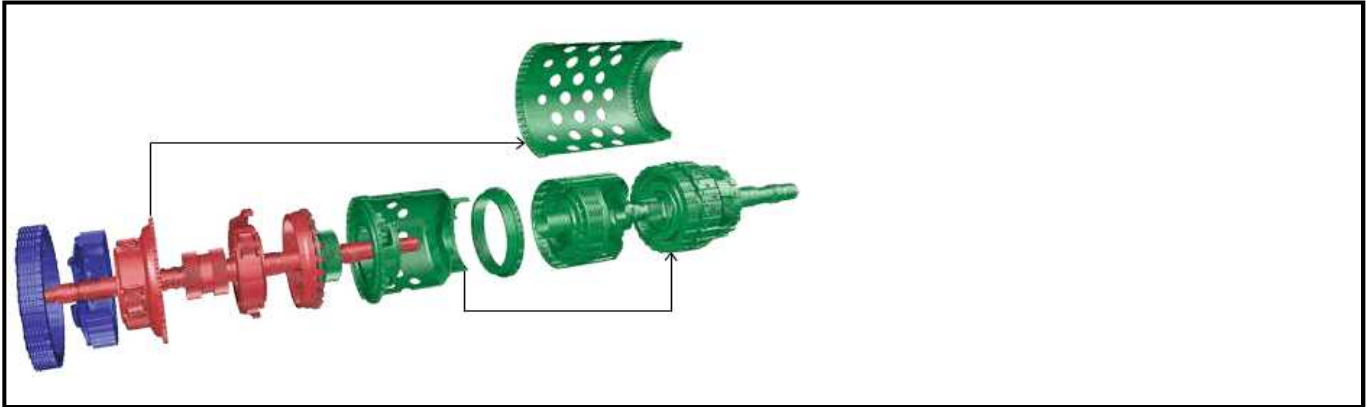
The connection from the epicyclic gear train EP1 to the internal crown gear H4 produces a corresponding transmission ratio in the epicyclic gear train EP4 (see force flow in 1st gear).



4th GEAR

Engagement elements activated: B, D and E.

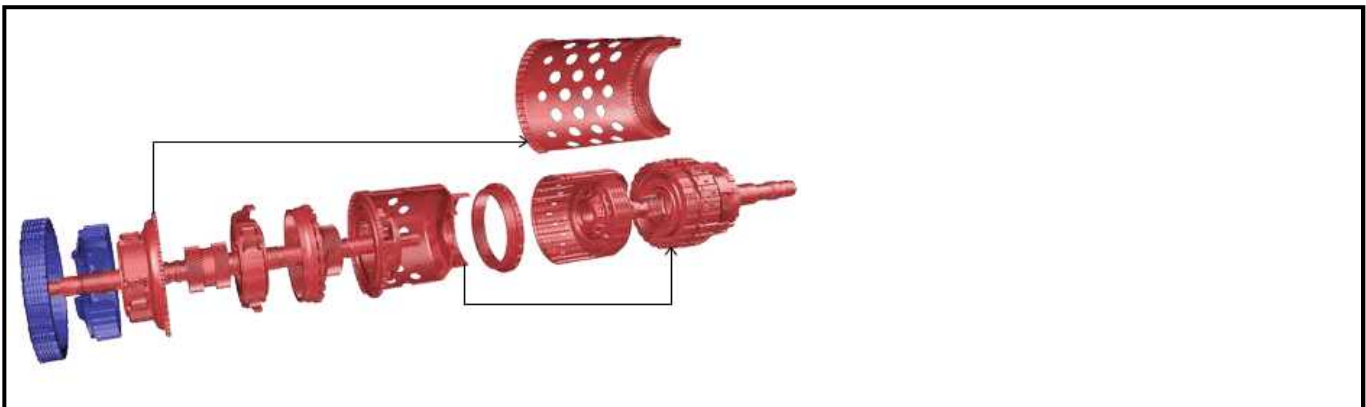
- Clutch E blocks the epicyclic gear train EP3 and clutch D and EP3 being blocked cause the epicyclic gear train EP4 to be blocked (gear trains 3 and 4 rotate at the same speed = output).
- Turbine shaft → planet carrier 2 → planet gears 2 → sun gears 1 / 2 → planet gears 1 → planet carrier 1 → internal crown gear 4 → planet gears 4 → planet carrier 4.



5th GEAR

Engagement elements activated: B, C and D.

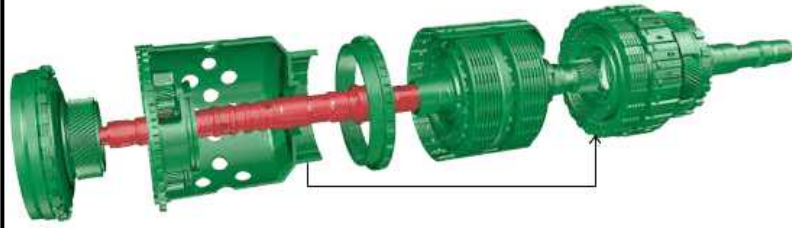
- Turbine shaft → clutch C → sun gear 4 + internal crown gear 3 (EP2, C2 and S4 = turbine speed).
- Clutch D connect epicyclic gear train 3 to epicyclic gear train 4 (= output shaft).
- Turbine shaft → planet carrier 2 → planet gears 2 → sun gears 1 / 2 → planet gears 1 → planet carrier 1 → internal crown gear 4 → gives a behavior that depends on the speed ratio of S4 (= turbine speed) to C4 with the corresponding speed on PT4.



6th GEAR

Engagement elements activated: C, D and E.

- Clutches D and E block epicyclic gear trains EP3 and EP4.
- The torque is applied to the epicyclic gear set through clutch C.
- The whole epicyclic gear set rotates at the same speed as the turbine (blocked).



7th GEAR

Engagement elements activated: A, C and D.

- Turbine shaft → clutch C → sun gear 4 + internal crown gear 3 (= turbine speed).
- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → sun gear 3 → planet gears 3 → planet carrier 3 → clutch D → planet carrier 4.
- Clutch D connects the epicyclic gear train EP3 to planet carrier PT4 (= output shaft).



8th GEAR

Engagement elements activated: A, D and E.

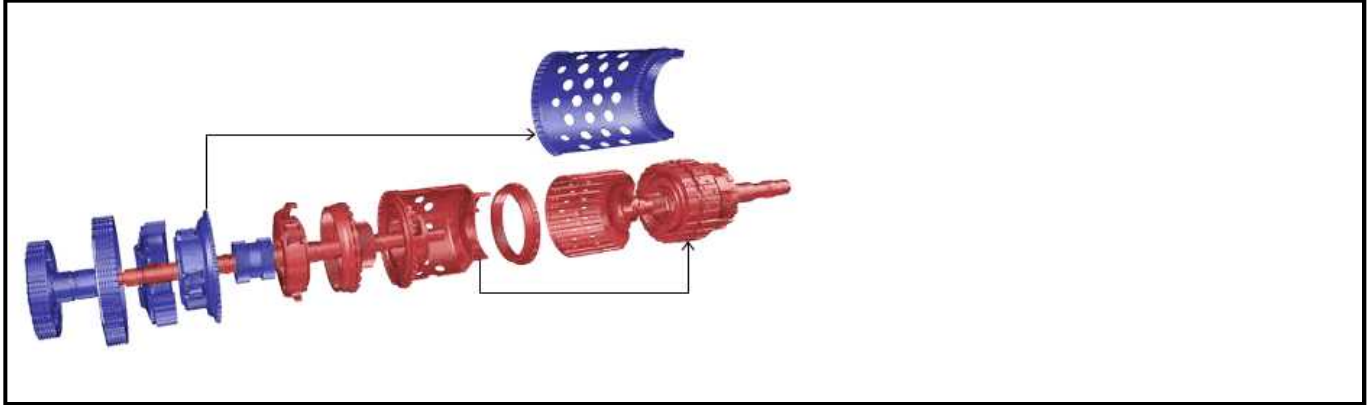
- Clutch E blocks epicyclic gear train EP3.
- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → epicyclic gear train EP3 (blocked) → clutch D → planet carrier 4.
- Clutch D connects planet carrier 3 to planet carrier 4 (= output shaft).



REVERSE GEAR

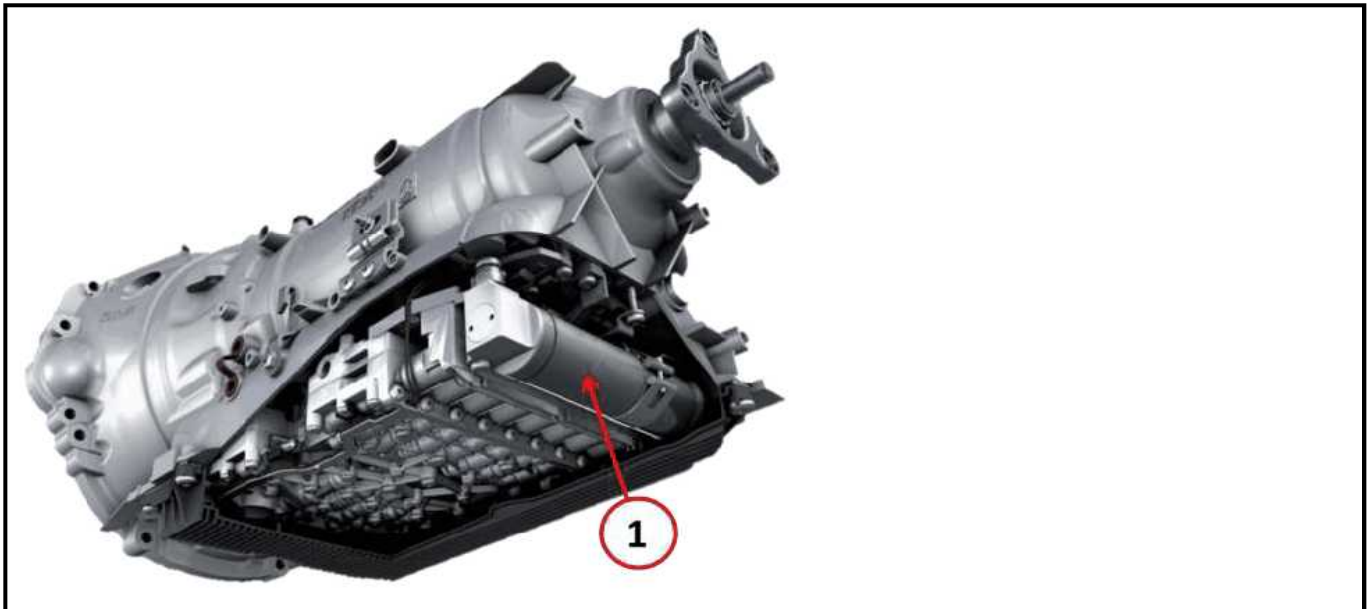
Engagement elements activated: A, B and D.

- Clutch D connects planet carrier 3 to planet carrier 4 (= output shaft).
- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → sun gear 3 → planet gears 3 → planet carrier 3 → clutch D → planet carrier 4.
- Internal crown gear C3 is firmly fixed to sun gear S4.
- S4 drives P4 in the opposite direction to that of the engine.
- Gears P4 roll around fixed C4, rotating PT4 with the transmission ratio indicated in the opposite direction to that of the engine.



FUNCTIONAL DESCRIPTION - HYDRAULIC IMPULSE SOLENOID (HIS)

A hydraulic impulse solenoid is installed on the transmission, inserted in the transmission housing close to the mechatronic unit solenoid valves. The HIS provides a hydraulic pressure reserve, to be sent to the mechatronic unit during engine starting due to the Engine Stop Start (ESS) function. The component is used for the ESS function as it allows the gear to be engaged in just 350 milliseconds from starting the engine, so that the driver does not perceive the engagement delay. The HIS charges when the engine is running, since the pump sends part of the oil to the HIS, in addition to sending it to the mechatronic unit.



1 - Hydraulic Impulse Solenoid

The HIS is fixed to the transmission housing. It receives and accumulates about 1 liter of oil from the transmission oil pump through a connector. The oil sent to the HIS by the pump, must pass through a regulating valve. The HIS is composed of a piston with a small hole and a spring. During accumulation, the oil only passes through the small hole in the piston. When the oil enters the HIS, the pressure overcomes the force of the spring. The spring is compressed and allows the piston to withdraw and attach to a blocking point controlled by a solenoid valve. If the HIS is powered or the oil pump is operating, the piston will remain blocked.

During Start & Stop operation, namely when the engine is off, the HIS is powered in order to keep the piston blocked, even when the oil is no longer being pumped. When the vehicle is restarted, the HIS will no longer be powered and the spring will be able push the piston, which will send the oil under pressure to the mechatronic unit to engage the gear. When the piston pushes the oil, the regulating valve spring compresses, opening the valve fully to allow the oil at the HIS outlet to pass.

SELECTABLE DRIVE MODES

TOW / HAUL MODE: When driving in hilly areas, towing a trailer, or carrying a heavy load and frequent transmission shifting occurs, pressing the TOW/HAUL switch to select TOW/HAUL mode will improve performance and reduce the potential for transmission overheating or failure due to excessive shifting. When operating in TOW/HAUL mode, transmission upshifts are delayed, 8th gear overdrive is prohibited, the Multiple Displacement System (MDS) system is prohibited from cylinder deactivation, and the transmission will automatically downshift (for engine braking) during steady braking maneuvers. The "TOW/HAUL Indicator Light" will illuminate in the Instrument Panel Cluster (IPC) to indicate that TOW/HAUL mode has been activated. Pressing the switch a second time restores normal operation. If TOW/HAUL mode is desired, the switch must be pressed each time the engine is started. The Radio serves as the user interface for the Drive Mode feature. When a vehicle is equipped with this feature the user will be able to select the TOW/HAUL mode in both run (engine not running/engine running) states. The Auxiliary Switch Bank Module (ASBM) houses the TOW/HAUL switch. The ASBM is responsible for performing any diagnostics necessary for the TOW/HAUL switch. When the switch is depressed, the ASBM module will update and send a Local Interface Network (LIN) signal value over the LIN BUS as a command to engage the vehicle in Tow Haul mode.

The TOW/HAUL mode feature will be inhibited if:

- The 4 Wheel Drive Low mode is selected while the TOW/HAUL Mode is active the TCM will automatically disengage TOW/HAUL mode.
- The TOW/HAUL mode is requested while the 4 Wheel Drive Low mode is already active the TCM will ignore the TOW/HAUL Request.
- The Hill Descent Control (HDC) mode is selected while the TOW/HAUL mode is active the TCM will automatically disengage TOW/HAUL mode.
- The HDC mode is active the TCM will inhibit the TOW/HAUL feature.

HILL DESCENT MODE: HDC is a low-speed limiter which allows the driver to concentrate on the path of the vehicle while negotiating off-road downhill terrain. HDC will apply hydraulic braking without requiring the driver to apply the brake pedal. HDC activates the front and rear brakes while descending a hill to limit the vehicle speed to a pre-set value. Descent speed is selectable (when the gear shifter is in the drive position) via the transmission gear +/- selectors. HDC is armed by a switch, but the Electronic Stability Control (ESC) will not actively control braking unless the conditions are met to activate the feature.

HDC WILL BE ACTIVE IF THE FOLLOWING CONDITIONS ARE MET:

- HDC has been enabled AND the vehicle is on downhill grade of sufficient magnitude (first trial 8%), this requirement is satisfied by sensory input to the ESC module.
- Vehicle speed is below the tunable threshold (first trial 20 mph). This requirement is satisfied by sensory input to the ESC module.
- Gear selector is in R, N, D, or any numeric indicated value (not P).

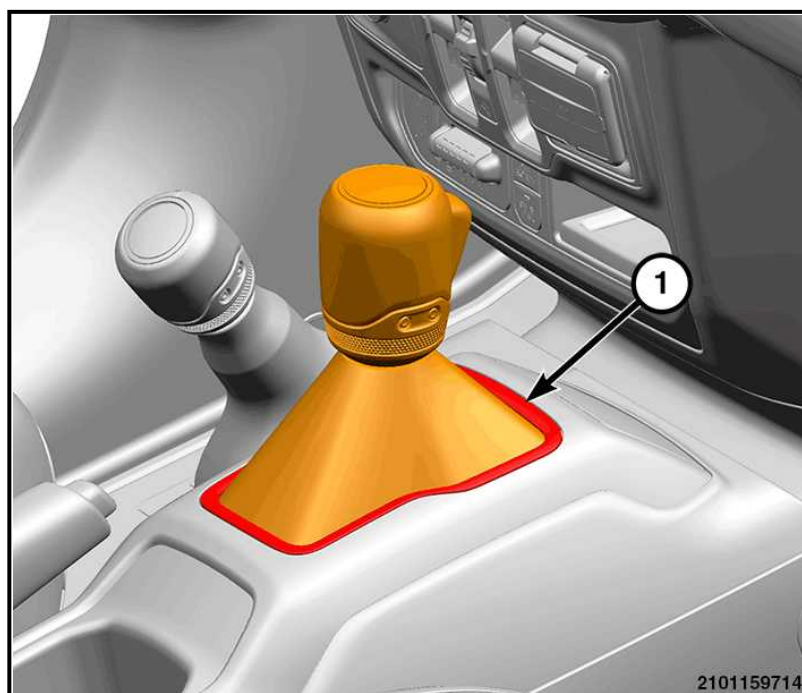
HDC WILL DEACTIVATE IF ANY OF THE FOLLOWING CONDITIONS ARE MET:

- Vehicle speed exceeds a tunable threshold (first trial 20 mph) for less than 70 seconds. This condition is satisfied by sensory input to the ESC module.
- Brakes exceed the calibrated thermal threshold.
- HDC is no longer actively controlling the vehicle speed during throttle override.
- Vehicle is on a downhill grade of insufficient magnitude (first trial 8%), or is on level or uphill grade.
- Vehicle is shifted to P.

HDC shall allow driver override but remain available: The driver may increase vehicle speed above HDC target speed for a short duration by applying throttle to accelerate the vehicle. The speed and duration of the driver override are limited. Upon release of the throttle HDC must control downhill vehicle speed back to the HDC target speed. The rate of return from driver override speed to target speed must be tunable to allow a smooth transition. The driver may decrease the vehicle speed below the HDC target speed by applying the brakes to slow the vehicle. Regardless of the braking level requested from the driver, HDC must control downhill vehicle speed to a maximum of the HDC target speed. The rate of return from the driver override speed to the target speed must be tunable to allow smooth transition. If the driver presses the brake and the brake torque level requested by the driver is insufficient keep the vehicle speed below the target speed set by the driver, the ESC shall continue to hold hydraulic braking in order to avoid an increase in vehicle speed while the driver is manually trying to decrease the vehicle speed.

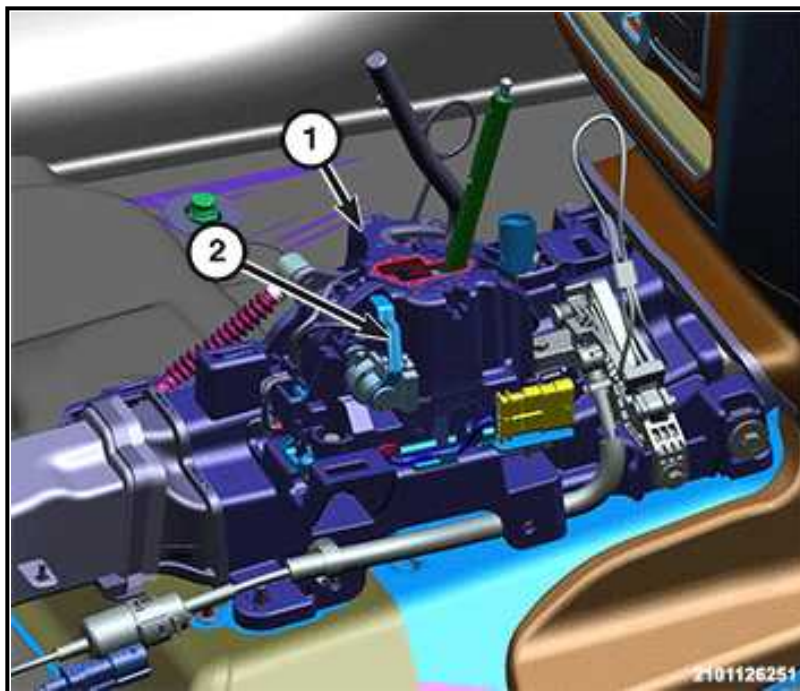
SHIFTER

DESCRIPTION



The automatic transmission is operated with the help of a Shift Lever Assembly (SLA) (1) located in the floor console.

All selector lever positions, as well as selected shift ranges in position "D", are identified by the SLA. The information is then sent to the Transmission Control Module (TCM) via a hard wire connection.



BTSI OVERRIDE

1.	SHIFT LEVER ASSEMBLY
2.	BTSI OVERRIDE

There are four positions to which the selection lever can be shifted: P, R, N, D. In addition, the selector lever can be moved sideways (+/-) in position "D" to adjust the shift range.

OPERATION

The SLA is comprised of the following functions:

- **Park lock:** The selector lever is not released from position "P" until the brake pedal has been applied and the ignition is in the "ON" position with the engine running. Shift lock is controlled by the brake light switch in conjunction with a locking solenoid in the SLA. As soon as the brake pedal is applied firmly, the locking solenoid is energized and retracted to unlock the selector lever. If the selector lever cannot be moved out of position "P" due to a malfunction, the shift lock function can be overridden. Refer to the appropriate information .
- **Reverse inhibitor:** As soon as the vehicle speed exceeds approximately 6-11 kmh (4-7 mph), it is still possible to move the shift from position "N" to position "R", but the system will not shift into reverse until the vehicle speed has fallen below 7 mph. The reverse inhibit functionality is controlled by the same solenoid as the park lock. As the vehicle accelerates past the calibrated speed threshold, the solenoid is energized to block the sideways motion of the shift lever necessary to move from NEUTRAL to REVERSE. The reverse inhibit is not released until the vehicle speed falls below approximately 4-7 mph and the shifter is moved out of the "D" shifter position.

With the selector lever in position "D", the TCM automatically shifts the gears that are best-suited to the current operating situation. This means that shifting of gears is continuously adjusted to current driving and operating conditions in line with the selected shift range and the accelerator pedal position. Starting off is always performed in 1st gear.

The SLA positions are determined by a sensor assembly internal to the SLA. The sensor assembly identifies the various positions of the SLA according to the following table.

SLA Position	Bit 0	Bit 1	Bit 2	Bit 3
Default	0	0	0	0
"D"	1	0	1	0
"N"	0	1	1	0

SLA Position	Bit 0	Bit 1	Bit 2	Bit 3
"R"	1	1	1	0
"P"	0	0	0	1
"+"	1	0	0	1
"-"	0	1	0	1
"ND"	1	1	0	1
"RN"	0	0	1	1
"PR"	1	0	1	1
Implausible	1	1	1	1

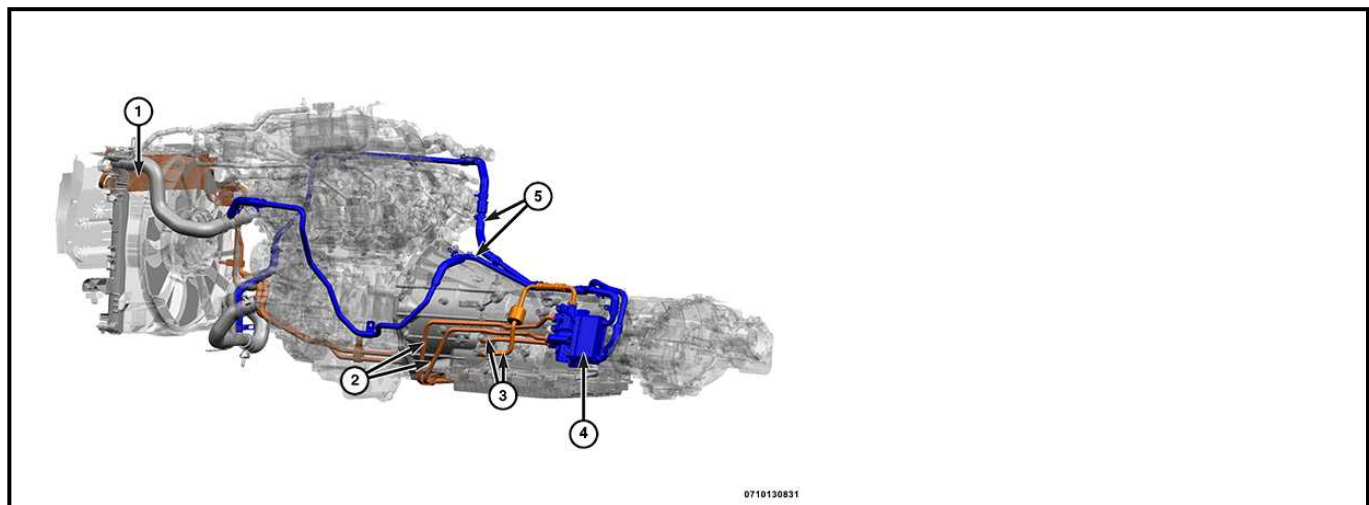
The current SLA position or, if the shift range has been limited, the current shift range is indicated in the instrument cluster display as well as the PRNDM.

The permissible shifter positions and transmission operating ranges are:

- P = Parking lock and engine starting.
- R = Reverse.
- N = Neutral and engine starting (no power is transmitted to the axles).
- D = The shift range includes all forward gears.
- M = Manual mode allows manual input of shifts up or down in all forward gears.

TRANSMISSION COOLING SYSTEM

DESCRIPTION



COMPONENT INDEX

1 - Transmission Fluid Cooler
2 - Cooler Lines
3 - Cooler Lines
4 - Trans Fluid Heat Exchanger
5 - Coolant Hoses

The automatic transmission fluid cooler is located behind the front fascia, and in the front of the condenser. The transmission fluid cooler is a air-to-oil cooler that allows heat in the transmission fluid to be transferred to the air passing over the cooler fins.

OPERATION:

Transmission fluid is routed through the transmission fluid cooler where heat is removed from the transmission fluid before returning to the transmission.

The transmission fluid heat exchanger uses engine coolant to assist in cooling the transmission fluid. It also incorporates the quick connect fittings for the transmission fluid cooler lines.

HEAT EXCHANGER:

- The transmission heat exchanger cools the Automatic Transmission Fluid (ATF) by means of engine coolant.
- The transmission heat exchanger coolant hoses are routed to the engine radiator hoses.
- ATF runs through the transmission heat exchanger through transmission fluid tubes.

DIAGNOSIS AND TESTING

GENERAL CONDITIONS

CAUTION: Before attempting any repair on an automatic transmission, check for Diagnostic Trouble Codes (DTC) with the appropriate scan tool.

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

NOTE: ZF transmissions are filled from the factory with UV leak detection dye. Do NOT add leak detection dye to the transmission. Adding oil dye can cause shift quality issues and is not recommended.

Transmission malfunctions may be caused by the following general conditions:

- Poor engine performance.
- Hydraulic malfunctions.
- Mechanical malfunctions.
- Electronic malfunctions.
- Transfer case performance (if equipped).

Diagnosis of these problems should always begin by checking the following easily accessible variables:

- Transmission fluid level
- Transmission fluid condition
- Transmission DTCs using an appropriate scan tool
- Perform a thorough road test to determine if the problem has been corrected or if more diagnosis is necessary

PRELIMINARY

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

1. Check for transmission Diagnostic Trouble Codes (DTCs) using the appropriate scan tool.

2. Check the transmission fluid level and condition.
3. Road test and note how transmission upshifts, downshifts, and engages.

VEHICLE IS DISABLED

1. Check for transmission fault codes using the appropriate scan tool.
2. Check for cracked or leaking transmission cooler lines.
3. Check the transmission fluid level and condition.
4. With the transmission in the Park position, attempt to rotate driveshaft(s) to ensure transmission output shaft coupler/flange is secure.
5. Check the transfer case operation (if equipped).
6. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE**.
7. Start the engine with the transmission in the Park position and allow the vehicle to idle for several minutes, shift the transmission into gear, and note following:
 - a. If driveshaft turns but wheels do not, the problem is with the differential or axles.
 - b. If driveshaft does not turn and transmission is noisy, turn off the engine. Remove the transmission oil pan and check for debris indicating an internal transmission failure. If debris is present, remove the transmission for repair. If the transmission oil pan is clear, remove the transmission and check for damaged flexplate, torque converter, transmission oil pump, or input shaft.
8. Check the Transmission Control Module Assembly (TCMA), wiring, valve body, and solenoids (utilize fault codes to diagnose if available).
9. Remove the support and lower the vehicle.

ROAD TESTING

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

Before road testing, be sure the transmission fluid level has been checked and adjusted if necessary. Verify that all Diagnostic Trouble Codes (DTCs) have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage.

NOTE: Take note during the road test if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, overrunning clutch, or line pressure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

CLUTCH APPLICATION

GEAR	A	B	C	D	E	RATIO
1	X	X	X	B	B	4.71: 1
2	X	X	B	B	X	3.14: 1
3	B	X	X	B	X	2.11: 1
4	B	X	B	X	X	1.67: 1
5	B	X	X	X	B	1.29: 1
6	B	B	X	X	X	1.00:1

GEAR	A	B	C	D	E	RATIO
7	X	B	X	X	B	0.84: 1
8	X	B	B	X	X	0.67: 1
P/N	X	X	B	B	B	N/A
R	X	X	B	X	B	3.30: 1

CLUTCH AIR PRESSURE TESTS



Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure using (special tool #10383, Plate, Clutch Pressure Test).

The clutches may be tested by applying air pressure to their respective passages. The valve body must be removed. To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 5-8 bar (73-116 psi).

Remove the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#). Install (special tool #10383, Plate, Clutch Pressure Test) and tighten bolts to 6 N.m (50 in. lbs.). When testing is finished install valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#). Fill the transmission. Refer to [TRANSMISSION FILL AFTER SERVICE](#).

NOTE: If any clutch does not appear to be functioning with the air, add some 8HP transmission fluid and try the test again. Some circuits will not operate without fluid.

STANDARD PROCEDURE

MANUAL PARK RELEASE (MPR) - DISENGAGE AND ENGAGE

DISENGAGE

The Manual Park Release (MPR) lever is used for putting the transmission in neutral anytime the vehicle needs to be moved with the engine off in neutral. This is achieved by a cable attached to the transmission park pawl. When the cable is pulled, the transmission is put into neutral, and when the cable is released, the transmission is back into park.

WARNING:

Always secure your vehicle by fully applying the parking brake, before activating the Manual Park Release. Activating the Manual Park Release will allow your vehicle to roll away if it is not secured by the parking brake or by proper connection to a tow vehicle. Activating the Manual Park Release on an unsecured vehicle could lead to serious injury or death for those in or around the vehicle.

1. Set the parking brake.
2. Apply firm pressure to the brake pedal while seated in the driver's seat.



3. Locate the Manual Park Release access cover (1) in front of the shifter.



4. Using a small screwdriver or similar tool, remove the Manual Park Release access cover (1).

NOTE:

Take care not to scratch or mar the console or cover.



5. Pull the tether strap (1) out as far as it will go, then release it. The transmission is now in **NEUTRAL** , allowing the vehicle to be moved.

NOTE: When the lever is locked in the released position, the tether will remain outside of the trim panel and the access cover cannot be re-installed.

6. Release the parking brake only after the vehicle is secure.

ENGAGE

WARNING: Always secure your vehicle by fully applying the parking brake, before activating the Manual Park Release. Activating the Manual Park Release will allow your vehicle to roll away if it is not secured by the parking brake or by proper connection to a tow vehicle. Activating the Manual Park Release on an unsecured vehicle could lead to serious injury or death for those in or around the vehicle.

1. Apply firm pressure to the brake pedal while seated in the driver's seat.



2. Pull the tether strap (1) out again, then release it.
3. Allow the tether (1) to retract with the lever back to its original position.
4. Verify that the transmission is in **PARK** .



5. Confirm that the tether has fully retracted and re-install the access cover (1).

CHECK FLUID LEVEL

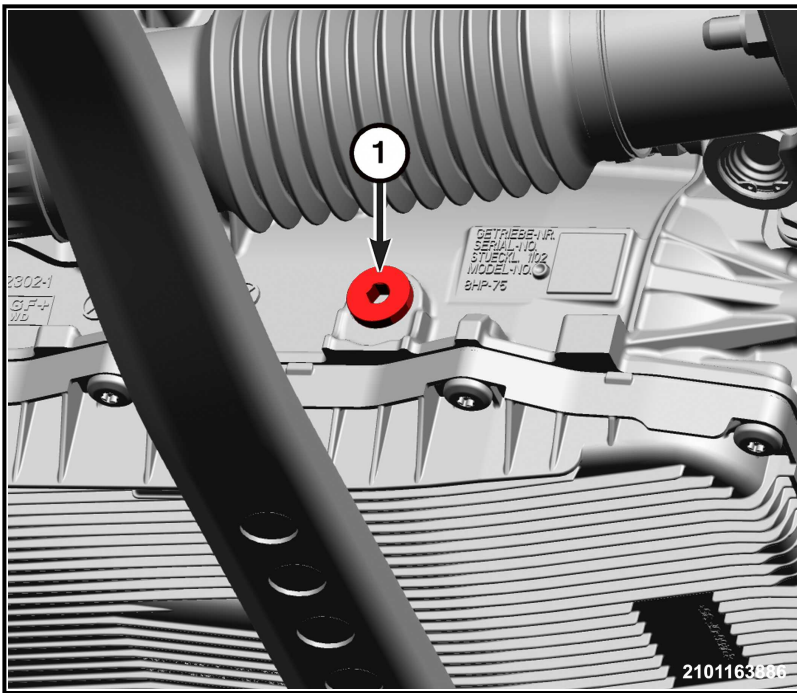
To properly check and fill the transmission, perform the following procedure:

WARNING: There is a risk of accident from vehicle moving when the engine is running. Secure vehicle to prevent it from moving. There is a risk of injury from contusions and burns if you insert your hands into the engine when it is running. Do not touch hot or rotating parts. Wear properly fitted work clothes.

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is **NOT** compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see **FLUIDS, LUBRICANTS AND GENUINE PARTS**.

NOTE: Oil dye is not required to find leaks in the 8HP transmission. The oil dye can cause shift quality issues and is not recommended. The 8HP fluid has illuminance that is visible under a black light.

1. Raise and support the vehicle **on a level hoist** . Refer to **HOISTING, STANDARD PROCEDURE** .
2. Start the engine. The engine must continue to run for the entire test.
3. Using a diagnostic scan tool or the Electronic Vehicle Information Center (EVIC), verify that the transmission fluid temperature is below 30B°C (86B°F).
4. Disable the Electronic Stability Control (ESC).



1 - Fill Plug

5. Remove the transmission fill plug from the left rear of the transmission case.
6. Add transmission fluid until it trickles from the transmission fill plug opening.
7. Install the transmission fill plug.
8. Lower the vehicle for access to inside of the vehicle, leaving the tires at least 8 inches off the ground.
9. With the brakes applied, place the transmission in REVERSE and hold for 5 seconds.
10. Place the transmission in DRIVE and hold for 5 seconds.
11. Release the brakes, slowly accelerate to 2nd gear and hold for 5 seconds.
12. Apply the brakes and place the transmission in NEUTRAL.
13. Raise the engine speed to 2000 RPM for 5 seconds.
14. Return the engine to idle and place the transmission in PARK.

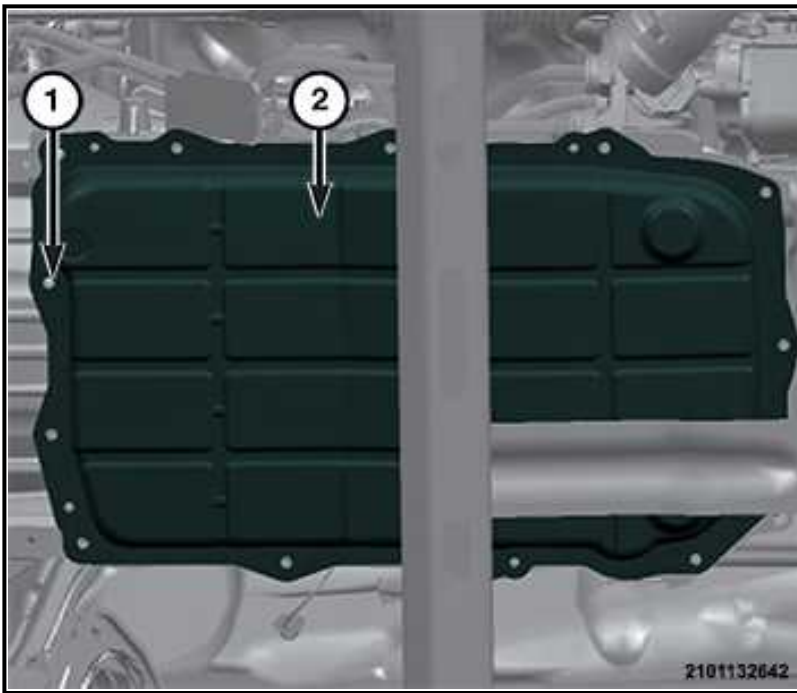
NOTE: **A full transmission will have fluid at the transmission fill hole with the transmission between 30B°C (86B°F) and 50B°C (122B°F). Do not over fill.**

15. Remove the transmission fill plug and allow excess fluid to drain from the transmission fill hole or add fluid as necessary.
16. Install the transmission fill plug.
17. Remove the support and lower the vehicle.
18. Using a diagnostic scan tool, clear any Diagnostic Trouble Codes (DTC).

TORQUE SPECIFICATIONS

FLUID/FILTER SERVICE

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Drain the transmission fluid by partially removing the transmission fluid pan bolts and letting the fluid drain from the transmission fluid pan.

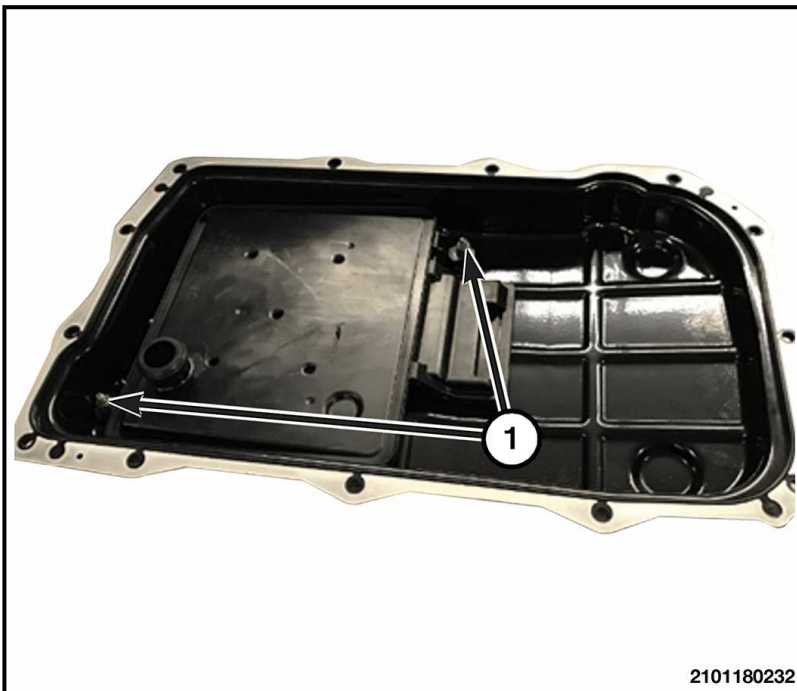


1 - Transmission Fluid Pan Bolts

2 - Transmission Fluid Pan

3. Remove the transmission fluid pan bolts and remove the transmission fluid pan.

NOTE: Inspect the gasket for reuse. If the seal is cut or torn, replace the gasket.

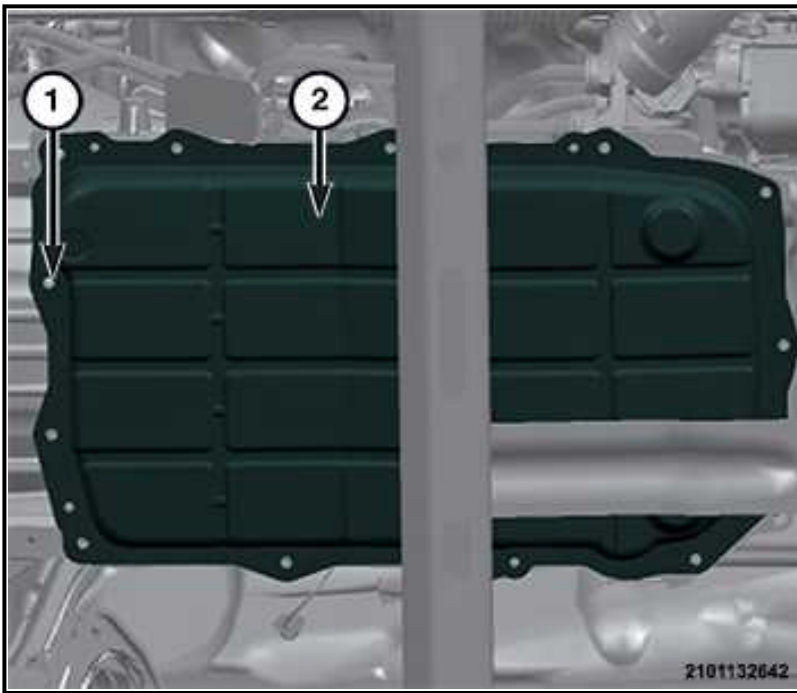


1 - Transmission Fluid Filter Nuts

NOTE: Check filter availability before removing. The filter is only available with the transmission oil pan in some applications.

4. Remove the transmission fluid filter nuts and **DISCARD** the transmission fluid filter.

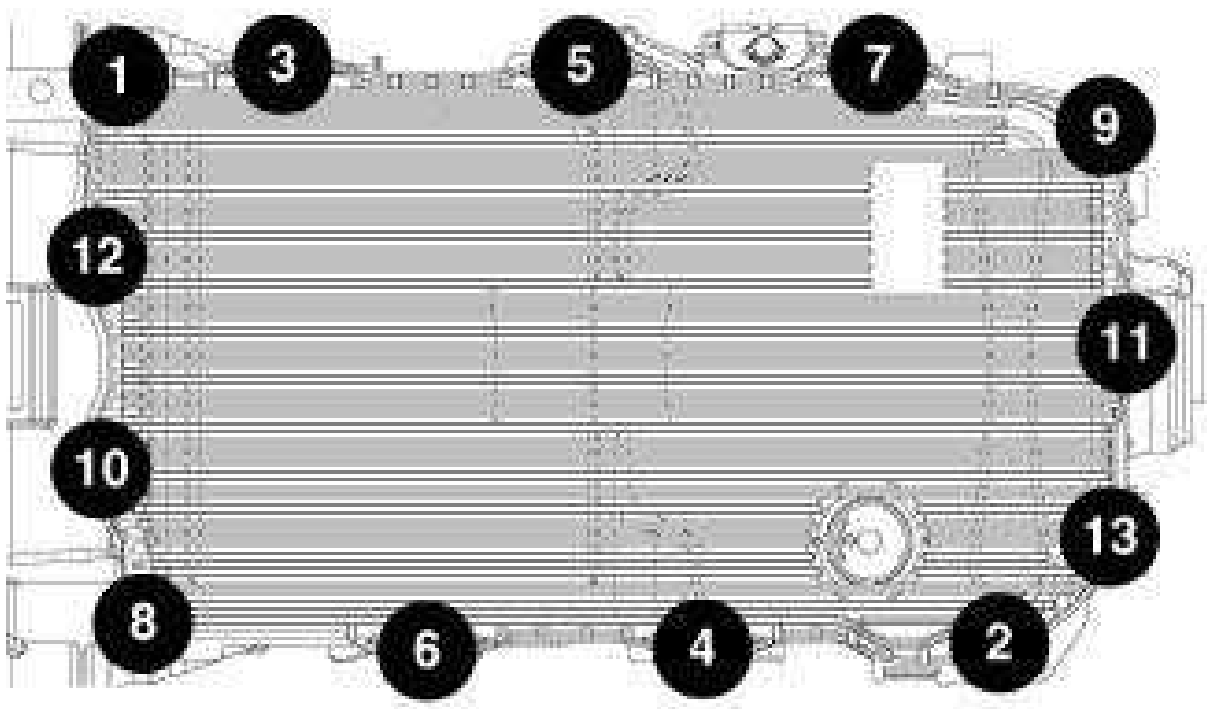
5. Install the **NEW** transmission fluid filter and tighten the nuts securely.



1 - Transmission Fluid Pan Bolts

2 - Transmission Fluid Pan

6. Install the transmission fluid pan and tighten the bolts hand tight.



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Fig. 1: Oil Pan Retaining Bolts Tightening Sequence

Courtesy of CHRYSLER GROUP, LLC

7. Tighten the transmission fluid pan bolts using the sequence shown.

8. Check and adjust the transmission fluid level. Refer to [CHECK FLUID LEVEL](#) .
9. Remove the support and lower the vehicle.

TORQUE SPECIFICATIONS

TRANSMISSION FILL AFTER SERVICE

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

To properly fill the transmission after an in vehicle service or overhaul, perform the following procedure:

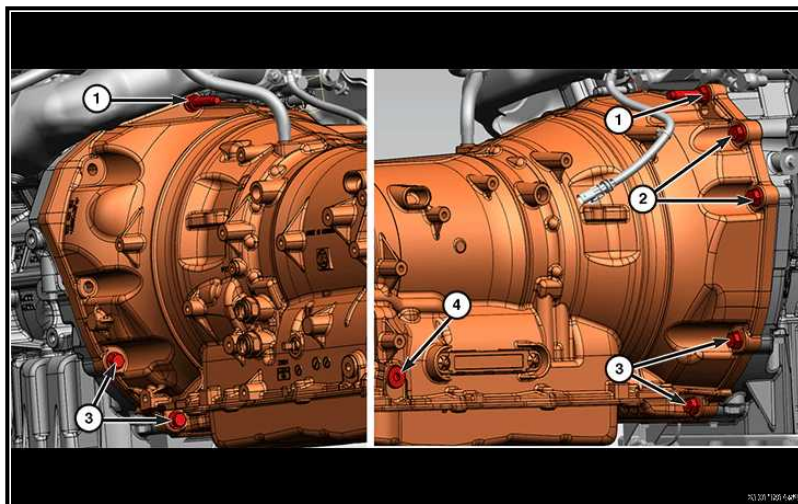
NOTE: If the transmission cooler was replaced, add an additional 0.7L (0.72 qts) of transmission fluid.

1. If the transmission was overhauled , prior to installing in the vehicle, tip the transmission on it side, remove the oil fill plug on the right rear side of the case and install 9L (9.5 qts) of transmission fluid. Install the fill plug. After installing the transmission, perform the CHECK FLUID LEVEL procedure. Refer to [CHECK FLUID LEVEL](#) .
2. If an in vehicle service was performed , raise and support the vehicle on a level hoist , and perform the CHECK FLUID LEVEL procedure. Refer to [HOISTING, STANDARD PROCEDURE](#) . Refer to [CHECK FLUID LEVEL](#) .

TECHNICAL SPECIFICATIONS

TORQUE SPECIFICATIONS

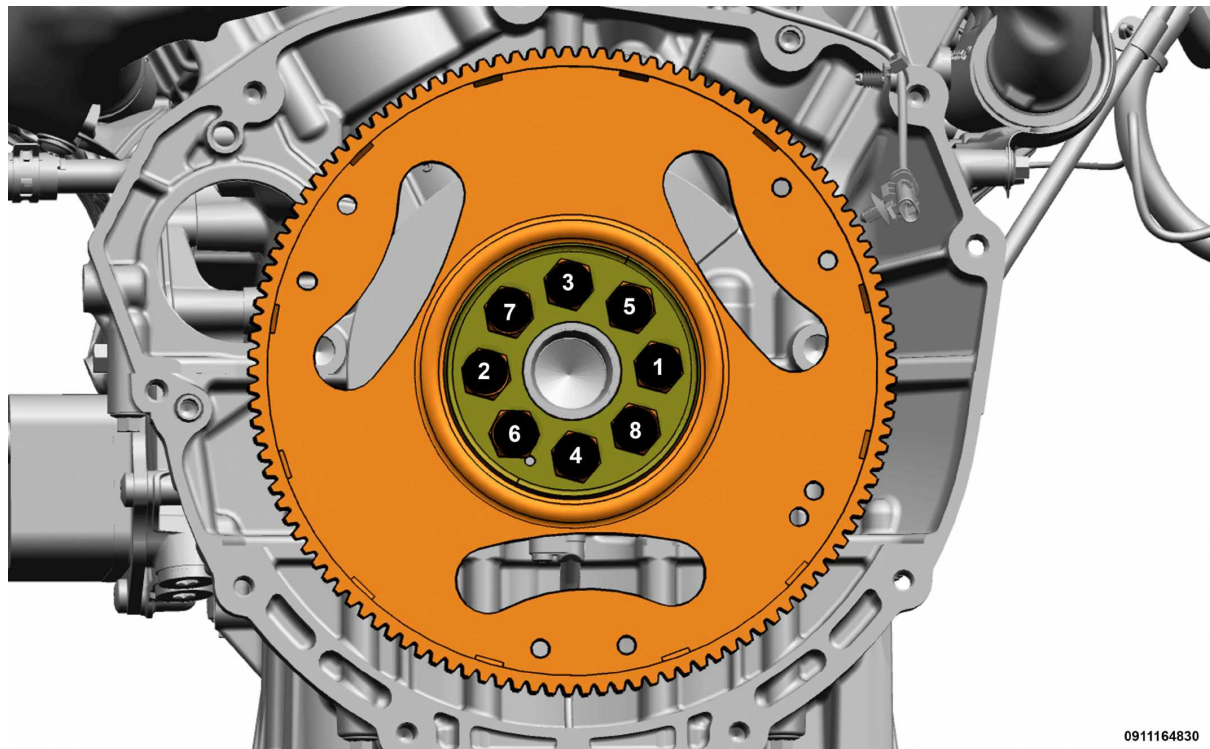
BELLHOUSING AND OIL FILL PLUG



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Double Ended Studs	48 N.m (35 Ft. Lbs.)	-
2	Bellhousing to Engine Bolts	50 N.m (37 Ft. Lbs.)	-
3	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
4	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

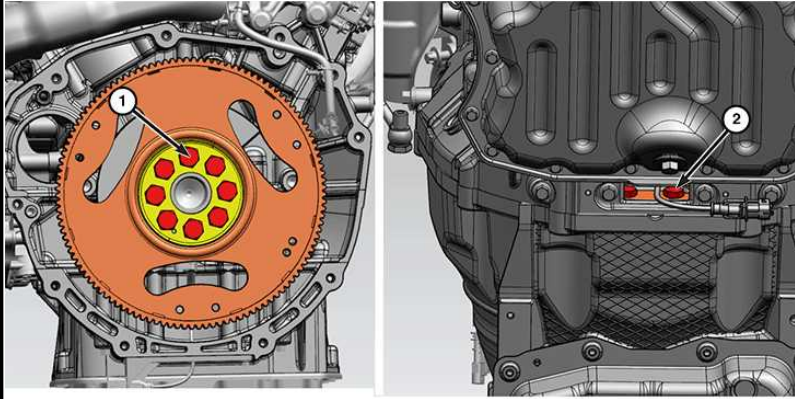
FLEXPLATE AND TORQUE CONVERTER

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	Torque Procedure: 1. With clean engine oil, lubricate the fastener side of backing plate. 2. Tighten the fasteners 50 N.m (37 ft. lbs.) . 3. Loosen one fastener at a time and then retighten the fastener 125 N.m (92 ft. lbs.) . 4. Using a torque angle gauge, tighten each fastener an additional 30 B° .	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Tightening Sequence
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.



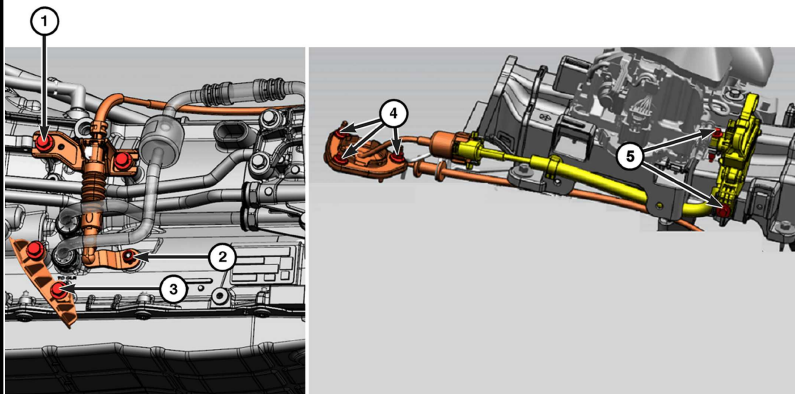
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Fig. 2: Flexplate Bolt Tightening Sequence
 Courtesy of CHRYSLER GROUP, LLC



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MANUAL PARK RELEASE



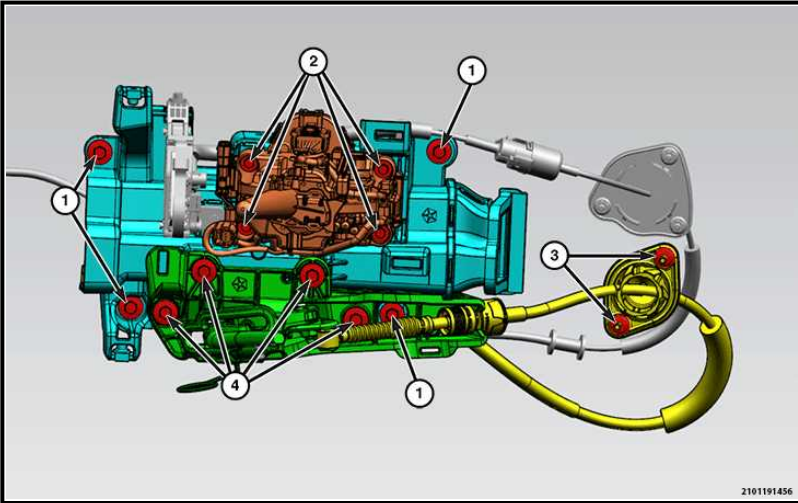
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CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

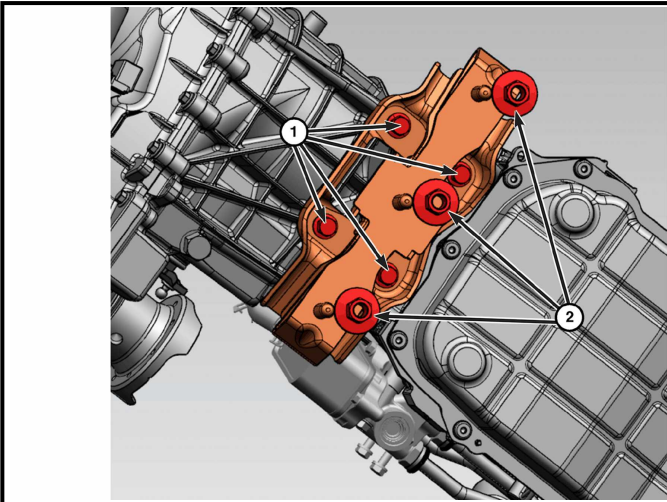
SHIFTER

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Shifter Base to Floor Nuts	6 N.m (53 In. Lbs.)	-
2	Transmission Shifter To Shifter Base Bolts	5 N.m (44 In. Lbs.)	-
3	Transfer Case Shifter Cable Grommet to floor Nuts	9 N.m (80 In. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
4	Transfer Case Shifter To Shifter Base Bolts	8 N.m (71 In. Lbs.)	-
Not Shown	Transfer Case Shift Knob	3 N.m (27 In. Lbs.)	-
Not Shown	Transmission Shift Knob	3 N.m (27 In. Lbs.)	-

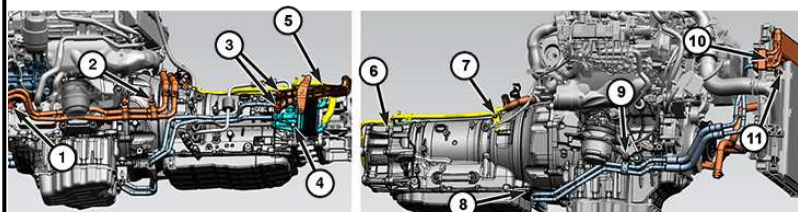


TRANSMISSION MOUNT



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

TRANSMISSION OIL COOLER AND HEATER



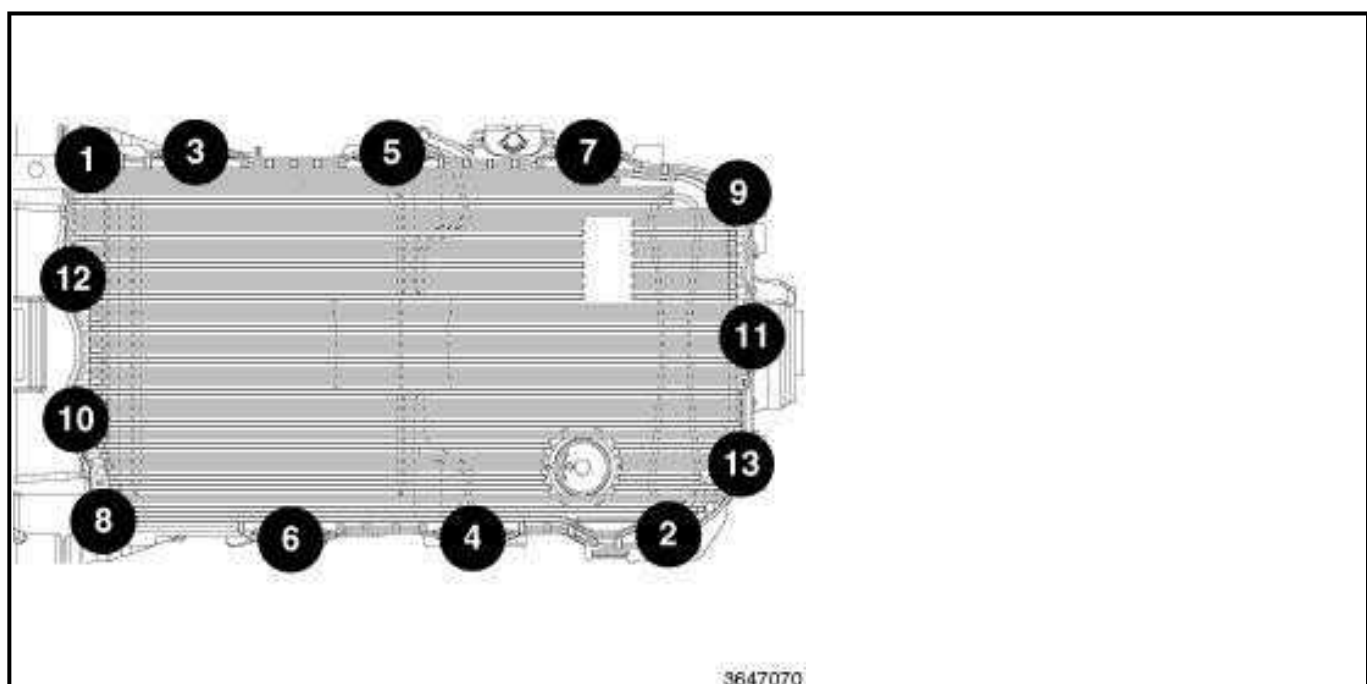
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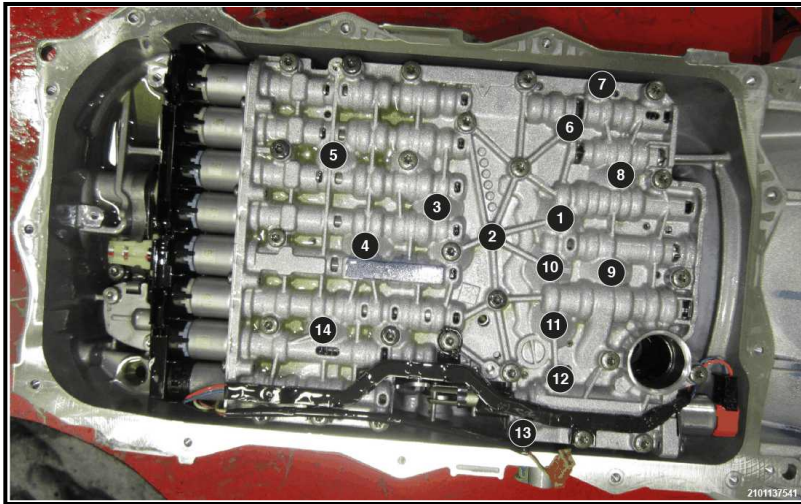
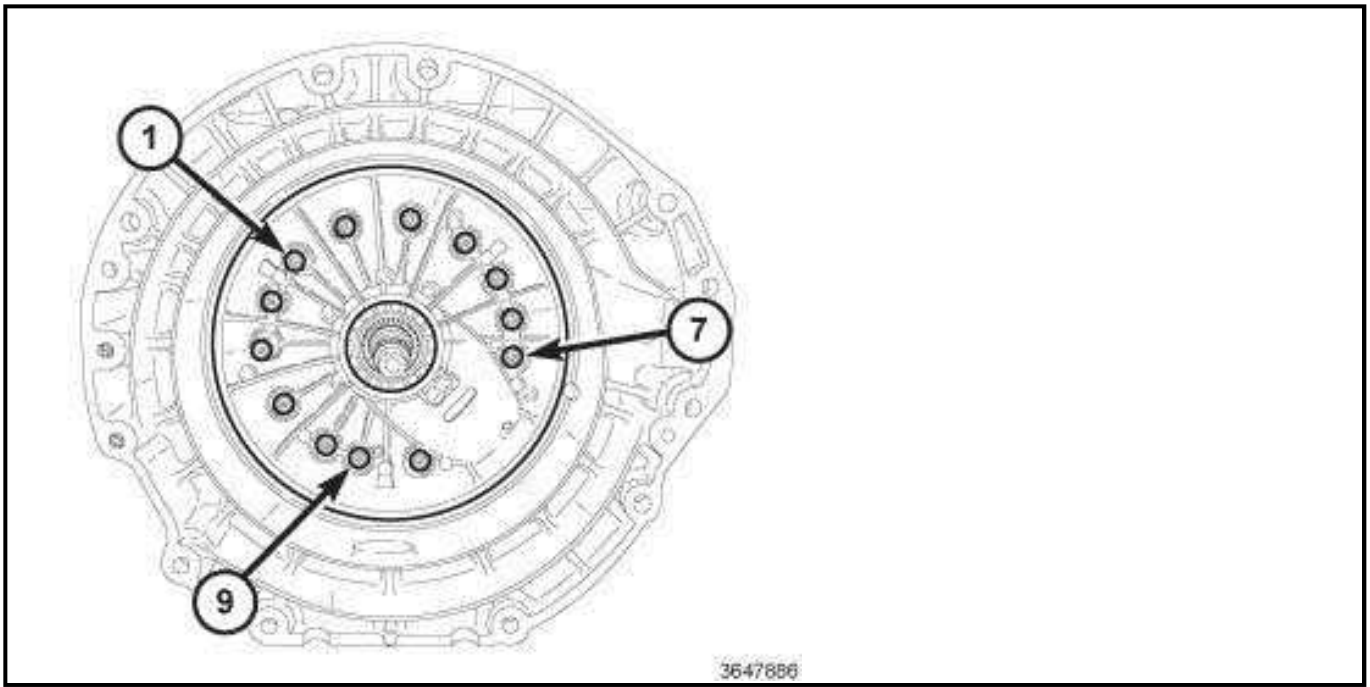
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket To AC Compressor Nut	9 N. m (80 In. Lbs.)	-
2	Transmission Oil Heater Line Bracket To Transmission Bolts	20 N. m (15 Ft. Lbs.)	-
3	Transmission Oil Heater To Transmission Bolts (Passing Through Transfer Case Cable Support Bracket)	23 N. m (17 Ft. Lbs.)	-
4	Transmission Oil Heater To Transmission Bolt	23 N. m (17 Ft. Lbs.)	-
5	Transfer Case Cable Support to Bracket Nut	19 N. m (14 Ft. Lbs.)	-
6	Transmission Oil Heater Line Bracket To Case Bolt	22 N. m (16 Ft. Lbs.)	-
7	Transmission Oil Heater Line Bracket To Transmission Bolt	22 N. m (16 Ft. Lbs.)	-
8	Transmission Oil Cooler Line Bracket To Transmission Bolt	9 N. m (80 In. Lbs.)	-
9	Transmission Oil Cooler Line Bracket To Engine Mount Bracket Bolt	9 N. m (80 In. Lbs.)	-
10	Transmission Oil Cooler Line Manifold To Radiator Bolt	-	Tighten Securely
11	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely

INTERNAL TRANSMISSION

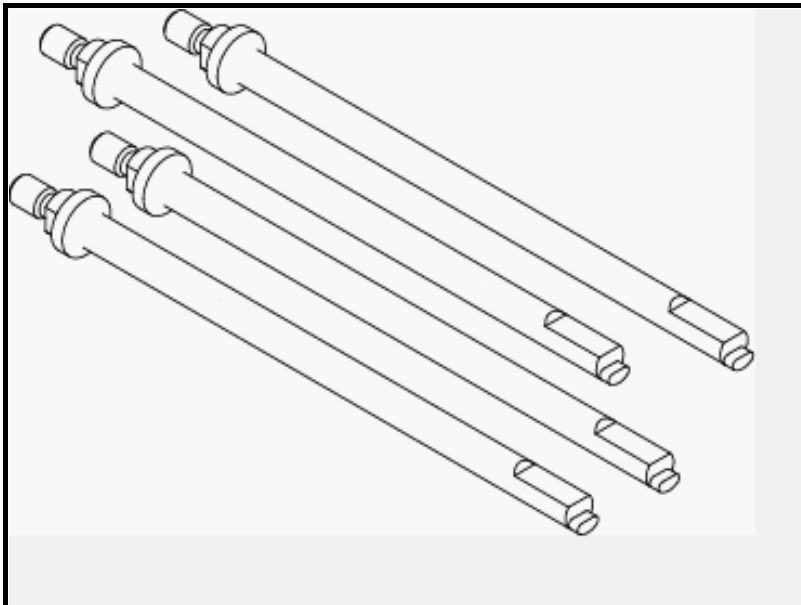
DESCRIPTION	SPECIFICATION	COMMENTS
Extension Housing to Transmission Bolt	27 N.m (20 Ft. Lbs.)	-
Hydraulic Impulse Solenoid (HIS) Bolts	27 N. m (20 Ft. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-

DESCRIPTION	SPECIFICATION	COMMENTS
Park Pawl Lock Rod Guide Plate Bolt	10 N.m (89 In. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	10 N.m (89 In. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	8 N.m (71 In. Lbs.)	Tightening Sequence

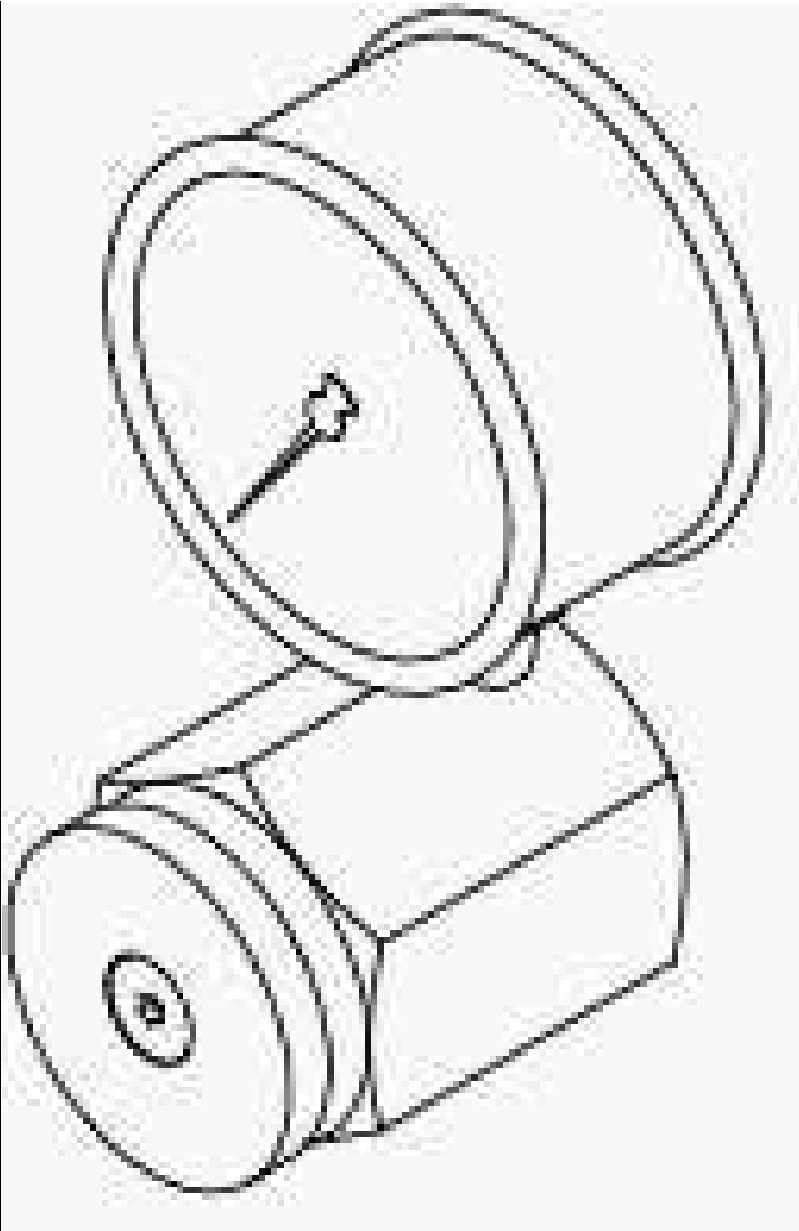




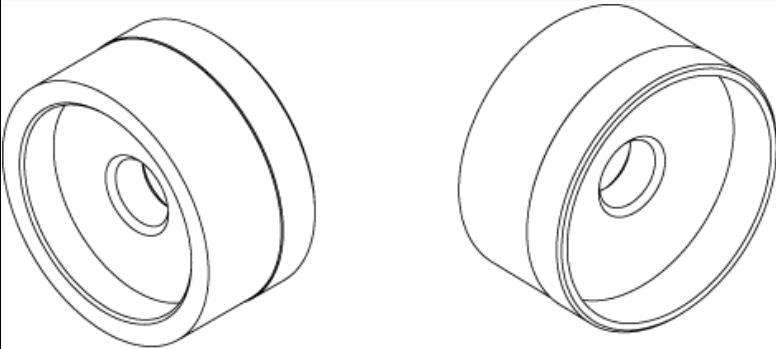
SPECIAL TOOLS



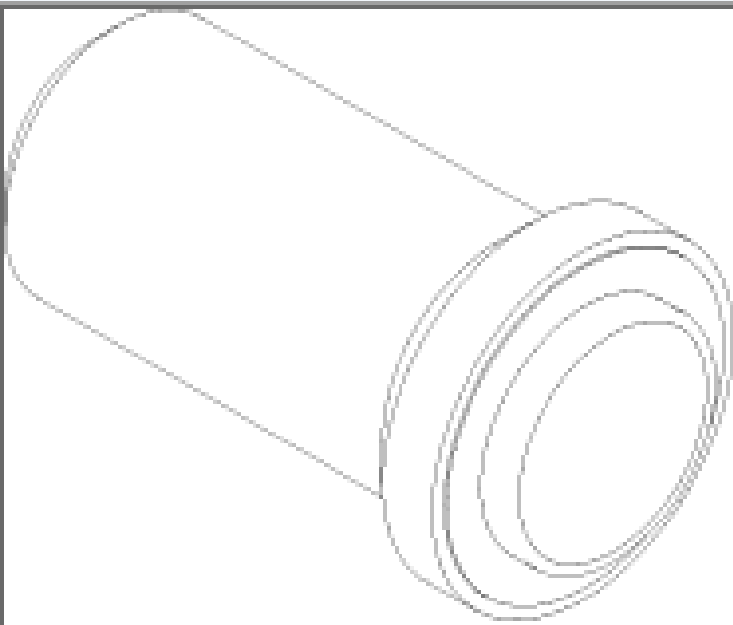
10428 - Adapter, Pressing Tool
(Originally Shipped In Kit Number(s).)



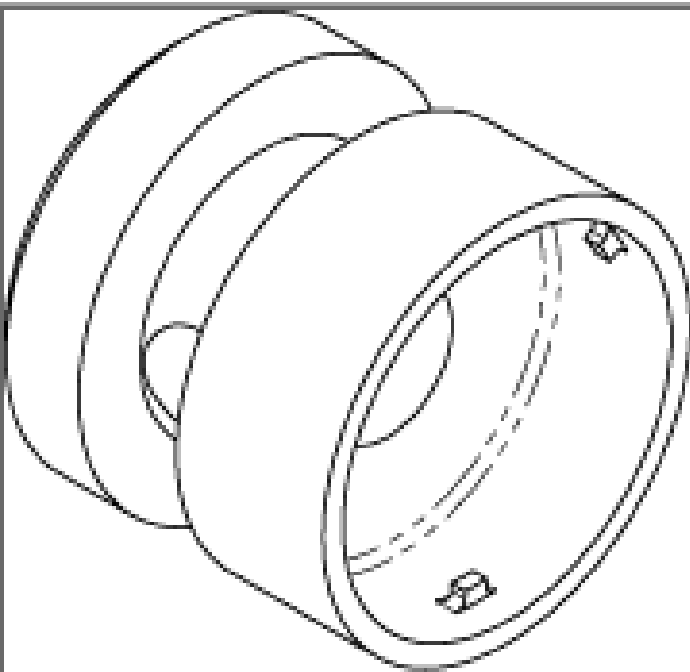
10429 - Gauge, Force
(Originally Shipped In Kit Number(s)
10419.)



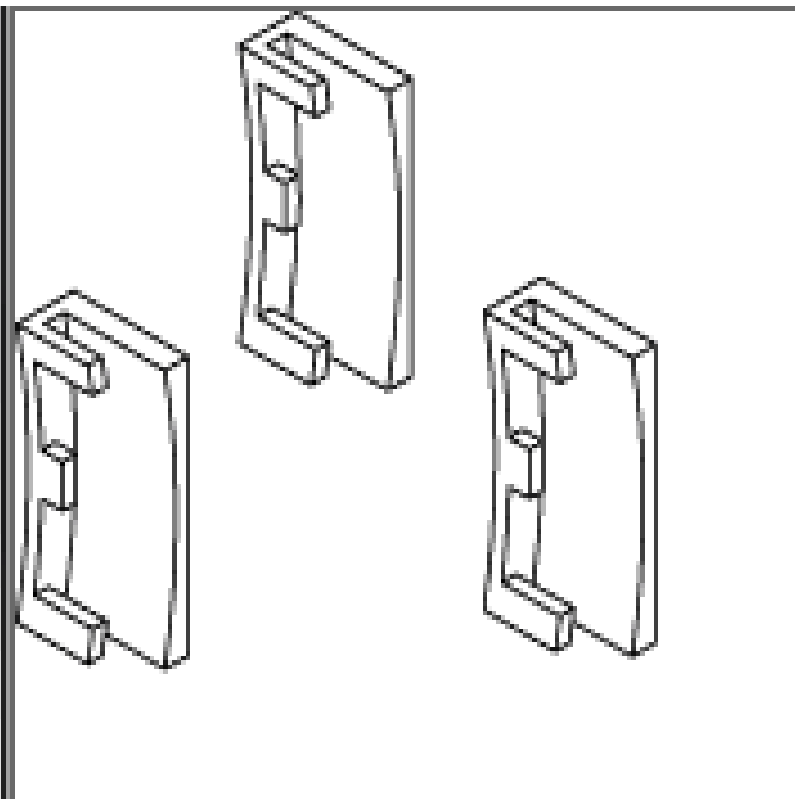
10373A - Installer, Output Needle
Bearing/Rear Oil Dam
(Originally Shipped In Kit Number(s)
10394A.)



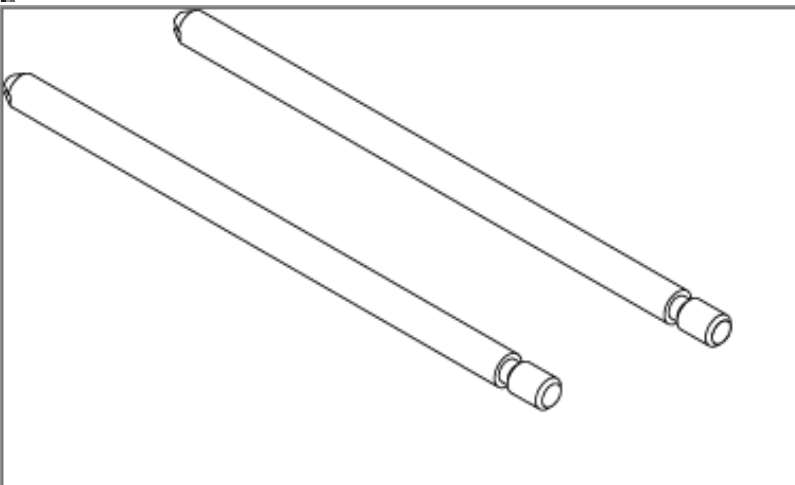
10375 - Installer, Oil Pump Cover Oil Seal



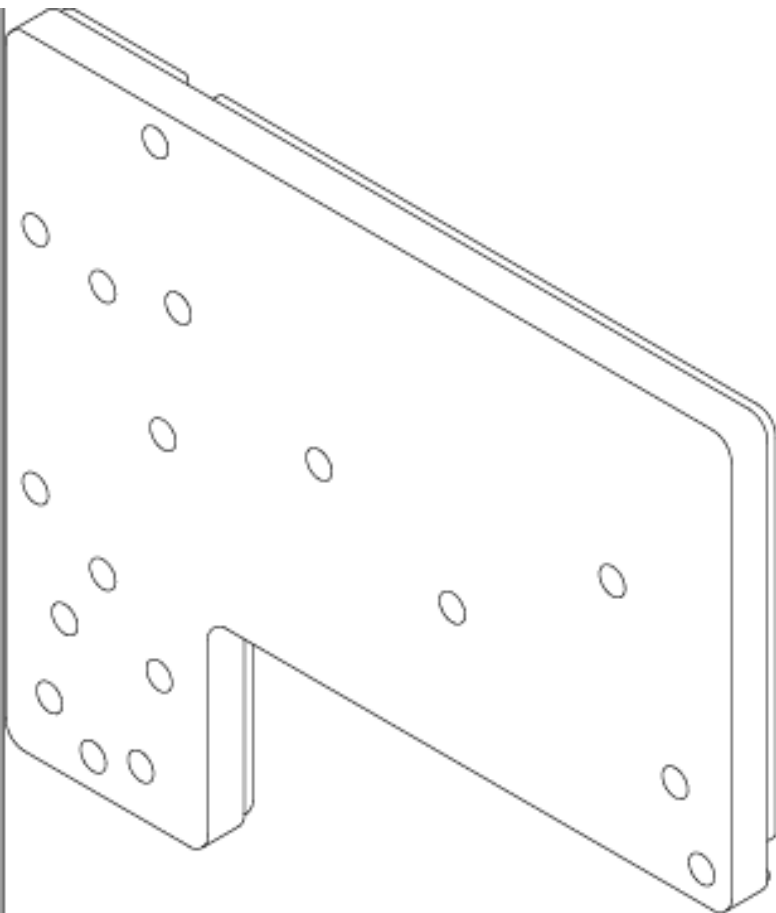
10377 - Remover/Installer, Guide Sleeve



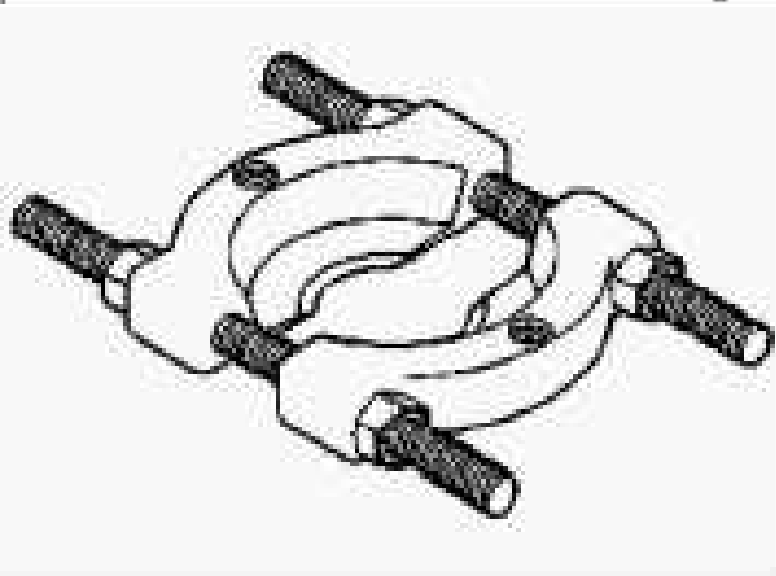
10378 - Rings, Support



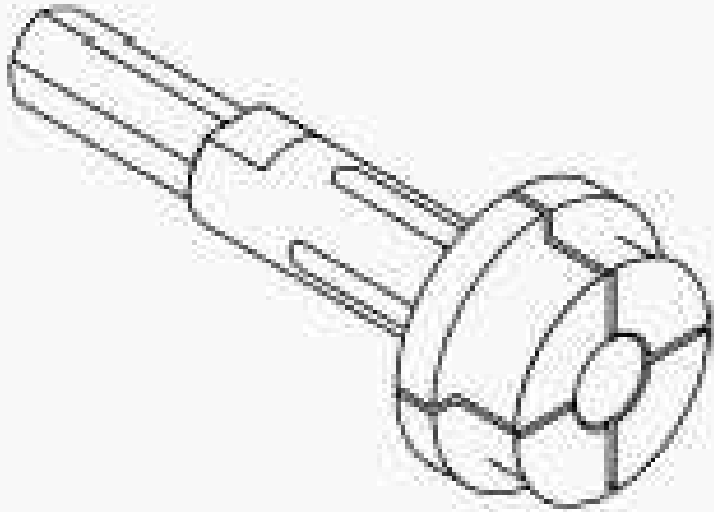
10379 - Pins, Valve Body Alignment



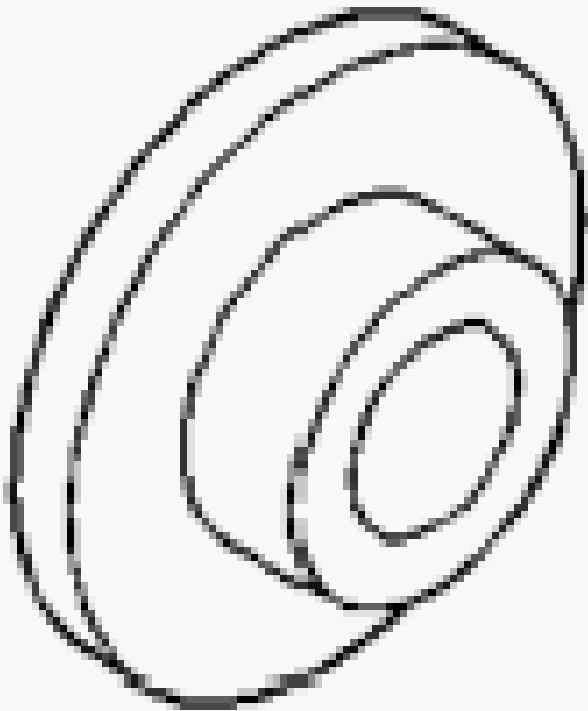
10383 - Plate, Clutch Pressure Test



1130 - Splitter, Bearing/Gear
(Originally Shipped In Kit Number(s)
6745, 6947, 6949, 9202, 9202A-CAN,
9202CC, 9299.)



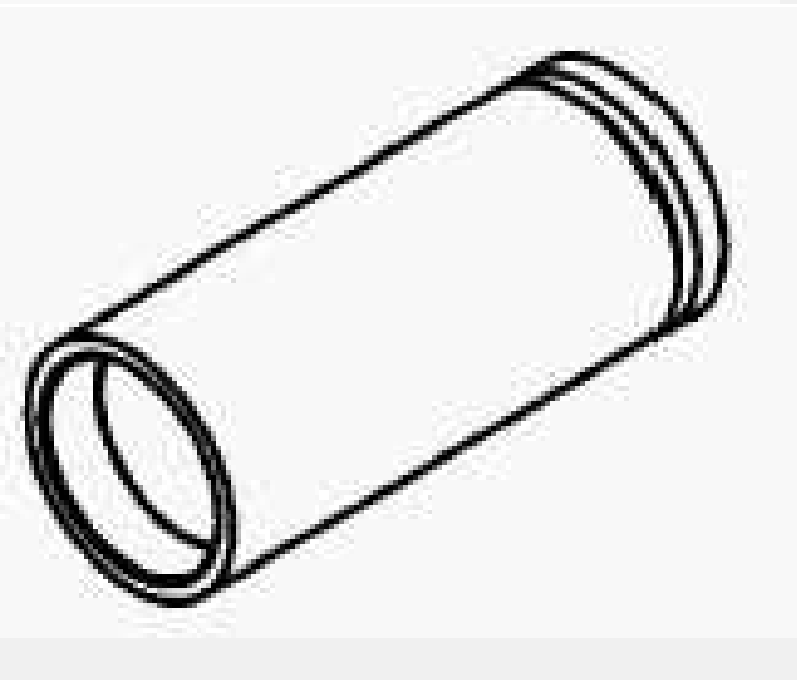
6787A - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
6784, 6809.)



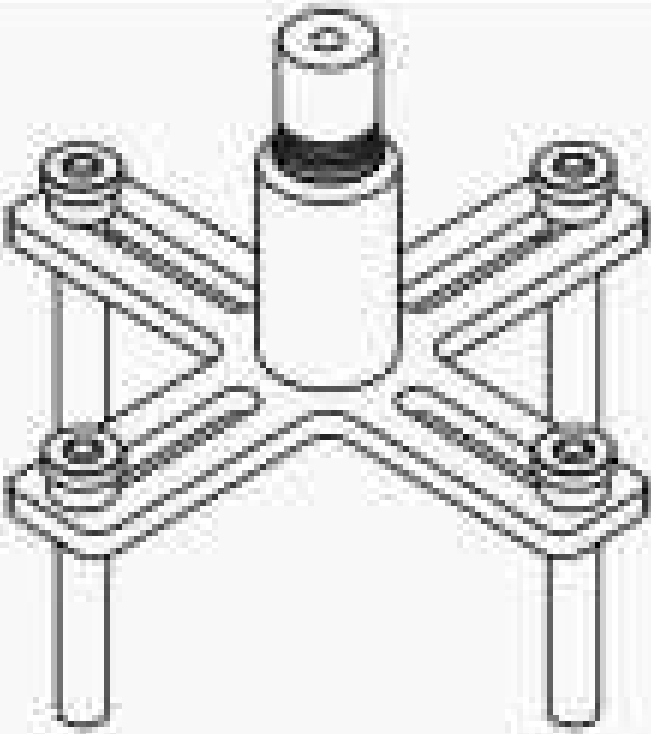
6936 - Spacer
(Originally Shipped In Kit Number(s)
6945, 6946, 6947, 6948.)



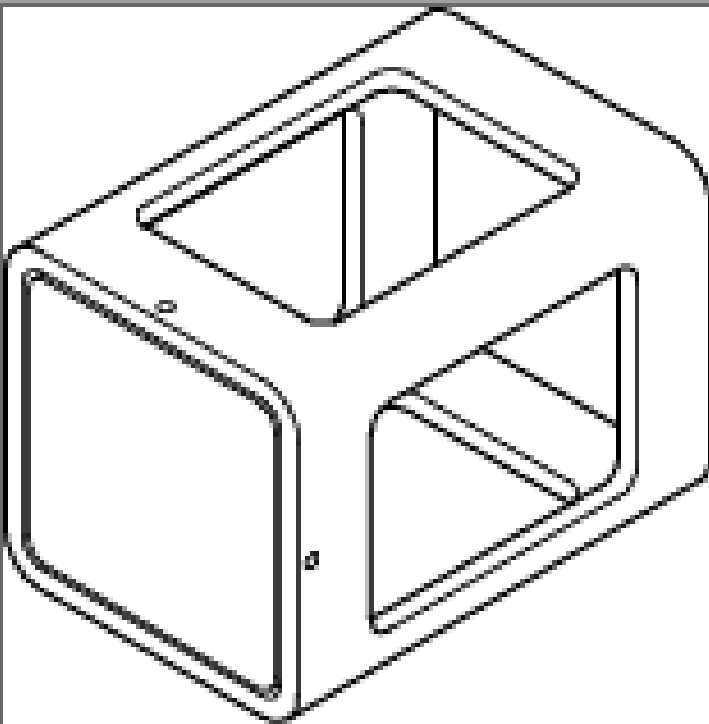
8285 - Compressor, Spring
(Originally Shipped In Kit Number(s)
8283, 8283CC, 8527, 8527CC, 8575,
8575CC, 9975.)



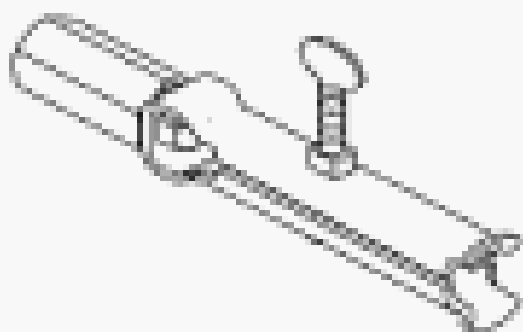
8481 - Installer, Gear
(Originally Shipped In Kit Number(s)
8708, 8708CC.)



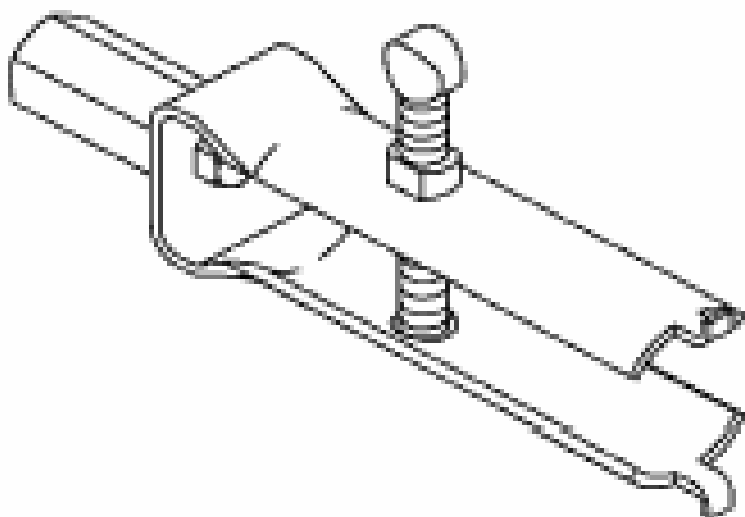
8901A - Pressing Tool
(Originally Shipped In Kit Number(s)
8901A.)



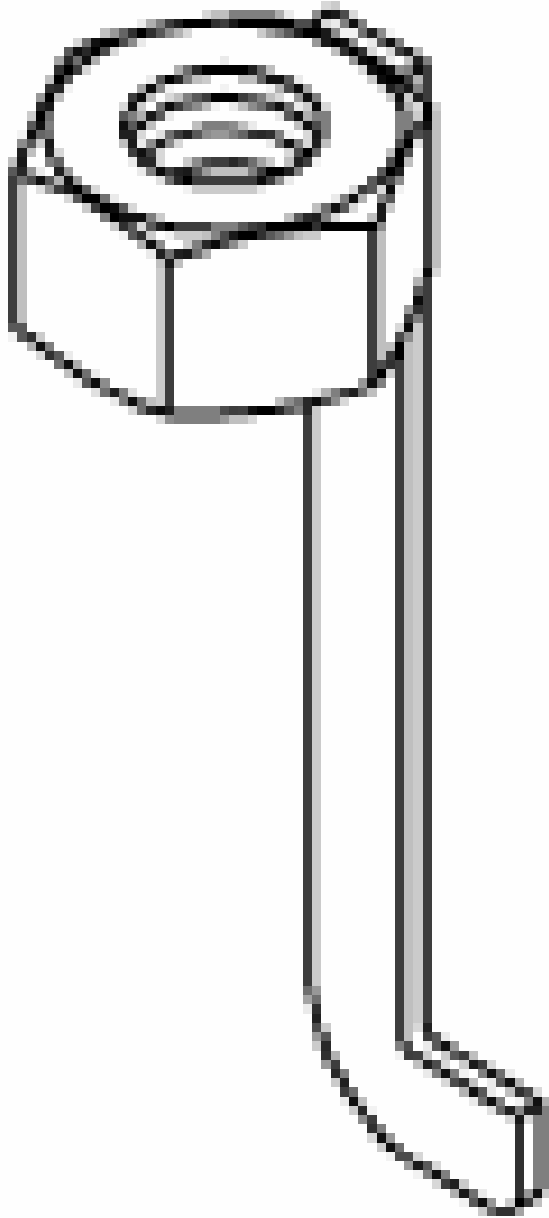
8925-3 - Assembly, Press Fixture
(Originally Shipped In Kit Number(s)
8998, 8998CC.)



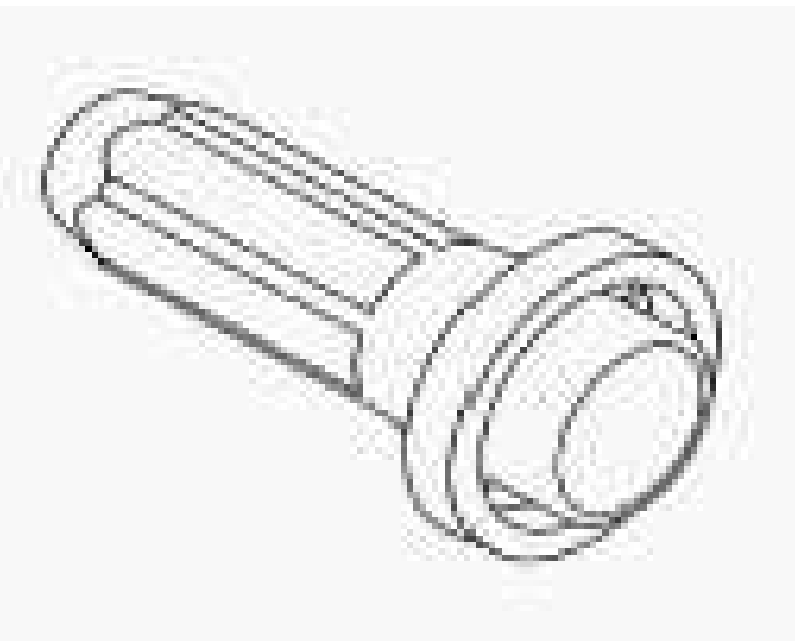
9585 - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
9691.)



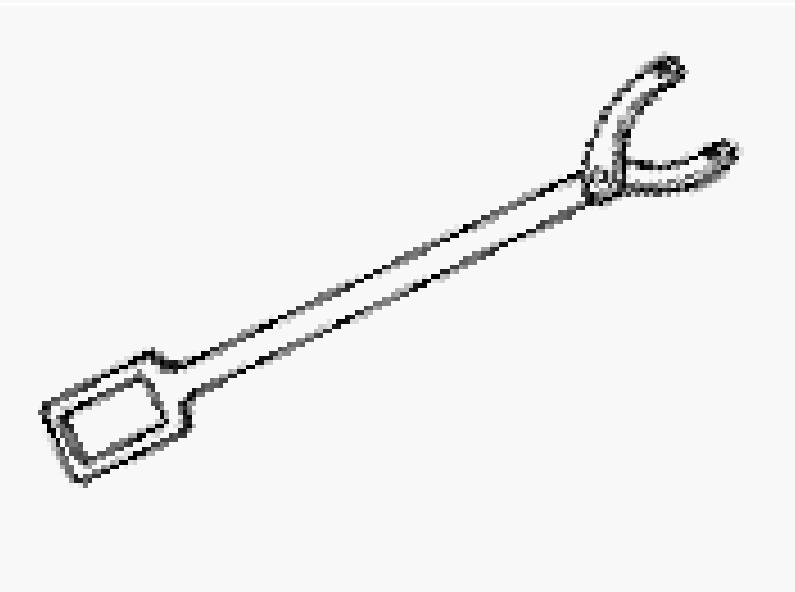
9664 - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
9675, 9685, 9695.)



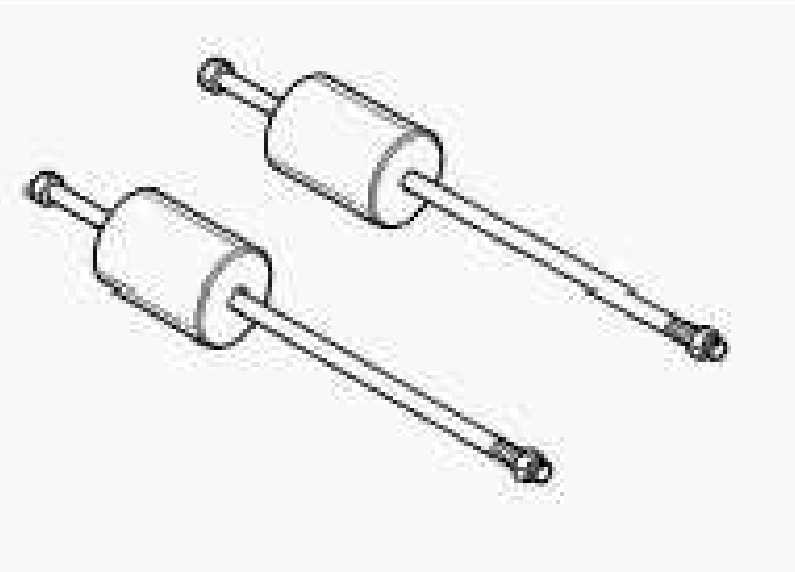
9667 - Remover, Seal
(Originally Shipped In Kit Number(s)
9691.)



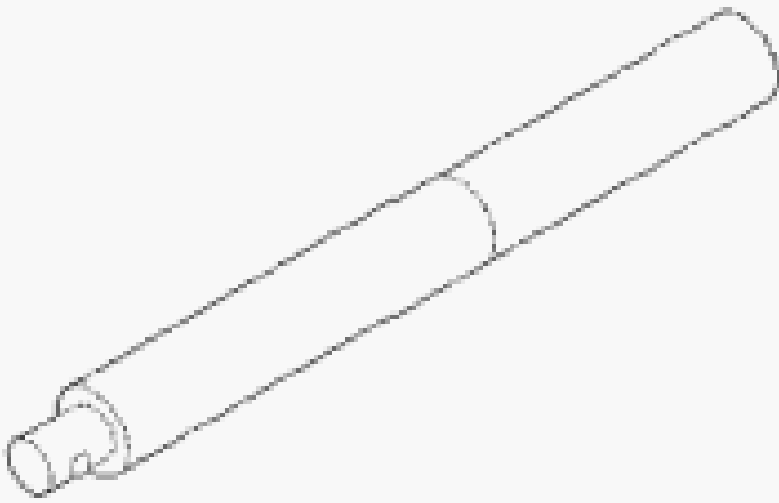
9677 - Installer, Seal
(Originally Shipped In Kit Number(s)
9675, 9685, 9695.)



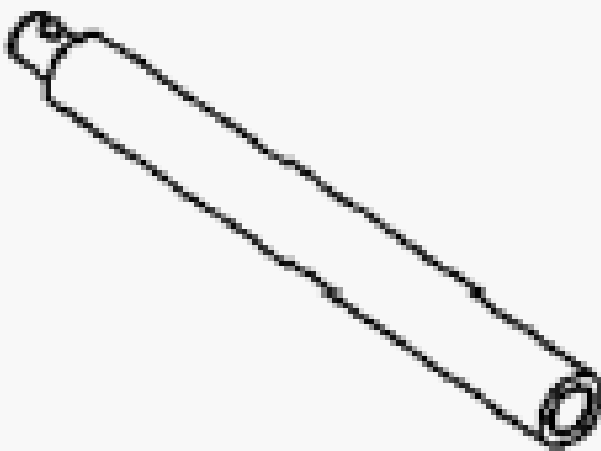
C-3281 - Holder, Flange
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



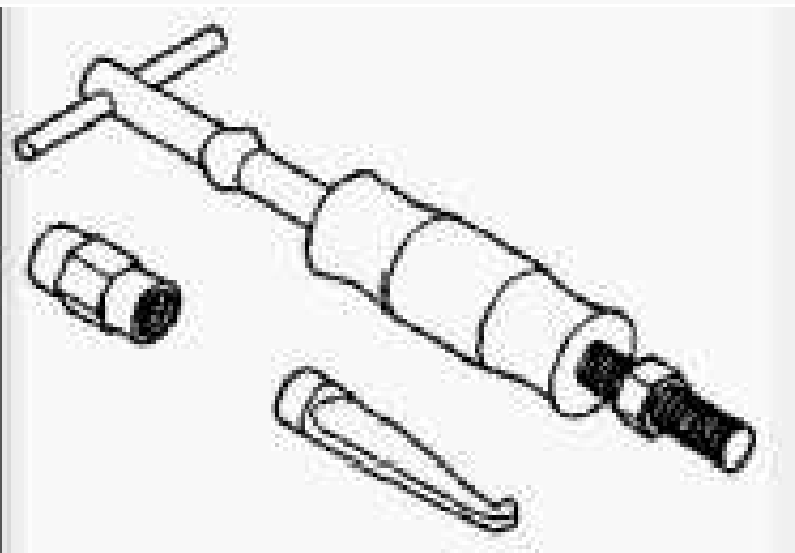
C-3752 - Slide Hammers
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202-CAN,
9202CC.)



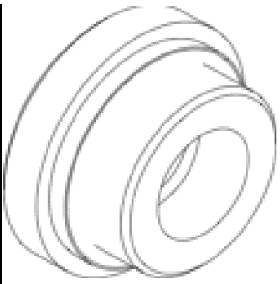
C-4171 - Driver Handle, Universal
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



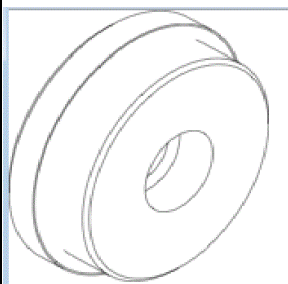
C-4171-4 - Extension, Drive Handle



C-637 - Slide Hammer, Universal
(Originally Shipped In Kit Number(s)
9202.)



10382 - Installer, Oil Pump Housing
Needle Bearing
(Originally Shipped In Kit Number(s)
10394A, 10394-UPD.)



10376 - Installer, Input Shaft Needle
Bearing
(Originally Shipped In Kit Number(s)
10394A, 10394-UPD.)



2055000090 - Installer, Oil Seal

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION

REMOVAL

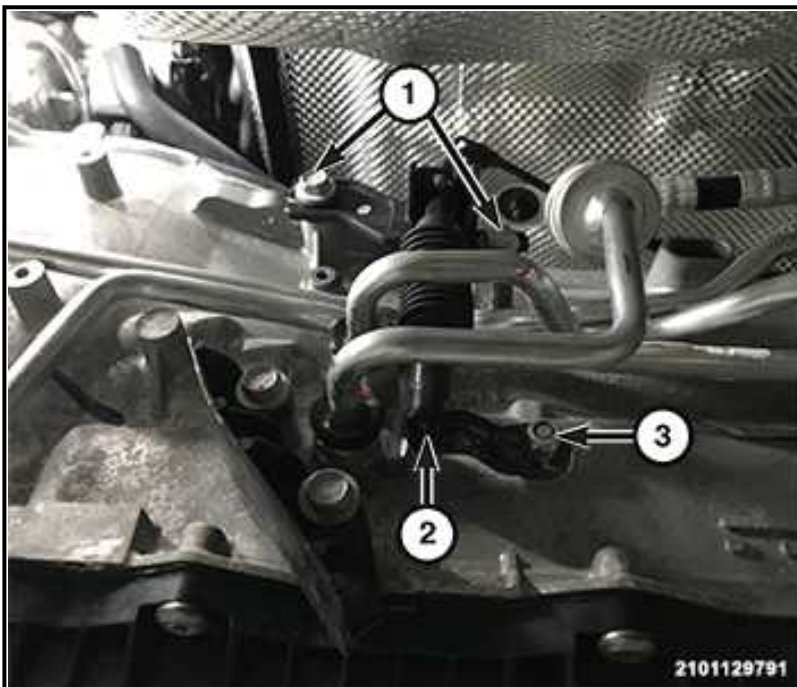
CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter driveplate, oil pump, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and converter as an assembly.

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Transmission Control Module (TCM) Adaptation Procedure using the scan tool. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#) .

1. Disconnect and isolate the negative battery cable(s). Refer to .
2. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
3. Remove the transmission mount nuts. Refer to [INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION](#) , or [INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND INSTALLATION](#) .
4. If equipped, remove the transfer case skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION](#) [PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .
5. Support the transmission with a suitable jack.

NOTE: Be careful not to damage the transmission pan.

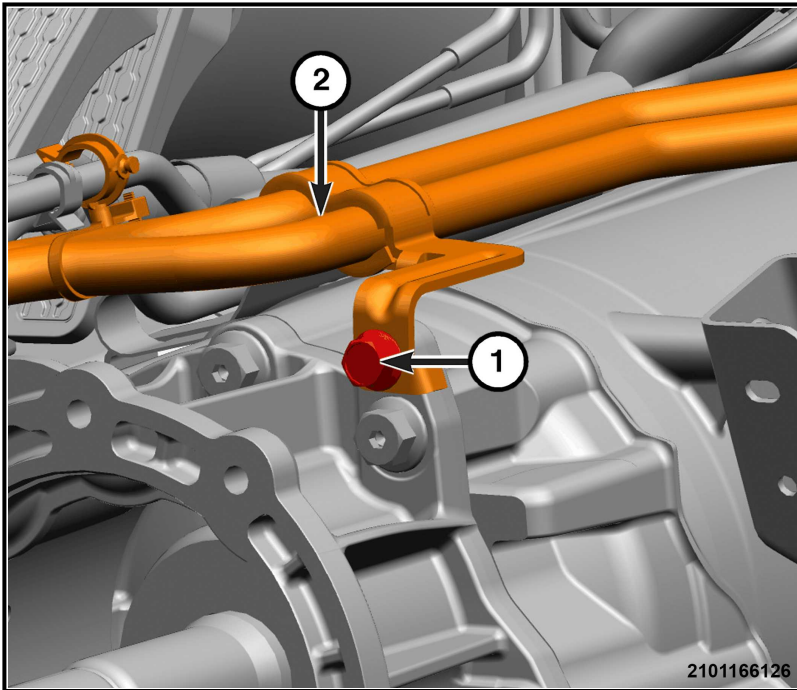
6. Remove the transmission crossmember. Refer to [CROSSMEMBER, FRONT REINFORCEMENT, REMOVAL AND INSTALLATION](#) .
7. Remove the Diesel Particulate Filter (DPF). Refer to [FILTER, DIESEL PARTICULATE, REMOVAL AND INSTALLATION](#) .



1 - Manual Park Release (MPR) Cable Bracket Bolts
2 - MPR Cable
3 - MPR Lever

8. Disconnect the Manual Park Release (MPR) cable from the MPR lever.
9. Remove the transfer case. Refer to [REMOVAL AND INSTALLATION](#) [REMOVAL AND INSTALLATION](#) .

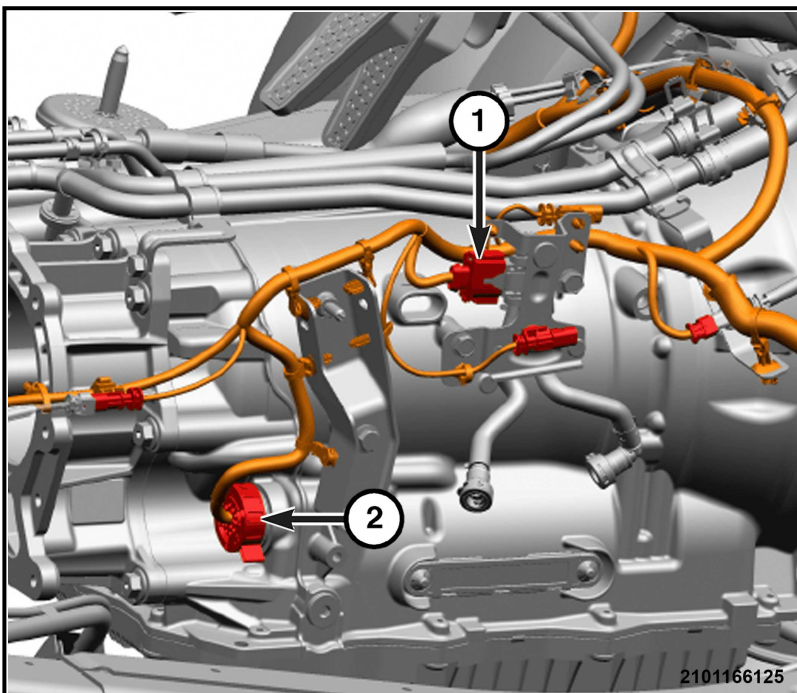
10. Remove the crank position sensor. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION](#)



1 - Transmission Heater Coolant Hoses Bracket Bolts

2 - Transmission Heater Coolant Hoses

11. Remove the fastener that hold the transmission heater coolant hoses to the transmission.



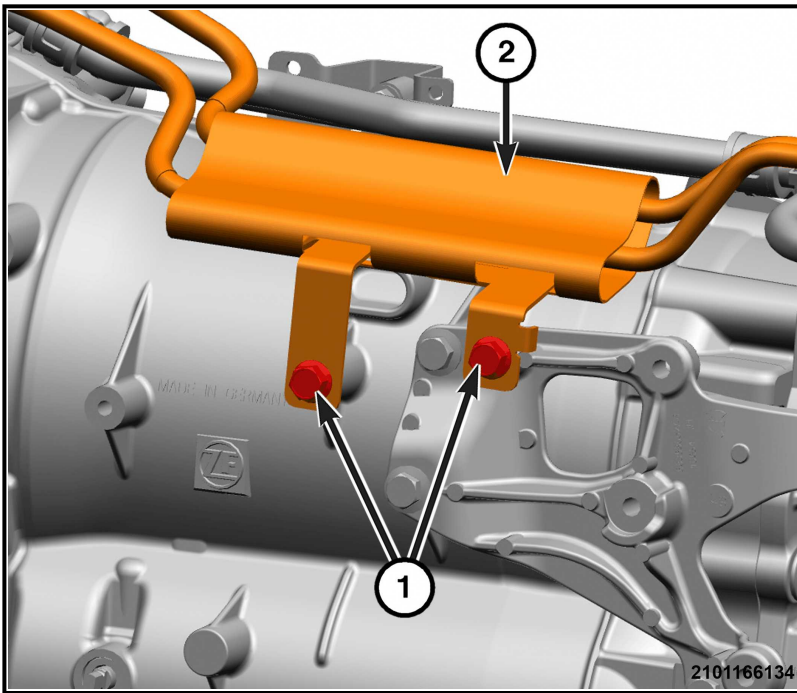
1 - Differential Pressure Sensor Wire Harness Connector

2 - Transmission Wire Harness Connector

12. Disconnect the differential pressure sensor wire harness connector.

13. Disconnect the 13-pin plug connector. Turn the connector counter-clockwise to release.

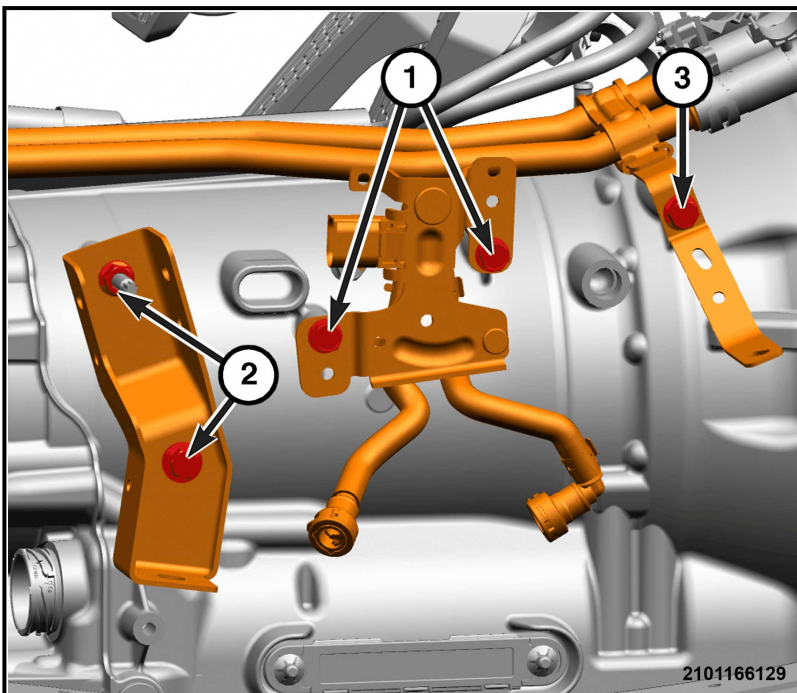
14. Remove all remaining wiring harness retainers from the transmission.



1 - Fuel Line Bracket Bolts

2 - Fuel Line Bracket And Lines

15. Remove the fuel line bracket fasteners and let the bracket and lines hang freely.



1 - Differential Pressure Sensor Bracket Bolts

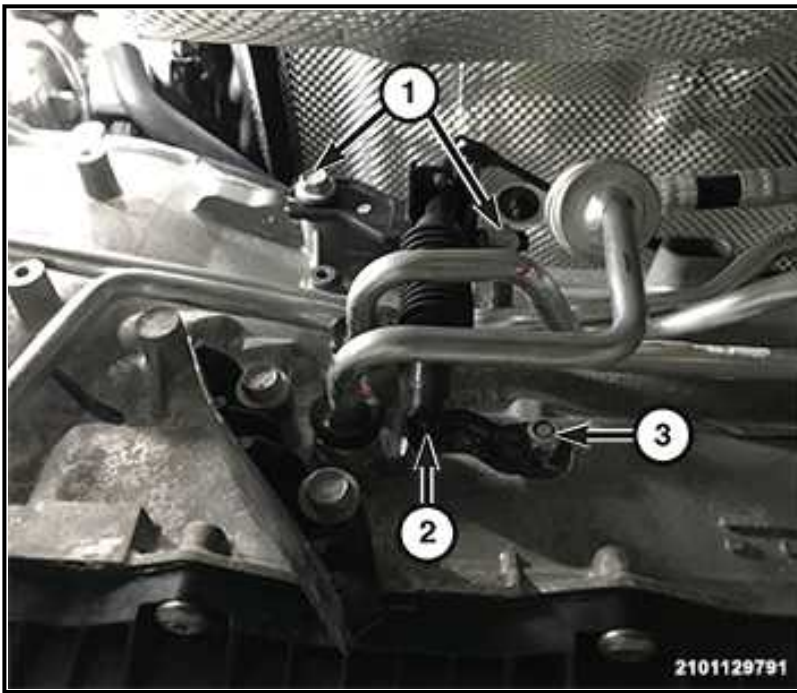
2 - Diesel Particulate Filter Bracket Bolts

3 - Transmission Heater Coolant Hoses Bracket Bolt

16. Remove the fasteners and remove the pressure differential sensor and bracket from the transmission.

17. Remove the fasteners and remove the diesel particulate filter bracket from the transmission.

18. Remove the fastener that hold the transmission heater coolant hoses to the transmission, and position aside.

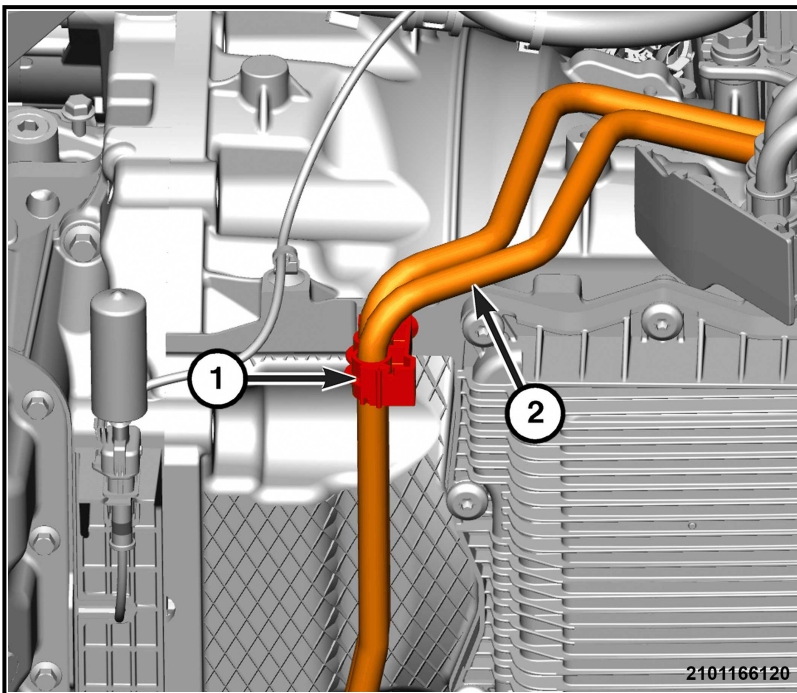


1 - Manual Park Release (MPR) Cable Bracket Bolts

2 - MPR Cable

3 - MPR Lever

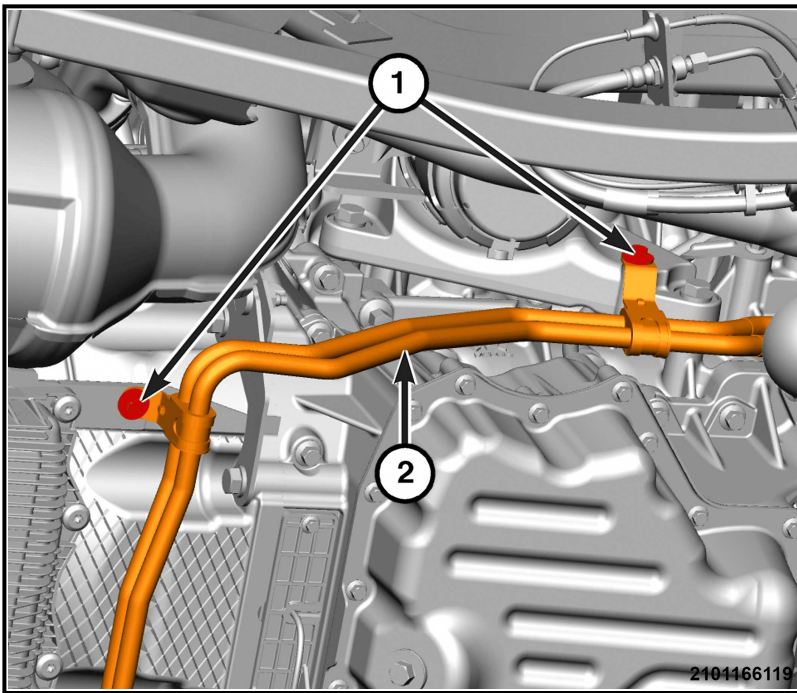
19. Remove the bolts from the MPR cable bracket and position the cable bracket aside.



1 - Transmission Oil Cooler Line Clip

2 - Transmission Oil Cooler Lines

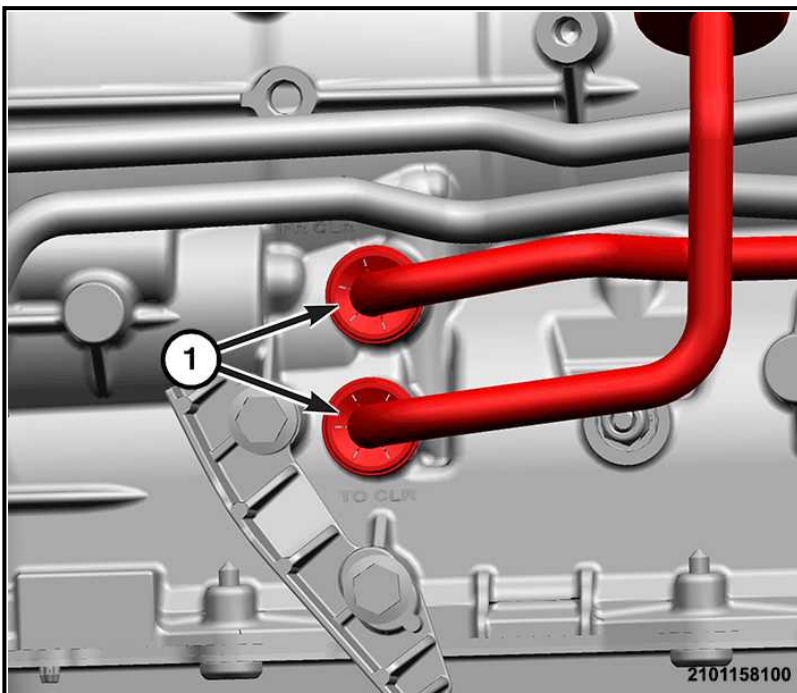
20. Remove the transmission oil cooler line retaining fastener from the transmission.



1 - Transmission Oil Cooler Line Bracket Bolts

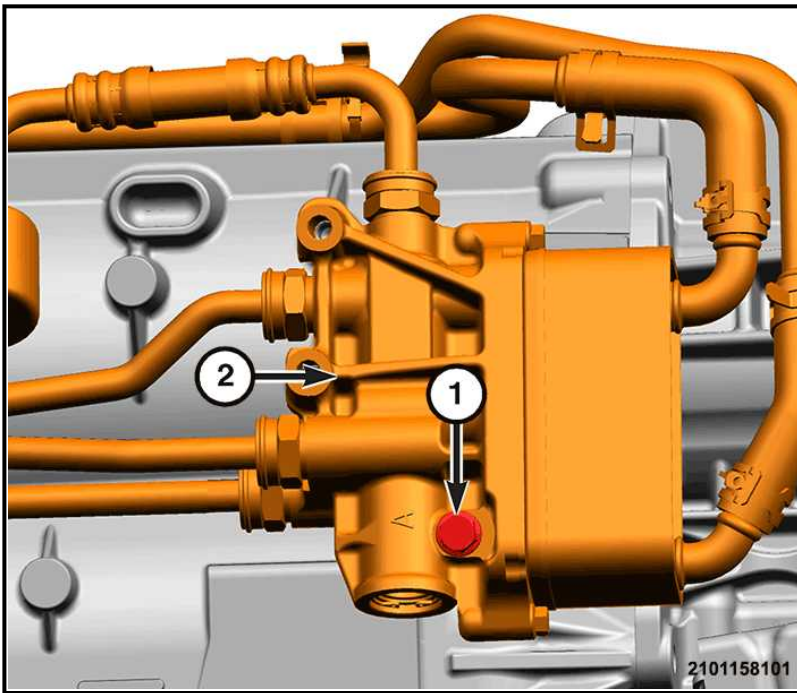
2 - Transmission Oil Cooler Lines

21. Remove the fasteners from the transmission oil cooler lines and position aside.



1 - Transmission Oil Cooler Lines

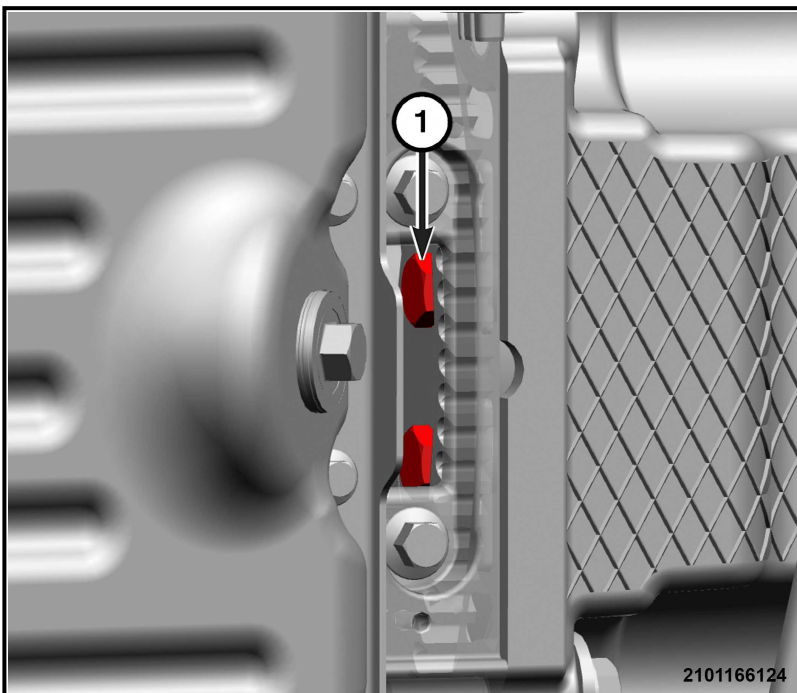
22. Using the (special tool #9546, Disconnect Tool), disconnect the transmission oil cooler lines from the transmission.



1 - Transmission Oil Heater Bolts

2 - Transmission Oil Heater

23. Remove the fastener retaining the transmission oil heater. Position and retain the transmission oil heater aside.

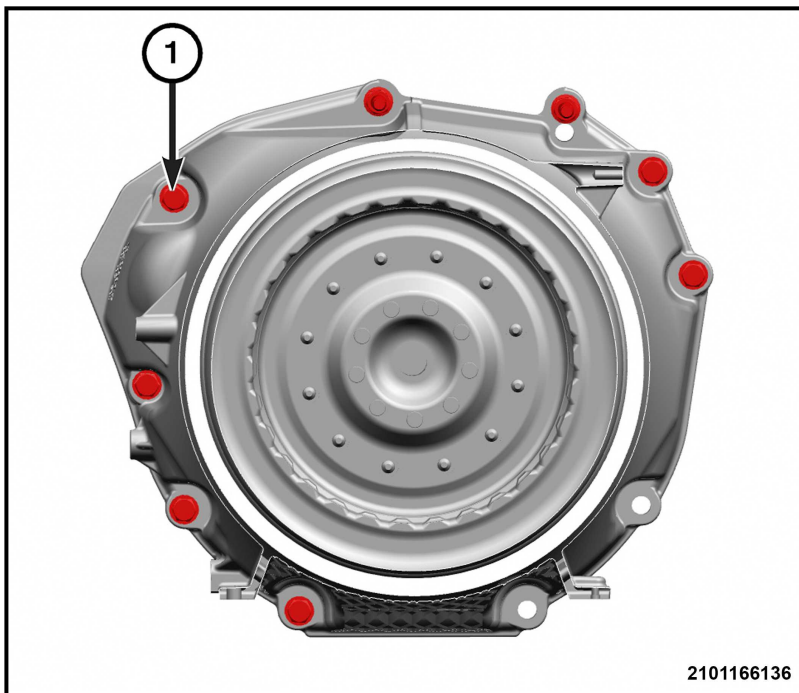


1 - Torque Converter Bolts

24. Rotate the crankshaft clockwise and remove six torque converter bolts through the crank position sensor pocket.

NOTE: There are three sets of two torque converter bolts located 120B° apart from each other.

NOTE: If necessary, use a grease pen or similar to mark crankshaft pulley every 120B° for converter bolt location.



1 - Transmission To Engine Bolts

25. Remove the transmission to engine fasteners.
26. Support engine with a suitable stand before removing transmission.

NOTE: Be careful not to damage the engine oil pan when using the stand. Use a rubber or wood block between the pan and the stand to support the engine.

27. Secure the transmission to a suitable jack.
28. Carefully maneuver the transmission and the torque converter assembly rearward off of the engine block dowels.

NOTE: Be careful not to damage or bend the transmission oil cooler lines.

29. Hold the torque converter in place during removal of the transmission.
30. Lower transmission and remove the assembly from under the vehicle.
31. Remove the torque converter. Refer to [TORQUE CONVERTER, REMOVAL AND INSTALLATION](#).

INSTALLATION

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TRANSMISSION VERIFICATION TEST

Refer to [TRANSMISSION VERIFICATION TEST](#) .

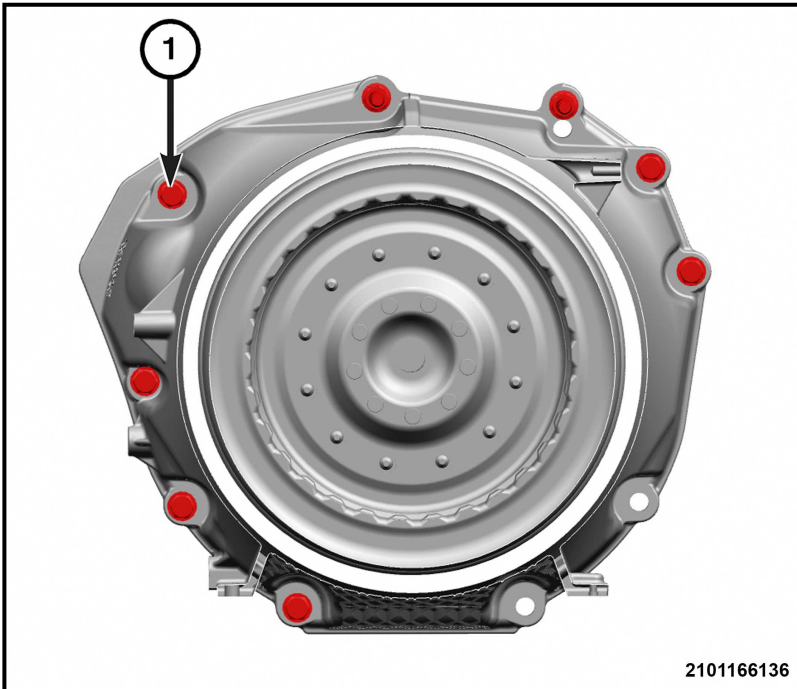
1. If a replacement transmission is being installed, transfer any components necessary such as the shift cable bracket and MPR bracket from the original transmission onto the replacement transmission.
2. Apply a light coating of MoparB® High Temp Grease to the torque converter hub pocket in the rear pocket of the engine crankshaft.
3. Install the torque converter. Refer to [TORQUE CONVERTER, REMOVAL AND INSTALLATION](#).
4. Place the transmission on a suitable jack and secure the transmission to the jack.
5. Raise the transmission and align the torque converter with the drive plate and the transmission converter housing with the engine block.

NOTE: If the torque converter was spun or removed, align the torque converter bolt holes with the starter pocket to ease the bolt installation.

6. Move the transmission forward. Then maneuver the transmission to align the converter housing with the engine block dowels.

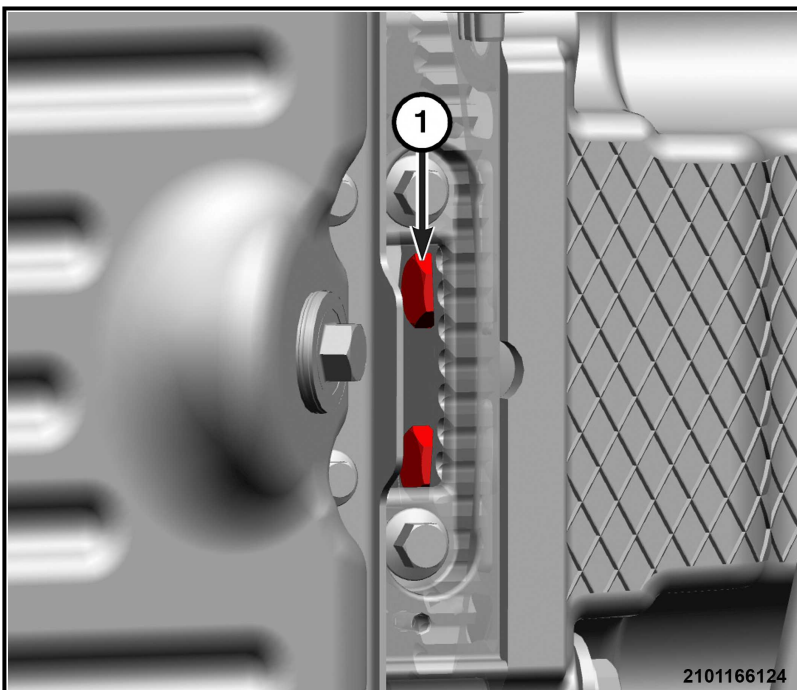
NOTE: It may be necessary to use a suitable jack to support the rear of the engine during transmission installation.

7. Carefully maneuver the transmission forward and over the engine block dowels until the converter hub is seated in the crankshaft. Verify that there are no wires loose or that the transmission vent hose have become trapped between the engine block and the transmission.



1 - Transmission To Engine Bolts

8. Install the torque converter housing to engine bolts. Tighten all of the torque converter housing bolts.

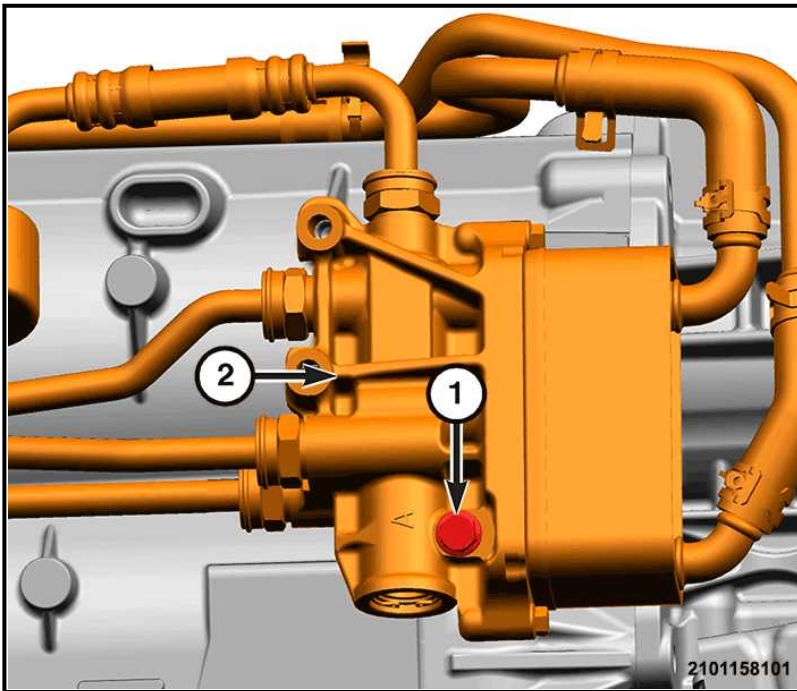


1 - Torque Converter Bolts

9. Rotate the crankshaft in a clockwise direction to line up the alignment hole in the flex plate, then start the first bolt.
10. Rotate the crankshaft in a clockwise direction until the flexplate to torque converter bolts are accessible. There are three sets of two bolts 120B° apart.

NOTE: Install all torque converter bolts by hand first. There are three sets of two bolts 120B° apart.

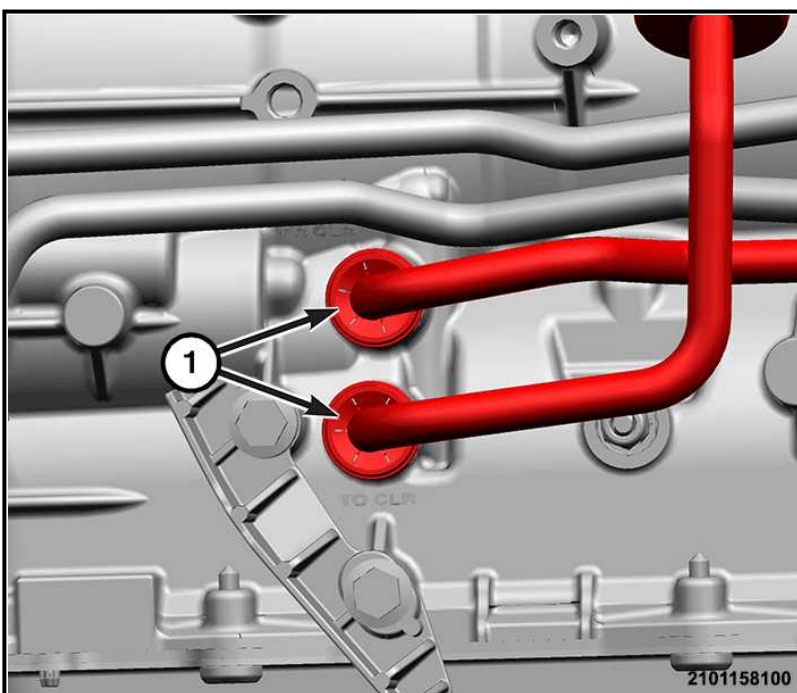
11. Install the torque converter to flexplate bolts through the crank position sensor pocket using a commercially available torque adapter.



1 - Transmission Oil Heater Bolts

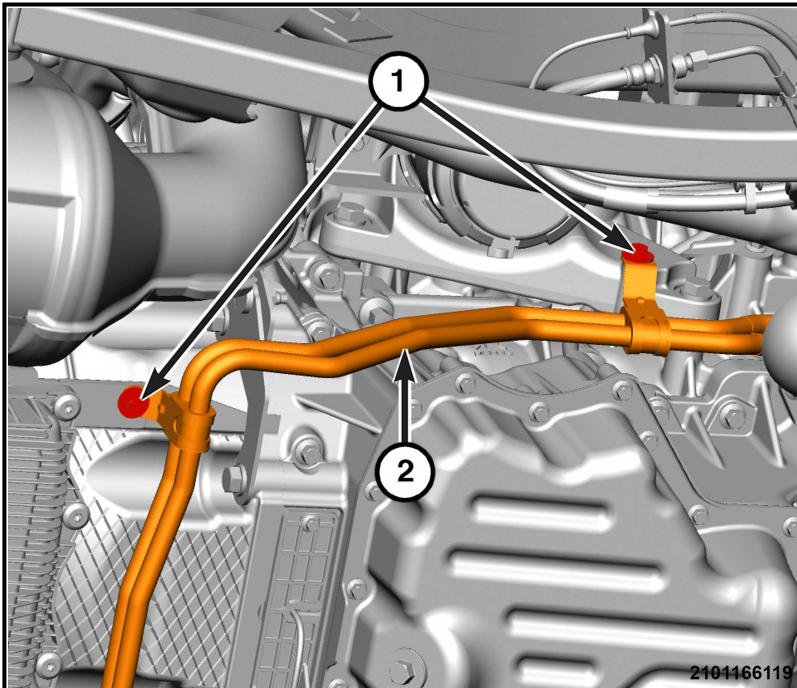
2 - Transmission Oil Heater

12. Place the transmission oil heater, install the fastener.



1 - Transmission Oil Cooler Lines

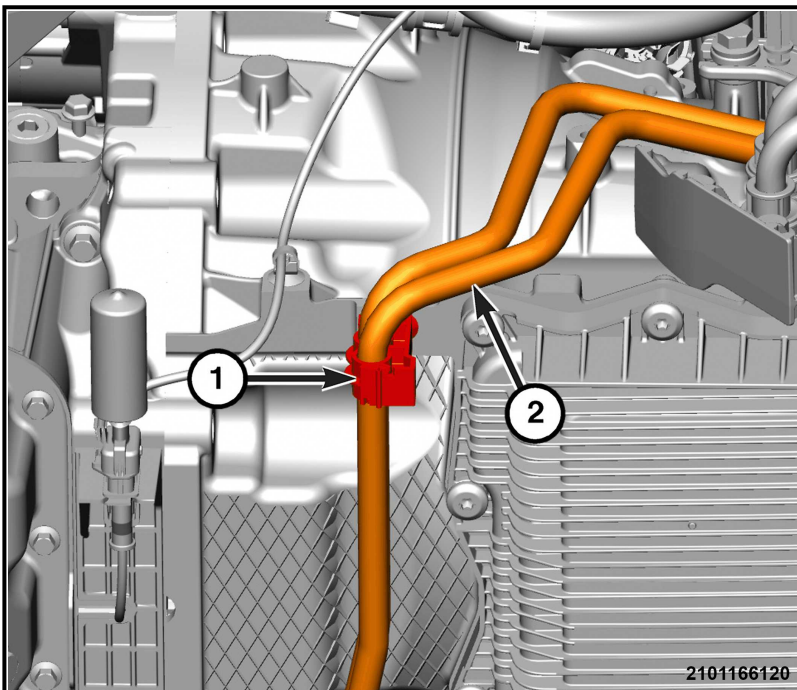
13. Connect the transmission lines to the transmission. Be sure that the lines are fully seated. Snap the lock ring over the line fitting.



1 - Transmission Oil Cooler Line Bracket Bolts
--

2 - Transmission Oil Cooler Lines

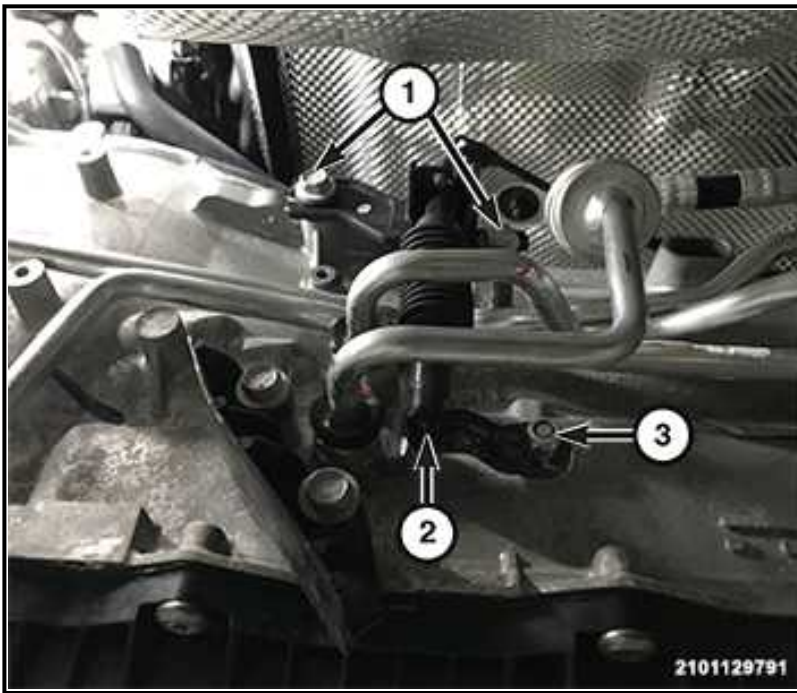
14. Position the transmission oil cooler lines. Install and tighten fasteners.



1 - Transmission Oil Cooler Line Clip

2 - Transmission Oil Cooler Lines

15. Position the transmission oil cooler lines and install the fastener.

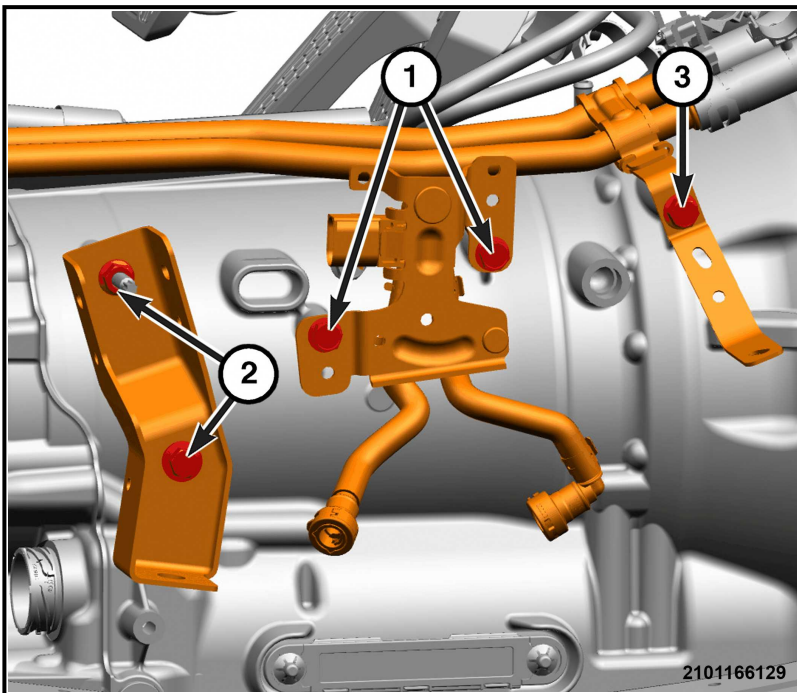


1 - Manual Park Release (MPR) Cable Bracket Bolts

2 - MPR Cable

3 - MPR Lever

16. Install the MPR cable onto the bracket and lock into place.



1 - Differential Pressure Sensor Bracket Bolts
--

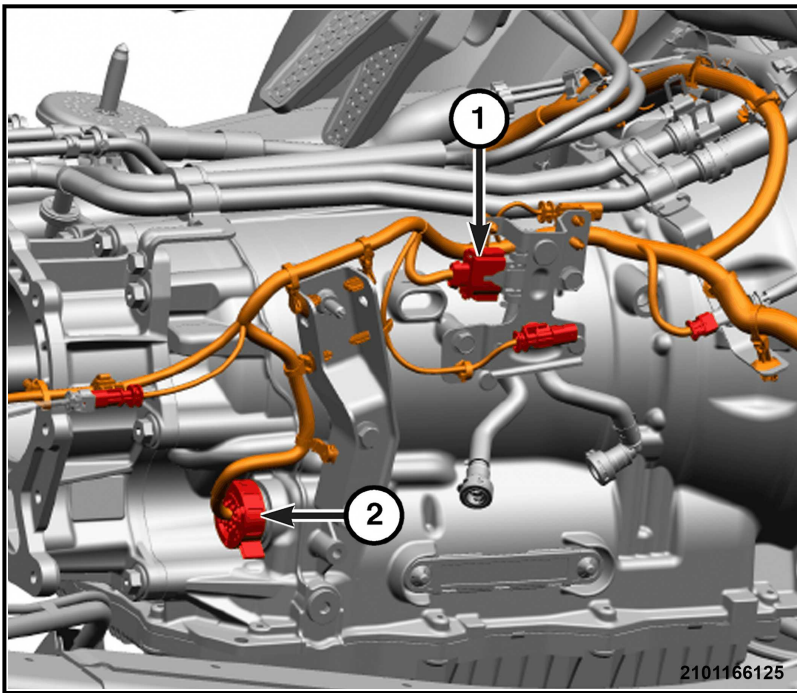
2 - Diesel Particulate Filter Bracket Bolts

3 - Transmission Heater Coolant Hoses Bracket Bolt
--

17. Position the transmission heater coolant hoses to the transmission.

18. Position the diesel particulate filter bracket and tighten the fasteners.

19. Position the pressure differential sensor and bracket to the transmission and tighten the fasteners.



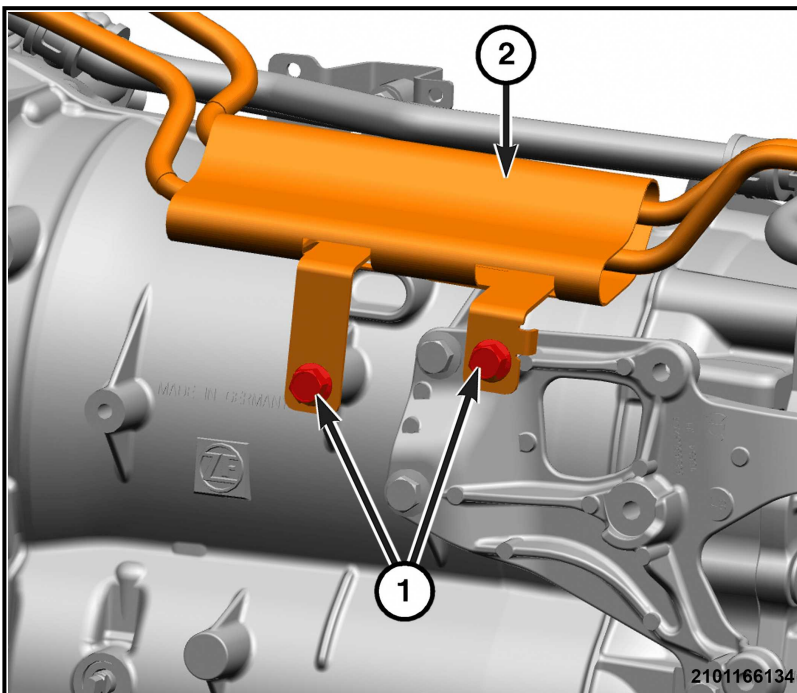
1 - Differential Pressure Sensor Wire Harness Connector

2 - Transmission Wire Harness Connector

20. Connect the 13-pin plug connector. Turn the connector clockwise to lock.

21. Connect the differential pressure sensor connector.

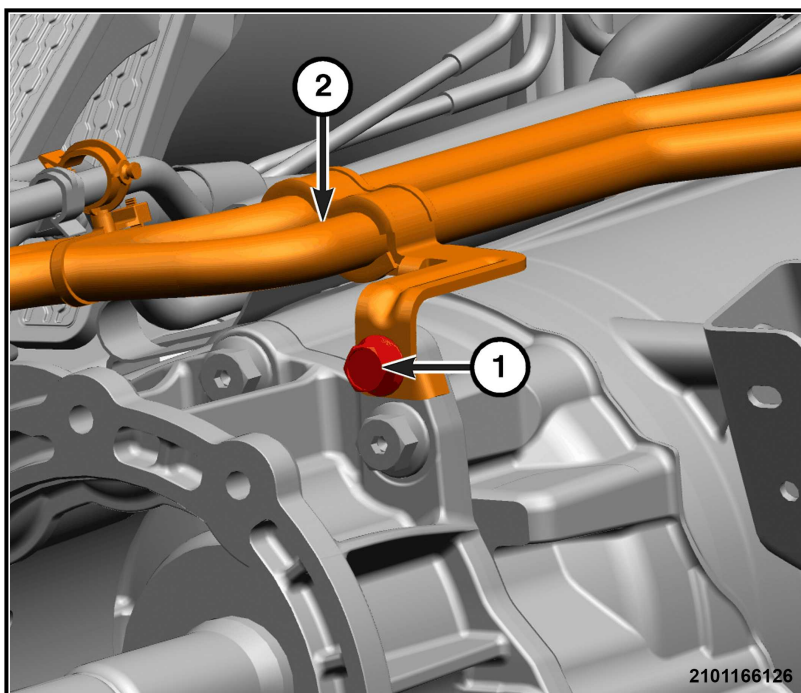
22. Install all remaining wiring harness retainers to the transmission.



1 - Fuel Line Bracket Bolts

2 - Fuel Line Bracket And Lines

23. Position the brackets and lines, and install the fuel line bracket fasteners.



1 - Transmission Heater Coolant Hoses Bracket Bolts

2 - Transmission Heater Coolant Hoses

24. Position the transmission heater coolant hoses to the transmission and tighten the fastener.

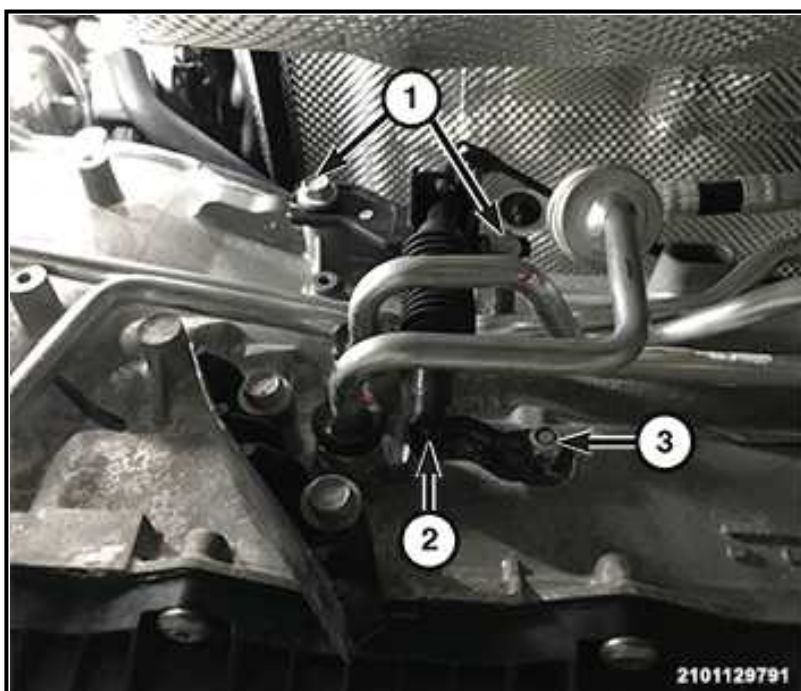
25. Install the transfer case. Refer to [REMOVAL AND INSTALLATION](#) [REMOVAL AND INSTALLATION](#) .

NOTE: Support the front of the front propeller shaft. Do not install the front propeller shaft to axle bolts until the left side catalytic converter is installed.

26. Install the front propeller shaft to the transfer case. Refer to [REMOVAL AND INSTALLATION](#) .

27. Install the transmission mount nuts. Refer to [INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION](#) [INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND INSTALLATION](#) .

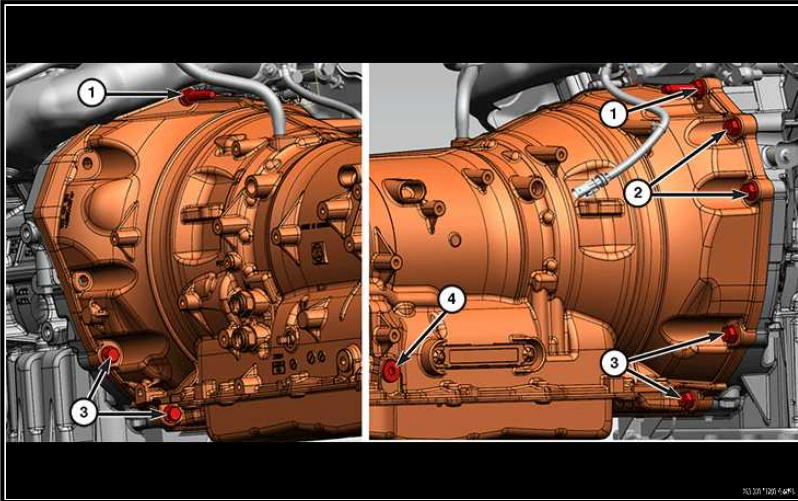
28. Install the rear propeller shaft. Refer to [REMOVAL AND INSTALLATION](#) .



29. Connect the MPR cable (2) to the MPR lever (3).
30. Install the crank position sensor. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION](#) .
31. Install the DPF. Refer to [FILTER, DIESEL PARTICULATE, REMOVAL AND INSTALLATION](#) .
32. Install the front propeller shaft. Refer to [REMOVAL AND INSTALLATION](#) .
33. Install the frame cross-member supporting the transmission. Refer to [CROSSMEMBER, FRONT REINFORCEMENT, REMOVAL AND INSTALLATION](#) [CROSSMEMBER, TRANSMISSION, REMOVAL AND INSTALLATION](#) .
34. Install the transfer case skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION](#) [PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION](#) [PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .
35. Fill the transmission with appropriate fluid. Refer to [TRANSMISSION FILL AFTER SERVICE](#) .
36. Lower the vehicle and remove the supports.
37. Connect the negative battery cable(s). Refer to [CABLES, BATTERY](#) .
38. If the valve body is replaced, program the Transmission Control Module (TCM). Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#) .
39. Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

TORQUE SPECIFICATIONS

BELLHOUSING AND OIL FILL PLUG

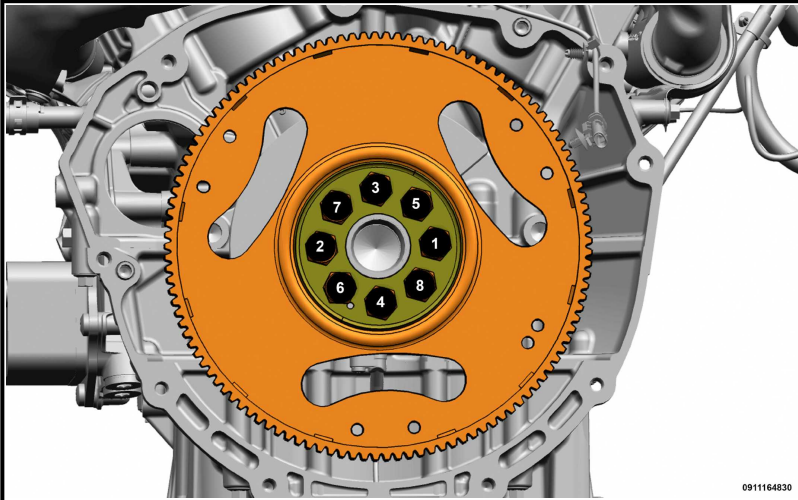


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Double Ended Studs	48 N.m (35 Ft. Lbs.)	-
2	Bellhousing to Engine Bolts	50 N.m (37 Ft. Lbs.)	-
3	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
4	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

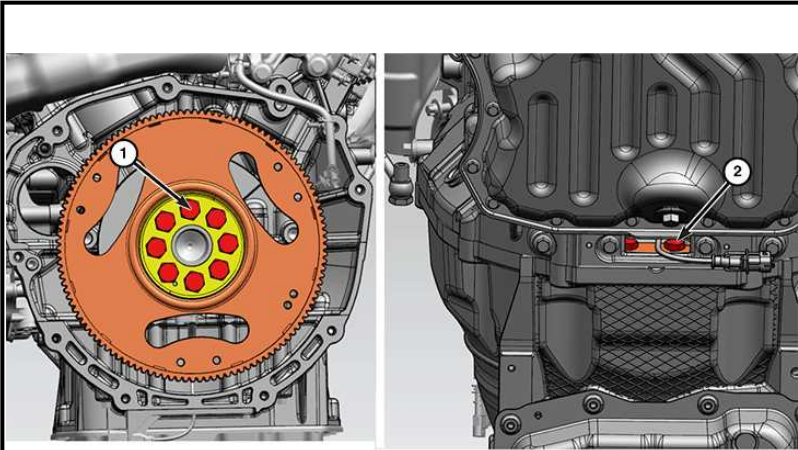
FLEXPLATE AND TORQUE CONVERTER

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	Torque Procedure: 1. With clean engine oil, lubricate the fastener side of backing plate.	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Tightening Sequence

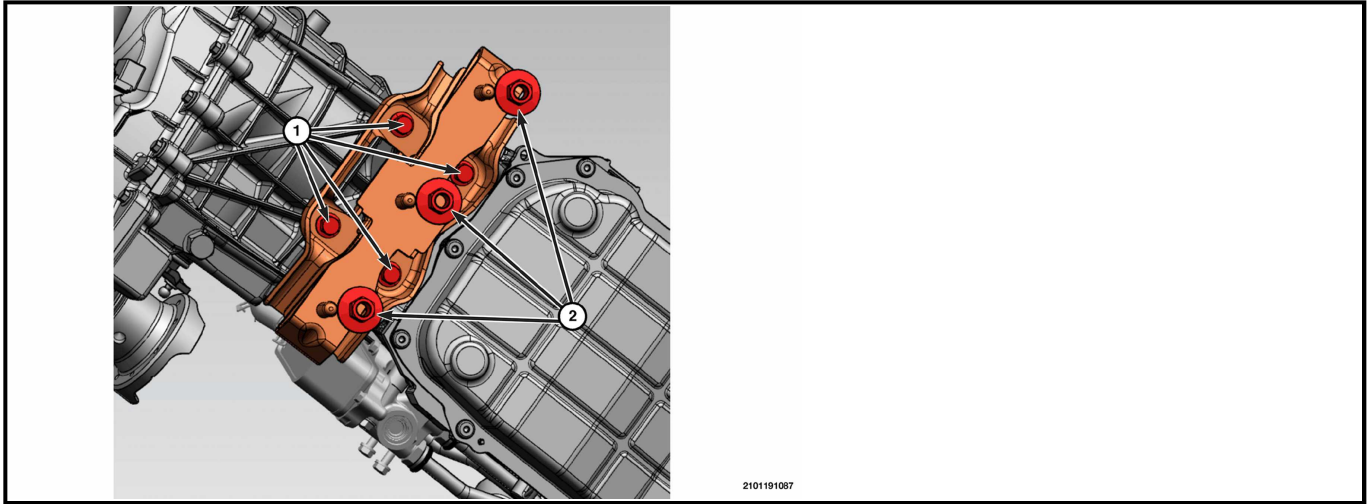
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
		2. Tighten the fasteners 50 N.m (37 ft. lbs.) . 3. Loosen one fastener at a time and then retighten the fastener 125 N.m (92 ft. lbs.) . 4. Using a torque angle gauge, tighten each fastener an additional 30 B° .	
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.



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CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

DISASSEMBLY AND ASSEMBLY

TRANSMISSION AND INTERNAL CLUTCHES

The individual clutches listed below provide the following information for each clutch assembly:

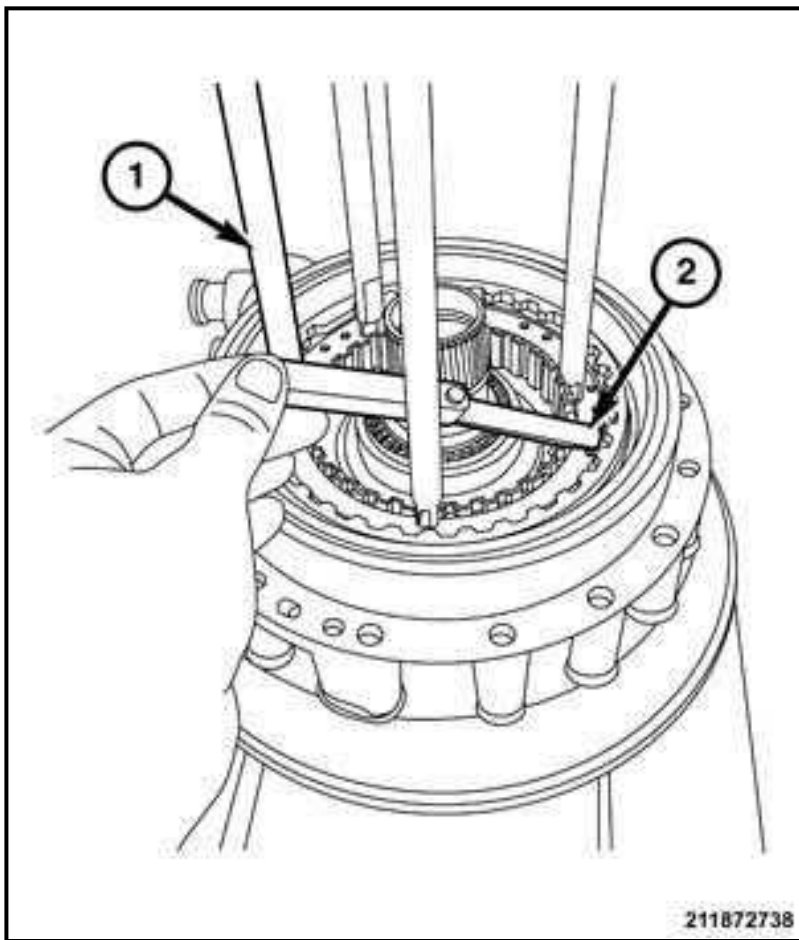
- Disassembly and assembly procedures
- Clutch pack clearance measurements
- Clutch pack clearance specifications
- Adjustments - selectable snap rings and backing plates

It is recommended to measure the clutch pack clearances for evaluation before disassembling a clutch to replace any of the clutch components.

CLUTCH A - DISASSEMBLY AND ADJUSTMENTS

CLUTCH A MEASUREMENT PROCEDURE

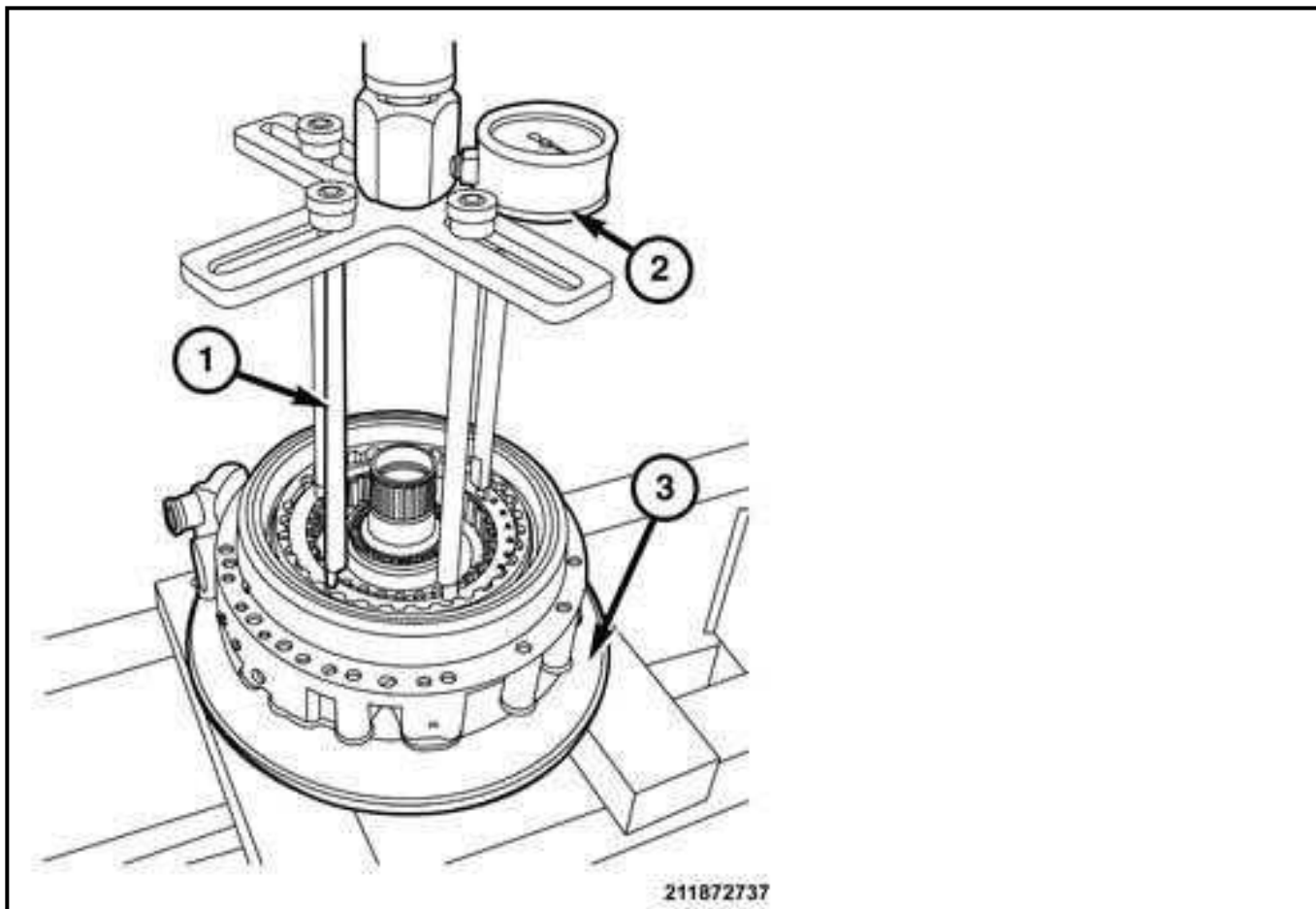
1. Using (special tool #10428, Adapter, Pressing Tool) and (special tool #10429, Gauge, Force), place the Clutch A/oil pump assembly in a suitable arbor press.
2. Apply 200 N (45 lbf.) of force to the Clutch A backing plate to compress the wave plate.



1 - Pressing Tool Adapter

2 - Feeler Gauge

3. With a suitable feeler gauge measure the gap between the Clutch A backing plate and the snap ring.
4. Refer to the clutch clearance table for specs. If clearance is not within specification, a thinner or thicker selectable snap ring can be installed for proper clearance.



1 - Pressing Tool Adapter
2 - Force Gauge
3 - Clutch A/Oil Pump Assembly

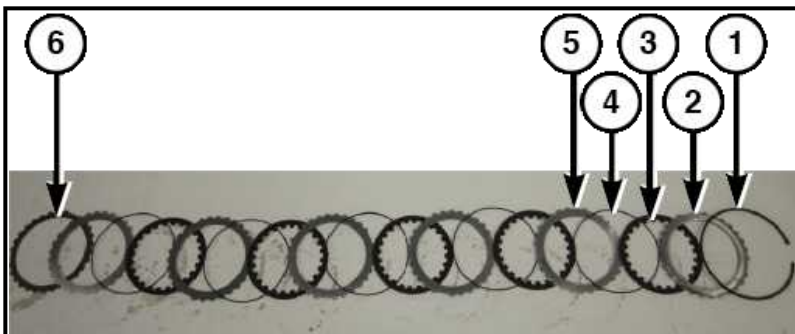
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
A	NEW	1.41 mm	1.555 mm	1.7 mm
		0.056 in.	0.061 in.	0.067 in.
	AFTER OPERATION	1.41 mm	1.655 mm	1.9 mm
		0.056 in.	0.065 in.	0.075 in.

CLUTCH A SELECTABLE SNAP RINGS

3.2 mm	0.125 in.
3.0 mm	0.118 in.
2.8 mm	0.110 in.
2.6 mm	0.102 in.
2.4 mm	0.0944 in.
2.2 mm	0.0866 in.

DISASSEMBLY Clutch A, depending on transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates, five wave springs, five steel plates, one support plate, one snap ring, and one wave plate.



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1 - Snap Ring

2 - Support Plate

3 - Friction Plates

4 - Wave Springs

5 - Steel Plates

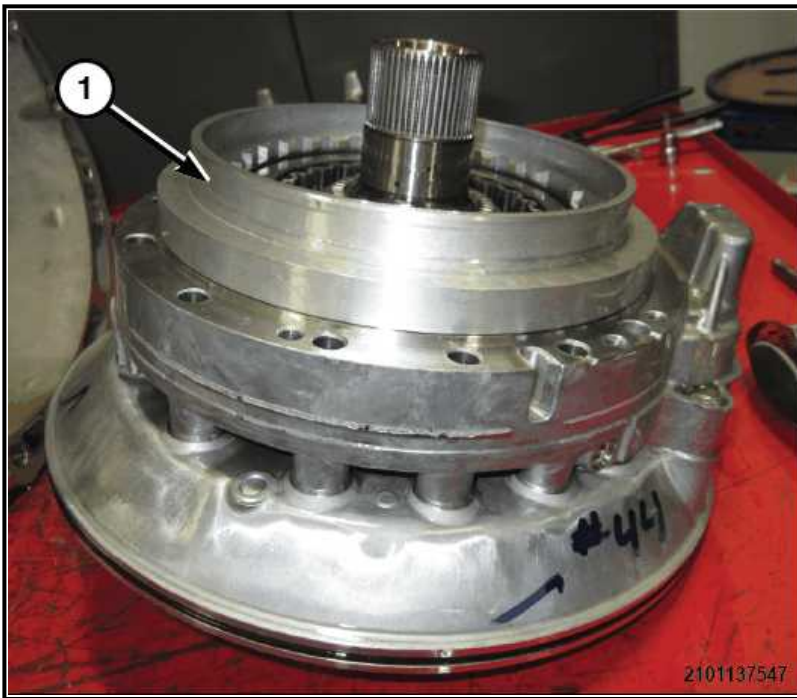
6 - Wave Plate

1. Remove the oil pump from the transmission case. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).



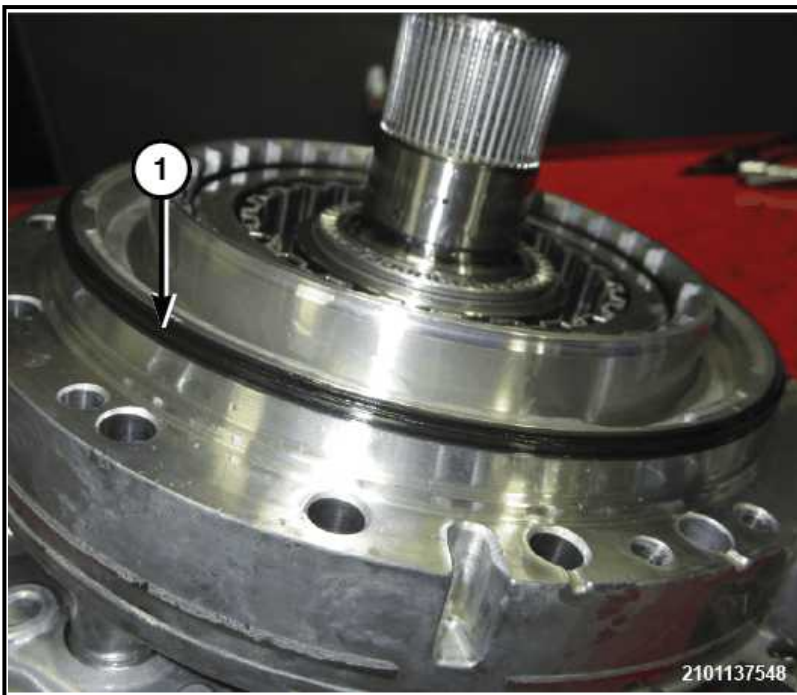
1 - Clutch B Damper Spring

2. Remove the Clutch B damper spring.



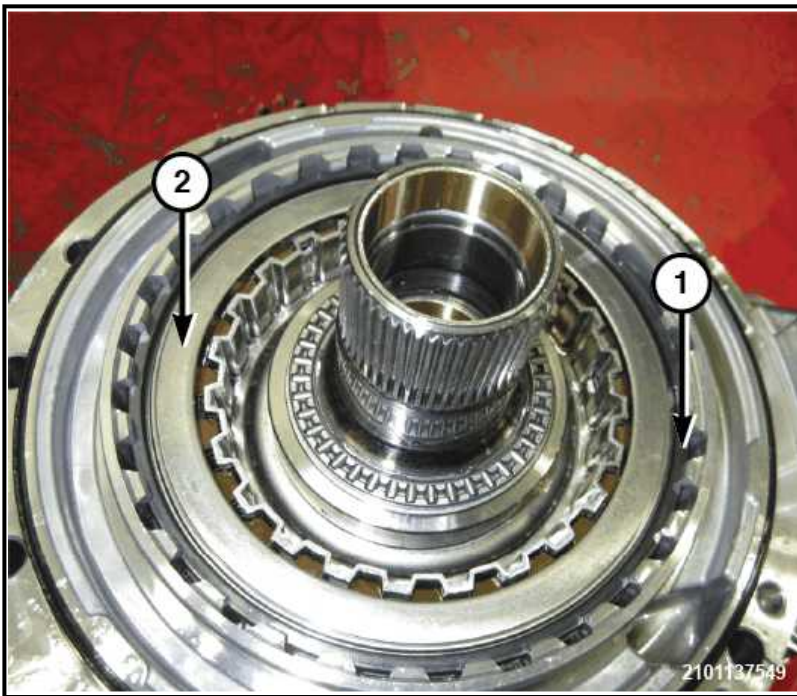
1 - Clutch B Piston

3. Remove the Clutch B piston from the assembly.



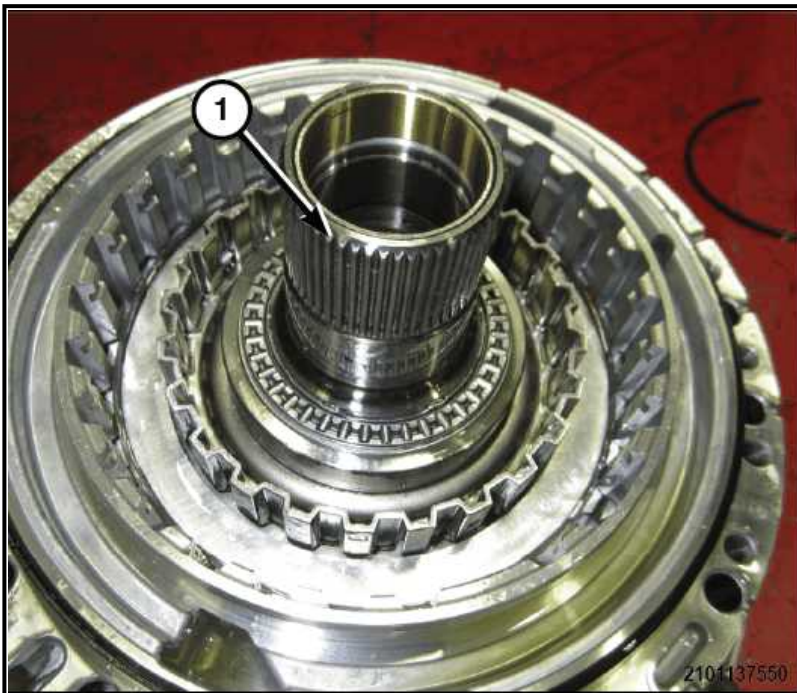
1 -Clutch B Piston Seal

4. Check the Clutch B piston seal for damage or wear and replace if necessary.



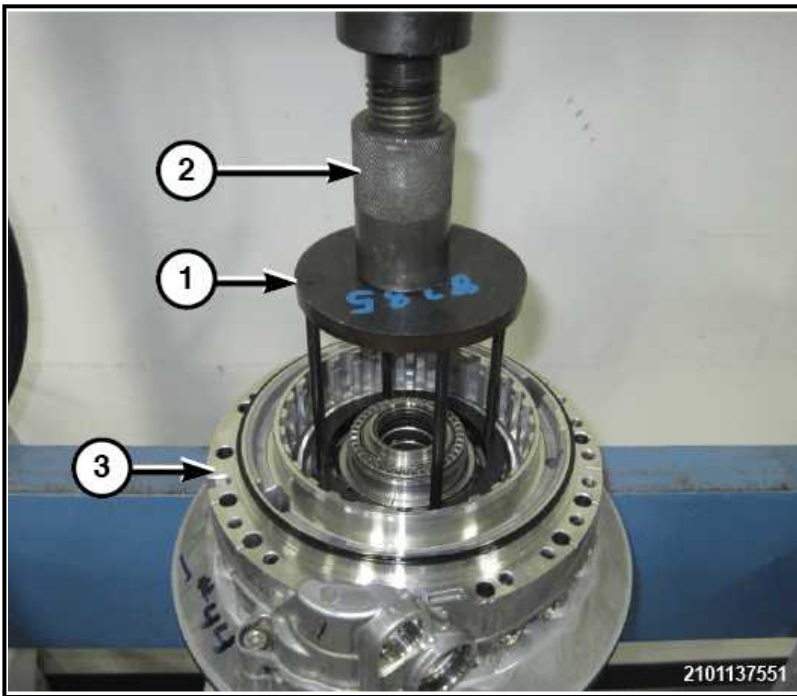
- | |
|-------------------------------|
| 1 - Snap Ring |
| 2 - Clutch A Discs and Plates |

5. Remove the snap ring.
6. Remove the Clutch A disks and plates.



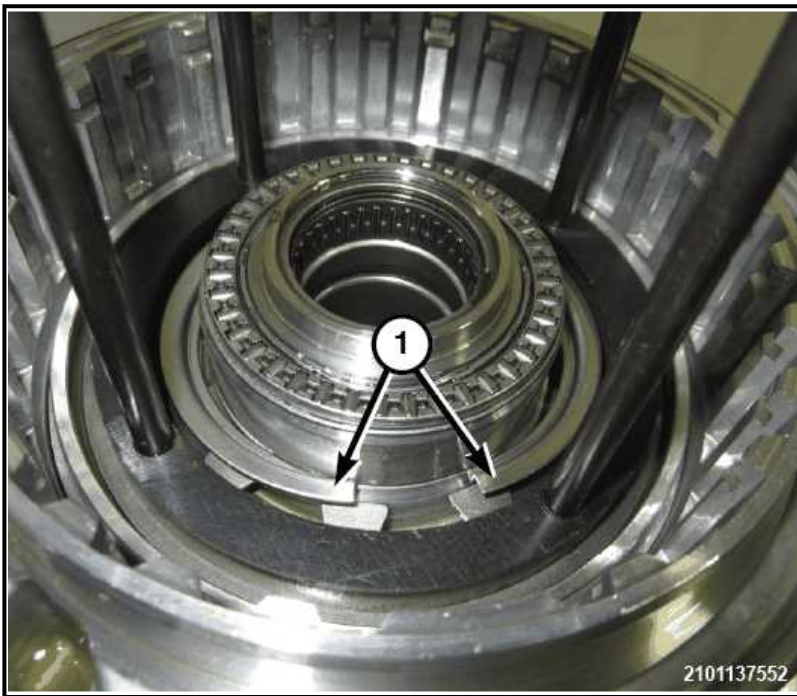
- | |
|---------|
| 1 - Hub |
|---------|

7. Remove the hub.



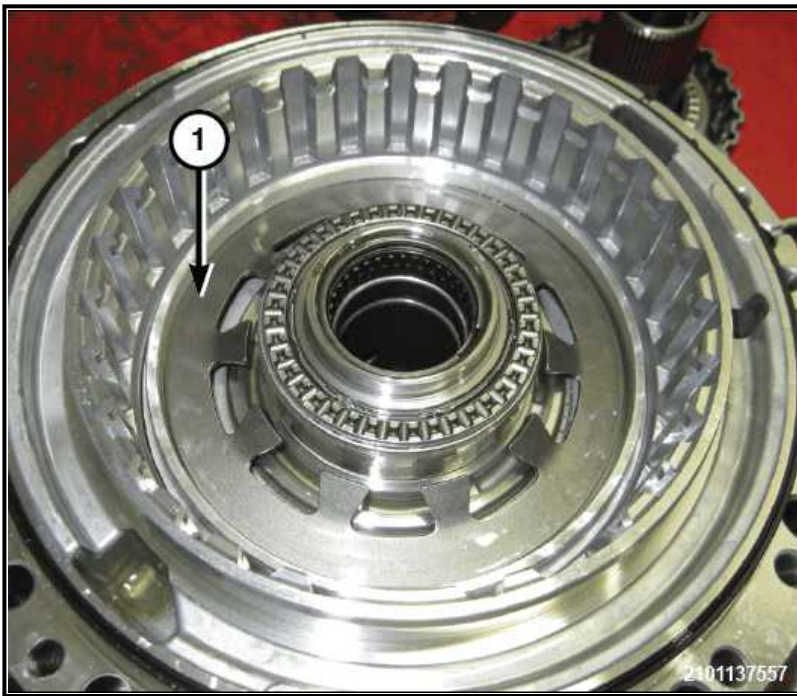
1 - Spring Compressor Tool
2 - Arbor Press
3 - Transmission Oil Pump Assembly

8. Position the oil pump housing assembly in a suitable arbor press.
9. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retaining ring to remove tension.



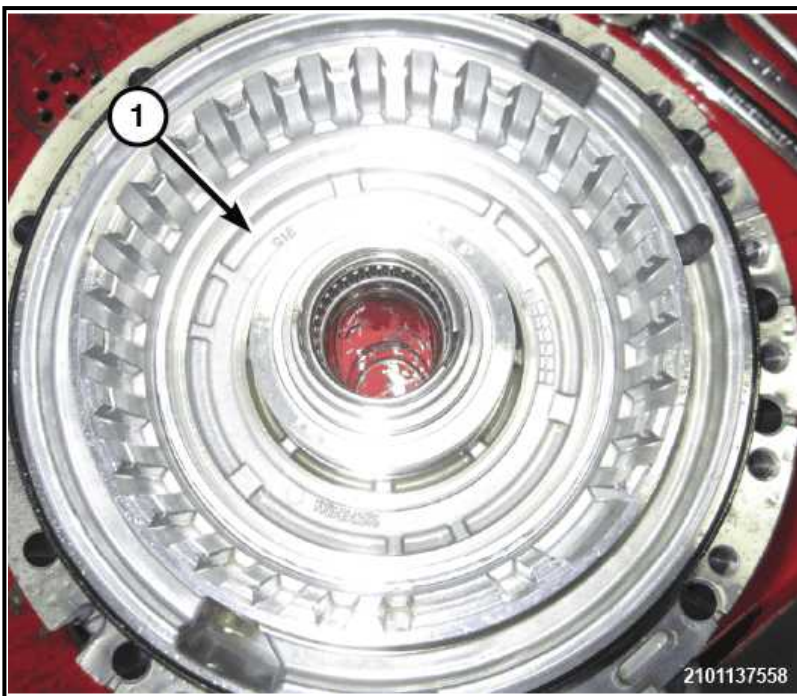
1 - Retaining Ring

10. Remove the two halves of the retaining ring.



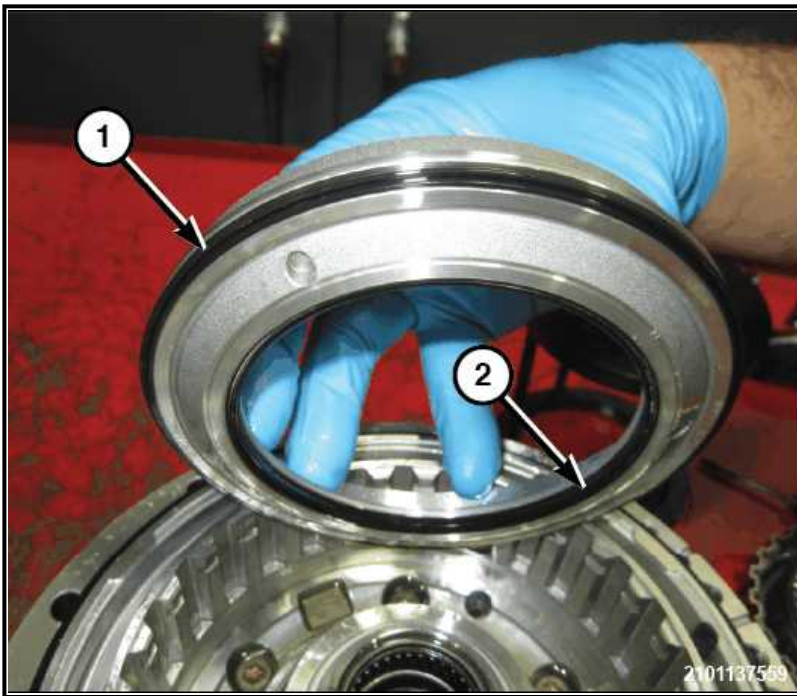
1 - Clutch A Belleville Spring

11. Remove the Clutch A belleville spring.



1 - Clutch A Piston

12. Remove the Clutch A piston (1) by rotating and gently lifting.



1 - Clutch A Piston Outer Seal

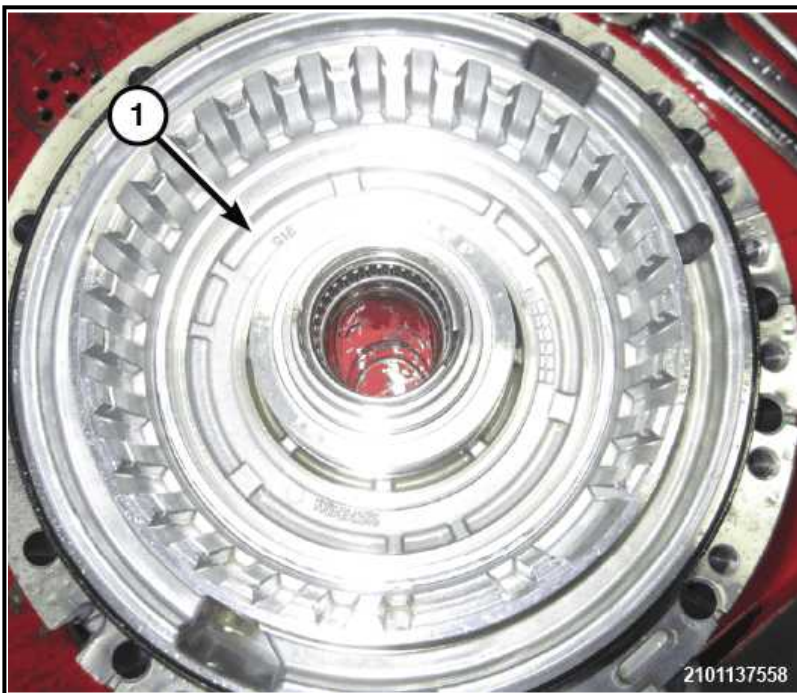
2 - Clutch A Piston Inner Seal

13. Remove and **DISCARD** the Clutch A Piston inner and outer seals.

ASSEMBLY

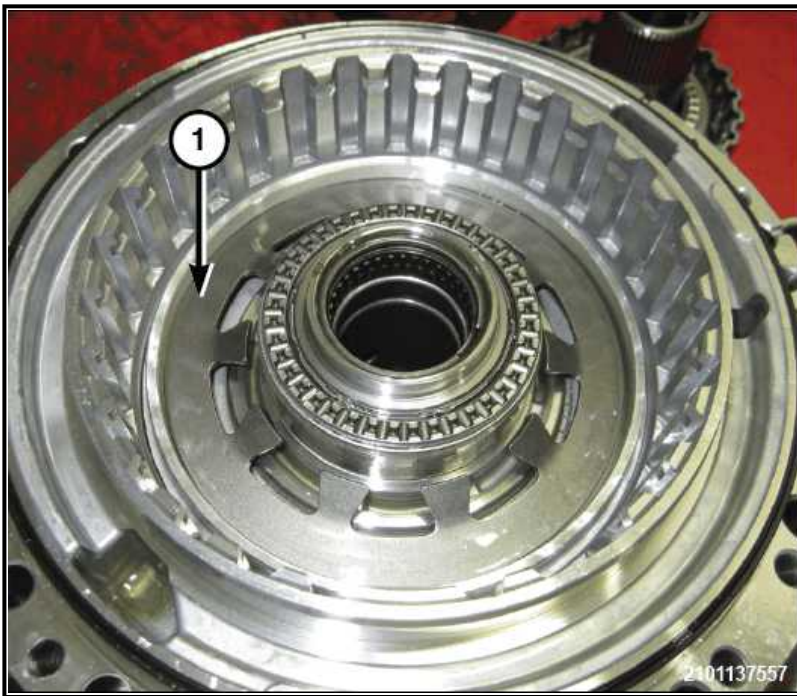
NOTE: If the clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Install new Clutch A inner and outer piston seals.



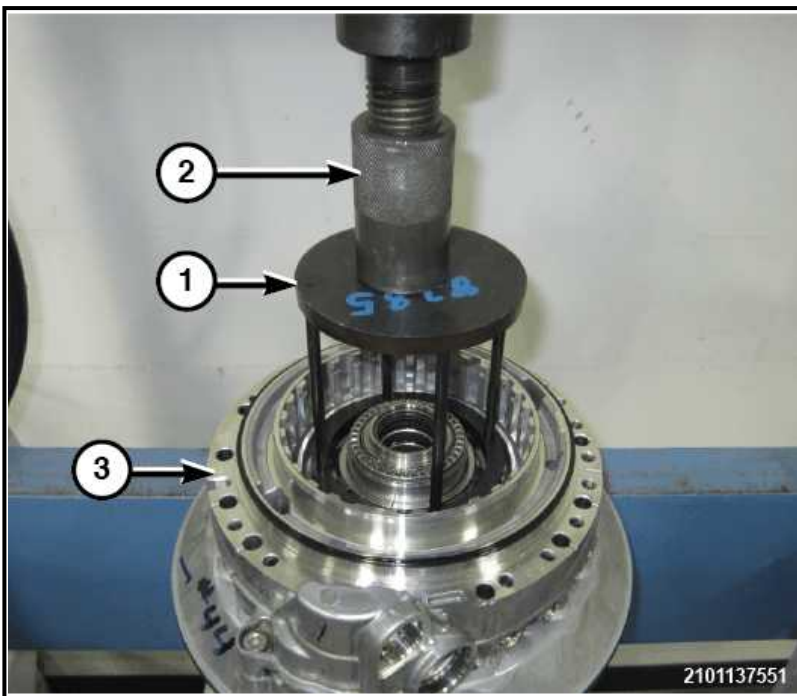
1 - Clutch A Piston

2. Insert the Clutch A piston into the housing. Lubricate the seals with transmission assembly lube prior to installing them into the housing.



1 - Clutch A Belleville Spring

3. Insert the belleville spring.



1 - Spring Compressor Tool

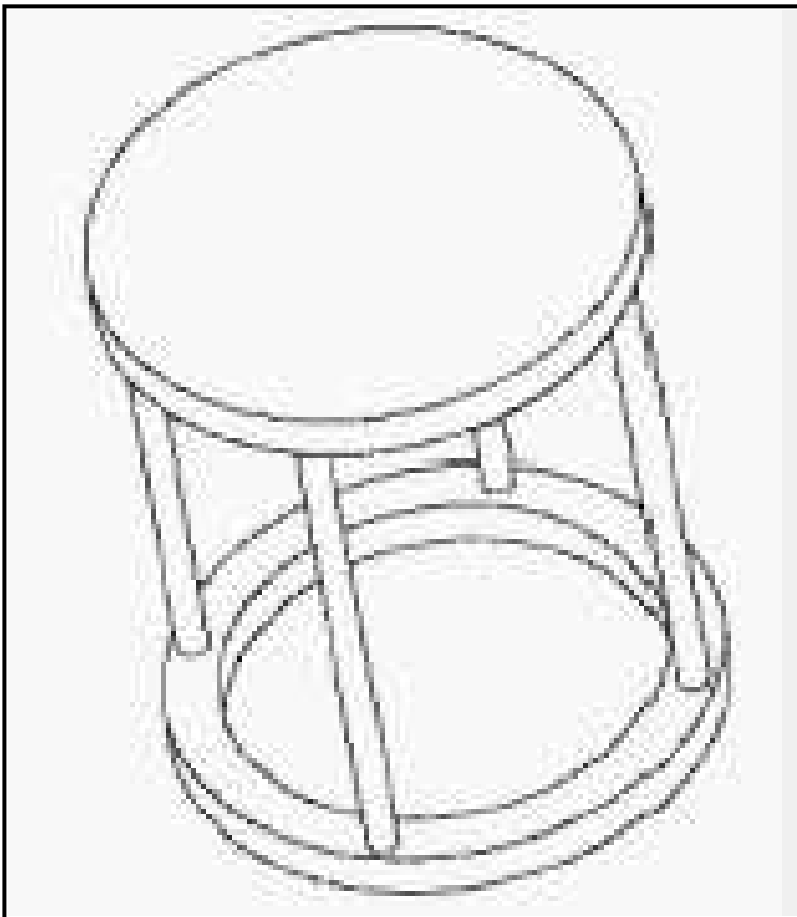
2 - Arbor Press

3 - Transmission Oil Pump Assembly

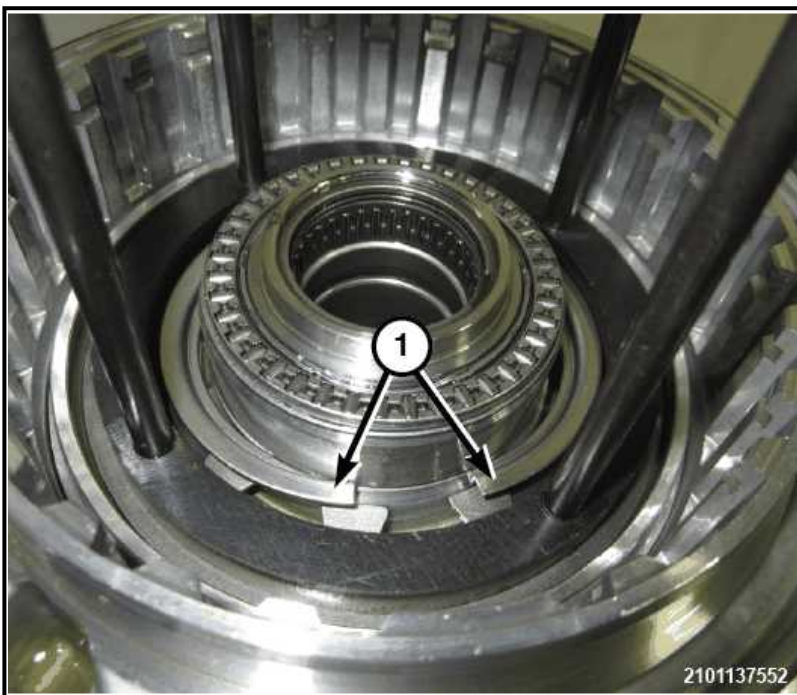
4. Position the oil pump housing assembly in a suitable arbor press.

5. Using

(special tool #8285, Compressor, Spring)

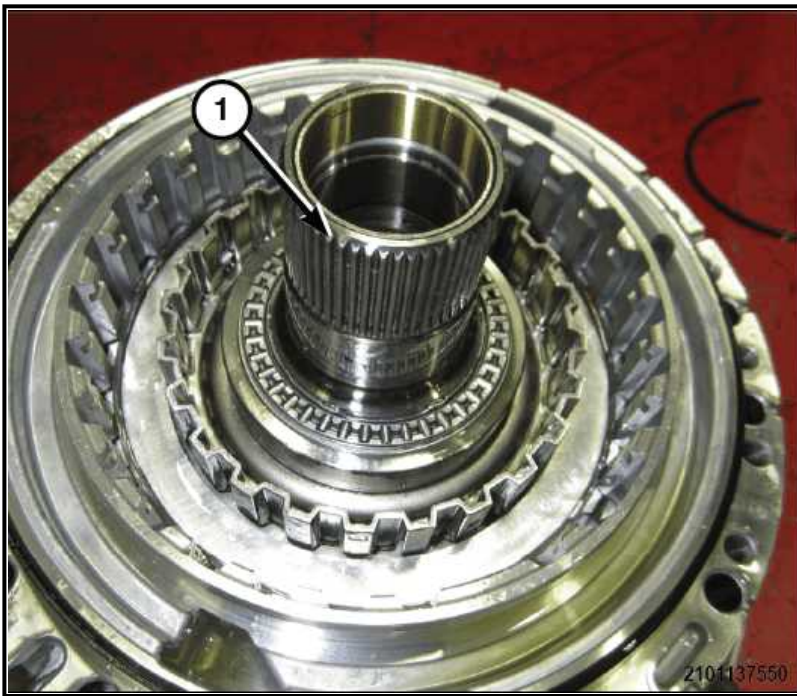


, press on the fingers of the piston retaining ring to remove tension.



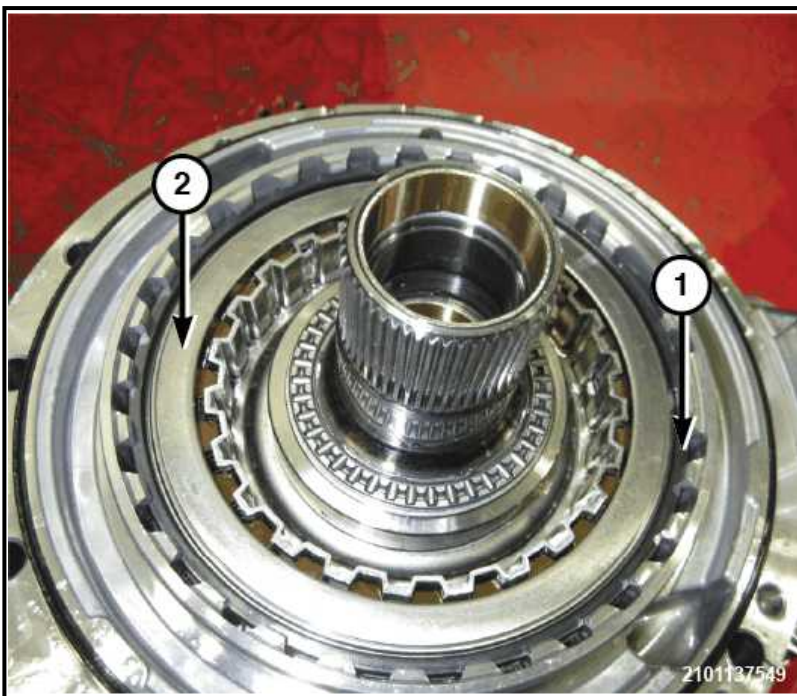
1 - Retaining Ring

6. Install the two retaining ring halves.



1 - Hub

7. Install the hub.

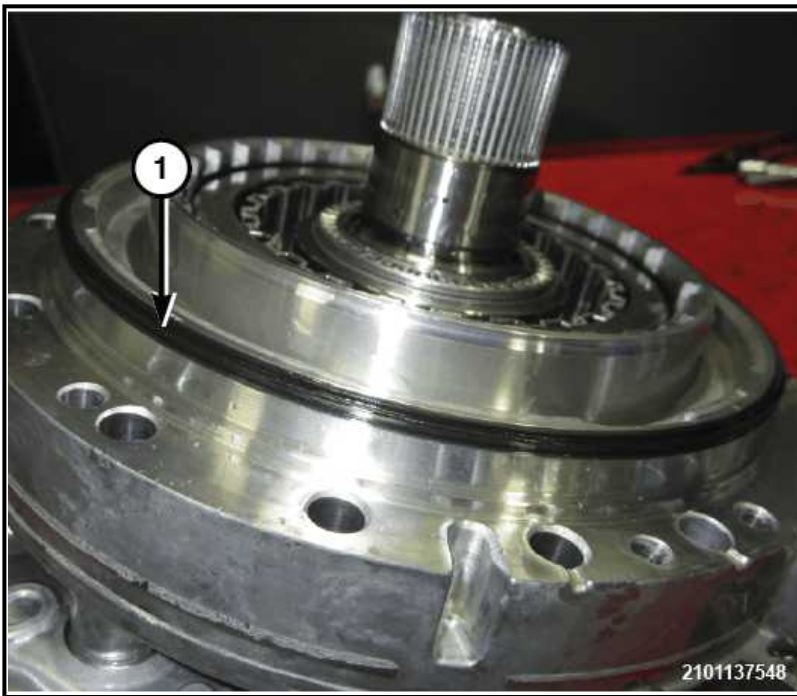


1 - Snap Ring

2 - Clutch A Discs and Plates

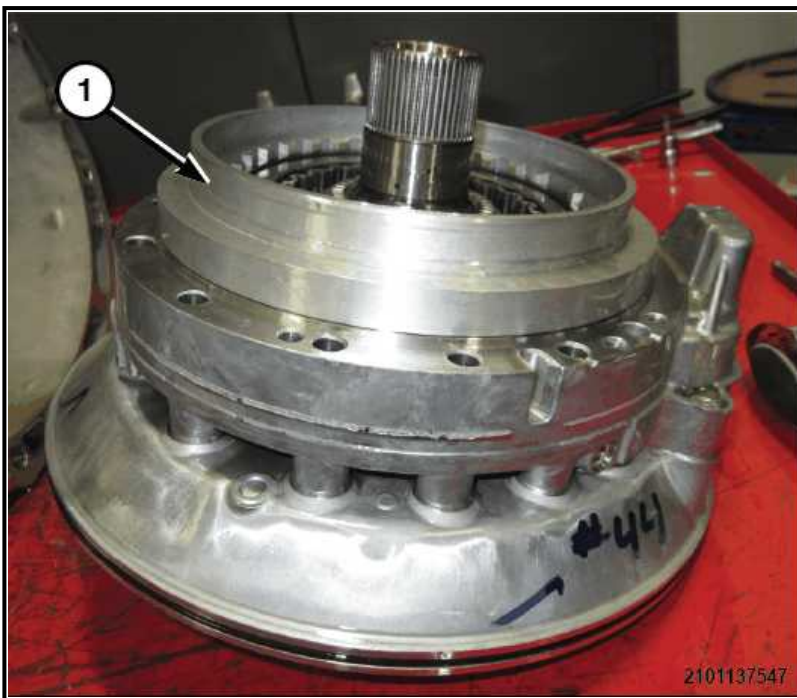
8. Install the Clutch A disks and plates.

9. Install the snap ring.



1 - Clutch B Piston Seal

10. Install a **NEW** Clutch B seal.



1 - Clutch B Piston

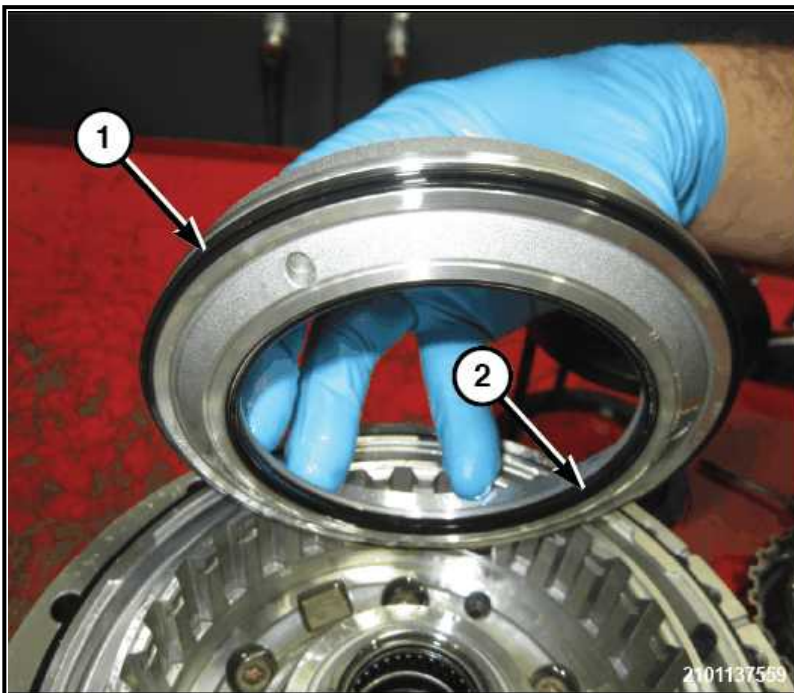
11. Install the Clutch B piston on the assembly.



1 - Clutch B Damper Spring

12. Install the Clutch B damper spring on the Clutch B piston.

13. Install the transmission oil pump. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).



1 - Clutch A Piston Outer Seal

2 - Clutch A Piston Inner Seal

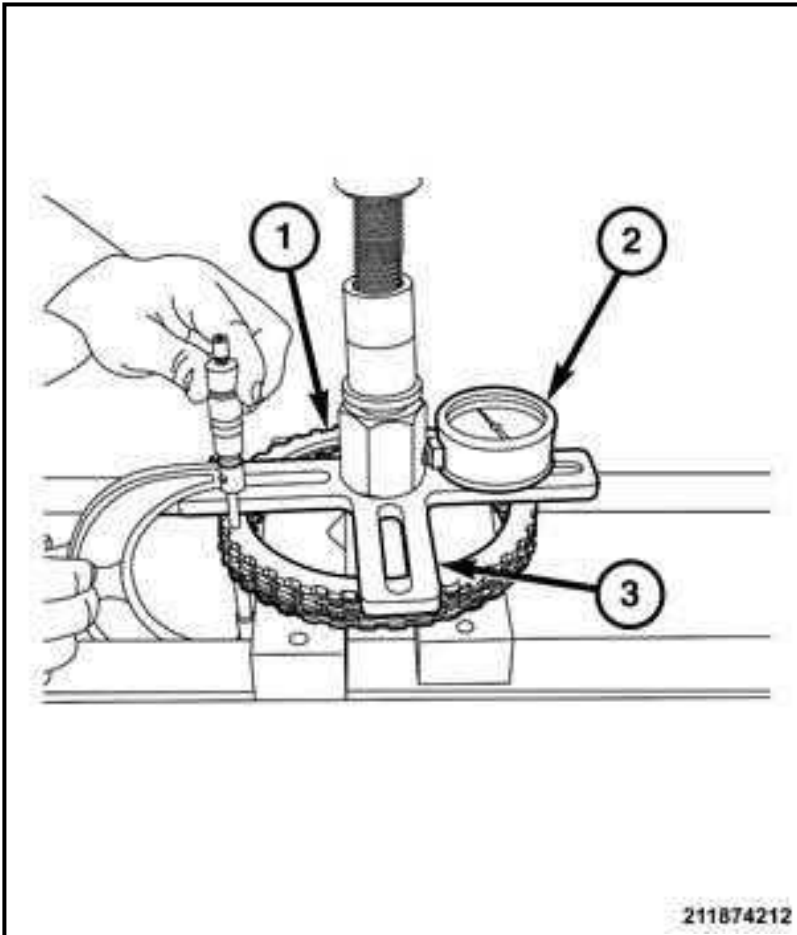
CLUTCH B - DISASSEMBLY AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

NOTE: When the Clutch B is replaced, the proper selectable shim must be installed to achieve specified clearance.

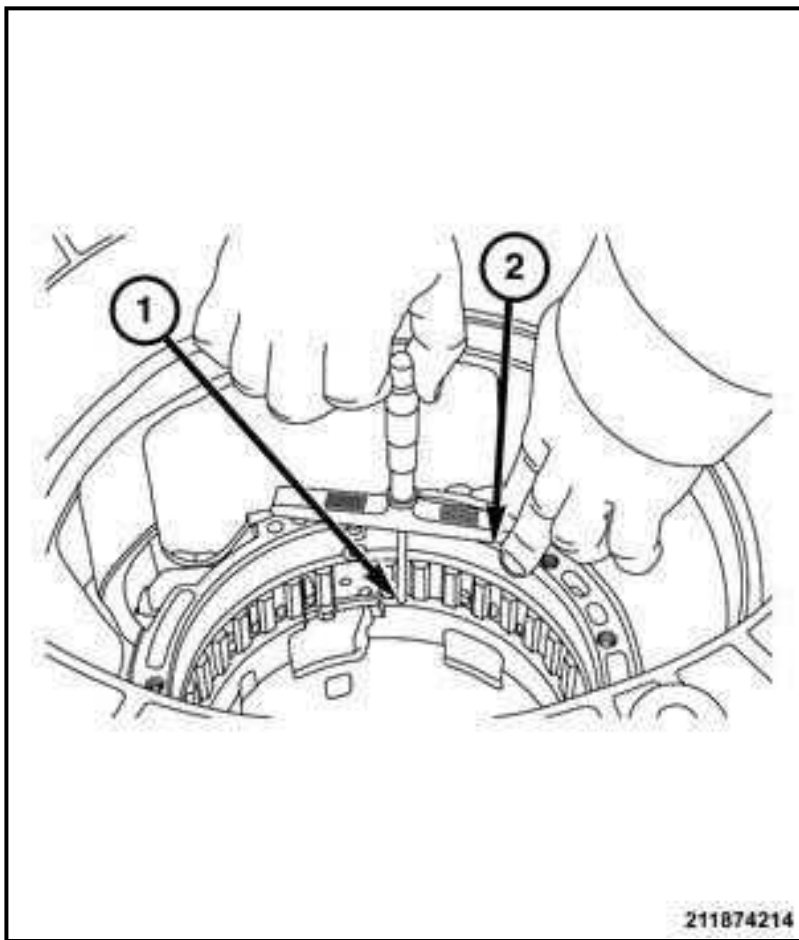
1. Place the Clutch B, with the wave plate on top, on a suitable arbor press.

2. Position tools (special tool #8901A, Pressing Tool) (using just the cross bar) and (special tool #10429, Gauge, Force) on top of the Clutch B wave plate and under the press ram.



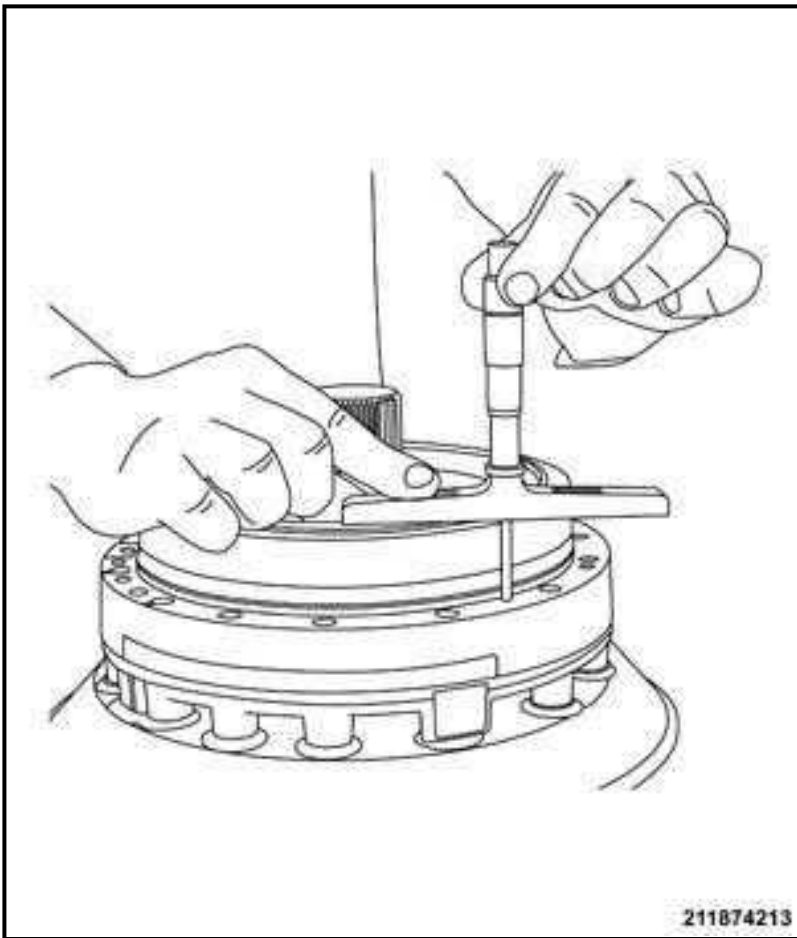
- | |
|-------------------------|
| 1 - Clutch B Wave Plate |
| 2 - Force Gauge |
| 3 - Compressed Clutch B |

3. Apply 500 N (112 lbf.) of downward force on the Clutch B to compress the wave plate.
4. Using a suitable micrometer, measure the thickness of the compressed Clutch B. **Record the measurement as (A)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



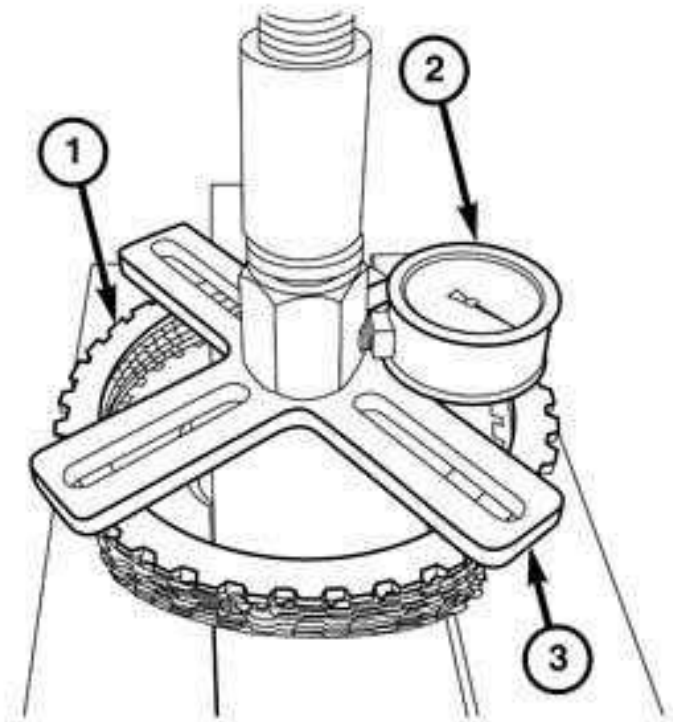
1 - Clutch B Retainer
2 - Transmission Oil Pump

5. With a suitable depth micrometer, place it at the mounting surface of the transmission oil pump and measure to the base of the Clutch B retainer on the case. This measurement should be 61.05 mm. **Record the measurement as (B)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



6. Using a suitable depth micrometer, measure the Clutch B piston.
7. Measure between the fluid pump sealing surface and the bottom of the straight edge. **Record the measurement as (C)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.

Calculation - Take the case depth (B) subtract (C) subtract (A) remainder is the clearance of the Clutch B. If the clearance is not within specification a thinner or thicker reaction plate can be installed to achieve proper clearance.



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1 - Clutch B Wave Plate

2 - Force Gauge

3 - Pressing Tool

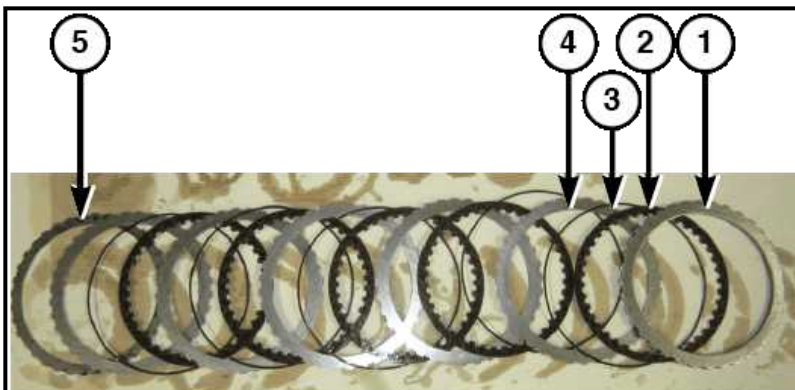
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
B	NEW	1.52 mm	1.725 mm	1.93 mm
		0.060 in.	0.068 in.	0.076 in.
	AFTER OPERATION	1.52 mm	1.825 mm	2.13 mm
		0.060 in.	0.072 in.	0.084 in.

CLUTCH B SELECTABLE BACKING PLATES

6.0 mm	.236 in.
5.8 mm	.228 in.
5.6 mm	.220 in.
5.4 mm	.212 in.
5.2 mm	.204 in.
5.0 mm	.196 in.
4.8 mm	.188 in.

DISASSEMBLY The Clutch B, depending on the transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates (2), five wave springs (3), five steel plates (4), one backing plate (1), and one wave plate (5).



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1 - Backing Plate

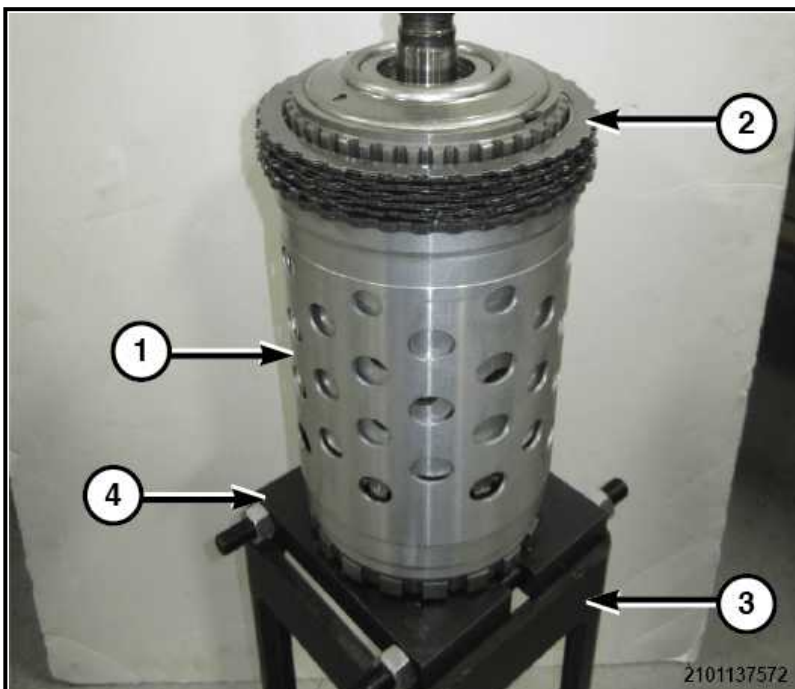
2 - Friction Plates

3 - Wave Springs

4 - Steel Plates

5 - Wave Plate

1. Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear) and remove the Clutch B discs and plates.



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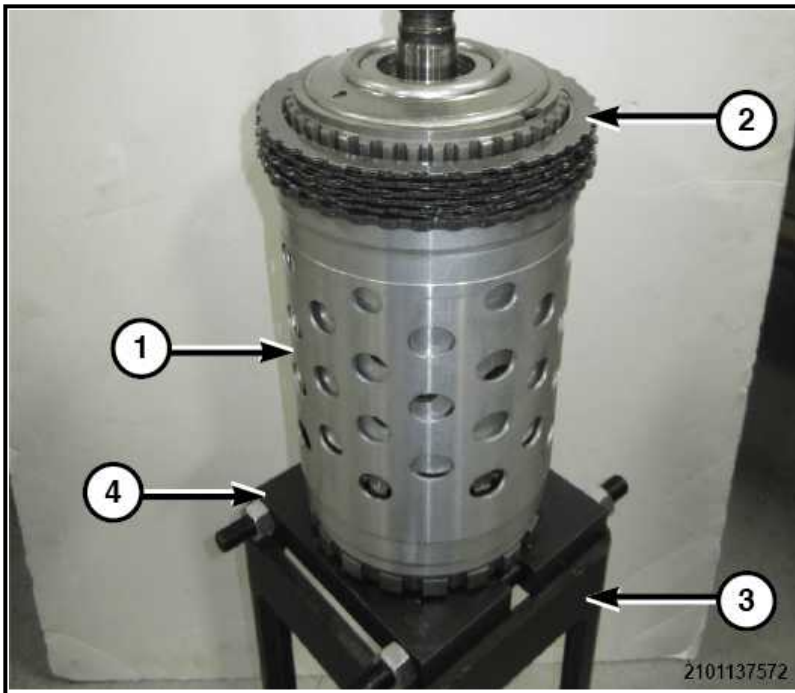
1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

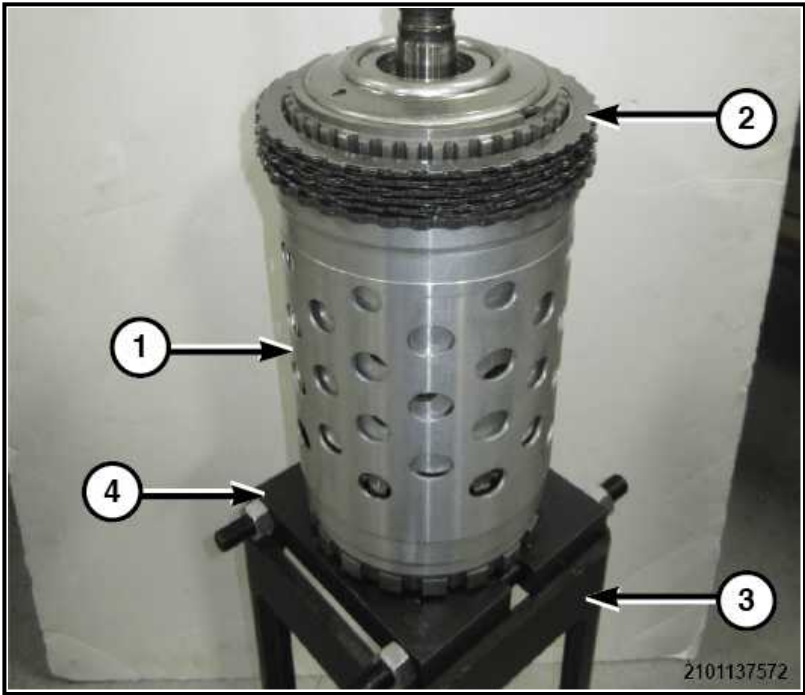
ASSEMBLY



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Splitter, Bearing/Gear

NOTE: If clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Position the input/output and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) and (special tool #1130, Splitter, Bearing/Gear).



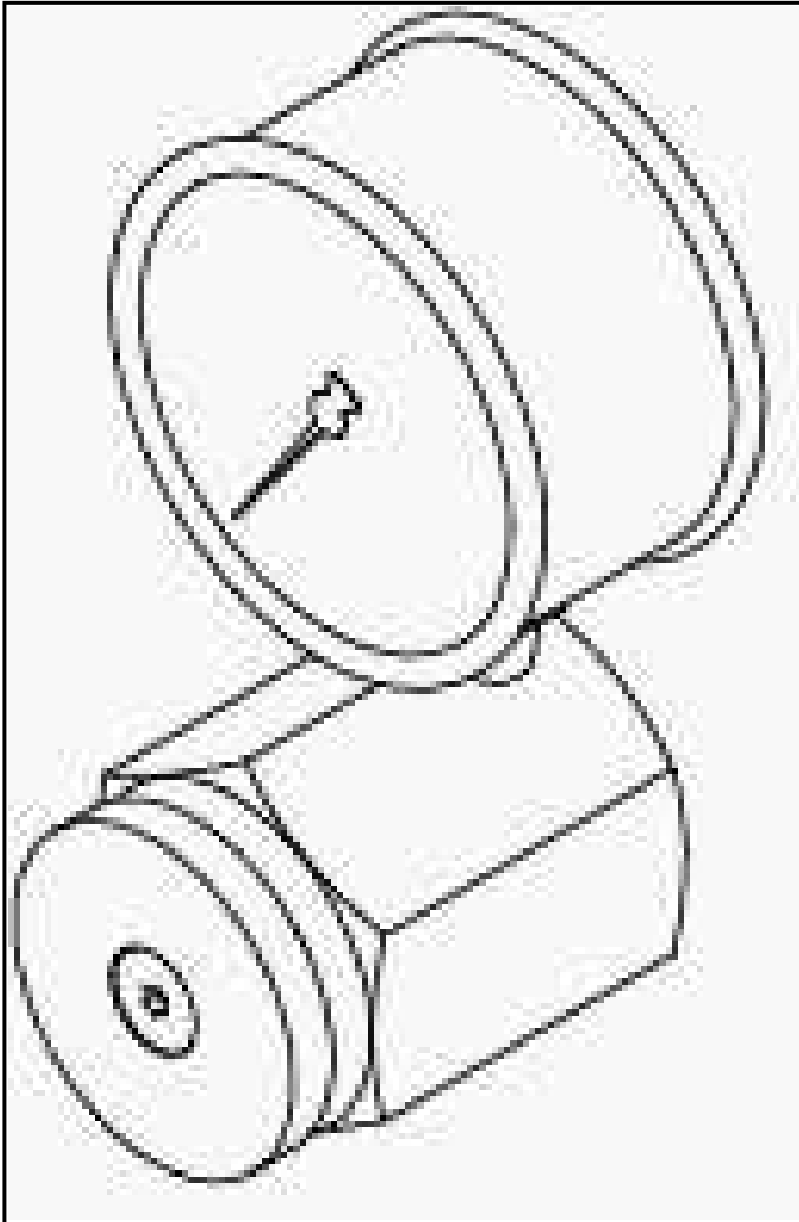
1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Bearing/Gear Splitter

2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.
5. Install the P1 annulus onto the input/output shaft.
6. Install the correct selectable shim onto the P1 annulus.

CLUTCH C - DISASSEMBLY AND ADJUSTMENTS

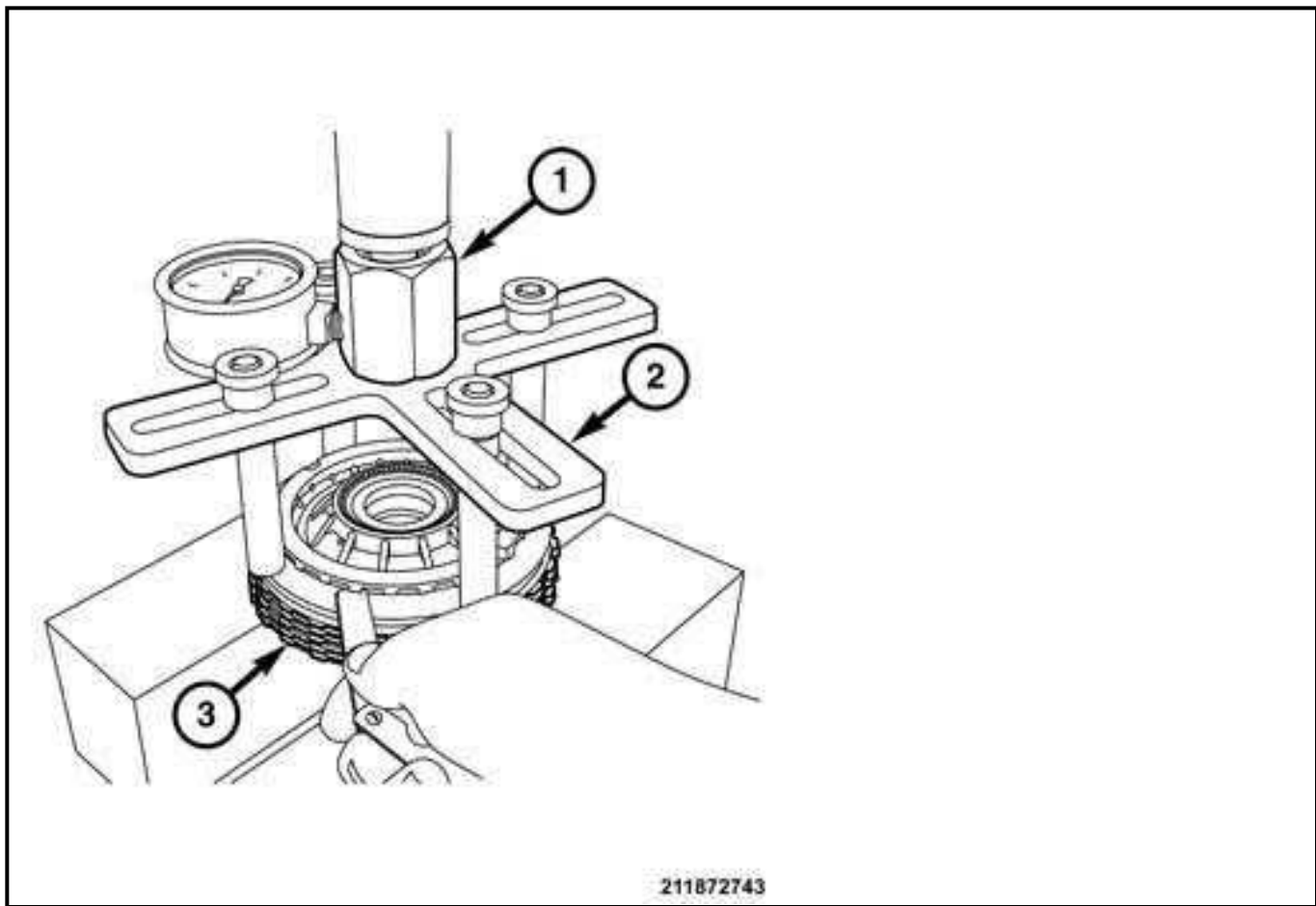
CLUTCH C MEASUREMENT PROCEDURE

1. Using (special tool #8901A, Pressing Tool) and (special tool #10429, Gauge, Force)



, place Clutch C in a suitable arbor press (with the backing plate facing up).

2. Apply 200 N (45 lbf.) of force to the Clutch C to compress the wave plate.
3. With a suitable feeler gauge, measure the gap between the Clutch C backing plate and the Clutch C retainer.
4. Refer to clutch clearance table for specifications. If clearance is not within specifications, a thinner or thicker selectable backing plate can be installed to achieve proper clearance.



1 - Force Gauge
2 - Pressing Tool
3 - Clutch C

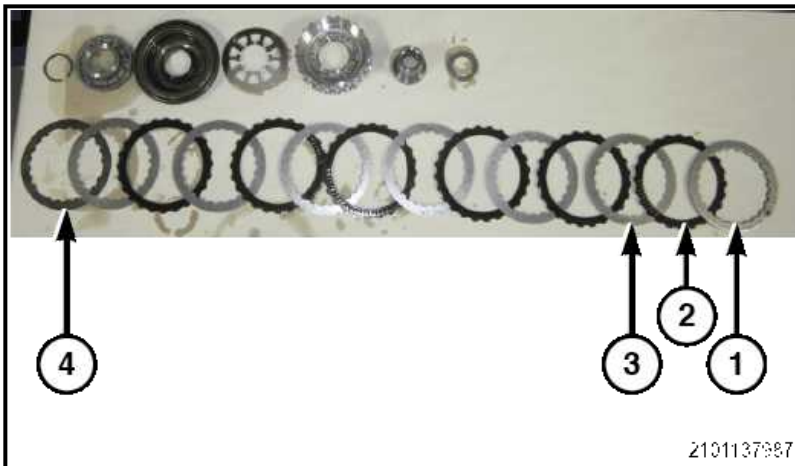
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
C	NEW	1.62 mm	1.815 mm	2.01 mm
		0.064 in.	0.071 in.	0.079 in.
	AFTER OPERATION	1.62 mm	1.935 mm	2.25 mm
		0.064 in.	0.076 in.	0.089 in.

CLUTCH C SELECTABLE BACKING PLATES

4.8 mm	0.188 in.
4.5 mm	0.177 in.
4.2 mm	0.165 in.
3.9 mm	0.153 in.
3.6 mm	0.141 in.
3.3 mm	0.129 in.
3.0 mm	0.118 in.

DISASSEMBLY Clutch C, depending on transmission Julian date, may contain wave springs that sit around each friction plate.



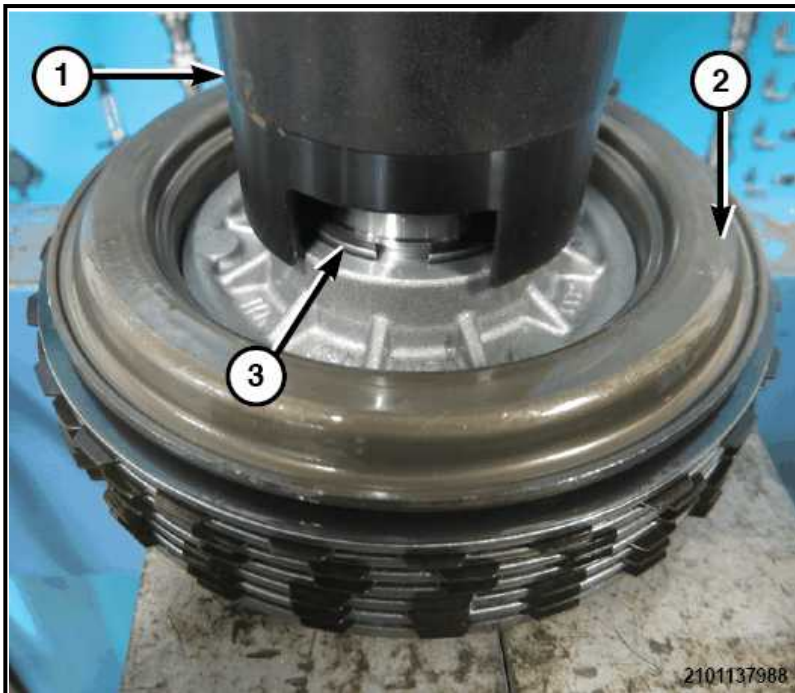
1 - Wave Plate

2 - Friction Plates

3 - Backing Plate

4 - Steel Plates

DISASSEMBLY



1 - Damper Installer

2 - Clutch C

3 - Snap Ring

1. Place Clutch C in a suitable press.

2. Using (special tool #8680A, Installer, Damper), compress Clutch C as needed to remove the snap ring.

3. Remove the snap ring.



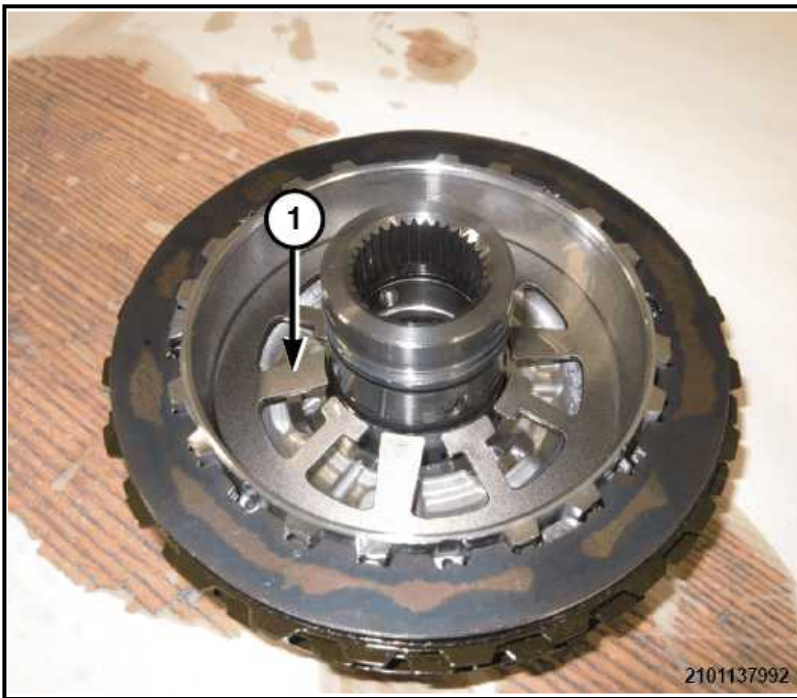
1 - Clutch C Retainer

4. Remove the Clutch C retainer.



1 - Clutch C Piston

5. Remove the Clutch C piston.



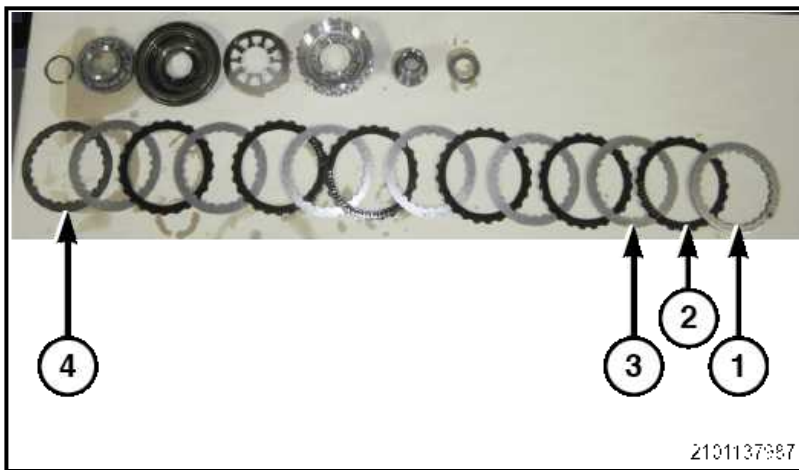
1 - Clutch C Belleville Spring

6. Remove the Clutch C belleville spring.



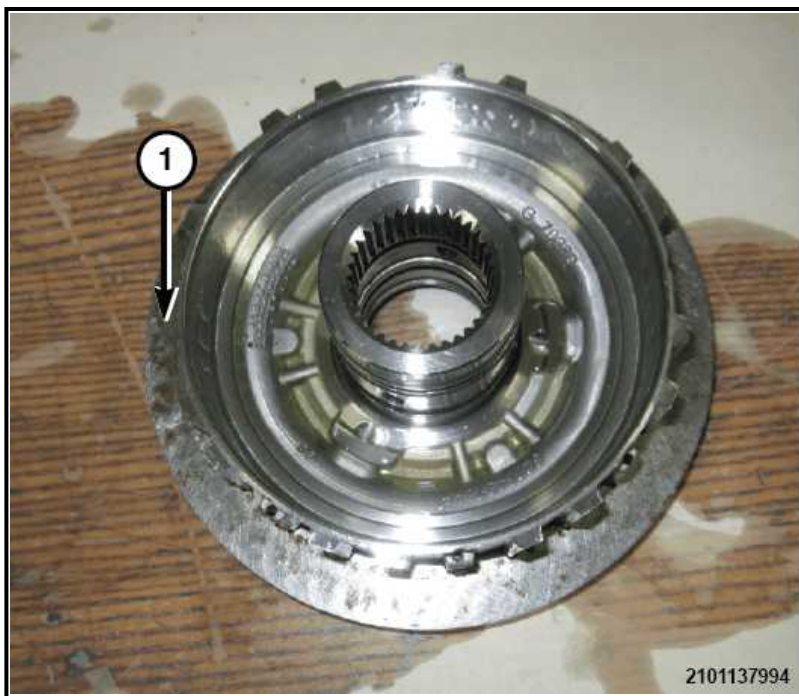
1 - Clutch C Wave Plate

7. Remove the Clutch C wave plate.



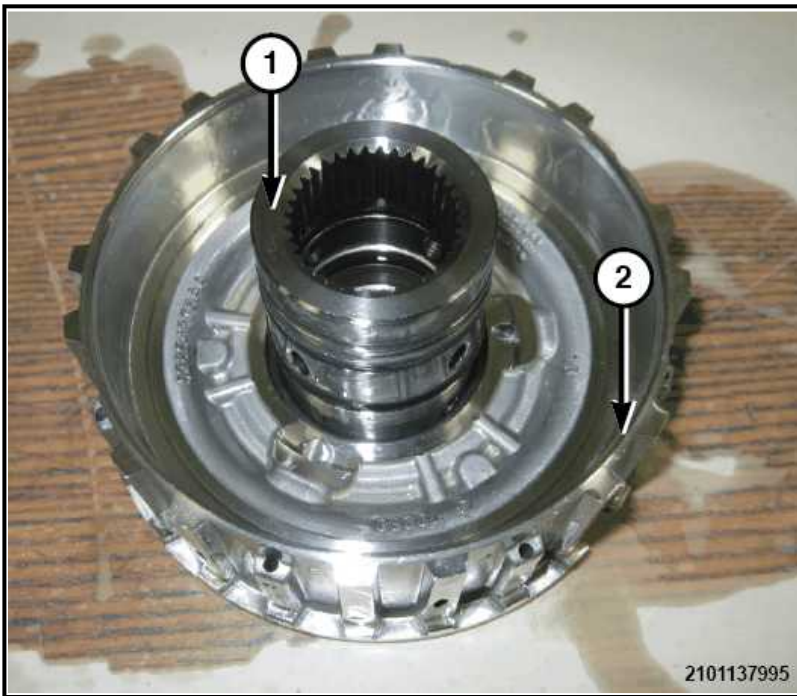
1 - Wave Plate
2 - Friction Plates
3 - Backing Plate
4 - Steel Plates

8. Remove the friction plates and the steel plates.



1 - Backing Plate

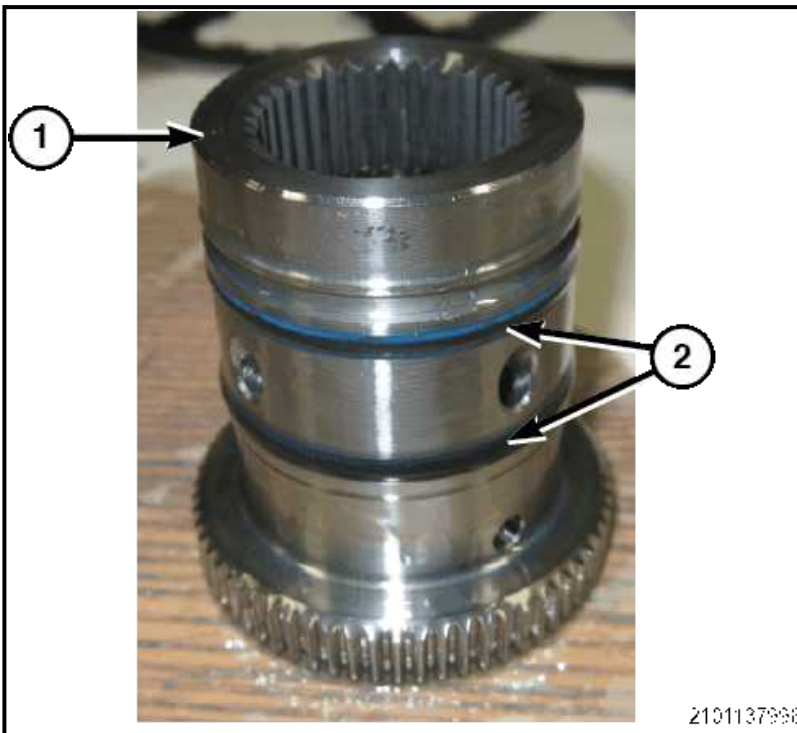
9. Remove the backing plate.



1 - Clutch C Shaft

2 - Clutch C Hub

10. Separate the Clutch C shaft from the Clutch C hub.



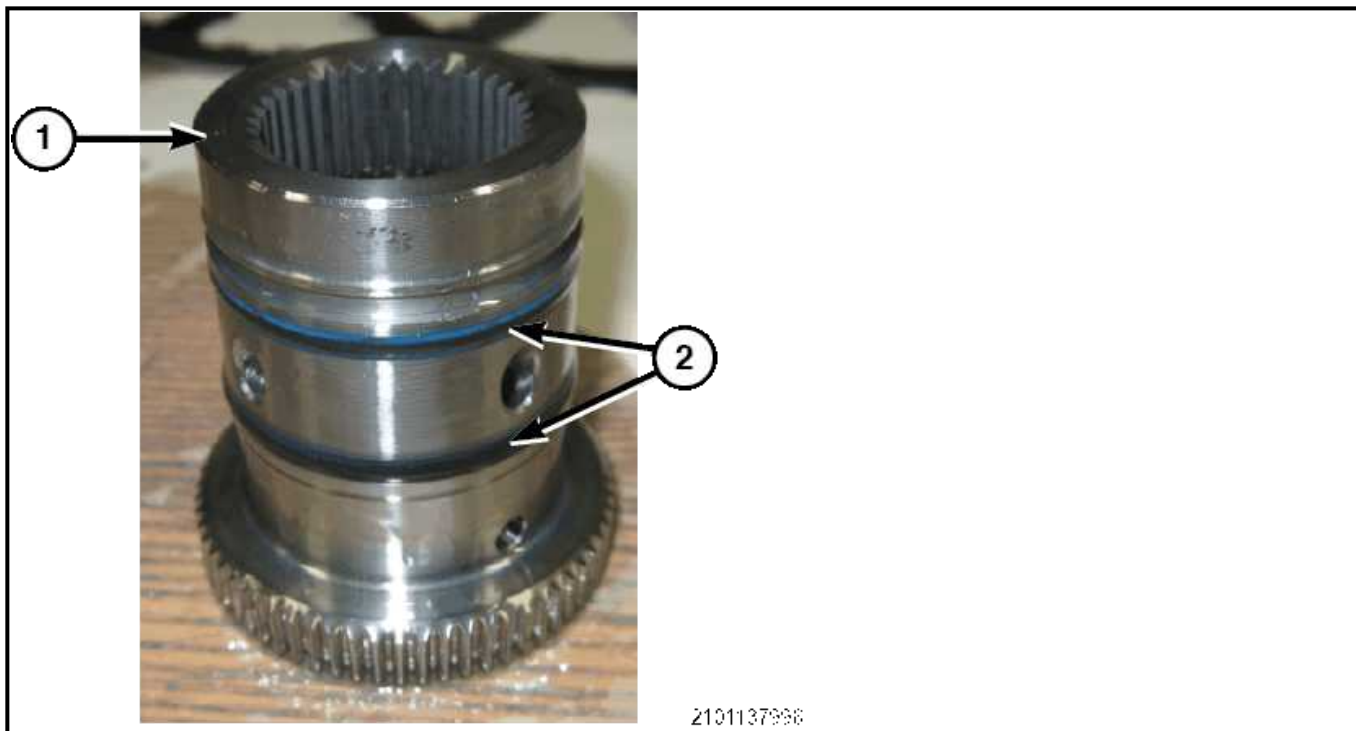
1 - Clutch C Shaft

2 - O-Rings

11. Remove and **DISCARD** the O-rings from the Clutch C shaft.

ASSEMBLY

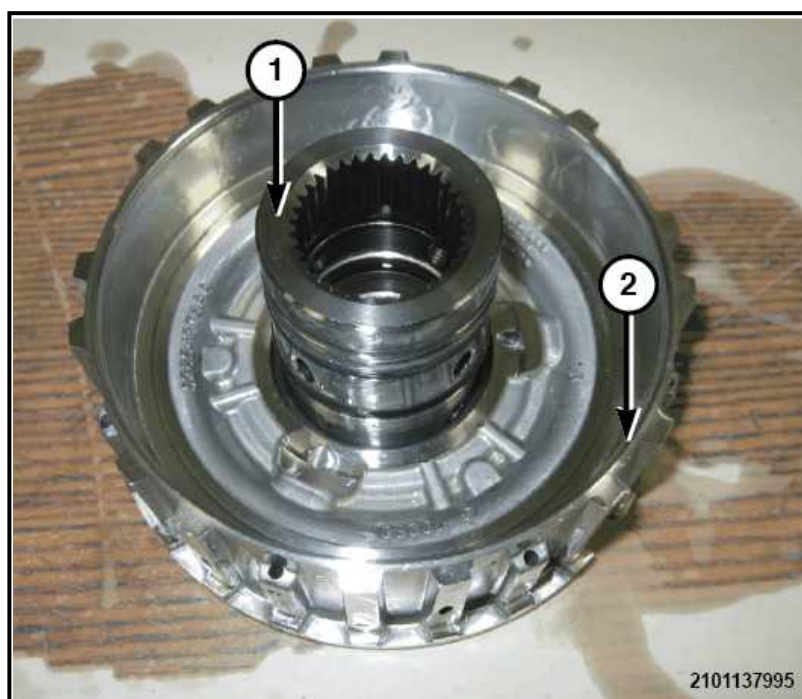
NOTE: If clutch discs are being replaced, soak in 8HP trans fluid before assembly.



1 - Clutch C Shaft

2 - O-Rings

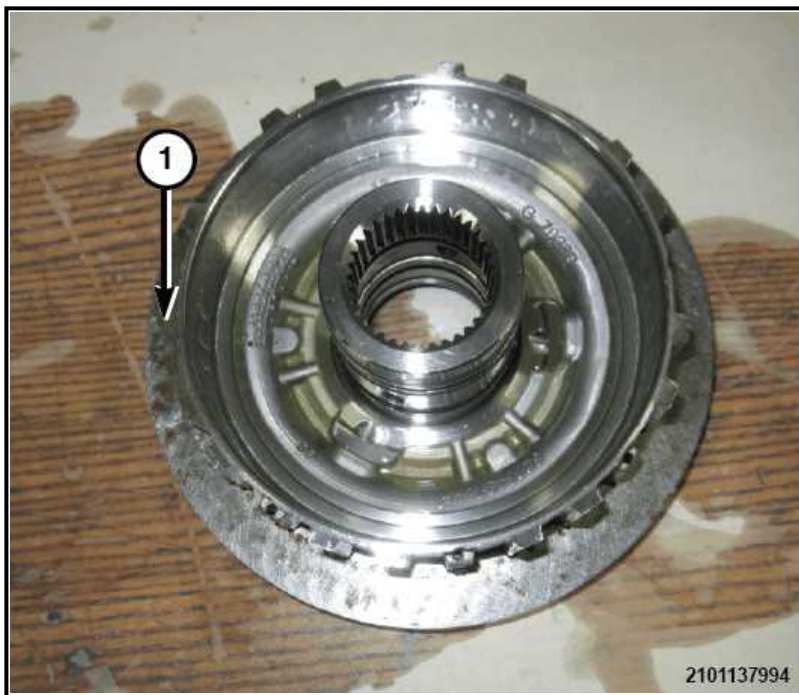
1. Install **NEW** the O-rings on the Clutch C shaft.



1 - Clutch C Shaft

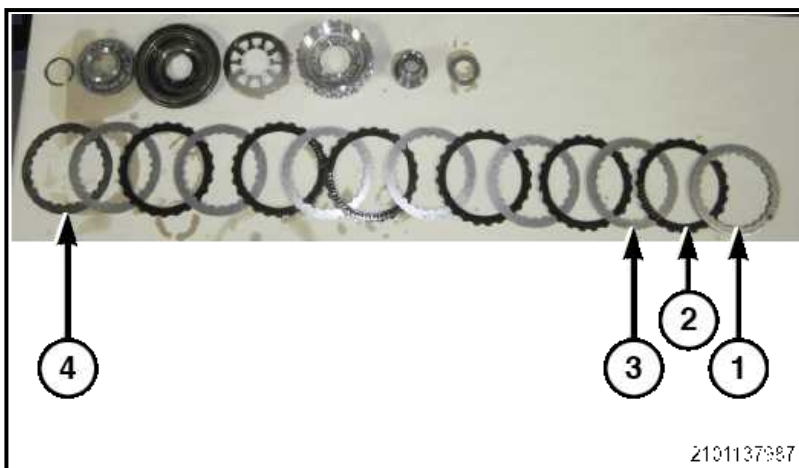
2 - Clutch C Hub

2. Install Clutch C hub onto the Clutch C shaft.



1 - Backing Plate

3. Install the backing plate.



1 - Wave Plate

2 - Friction Plates

3 - Backing Plate

4 - Steel Plates

4. Install friction plates and steel plates.



1 - Clutch C Wave Plate

5. Install the wave plate.



1 - Clutch C Belleville Spring

6. Install the belleville spring.



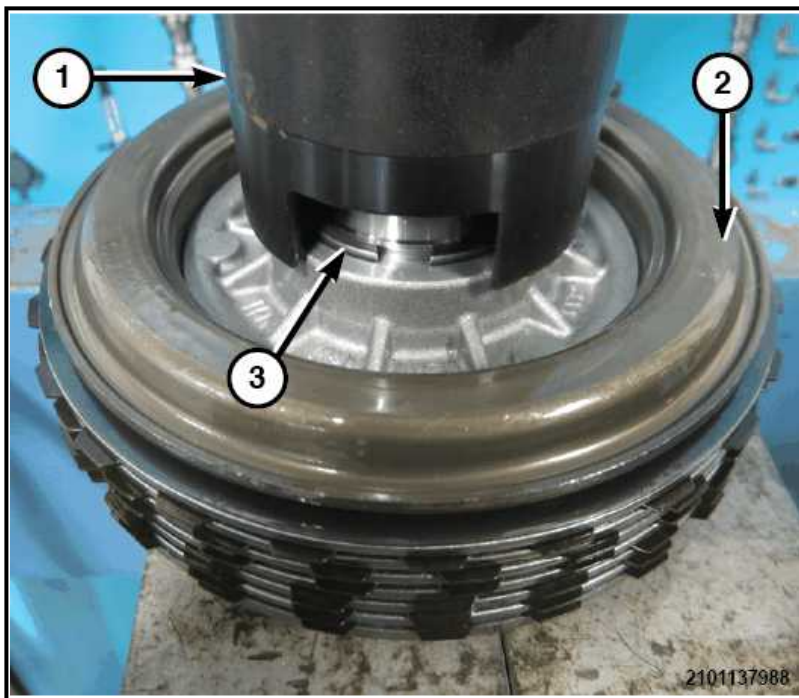
1 - Clutch C Piston

7. Install the Clutch C piston.



1 - Clutch C Retainer

8. Install the Clutch C retainer.



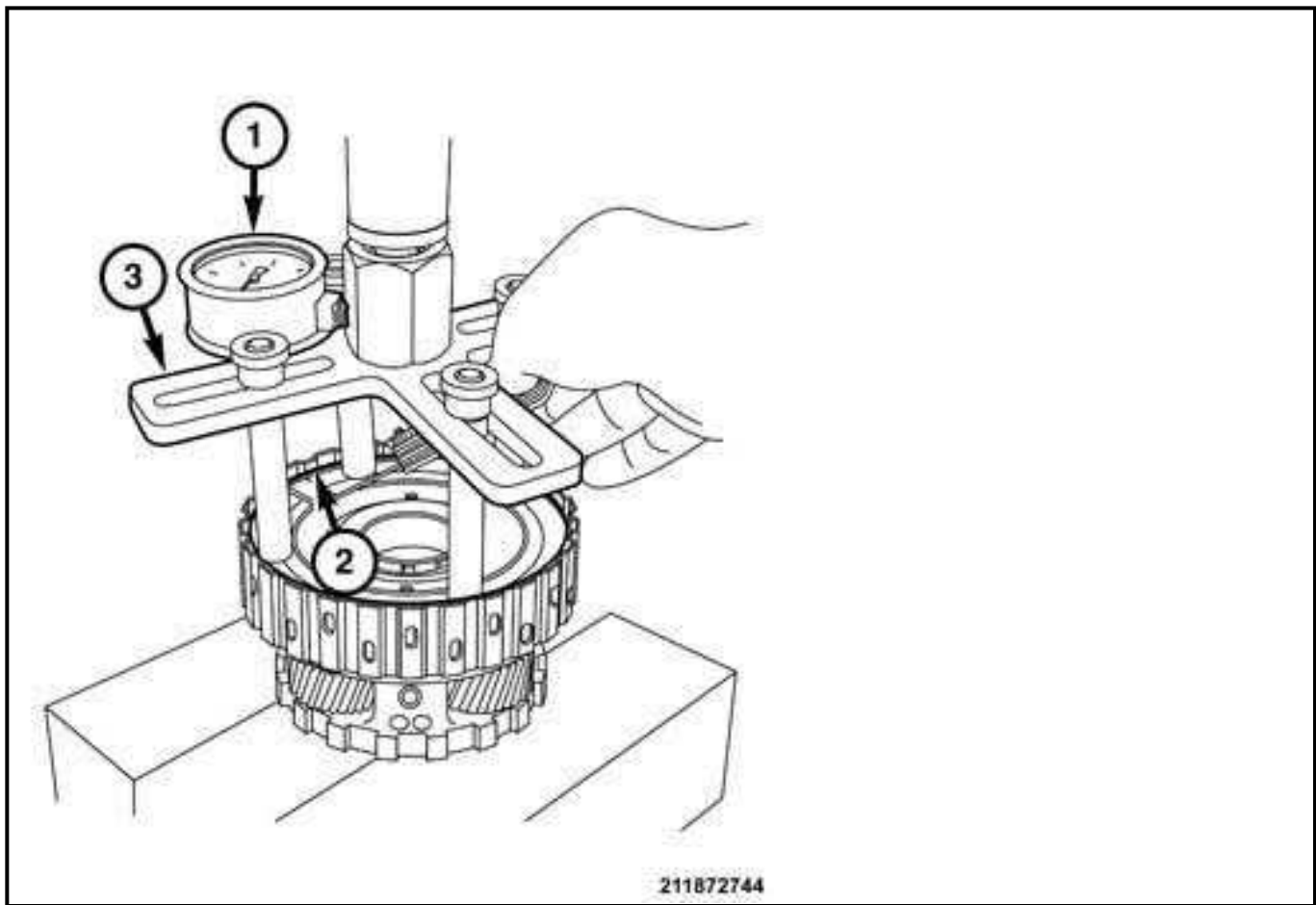
1 - Damper Installer
2 - Clutch C
3 - Snap Ring

9. Place Clutch C in a suitable press.
10. Using (special tool #8680A, Installer, Damper), compress the clutch enough to install the snap ring.
11. Install the snap ring.
12. Using (special tool #8901A, Pressing Tool) and (special tool #10429, Gauge, Force) measure the Clutch C clearance. Refer to clutch clearance chart for specifications.

CLUTCH D - DISASSEMBLY AND ADJUSTMENTS

CLUTCH D MEASUREMENT PROCEDURE

1. Using (special tool #8901A, Pressing Tool) and (special tool #10429, Gauge, Force), place the Clutch D in a suitable arbor press.
2. Apply 200 N (45 lbf.) of force to the Clutch D backing plate to compress the wave plate.
3. With a suitable feeler gauge, measure the gap between the Clutch D backing plate and the Clutch D retainer.
4. Refer to clutch clearance table for specs. If clearance is not within specification a thinner or thicker selectable snap ring can be Installed to achieve proper clearance.



1 - Force Gauge
2 - Pressing Tool
3 - Clutch D

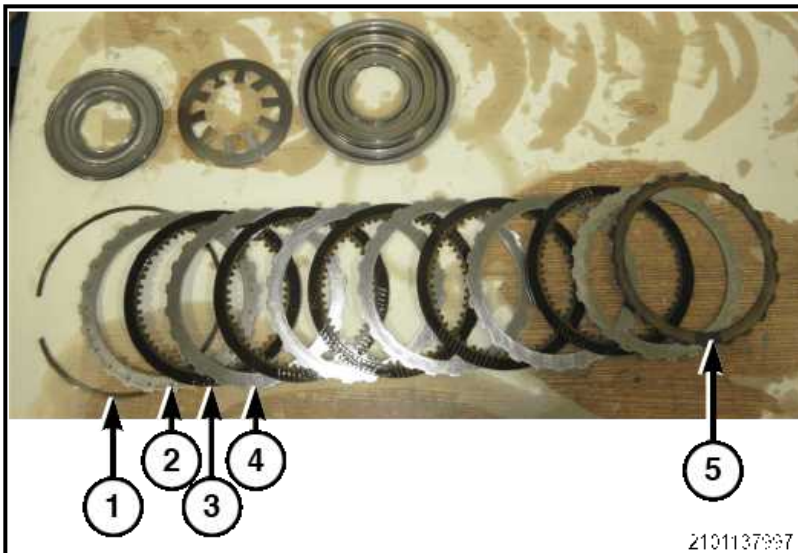
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
D	NEW	1.37 mm	1.515 mm	1.66 mm
		0.054 in.	0.060 in.	0.065 in.
	AFTER OPERATION	1.37 mm	1.615 mm	1.86 mm
		0.054 in.	0.064 in.	0.073 in.

CLUTCH D SELECTABLE SNAP RINGS

3.0 mm	0.118 in.
2.8 mm	0.110 in.
2.6 mm	0.102 in.
2.4 mm	0.0944 in.
2.2 mm	0.0866 in.
2.0 mm	0.0787 in.
1.8 mm	0.0708 in.
1.6 mm	0.0629 in.

DISASSEMBLY Clutch D, depending on transmission Julian date, may contain wave springs that sit around each friction plate.



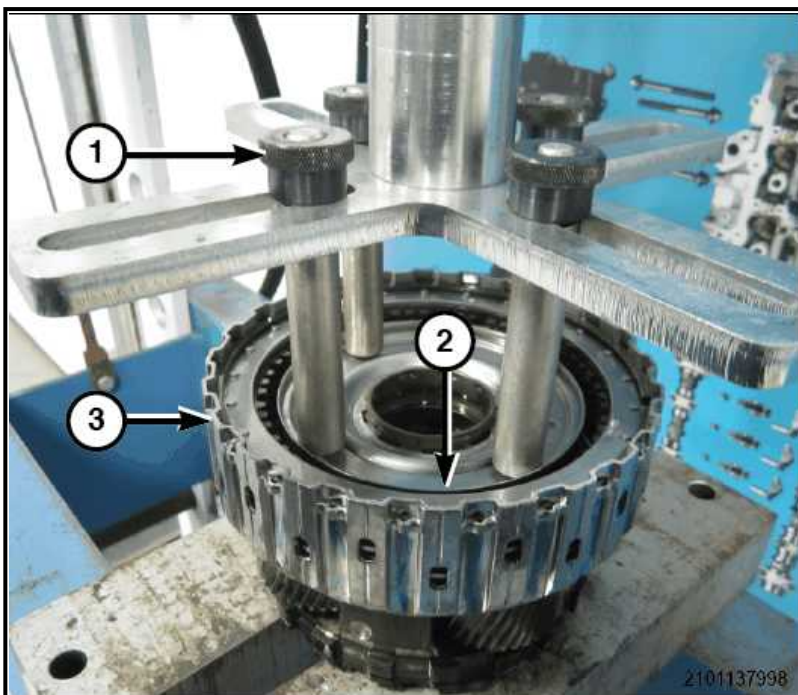
1 - Clutch D Selective Snap Ring

2 - Backing Plate

3 - Friction Plates

4 - Steel Plates

5 - Wave Plate



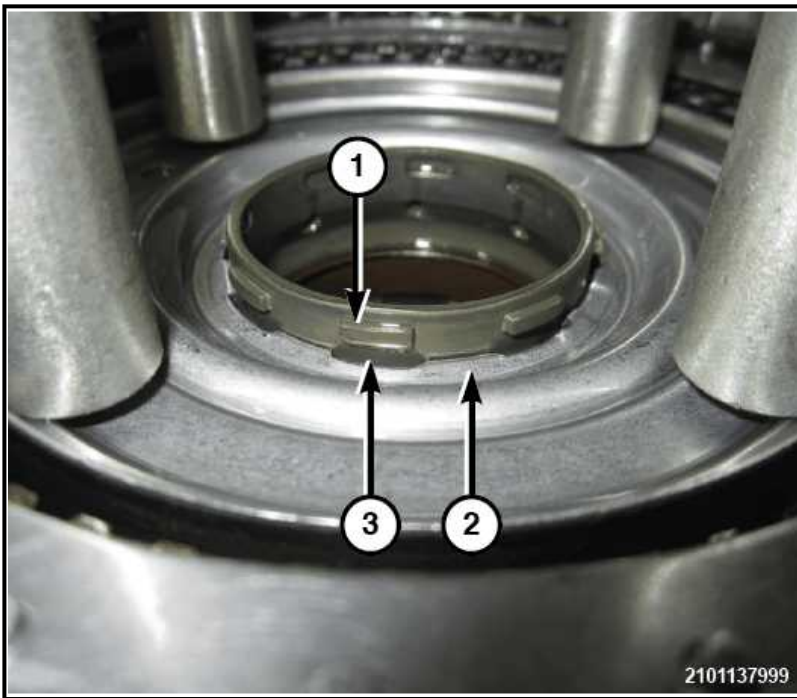
1 - Pressing Tool

2 - Oil Baffle

3 - Clutch D

1. Place Clutch D in a suitable arbor press.

2. Using (special tool #8901A, Pressing Tool), to compress the oil baffle enough to clear the locking tabs.



1 - Clutch D Hub

2 - Oil Baffle

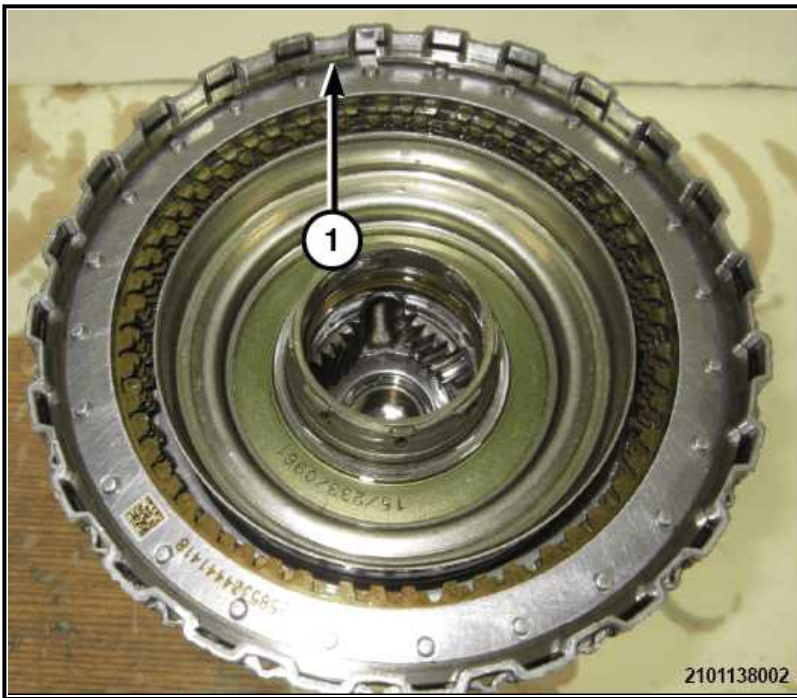
3 - Tabs

3. Rotate the oil baffle slightly until the tabs on the Clutch D hub are clear of the tabs on the baffle.
4. Remove the oil baffle.



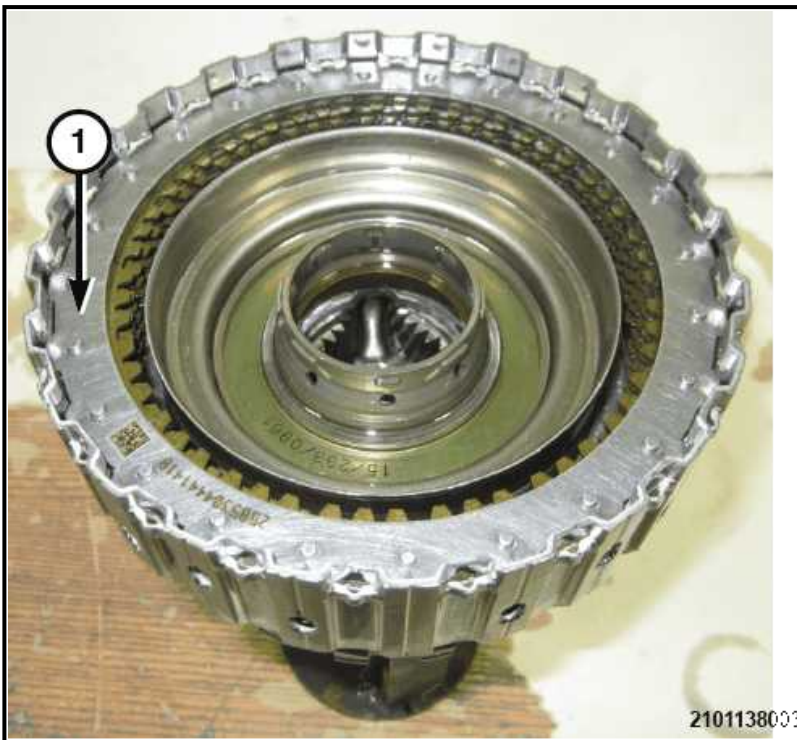
1 - Clutch D Belleville Spring

5. Remove the Clutch D belleville spring.



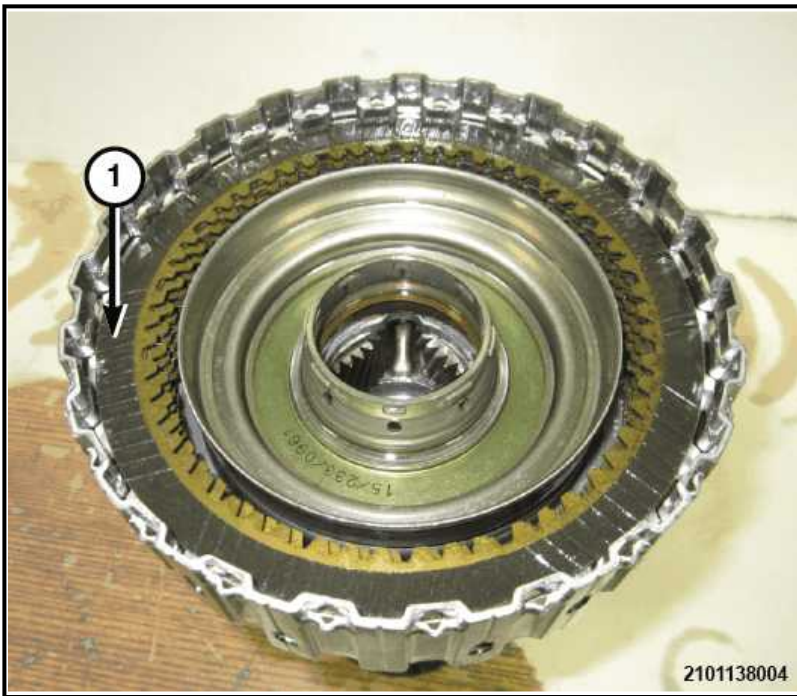
1 - Clutch D Selective Snap Ring

6. Remove the Clutch D selective snap ring.



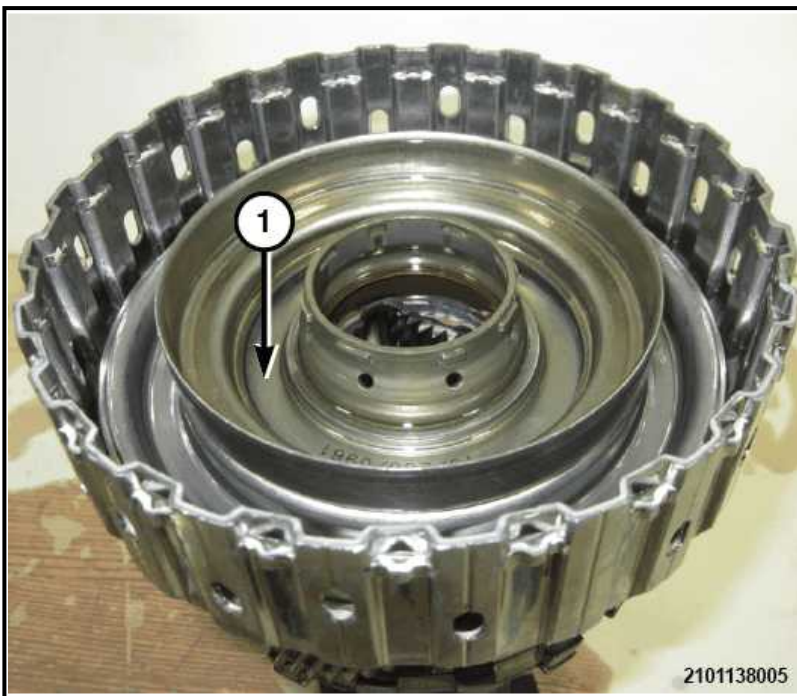
1 - Clutch D Backing Plate

7. Remove the Clutch D backing plate.



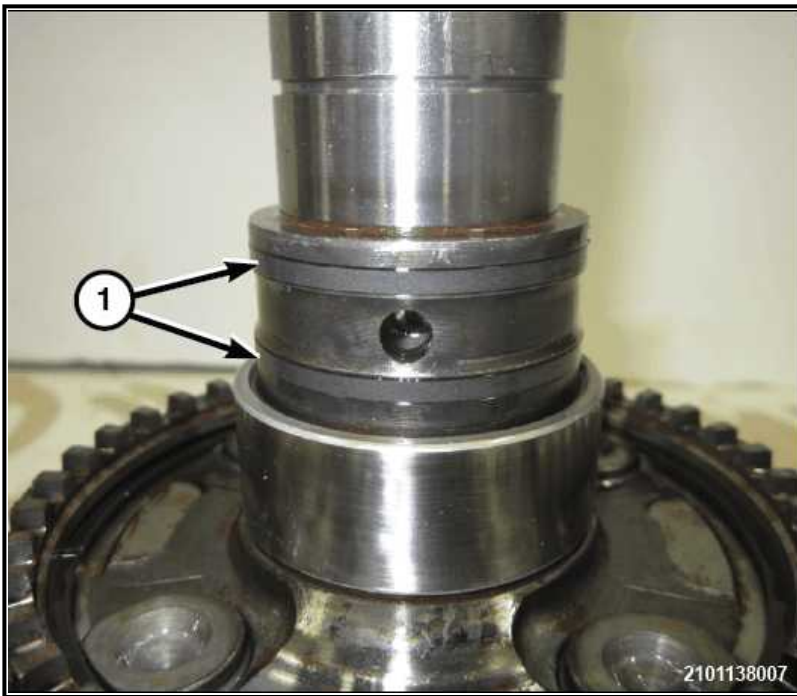
1 - Clutch D Friction Plate

8. Remove the Clutch D friction and steel plate elements, paying attention to the orientation.



1 - Clutch D Piston

9. Remove the Clutch D piston.

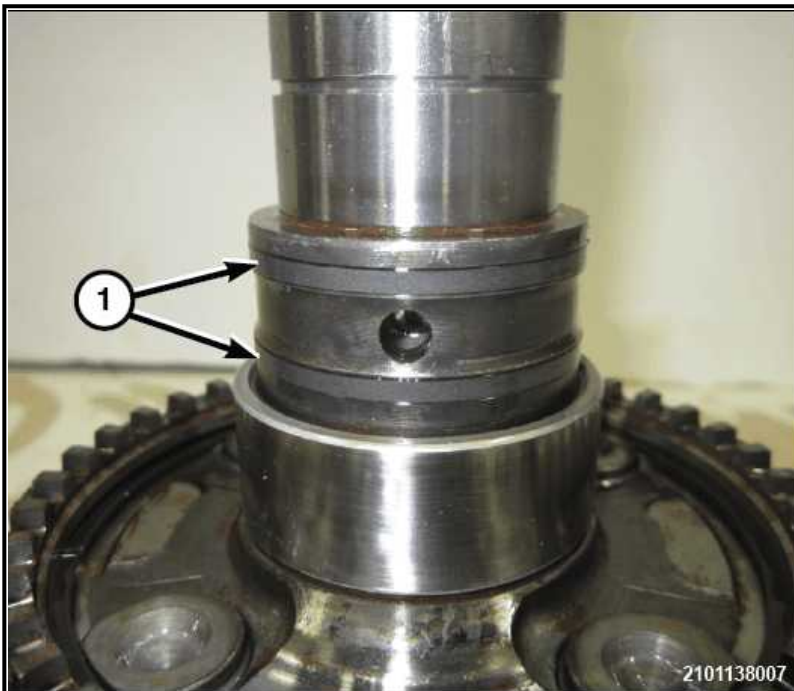


1 - Clutch D Carrier Seal Rings

10. Remove the Clutch D housing seal rings.

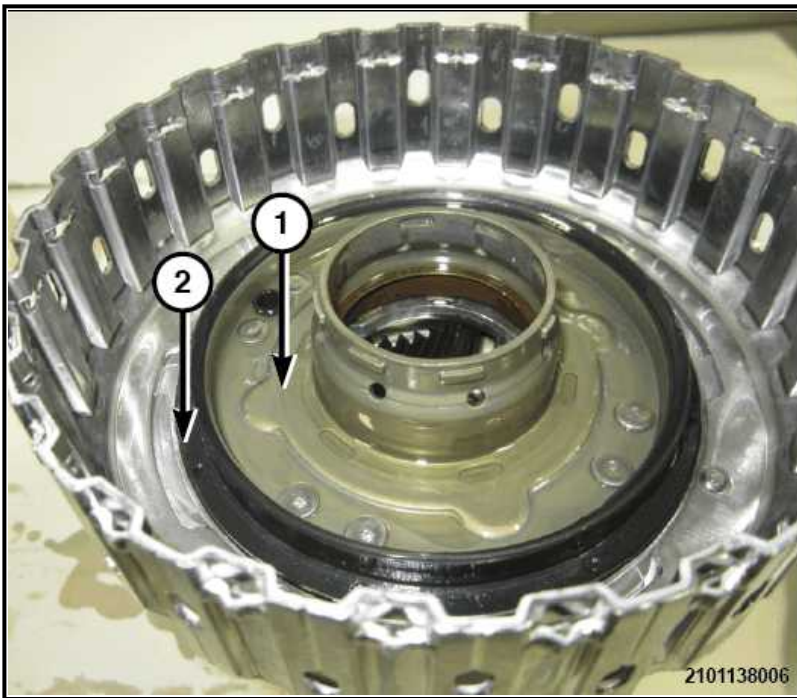
ASSEMBLY

NOTE: If clutch discs are being replaced, soak them in 8HP trans fluid before assembly.



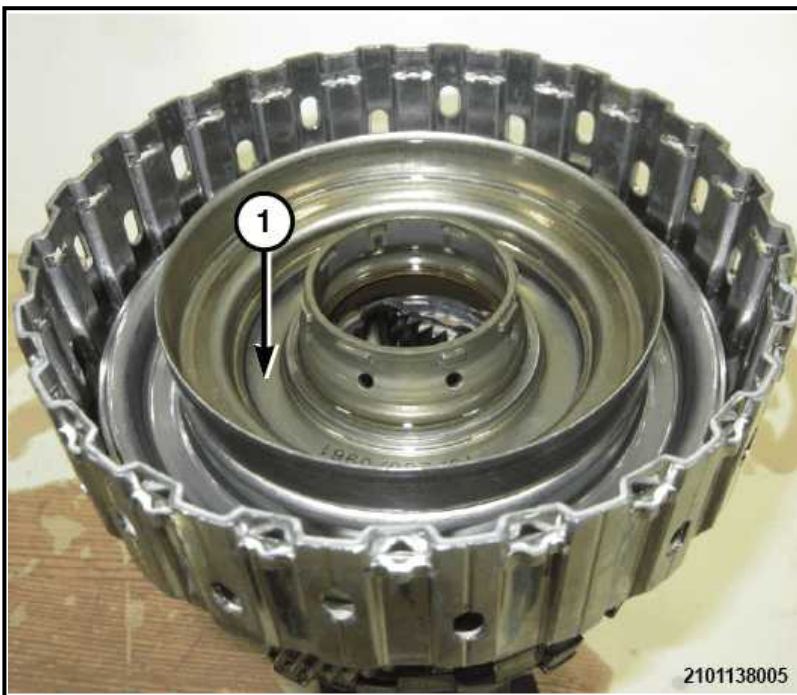
1 - Clutch D Carrier Seal Rings

1. Install the Clutch D housing seal rings.



- | |
|--------------------------|
| 1 - Clutch D Housing |
| 2 - Clutch D Piston Seal |

2. Verify the Clutch D piston seal is in good condition. Replace the Clutch D housing if there are any tears or nicks in the seal.
3. Coat the Clutch D piston seal with 8HP fluid.



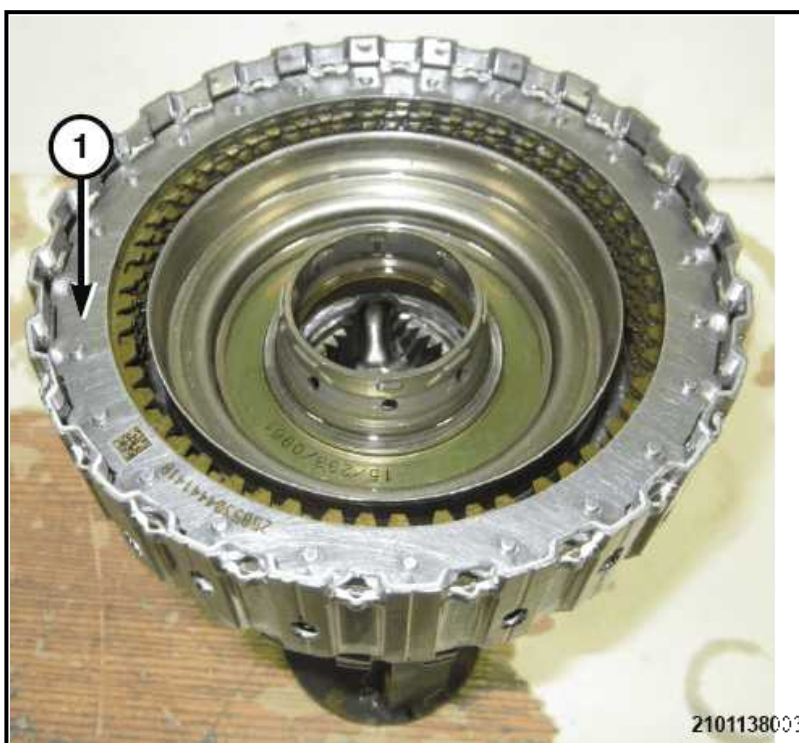
- | |
|---------------------|
| 1 - Clutch D Piston |
|---------------------|

4. Install the Clutch D piston (1) in the housing.



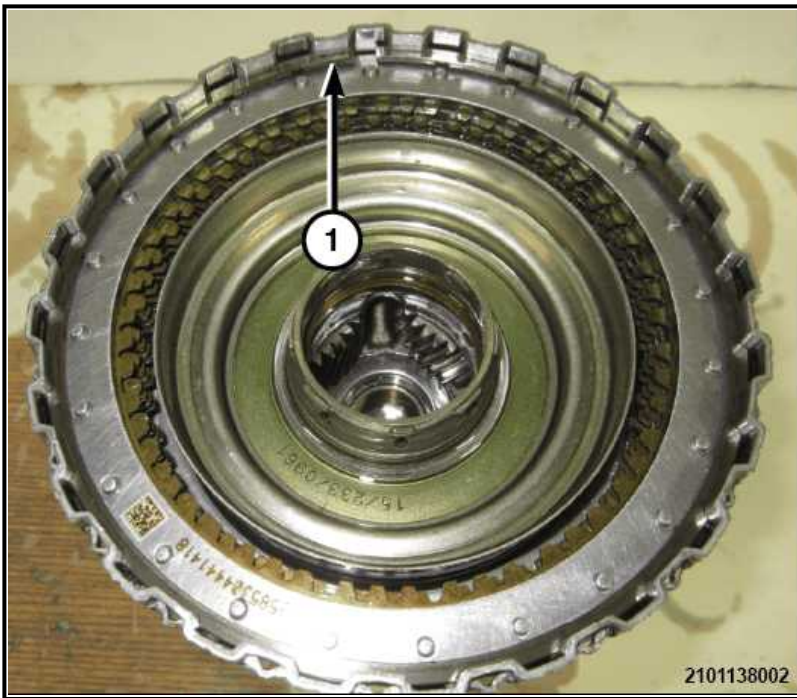
1 - Clutch D Selective Snap Ring
2 - Backing Plate
3 - Friction Plates
4 - Steel Plates
5 - Wave Plate

5. Install the wave plate into the housing first.
6. Install the friction plates and steel plates into the housing.



1 - Clutch D Backing Plate

7. Install the backing plate last onto the housing.



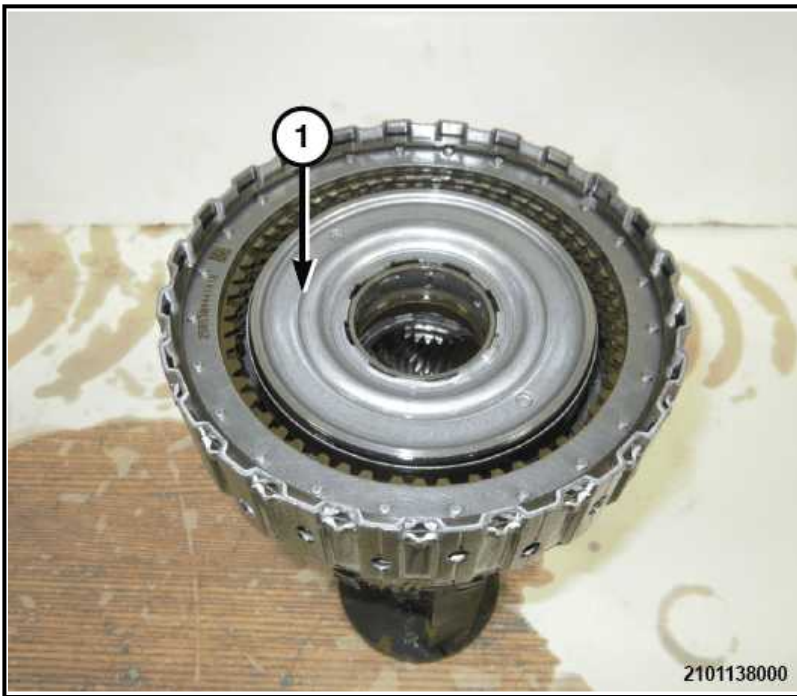
1 - Clutch D Selective Snap Ring

8. Install the proper selective snap ring onto the Clutch D housing.



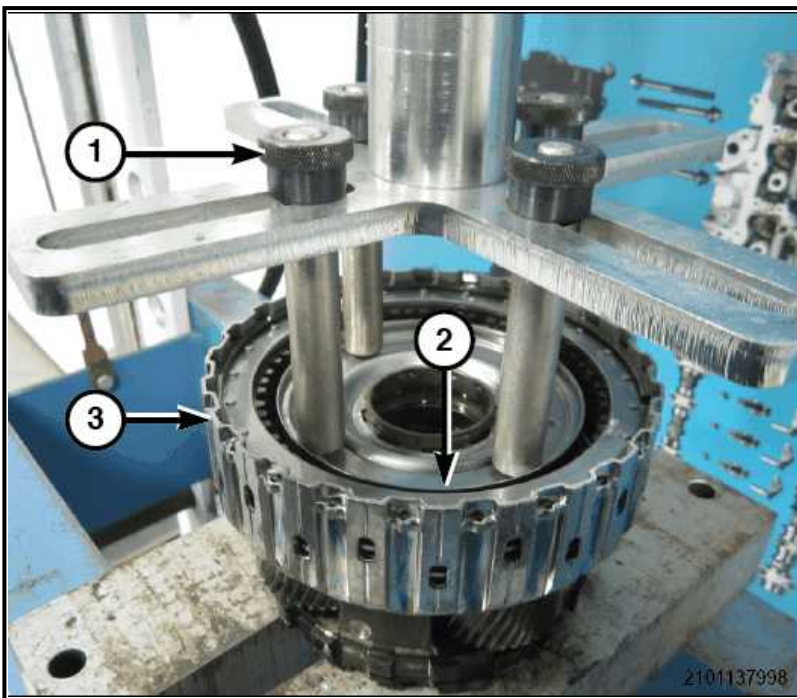
1 - Clutch D Belleville Spring

9. Install the belleville spring.



1 - Oil Baffle

10. Place the oil baffle onto the hub of the Clutch D housing.



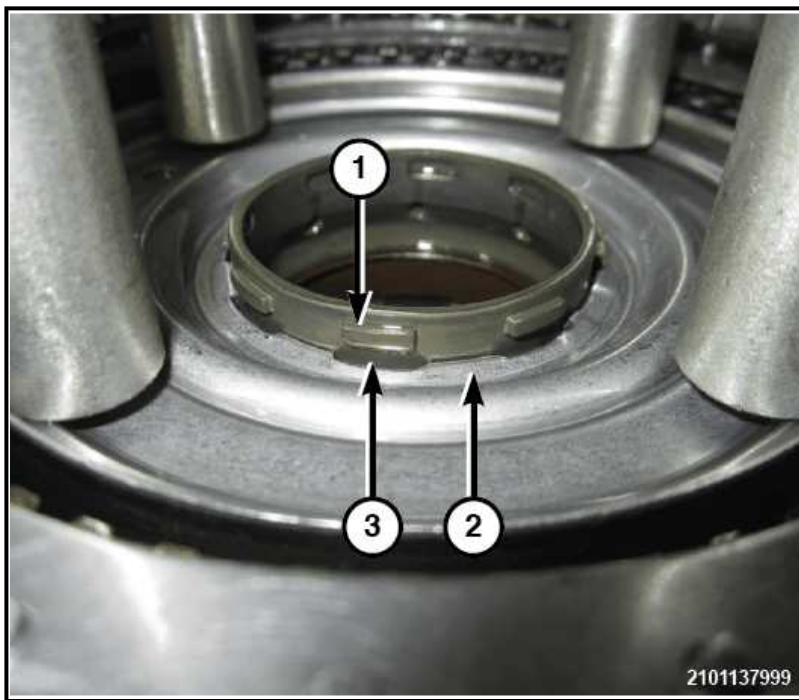
1 - Pressing Tool

2 - Oil Baffle

3 - Clutch D

11. Place the Clutch D in a suitable arbor press.

12. Using (special tool #8901A, Pressing Tool), compress the oil baffle enough to engage the lock tabs.



1 - Clutch D Hub
2 - Oil Baffle
3 - Tabs

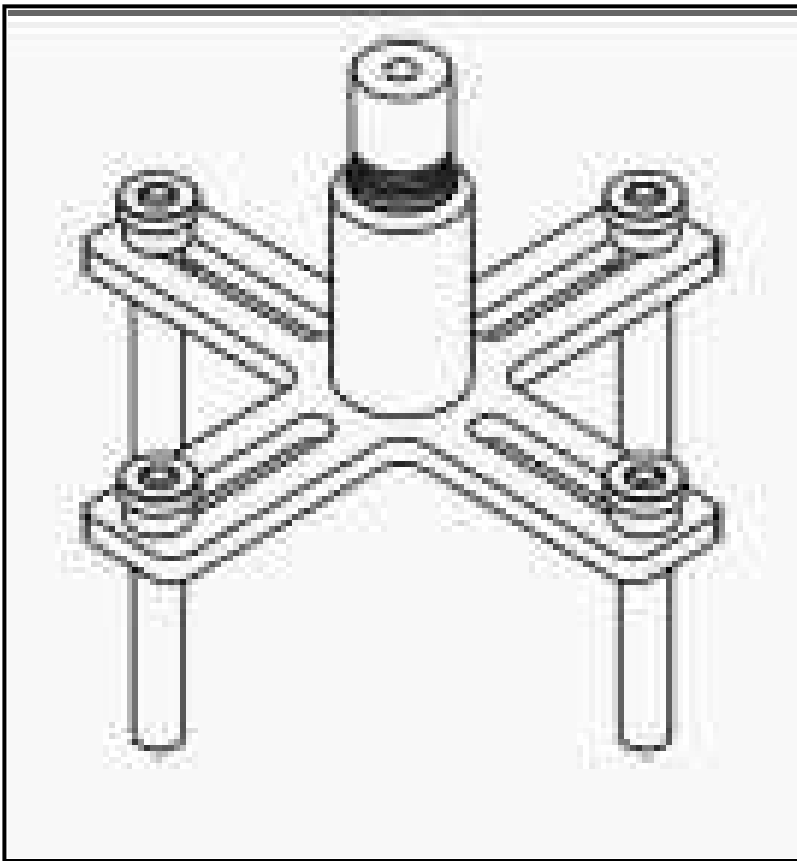
13. Rotate the baffle so the tabs on the Clutch D hub and the tabs on the baffle line up to the locked position.

14. Release the arbor press.

CLUTCH E - DISASSEMBLY AND ADJUSTMENTS

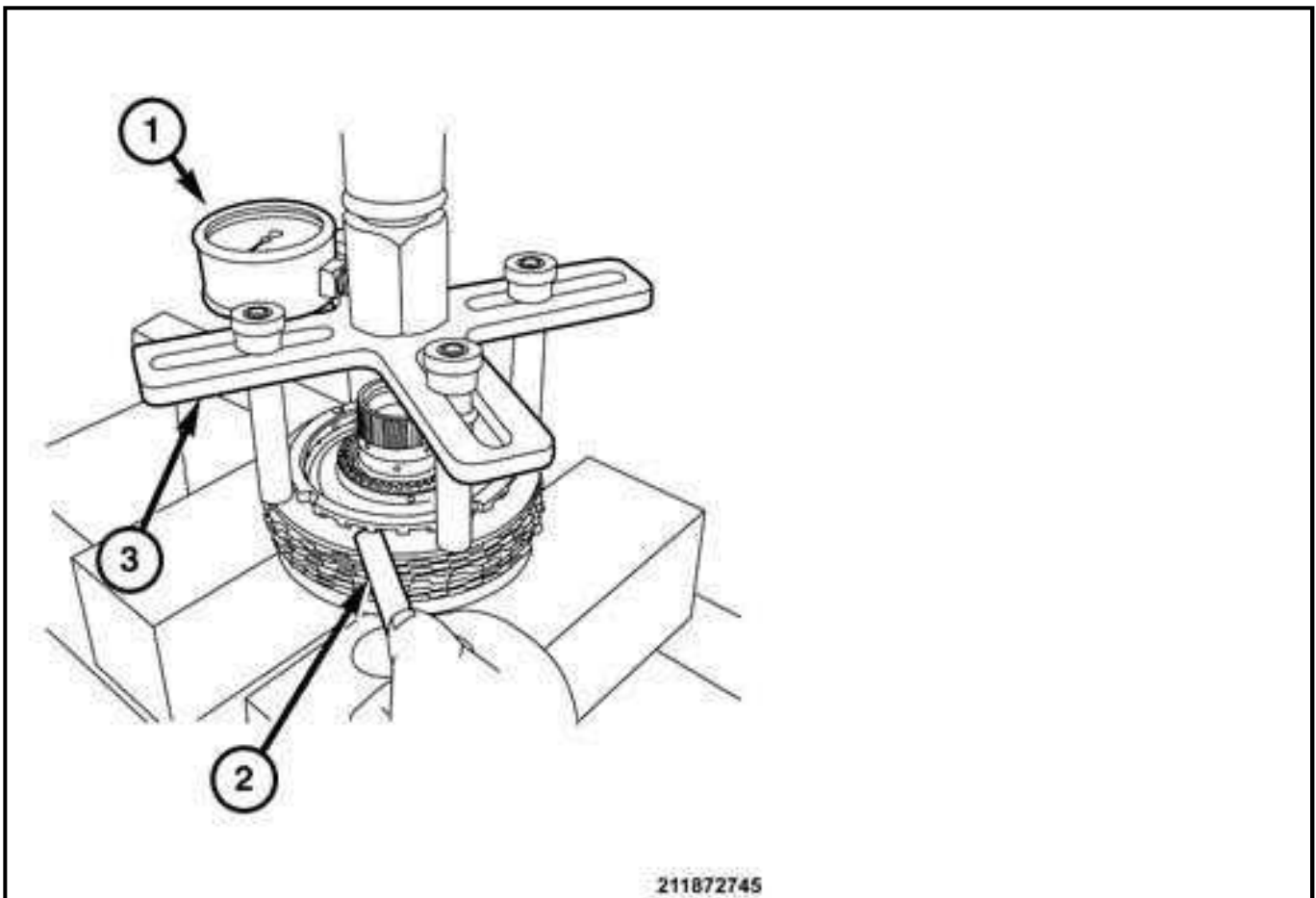
CLUTCH E MEASUREMENT PROCEDURE

1. Place Clutch E in a suitable arbor press.
2. Using (special tool #10429, Gauge, Force) and
(special tool #8901A, Pressing Tool)



, apply 200 N (45 lbf.) to the backing plate of the Clutch E.

3. Using a set of feeler gauges, measure the gap between the backing plate and the retainer of Clutch E.
4. Refer to the clutch measurements table for specifications. If clearance is not within specifications, a thinner or thicker selectable backing plate can be installed to achieve proper clearance.



1 - Force Gauge
2 - Clutch E
3 - Pressing Tool

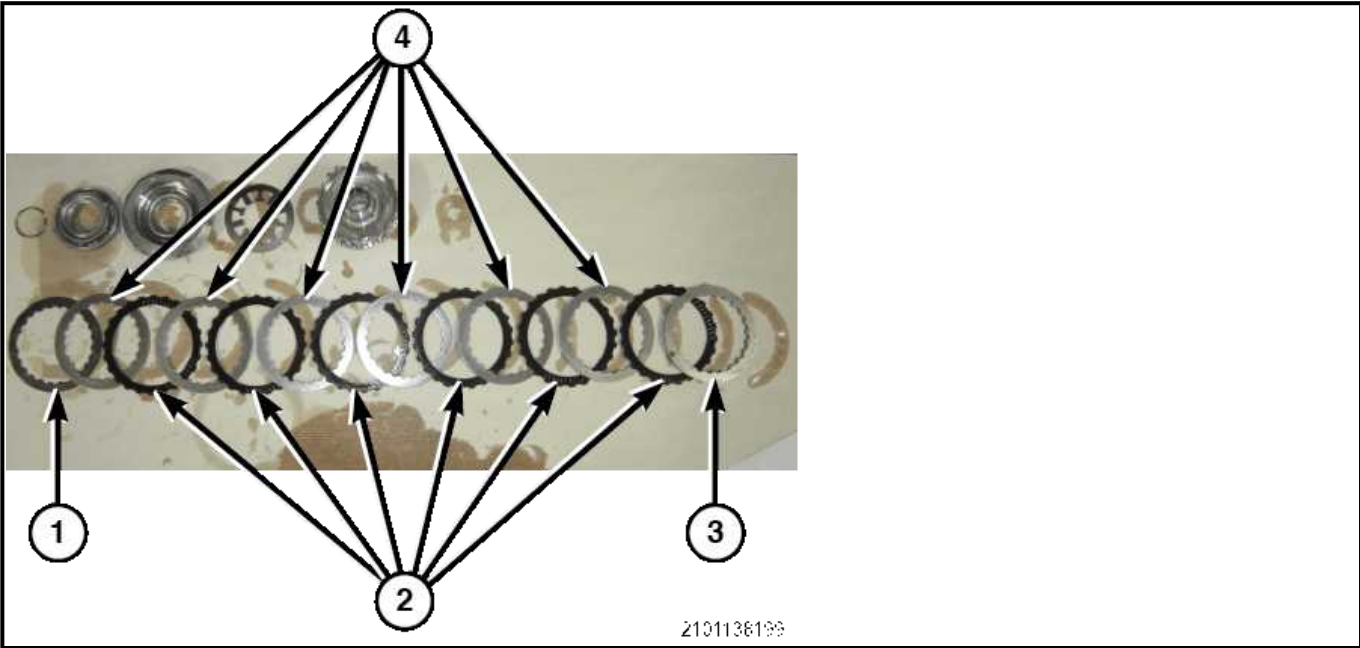
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
E	NEW	1.62 mm	1.815 mm	2.01 mm
		0.064 in.	0.071 in.	0.079 in.
	AFTER OPERATION	1.62 mm	1.935 mm	2.25 mm
		0.064 in.	0.076 in.	0.089 in.

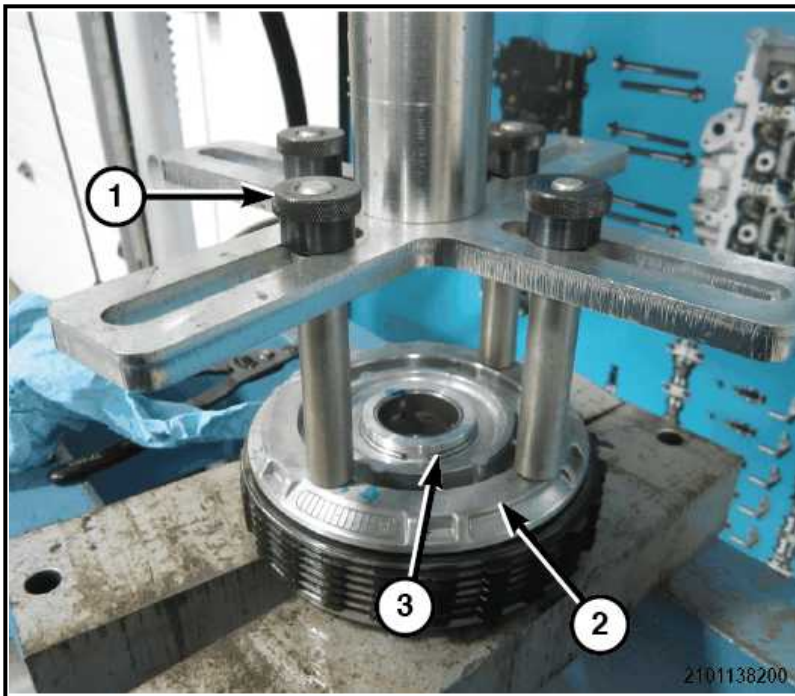
CLUTCH E SELECTABLE BACKING PLATES

4.8 mm	0.188 in.
4.5 mm	0.177 in.
4.2 mm	0.165 in.
3.9 mm	0.153 in.
3.6 mm	0.141 in.
3.3 mm	0.129 in.
3.0 mm	0.118 in.

DISASSEMBLY Clutch E, depending on the transmission Julian date, may contain wave springs that sit around each friction plate.

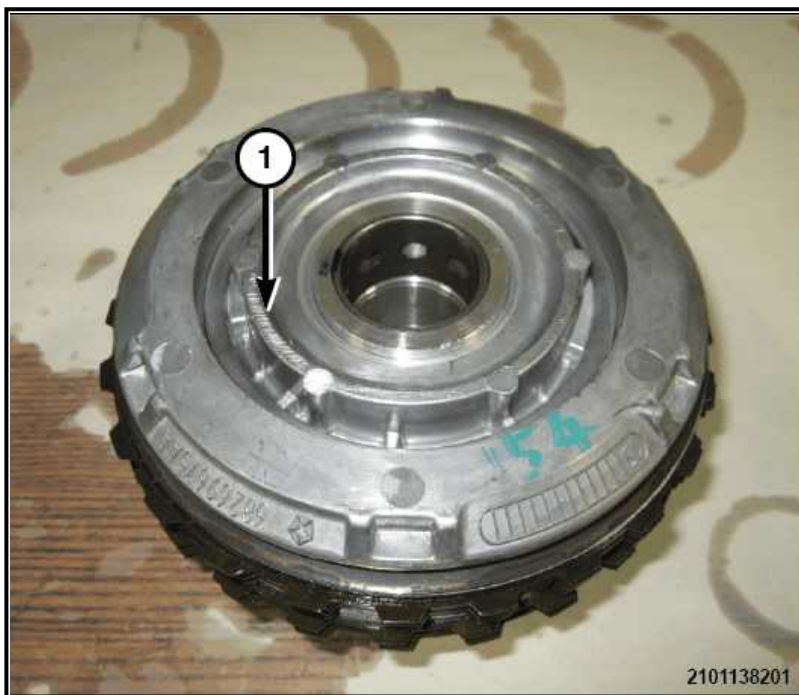


1 - Wave Plate
2 - Friction Plates
3 - Backing Plate
4 - Steel Plates



- | |
|---------------------|
| 1 - Pressing Tool |
| 2 - Clutch E Piston |
| 3 - Snap Ring |

1. Place Clutch E in a suitable press.
2. Using (special tool #8901A, Pressing Tool), compress the Clutch E piston enough to remove the snap ring.



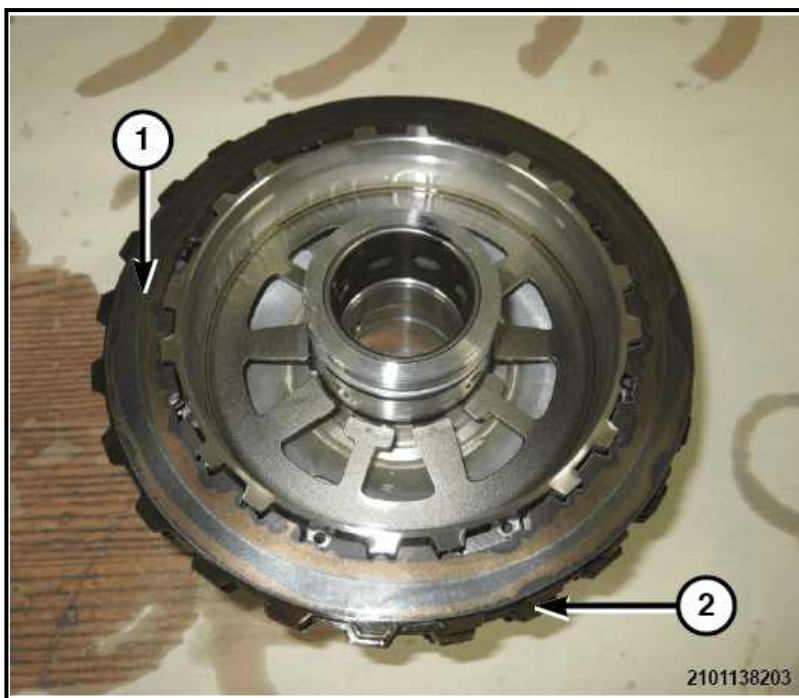
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|-----------------------------|
| 1 - Clutch E Piston Support |
|-----------------------------|

3. Remove the Clutch E piston support.



1 - Clutch E Piston

4. Remove the Clutch E piston.

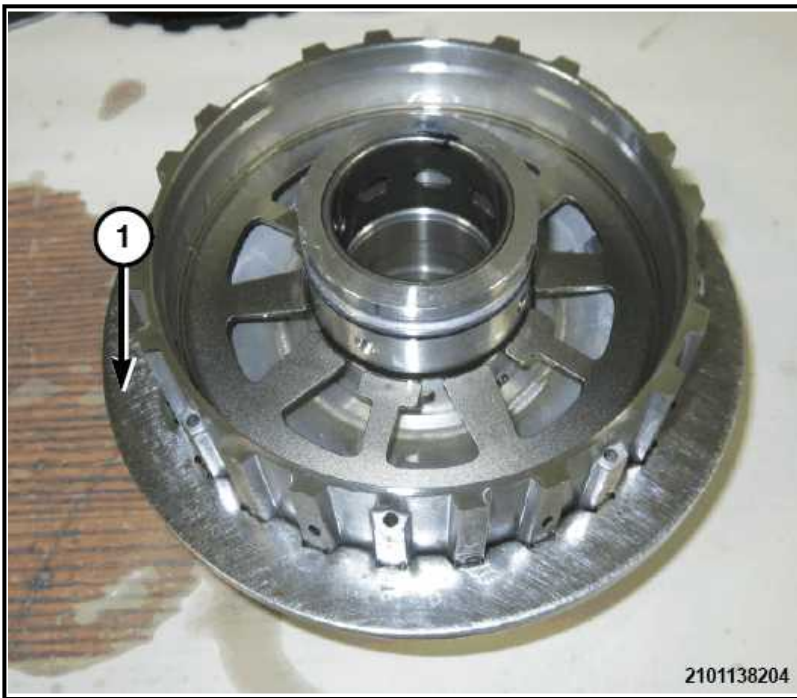


1 - Clutch E Wave Plate

2 - Clutch E Friction and Steel Plates

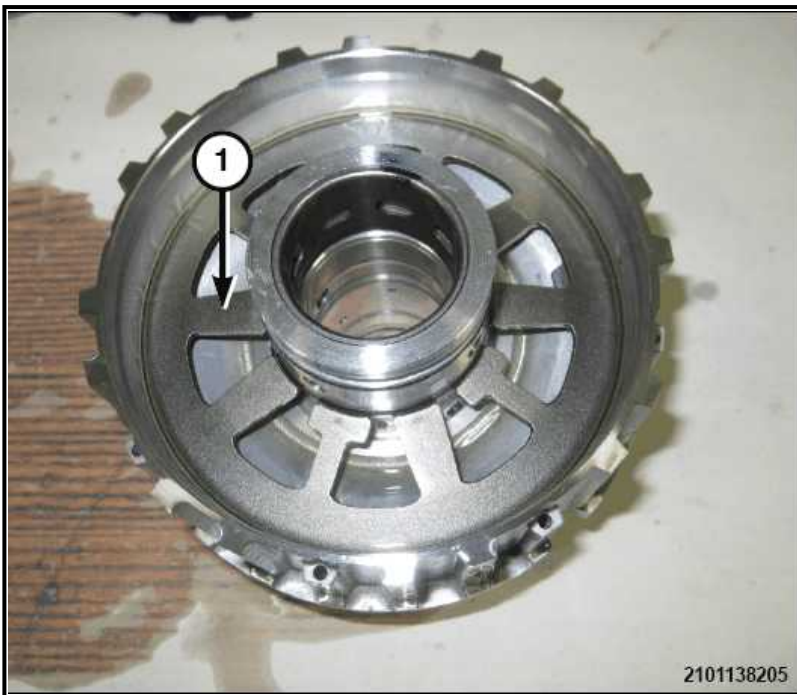
NOTE: Pay attention to the orientation of the plates.

5. Remove the Clutch E wave plate and the friction and steel plates.



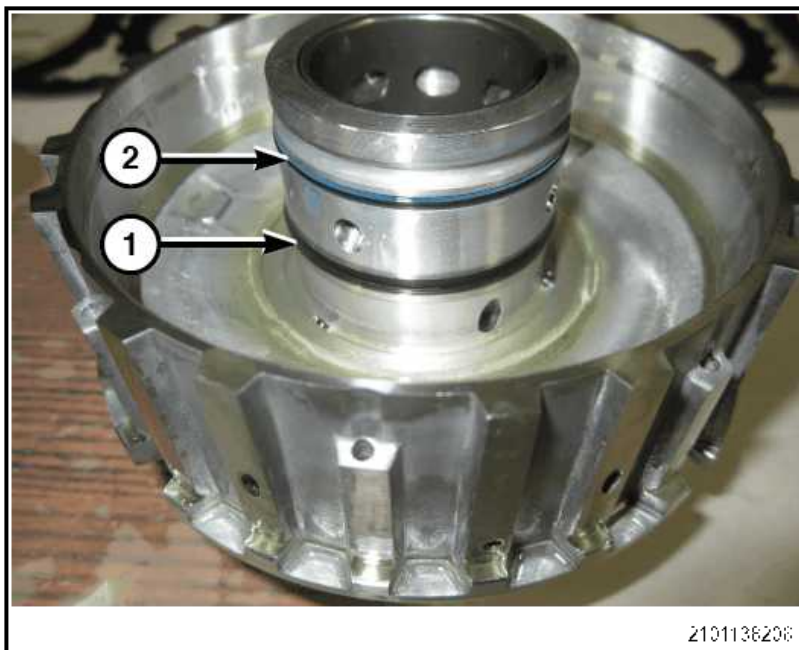
1 - Clutch E Backing Plate

6. Remove the Clutch E backing plate.



1 - Belleville Spring

7. Remove the belleville spring.



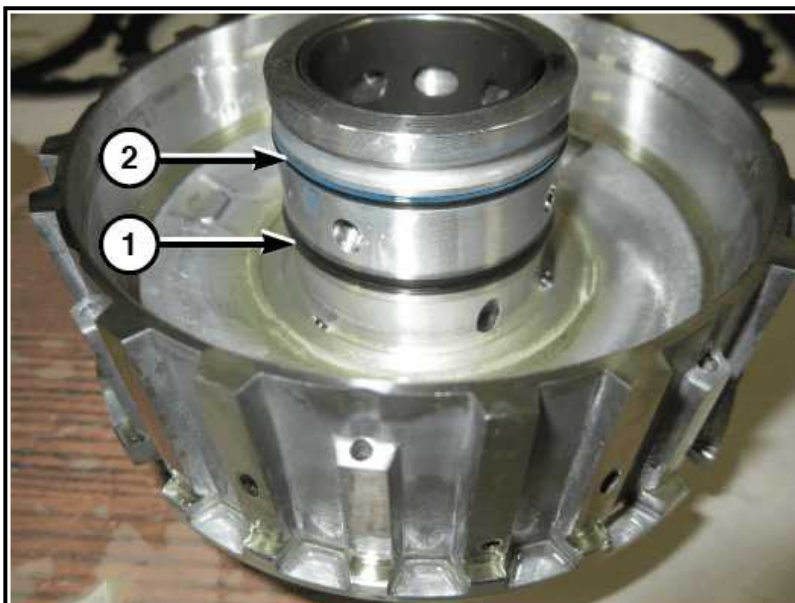
1 - Clutch E Seal

2 - Clutch E O-Ring

8. Remove the Clutch E seal and O-ring.

ASSEMBLY

NOTE: If the clutch discs are being replaced, soak them in 8HP transmission fluid before assembly.



2101136206

1 - Clutch E Seal

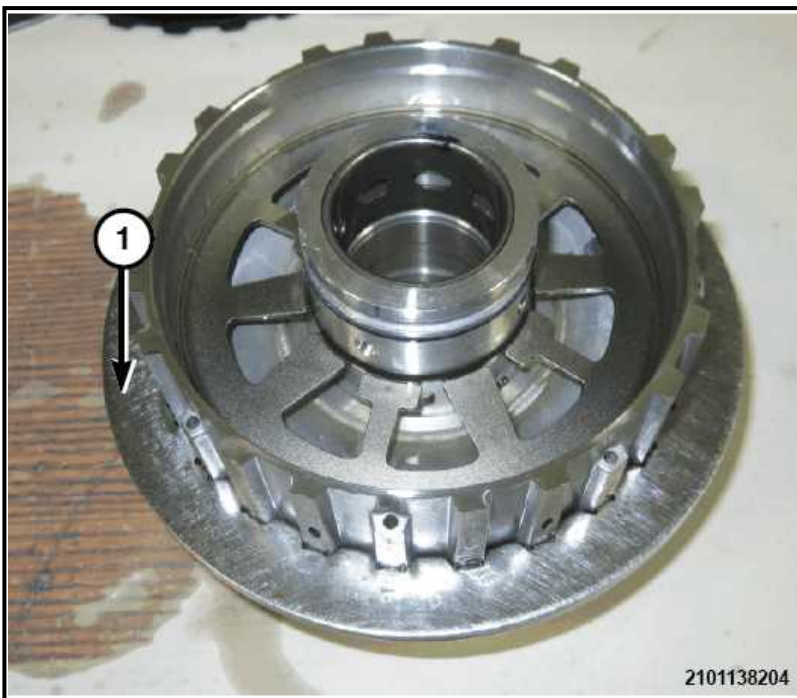
2 - Clutch E O-Ring

1. Install the Clutch E seal and O-ring.



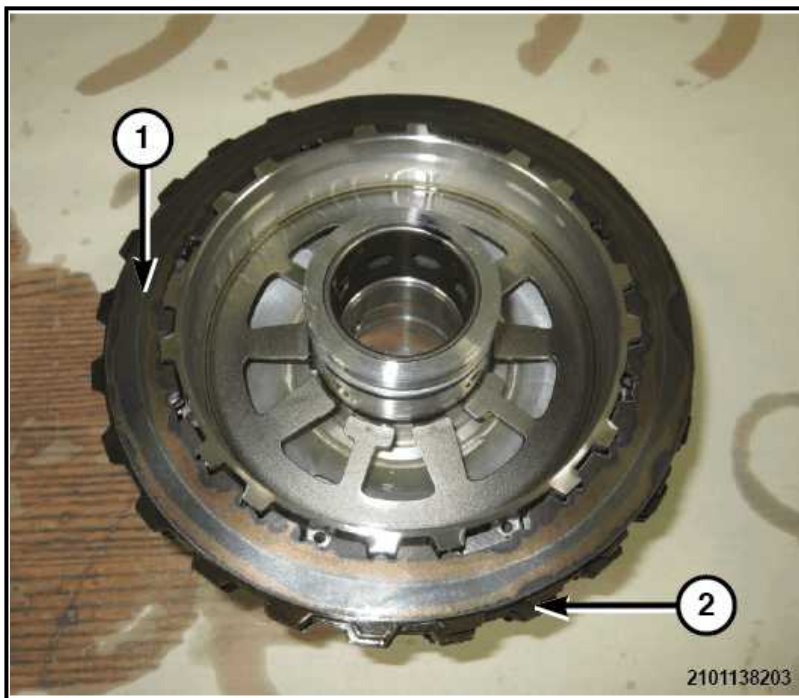
1 - Belleville Spring

2. Install the belleville spring into the Clutch E hub.



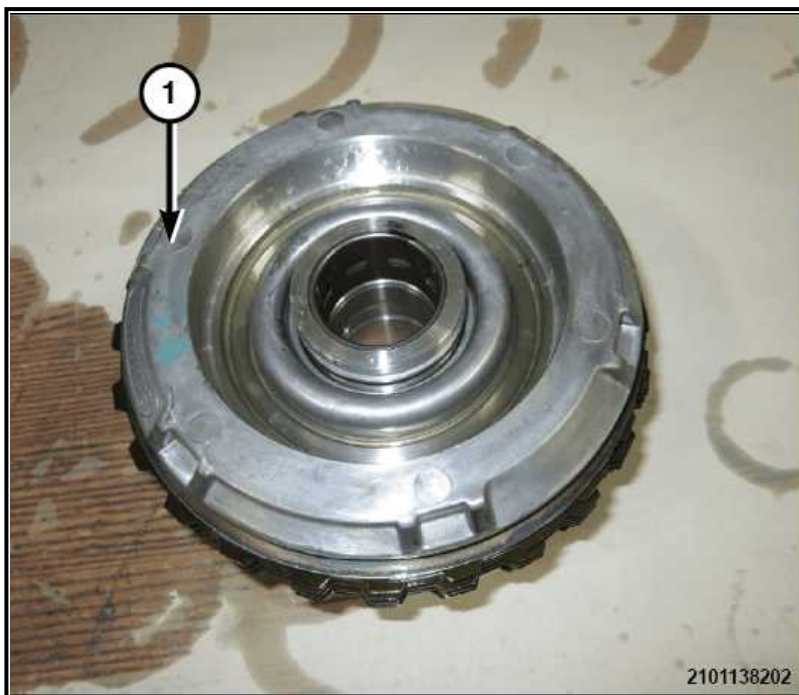
1 - Clutch E Backing Plate

3. Install the Clutch E backing plate.



- | |
|--|
| 1 - Clutch E Wave Plate |
| 2 - Clutch E Friction and Steel Plates |

4. Install the Clutch E friction and steel plates, and install the wave plate.



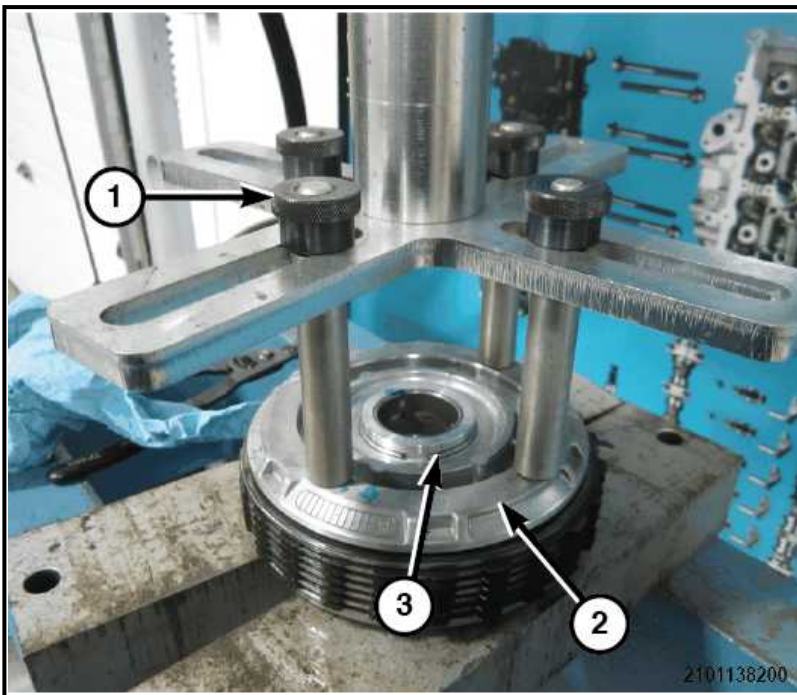
- | |
|---------------------|
| 1 - Clutch E Piston |
|---------------------|

5. Install the Clutch E piston onto the hub.



1 - Clutch E Piston Support

6. Install the Clutch E piston support.



1 - Pressing Tool

2 - Clutch E Piston

3 - Snap Ring

7. Place Clutch E in a suitable arbor press.

8. Using (special tool #8901A, Pressing Tool) compress the Clutch E piston enough to install the snap ring.

CLUTCH AIR PRESSURE TESTS



Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure using (special tool #10383, Plate, Clutch Pressure Test).

The clutches may be tested by applying air pressure to their respective passages. To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 5-8 bar (73-116 psi).

1. Remove the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
2. Install (special tool #10383, Plate, Clutch Pressure Test) and tighten bolts to 6 N.m (50 in. lbs.).
3. Apply air pressure to the respective clutch passages and look/listen for clutch movement.
4. Remove the air pressure from the respective clutch passages and look/listen for clutch to return to original position.

NOTE: If any clutch does not appear to be functioning during the air test, add a small amount of 8HP transmission fluid and try the test again. Some circuits will not operate without fluid.

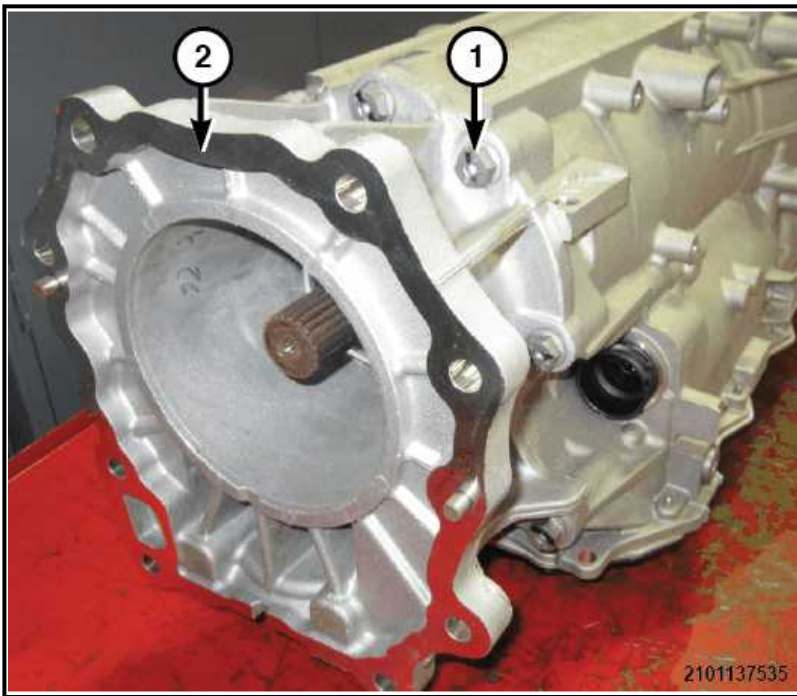
5. When testing is finished install the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
6. Fill the transmission with the proper transmission fluid. Refer to [FLUID/FILTER SERVICE](#).

END PLAY - MEASUREMENT AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

NOTE: The proper selectable shim must be installed to achieve specified clearance.

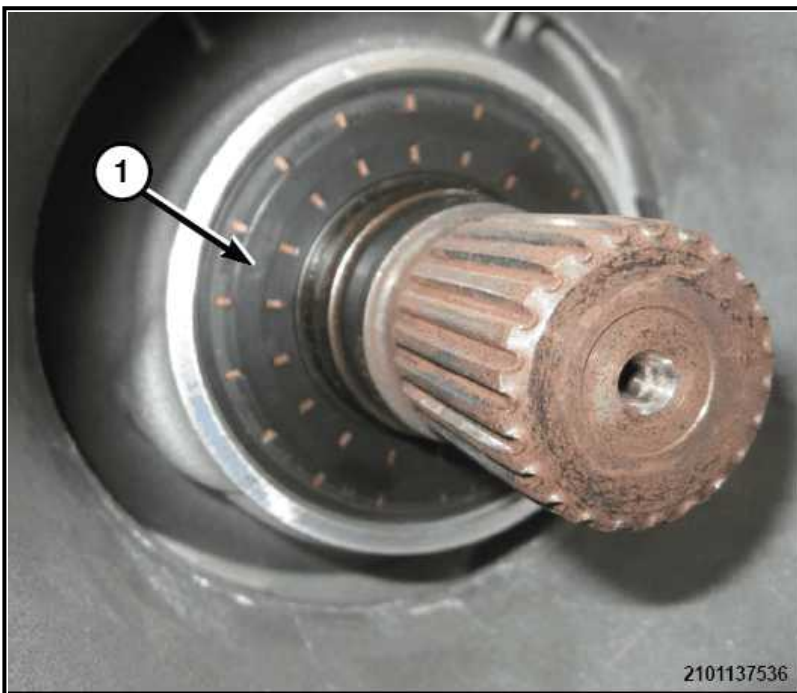
1. Remove the torque converter.



- | |
|-----------------------------|
| 1 - Extension Housing Bolts |
| 2 - Extension Housing |

NOTE: **4WD Only**

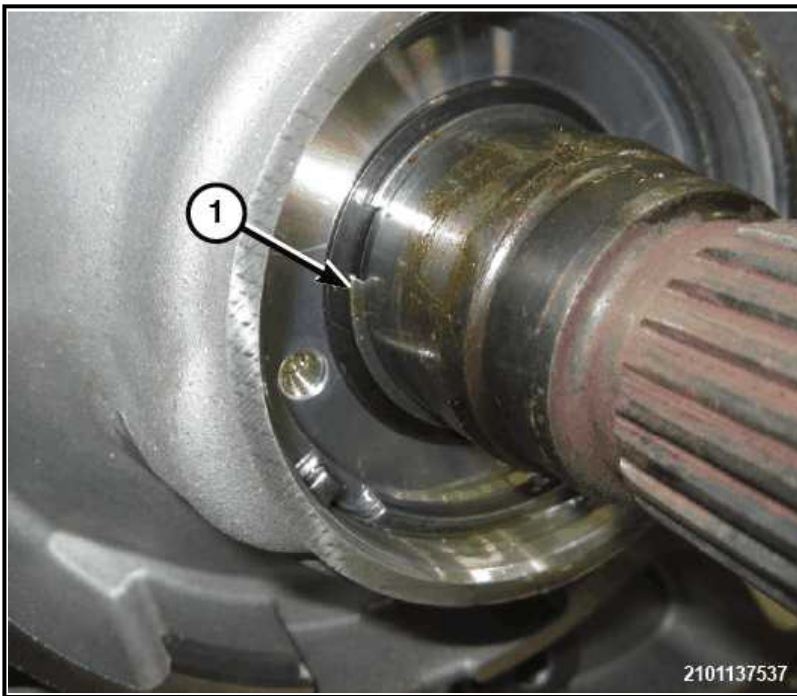
2. If the vehicle is **2WD** , proceed to Step 6. If the vehicle is **4WD** proceed to Step 2.
3. If equipped, remove the transmission housing extension housing bolts and remove the extension housing.



- | |
|-----------------------|
| 1 - Output Shaft Seal |
|-----------------------|

NOTE: **4WD Only**

4. Remove the transmission output shaft seal with a suitable slide hammer and screw.

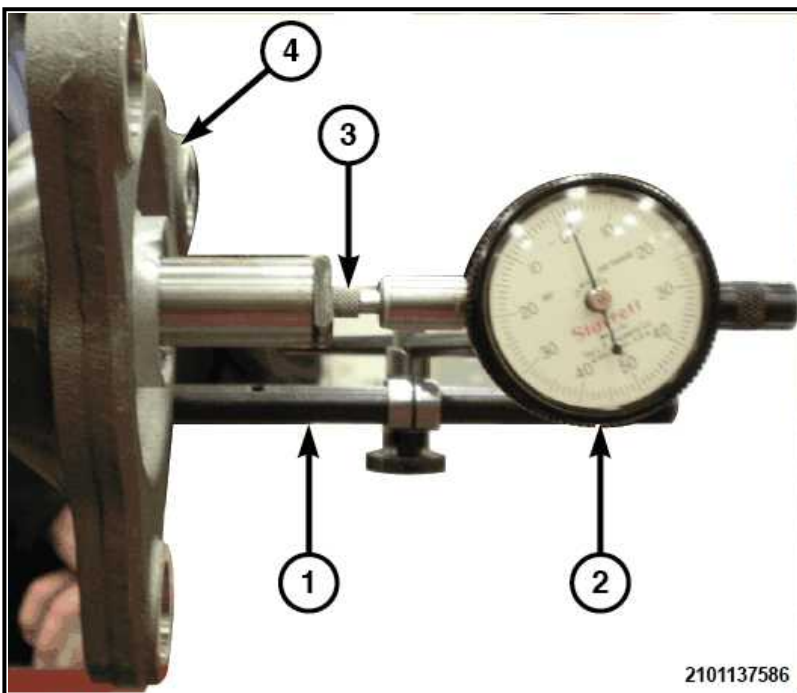


1 - Output Shaft Snap Ring

NOTE: 4WD Only

5. Remove the output shaft snap ring.

NOTE: 2WD shown, 4WD similar.



1 - Transmission Output Flange

2 - Dial Indicator

3 - Plunger

4 - Transmission Output Flange

6. Measure the output shaft end play as follows:

- a. Attach a dial indicator and position the plunger against the end of the output shaft.
- b. Zero the dial indicator.

- c. Move the output shaft flange in and out, and record the maximum travel on the dial for assembly reference.

If the end play is not within specification a thinner or thicker selectable shim can be installed to achieve proper end play.

END PLAY SPECIFICATIONS

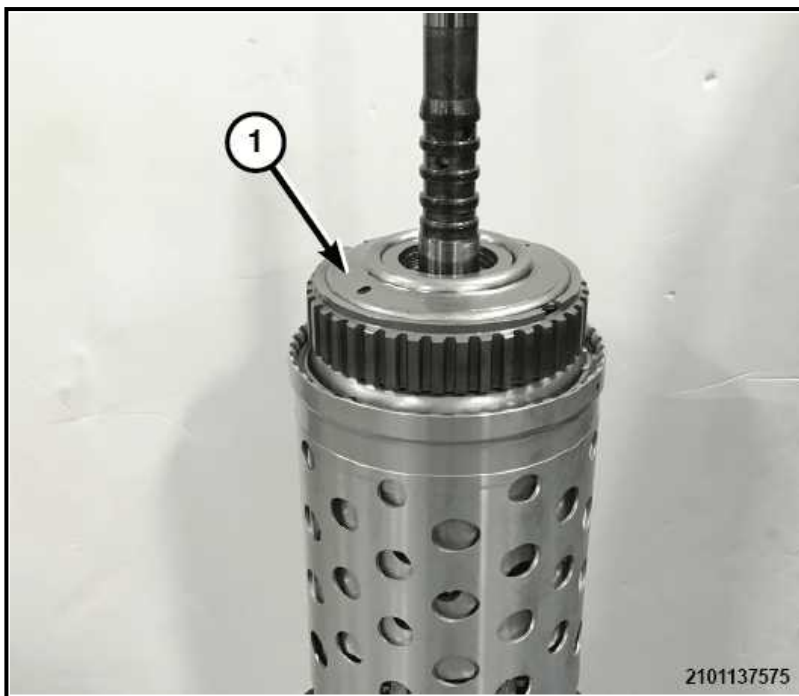
Minimum	Maximum
0.11 mm	0.42 mm
0.0043 in.	0.0165 in.

END PLAY SELECTABLE SHIMS

NOTE: Check with parts for selectable shim thicknesses and availability.

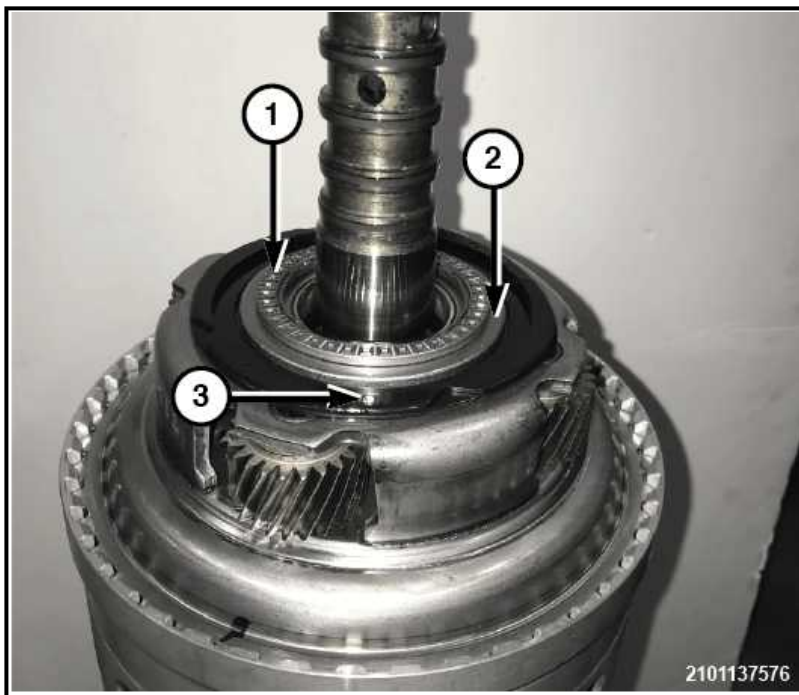
DISASSEMBLY

1. Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear).
2. Remove the Clutch B discs and plates.



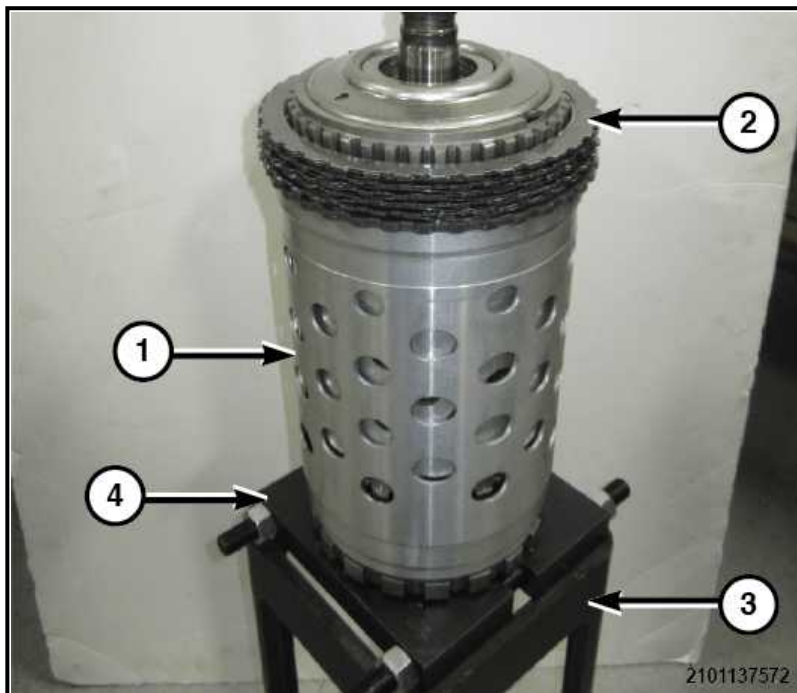
1 - P1 Annulus/Clutch B Hub Assembly

3. Remove the O-ring and five squared O-rings from the input shaft.
4. Remove the P1 annulus/Clutch B hub assembly from the P4 annulus drum.



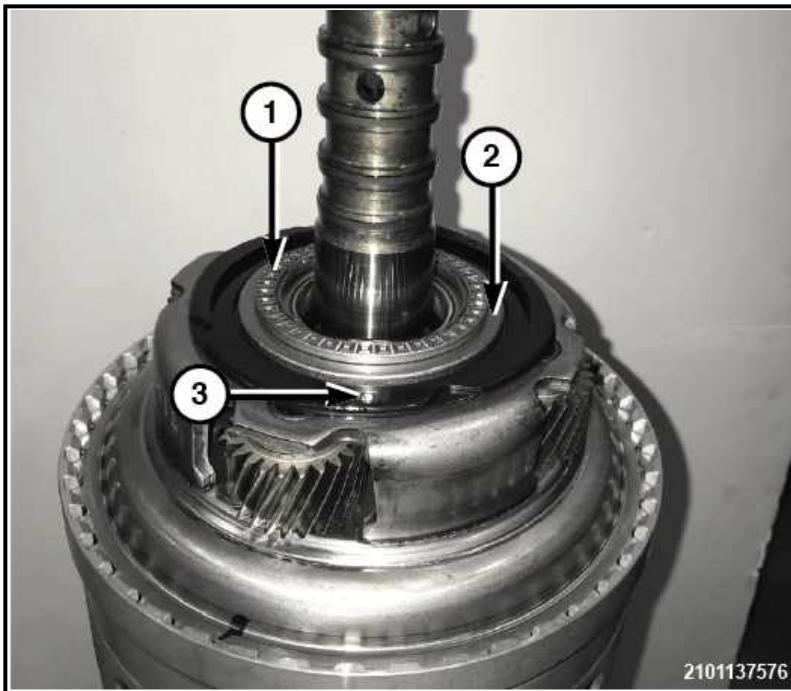
1 - Thrust Bearing
2 - Holding Plate
3 - Selectable Shim

5. Remove the selectable shim from the P1 planetary carrier.
6. Measure the selectable shim and calculate the thickness of the shim to obtain the correct end play.



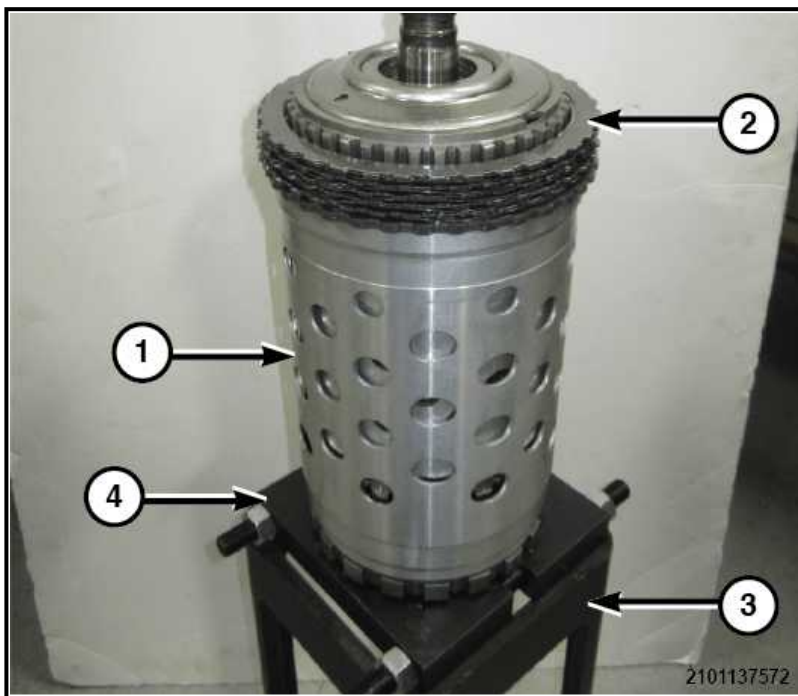
1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Bearing/Gear Splitter

ASSEMBLY



- | |
|---------------------|
| 1 - Thrust Bearing |
| 2 - Holding Plate |
| 3 - Selectable Shim |

1. Install the selectable shim onto the P1 planetary carrier.



- | |
|-------------------------------|
| 1 - P4 Annulus Drum Assembly |
| 2 - Clutch B Discs and Plates |
| 3 - Press Fixture Assembly |
| 4 - Bearing/Gear Splitter |

2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.

5. Install the P1 annulus onto the input/output shaft.
6. Install the input/output shaft and the P4 annulus drum assembly into the transmission.

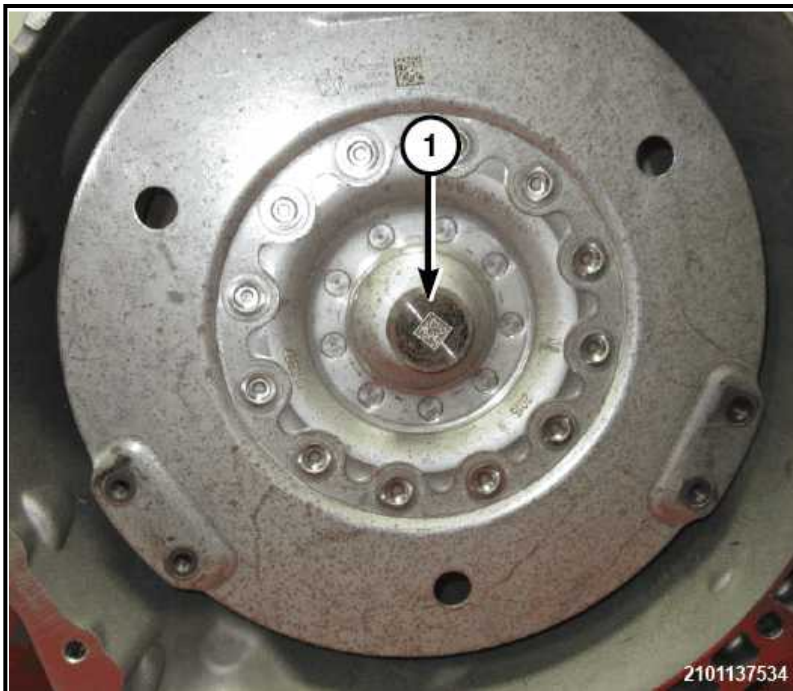
8HP75 - DISASSEMBLY

DISASSEMBLY

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

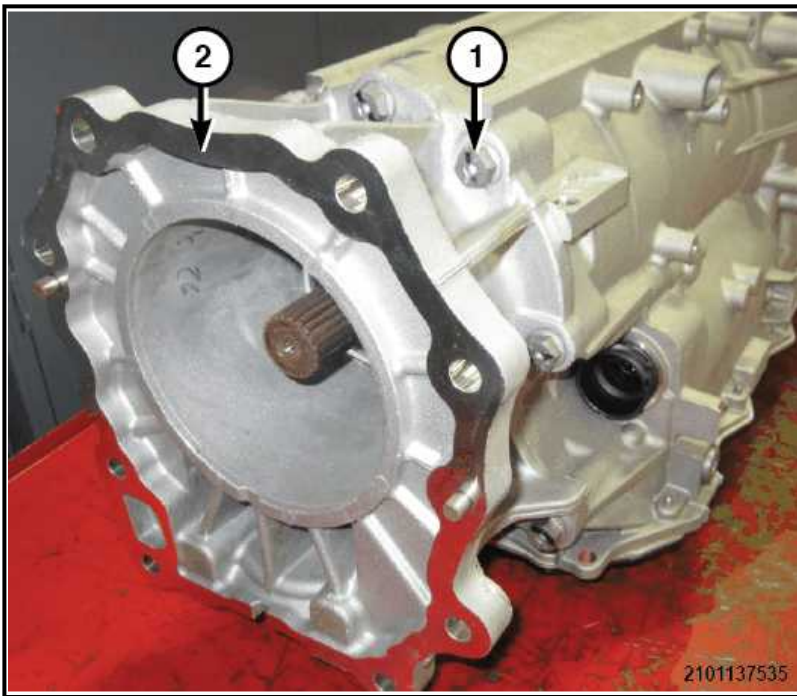
NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TCM Adaptation Procedure. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\)](#), [MODULE PROGRAMMING](#) .

NOTE: Tag all clutch pack assemblies as they are removed, for reassembly identification.



1 - Torque Converter

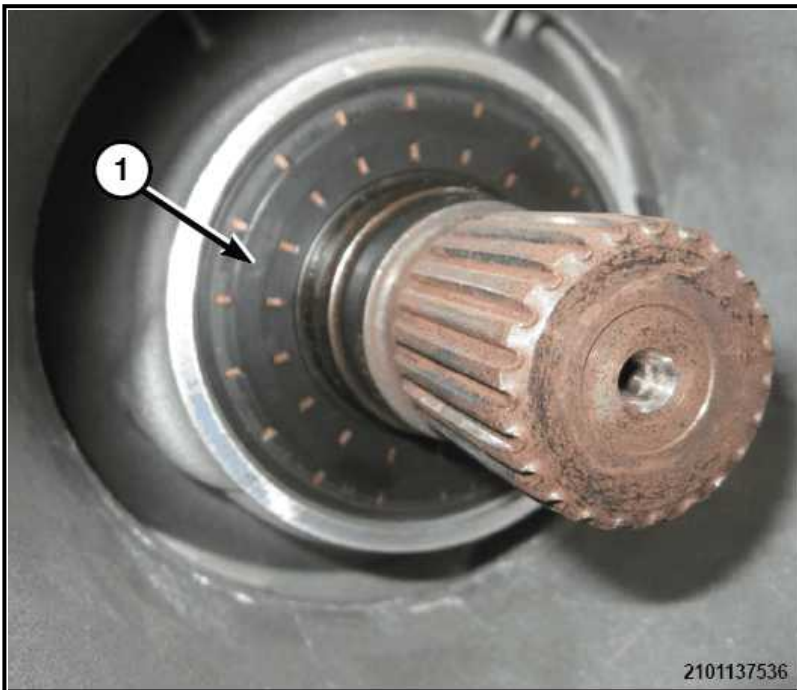
1. Remove the torque converter.



- | |
|-----------------------------|
| 1 - Extension Housing Bolts |
| 2 - Extension Housing |

NOTE: 4X4 Only.

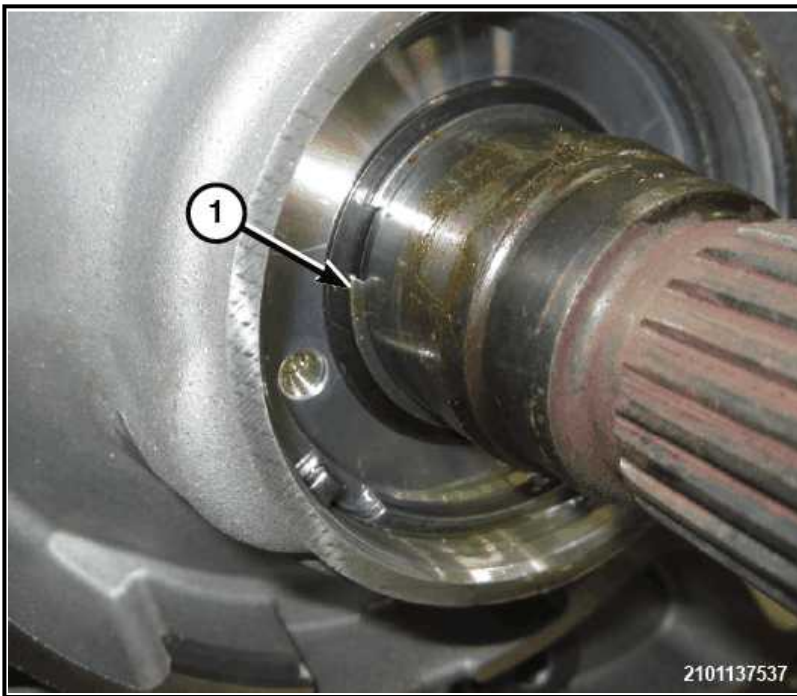
2. If equipped, remove the transmission housing extension housing bolts and remove the extension housing.



- | |
|-----------------------|
| 1 - Output Shaft Seal |
|-----------------------|

NOTE: 4X4 Only.

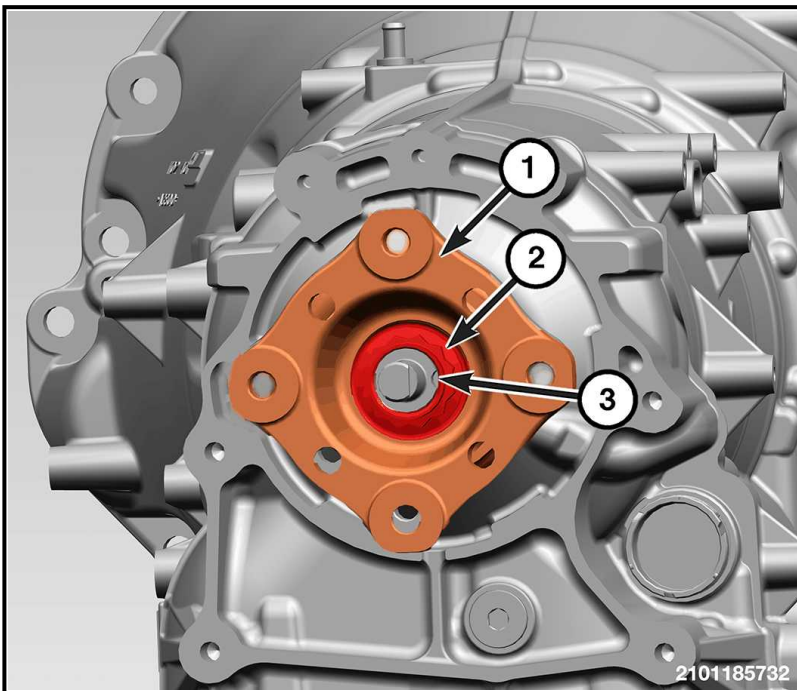
3. Remove the transmission output shaft seal with a suitable slide hammer and screw.



1 - Output Shaft Snap Ring

NOTE: 4X4 Only.

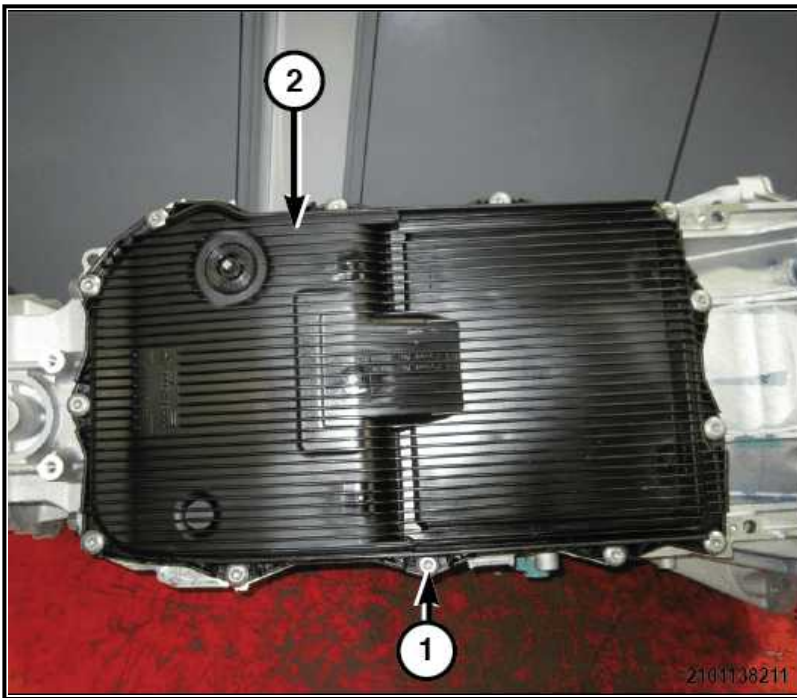
4. Remove the output shaft snap ring.



- | |
|--|
| 1 - Transmission Output Flange |
| 2 - Transmission Output Flange Nut |
| 3 - Transmission Output Flange Nut Stake |

NOTE: 2WD Only.

5. Remove the output shaft flange locknut staking.
6. Using a flange holder (special tool #C-3281, Holder, Flange), remove the output shaft flange nut.
7. Remove the output shaft flange and output shaft seal.



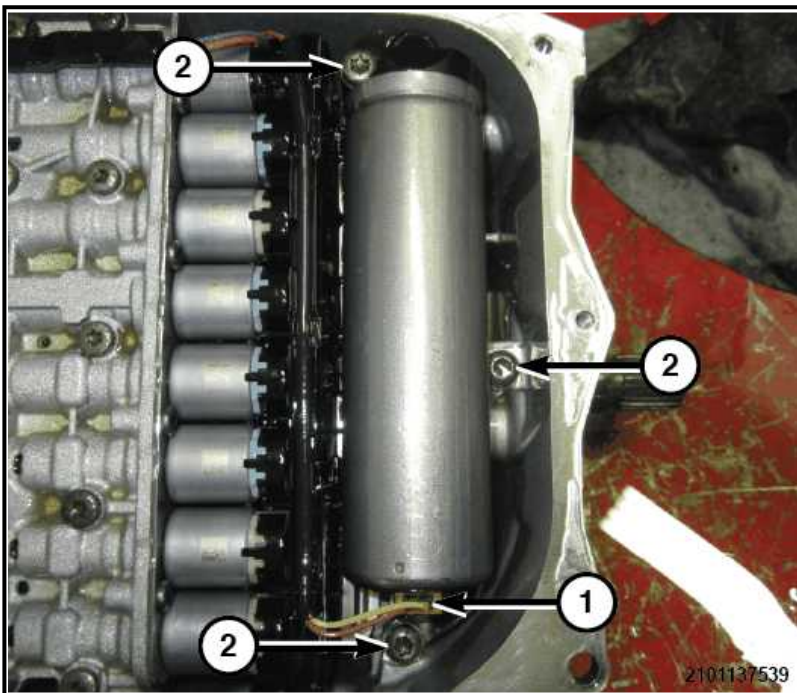
1 - Transmission Oil Pan Bolts

2 - Transmission Oil Pan

8. Remove the transmission oil pan bolts.

NOTE: Inspect the gasket for reuse. If the seal is cut or torn, replace the gasket.

9. Carefully remove the transmission oil pan and gasket.

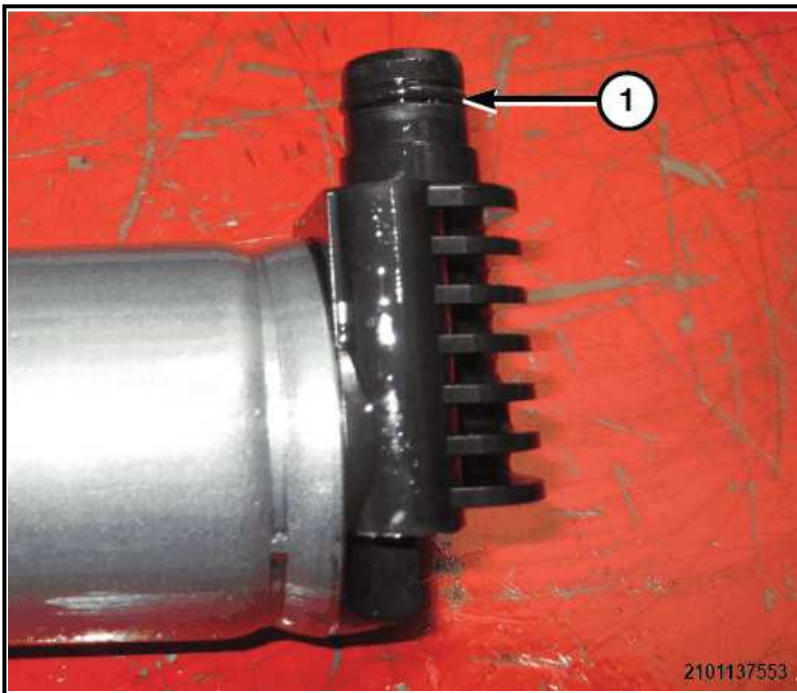


1 - Hydraulic Impulse Solenoid (HIS) Wire Harness Connector

2 - Hydraulic Impulse Solenoid (HIS) Bolts

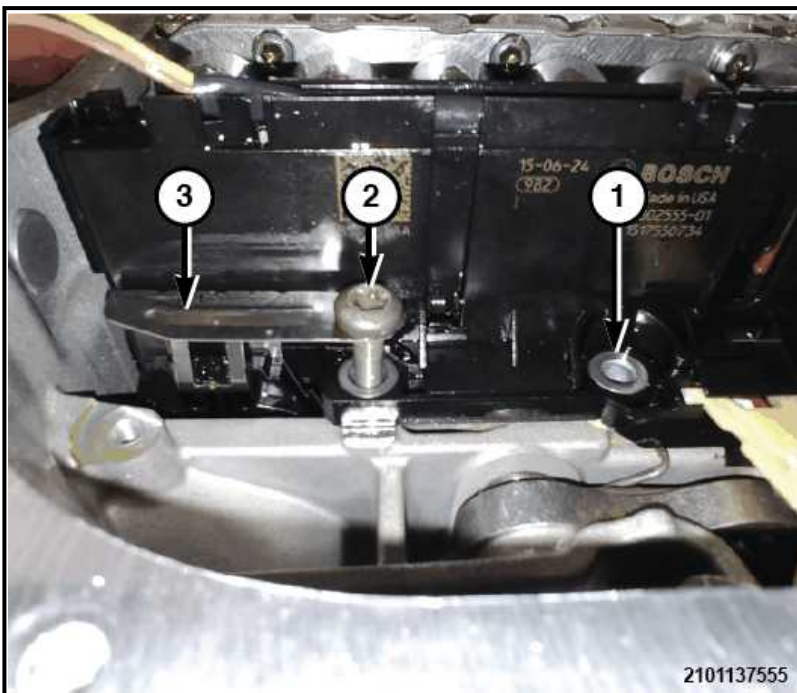
10. If equipped, disconnect the Hydraulic Impulse Solenoid (HIS) connector.

11. If equipped, remove bolts and the HIS accumulator.



1 - Hydraulic Impulse Solenoid (HIS) Seal

12. Verify the seal on the input end of the HIS is not torn or cut. Replace the seal if it looks worn or damaged.

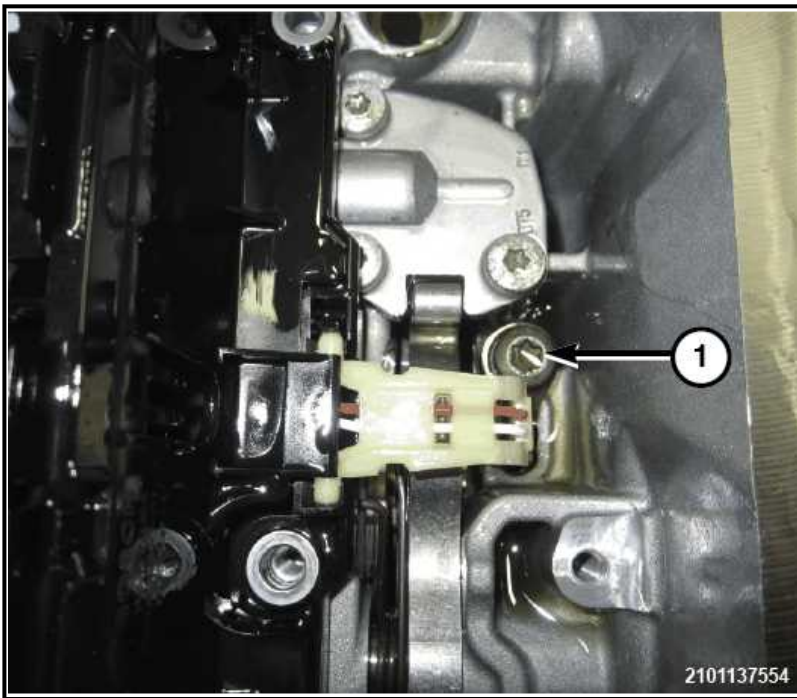


1 - Valve Body End Bolt

2 - Electrical Connector Lock Bolt

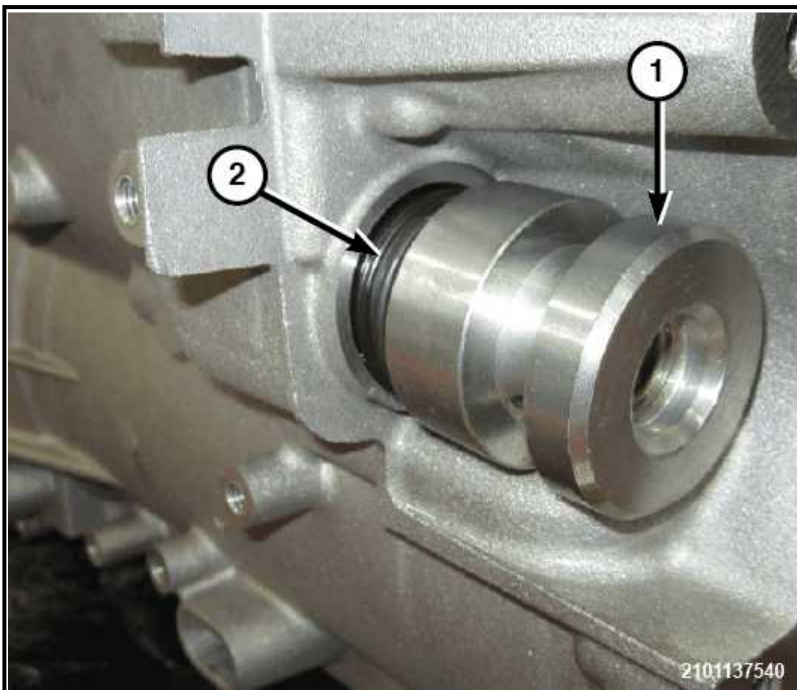
3 - Electrical Connector Lock

13. Remove the valve body end bolt.
 14. Remove the electrical connector lock bolt.
 15. Lift the electrical connector lock to release the internal harness end from inside the transmission for valve body removal.



1 - Output Speed Sensor Bolt

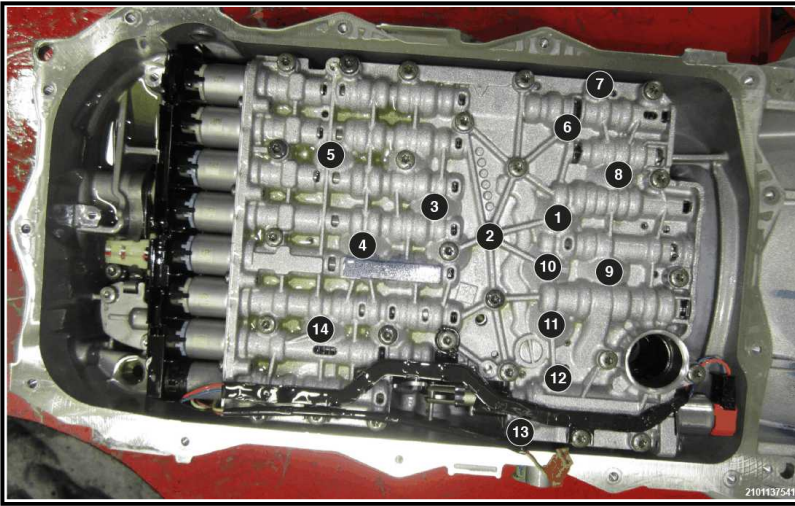
16. Remove the Output Speed Sensor (OSS) bolt and gently lift the output speed sensor out from the case.



1 - Remover/Installer, Guide Sleeve

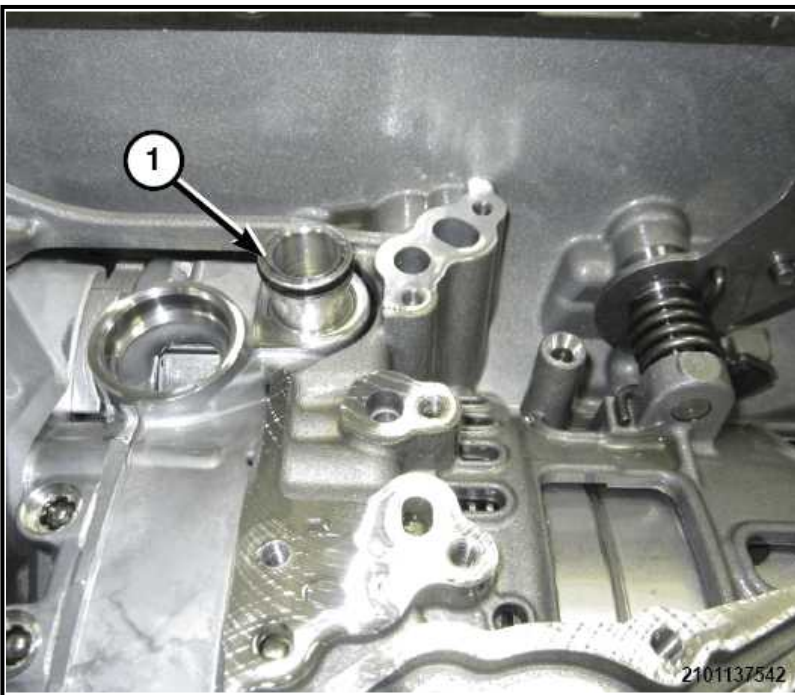
2 - Electrical Harness Guide Sleeve

17. Using (special tool #10377, Remover/Installer, Guide Sleeve), carefully pull the electrical harness guide sleeve straight out from the transmission case.



1-14 - Valve Body Bolt Removal Sequence

18. Remove the valve body bolts in the sequence shown and remove the valve body.



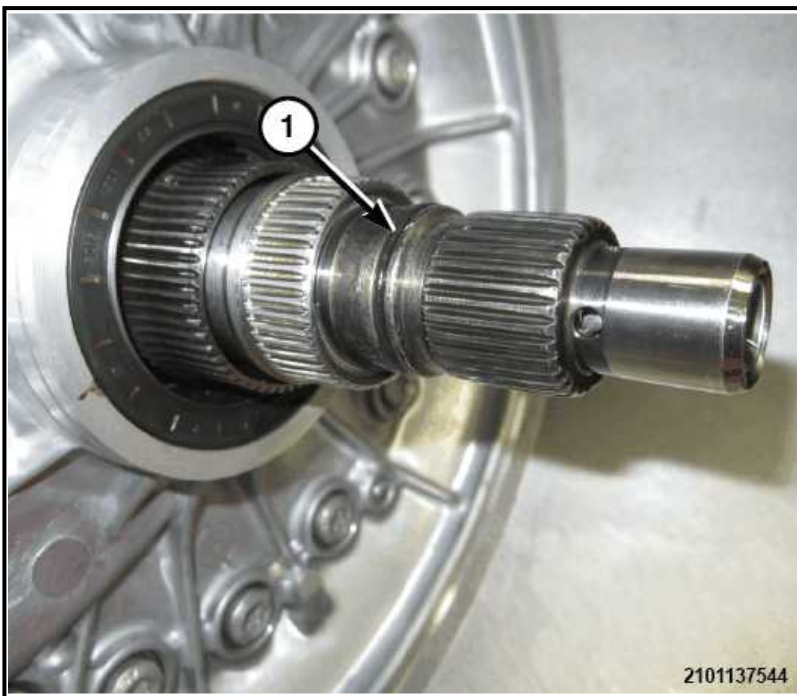
1 - Fluid Transfer Port

19. Remove the fluid transfer port from the transmission or valve body assembly (the transfer port may stick in the valve body during removal).
20. Inspect the fluid transfer port O-rings for damage or wear and replace as necessary.



1 - Transmission Oil Pump Assembly to Case Bolts

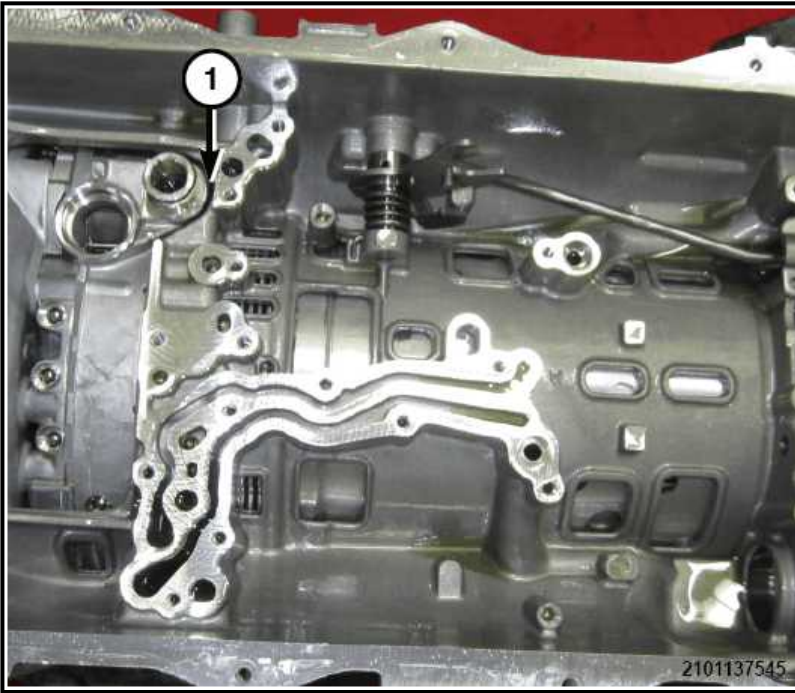
21. Remove and **DISCARD** the transmission oil pump assembly to case bolts.



1 - Input Shaft O-Ring

NOTE: Remove the input shaft O-ring before the oil pump is removed.

22. Remove the input shaft O-ring using a small pick or equivalent.



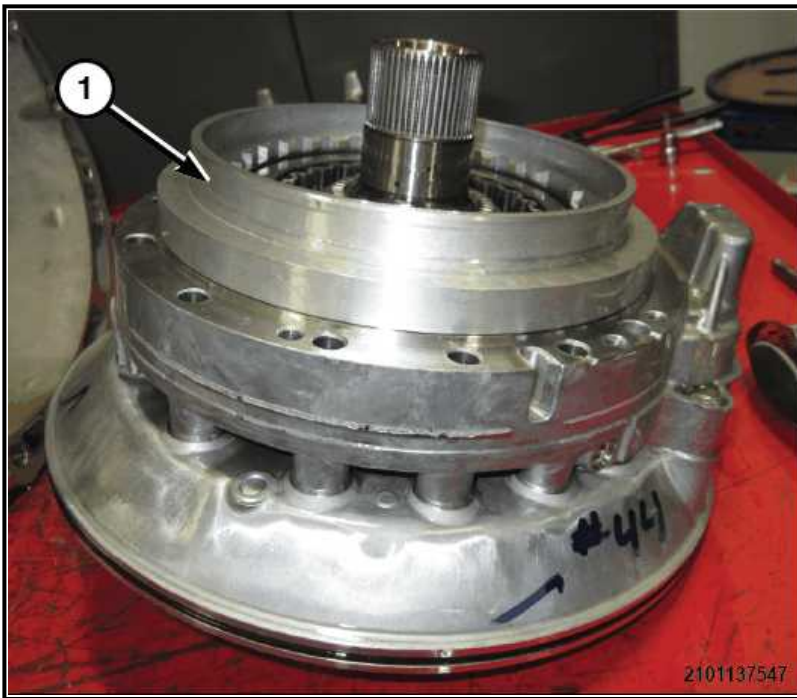
1 - Transmission Oil Pump Assembly

23. Carefully pry the oil pump housing away from the case with a small flat blade screwdriver or equivalent through the case opening.
24. From the front of the transmission, remove the oil pump housing.



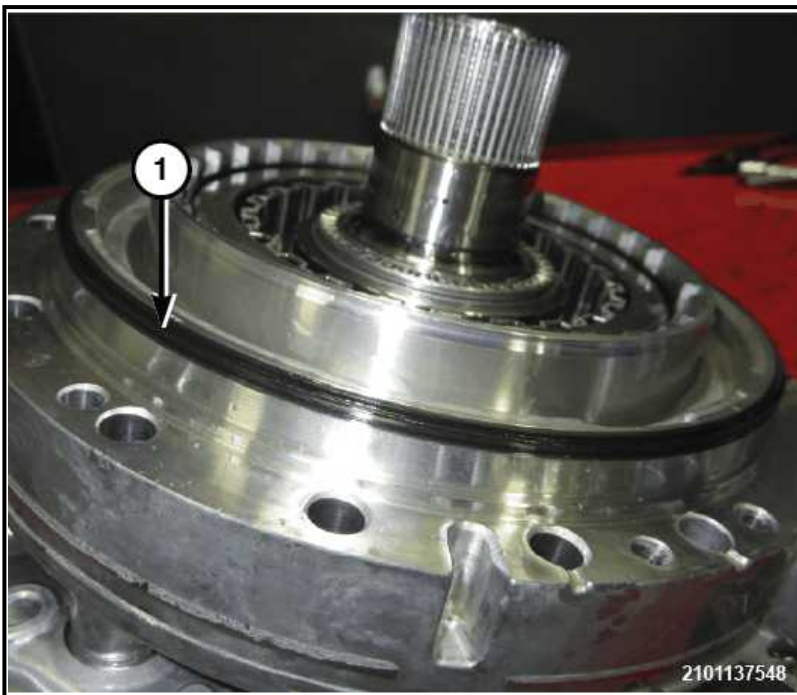
1 - Clutch B Damper Spring

25. Remove the Clutch B damper spring.



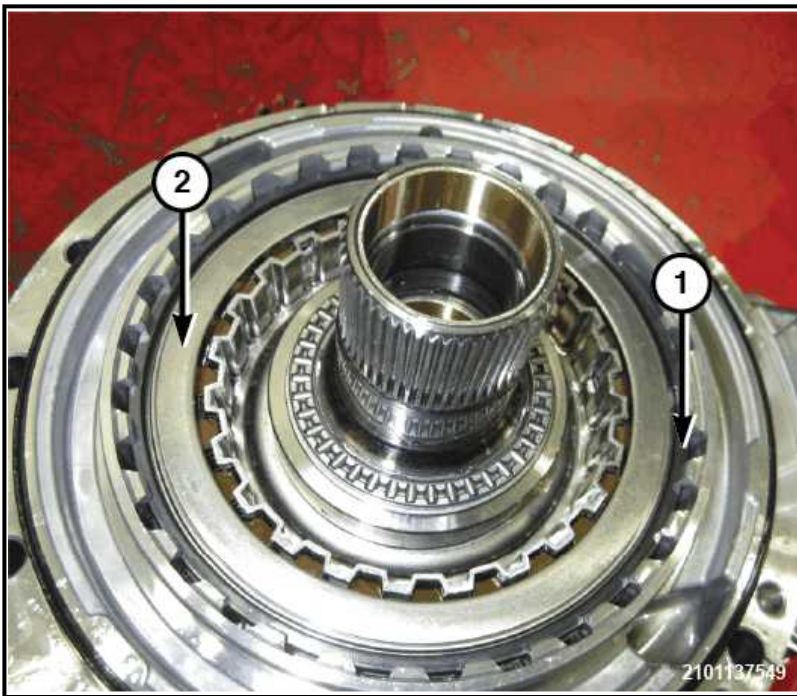
1 - Clutch B Piston

26. Remove the Clutch B piston from the assembly.



1 - Clutch B Piston Seal

27. Check the Clutch B piston seal for damage or wear and replace if necessary.

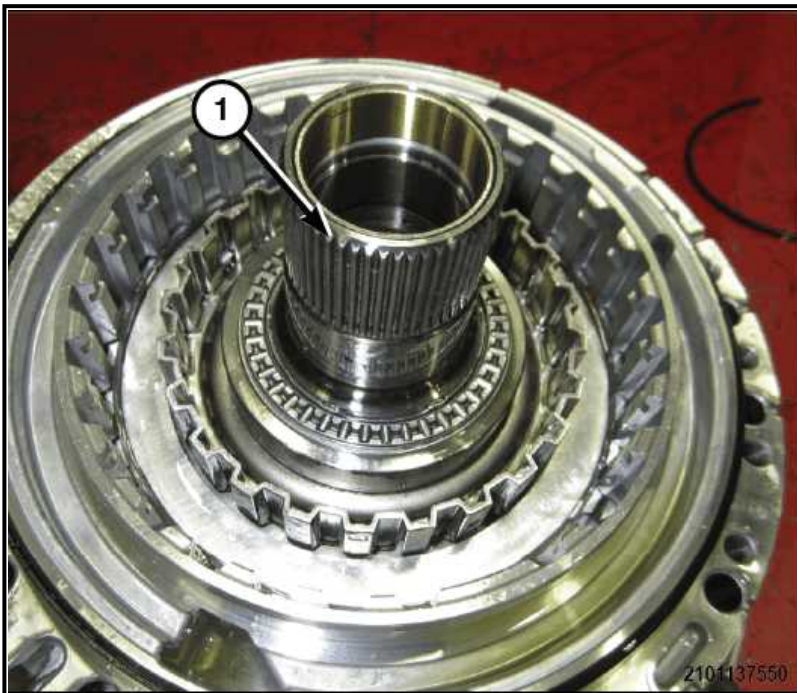


1 - Snap Ring

2 - Clutch A Discs and Plates

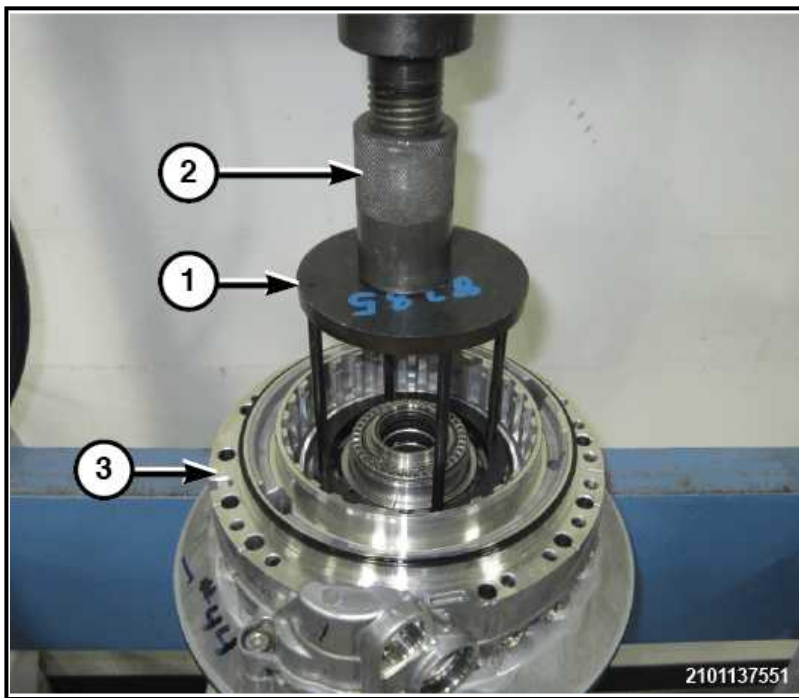
28. Remove the snap ring.

29. Remove the Clutch A disks and plates.



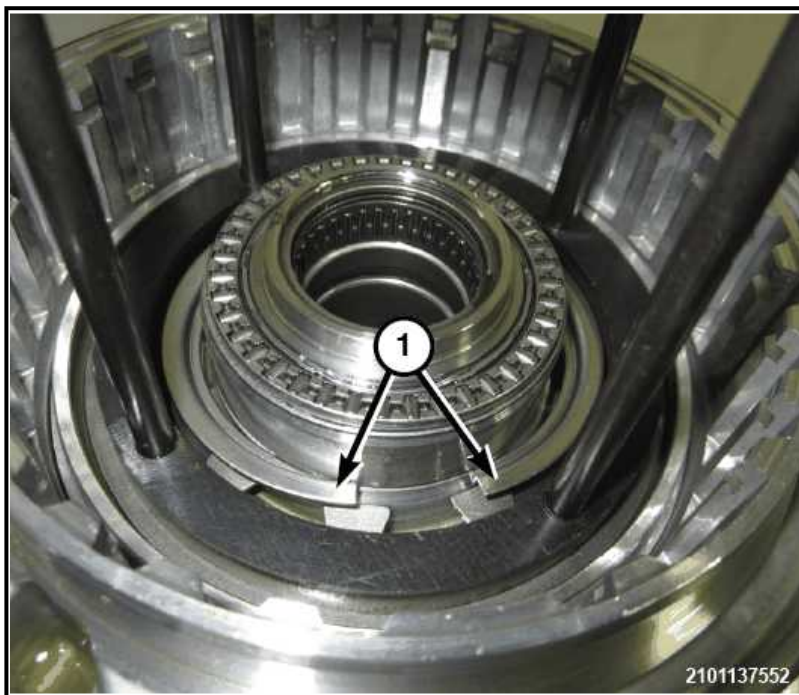
1 - Hub

30. Remove the hub.



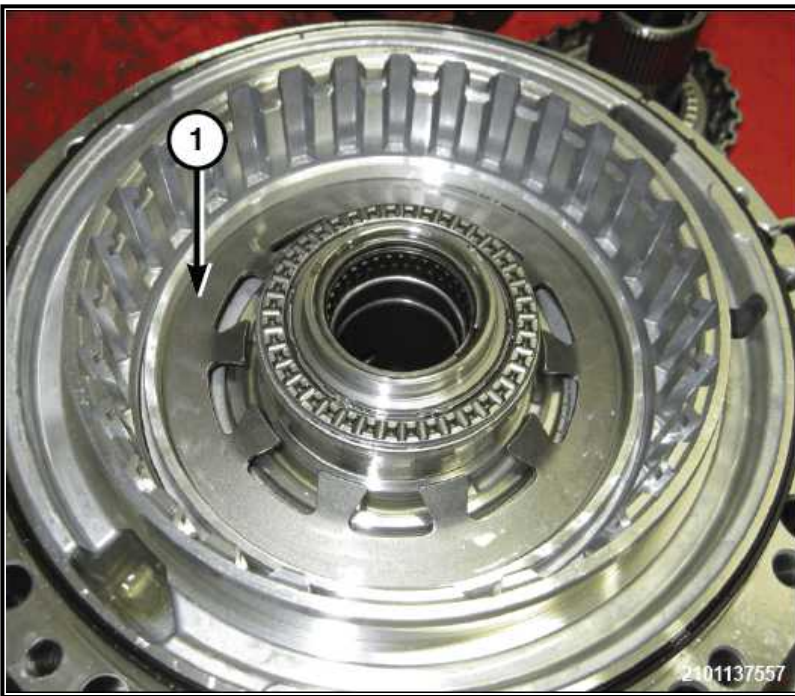
1 - Spring Compressor Tool
2 - Arbor Press
3 - Transmission Oil Pump Assembly

31. Position the oil pump housing assembly in a suitable arbor press.
32. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retaining ring to remove tension.



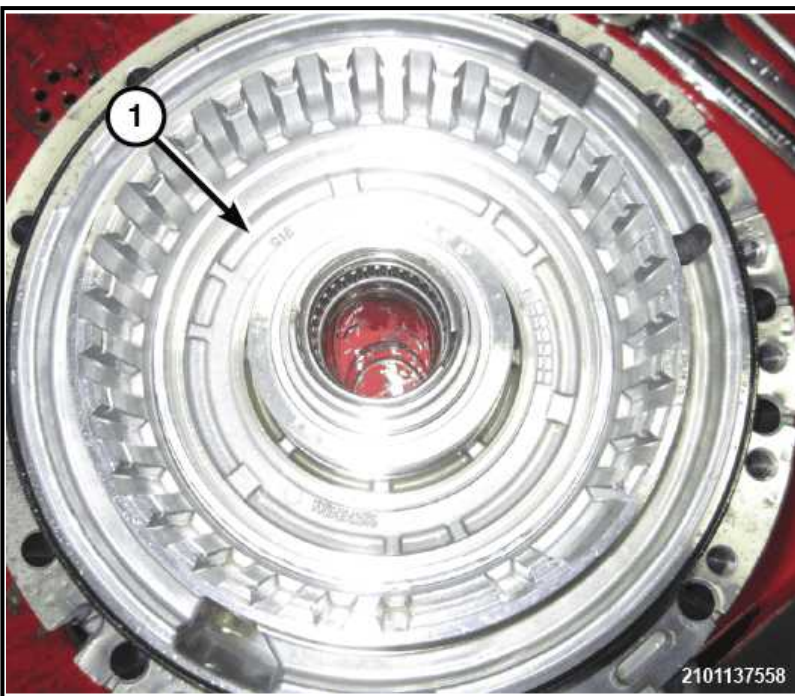
1 - Retaining Ring

33. Remove the two halves of the retaining ring.



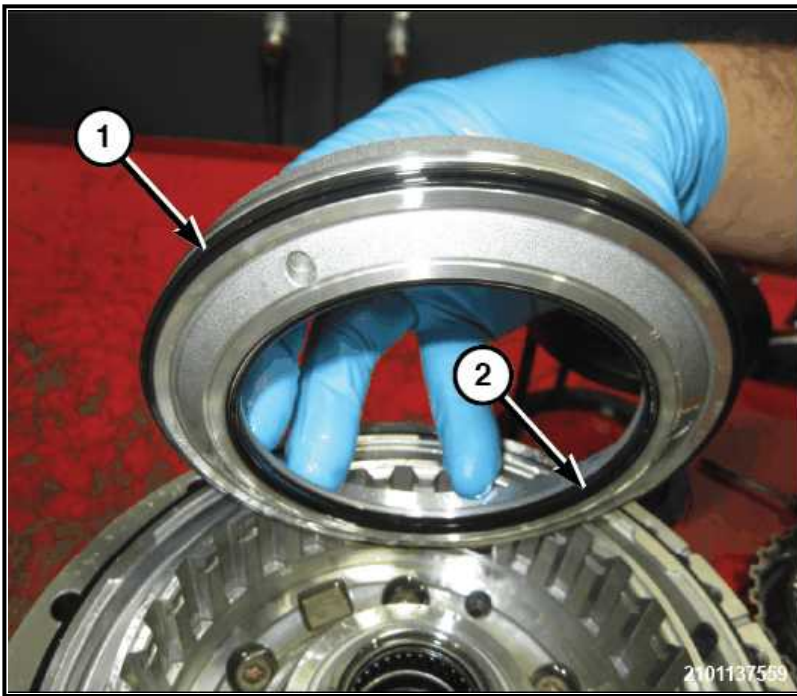
1 - Clutch A Belleville Spring

34. Remove the Clutch A belleville spring.



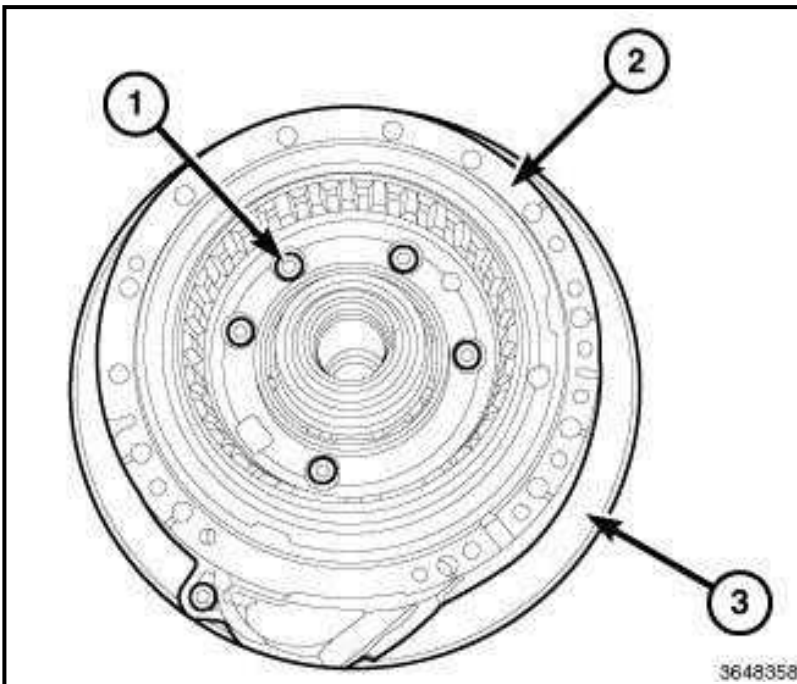
1 - Clutch A Piston

35. Remove the Clutch A piston (1) by rotating and gently lifting.



- | |
|--------------------------------|
| 1 - Clutch A Piston Outer Seal |
| 2 - Clutch A Piston Inner Seal |

36. Inspect the inner and outer piston seals for wear or damage and replace as necessary.



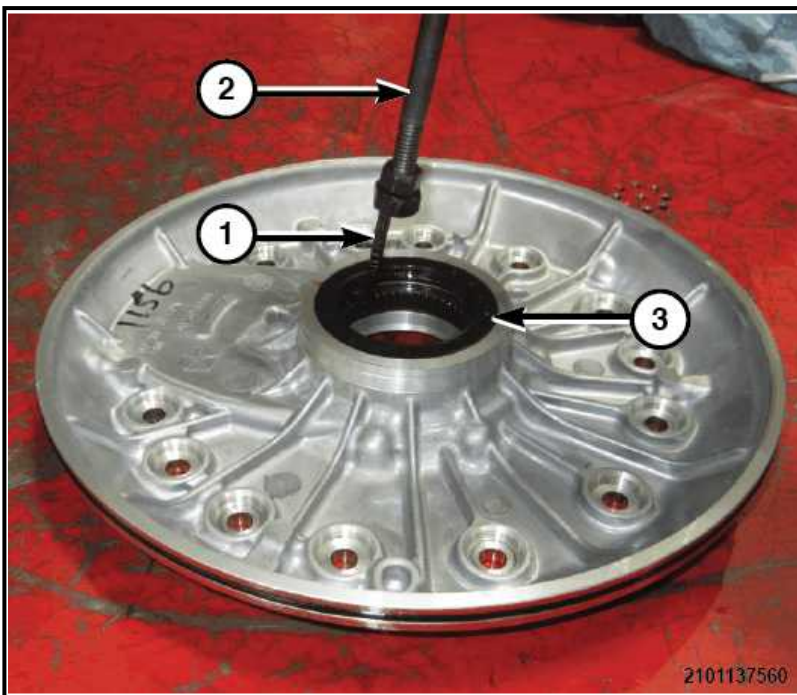
- | |
|--|
| 1 - Transmission Oil Pump Housing to Cover Bolts |
| 2 - Transmission Oil Pump Housing |
| 3 - Transmission Oil Pump Front Cover |

37. Remove the transmission oil pump housing to cover bolts and separate the transmission oil pump housing from the transmission oil pump front cover.



1 - Oil Pump Front Cover O-Ring Seal

38. Remove and **DISCARD** the oil pump housing O-ring seal.



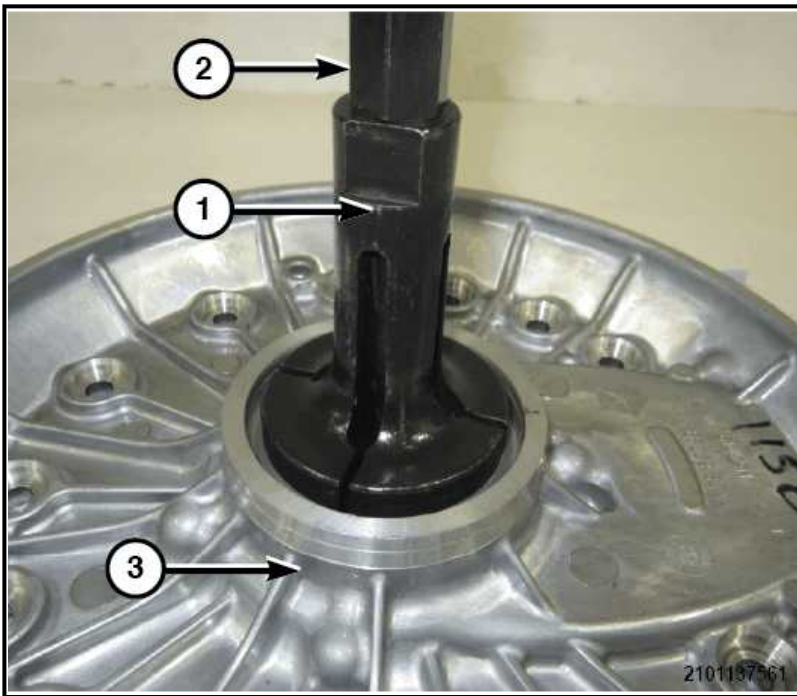
1 - Seal Remover

2 - Slide Hammer

3 - Front Pump Cover Oil Seal

39. Using (special tool #9667, Remover, Seal) and (special tool #C-3752, Slide Hammers), remove the oil seal from the front pump cover.

40. Remove the snap ring.

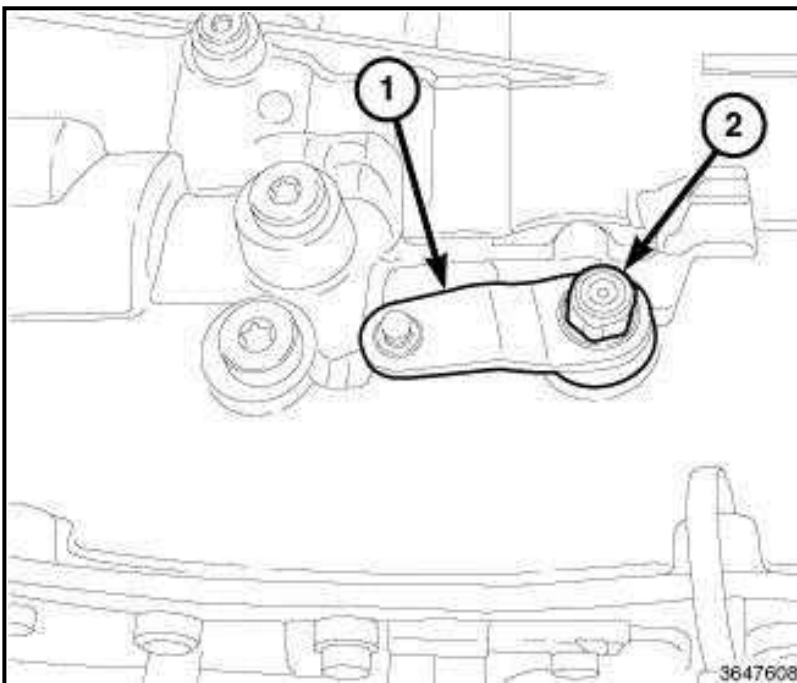


1 - Bearing Cup Remover

2 - Slide Hammer

3 - Front Pump Cover

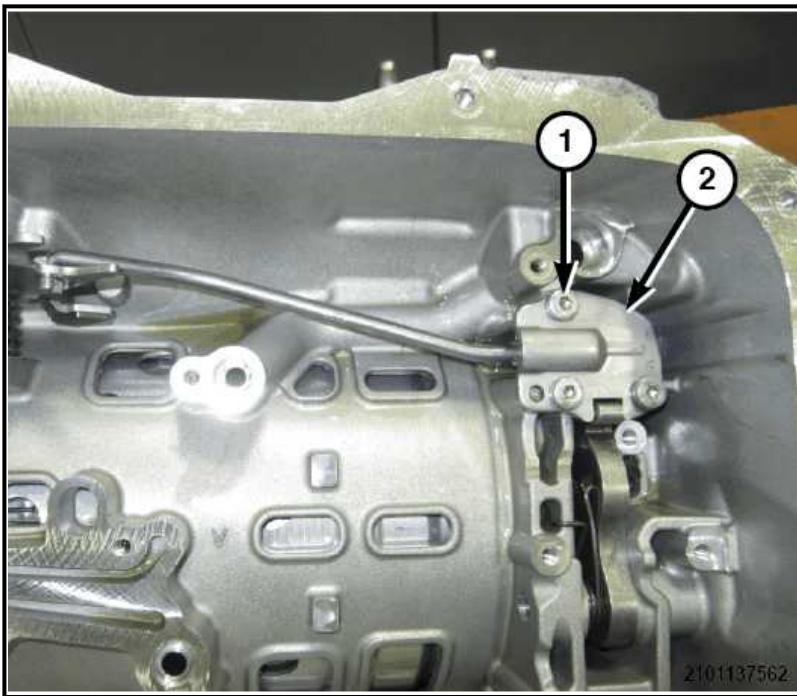
41. Using (special tool #6787A, Remover, Bearing Cup) and (special tool #C-3752, Slide Hammers), remove the needle bearing from the front cover.
42. Remove the front pump needle bearing snap ring.
43. Using (special tool #9585, Remover, Bearing Cup) and (special tool #C-637, Slide Hammer, Universal) remove the front pump needle bearing.



1 - Manual Park Release (MPR) Lever

2 - Manual Park Release (MPR) Lever Retaining Nut

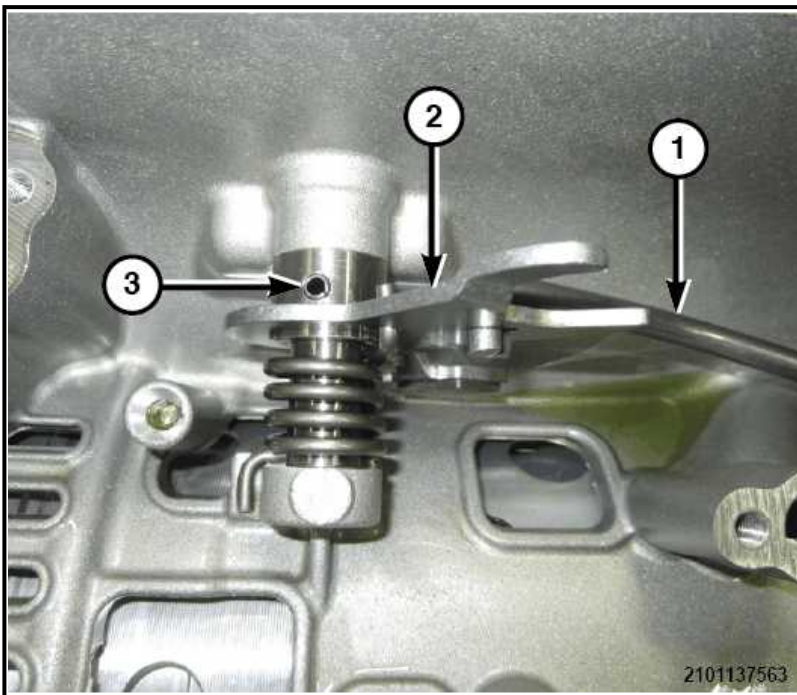
44. Remove the Manual Park Release (MPR) lever retaining nut and remove the lever.



1 - Park Pawl Lock Rod Guide Plate Retaining Bolts
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2 - Park Pawl Lock Rod Guide Plate

45. Remove the three park pawl lock rod guide plate retaining bolts and remove the plate.



1 - Park Pawl Lock Rod

2 - Fork

3 - Roll Pin

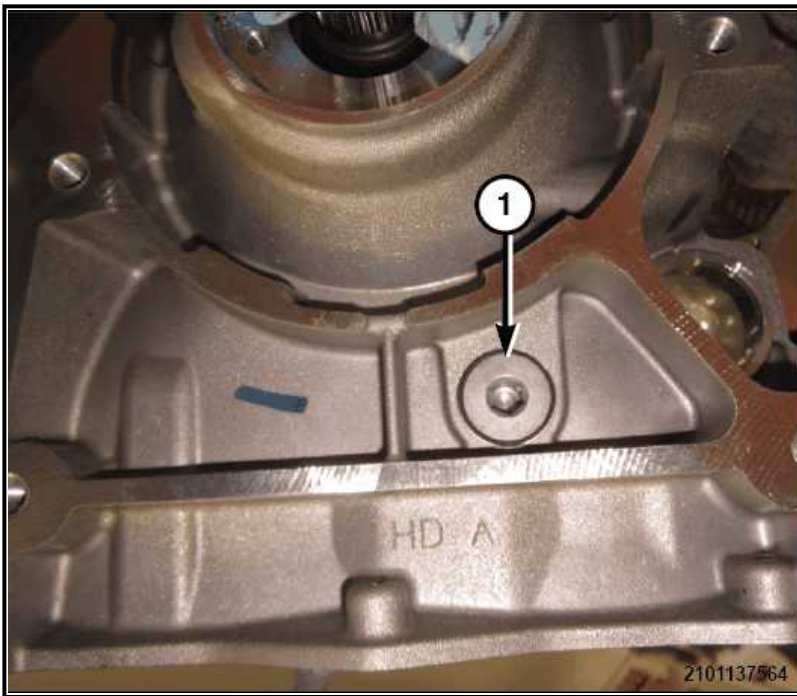
46. Remove the park pawl lock rod from the fork.

NOTE: Pay attention to the spring position for installation.

47. Remove the roll pin from the MPR shaft using a suitable pin punch.

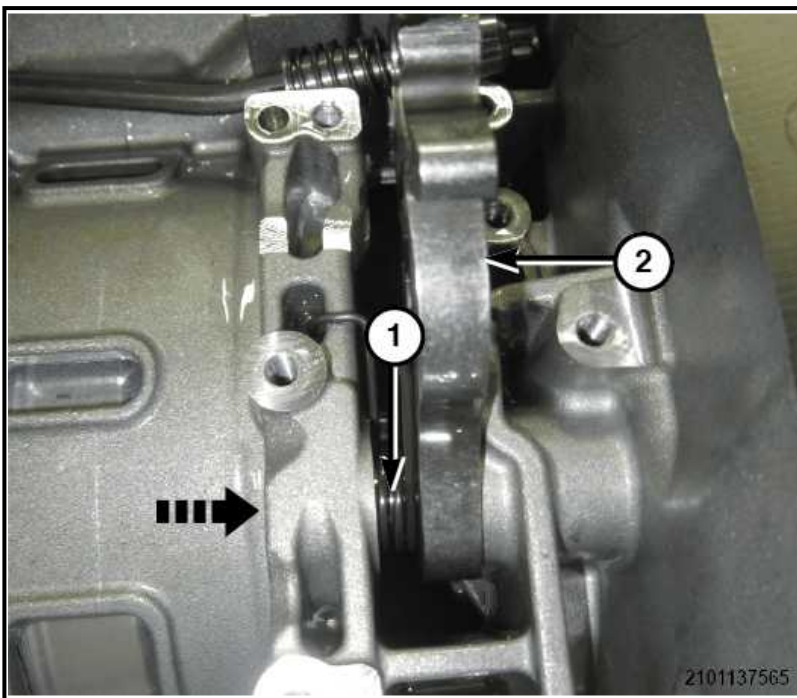
48. Remove the MPR shaft, spring and lever assembly from the case.

49. Remove the selector shaft seal using a small screwdriver or equivalent.



1 - Park Pawl Shaft Plug

50. Remove the park pawl shaft plug from the rear of the case.



1 - Park Pawl Spring

2 - Park Pawl

NOTE: Pay attention to the spring position for installation.

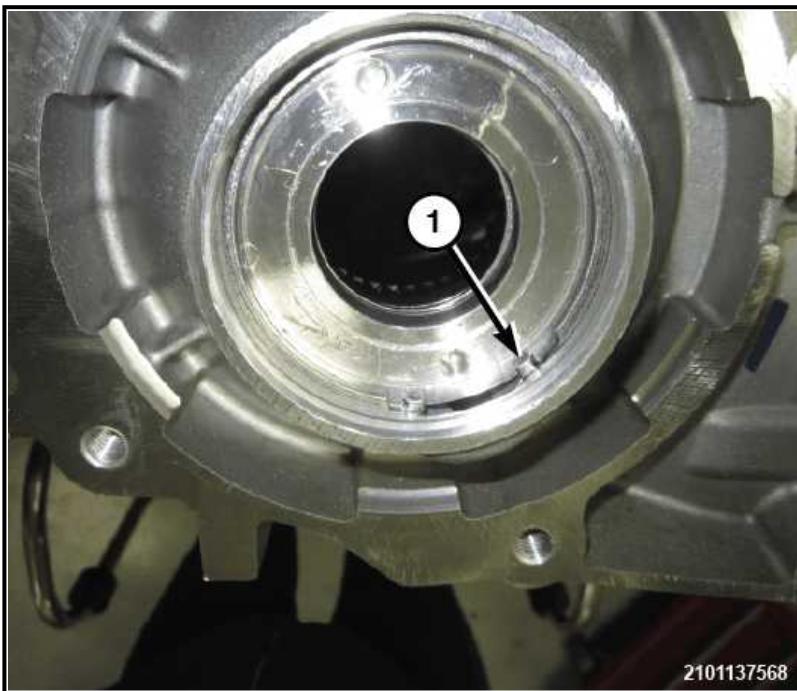
51. Remove the park pawl shaft using a suitable pin punch (Notation arrow for location and drive-out direction), remove the park pawl and spring.



1 - Input/Output Shaft and P4 Annulus Drum Assembly

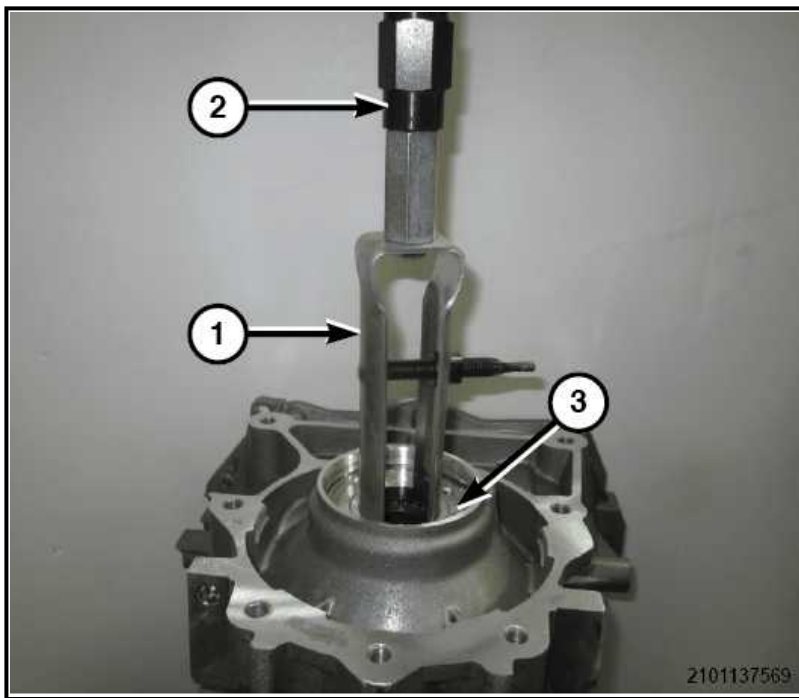
NOTE: The transmission must be in a vertical position before the main stack is removed, so damage to the drums do not occur.

52. Remove the input/output shaft and P4 annulus drum assembly from the case.



1 - Outer Bearing Cup Snap Ring

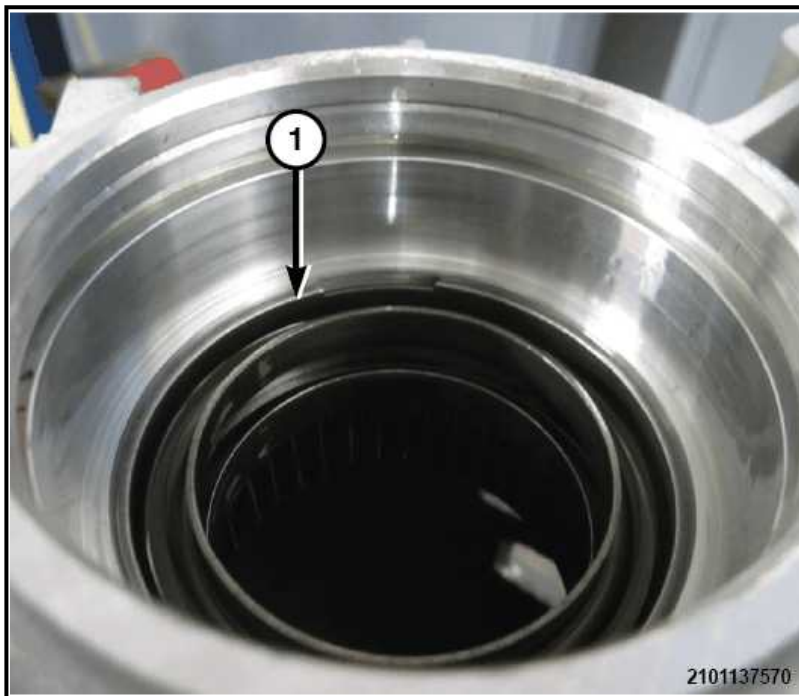
53. Remove the outer bearing cup snap ring.



1 - Bearing Cup Remover,
2 - Slide Hammer
3 - Outer Bearing Cup

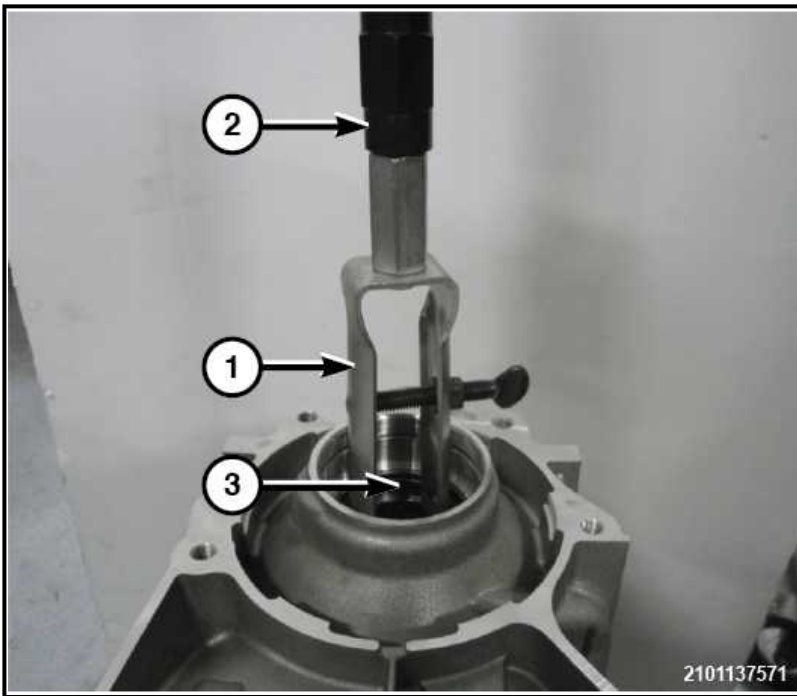
NOTE: 4X4 shown, 2WD similar.

54. Using (special tool #9664, Remover, Bearing Cup) and (special tool #C-637, Slide Hammer, Universal), remove the outer bearing cup.



1 - Output Shaft Oil Dam Snap Ring

55. Remove the output shaft oil dam snap ring.

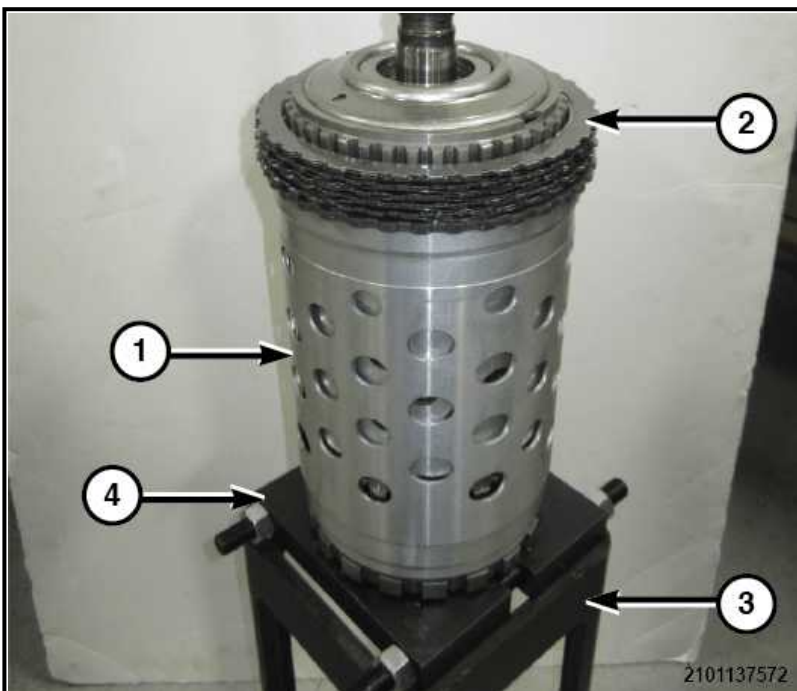


1 - Bearing Cup Remover

2 - Slide Hammer

3 - Output Shaft Oil Dam

56. Using (special tool #9664, Remover, Bearing Cup) and (special tool #C-637, Slide Hammer, Universal), remove the output shaft oil dam.



1 - Input/Output Shaft and P4 Annulus Drum Assembly

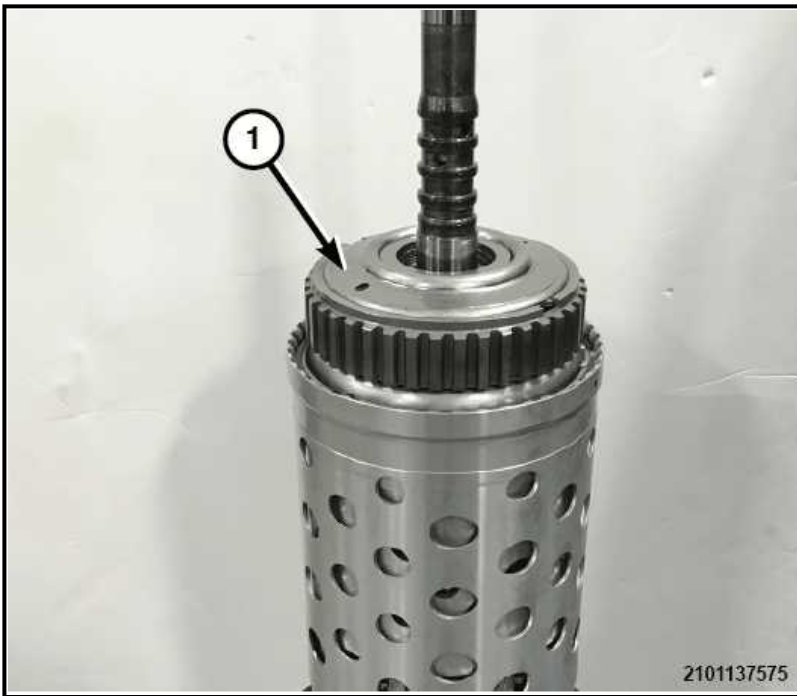
2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

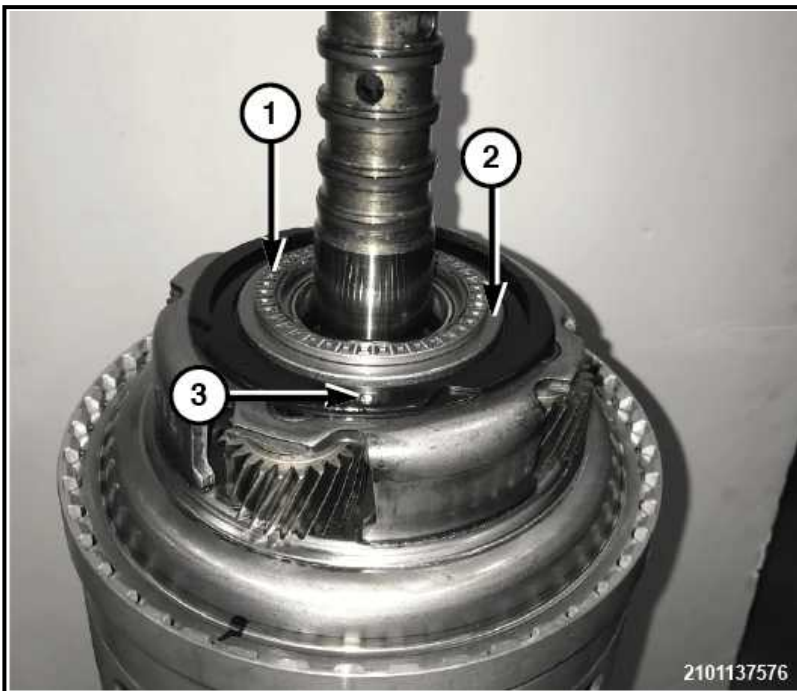
57. Position the input/output shaft and P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) and (special tool #1130, Splitter, Bearing/Gear).

58. Remove the Clutch B discs and plates.



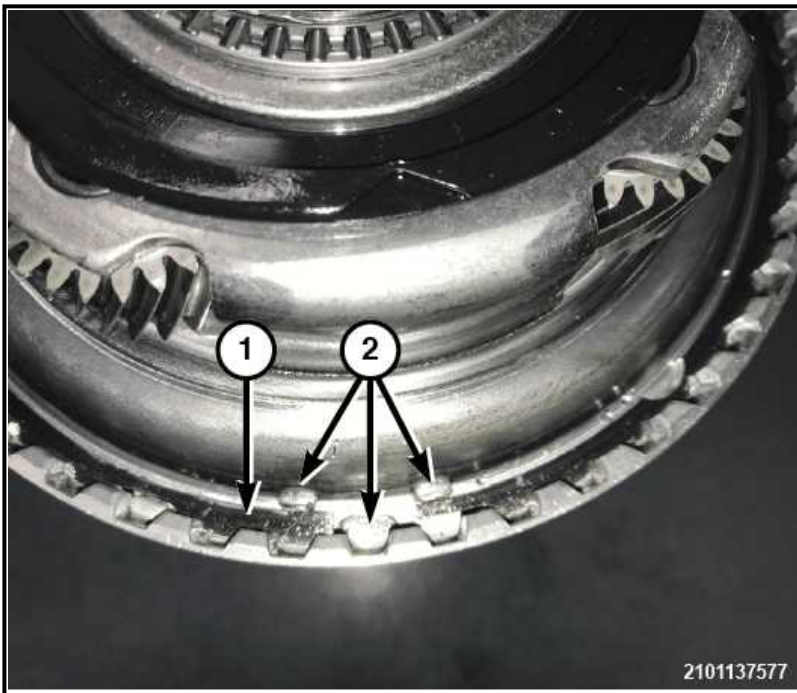
1 - P1 Annulus/Clutch B Hub Assembly

59. Remove the O-ring and five squared O-rings from the input shaft.
60. Remove the P1 annulus/Clutch B hub assembly from the P4 annulus drum.



1 - Thrust Bearing
2 - Holding Plate
3 - Selectable Shim

61. Remove the selectable shim from the P1 annulus/Clutch B hub.
62. Remove the thrust bearing and holding plate from the P1 planetary carrier.



1 - Snap Ring
2 - Snap Ring Openings

NOTE: The (special tool #10378, Rings, Support) are three pieces intended to be used in multiple locations around the drum to prevent damage from prying.

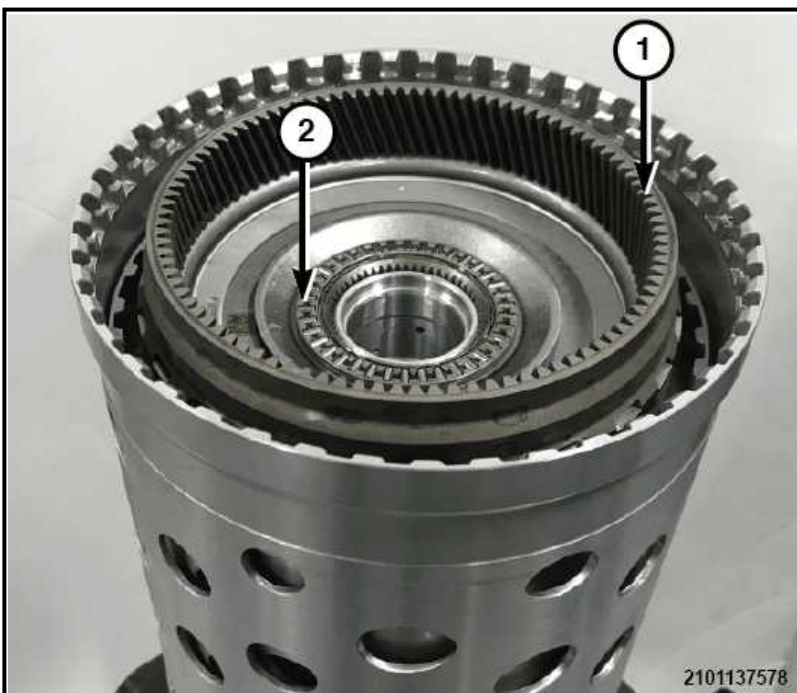
63. Position the (special tool #10378, Rings, Support) on the P4 annulus drum assembly to protect the drum.

NOTE: Pry the snap ring from the opposite side of the snap ring openings to release.

NOTE: When the snap ring is removed the internal clutch drum may drop slightly.

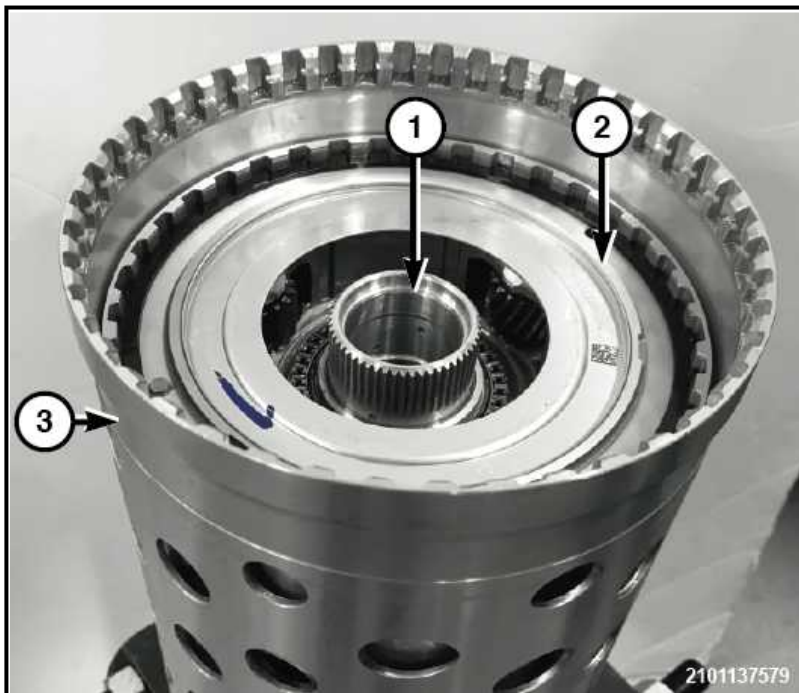
64. Using a suitable tool release the snap ring by prying in and up from the opposite side of the snap ring openings.

65. Remove the P1 planetary carrier.



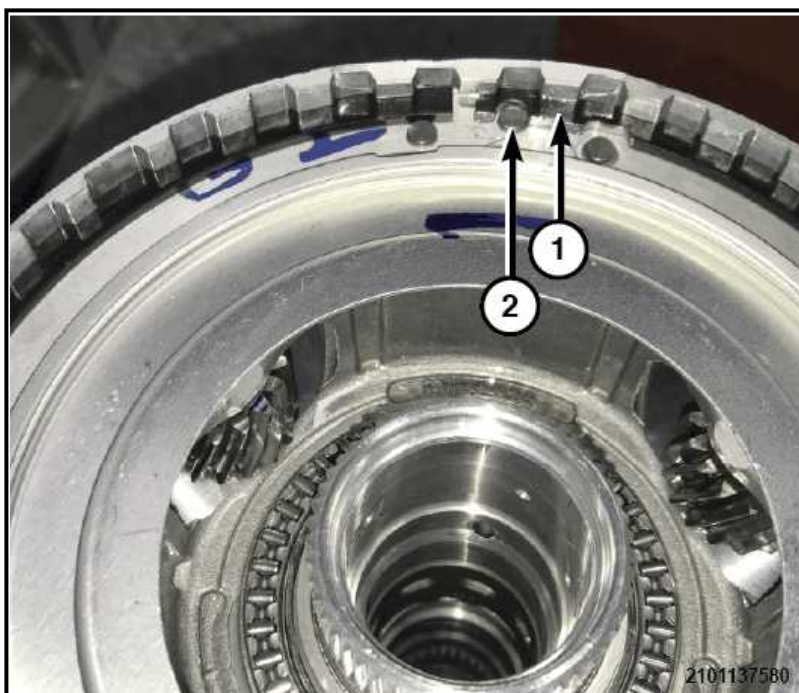
- | |
|-------------------------------|
| 1 - P2 Planetary Carrier |
| 2 - Thrust Bearing and Washer |

66. Remove the input shaft with P2 planetary carrier from the drum assembly.
67. Remove the thrust bearing and washer.



- | |
|----------------------------|
| 1 - P2 Annulus/P3 Sun Gear |
| 2 - Clutch D Drum |
| 3 - P4 Annulus Drum |

68. Remove the P2 annulus/P3 sun gear from the P4 annulus drum assembly.
69. Remove the Clutch D drum from the P4 annulus drum.



- | |
|--------------------------|
| 1 - Snap Ring |
| 2 - P3 Planetary Carrier |

NOTE: The (special tool #10378, Rings, Support) are three pieces intended to be used in multiple locations around the drum to prevent damage from prying.

70. Position the (special tool #10378, Rings, Support) on the P4 annulus drum assembly to protect the drum.

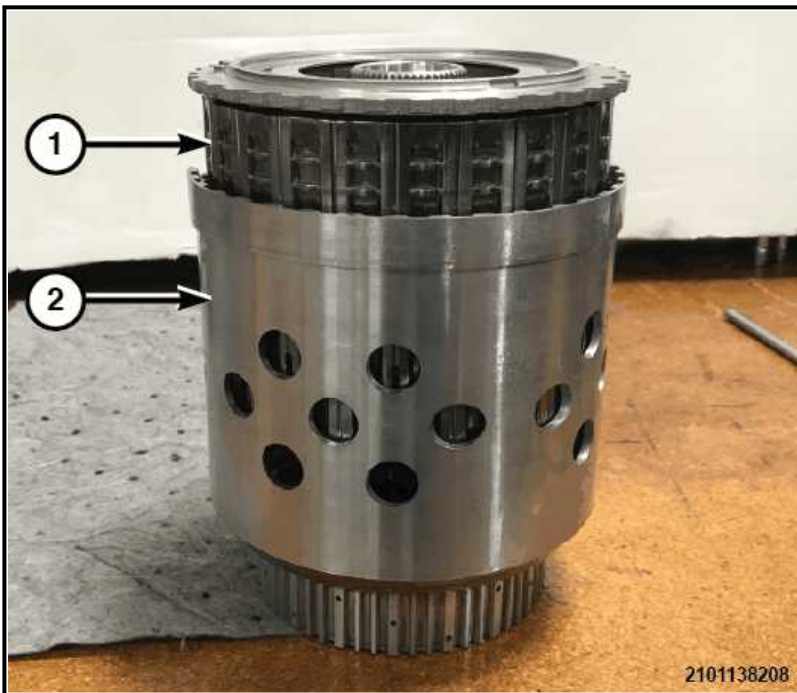
71. Using a suitable tool, release and remove the snap ring holding down the P3 Planetary Carrier.



1 - P3 Planetary Carrier

72. Remove the P3 planetary carrier.

73. Remove the thrust bearing from the P3 planetary carrier.



1 - P4 Sun Gear/Clutch C/E Retainer

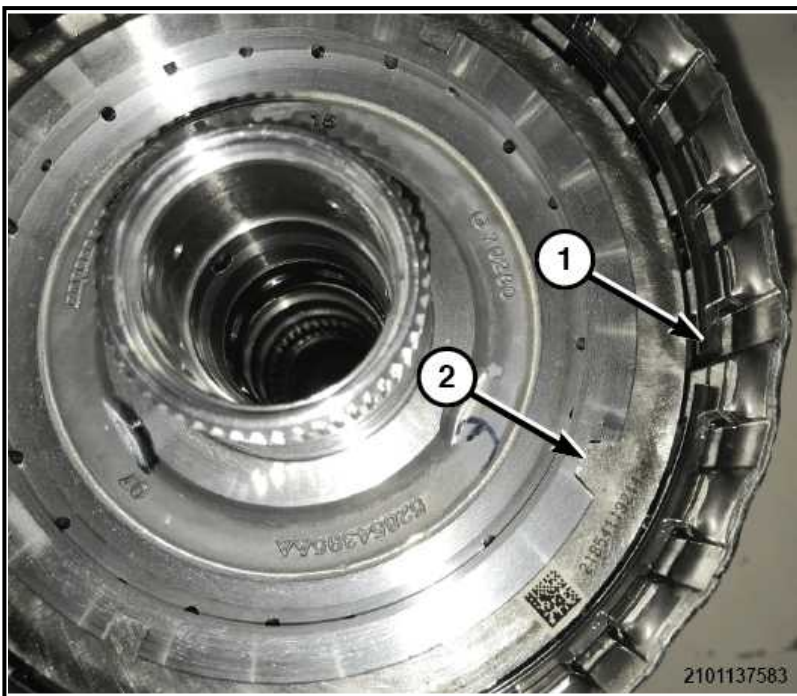
2 - Clutch D Drum

74. Remove the P4 sun gear/Clutch C/E retainer from the Clutch D drum.



1 - Snap Ring

75. Remove the snap ring from the P4 sun gear/Clutch C/E retainer and remove the annulus ring.



1 - Snap Ring

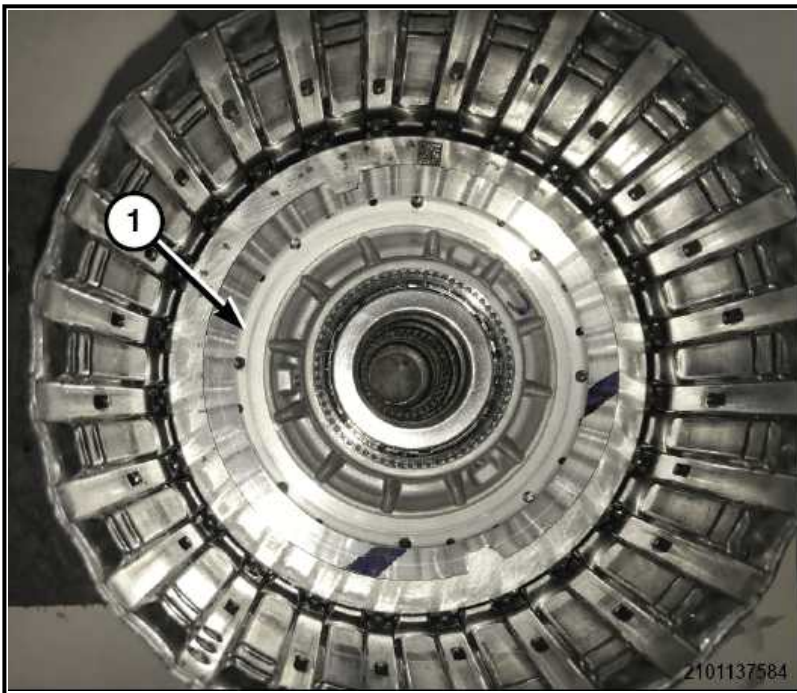
2 - Clutch E

76. Remove the snap ring (1) from the P4 sun gear/Clutch C/E retainer.

77. Remove Clutch E (2) from the P4 sun gear/Clutch C/E retainer.

78. Remove the thrust bearing from Clutch E (2).

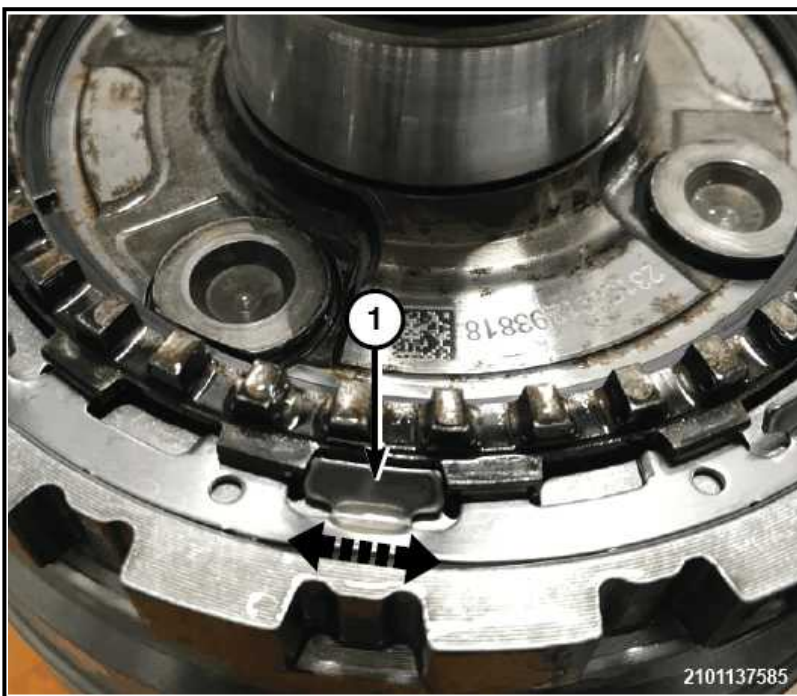
NOTE: Thrust bearing may stick to sun gear upon removal.



1 - Clutch C

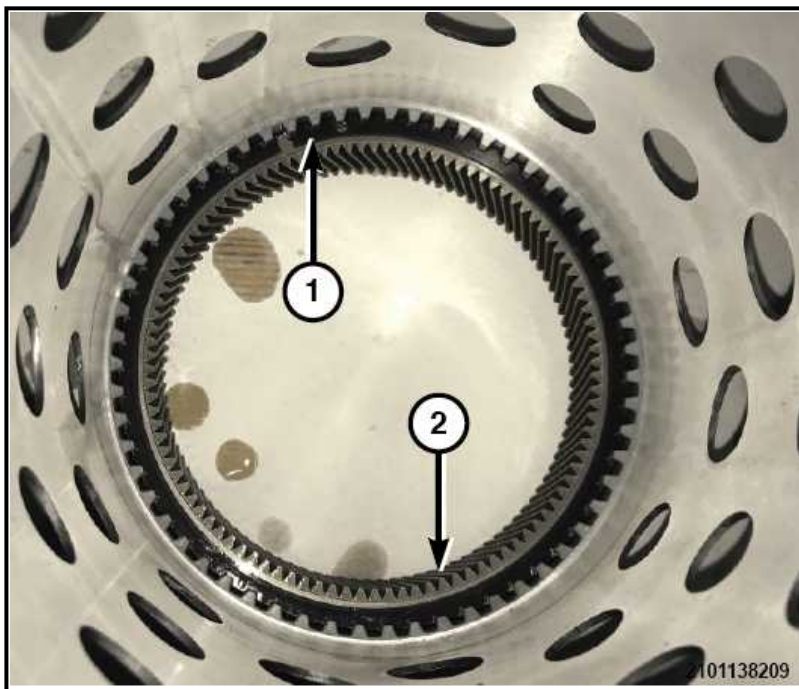
NOTE: Clutch E and Clutch C are similar. The Clutch C hub is removable and has six friction plates.

- 79. Remove Clutch C from the P4 sun gear/Clutch C/E retainer.
- 80. Remove the bearings from the top and bottom of Clutch C.



1 - P4 Planetary Carrier/Output Shaft Lock Ring

- 81. Remove the P4 planetary carrier/output shaft lock ring from the P4 annulus drum by gently prying the locking tabs open and turning the lock ring to center the locating tabs in the output shaft tab openings. **DISCARD** the lock ring and install a **NEW** lock ring during assembly.



1 - Snap Ring
2 - P4 Annulus

82. Remove the snap ring from the P4 annulus drum.

83. Remove the P4 annulus from the P4 annulus drum.

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in ELECTROSTATIC DISCHARGE SENSITIVE DEVICES. Failure to follow these instructions may result in damage to the TCM/TCMA.

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TCM Adaptation Procedure. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#) .

8HP75 - ASSEMBLY

CAUTION: A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

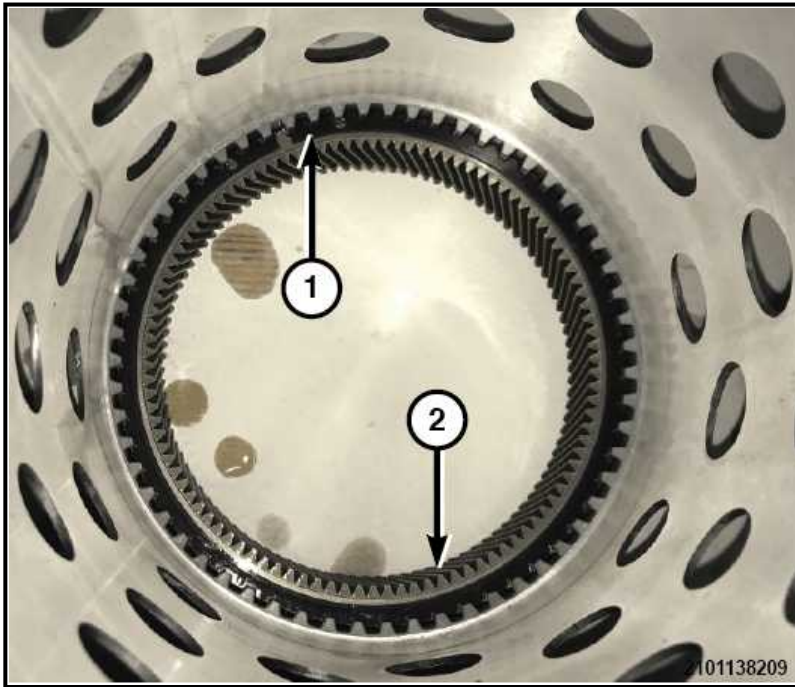
CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in ELECTROSTATIC DISCHARGE SENSITIVE DEVICES. Failure to follow these instructions may result in damage to the TCM/TCMA.

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the TCM Adaptation Procedure. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#) .

ASSEMBLY

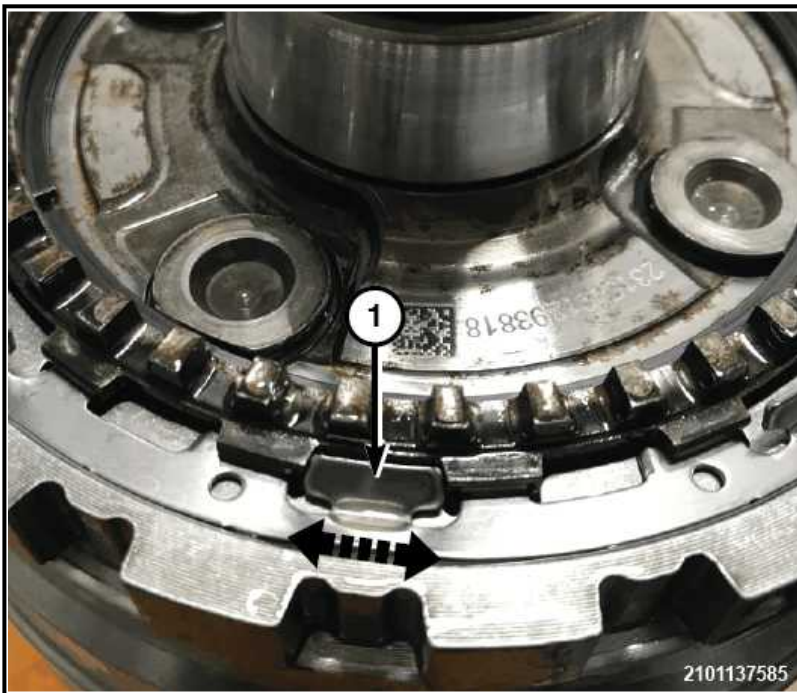
NOTE:

During assembly, torque the fasteners to the specifications in the torque table below.



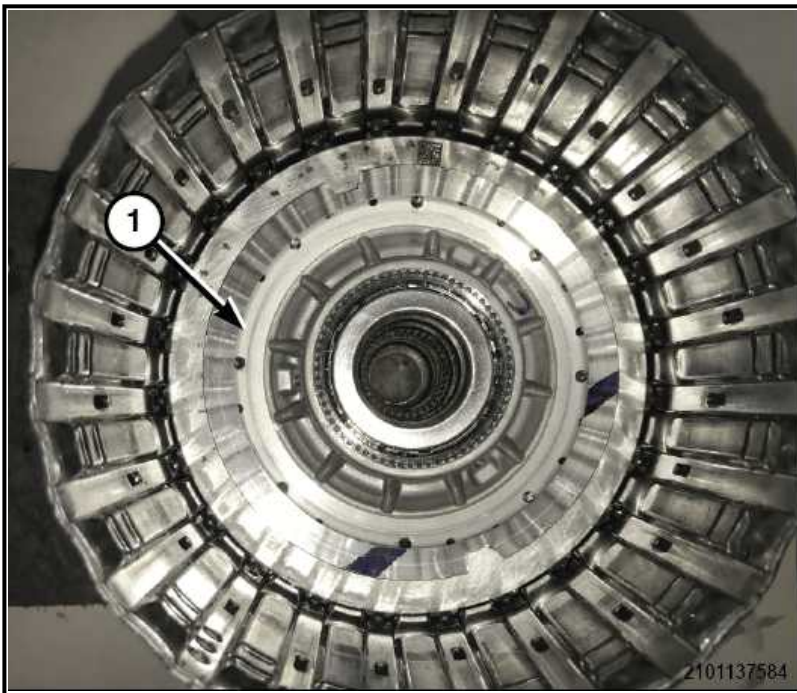
1 - Snap Ring
2 - P4 Annulus

1. Insert the P4 annulus) into the P4 annulus drum.
2. Install the snap ring into the P4 annulus drum.



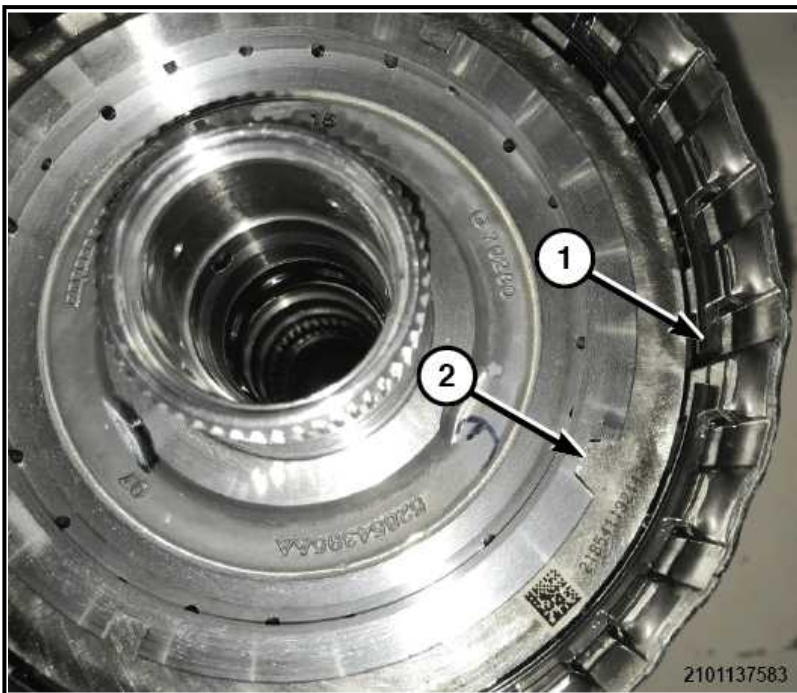
1 - P4 Planetary Carrier/Output Shaft Lock Ring

3. Install the **NEW** P4 planetary carrier/output shaft lock ring from the P4 annulus drum by turning the lock ring to center the lock ring tabs in the output shaft tab openings and gently staking the locking tabs closed.



1 - Clutch C

4. Position the bearings on the top and the bottom of Clutch C.
5. Install Clutch C into the P4 sun gear/Clutch C/E retainer.



1 - Snap Ring

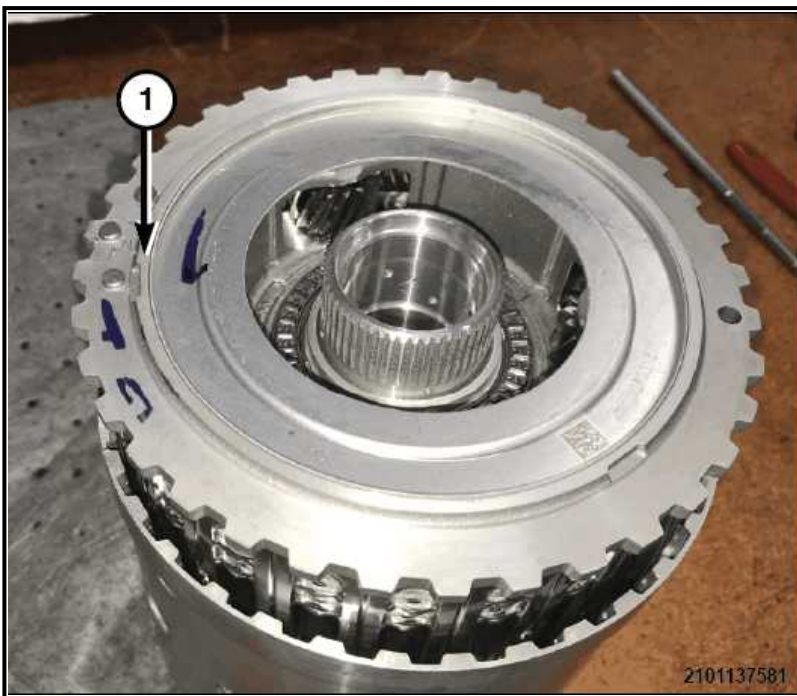
2 - Clutch E

6. Install the needle bearing onto the hub of the Clutch E.
7. Install the Clutch E into the P4 sun gear/Clutch C/E retainer.
8. Install the snap ring into the P4 sun gear/Clutch C/E retainer.



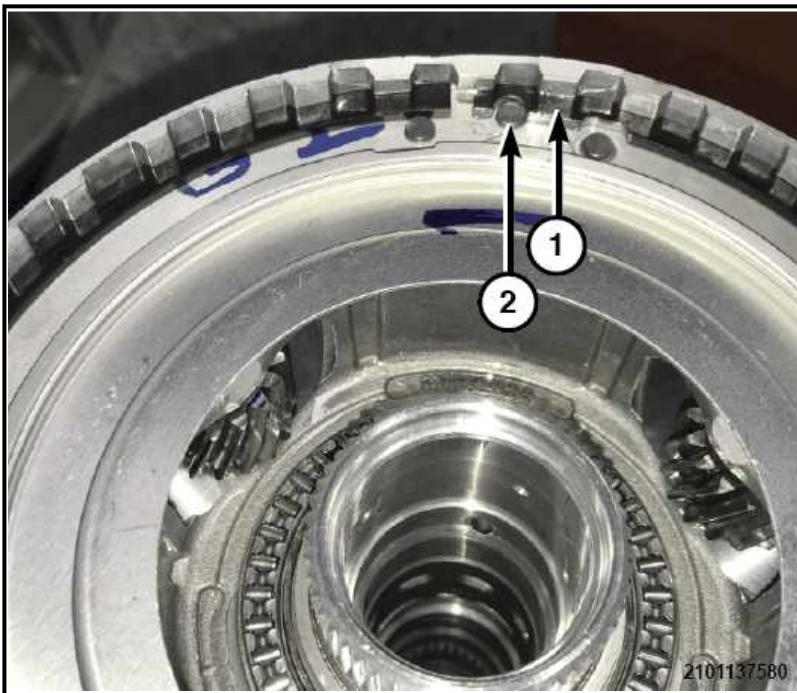
1 - Snap Ring

9. Install the P3 annulus ring into the P4 sun gear/Clutch C/E retainer and install the snap ring.



1 - P3 Planetary Carrier

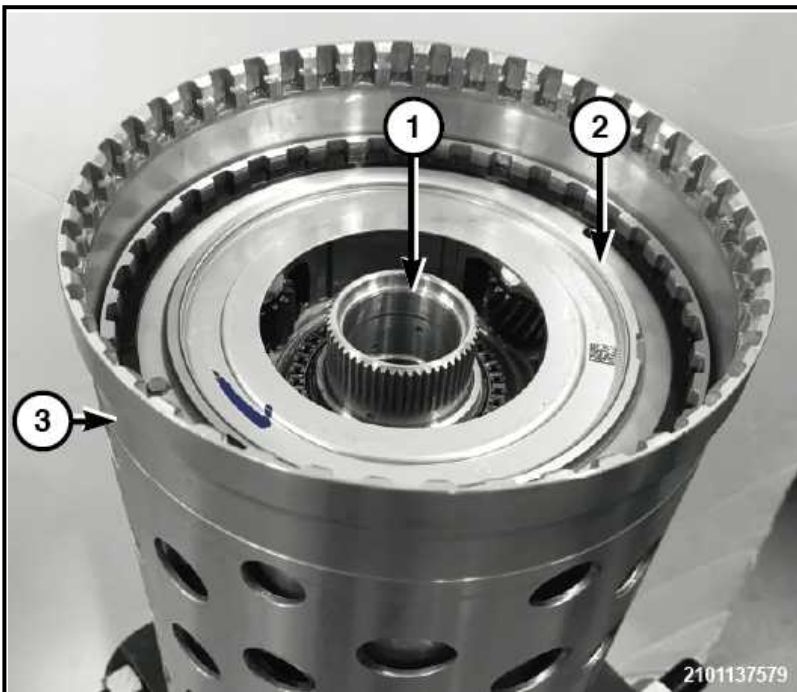
10. Install the P3 sun gear/Clutch C/E retainer into the Clutch D drum.



1 - Snap Ring

2 - P3 Planetary Carrier

11. Install the needle bearing onto the planetary carrier.
12. Install the P3 planetary carrier in the Clutch D drum.
13. Install the snap ring and verify the relief on the snap ring is set in the locating pin.

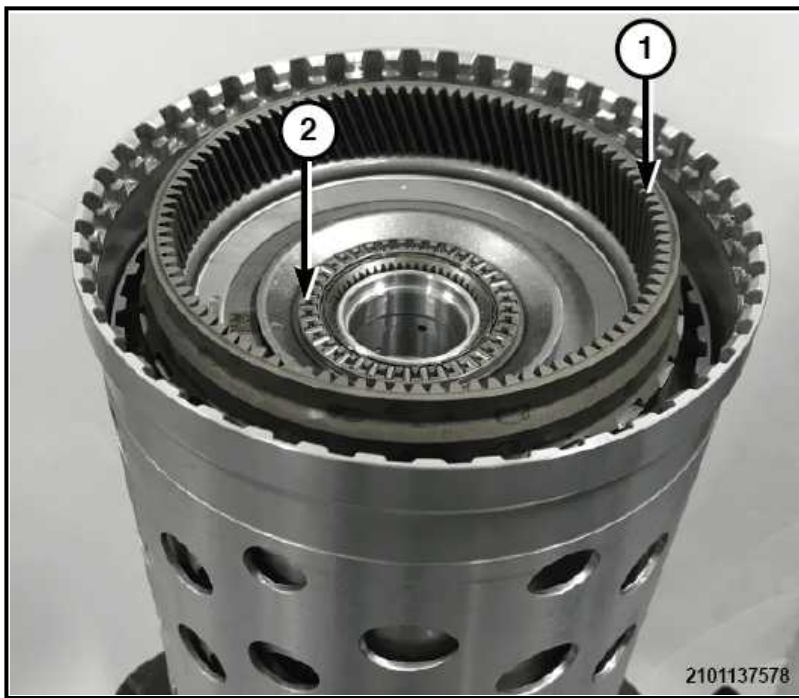


1 - P2 Annulus/P3 Sun Gear

2 - Clutch D Drum

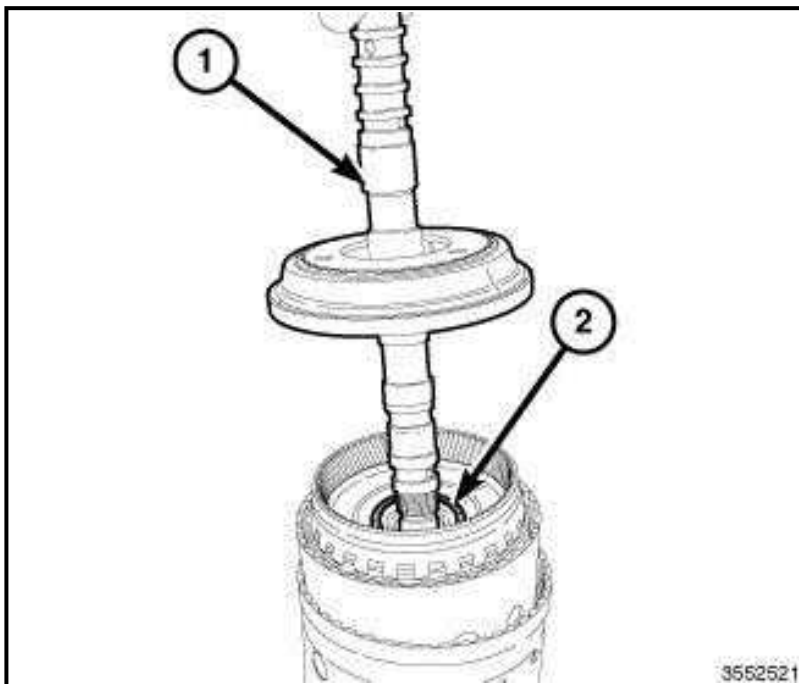
3 - P4 Annulus Drum

14. Install the Clutch D drum into the P4 annulus drum.



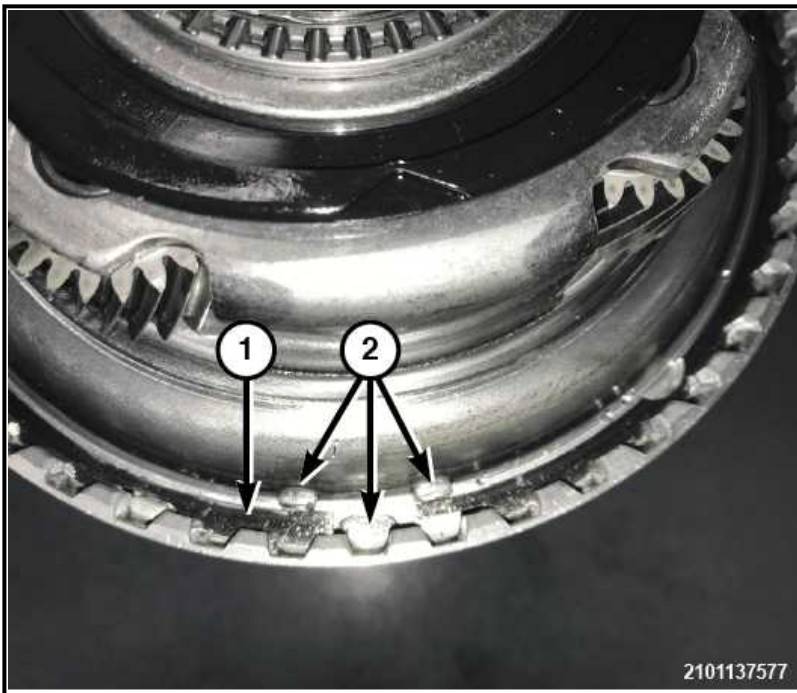
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|-------------------------------|
| 1 - P2 Annulus\P3 Sun Gear |
| 2 - Thrust Bearing and Washer |

15. Install the P2 annulus\P3 sun gear in the drum assembly.
16. Install the thrust bearing and washer.



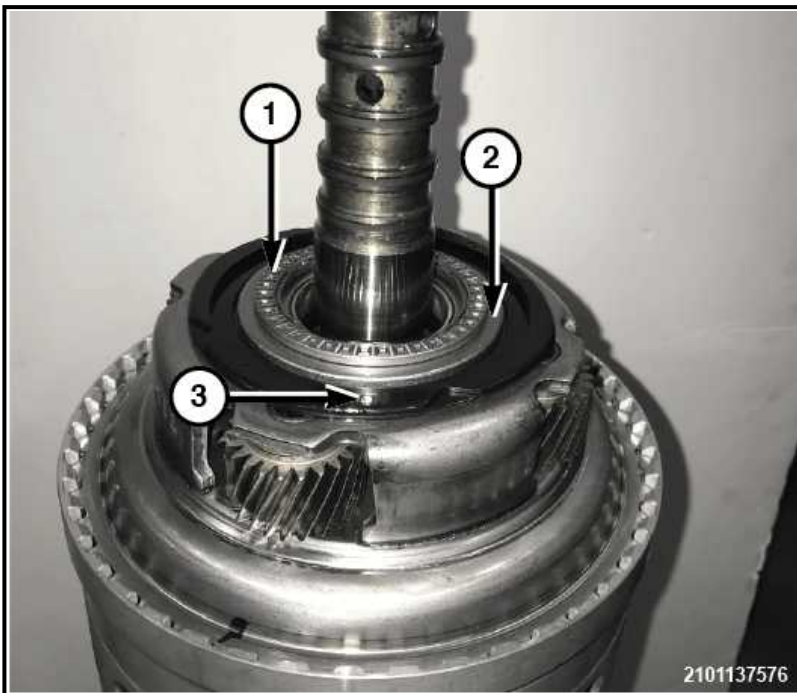
- | |
|--------------------------|
| 1 - Input Shaft |
| 2 - P2 Planetary Carrier |

17. Install the input shaft with P2 planetary carrier into the drum assembly.



1 - Snap Ring
2 - Snap Ring Locating Tabs

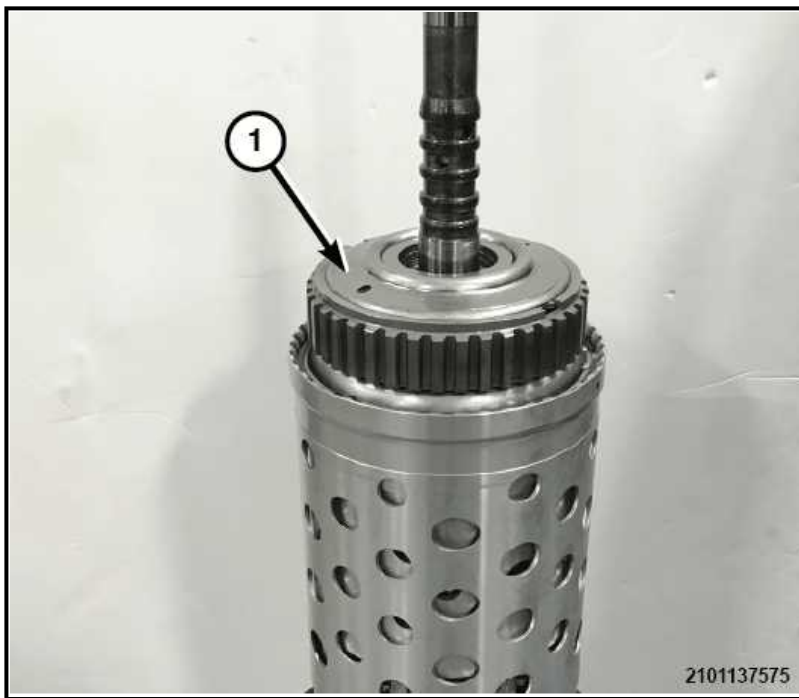
18. Install the snap ring in the orientation shown (snap ring will only install one way) with the locating tabs.



1 - Thrust Bearing
2 - Holding Plate
3 - Selectable Shim

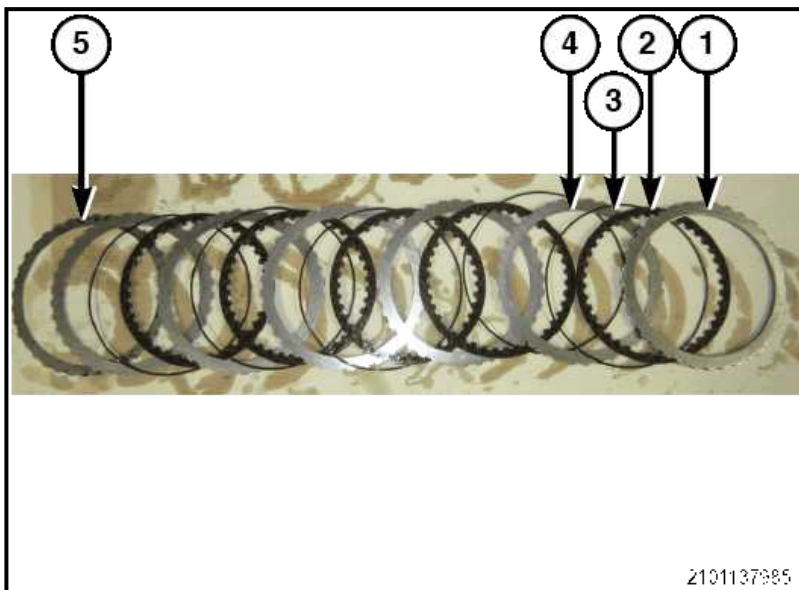
19. Install the thrust bearing and holding plate onto the P1 planetary carrier.

20. Install the selectable shim to the P1 annulus/Clutch B hub.



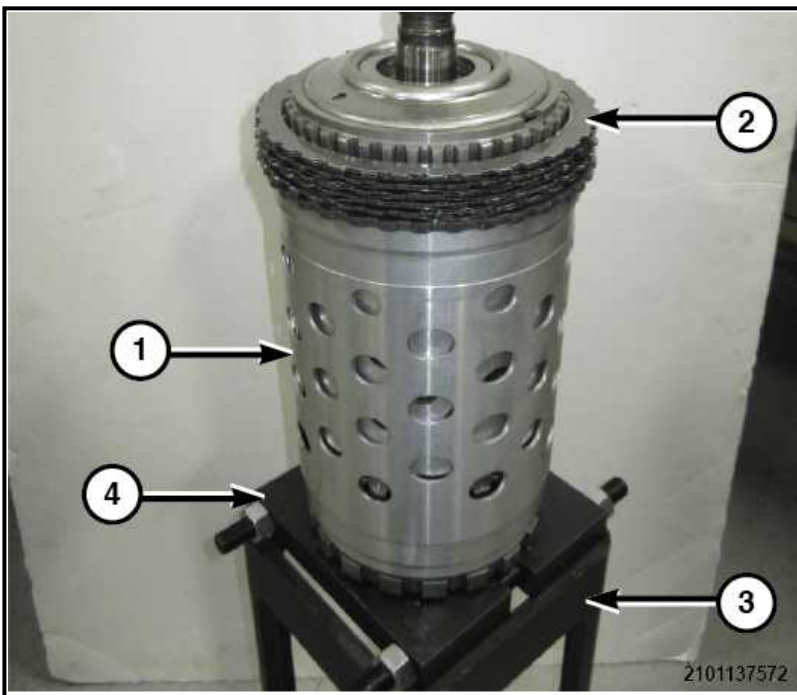
1 - P1 Annulus/Clutch B Hub Assembly

21. Install the P1 annulus\Clutch B hub assembly onto the P4 annulus drum.
22. Install the O-ring and five squared O-rings on the input shaft.



- | |
|---------------------|
| 1 - Cover Plate |
| 2 - Friction Plates |
| 3 - Wave Springs |
| 4 - Steel Plates |
| 5 - Wave Plate |

23. The Clutch B, dependent on transmission Julian Date, may contain wave springs that sit around each fiber. There will be five friction plates (discs), five wave springs, five steel plates, one cover plate, one snap ring, and one wave plate (last plate far left in figure).



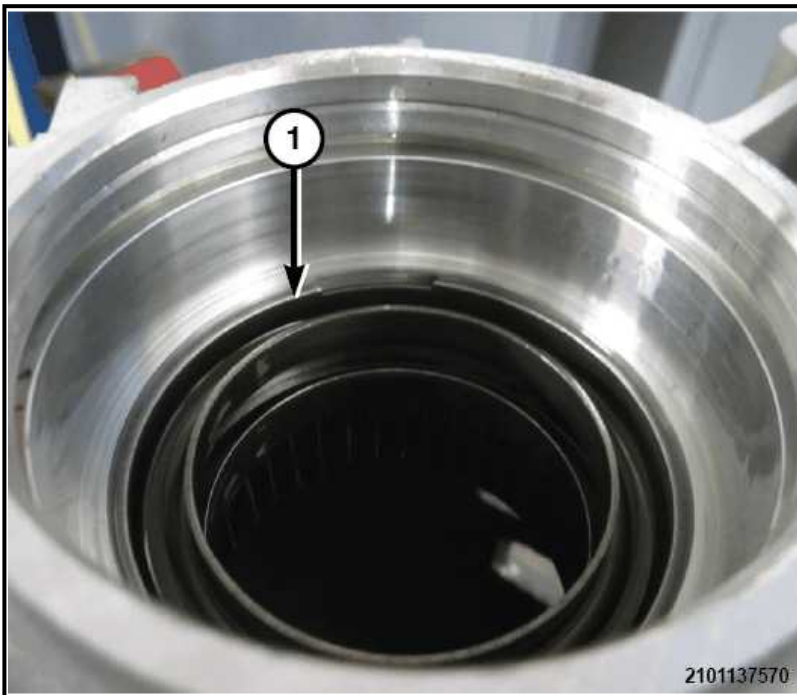
1 - Input/Output Shaft and P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

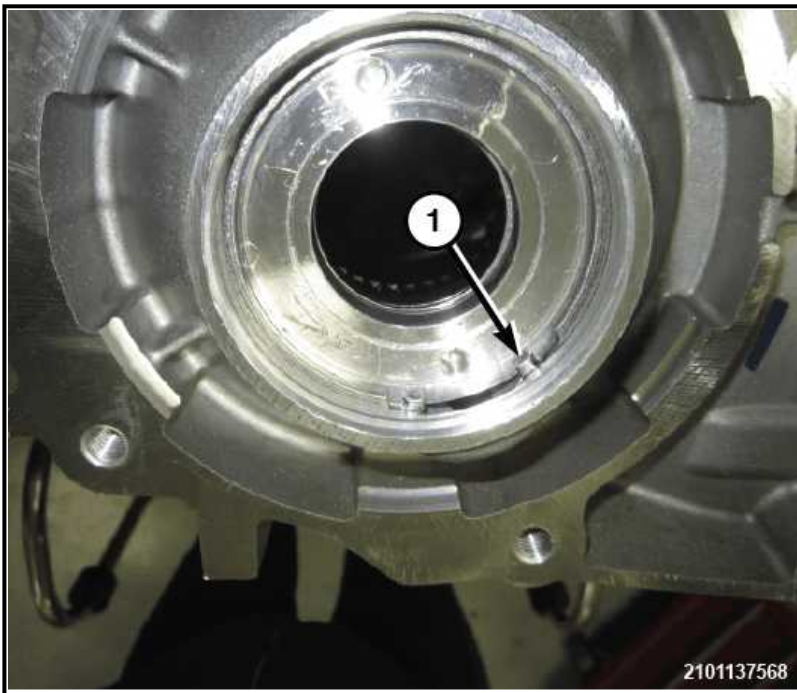
4 - Bearing/Gear Splitter

24. Install the Clutch B discs and plates.



1 - Output Shaft Oil Dam Snap Ring

25. Install the output shaft oil dam and the snap ring.



1 - Outer Bearing Cup Snap Ring

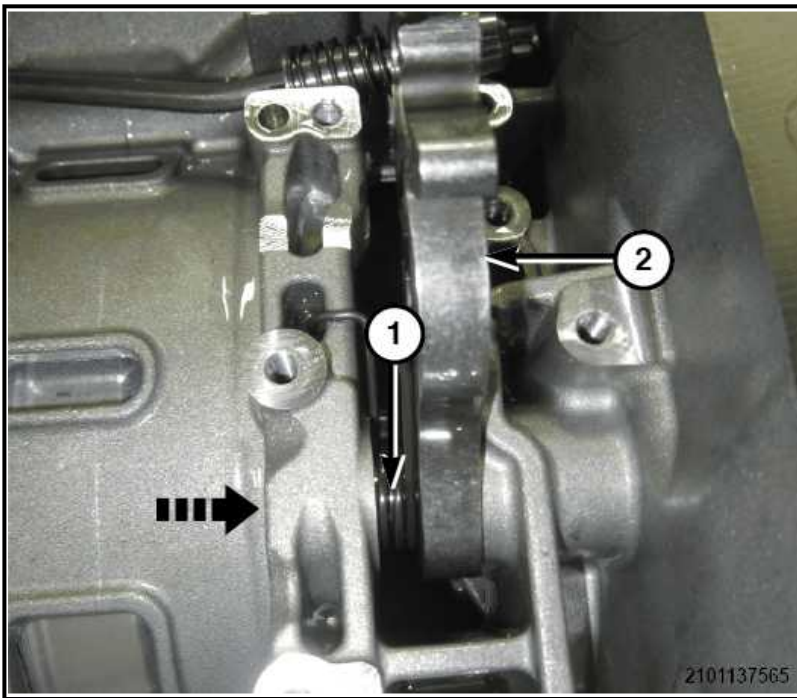
26. Install the needle bearing (4WD) or ball bearing (2WD).
27. Install the snap ring.



1 - Input/Output Shaft and P4 Annulus Drum Assembly

NOTE: The transmission must be in a vertical position when installing the main stack, so damage to the drums does not occur.

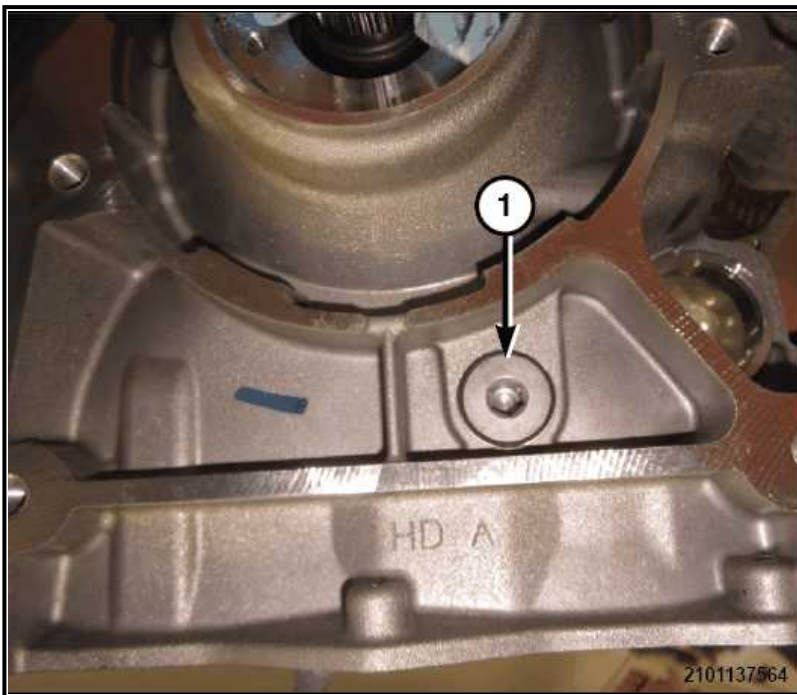
28. Install the input/output shaft and P4 annulus drum assembly into the case.



1 - Park Pawl Spring

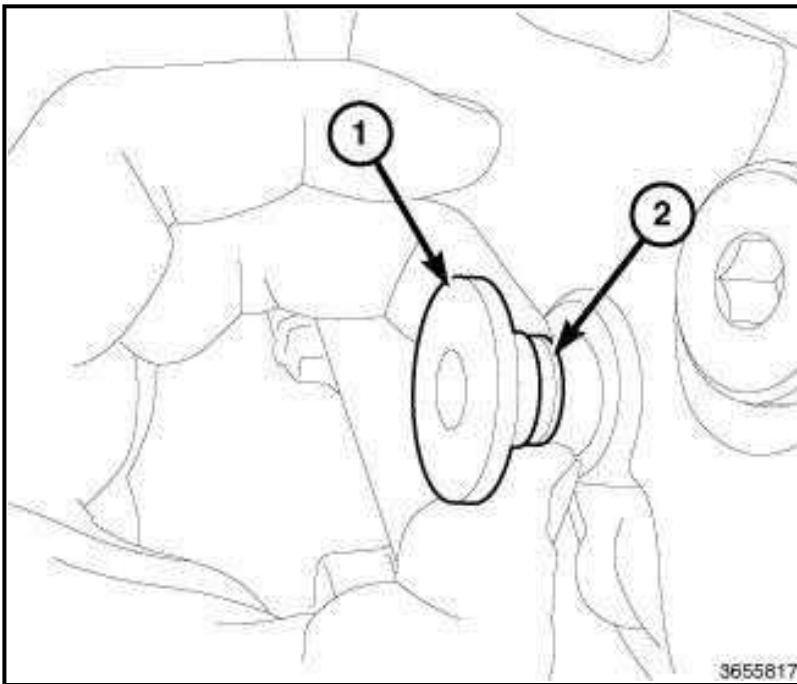
2 - Park Pawl

29. From outside the transmission case, install the park pawl shaft and install the park pawl and spring.



1 - Park Pawl Shaft Plug

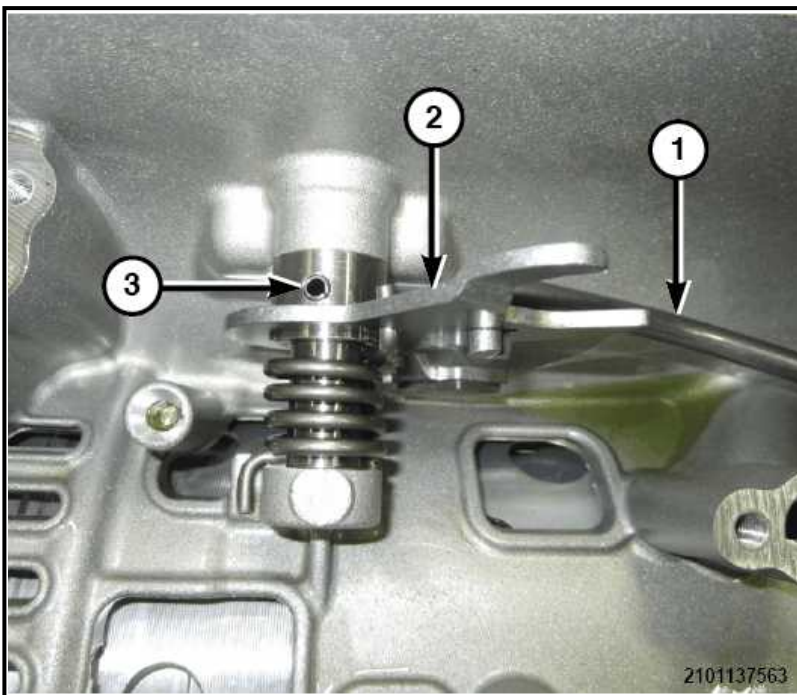
30. Install the park pawl shaft plug into the rear of the case.



1 - Spacer 6936

2 - Manual Park Release Shaft Seal

31. Using (special tool #6936, Spacer), install the Manual Park Release (MPR) shaft seal.



1 - Park Pawl Lock Rod

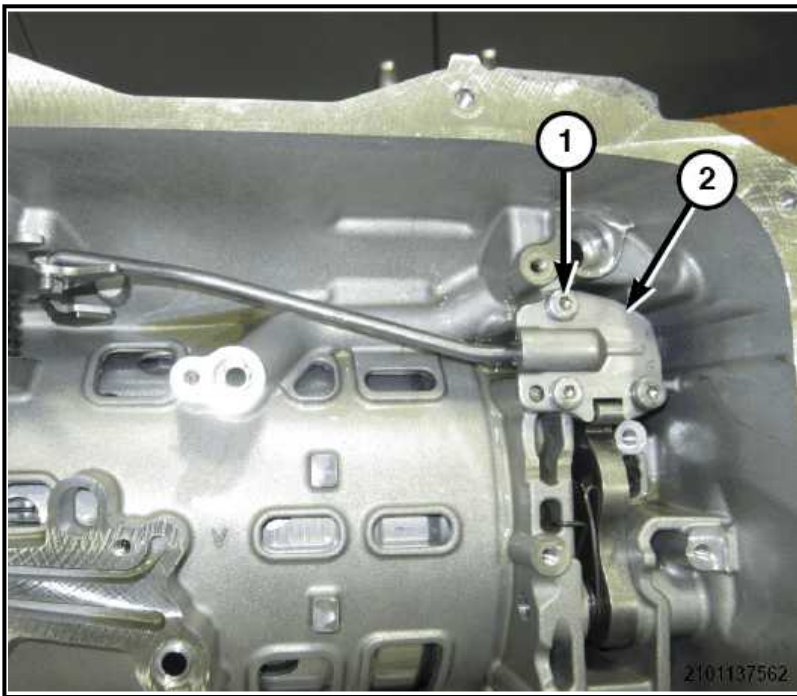
2 - Fork

3 - Roll Pin

32. Install the MPR shaft, spring, and lever assembly into the case.

33. Install the roll pin flush with the MPR lever assembly hub using a suitable pin punch.

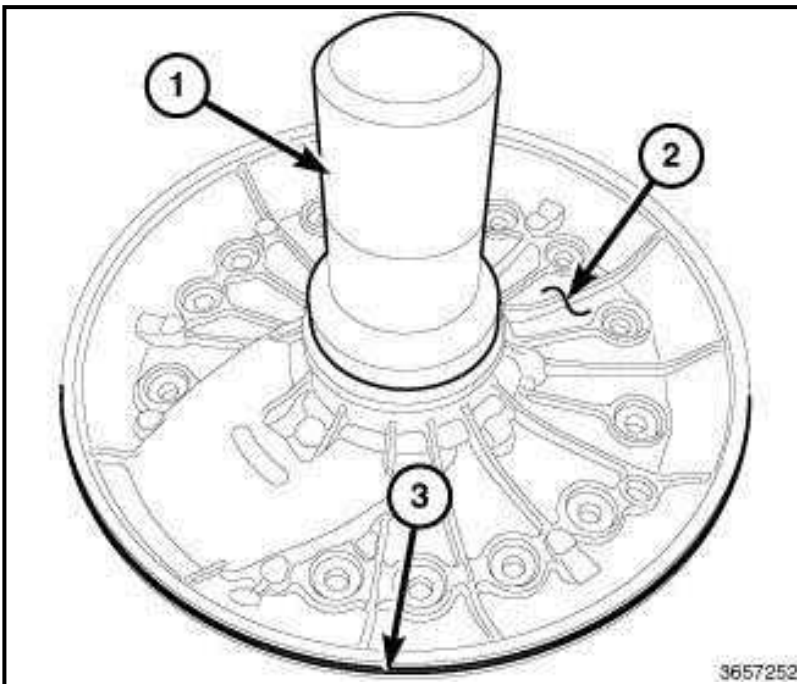
34. Install the park pawl lock rod onto the fork.



1 - Park Pawl Lock Rod Guide Plate Retaining Bolts
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2 - Park Pawl Lock Rod Guide Plate

35. Position the park pawl lock rod guide plate, install the three park pawl lock rod guide plate retaining bolts.

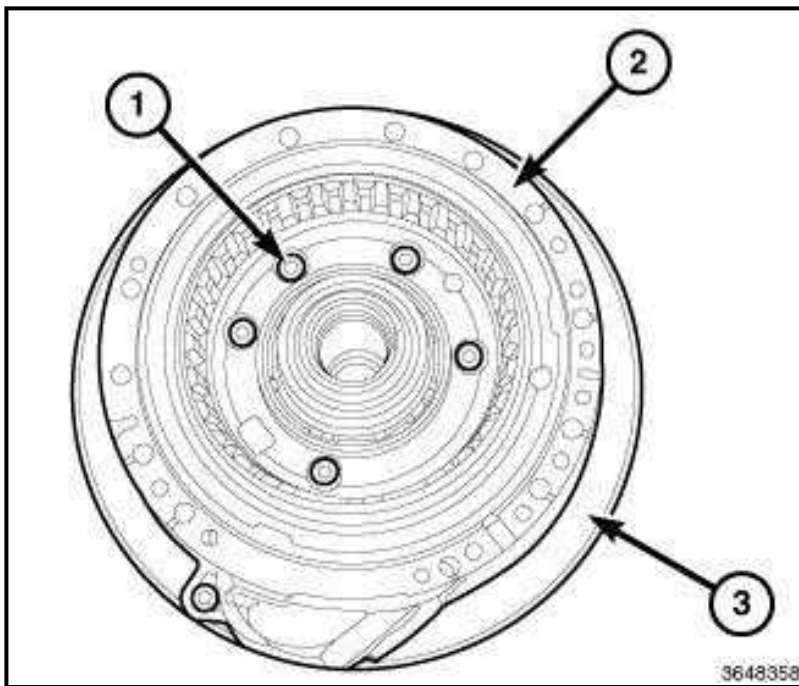


1 - Oil Pump Cover Oil Seal Installer

2 - Oil Pump Cover

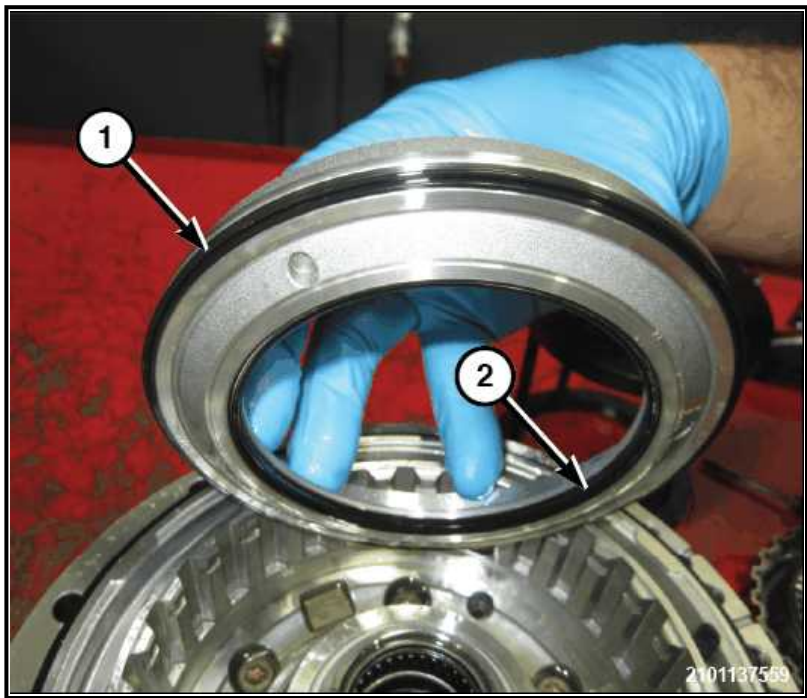
3 - Oil Pump Cover Lip Seal

36. Using (special tool #10375, Installer, Oil Pump Cover Oil Seal), install the oil pump cover oil seal.



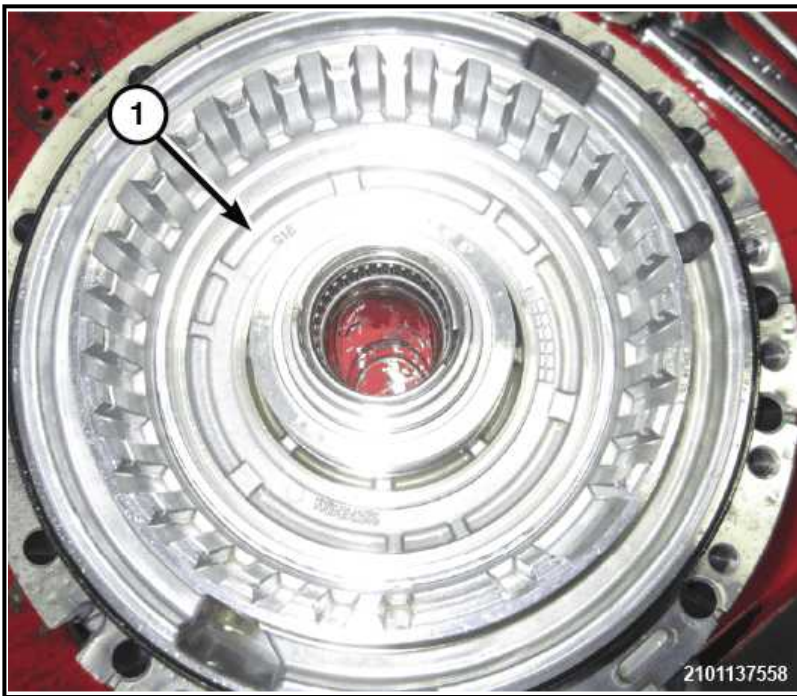
1 - Transmission Oil Pump Housing to Cover Bolts
2 - Transmission Oil Pump Housing
3 - Transmission Oil Pump Front Cover

- 37. Position the transmission oil pump housing and oil pump cover together.
- 38. Install the transmission oil pump housing to cover bolts.



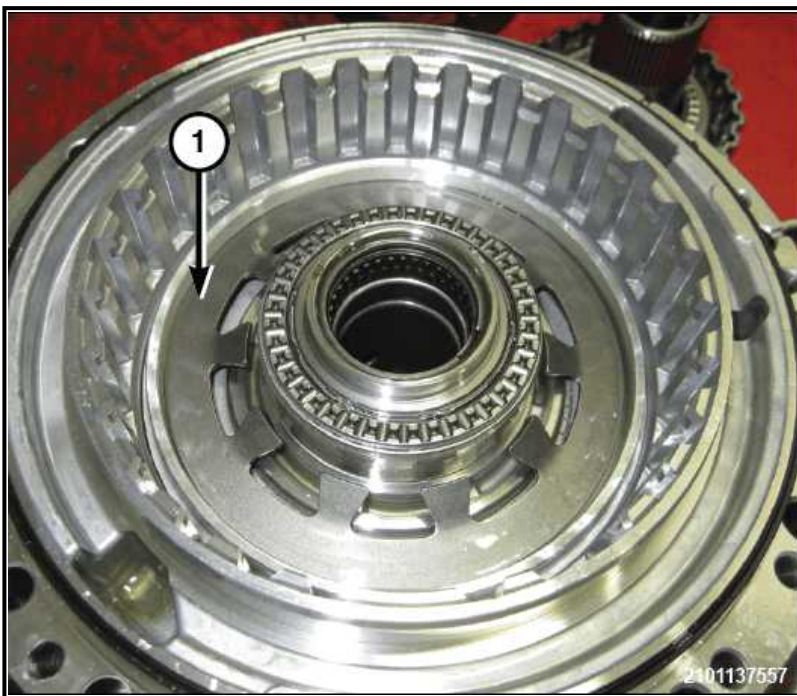
1 - Clutch A Piston Outer Seal
2 - Clutch A Piston Inner Seal

- 39. Lube the Clutch A piston inner and outer seals using transmission assembly lube.



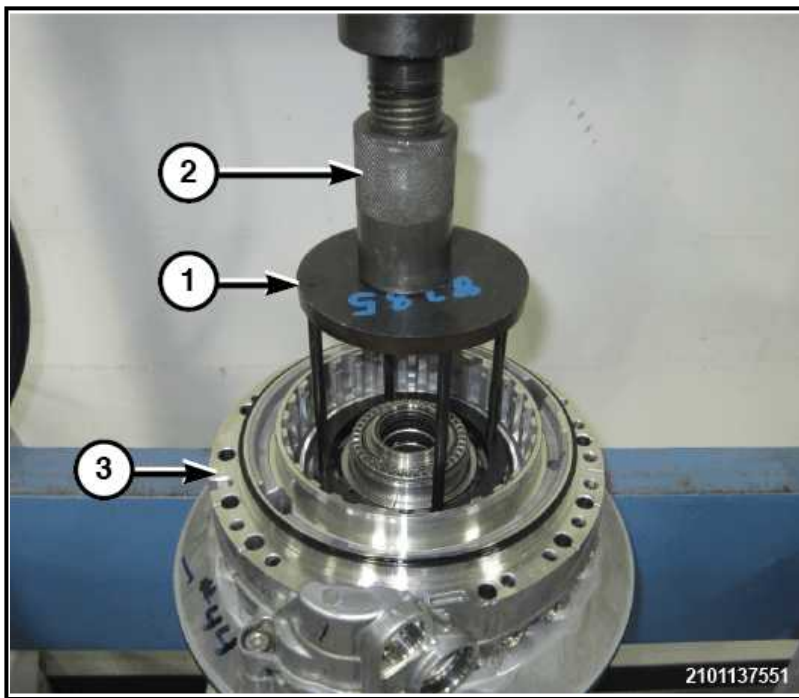
1 - Clutch A Piston

40. Install the Clutch A piston in the housing.



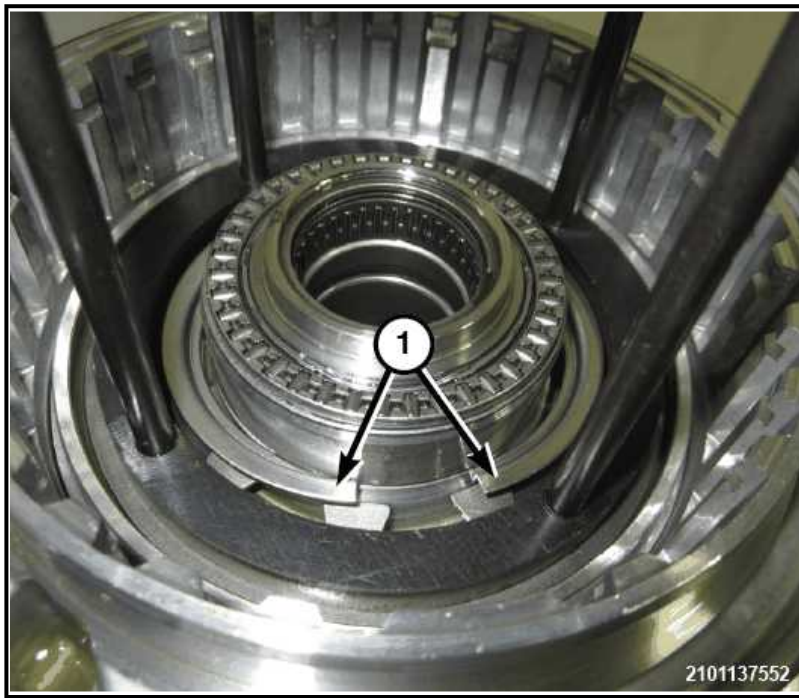
1 - Clutch A Belleville Spring

41. Install the Clutch A belleville spring in the housing.



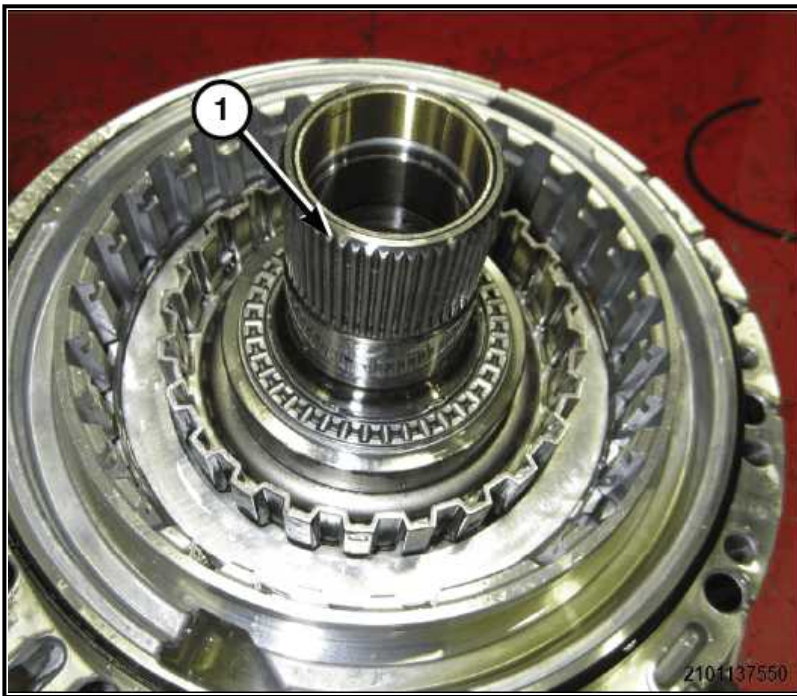
1 - Spring Compressor Tool
2 - Arbor Press
3 - Transmission Oil Pump Assembly

42. Position the oil pump assembly in a suitable arbor press.
43. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retaining ring to remove tension, and install the two halves of the split retainer ring.



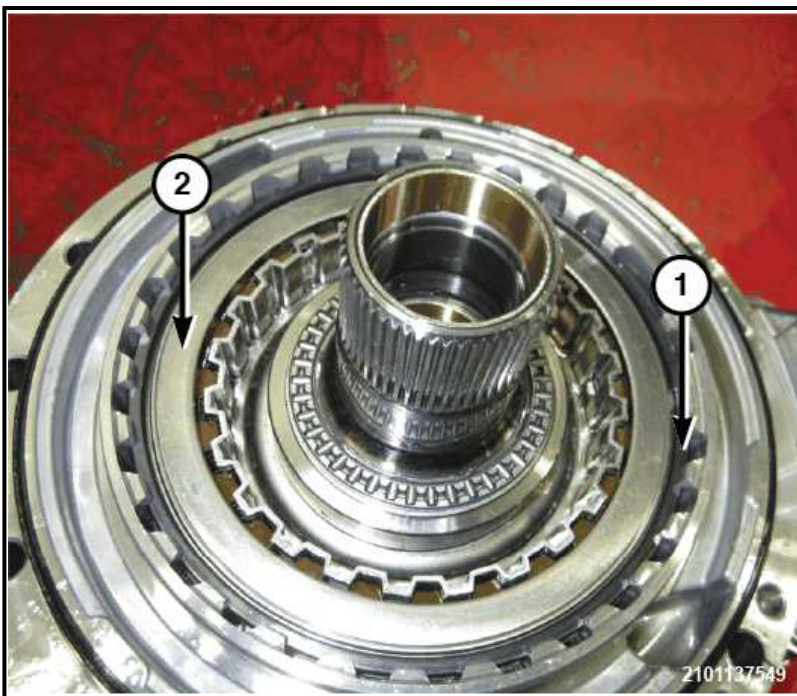
1 - Retaining Ring

44. Verify the split retainer ring halves are seated in the groove.



1 - Hub

45. Install the hub.

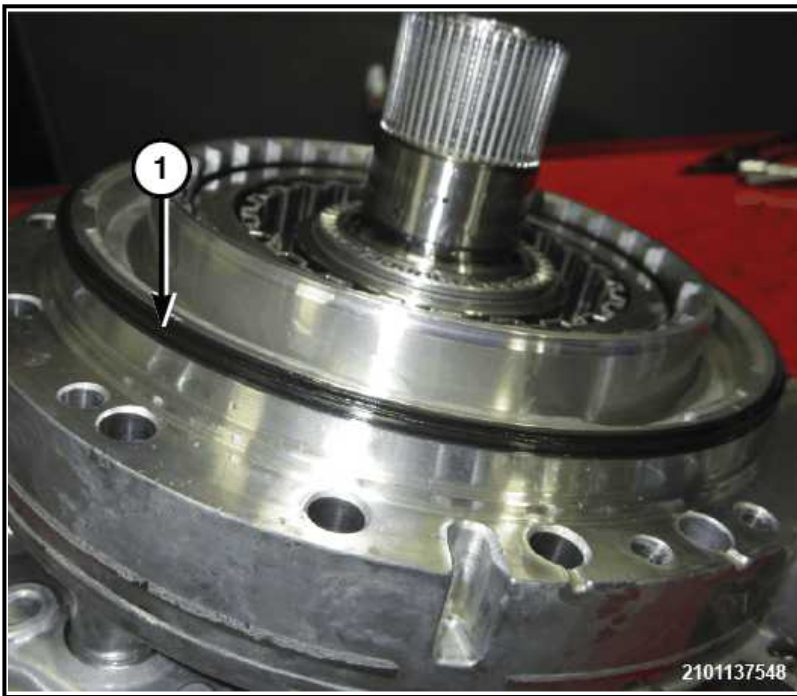


1 - Snap Ring

2 - Clutch A Discs and Plates

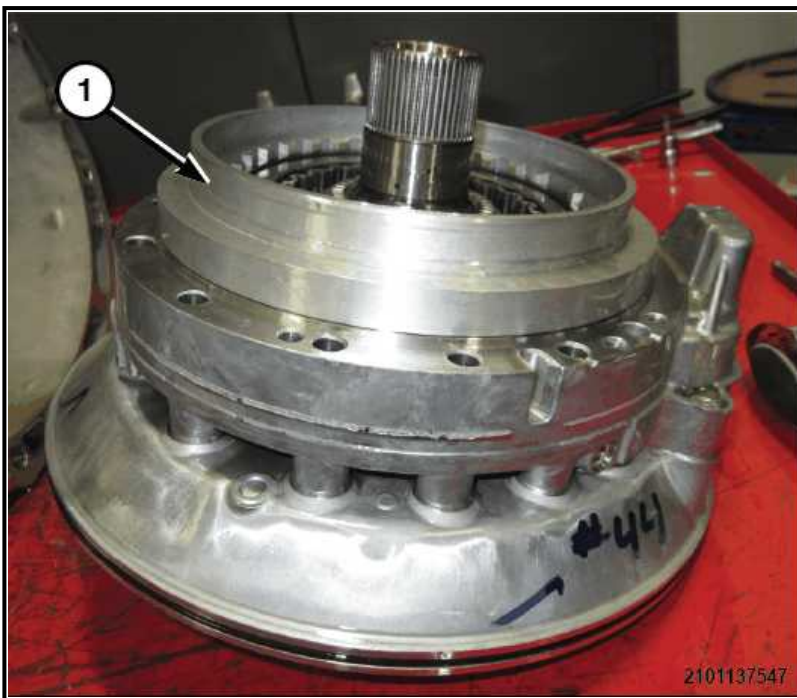
46. Install the Clutch A disks and plates.

47. Install the snap ring.



1 - Clutch B Piston Seal

48. Verify the Clutch B seal is not worn or damaged, replace if the seal is questionable.



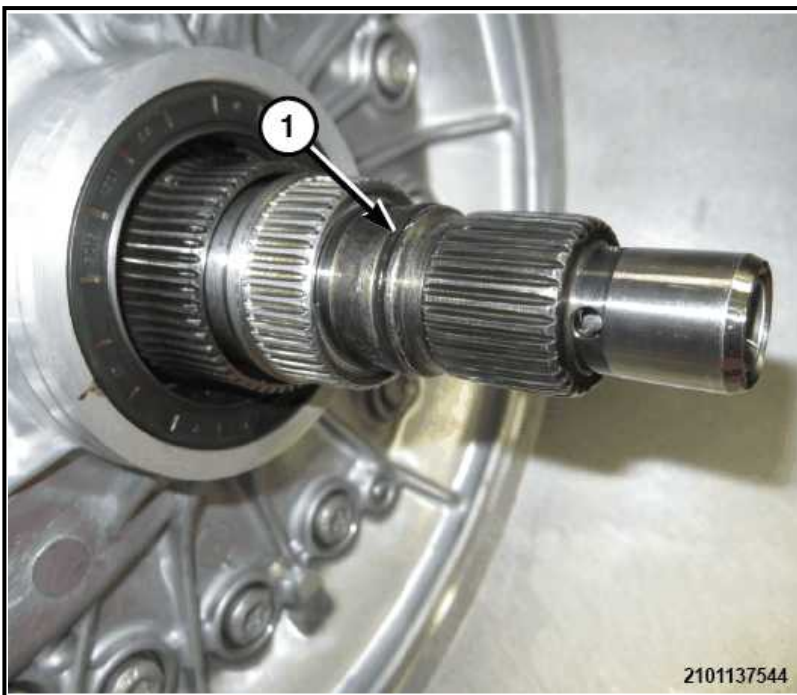
1 - Clutch B Piston

49. Install the Clutch B piston.



1 - Clutch B Damper Spring

50. Install the Clutch B damper spring on the assembly.



1 - Input Shaft O-Ring

51. Carefully position the oil pump housing assembly into the case.

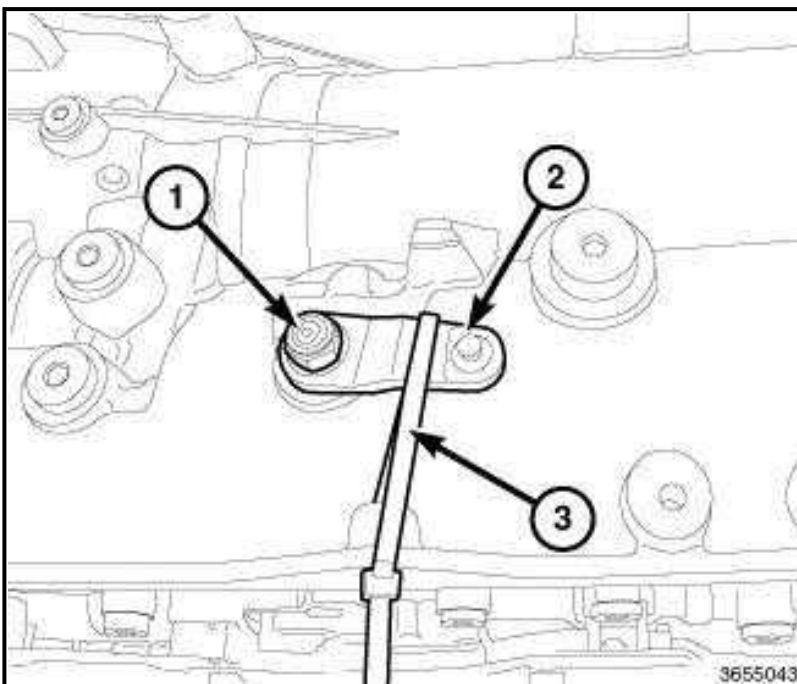
52. Install the **NEW** input shaft O-ring.



1 - Transmission Oil Pump Assembly to Case Bolts

NOTE: Firmly press the oil pump in place before drawing it in with the bolts.

53. Install **NEW** transmission oil pump assembly to case bolts.



1 - Manual Park Release (MPR) Lever Retaining Nut

2 - Manual Park Release (MPR) Lever

3 - Tie Strap

NOTE: The Manual Park Release (MPR) lever can be reversed to release tension and ease the installation of the valve body assembly.

54. Temporarily install the MPR lever to release tension on the shift fork as follows:

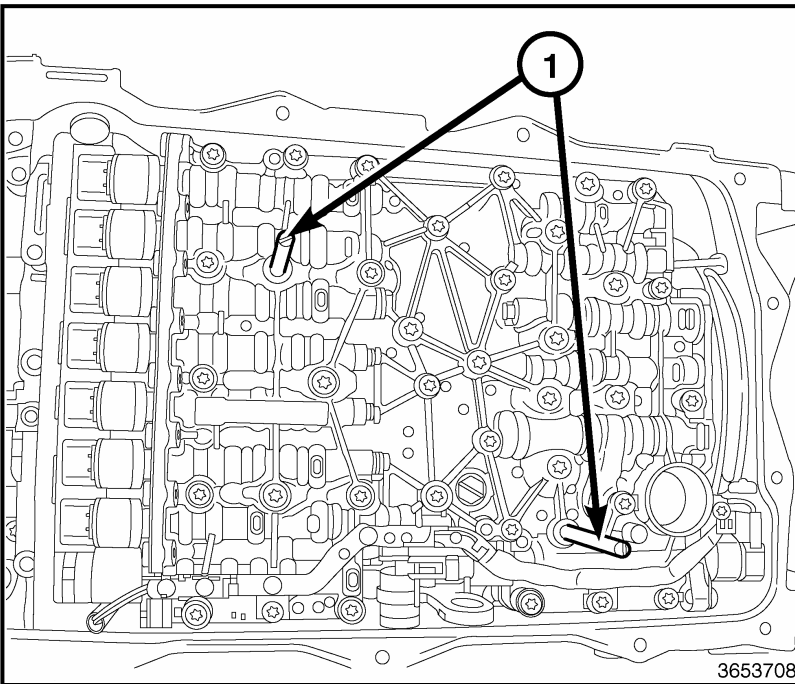
- a. Install the MPR lever 180 degrees offset from its original position.
- b. Install the MPR retaining nut and hand tighten.

- c. Turn the MPR lever and using a tie strap, secure the lever into position so the park release fork is in the same position as it was before valve body assembly removal.



1 - Fluid Transfer Port

55. Install the fluid transfer port with **NEW** O-rings to the transmission case.



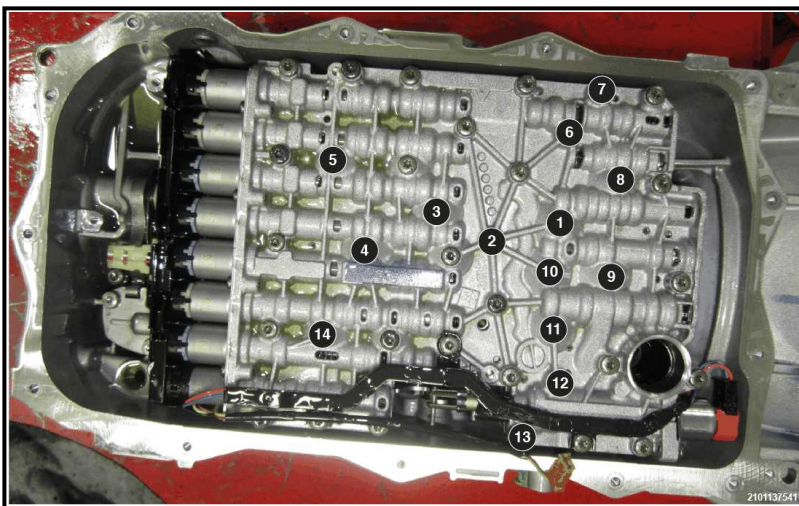
1 - Pins, Valve Body Alignment 10379

56. Install the (special tool #10379, Pins, Valve Body Alignment) in the transmission case as guides for the valve body assembly.

NOTE: Make sure the shift fork lines up properly.

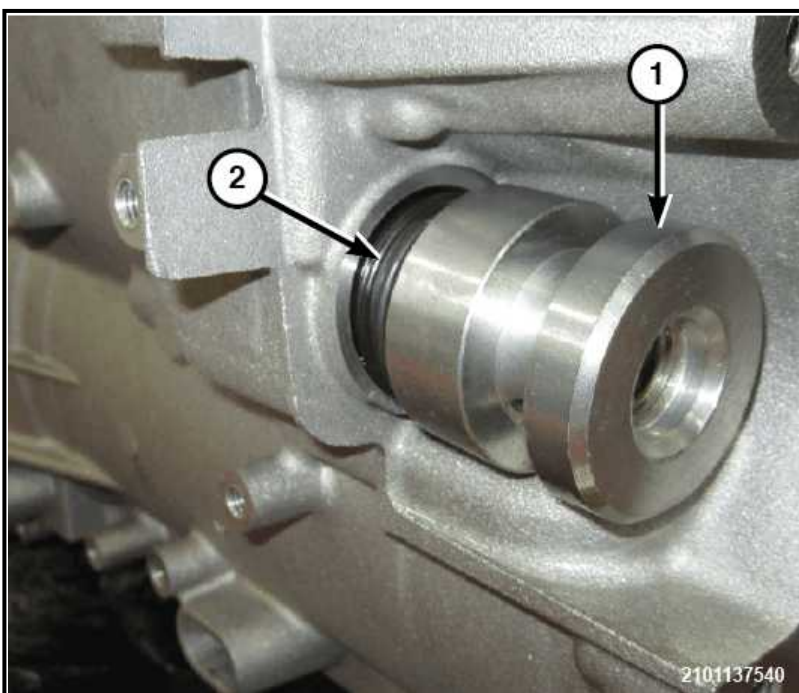
57. Using the valve body alignment pins position the valve body assembly to the transmission.

NOTE: After several bolts have been hand tightened, remove the guide pins.



1-14 - Valve Body Bolt Installation Sequence

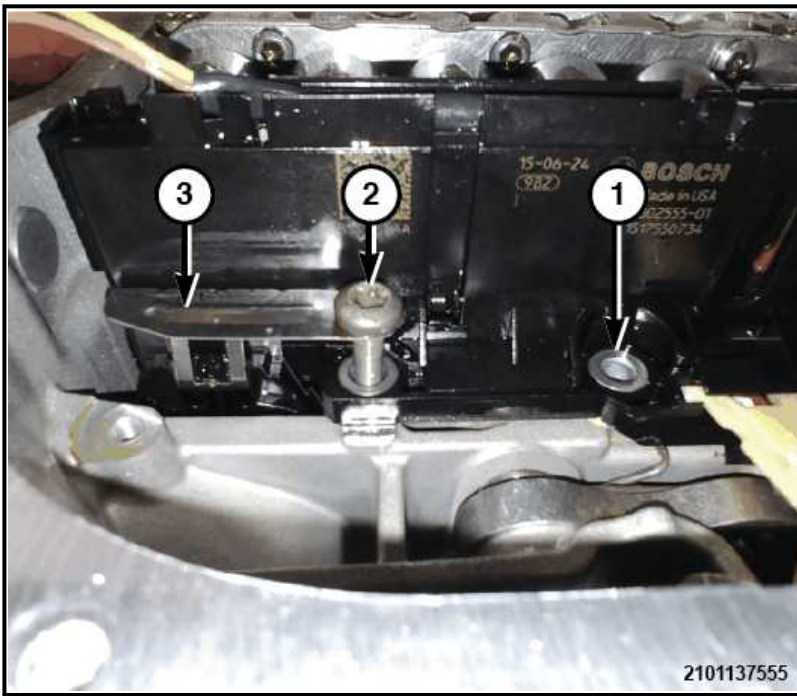
58. Install the valve body assembly bolts.



1 - Guide Sleeve Remover/Installer

2 - Electrical Harness Guide Sleeve

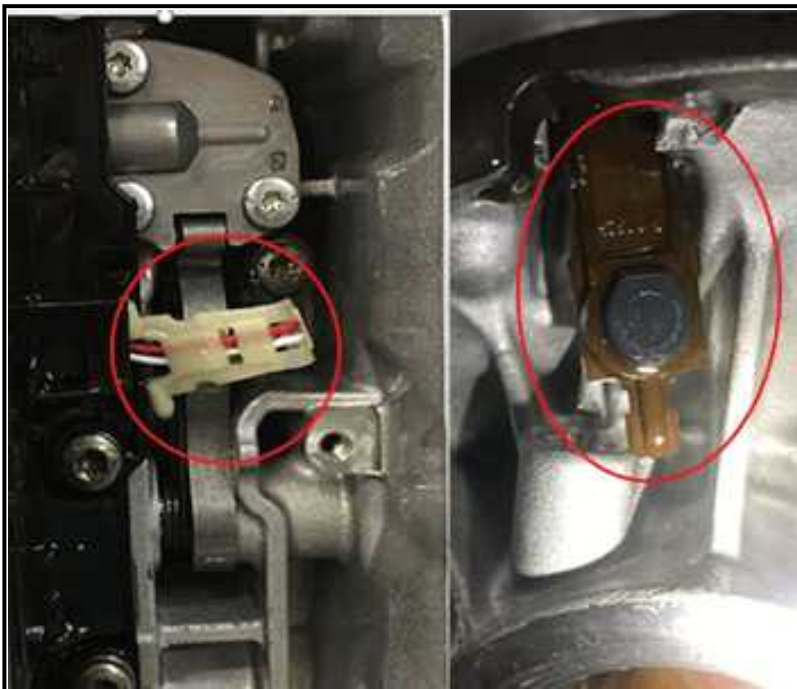
59. Using (special tool #10377, Remover/Installer, Guide Sleeve), carefully install the electrical harness guide sleeve into the transmission case.



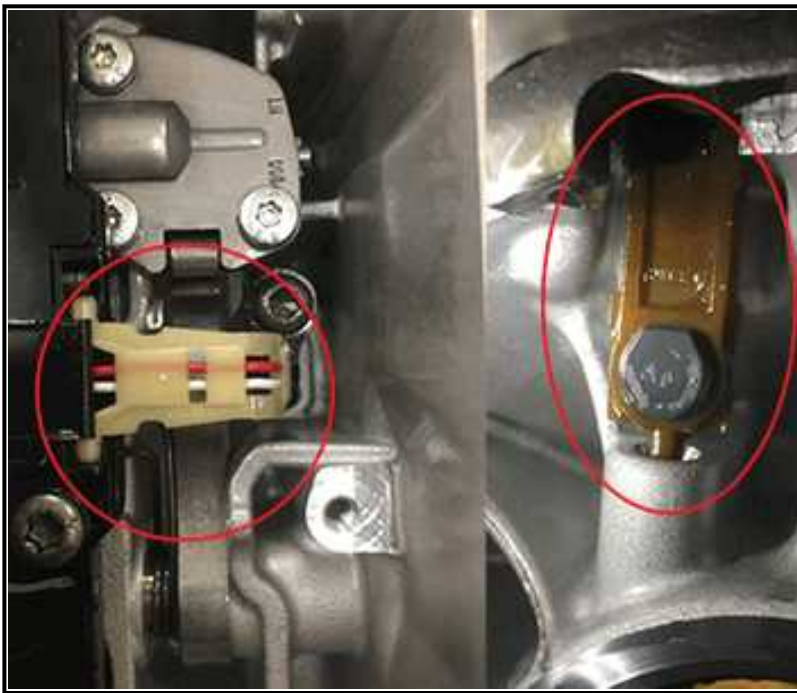
1 - Valve Body End Bolt
2 - Electrical Connector Lock Bolt
3 - Electrical Connector Lock

60. Latch the electrical connector lock by pushing down.

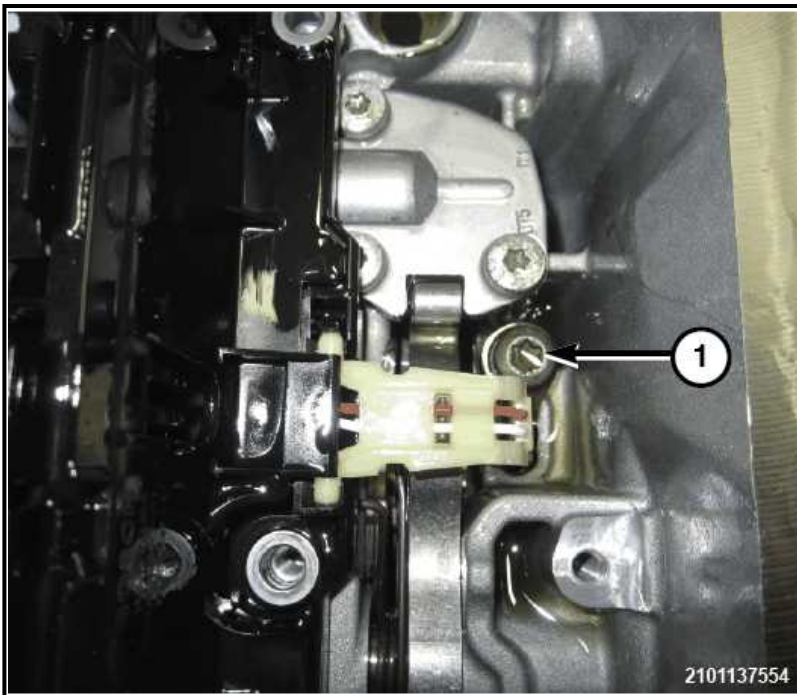
61. Install the valve body end bolt and electrical connector lock bolt.



62. When installing the Output Speed Sensor (OSS) into the case, take care to position the OSS guide pin as shown below or **DAMAGE** to the sensor may result. This is the **INCORRECT** alignment of the pin.

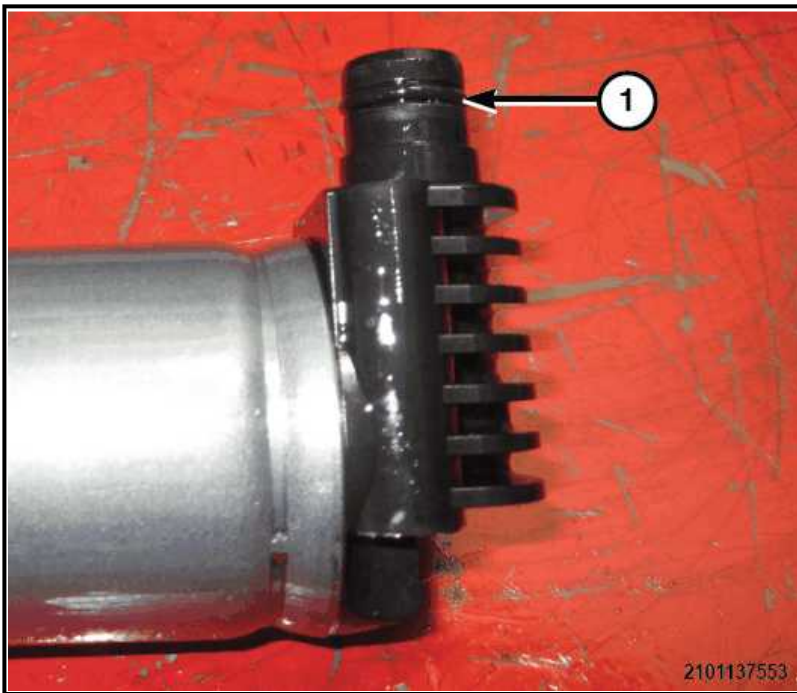


63. This is the **CORRECT** installation and pin alignment.



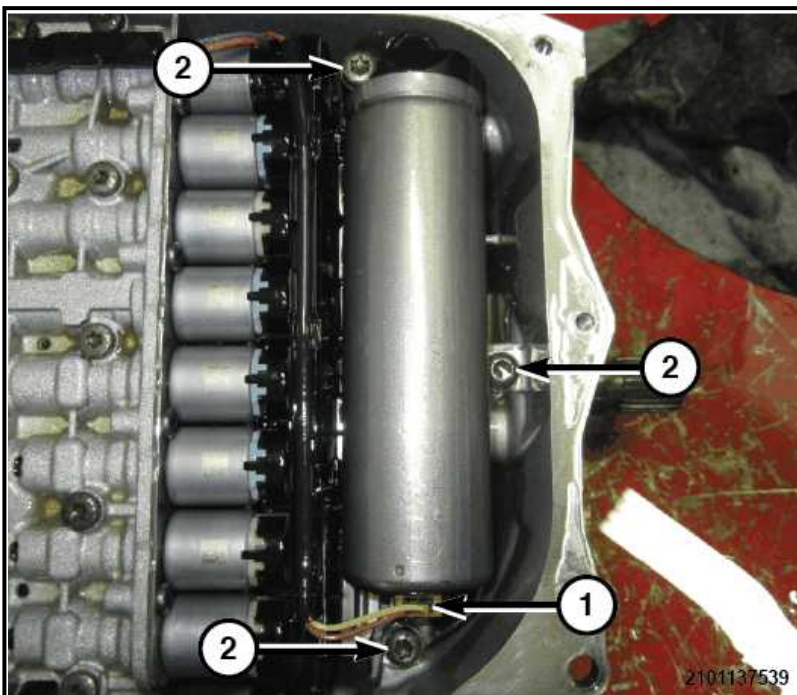
1 - Output Speed Sensor Bolt

64. Install the output speed sensor and the bolt in the case and tighten to.



1 - Hydraulic Impulse Solenoid (HIS) O-ring

65. Verify the Hydraulic Impulse Solenoid (HIS) accumulator O-ring is not torn or damaged. Replace if necessary.

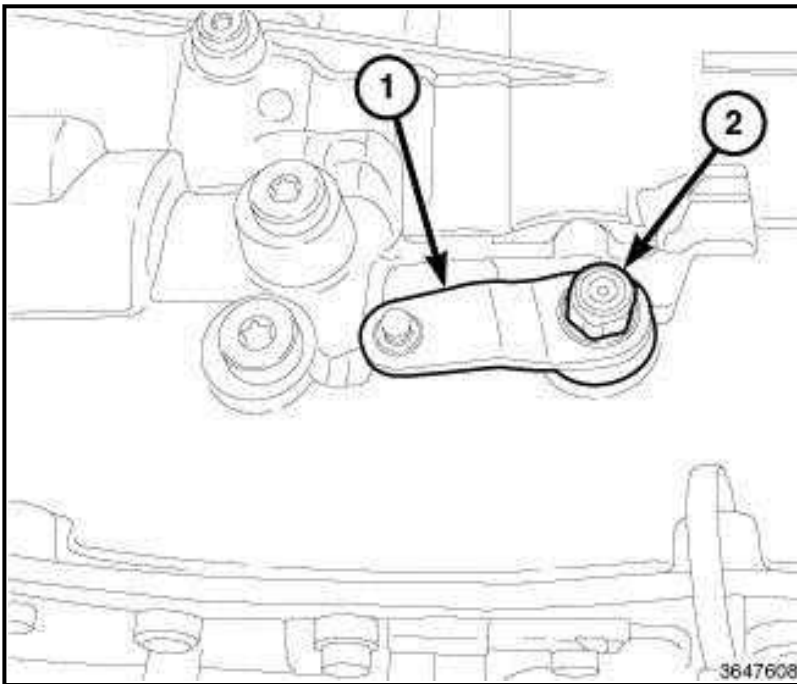


1 - Hydraulic Impulse Solenoid (HIS) Wire Harness Connector

2 - Hydraulic Impulse Solenoid (HIS) Bolts

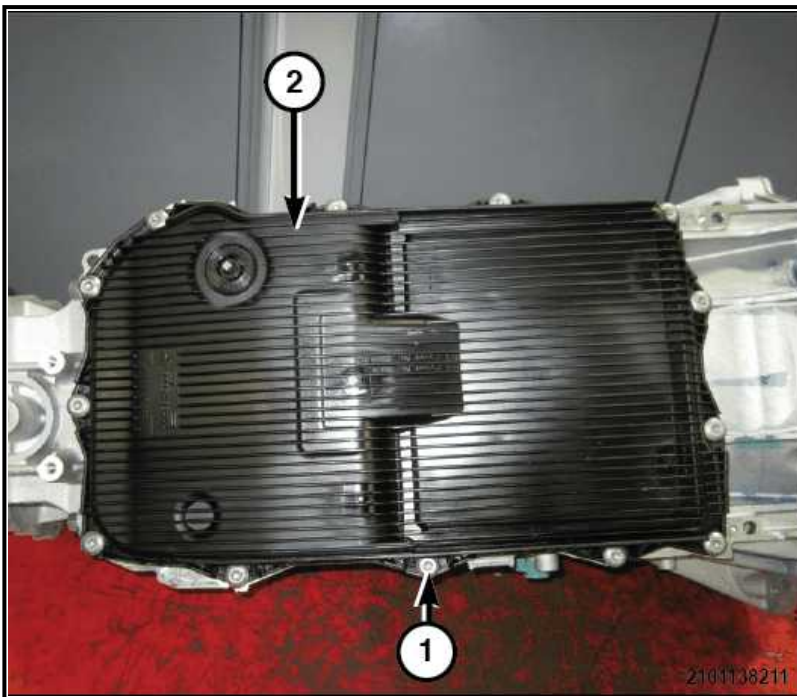
66. If equipped, install the HIS.

67. Connect the HIS electrical connector.



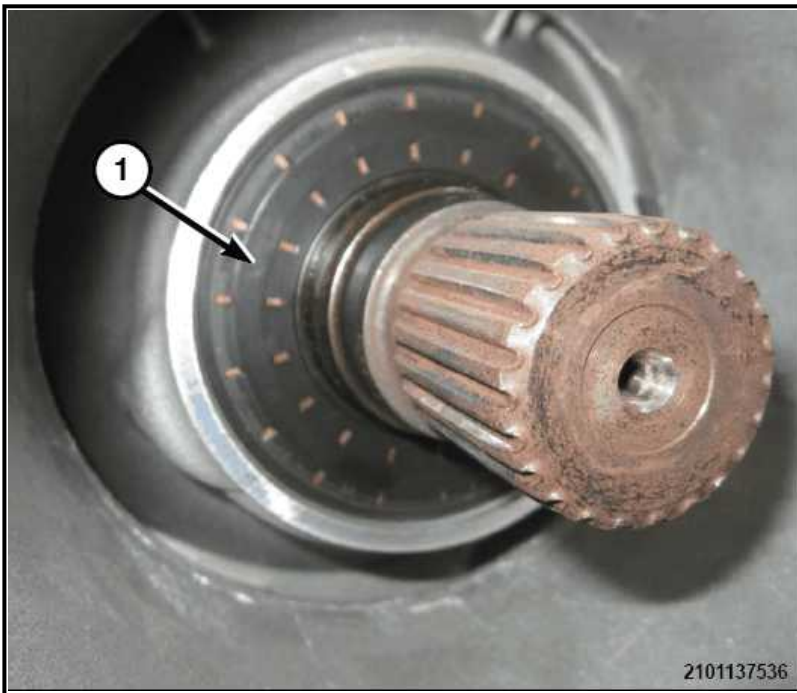
- | |
|---|
| 1 - Manual Park Release (MPR) Lever |
| 2 - Manual Park Release (MPR) Lever Retaining Nut |

68. Remove the tie strap and return the manual release lever to the original position.
69. Install the manual release lever nut.



- | |
|--------------------------------|
| 1 - Transmission Oil Pan Bolts |
| 2 - Transmission Oil Pan |

70. Position the transmission oil pan and gasket.
71. Install the transmission oil pan bolts.

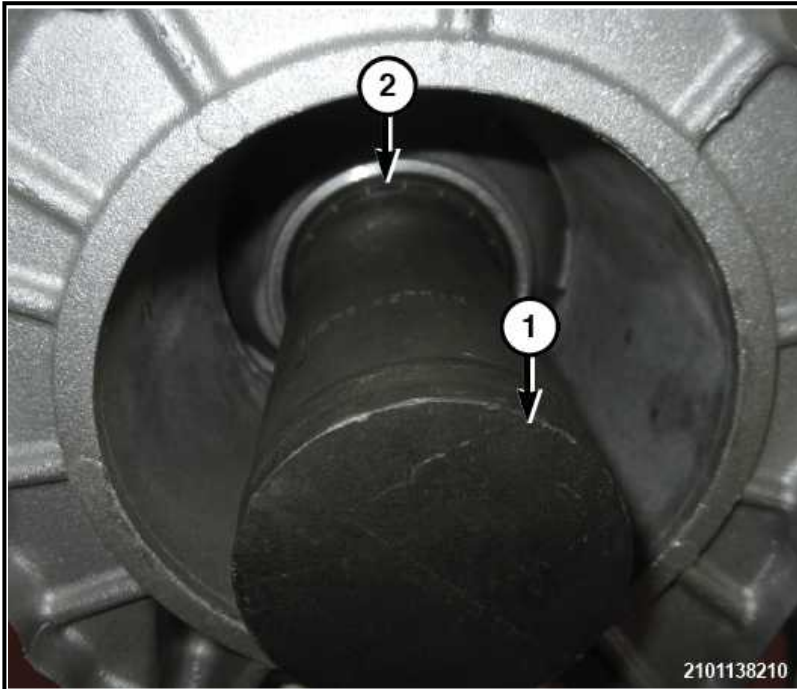


1 - Output Shaft Seal

NOTE: 4X4 only.

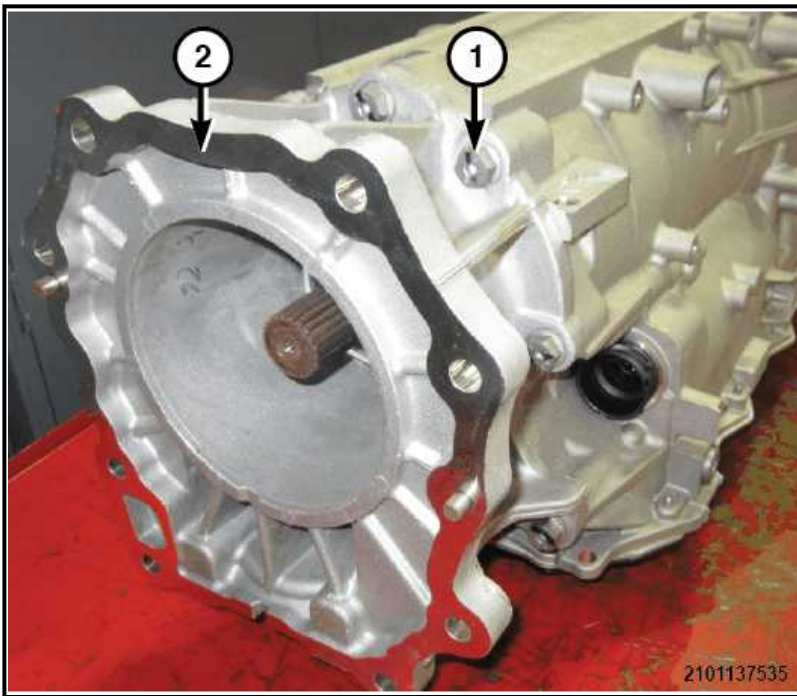
CAUTION: The seal must be installed flush with the case. Driving the seal deeper could damage the seal causing a leak.

72. Position the new output shaft seal over the output shaft and against the transmission case.



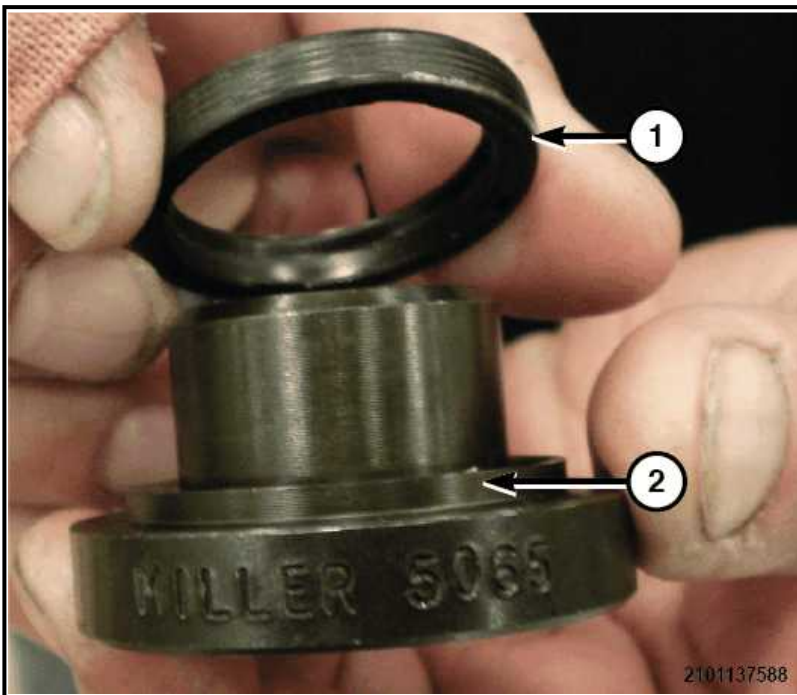
1 - Seal Installer
2 - Output Shaft Seal

73. Using (special tool #9677, Installer, Seal), install the output shaft seal.



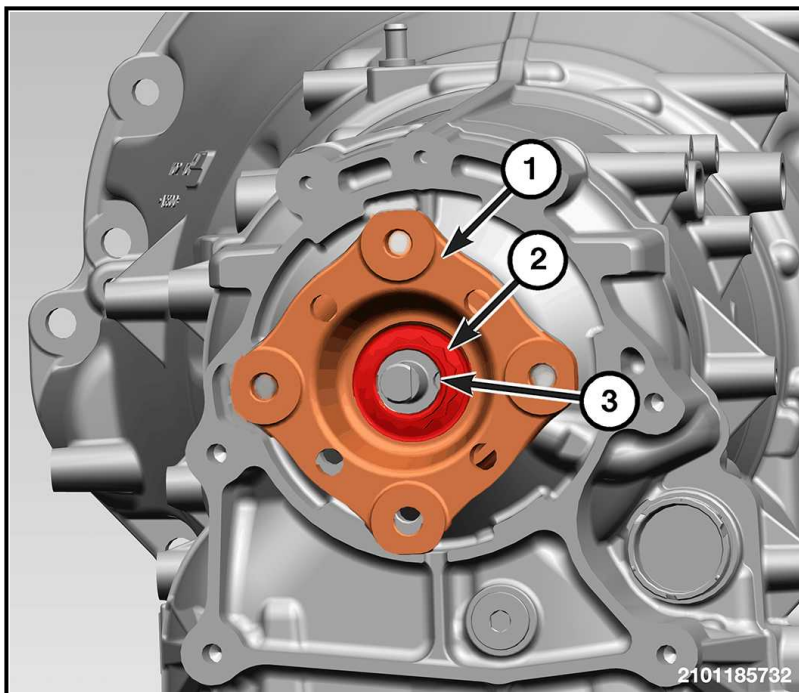
- | |
|-----------------------------|
| 1 - Extension Housing Bolts |
| 2 - Extension Housing |

74. **4X4 ONLY**, If equipped, position the extension housing and install the extension housing bolts.



- | |
|---------------------------|
| 1 - Output Flange Oil Dam |
| 2 - Bearing Installer |

75. For 2WD vehicles, using (special tool #5065, Installer, Bearing) install the **NEW** output flange oil dam into the output flange.



- | |
|--|
| 1 - Transmission Output Flange |
| 2 - Transmission Output Flange Nut |
| 3 - Transmission Output Flange Nut Stake |

76. For 2WD vehicles, install the output shaft flange.
77. For 2WD vehicles, install a **NEW** output shaft flange nut and washer using a 34 mm 12 point socket and (special tool #C-3281, Holder, Flange) to hold the flange.
78. For 2WD vehicles, stake the nut.



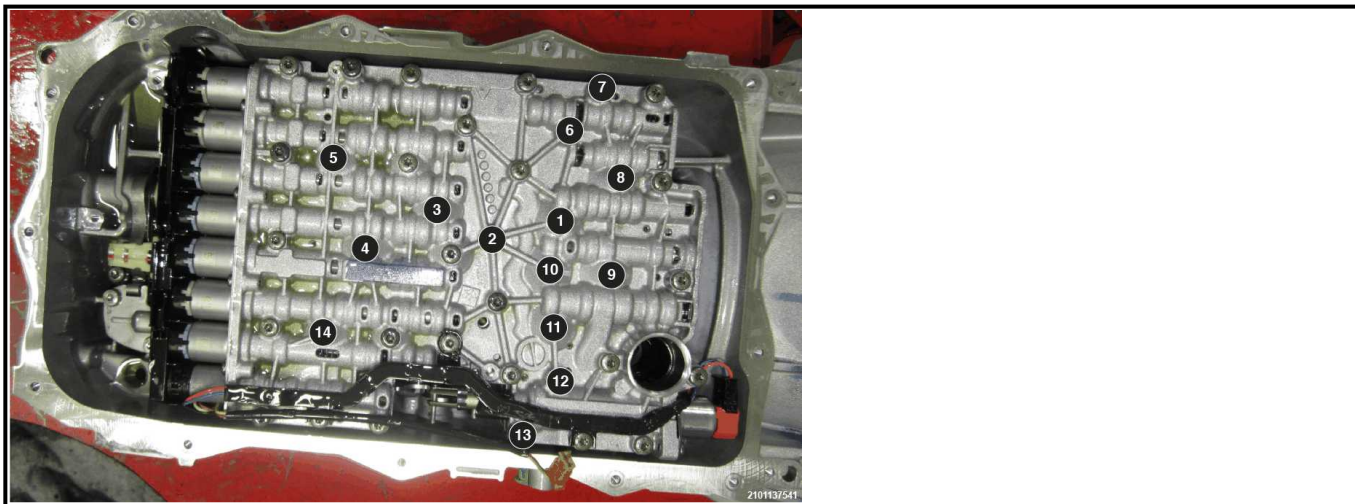
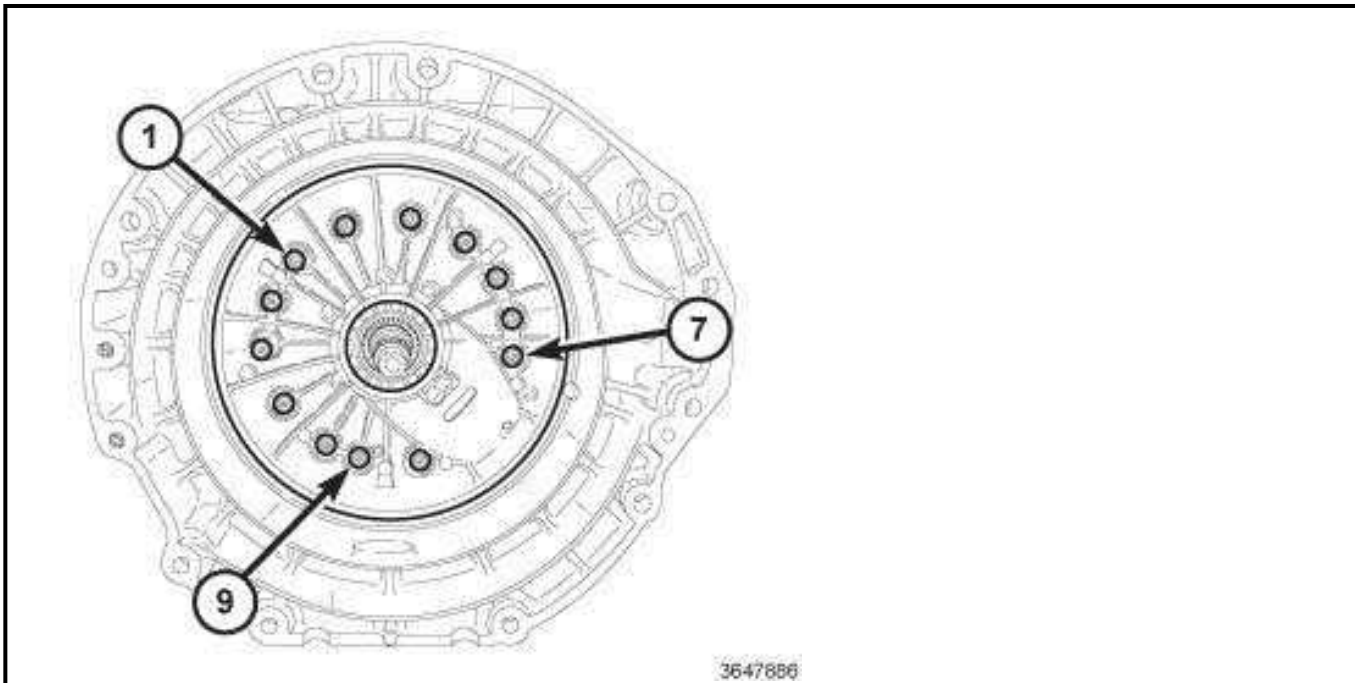
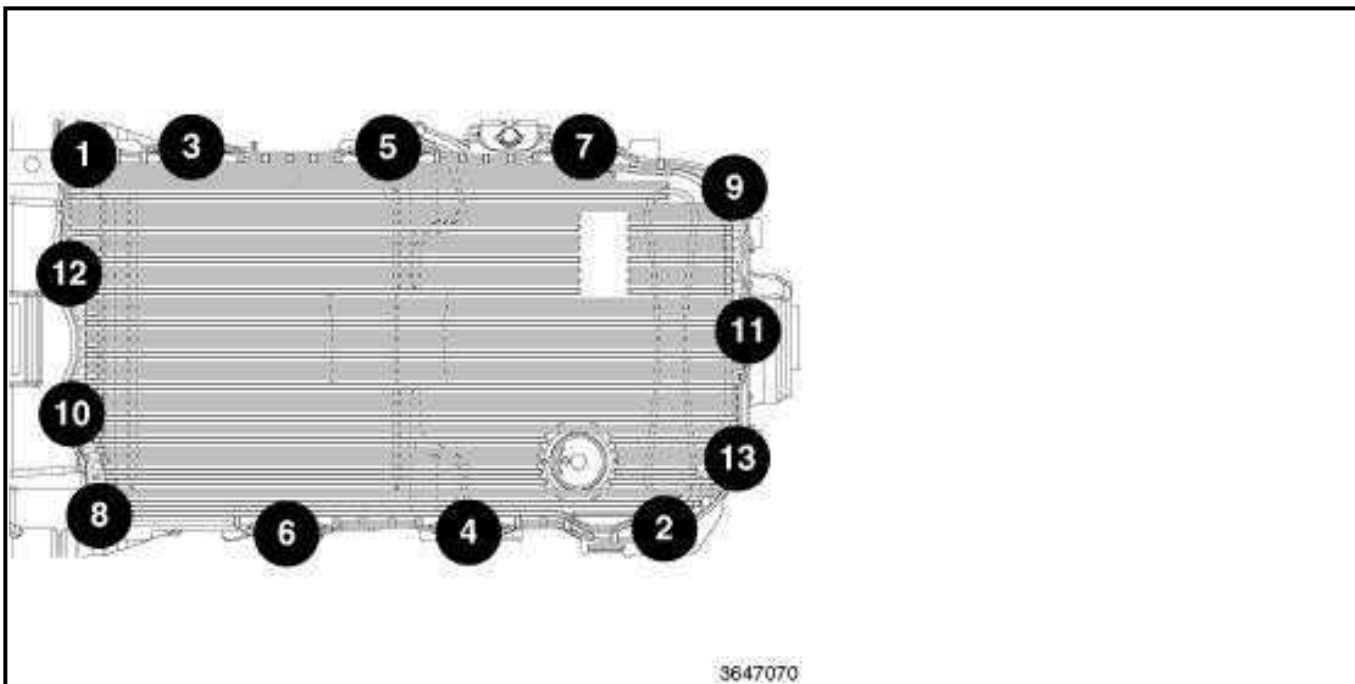
- | |
|----------------------|
| 1 - Torque Converter |
|----------------------|

79. Install the torque converter.
80. Before installing the transmission in the vehicle, pre-fill the transmission as outlined in **FILL TRANSMISSION AFTER SERVICE**. Refer to **TRANSMISSION FILL AFTER SERVICE** .

TORQUE SPECIFICATIONS

INTERNAL TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Extension Housing to Transmission Bolt	27 N.m (20 Ft. Lbs.)	-
Hydraulic Impulse Solenoid (HIS) Bolts	27 N. m (20 Ft. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	10 N.m (89 In. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	10 N.m (89 In. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: Firmly press the oil pump in place by hand before drawing it in with bolts. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: Tighten to 5 N.m (44 In. Lbs.) Rotate additional 45B°	-
Valve Body Bolt	8 N.m (71 In. Lbs.)	Tightening Sequence



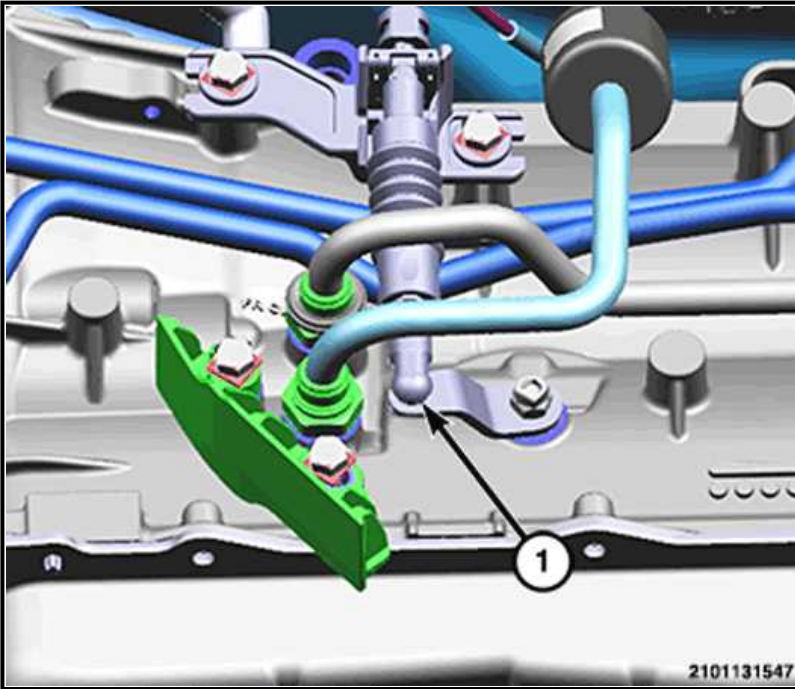
CABLE, MANUAL PARK RELEASE

REMOVAL AND INSTALLATION

MANUAL PARK RELEASE CABLE

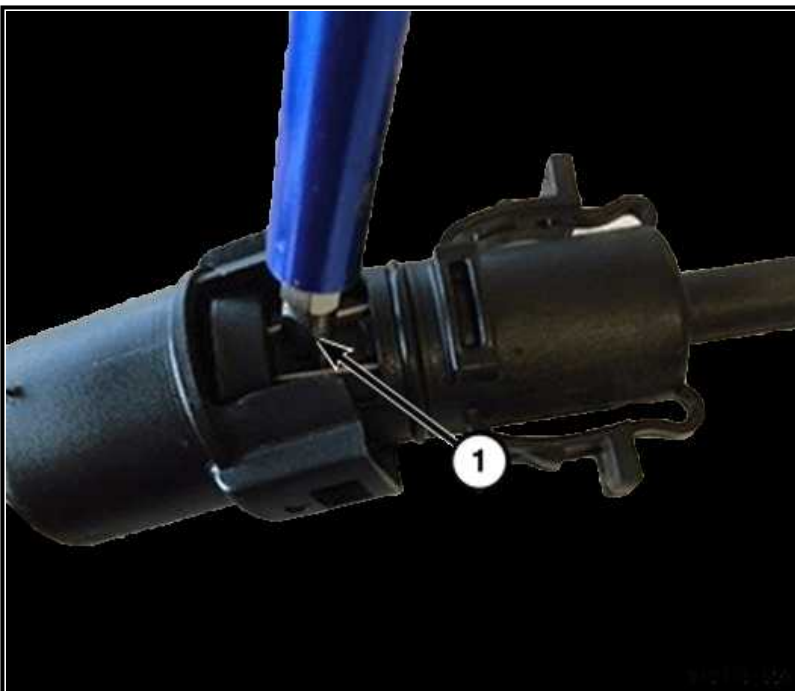
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to [CABLES, BATTERY](#) .
2. Apply the parking brake.
3. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



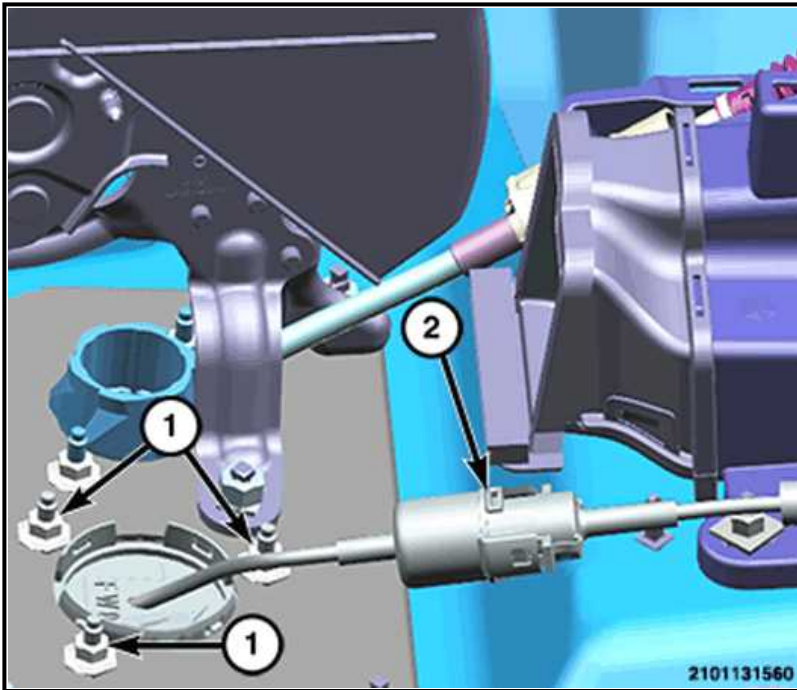
1 - Manual Park Release Cable

4. Disconnect the Manual Park Release (MPR) cable from the lever.
5. Remove the floor console from the vehicle. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Cable Retainer

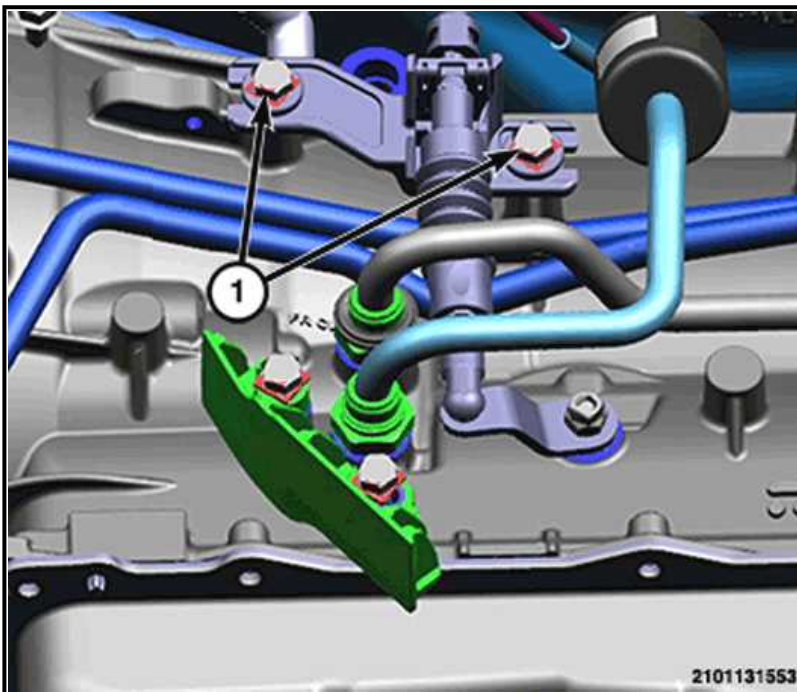
6. Separate the two piece cable by squeezing the side tabs on the barrel and pulling the ends apart. Then pry the retainer apart holding the two-piece cable.



1 - Manual Park Release Cable Body Grommet Nuts

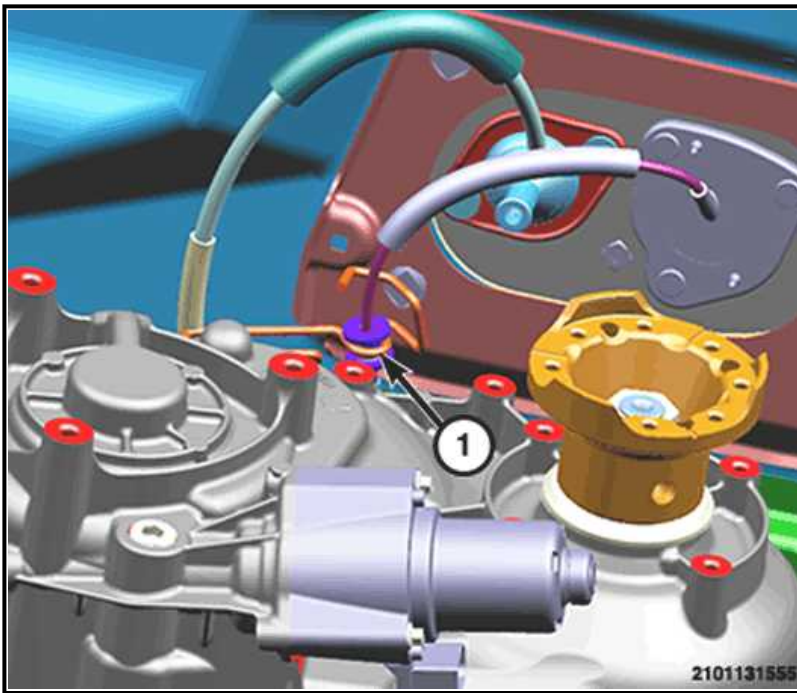
2 - Manual Park Release Cable

7. Remove the body grommet nuts. Push the body grommet through the floor with the remaining end of cable.



1 - Manual Park Release Bracket Bolts

8. Remove the MPR bracket bolts.



1 - Cable Routing Guide

9. Remove the cable from the cable routing guide and remove the cable from under the vehicle.

INSTALLATION

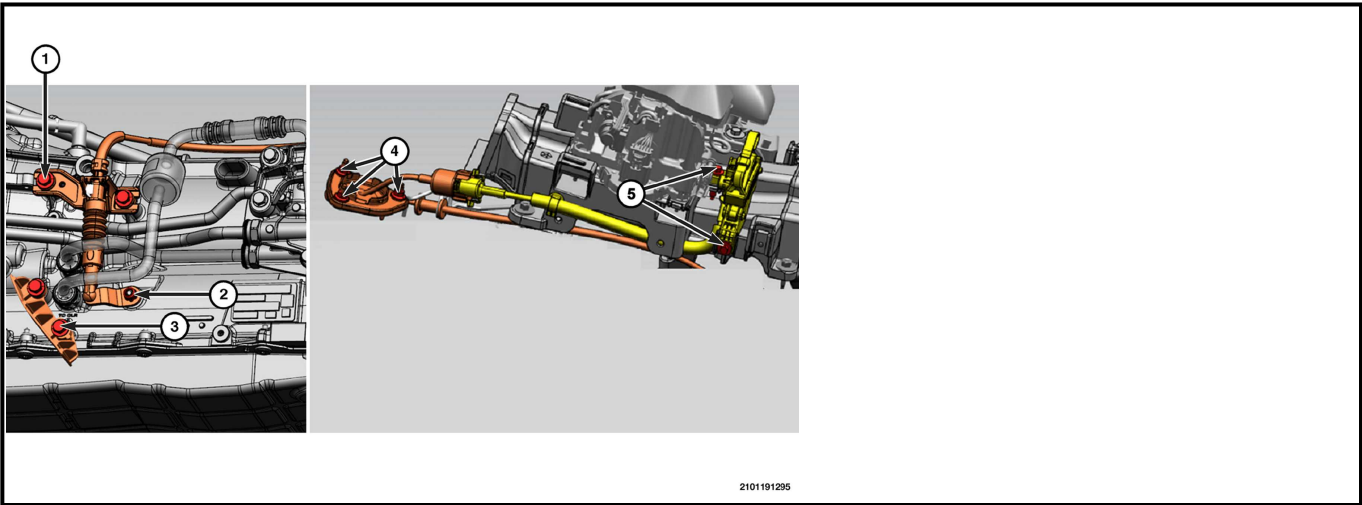
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Route the MPR cable in the same way as the original MPR cable and attach the cable stays to the transmission.

TORQUE SPECIFICATIONS

MANUAL PARK RELEASE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at	20 N. m (15 Ft. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
	Transmission)		
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

COOLER, TRANSMISSION OIL

REMOVAL AND INSTALLATION

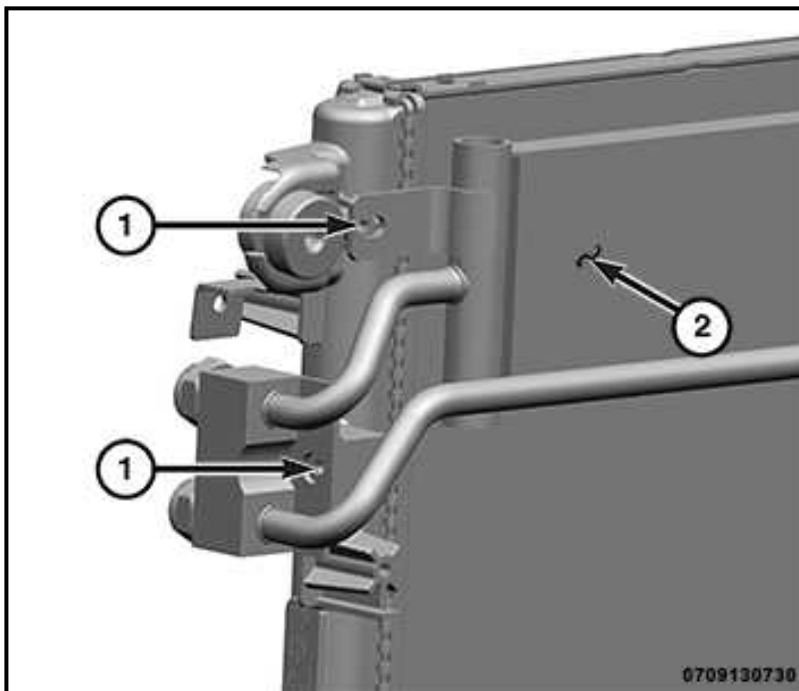
TRANSMISSION OIL COOLER

REMOVAL

1. Disconnect and isolate the negative battery cable. Refer to [CABLES, BATTERY](#) .
2. Remove the cooling fan assembly. Refer to [FAN, COOLING, REMOVAL AND INSTALLATION](#) .
3. Loosen and move radiator to gain access to transmission cooler. Refer to [RADIATOR, REMOVAL AND INSTALLATION](#) .

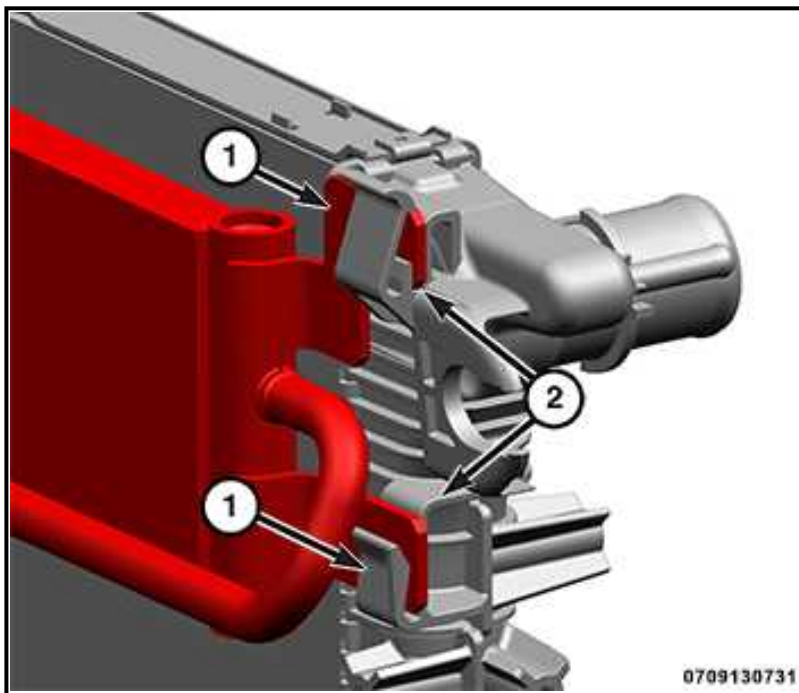
NOTE: Plug and seal the ends of the transmission fluid cooler and the transmission fluid cooler lines to prevent leakage of oil, or moisture, contaminants, or impurities from entering into the system.

NOTE: It is not necessary to remove the coolant hoses or drain the coolant from the radiator.



1 - Transmission Cooler Bolts
2 - Radiator

4. Remove the two transmission fluid cooler bolts from the radiator.



1 - Transmission Cooler
2 - Radiator

5. Lift and remove the left side transmission fluid cooler from the radiator, and remove the transmission fluid cooler.

INSTALLATION

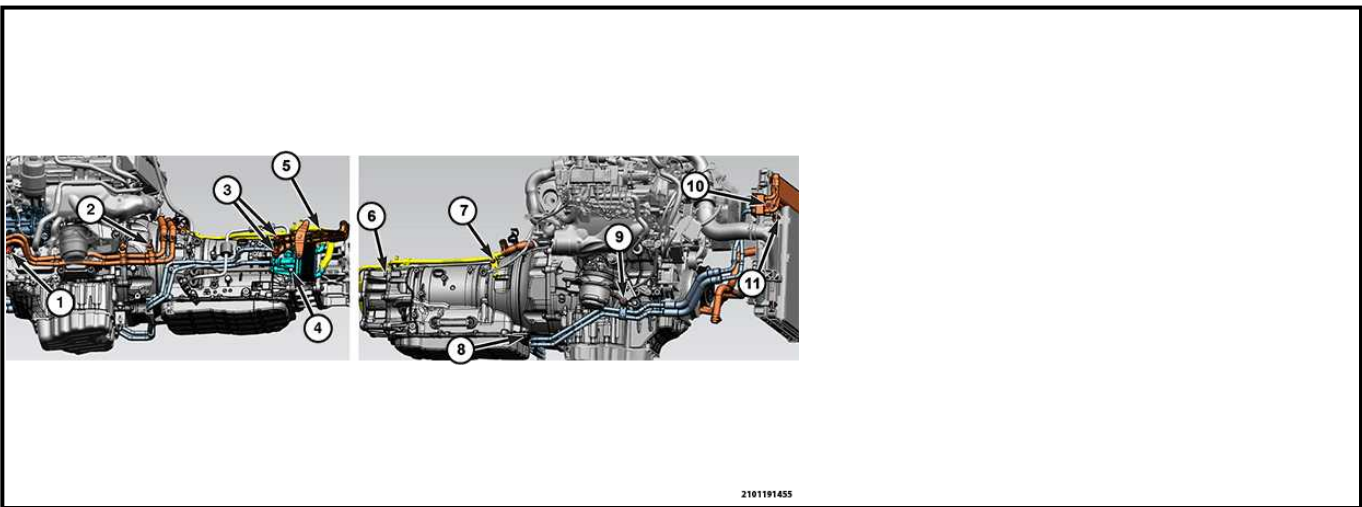
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Use **NEW** seals when installing the transmission cooler lines to the transmission cooler.
- Check transmission fluid level and correct as necessary. Refer to **CHECK FLUID LEVEL** .

TORQUE SPECIFICATIONS

TRANSMISSION OIL COOLER AND HEATER



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket To AC	9 N. m (80 In. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
	Compressor Nut		
2	Transmission Oil Heater Line Bracket To Transmission Bolts	20 N. m (15 Ft. Lbs.)	-
3	Transmission Oil Heater To Transmission Bolts (Passing Through Transfer Case Cable Support Bracket)	23 N. m (17 Ft. Lbs.)	-
4	Transmission Oil Heater To Transmission Bolt	23 N. m (17 Ft. Lbs.)	-
5	Transfer Case Cable Support to Bracket Nut	19 N. m (14 Ft. Lbs.)	-
6	Transmission Oil Heater Line Bracket To Case Bolt	22 N. m (16 Ft. Lbs.)	-
7	Transmission Oil Heater Line Bracket To Transmission Bolt	22 N. m (16 Ft. Lbs.)	-
8	Transmission Oil Cooler Line Bracket To Transmission Bolt	9 N. m (80 In. Lbs.)	-
9	Transmission Oil Cooler Line Bracket To Engine Mount Bracket Bolt	9 N. m (80 In. Lbs.)	-
10	Transmission Oil Cooler Line Manifold To Radiator Bolt	-	Tighten Securely
11	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely

FLEXPLATE

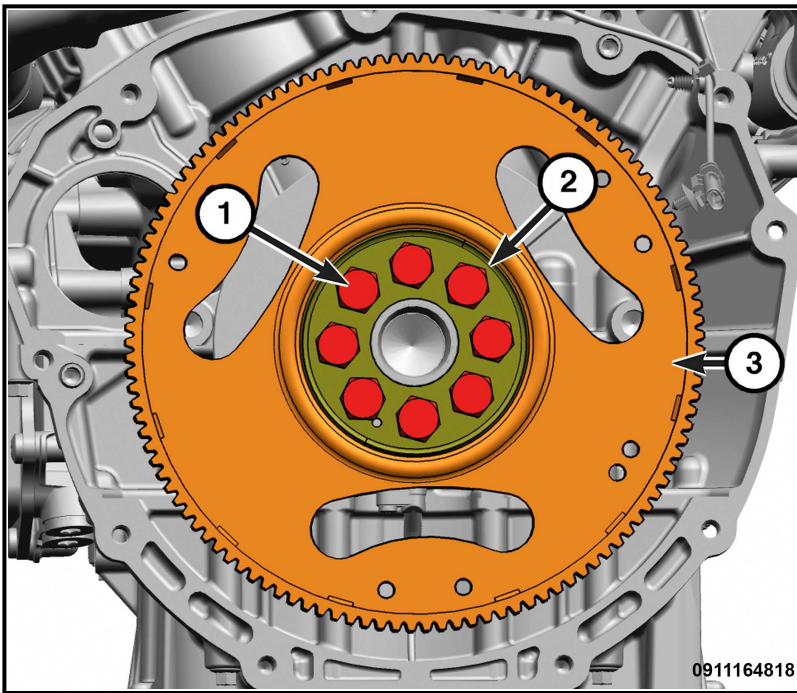
REMOVAL AND INSTALLATION

FLEXPLATE - 3.0L

REMOVAL

CAUTION: Do not use an impact socket or a thick walled socket when removing or installing the flexplate retaining bolts, damage to the crankshaft, internal engine or the transmission may occur.

1. Remove the transmission. Refer to [REMOVAL AND INSTALLATION](#).

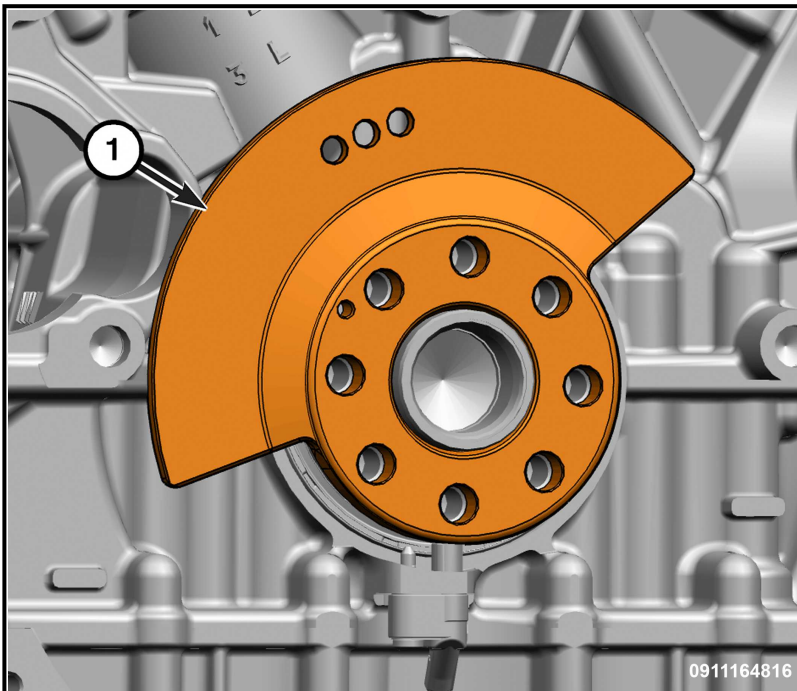


1 - Flexplate Bolts

2 - Backing Plate

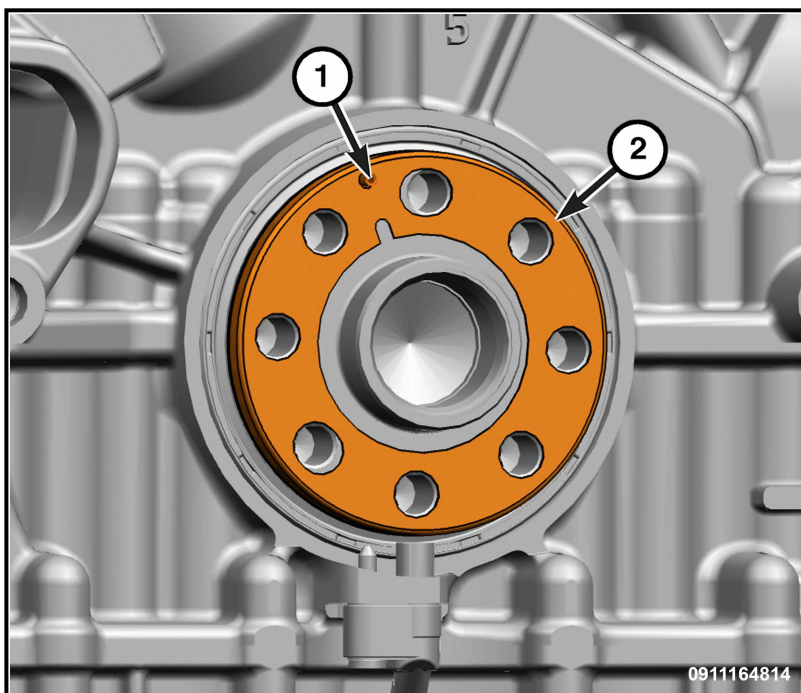
3 - Flexplate

2. Paint mark the flex plate hub to flex plate relation.
3. Remove the fasteners, backing plate, and the flexplate.



1 - Counter Weight

4. If necessary, remove the counter weight.



1 - Tone Wheel
2 - Dowel Pin

5. If necessary, remove the and tone wheel.
6. Inspect the flex plate for damage.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- The dead hole of the counter weight is for the dowel pin. The other hole is a through hole that is not to be used.
- Do Not lubricate the **NEW** bolts as they are already coated with an anti-scuff treatment.
- Install the spacer and the bolts hand tight.
- Using a criss-cross pattern, tighten the flexplate retaining bolts to the proper torque specification in the torque table.

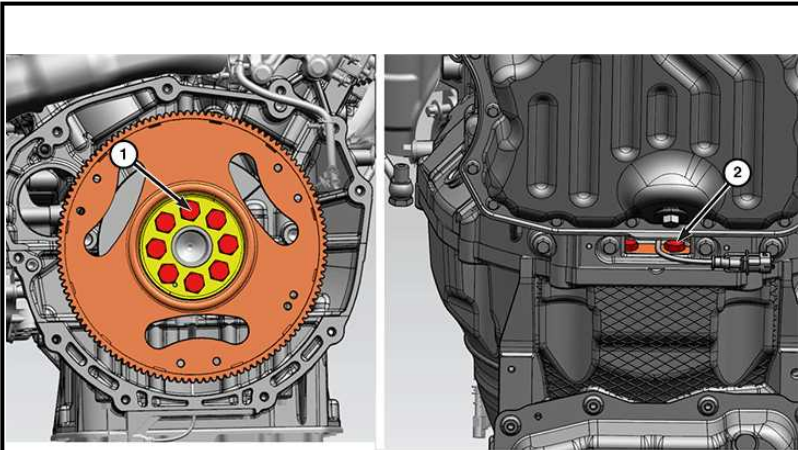
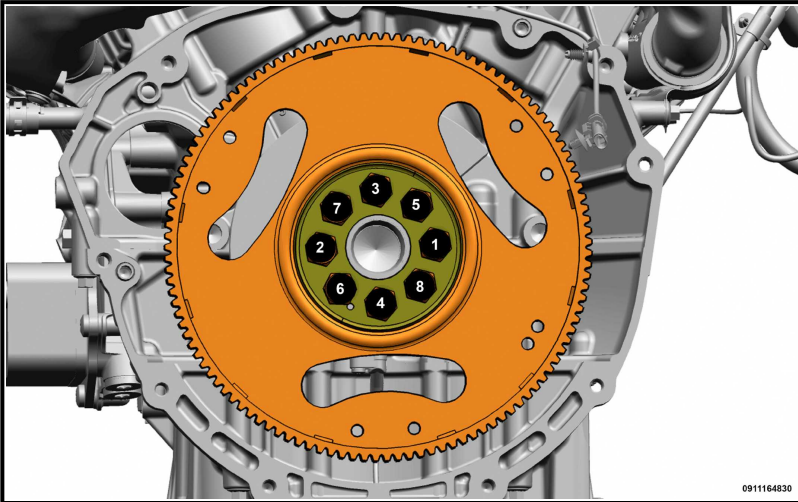
CAUTION: Do not use an impact socket or a thick walled socket when removing or installing the flexplate retaining bolts, damage to the crankshaft, internal engine or the transmission may occur.

TORQUE SPECIFICATIONS

FLEXPLATE AND TORQUE CONVERTER

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	Torque Procedure: 1. With clean engine oil, lubricate the fastener side of backing plate. 2. Tighten the fasteners 50 N.m (37 ft. lbs.) .	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Tightening Sequence

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
		3. Loosen one fastener at a time and then retighten the fastener 125 N.m (92 ft. lbs.) . 4. Using a torque angle gauge, tighten each fastener an additional 30 B° .	
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-used, Loc-TiteB® must be applied to the threads.



HEATER, TRANSMISSION

REMOVAL AND INSTALLATION

TRANS FLUID HEATER

REMOVAL

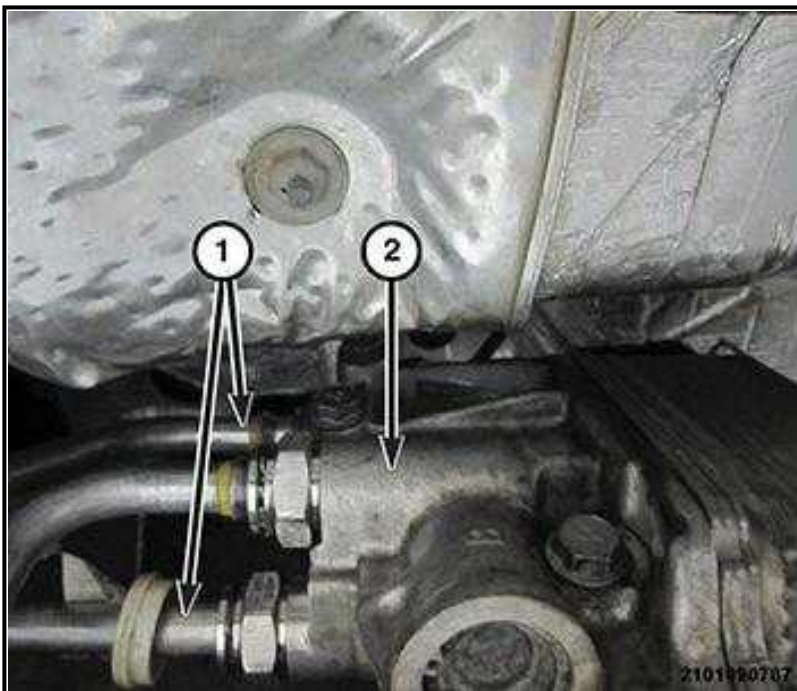
1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Drain the engine cooling system. Refer to the appropriate information .
3. Remove front drive shaft. Refer to [REMOVAL AND INSTALLATION](#) .



1 - Coolant Pipe

2 - Coolant Pipe

4. Remove the spring clamps and disconnect the coolant supply and return pipes from the transmission fluid heat exchanger.



1 - Transmission Fluid Tubes

2 - Transmission Heat Exchanger

5. Disconnect the transmission fluid tubes from the transmission heat exchanger.
6. Remove the transmission fluid heat exchanger bolts and remove the transmission fluid heat exchanger.

INSTALLATION

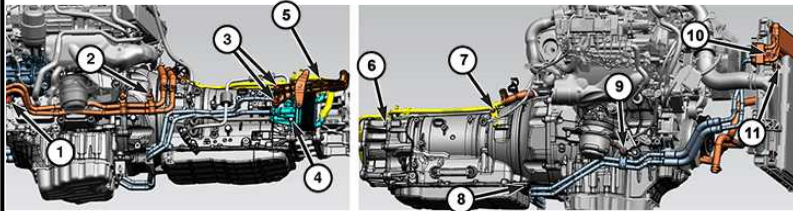
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Check transmission fluid level and correct as necessary. Refer to [CHECK FLUID LEVEL](#) .

TORQUE SPECIFICATIONS

TRANSMISSION OIL COOLER AND HEATER



2101191455

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket To AC Compressor Nut	9 N. m (80 In. Lbs.)	-
2	Transmission Oil Heater Line Bracket To Transmission Bolts	20 N. m (15 Ft. Lbs.)	-
3	Transmission Oil Heater To Transmission Bolts (Passing Through Transfer Case Cable Support Bracket)	23 N. m (17 Ft. Lbs.)	-
4	Transmission Oil Heater To Transmission Bolt	23 N. m (17 Ft. Lbs.)	-
5	Transfer Case Cable Support to Bracket Nut	19 N. m (14 Ft. Lbs.)	-
6	Transmission Oil Heater Line Bracket To Case Bolt	22 N. m (16 Ft. Lbs.)	-
7	Transmission Oil Heater Line Bracket To Transmission Bolt	22 N. m (16 Ft. Lbs.)	-
8	Transmission Oil Cooler Line Bracket To Transmission Bolt	9 N. m (80 In. Lbs.)	-
9	Transmission Oil Cooler Line Bracket To Engine Mount Bracket Bolt	9 N. m (80 In. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
10	Transmission Oil Cooler Line Manifold To Radiator Bolt	-	Tighten Securely
11	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely

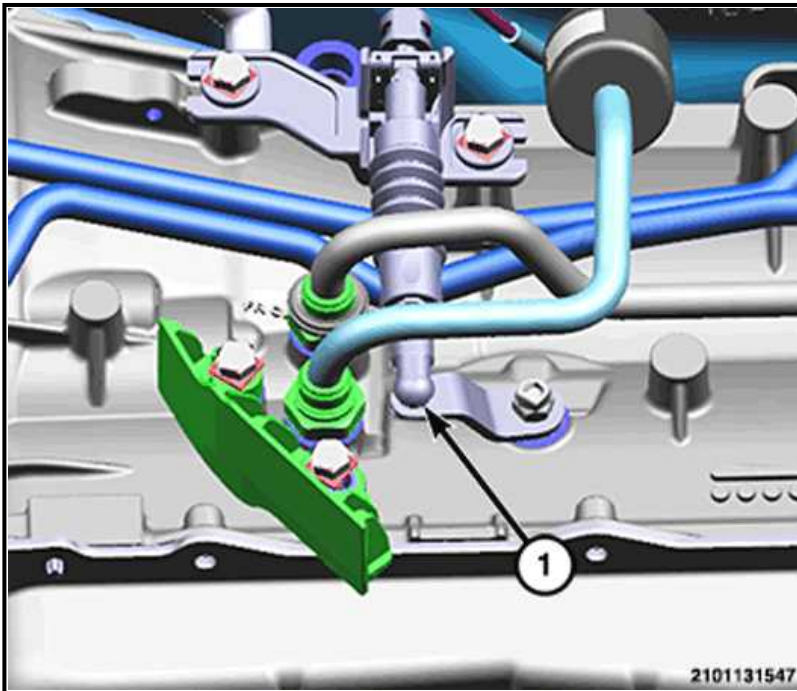
LEVER, MANUAL PARK RELEASE

REMOVAL AND INSTALLATION

MANUAL PARK RELEASE LEVER

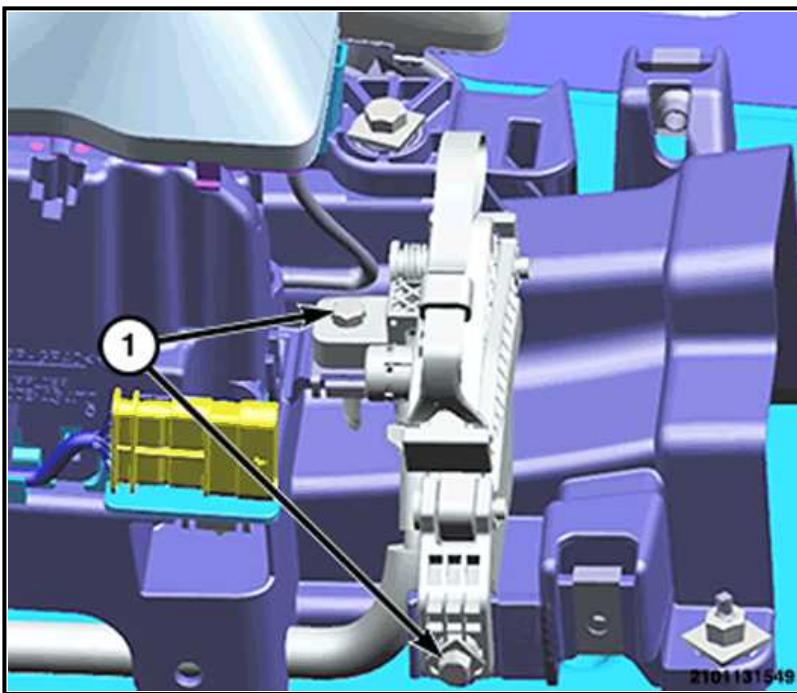
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to [CABLES, BATTERY](#) .
2. Apply the parking brake.
3. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



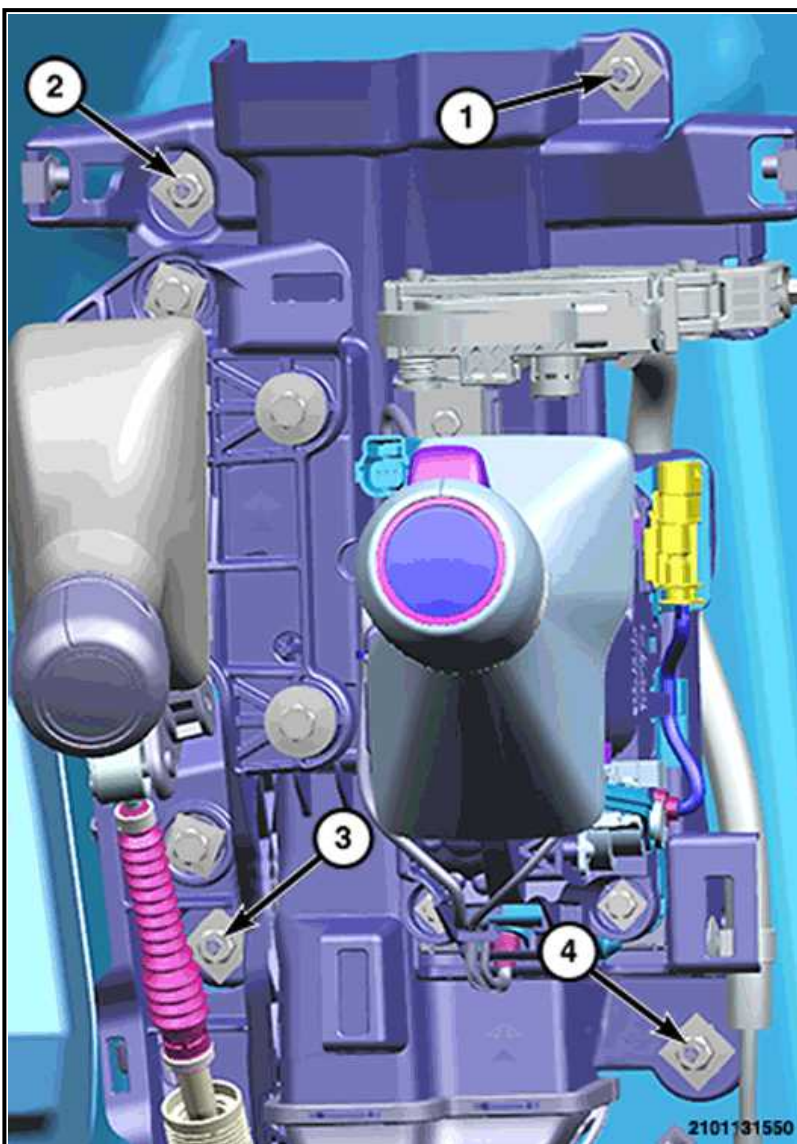
1 - Manual Park Release Cable

4. Disconnect the Manual Park Release (MPR) cable from the lever.
5. Remove the floor console from the vehicle. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Shifter Base Bolts

6. Remove the bolts securing the MPR lever to the shifter base.



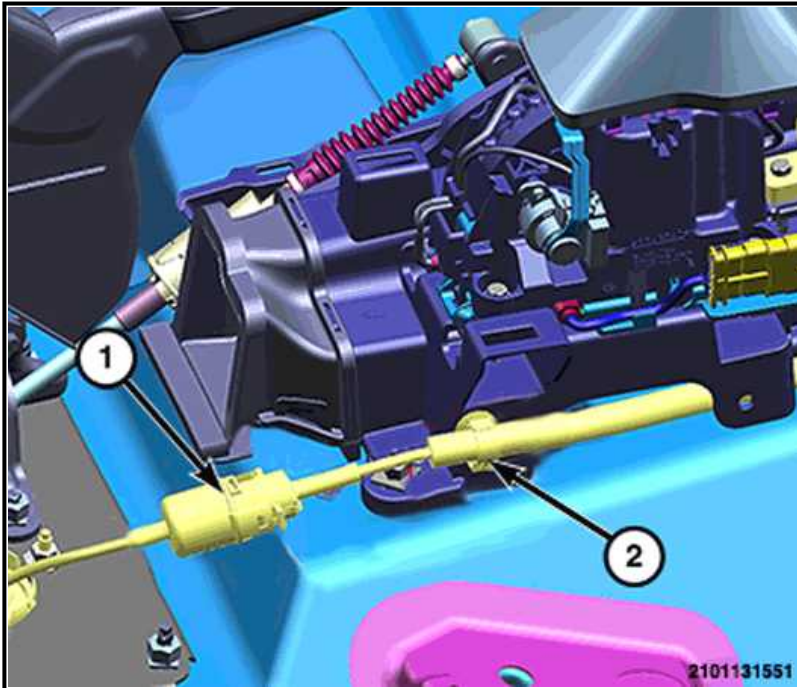
1 - Shifter Base Bolt

2 - Shifter Base Bolt

3 - Shifter Base Bolt

4 - Shifter Base Bolt

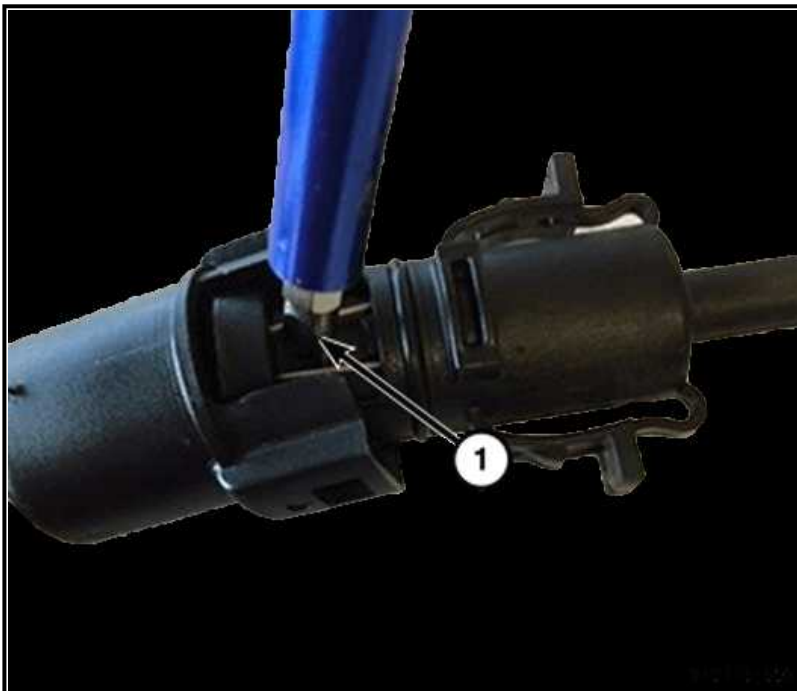
7. Remove the shifter base bolts securing the shifter base.



1 - Manual Park Release Retainer

2 - Manual Park Release Cable Securing Clip

8. Release the two-piece cable securing clip from the shifter base.



1 - Manual Park Release Retainer

9. Separate the two piece cable by squeezing the side tabs on the barrel and pulling the ends apart. Then pry the retainer apart holding the two-piece cable.

10. Remove the cable and the MPR lever from inside the vehicle.

INSTALLATION

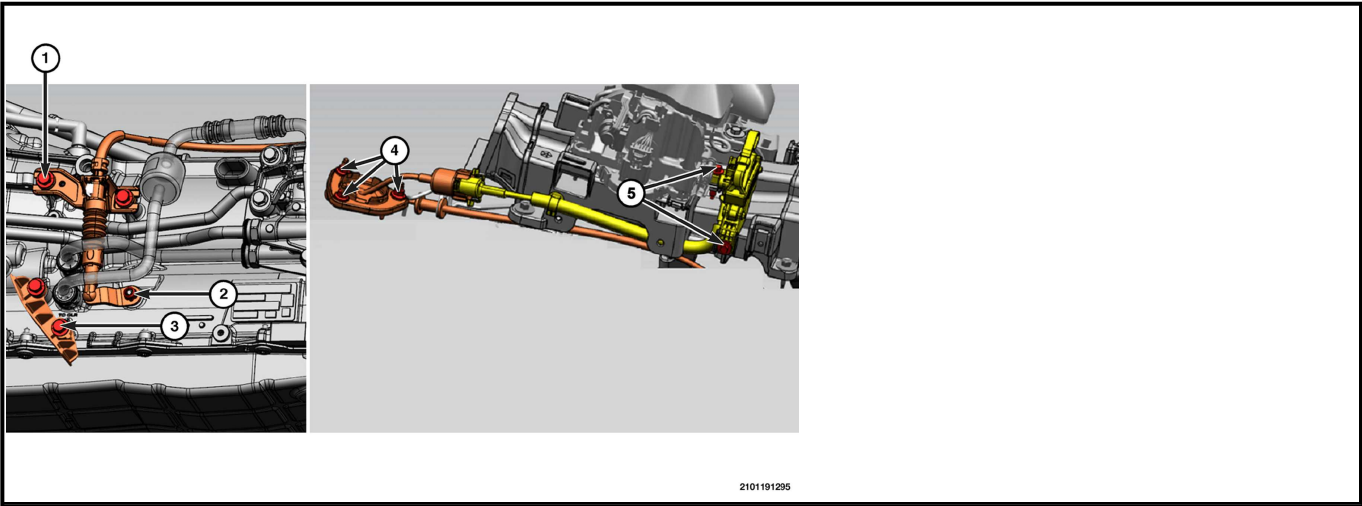
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Route the cables into the bulkhead and install the grommet into the bulkhead. Verify that the grommet is fully seated to prevent leakage.

TORQUE SPECIFICATIONS

MANUAL PARK RELEASE



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Manual Park Release (MPR) Cable Bracket Bolts	20 N. m (15 Ft. Lbs.)	-
2	Manual Park Release (MPR) Lever Shaft Nut (at Transmission)	20 N. m (15 Ft. Lbs.)	-
3	Splash Shield To Transmission Bolts	17 N. m (13 Ft. Lbs.)	-
4	Manual Park Release (MPR) Cable Grommet Nuts	7 N. m (62 In. Lbs.)	-
5	Manual Park Release (MPR) Lever to Shifter Sled Screws	5 N. m (44 In. Lbs.)	-

MOUNT, TRANSMISSION

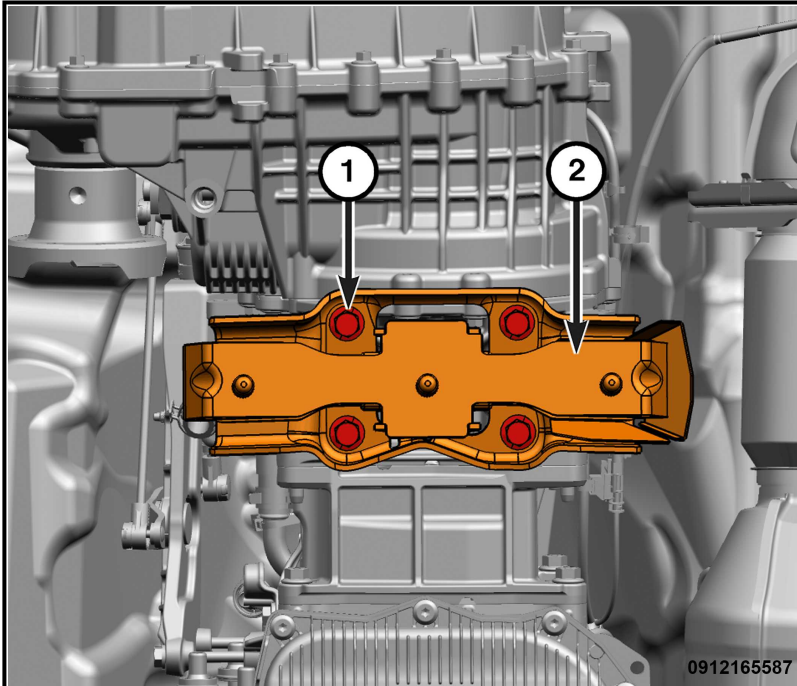
REMOVAL AND INSTALLATION

TRANSMISSION MOUNT

REMOVAL

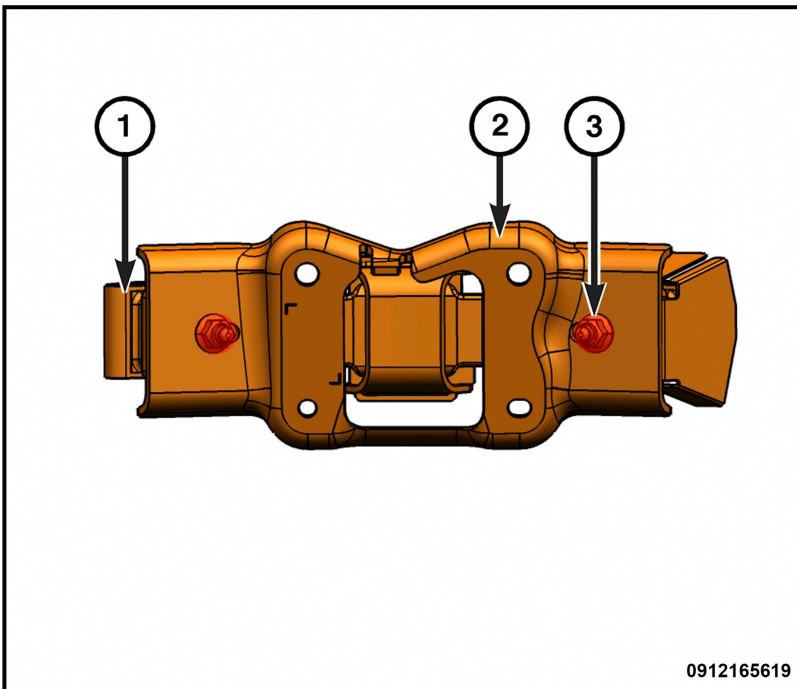
1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the transfer case skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION](#) [PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION](#) [PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .

3. Remove the transmission crossmember. Refer to [CROSSMEMBER, FRONT REINFORCEMENT, REMOVAL AND INSTALLATION](#) [CROSSMEMBER, TRANSMISSION, REMOVAL AND INSTALLATION](#) .



- | |
|---------------------------------------|
| 1 - Rear Mount Isolator Bracket Bolts |
| 2 - Rear Mount Isolator Bracket |

4. Remove the bolts and the rear mount isolator bracket.



- | |
|--------------------------------------|
| 1 - Rear Mount Isolator |
| 2 - Rear Mount Isolator Bracket |
| 3 - Rear Mount Isolator Bracket Nuts |

5. Remove the nuts and the rear mount isolator from bracket.

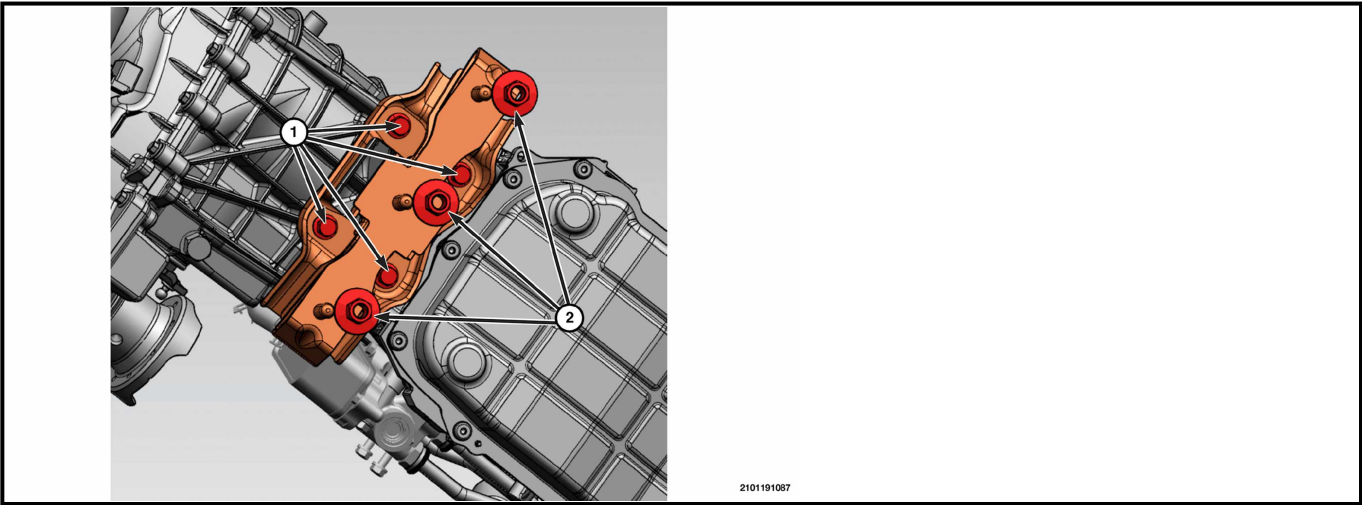
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS

TRANSMISSION MOUNT



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

PUMP, TRANSMISSION OIL

REMOVAL AND INSTALLATION

TRANSMISSION OIL PUMP

Transmission oil pump service will require disassembly and assembly of Clutch A and Clutch B. The individual clutches listed below provide the following information for each clutch assembly:

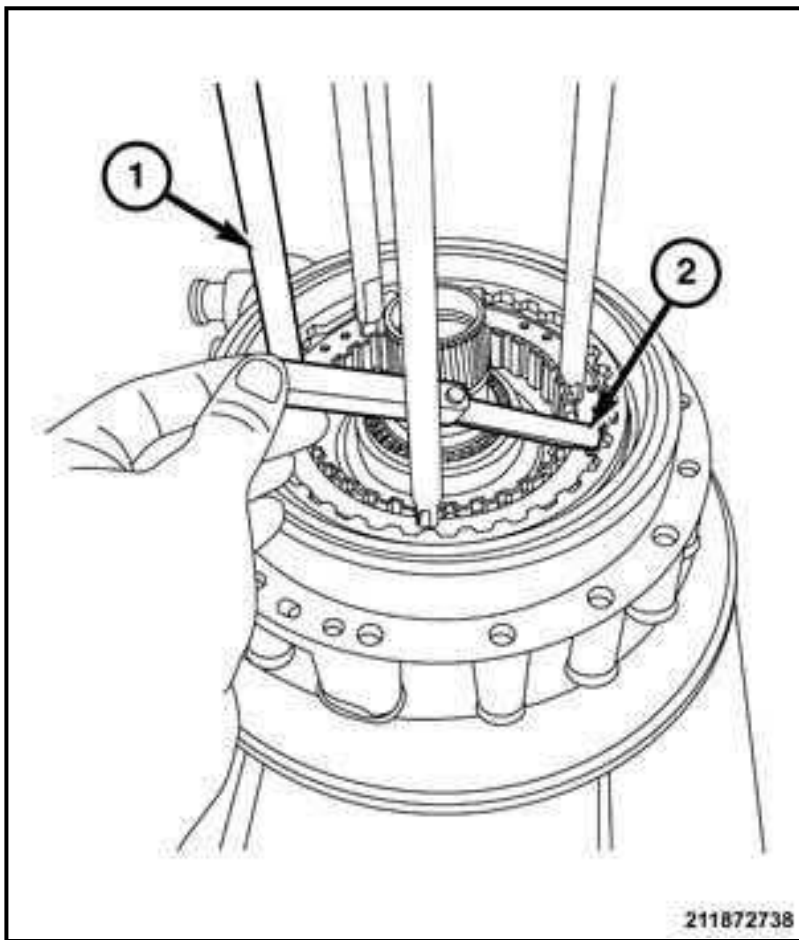
- Disassembly and assembly procedures
- Clutch pack clearance measurements
- Clutch pack clearance specifications
- Adjustments - selectable snap rings and backing plates

It is recommended to measure the clutch pack clearances for evaluation before disassembling the transmission oil pump and making sure they remain in specification after reassembling the transmission oil pump.

CLUTCH A - DISASSEMBLY AND ADJUSTMENTS

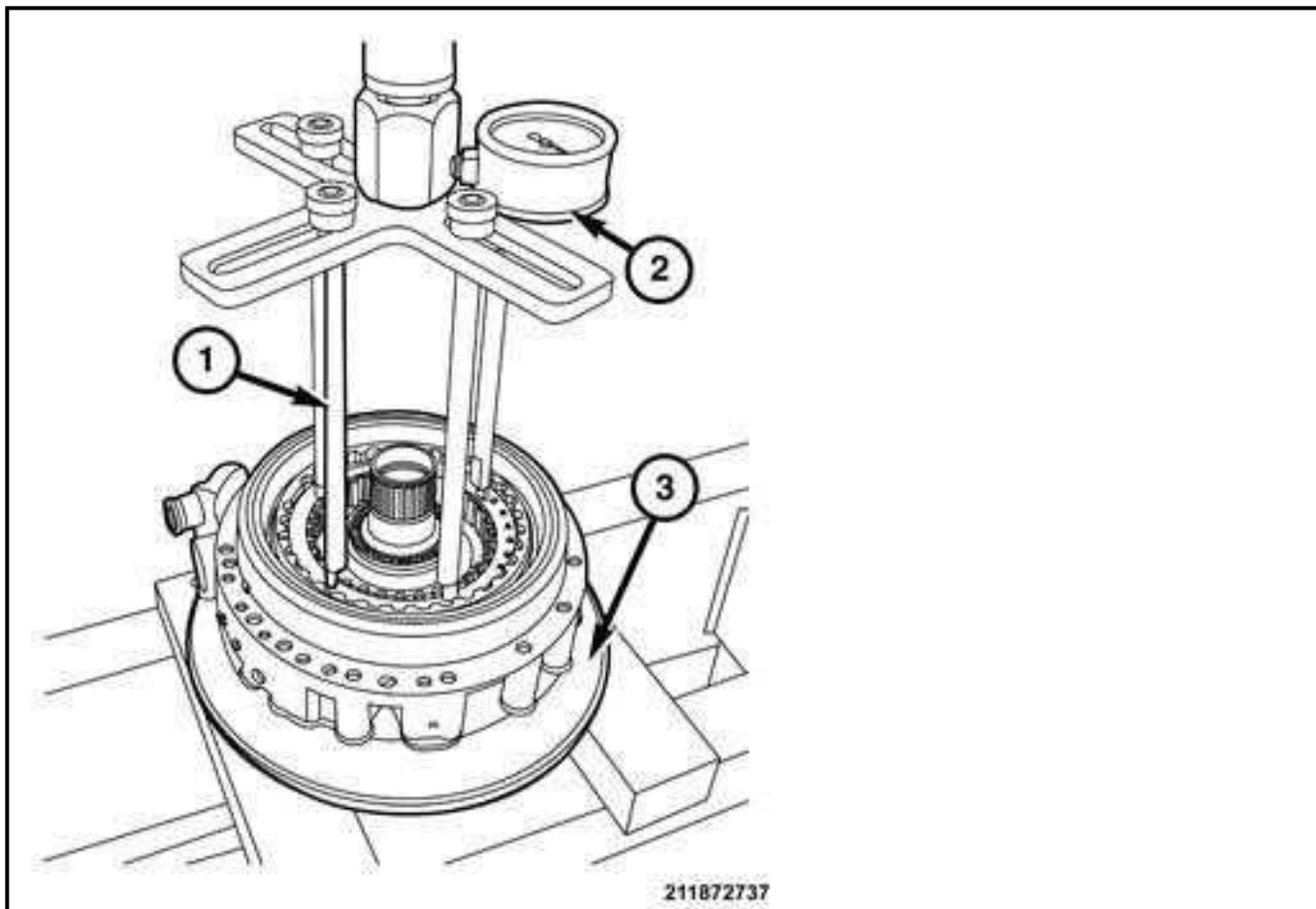
CLUTCH A MEASUREMENT PROCEDURE

1. Using (special tool #10428, Adapter, Pressing Tool) and (special tool #10429, Gauge, Force), place the Clutch A/oil pump assembly in a suitable arbor press.
2. Apply 200 N (45 lbf.) of force to the Clutch A backing plate to compress the wave plate.



1 - Pressing Tool Adapter
2 - Feeler Gauge

3. With a suitable feeler gauge measure the gap between the Clutch A backing plate and the snap ring.
4. Refer to the clutch clearance table for specs. If clearance is not within specification, a thinner or thicker selectable snap ring can be installed for proper clearance.



1 - Pressing Tool Adapter
2 - Force Gauge
3 - Clutch A/Oil Pump Assembly

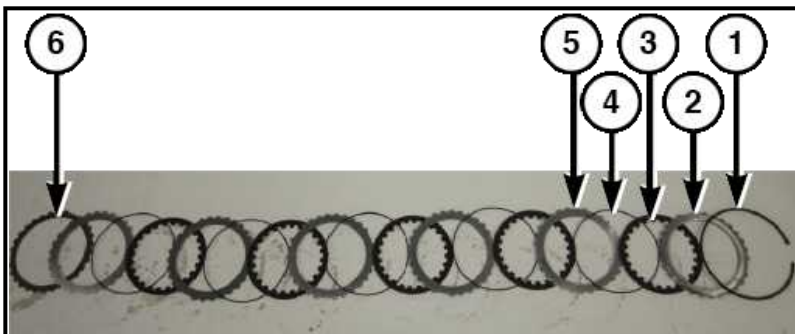
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
A	NEW	1.41 mm	1.555 mm	1.7 mm
		0.056 in.	0.061 in.	0.067 in.
	AFTER OPERATION	1.41 mm	1.655 mm	1.9 mm
		0.056 in.	0.065 in.	0.075 in.

CLUTCH A SELECTABLE SNAP RINGS

3.2 mm	0.125 in.
3.0 mm	0.118 in.
2.8 mm	0.110 in.
2.6 mm	0.102 in.
2.4 mm	0.0944 in.
2.2 mm	0.0866 in.

DISASSEMBLY Clutch A, depending on transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates, five wave springs, five steel plates, one support plate, one snap ring, and one wave plate.



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1 - Snap Ring

2 - Support Plate

3 - Friction Plates

4 - Wave Springs

5 - Steel Plates

6 - Wave Plate

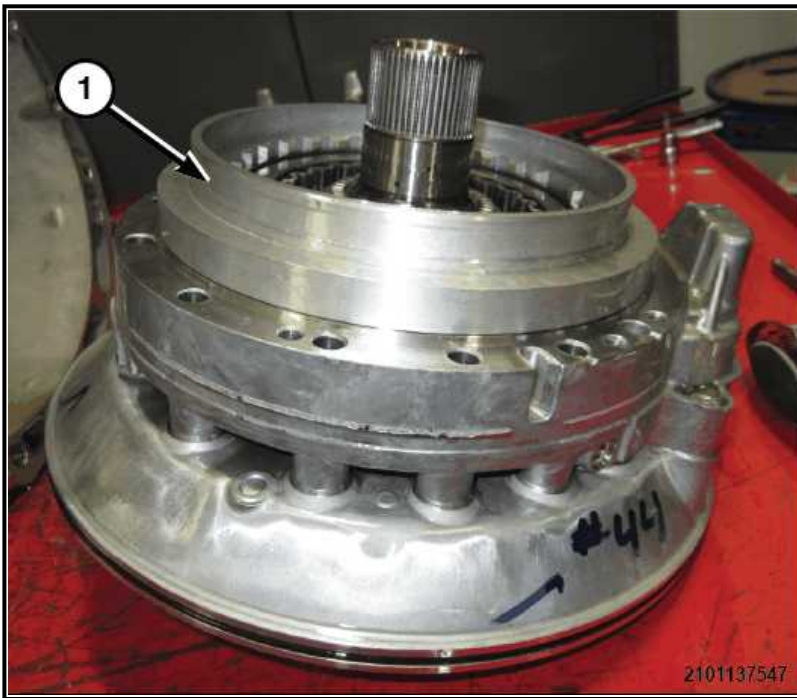
1. Remove the oil pump from the transmission case. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).



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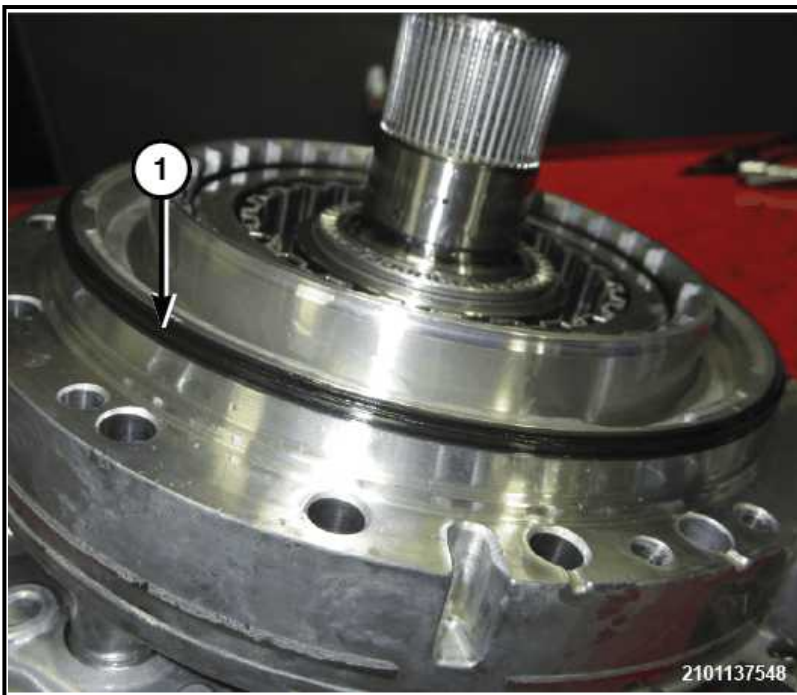
1 - Clutch B Damper Spring

2. Remove the Clutch B damper spring.



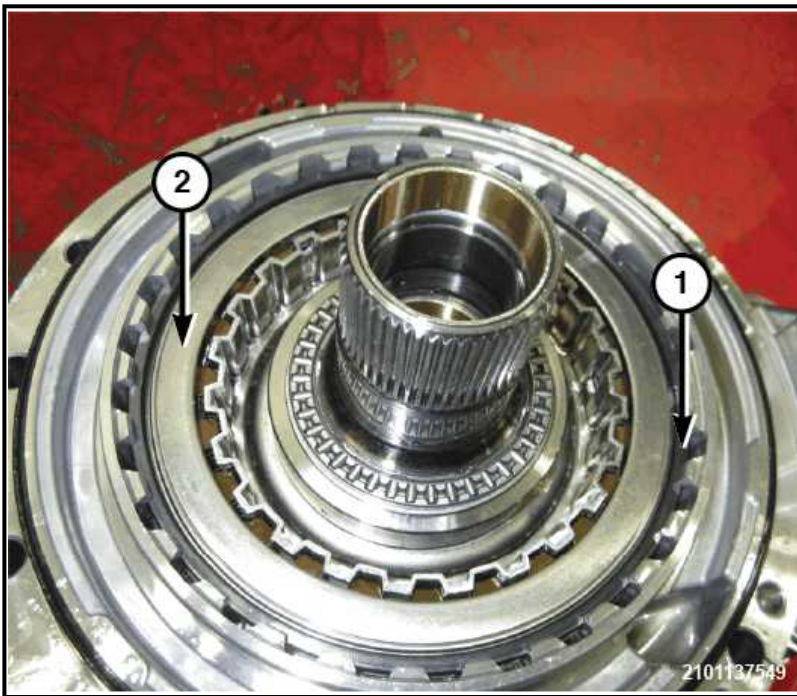
1 - Clutch B Piston

3. Remove the Clutch B piston from the assembly.



1 -Clutch B Piston Seal

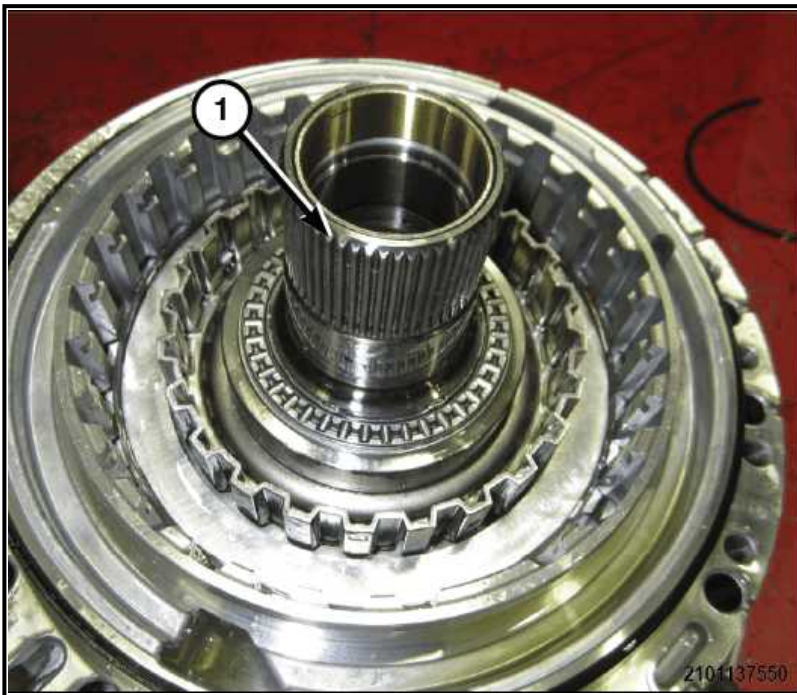
4. Check the Clutch B piston seal for damage or wear and replace if necessary.



1 - Snap Ring

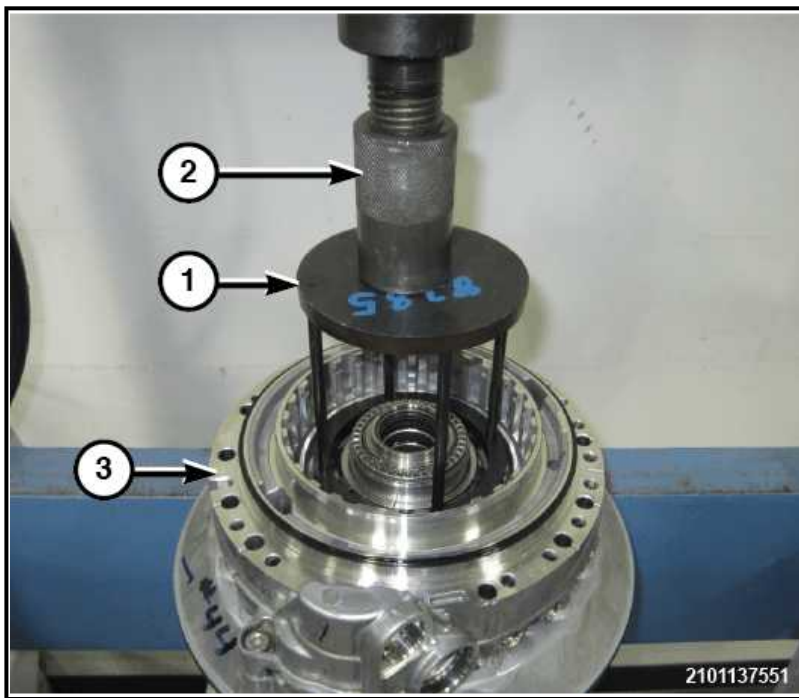
2 - Clutch A Discs and Plates

5. Remove the snap ring.
6. Remove the Clutch A disks and plates.



1 - Hub

7. Remove the hub.



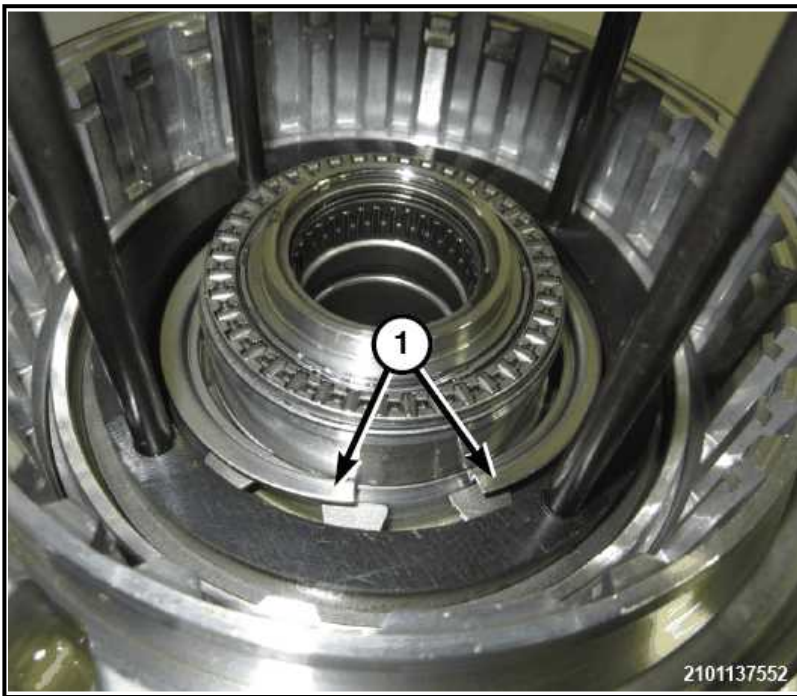
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

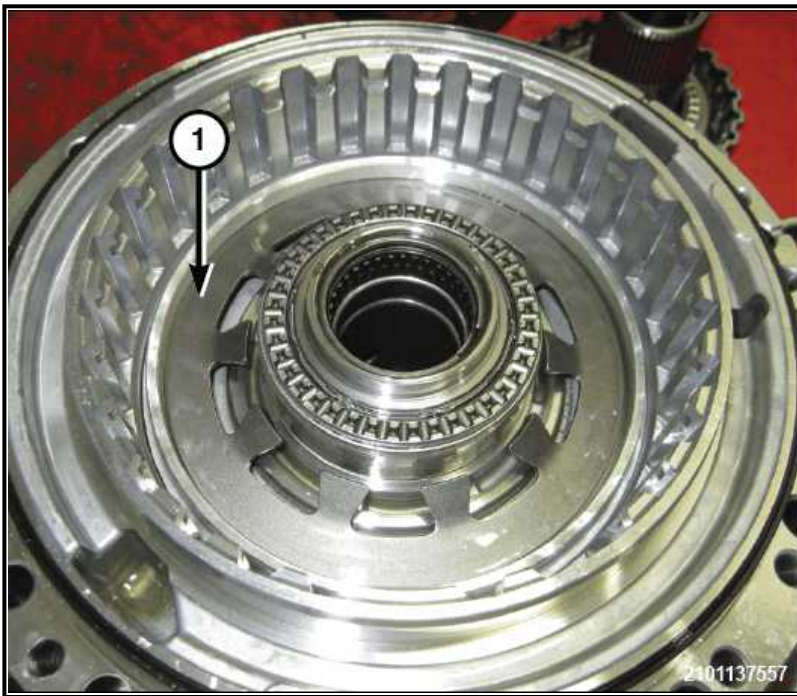
8. Position the oil pump housing assembly in a suitable arbor press.

9. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retaining ring to remove tension.



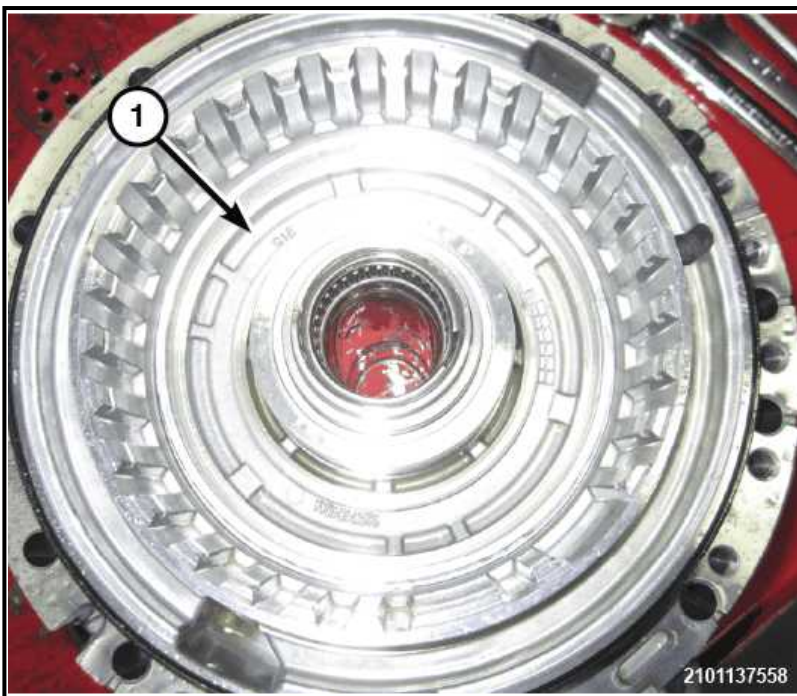
1 - Retaining Ring

10. Remove the two halves of the retaining ring.



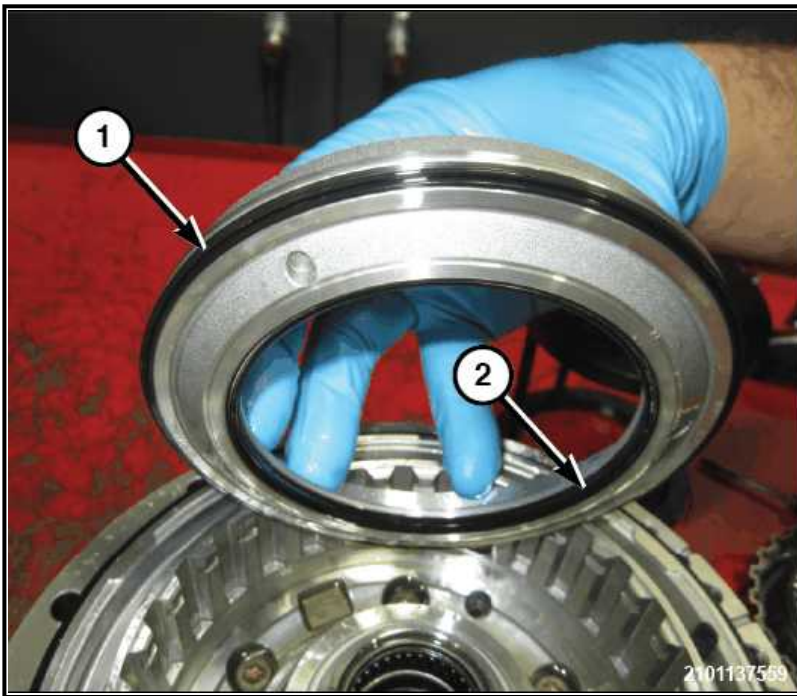
1 - Clutch A Belleville Spring

11. Remove the Clutch A belleville spring.



1 - Clutch A Piston

12. Remove the Clutch A piston (1) by rotating and gently lifting.



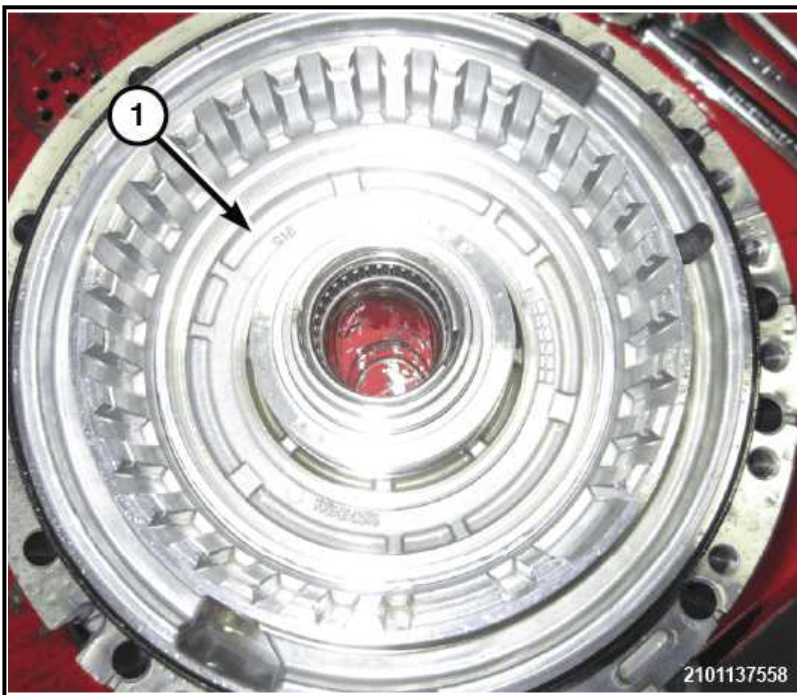
- | |
|--------------------------------|
| 1 - Clutch A Piston Outer Seal |
| 2 - Clutch A Piston Inner Seal |

13. Remove and **DISCARD** the Clutch A Piston inner and outer seals.

ASSEMBLY

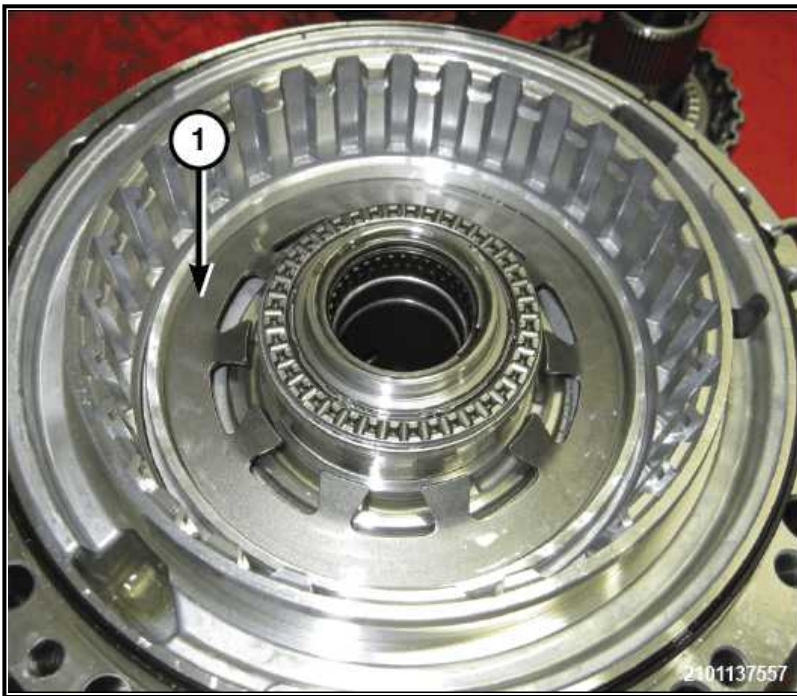
NOTE: If the clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Install new Clutch A inner and outer piston seals.



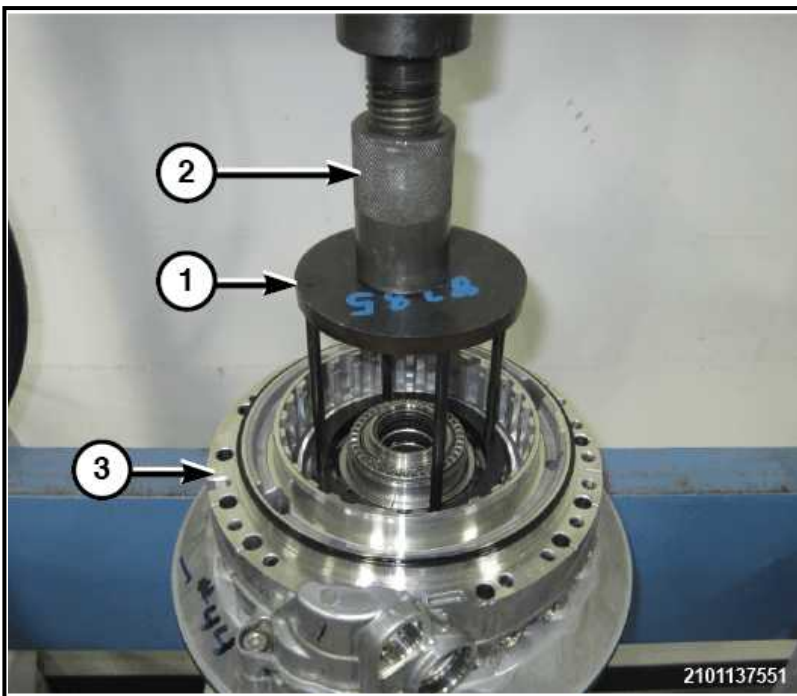
- | |
|---------------------|
| 1 - Clutch A Piston |
|---------------------|

2. Insert the Clutch A piston into the housing. Lubricate the seals with transmission assembly lube prior to installing them into the housing.



1 - Clutch A Belleville Spring

3. Insert the belleville spring.



1 - Spring Compressor Tool

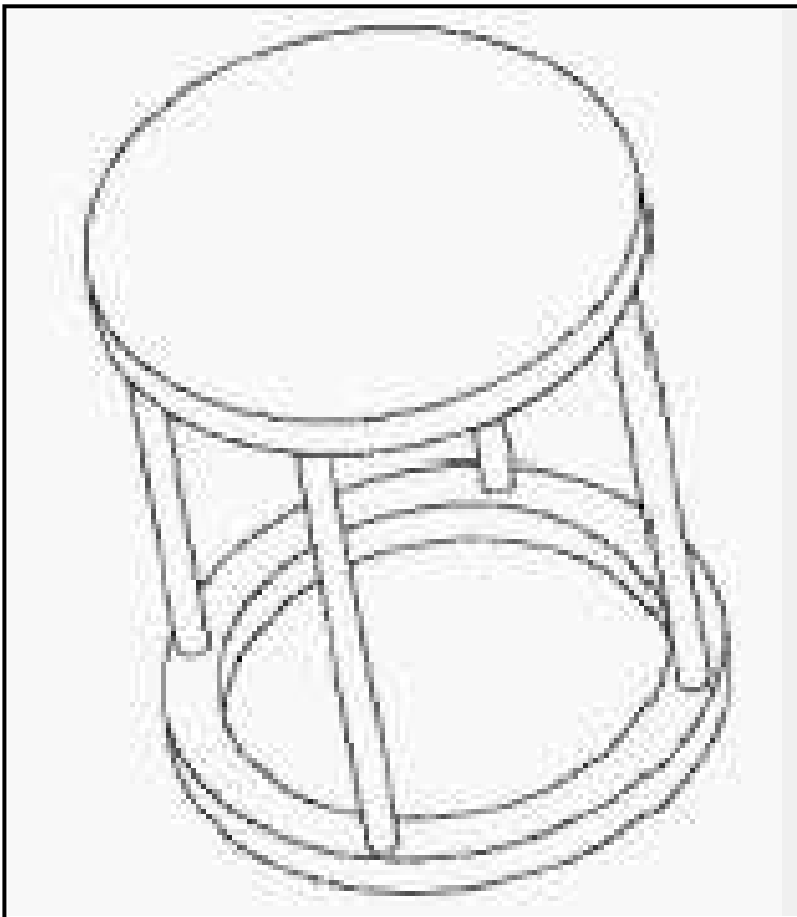
2 - Arbor Press

3 - Transmission Oil Pump Assembly

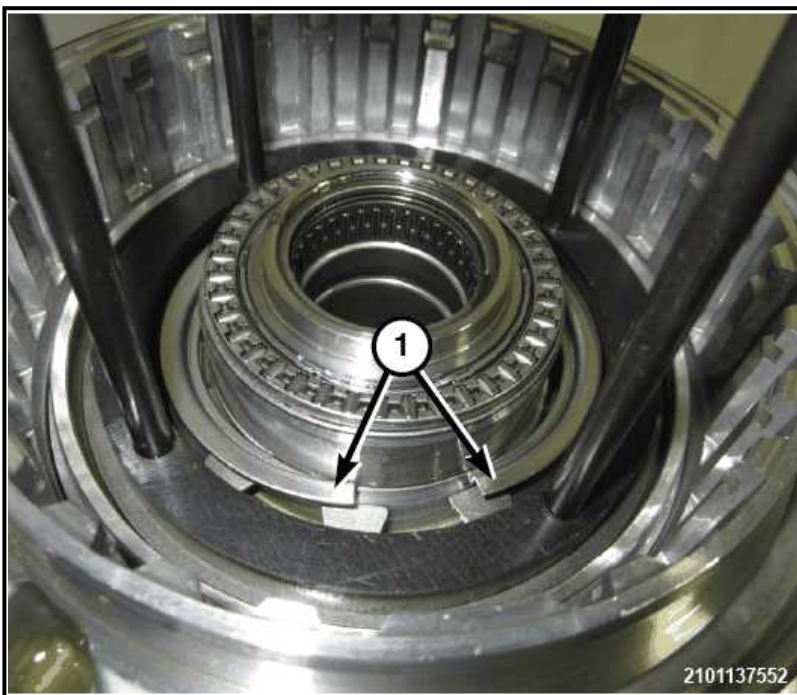
4. Position the oil pump housing assembly in a suitable arbor press.

5. Using

(special tool #8285, Compressor, Spring)

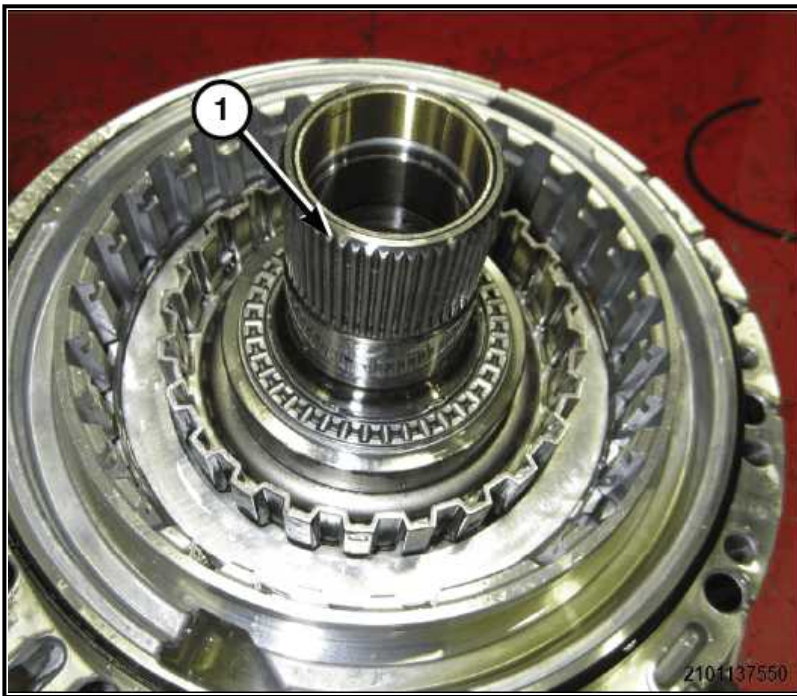


, press on the fingers of the piston retaining ring to remove tension.



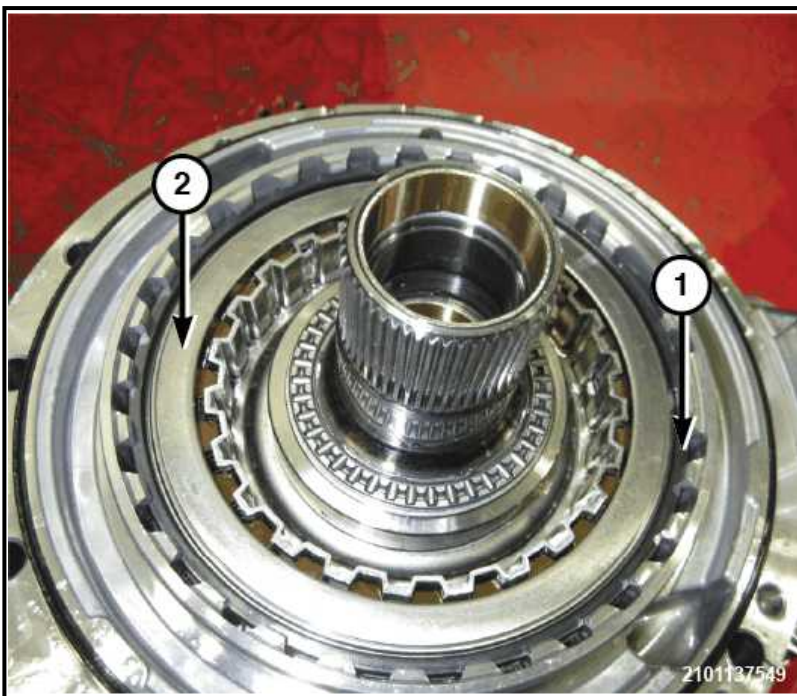
1 - Retaining Ring

6. Install the two retaining ring halves.



1 - Hub

7. Install the hub.

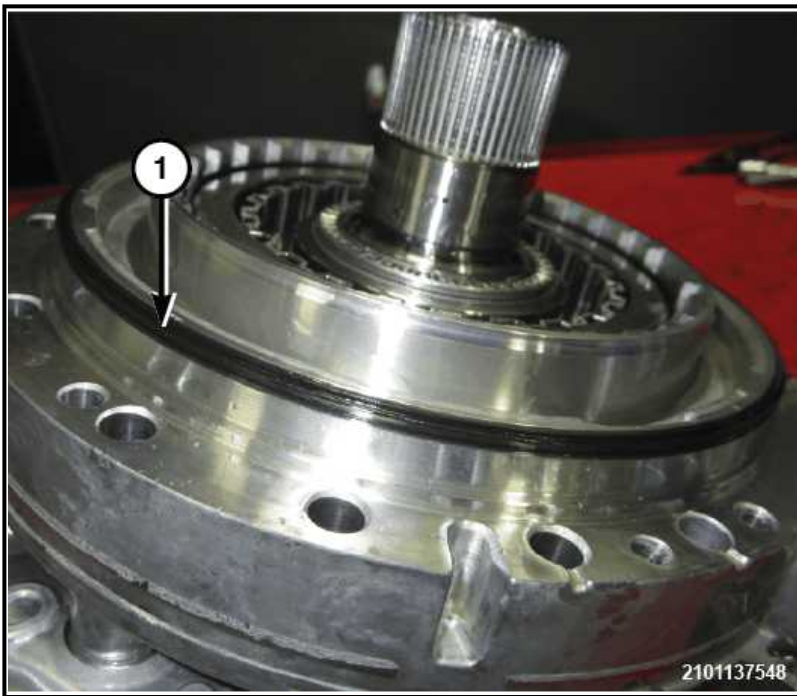


1 - Snap Ring

2 - Clutch A Discs and Plates

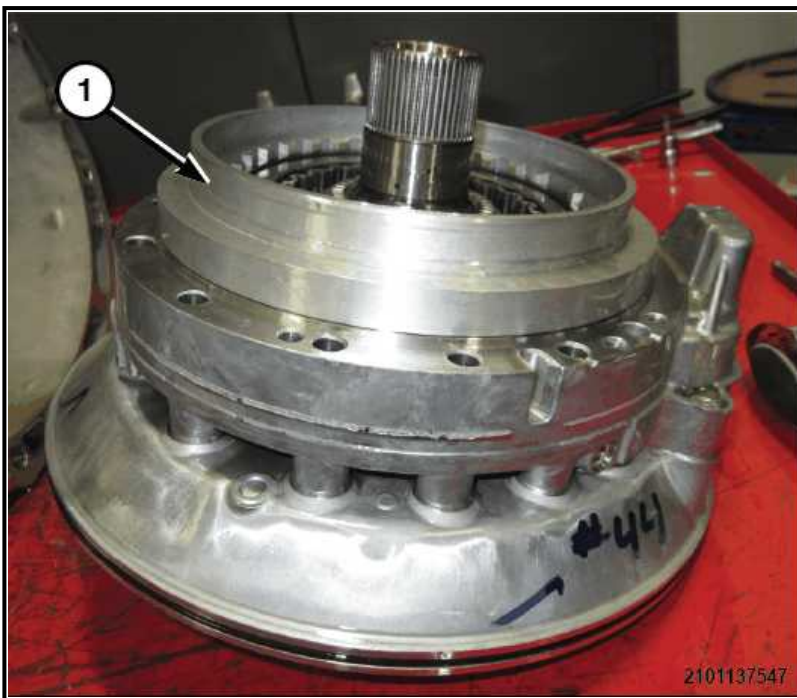
8. Install the Clutch A disks and plates.

9. Install the snap ring.



1 - Clutch B Piston Seal

10. Install a **NEW** Clutch B seal.



1 - Clutch B Piston

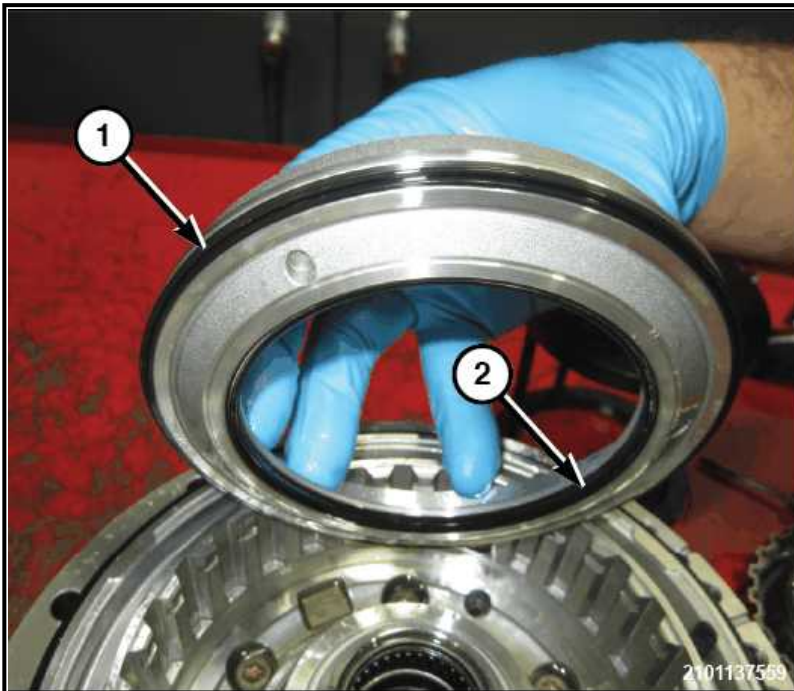
11. Install the Clutch B piston on the assembly.



1 - Clutch B Damper Spring

12. Install the Clutch B damper spring on the Clutch B piston.

13. Install the transmission oil pump. Refer to [PUMP, TRANSMISSION OIL, REMOVAL AND INSTALLATION](#).



1 - Clutch A Piston Outer Seal

2 - Clutch A Piston Inner Seal

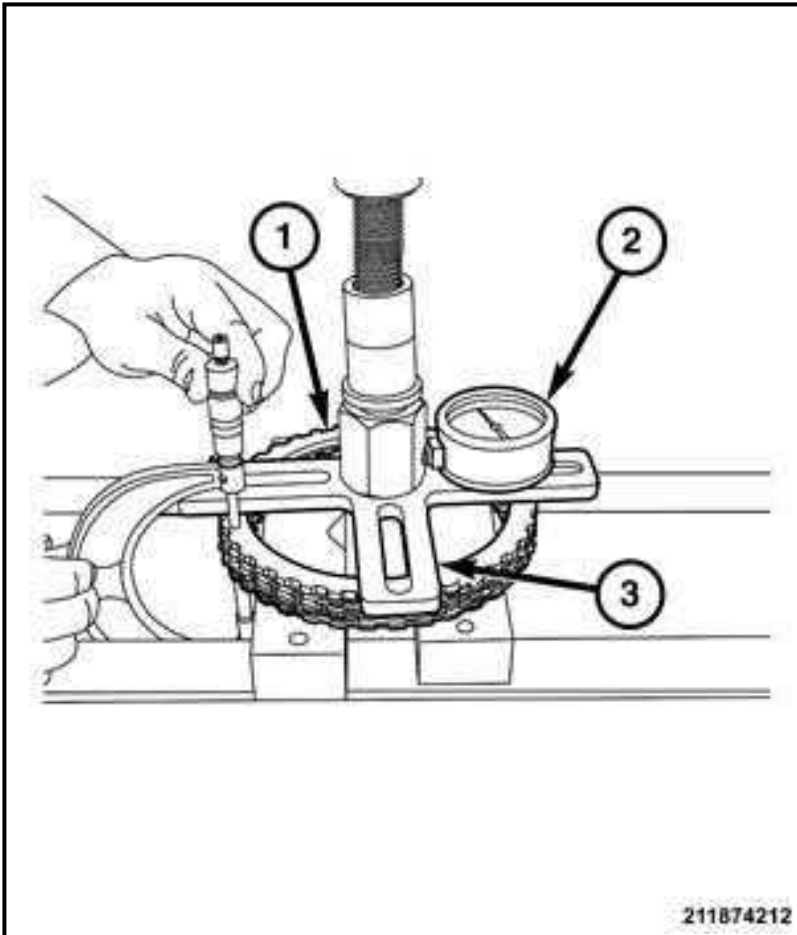
CLUTCH B - DISASSEMBLY AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

NOTE: When the Clutch B is replaced, the proper selectable shim must be installed to achieve specified clearance.

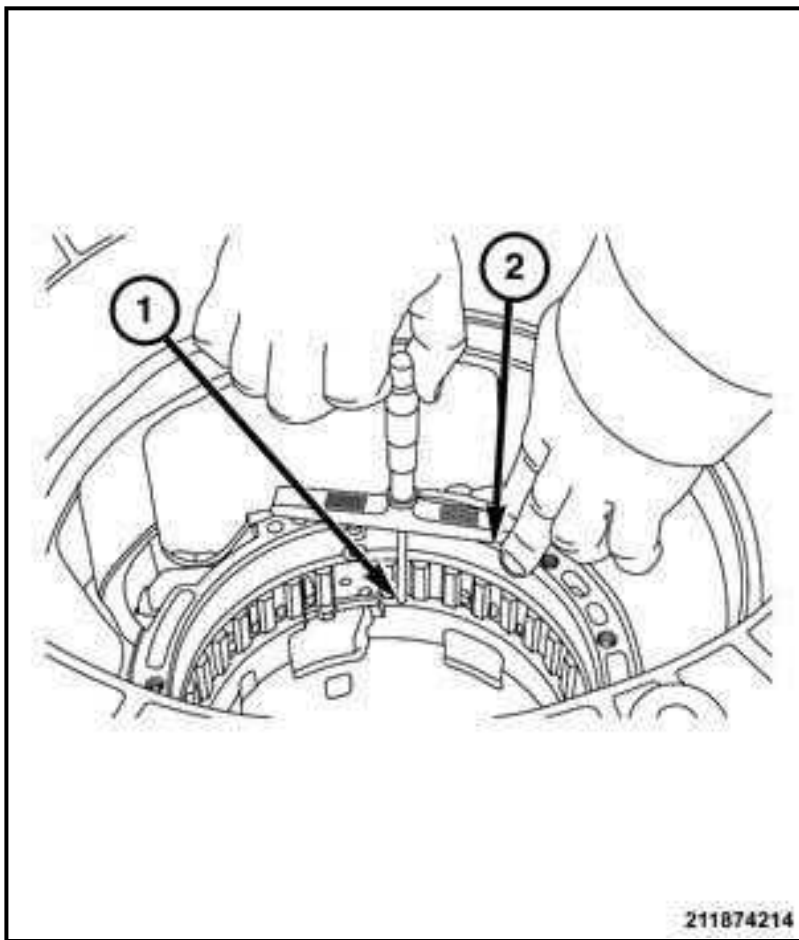
1. Place the Clutch B, with the wave plate on top, on a suitable arbor press.

2. Position tools (special tool #8901A, Pressing Tool) (using just the cross bar) and (special tool #10429, Gauge, Force) on top of the Clutch B wave plate and under the press ram.



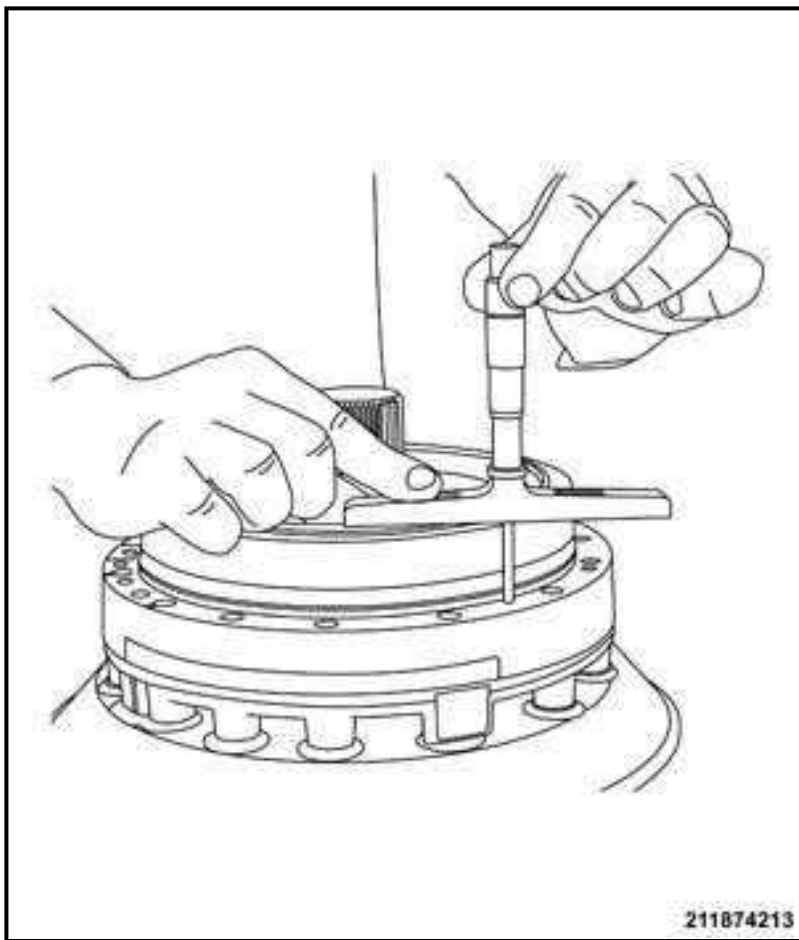
- | |
|-------------------------|
| 1 - Clutch B Wave Plate |
| 2 - Force Gauge |
| 3 - Compressed Clutch B |

3. Apply 500 N (112 lbf.) of downward force on the Clutch B to compress the wave plate.
4. Using a suitable micrometer, measure the thickness of the compressed Clutch B. **Record the measurement as (A)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



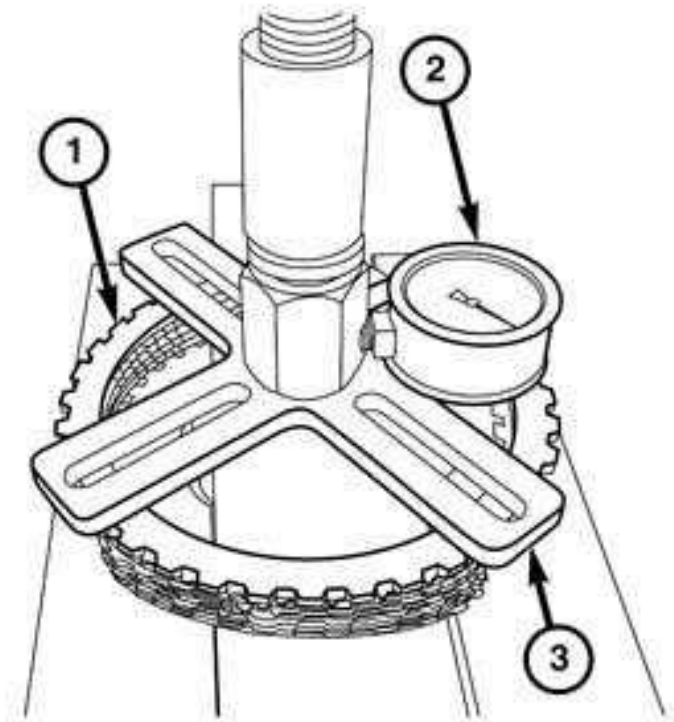
1 - Clutch B Retainer
2 - Transmission Oil Pump

5. With a suitable depth micrometer, place it at the mounting surface of the transmission oil pump and measure to the base of the Clutch B retainer on the case. This measurement should be 61.05 mm. **Record the measurement as (B)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.



6. Using a suitable depth micrometer, measure the Clutch B piston.
7. Measure between the fluid pump sealing surface and the bottom of the straight edge. **Record the measurement as (C)** to calculate the Clutch B clearance in order to determine the correct selectable shim thickness.

Calculation - Take the case depth (B) subtract (C) subtract (A) remainder is the clearance of the Clutch B. If the clearance is not within specification a thinner or thicker reaction plate can be installed to achieve proper clearance.



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1 - Clutch B Wave Plate

2 - Force Gauge

3 - Pressing Tool

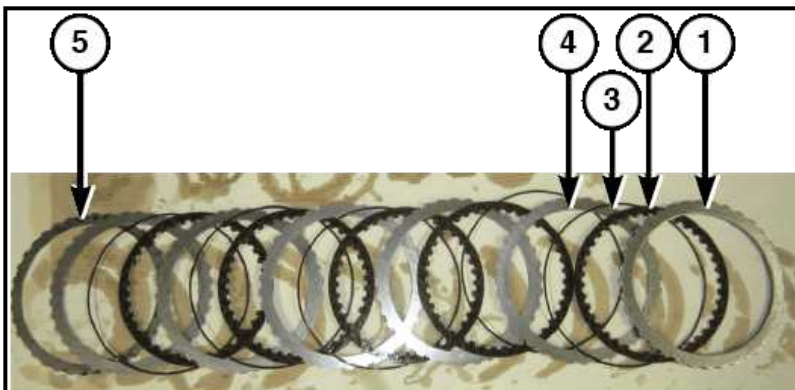
CLUTCH SPECIFICATIONS

Clutch	Condition	Minimum	Normal	Maximum
B	NEW	1.52 mm	1.725 mm	1.93 mm
		0.060 in.	0.068 in.	0.076 in.
	AFTER OPERATION	1.52 mm	1.825 mm	2.13 mm
		0.060 in.	0.072 in.	0.084 in.

CLUTCH B SELECTABLE BACKING PLATES

6.0 mm	.236 in.
5.8 mm	.228 in.
5.6 mm	.220 in.
5.4 mm	.212 in.
5.2 mm	.204 in.
5.0 mm	.196 in.
4.8 mm	.188 in.

DISASSEMBLY The Clutch B, depending on the transmission Julian date, may contain wave springs that sit around each friction plate. There will be five friction plates (2), five wave springs (3), five steel plates (4), one backing plate (1), and one wave plate (5).



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1 - Backing Plate

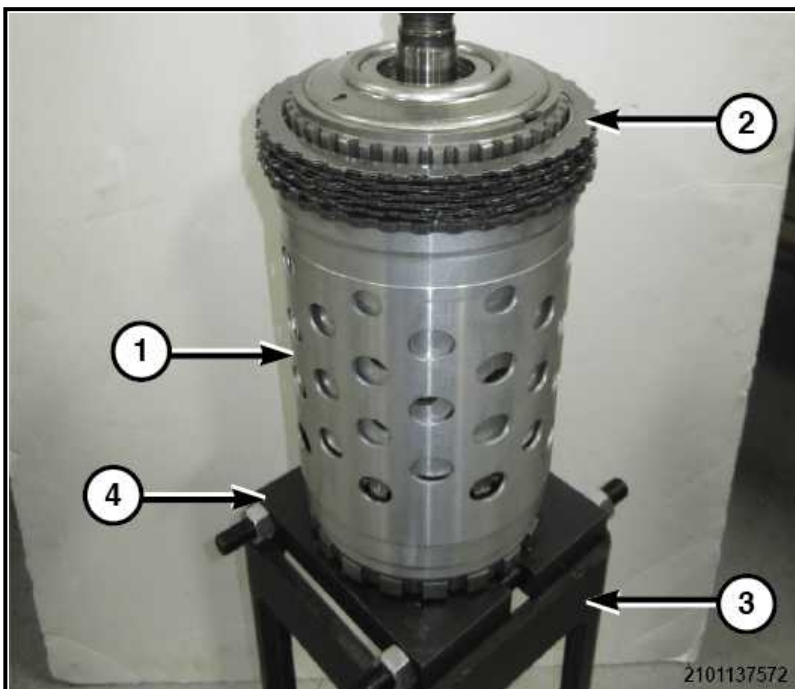
2 - Friction Plates

3 - Wave Springs

4 - Steel Plates

5 - Wave Plate

1. Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear) and remove the Clutch B discs and plates.



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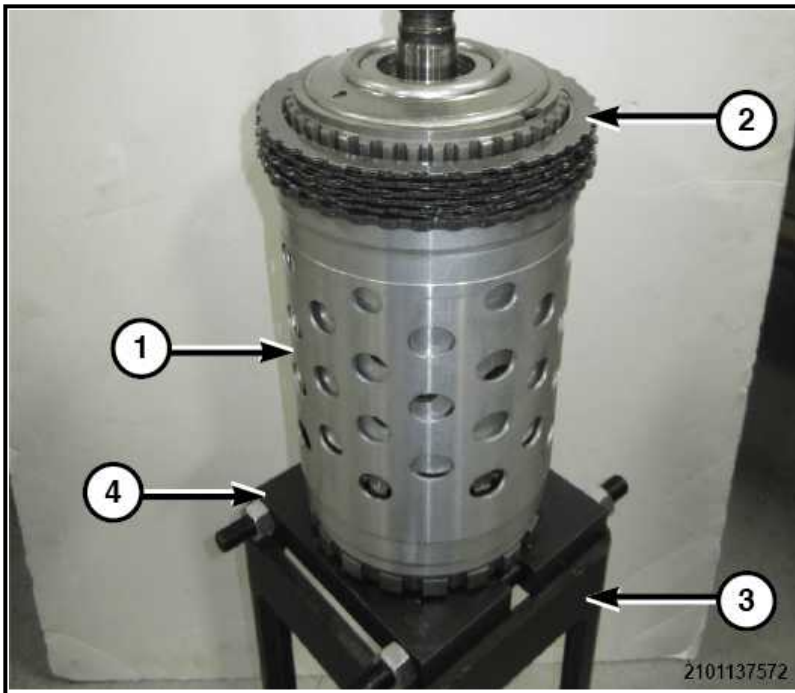
1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

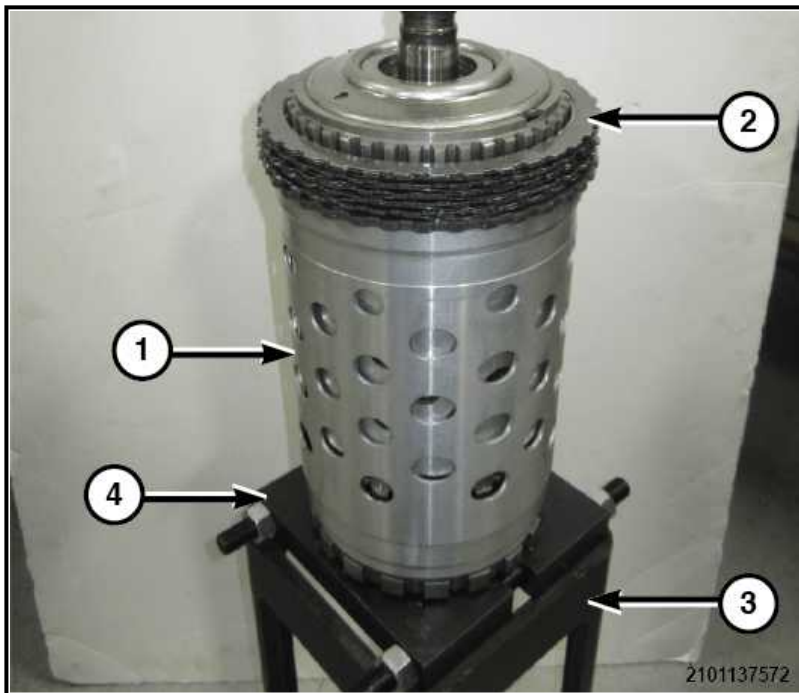
ASSEMBLY



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Splitter, Bearing/Gear

NOTE: If clutch discs are being replaced, soak in 8HP transmission fluid before assembly.

1. Position the input/output and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) and (special tool #1130, Splitter, Bearing/Gear).



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Bearing/Gear Splitter

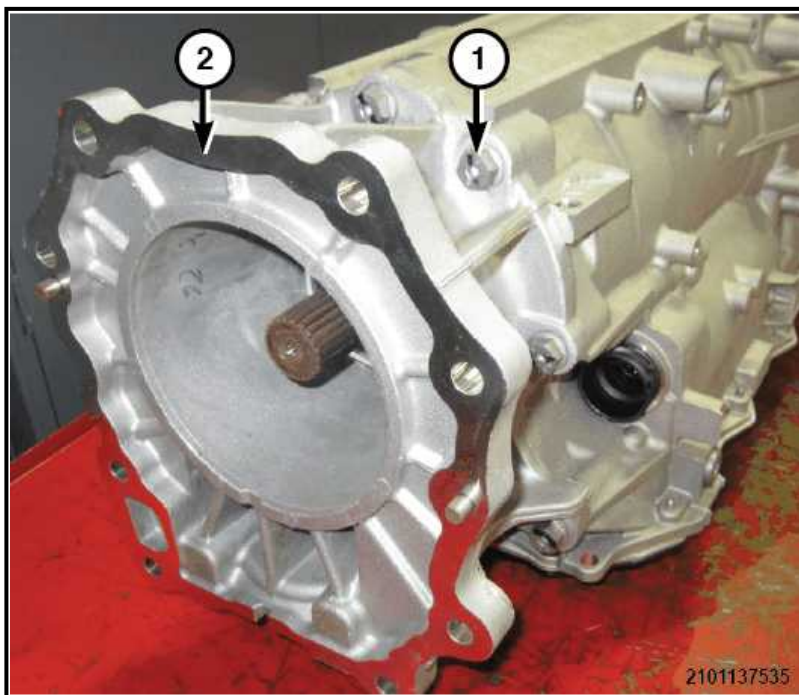
2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.
5. Install the P1 annulus onto the input/output shaft.
6. Install the correct selectable shim onto the P1 annulus.

END PLAY - MEASUREMENT AND ADJUSTMENTS

CLUTCH B MEASUREMENT PROCEDURE

NOTE: The proper selectable shim must be installed to achieve specified clearance.

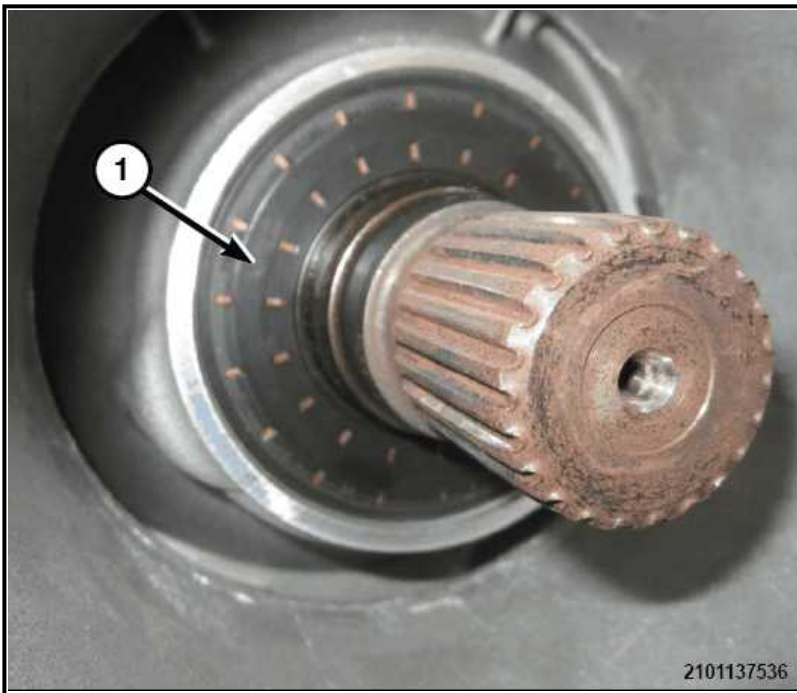
1. Remove the torque converter.



1 - Extension Housing Bolts
2 - Extension Housing

NOTE: 4WD Only

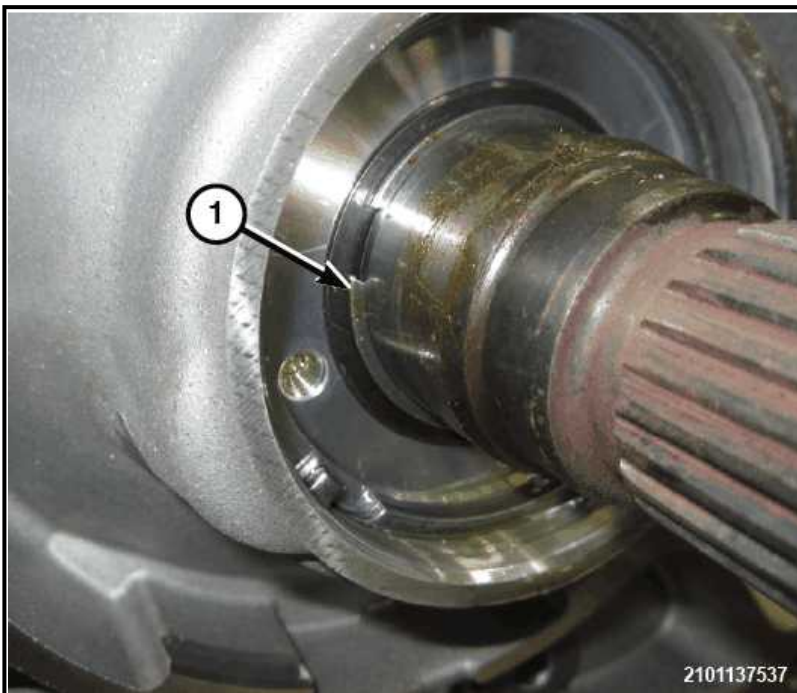
2. If the vehicle is **2WD** , proceed to Step 6. If the vehicle is **4WD** proceed to Step 2.
3. If equipped, remove the transmission housing extension housing bolts and remove the extension housing.



1 - Output Shaft Seal

NOTE: 4WD Only

4. Remove the transmission output shaft seal with a suitable slide hammer and screw.

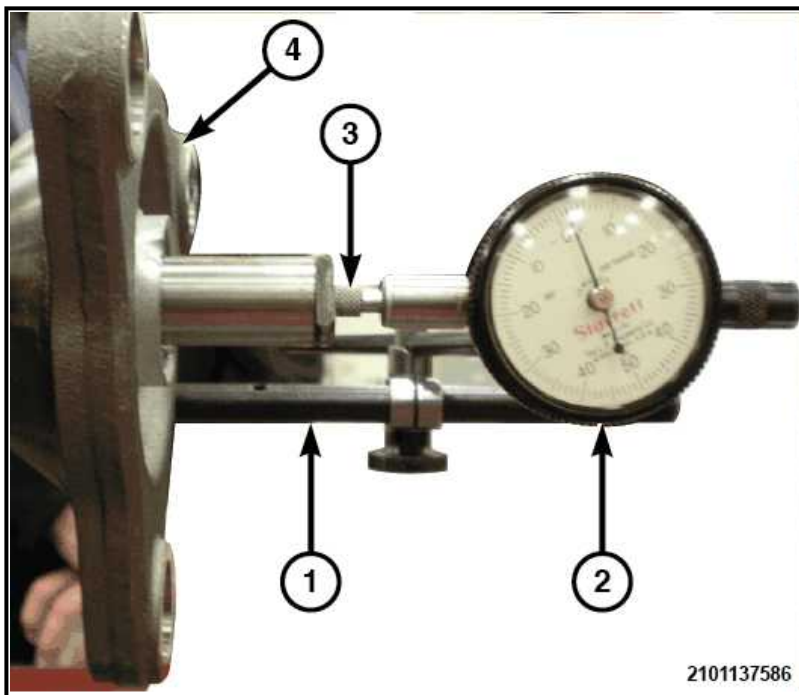


1 - Output Shaft Snap Ring

NOTE: 4WD Only

5. Remove the output shaft snap ring.

NOTE: 2WD shown, 4WD similar.



1 - Transmission Output Flange
2 - Dial Indicator
3 - Plunger
4 - Transmission Output Flange

6. Measure the output shaft end play as follows:

- Attach a dial indicator and position the plunger against the end of the output shaft.
- Zero the dial indicator.
- Move the output shaft flange in and out, and record the maximum travel on the dial for assembly reference.

If the end play is not within specification a thinner or thicker selectable shim can be installed to achieve proper end play.

END PLAY SPECIFICATIONS

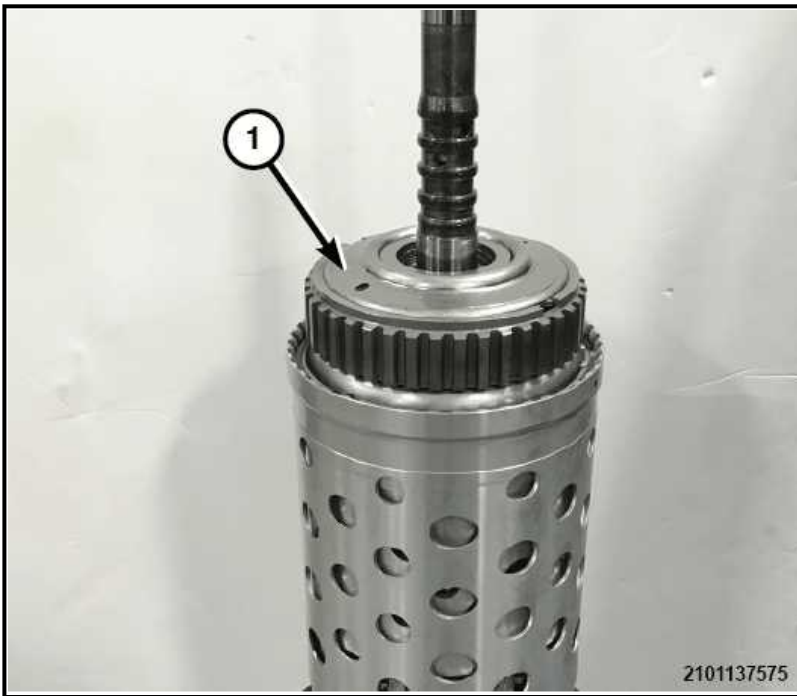
Minimum	Maximum
0.11 mm	0.42 mm
0.0043 in.	0.0165 in.

END PLAY SELECTABLE SHIMS

NOTE: Check with parts for selectable shim thicknesses and availability.

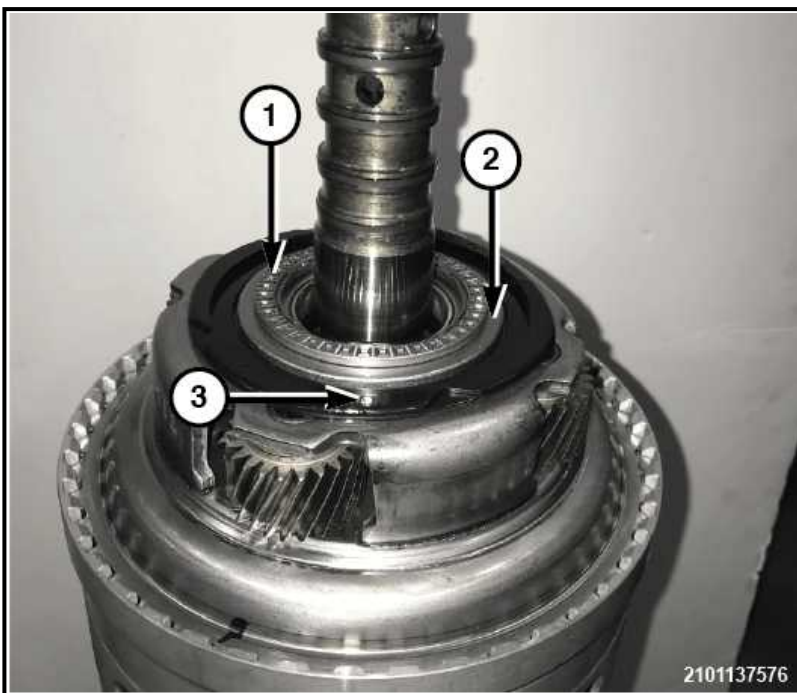
DISASSEMBLY

- Position the input/output shaft and the P4 annulus drum assembly on (special tool #8925-3, Assembly, Press Fixture) with (special tool #1130, Splitter, Bearing/Gear).
- Remove the Clutch B discs and plates.



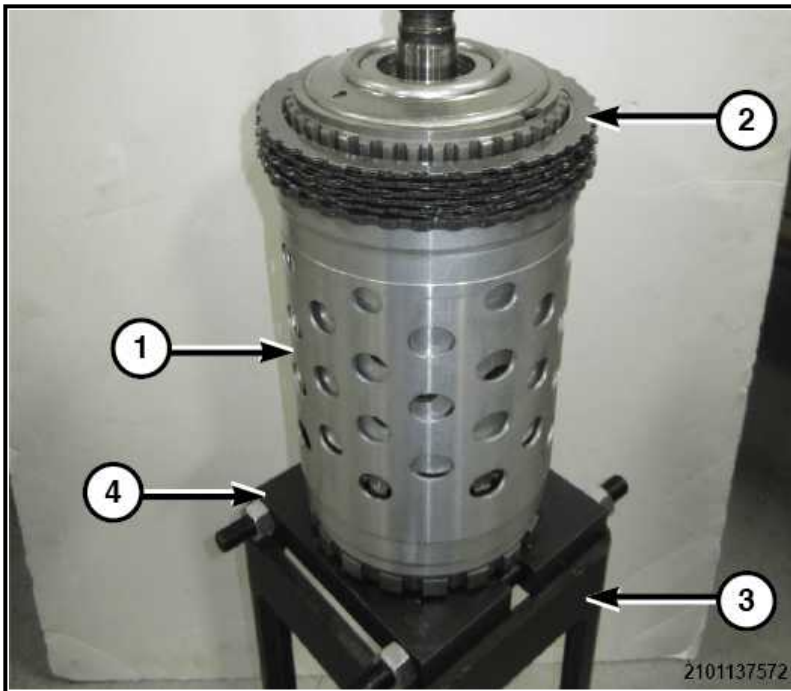
1 - P1 Annulus/Clutch B Hub Assembly

3. Remove the O-ring and five squared O-rings from the input shaft.
4. Remove the P1 annulus/Clutch B hub assembly from the P4 annulus drum.



1 - Thrust Bearing
2 - Holding Plate
3 - Selectable Shim

5. Remove the selectable shim from the P1 planetary carrier.
6. Measure the selectable shim and calculate the thickness of the shim to obtain the correct end play.



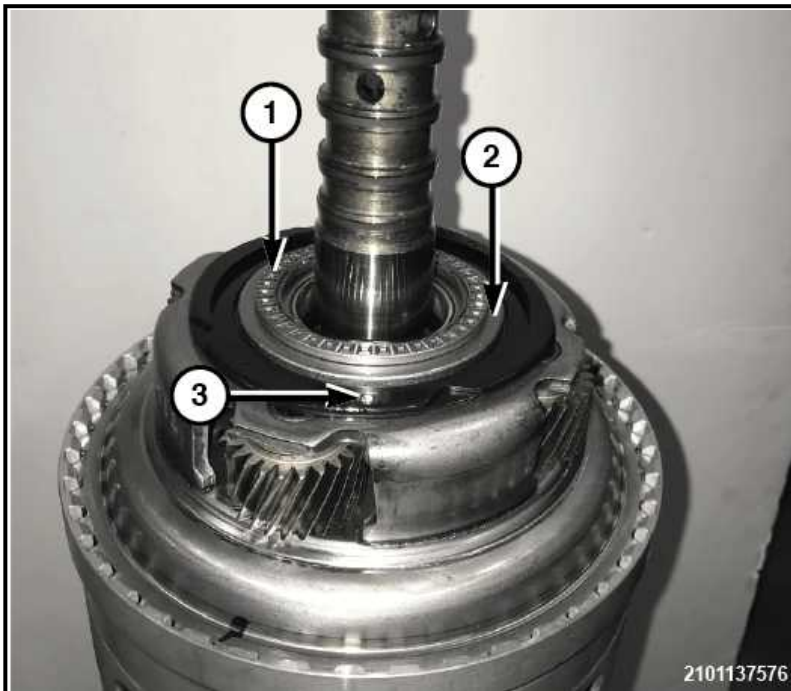
1 - P4 Annulus Drum Assembly

2 - Clutch B Discs and Plates

3 - Press Fixture Assembly

4 - Bearing/Gear Splitter

ASSEMBLY

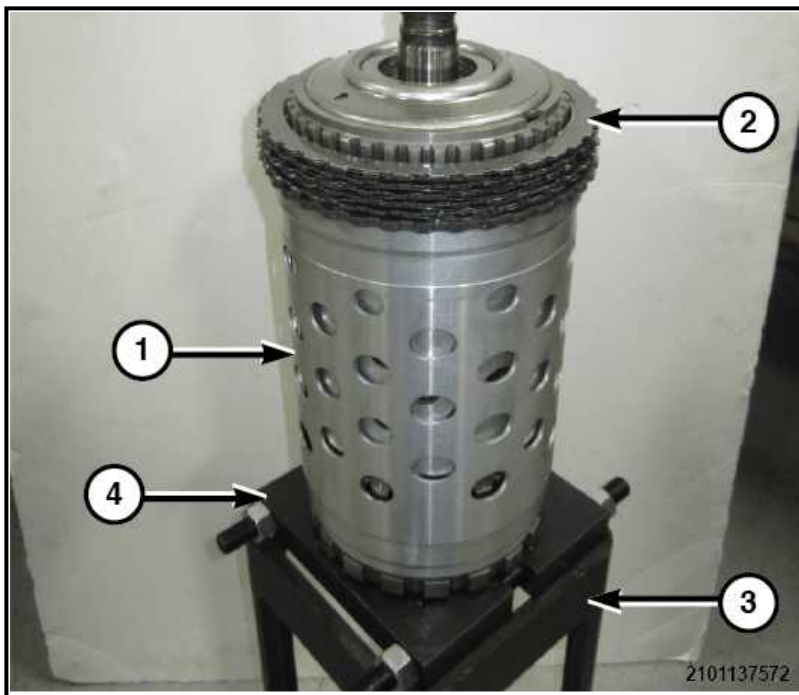


1 - Thrust Bearing

2 - Holding Plate

3 - Selectable Shim

1. Install the selectable shim onto the P1 planetary carrier.



1 - P4 Annulus Drum Assembly
2 - Clutch B Discs and Plates
3 - Press Fixture Assembly
4 - Bearing/Gear Splitter

2. Install the backing plate first, bevel down.
3. Install the Clutch B plates. If equipped with wave springs, install the first friction plate on the backing plate, then install a wave spring (it will lay just outside the diameter of the friction plate), then a steel plate, and repeat until all plates are installed.
4. Install the Clutch B wave plate.
5. Install the P1 annulus onto the input/output shaft.
6. Install the input/output shaft and the P4 annulus drum assembly into the transmission.

TRANSMISSION OIL PUMP

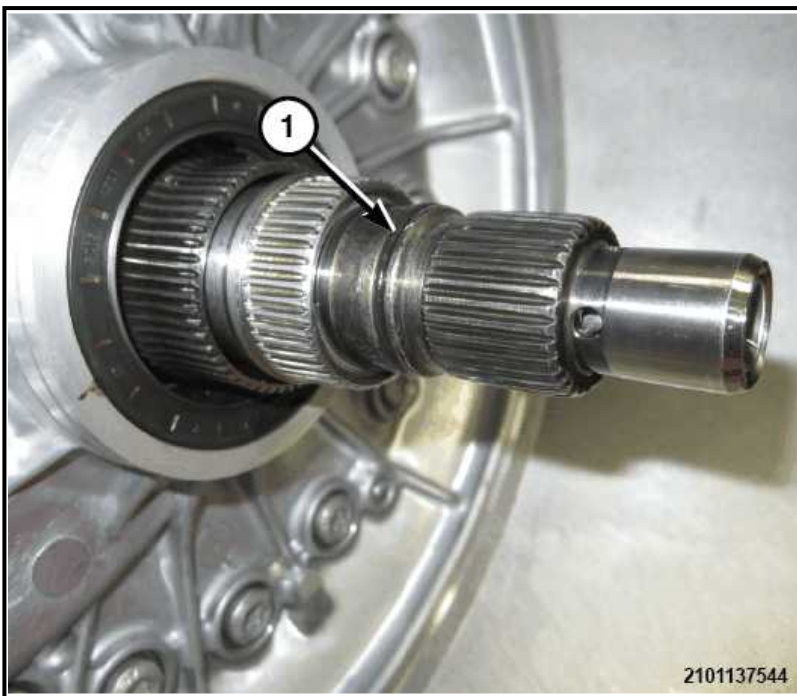
REMOVAL

1. Remove the transmission. Refer to [REMOVAL AND INSTALLATION](#).
2. Remove the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).



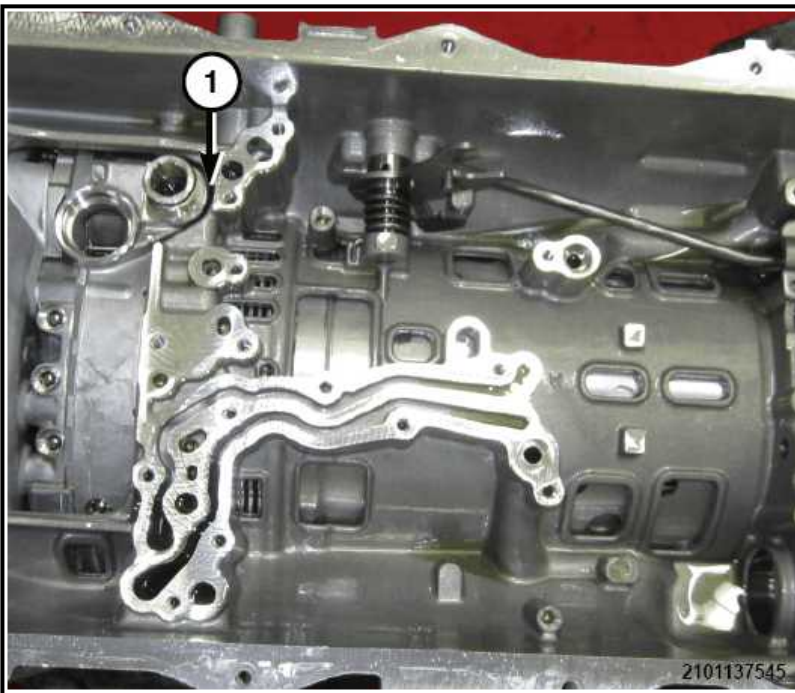
1 - Transmission Oil Pump Assembly To Case Bolts

3. Remove and **DISCARD** the transmission oil pump assembly to case bolts.



1 - Input Shaft O-Ring

4. Remove and **DISCARD** the input shaft O-ring using a small pick or equivalent.



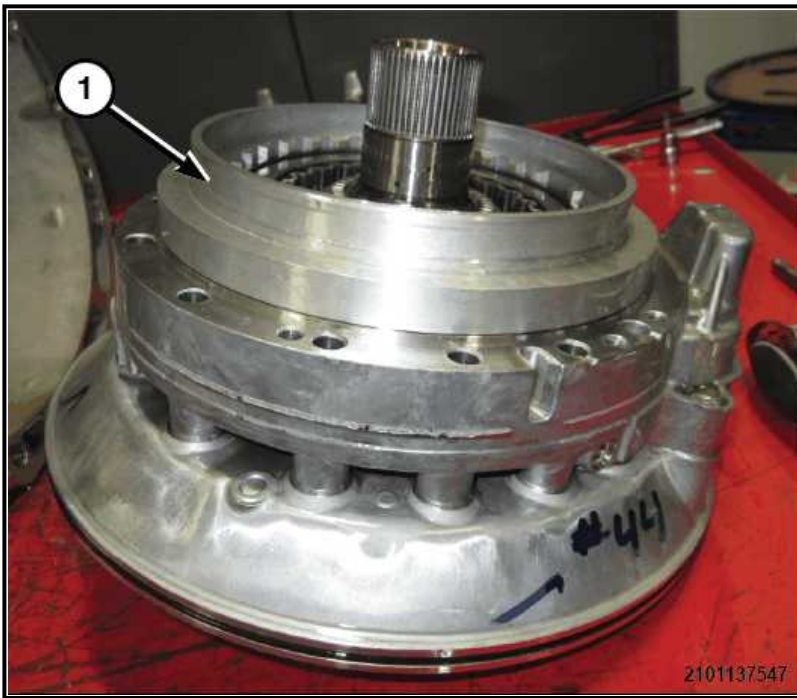
1 - Transmission Oil Pump Assembly

5. Carefully pry the transmission oil pump assembly away from the case with a small flat bladed screwdriver or equivalent through the case opening.
6. From the front of the transmission, remove the transmission oil pump assembly.



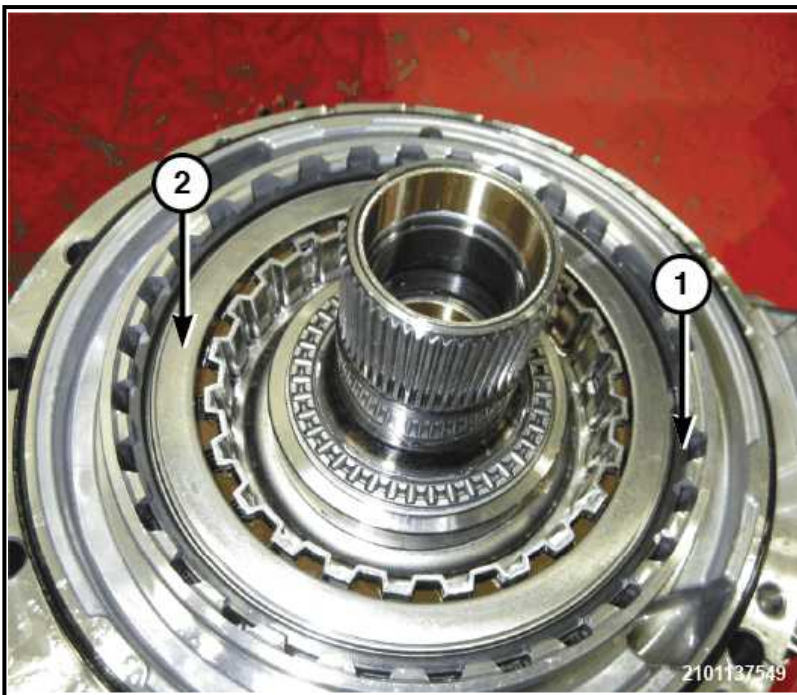
1 - B-Clutch Damper Spring

7. Remove the B-clutch damper spring.



1 - B-Piston

8. Remove the B-piston from the assembly.

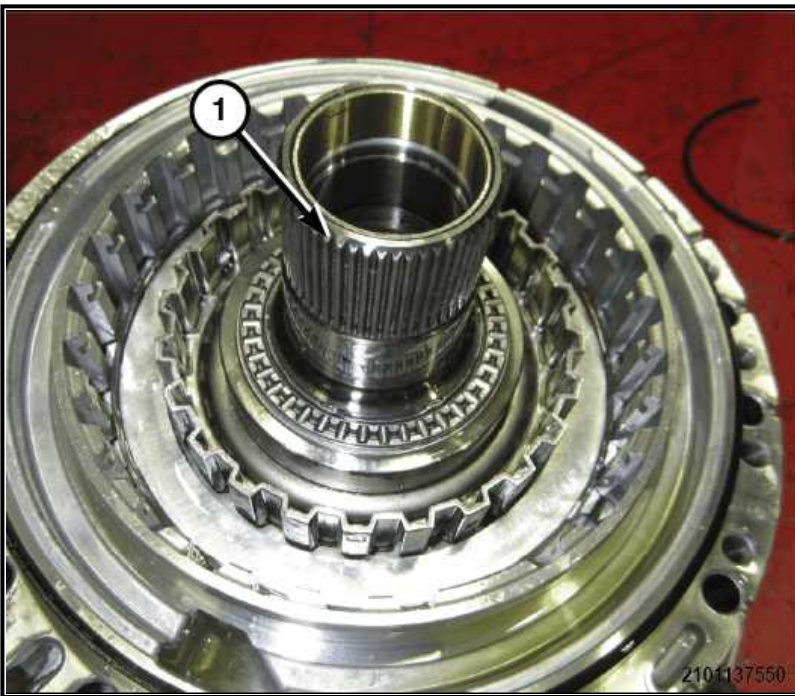


1 - Snap Ring

2 - Clutches and Plates

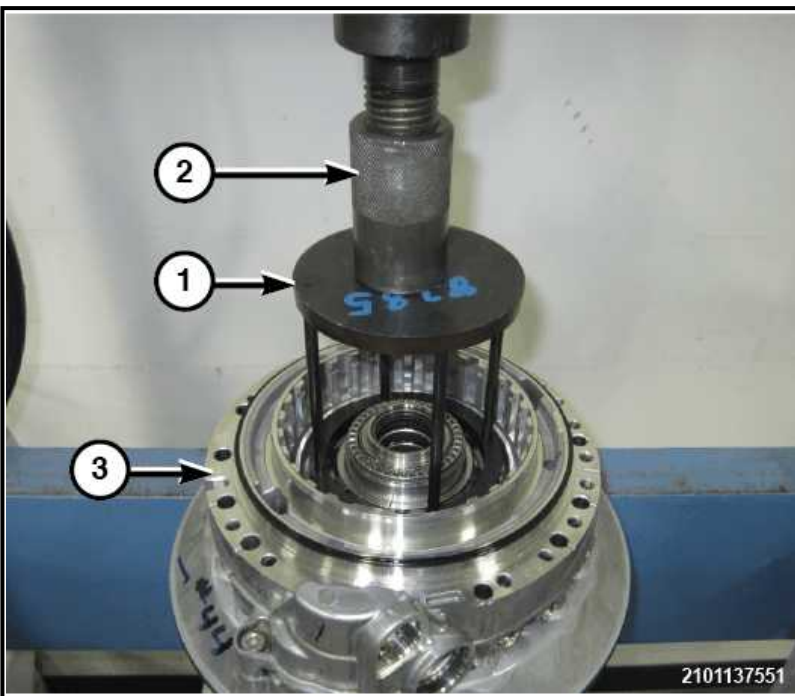
9. Remove the snap ring.

10. Remove the clutches and plates.



1 - Hub

11. Remove the hub.



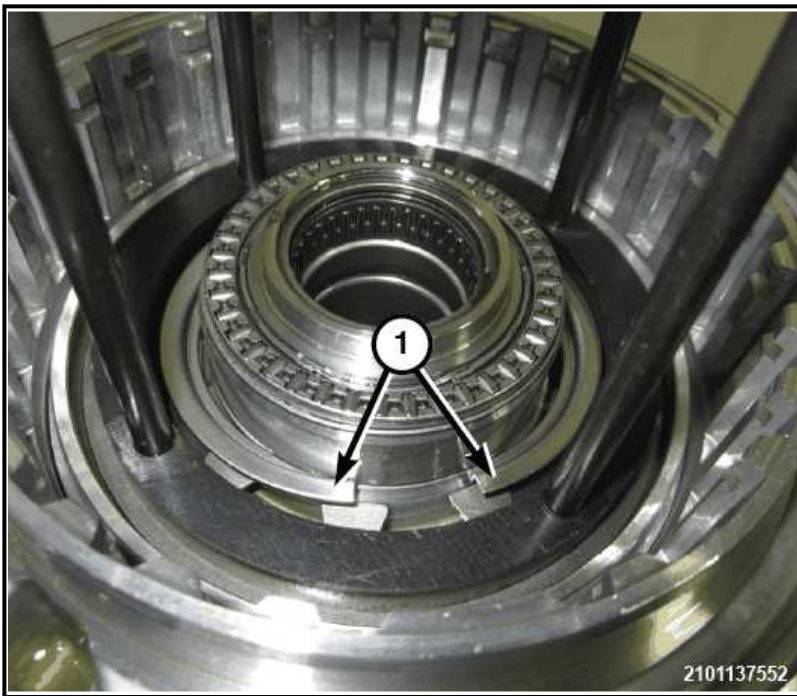
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

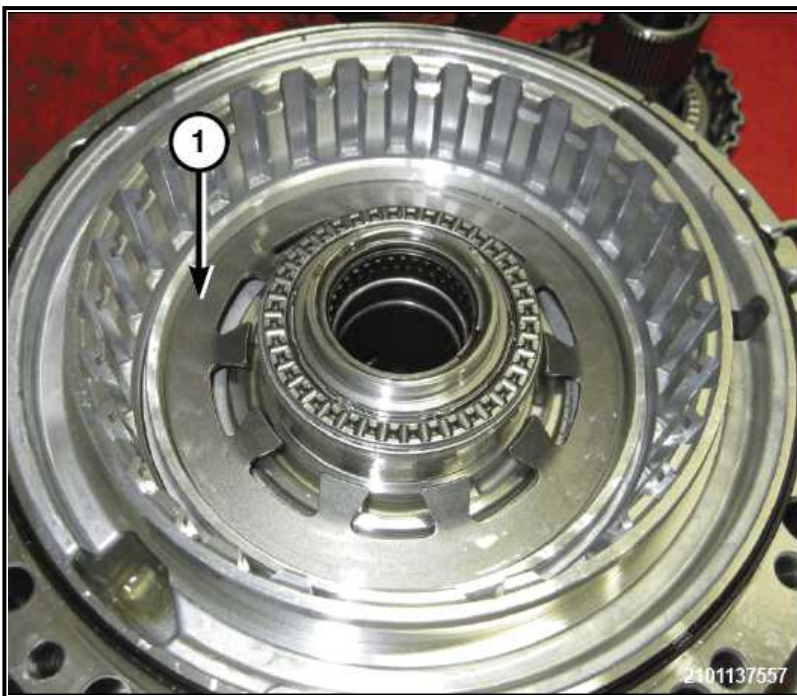
12. Position the transmission oil pump housing assembly in a suitable press.

13. Using (special tool #8285, Compressor, Spring), press on the fingers of the piston retainer to remove tension on the split retaining ring.



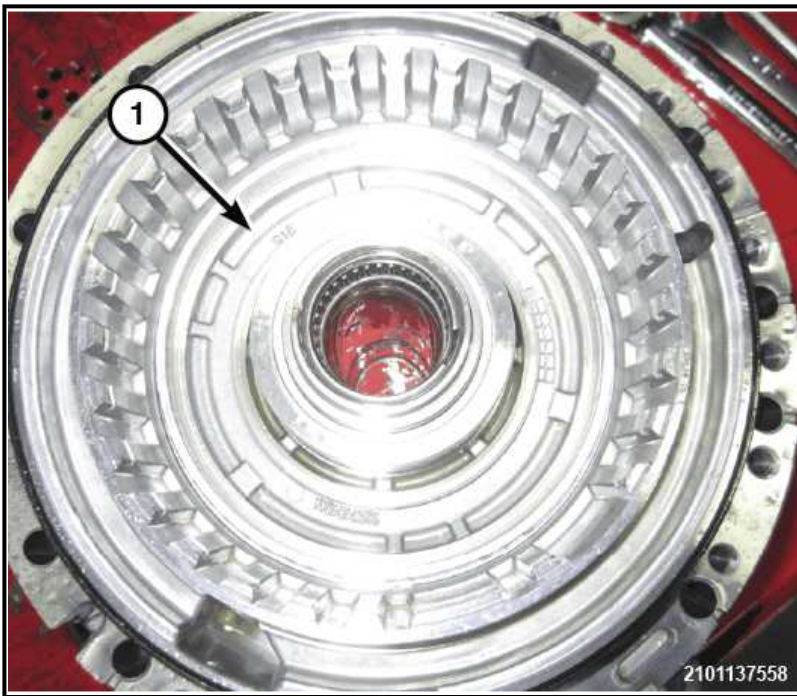
1 - Retaining Ring

14. Remove the two halves of the retaining ring.



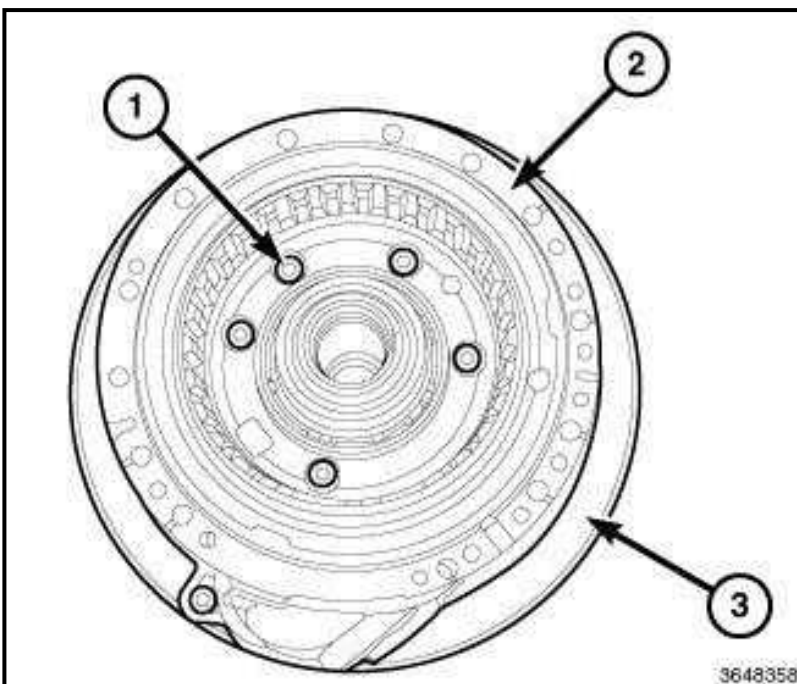
1 - A-Clutch Belleville Spring

15. Remove the A-clutch belleville spring.



1 - A-Clutch Piston

16. Remove the A-clutch piston.



1 - Bolts

2 - Transmission Oil Pump Housing

3 - Transmission Oil Pump Front Cover

17. Remove the bolts and separate the transmission oil pump housing from the transmission oil pump front cover.



1 - Oil Pump Front Cover and O-Ring Seal

18. Separate the transmission oil pump front cover from the transmission oil pump housing and **DISCARD** the oil pump housing O-ring seal.



1 - Drive Sprockets

2 - Chain

19. Remove the drive sprockets, chain and pump body as an assembly.
20. Remove and **DISCARD** all O-rings.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

NOTE: If transmission oil pump was disassembled, replace all O-rings.



1 - Drive Sprockets

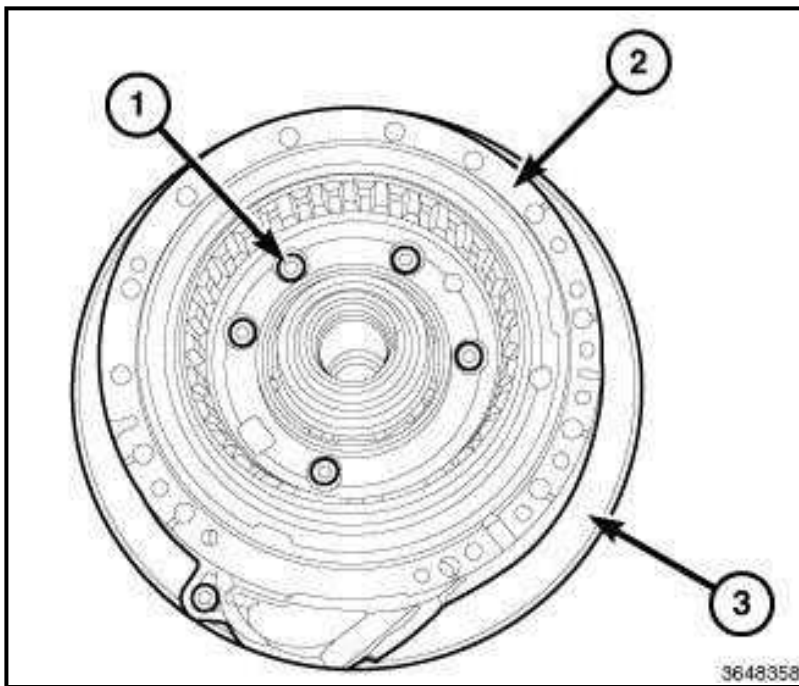
2 - Chain

1. Install the drive sprockets, chain and pump body as an assembly into the transmission oil pump housing.



1 - Oil Pump Front Cover and O-Ring Seal

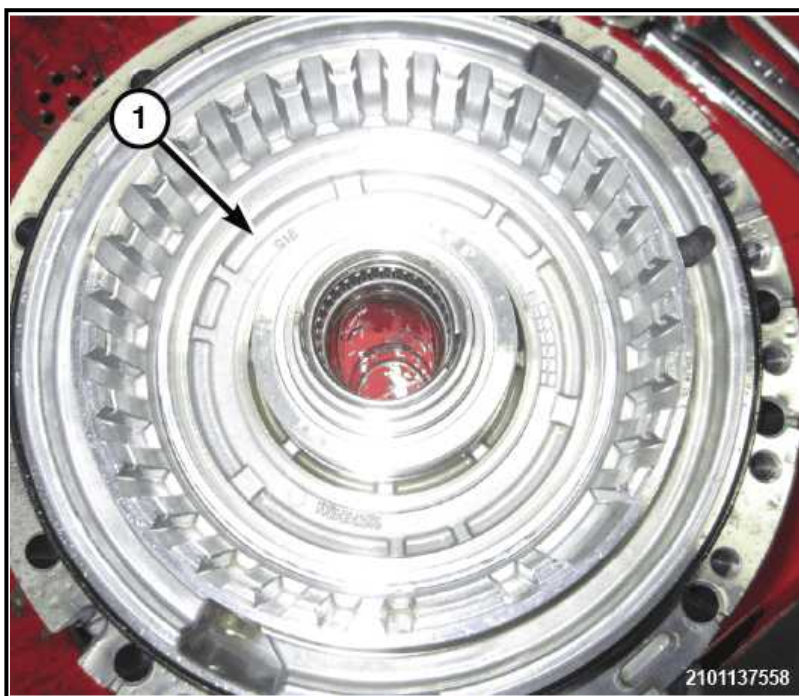
2. Set the transmission oil pump front cover onto the transmission oil pump housing.



1 - Transmission Oil Pump Housing To Cover Bolts
2 - Transmission Oil Pump Housing
3 - Transmission Oil Pump Front Cover

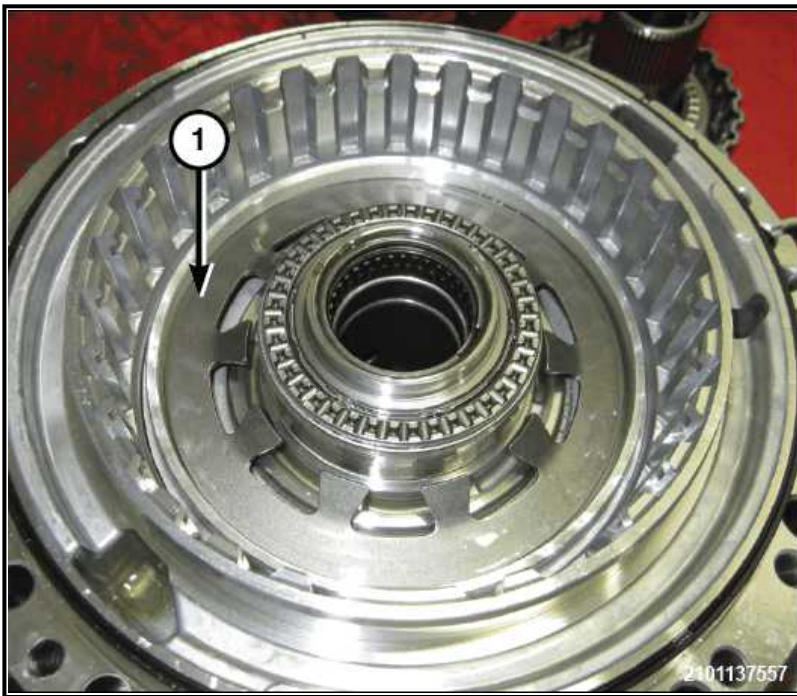
NOTE: The transmission oil pump bolts under the A-clutch must be replaced.

3. Install the **NEW** transmission oil pump housing to cover bolts.



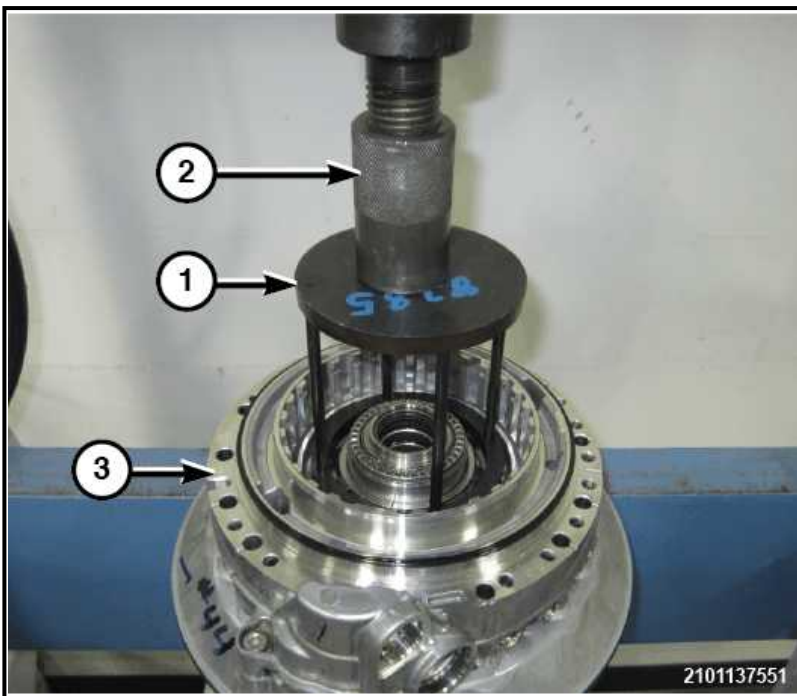
1 - A-Clutch Piston

4. Install the A-clutch piston with **NEW** O-ring seals.



1 - A-Clutch Belleville Spring

5. Install the A-clutch belleville spring.



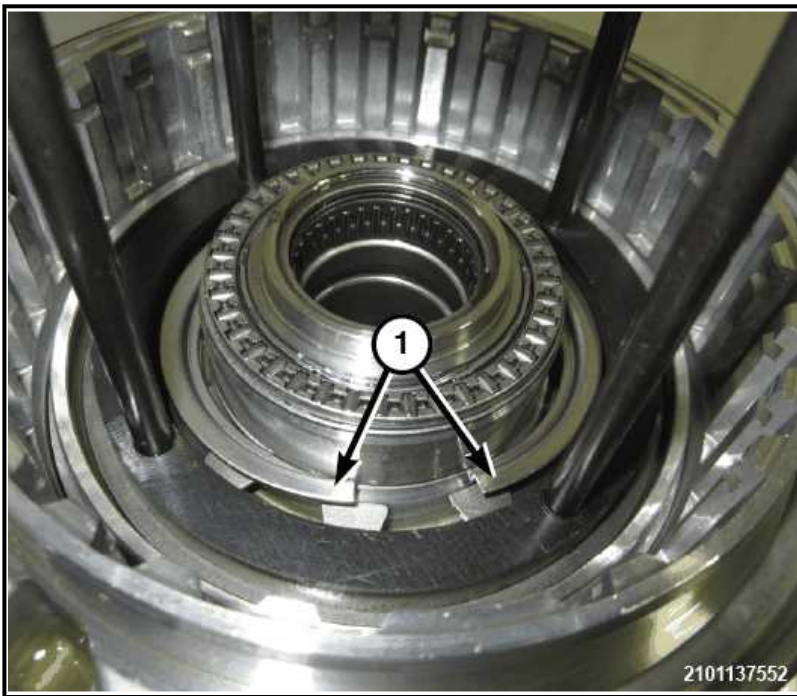
1 - Spring Compressor Tool

2 - Arbor Press

3 - Transmission Oil Pump Assembly

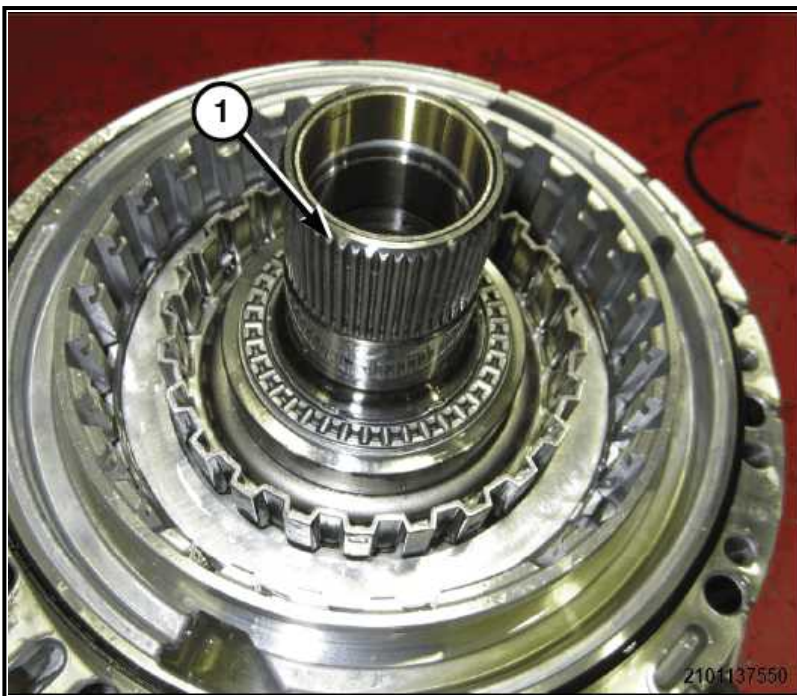
6. Position the transmission oil pump housing assembly in a suitable arbor press.

7. Using (special tool #8285, Compressor, Spring), press down on the fingers of the piston retainer.



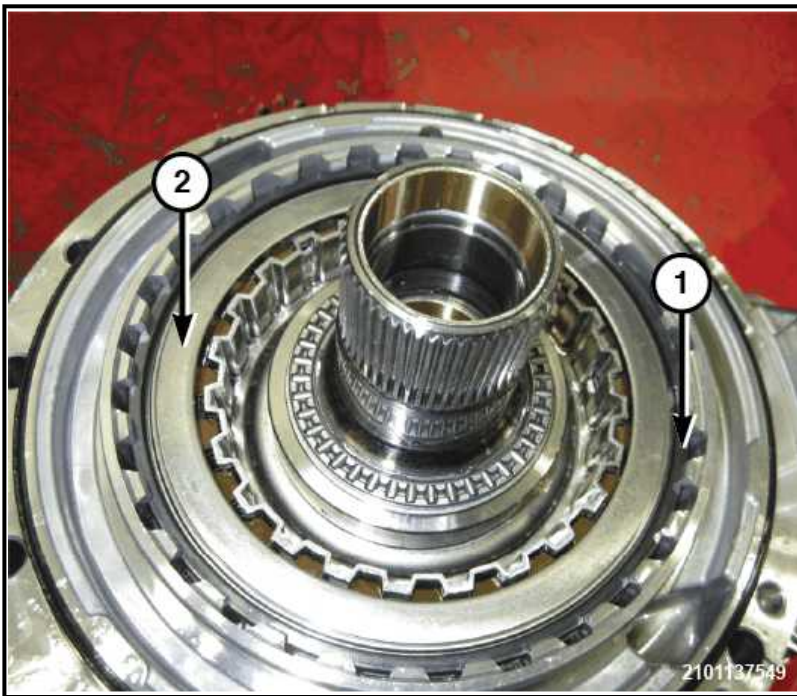
1 - Retaining Ring

8. Install the two retaining ring halves.



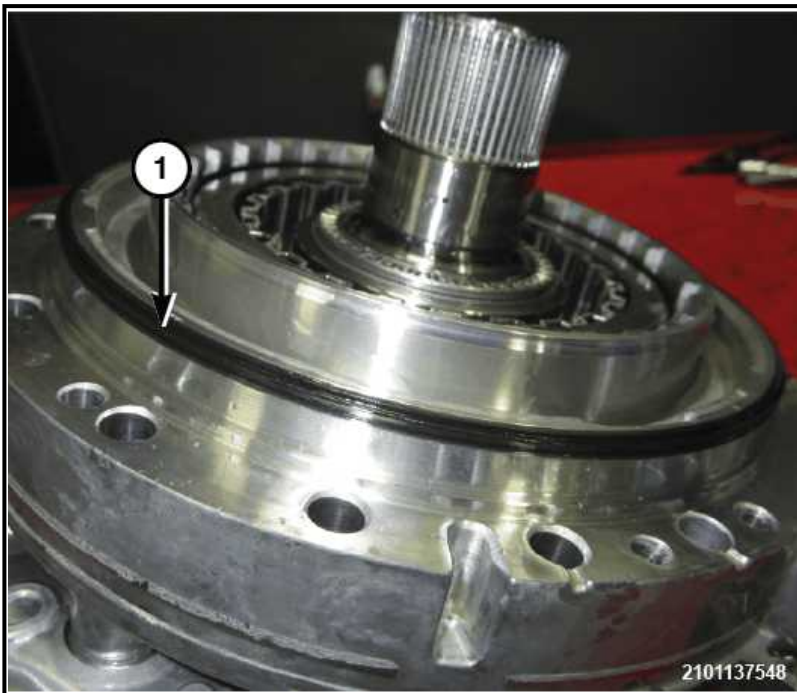
1 - Hub

9. Install the hub.

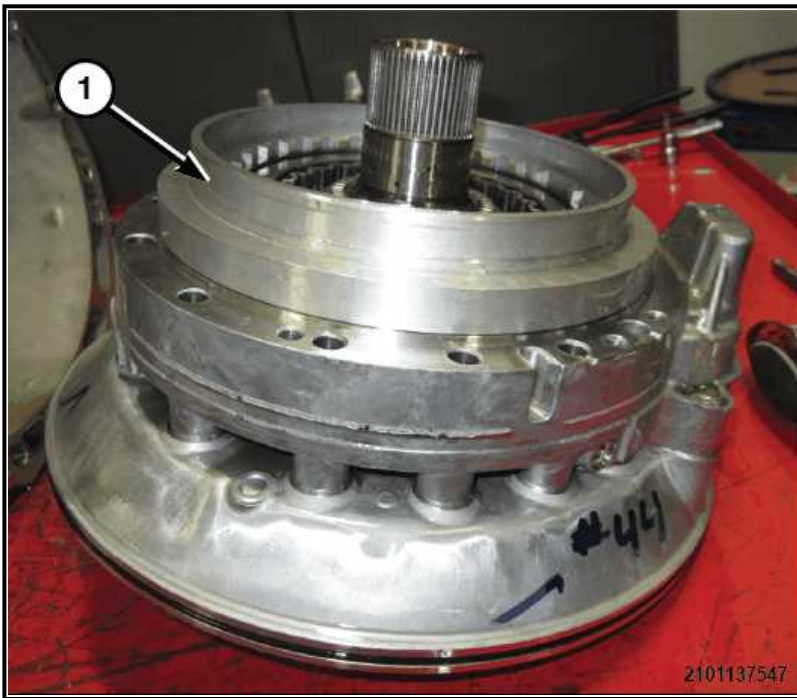


- | |
|-------------------------|
| 1 - Snap Ring |
| 2 - Clutches and Plates |

10. Install the clutches and plates.
11. Install the snap ring.



12. Install a new B-piston seal.



1 - B-Piston

13. Install the B-piston.



1 - B-Clutch Damper Spring

14. Install the B-clutch damper spring.

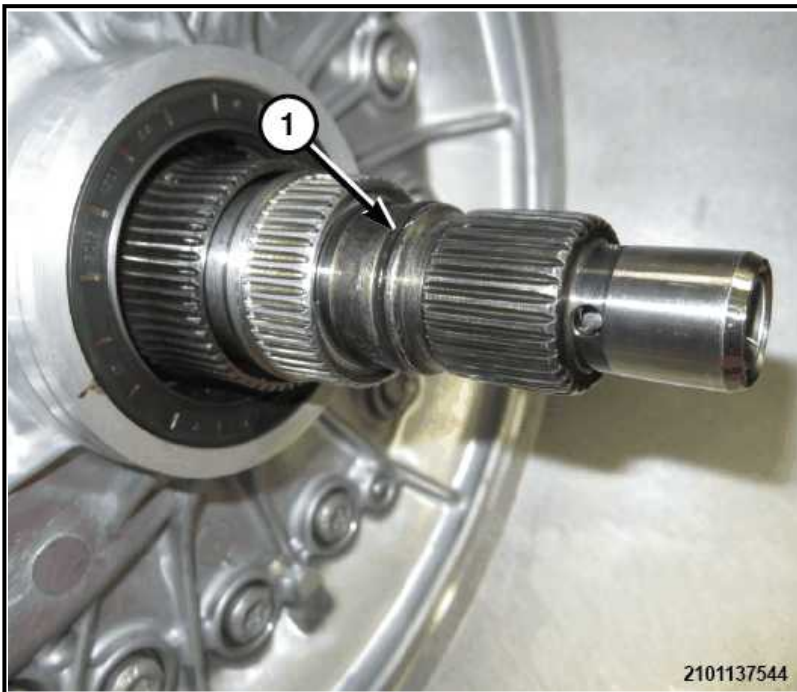
15. Install a **NEW** transmission oil pump front cover seal and install the oil pump in the case.



1 - Transmission Oil Pump Assembly To Case Bolts

16. Firmly press the transmission oil pump in place by hand before drawing it in with the **NEW** transmission oil pump assembly to case bolts.

The transmission oil pump assembly to case bolts must be tightened in the sequence shown in the torque table below.



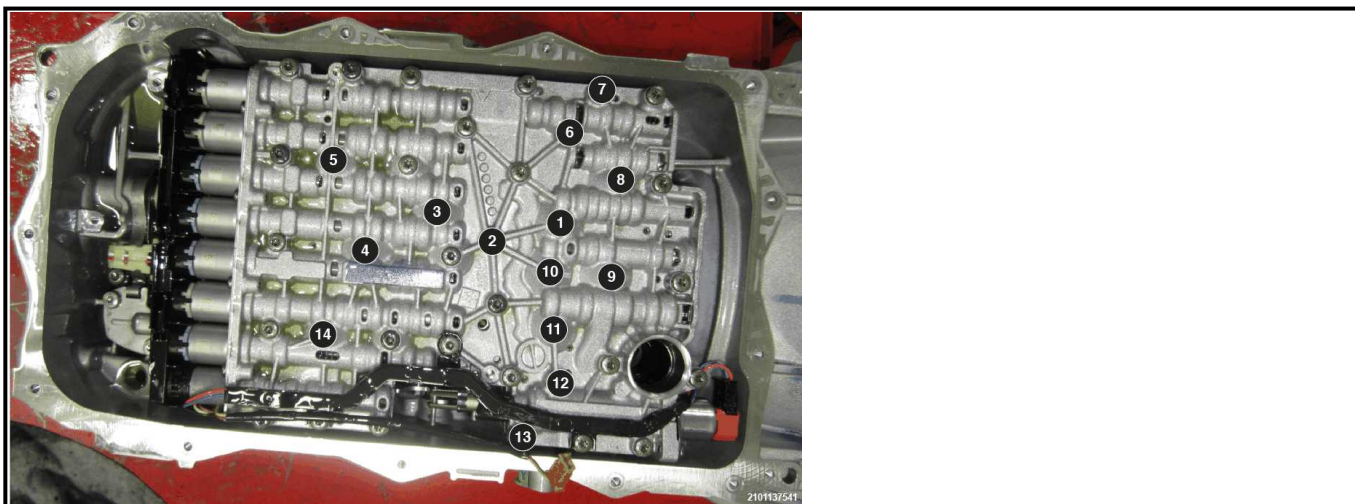
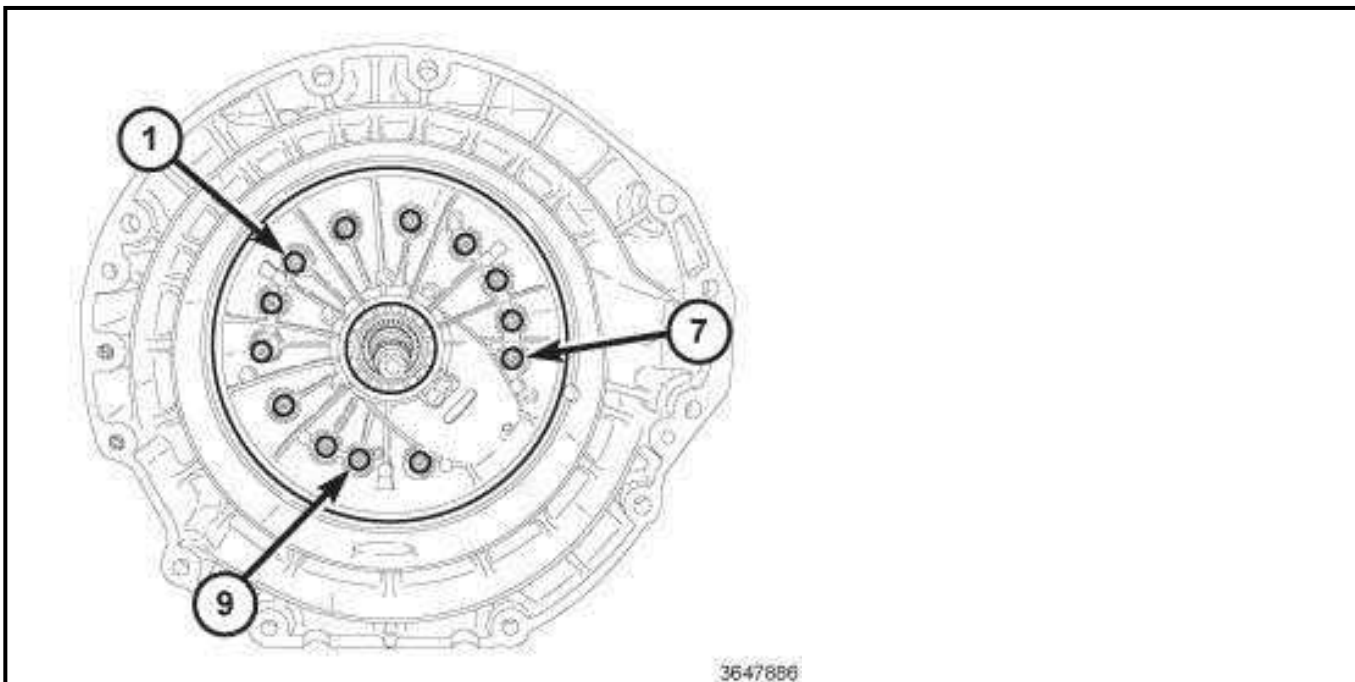
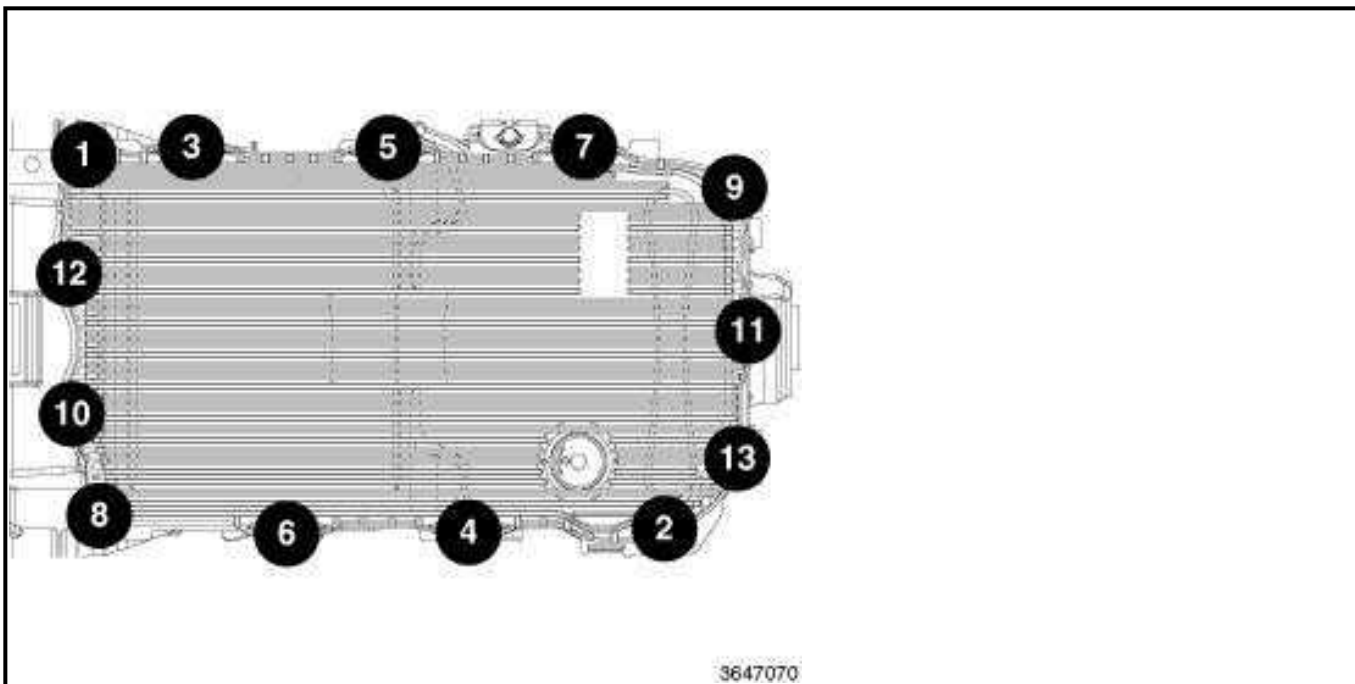
1 - Input Shaft O-Ring

17. Install the **NEW** input shaft O-ring.
18. Install the valve body. Refer to [VALVE BODY, REMOVAL AND INSTALLATION](#).
19. Install the transmission. Refer to [REMOVAL AND INSTALLATION](#).

TORQUE SPECIFICATIONS

INTERNAL TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Extension Housing to Transmission Bolt	27 N.m (20 Ft. Lbs.)	-
Hydraulic Impulse Solenoid (HIS) Bolts	27 N. m (20 Ft. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	10 N.m (89 In. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	10 N.m (89 In. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: Firmly press the oil pump in place by hand before drawing it in with bolts. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: Tighten to 5 N.m (44 In. Lbs.) Rotate additional 45B°	-
Valve Body Bolt	8 N.m (71 In. Lbs.)	Tightening Sequence



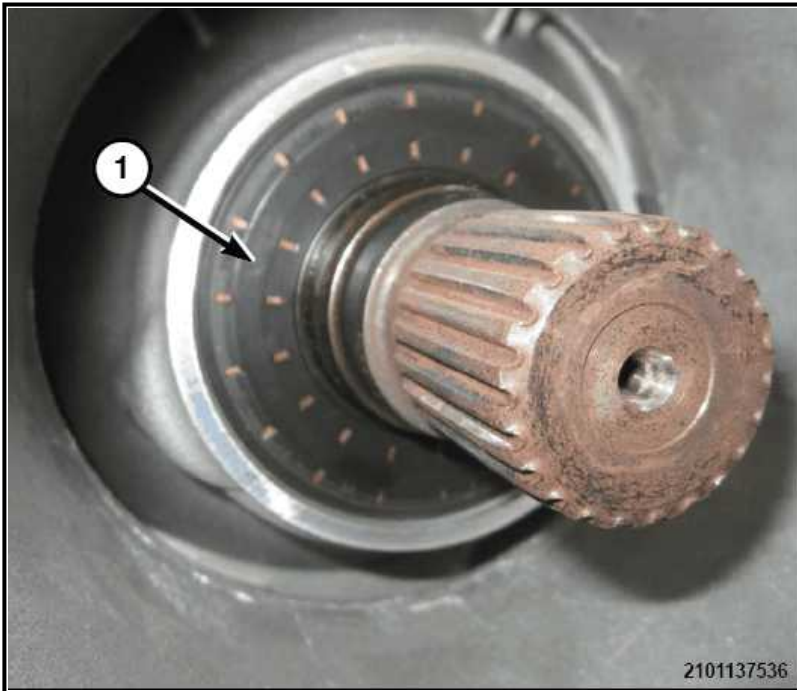
SEAL, OUTPUT SHAFT

REMOVAL AND INSTALLATION

OUTPUT SHAFT SEAL

REMOVAL

1. Remove the transfer case. Refer to [REMOVAL AND INSTALLATION](#) [REMOVAL AND INSTALLATION](#) .



1 - Output Shaft Seal

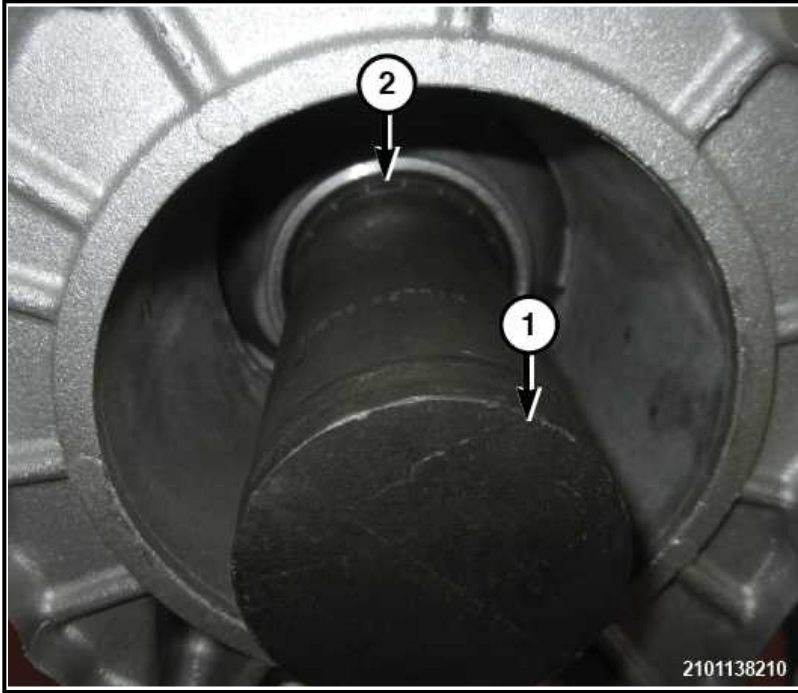
2. Remove and **DISCARD** the output shaft seal with a suitable screw and slide hammer.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Use the (special tool #8481, Installer, Gear) to install the **NEW** output shaft seal.
- Check the transmission fluid level and add as necessary. Refer to [CHECK FLUID LEVEL](#) .



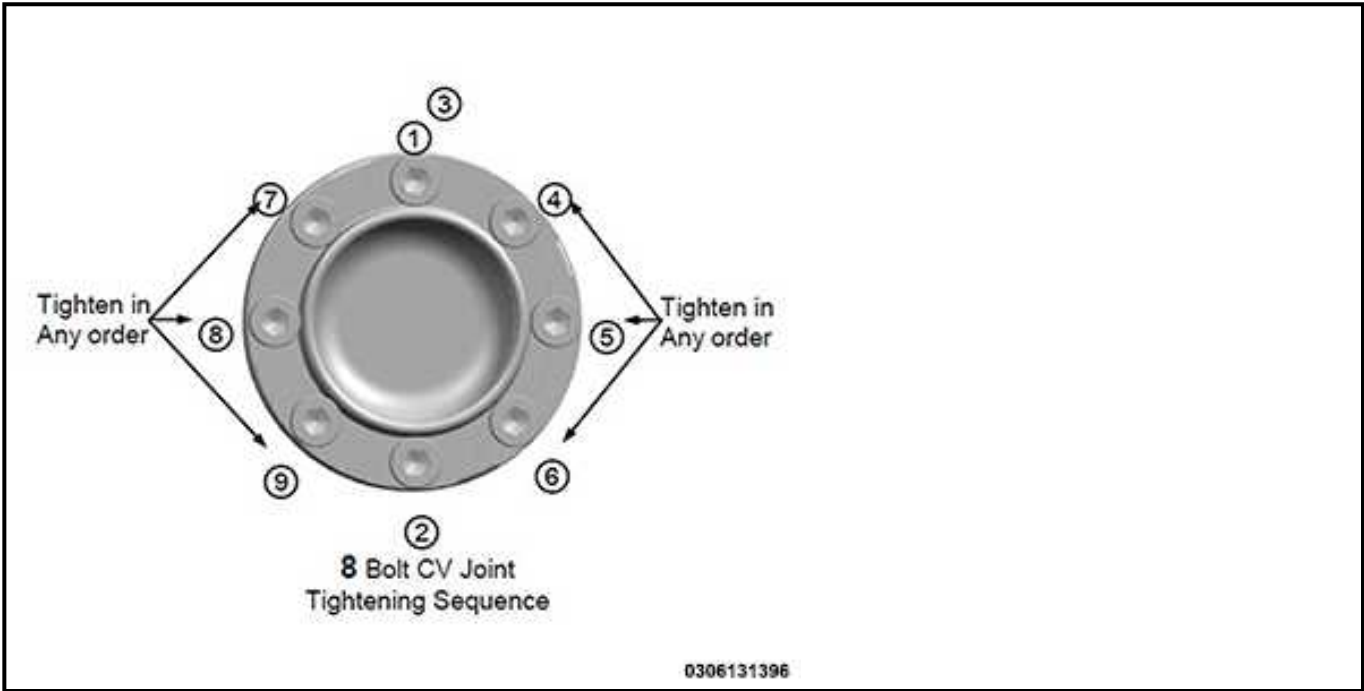
1 - Seal Installer Tool

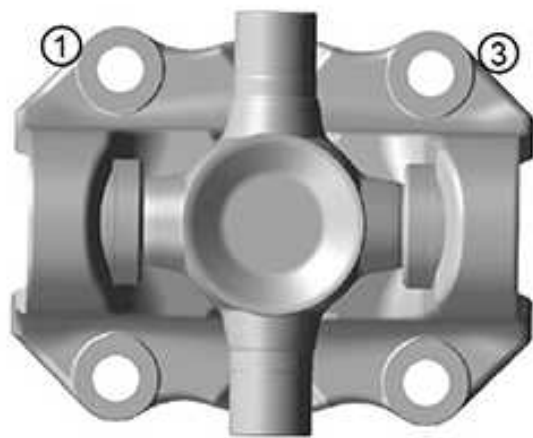
2 - Output Shaft Seal

TORQUE SPECIFICATIONS

DRIVESHAFTS

Identify the proper CV joint bolt configuration, four or eight bolts, and begin with the first bolt referred to as "1", follow the torque sequence as indicated. In the case where there are two numbers shown for a given bolt it indicates the bolt is to be torqued again within the sequence.





④ 4 Bolt Cardan Joint
Tightening
Sequence

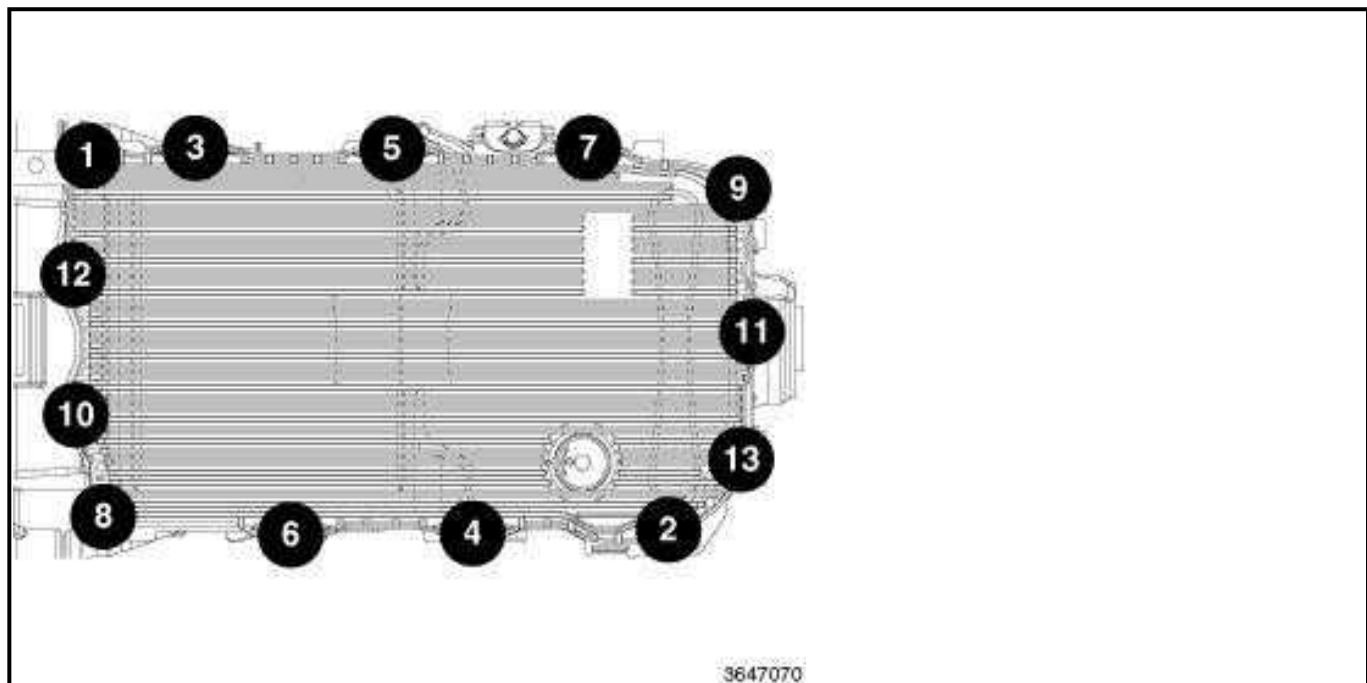
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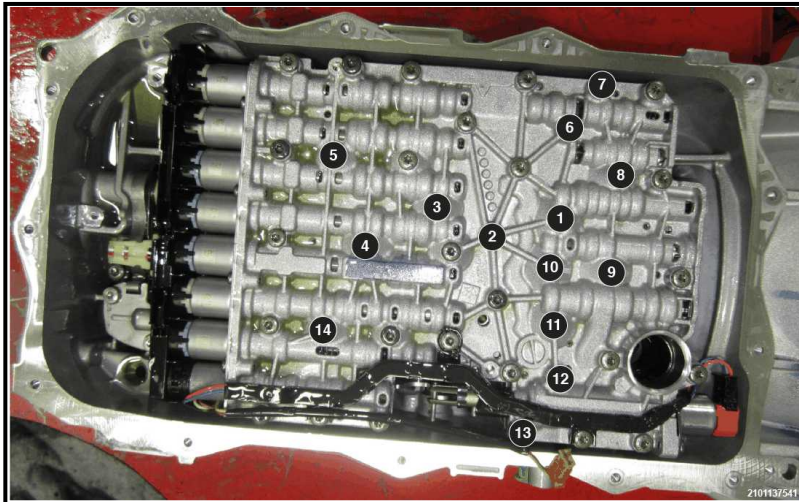
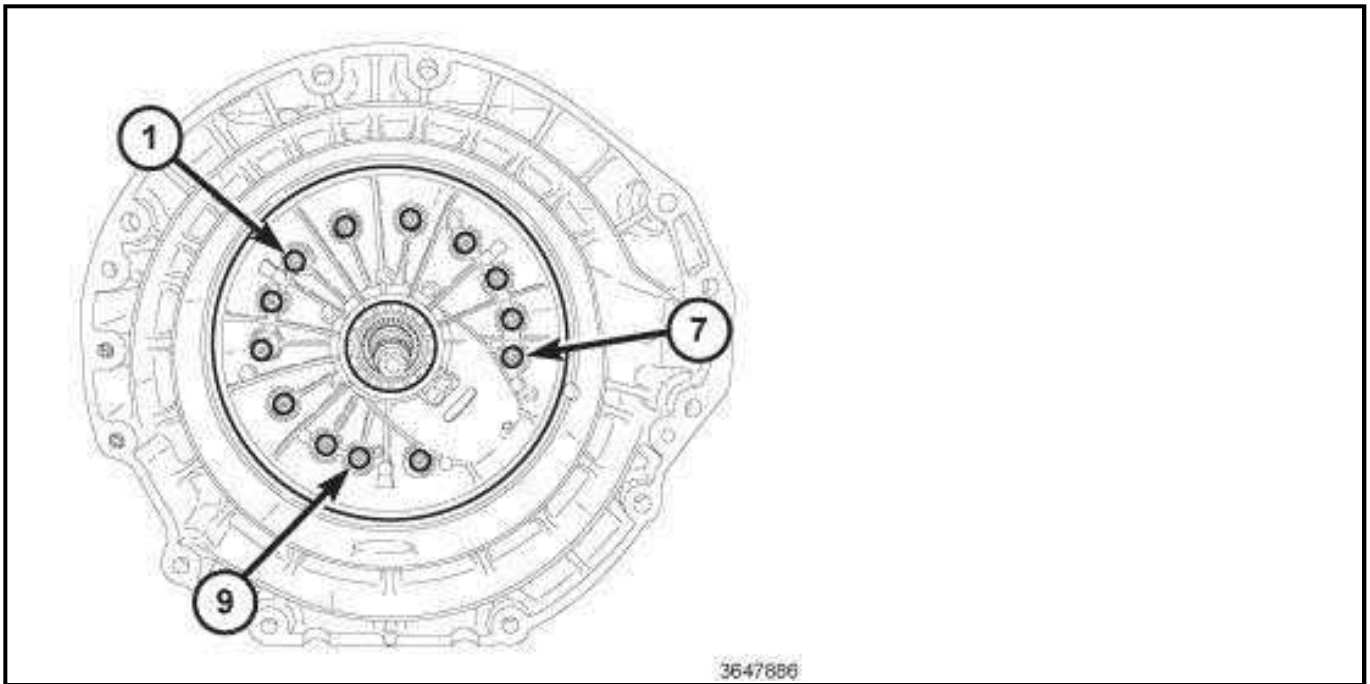
DESCRIPTION	SPECIFICATION	COMMENT
Front Driveshaft to Front Axle Flange Bolts	121 N.m (89 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Front Driveshaft to Transfer-Case Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft to Transfer-Case Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft to Rear Axle Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft Carrier Bearing to Frame	62 N.m (46 Ft. Lbs.)	-

INTERNAL TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Extension Housing to Transmission Bolt	27 N.m (20 Ft. Lbs.)	-
Hydraulic Impulse Solenoid (HIS) Bolts	27 N. m (20 Ft. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	10 N.m (89 In. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	10 N.m (89 In. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATION	COMMENTS
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	8 N.m (71 In. Lbs.)	Tightening Sequence





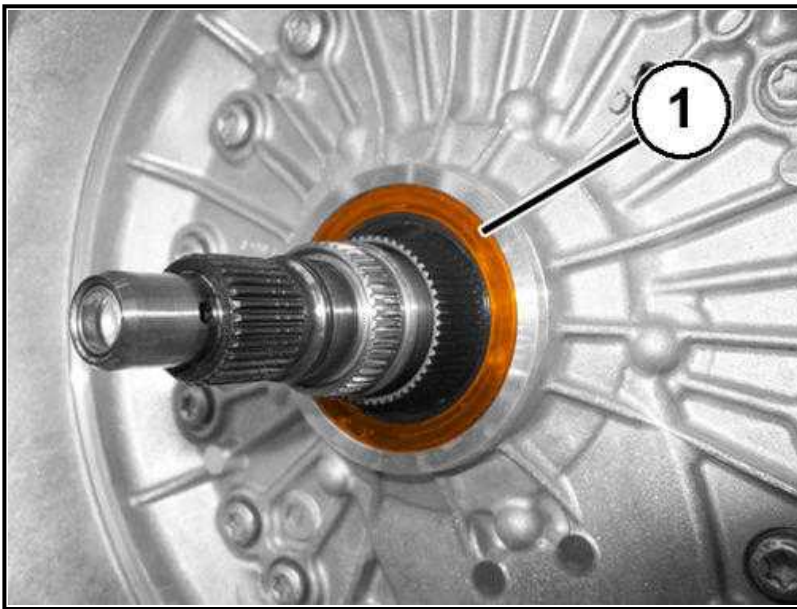
SEAL, TORQUE CONVERTER HUB

REMOVAL AND INSTALLATION

TORQUE CONVERTER HUB SEAL

REMOVAL

1. Remove the transmission and torque converter. Refer to [TORQUE CONVERTER, REMOVAL AND INSTALLATION](#).



1 - Torque Converter Hub Seal

2. Using a suitable tool, remove the torque converter hub seal.

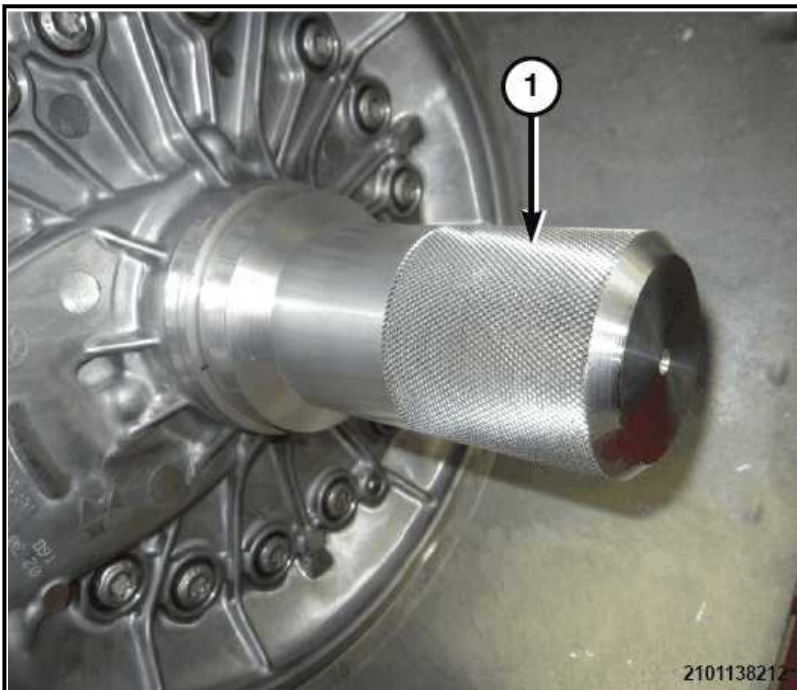
NOTE: Take care not to mar or damage the pump sealing surface during the seal removal.

INSPECTION AND CLEANING

1. Clean and inspect the sealing surface before installing the new seal.

INSTALLATION

1. Position the torque converter hub seal over the input shaft and against the transmission oil pump cover.

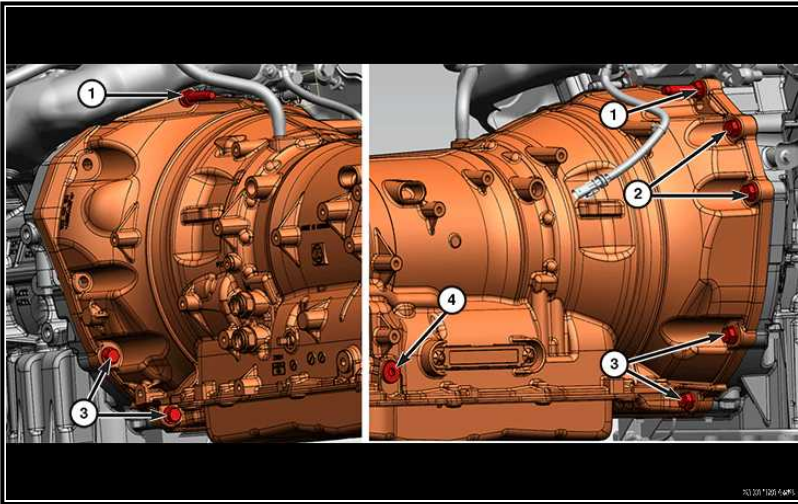


1 - Seal Installer Tool

2. Using (special tool #10375, Installer, Oil Pump Cover Oil Seal) install a new torque converter hub seal.
3. Install the torque converter. Refer to **TORQUE CONVERTER, REMOVAL AND INSTALLATION.**

TORQUE SPECIFICATIONS

BELLHOUSING AND OIL FILL PLUG

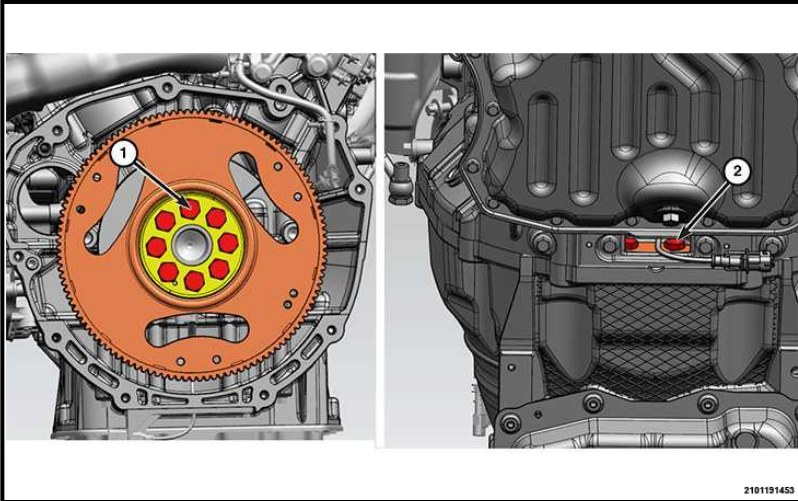
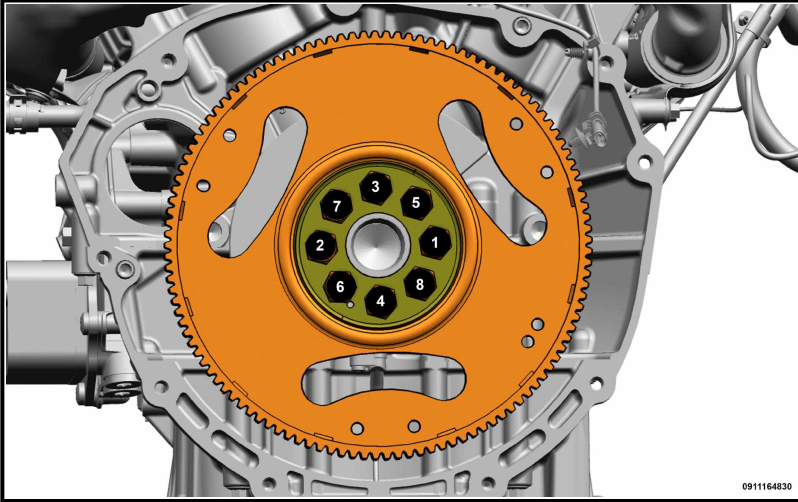


CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Double Ended Studs	48 N.m (35 Ft. Lbs.)	-
2	Bellhousing to Engine Bolts	50 N.m (37 Ft. Lbs.)	-
3	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
4	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

FLEXPLATE AND TORQUE CONVERTER

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Flexplate to Crankshaft Bolts	Torque Procedure: 1. With clean engine oil, lubricate the fastener side of backing plate. 2. Tighten the fasteners 50 N.m (37 ft. lbs.) . 3. Loosen one fastener at a time and then retighten the fastener 125 N.m (92 ft. lbs.) . 4. Using a torque angle gauge, tighten each fastener an additional 30 B° .	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Tightening Sequence
2	Torque Converter to Flex Plate Bolt	41 N.m (30 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. NOTE: If old fastener must be re-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
			used, Loc-TiteB® must be applied to the threads.

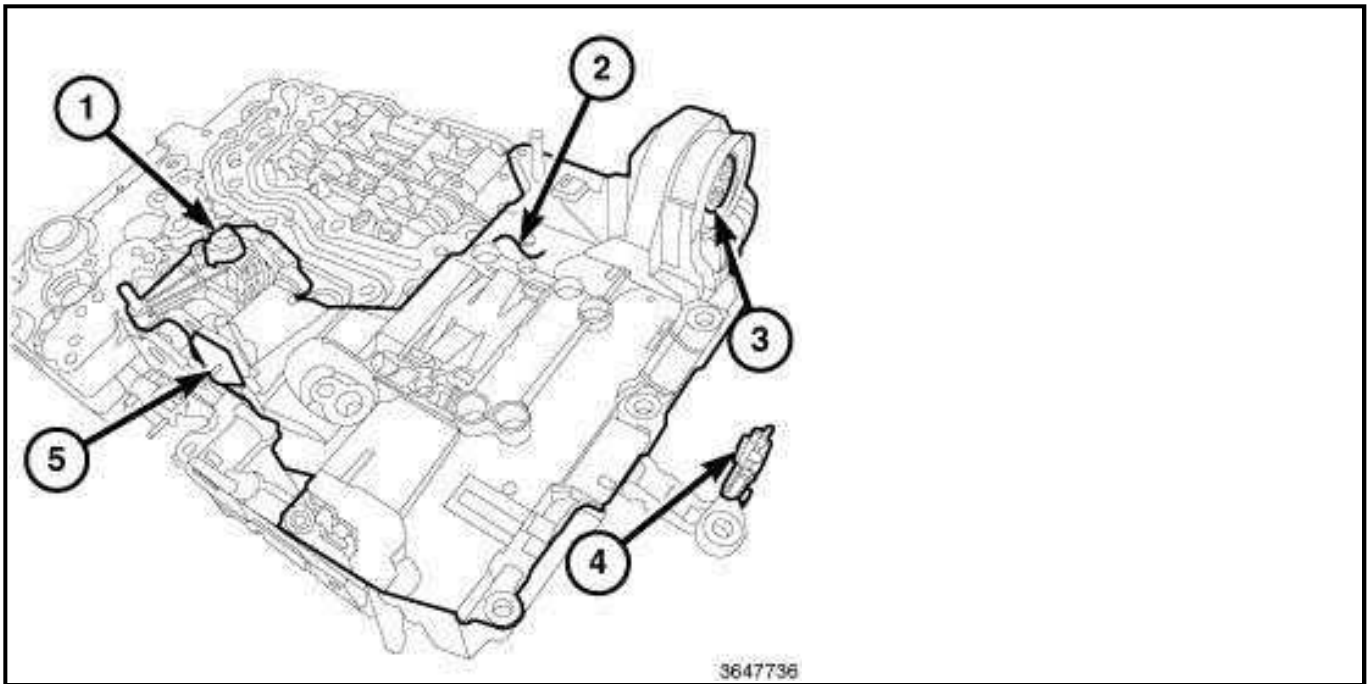


SENSOR, SPEED

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION



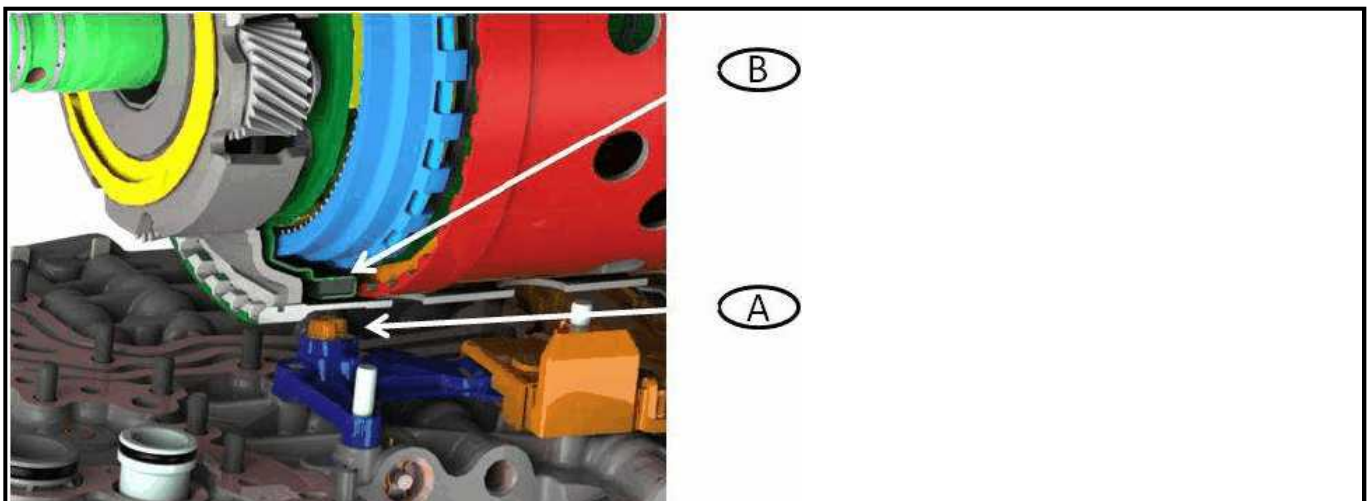
- 1 - Input Speed Sensor (ISS)
 - 4 - Output Speed Sensor (OSS)
 - 2 - Transmission Control Module (TCM) (Includes Transmission Temperature Sensor)
 - 5 - Park Position Sensor
 - 3 - External Wire Harness Connector
- B

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

The ISS (1) and the OSS (4) are integrated components of the TCMA and not serviced individually.

OPERATION

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.



The ISS and OSS are Hall-effect sensors that measure shaft rotational speed. The ISS (A) is located at the front of the TCMA and reads input shaft speed from the magnetic ring (B) on the P2 carrier.



The OSS is located at the back of the TCMA and reads output shaft speed from the P4 carrier.

SHIFTER, TRANSMISSION

REMOVAL AND INSTALLATION

SHIFTER

REMOVAL

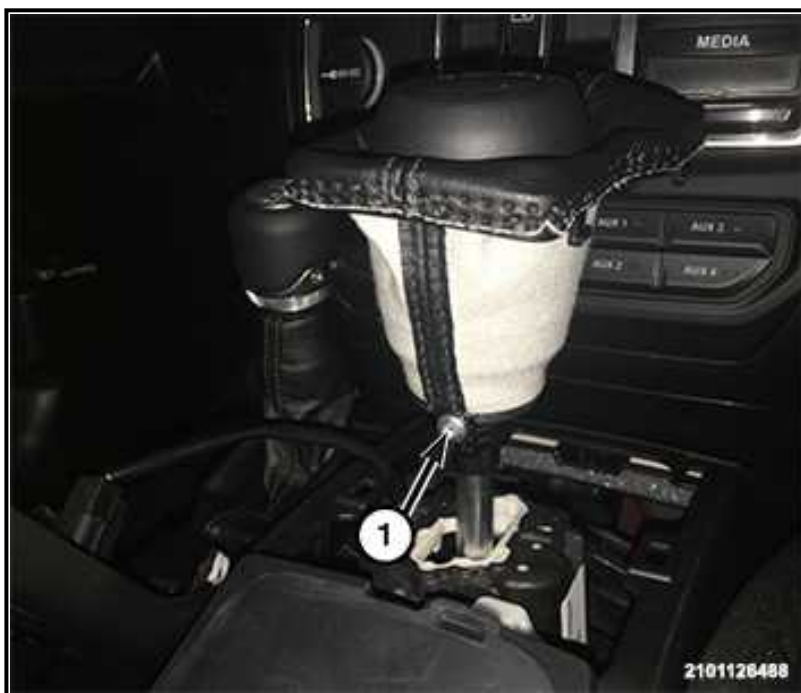


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1 - Shifter Boot

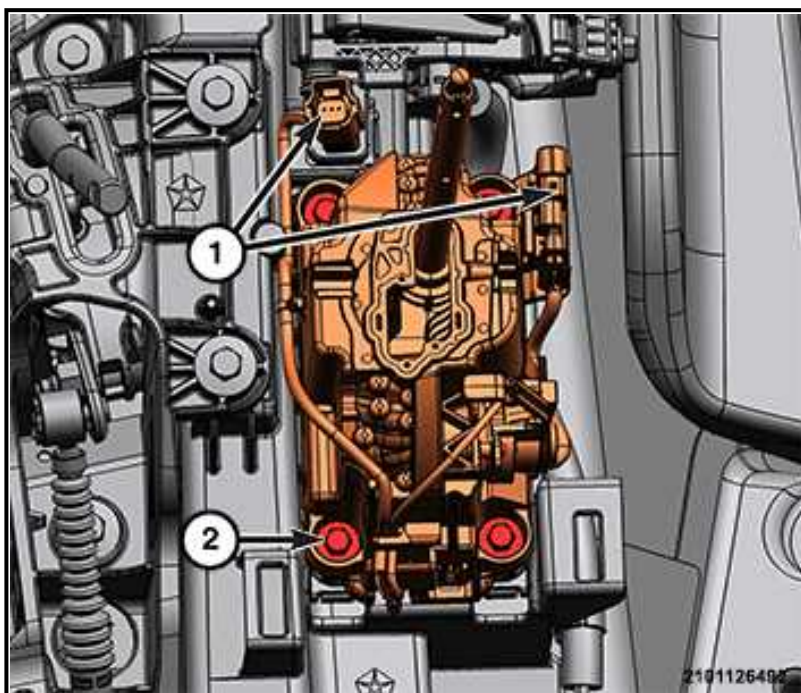
1. Using a plastic trim tool, carefully pry upward on the shifter boot while gently pulling upward on the fabric to release it.

NOTE: Be careful not to damage the trim or boot.



1 - Shifter Knob Bolt

2. Remove the shifter knob bolt and remove the shifter knob.
3. Remove any necessary console parts for access to the Shift Lever Assembly (SLA). Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Wire Harness Connectors

2 - Shifter Bolts

4. Disconnect the wire harness connectors from the SLA.
5. Remove the shifter bolts.
6. Remove the SLA from the vehicle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS

TORQUE CONVERTER

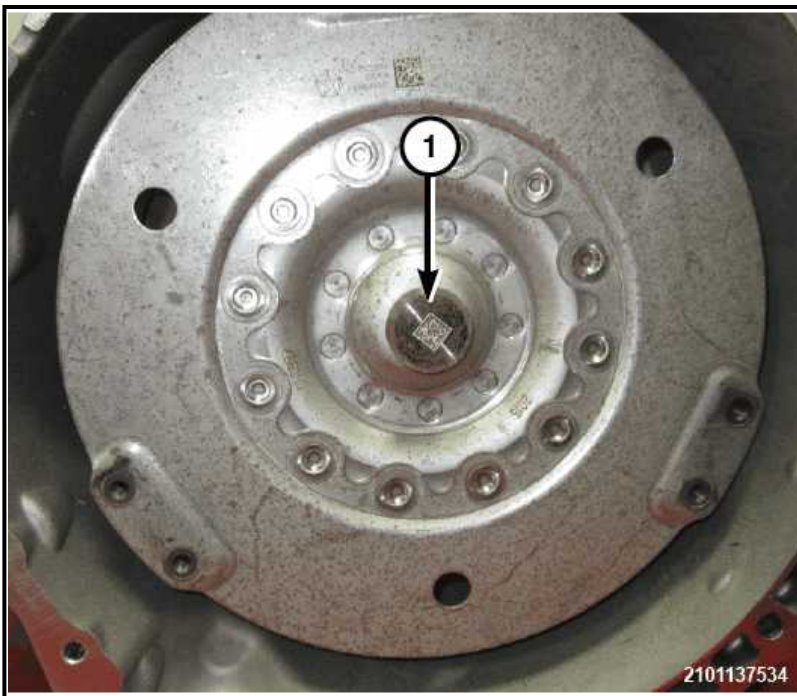
REMOVAL AND INSTALLATION

TORQUE CONVERTER

REMOVAL

1. Remove the transmission from the vehicle. Refer to [REMOVAL AND INSTALLATION](#).
2. Place a suitable drain pan under the torque converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.



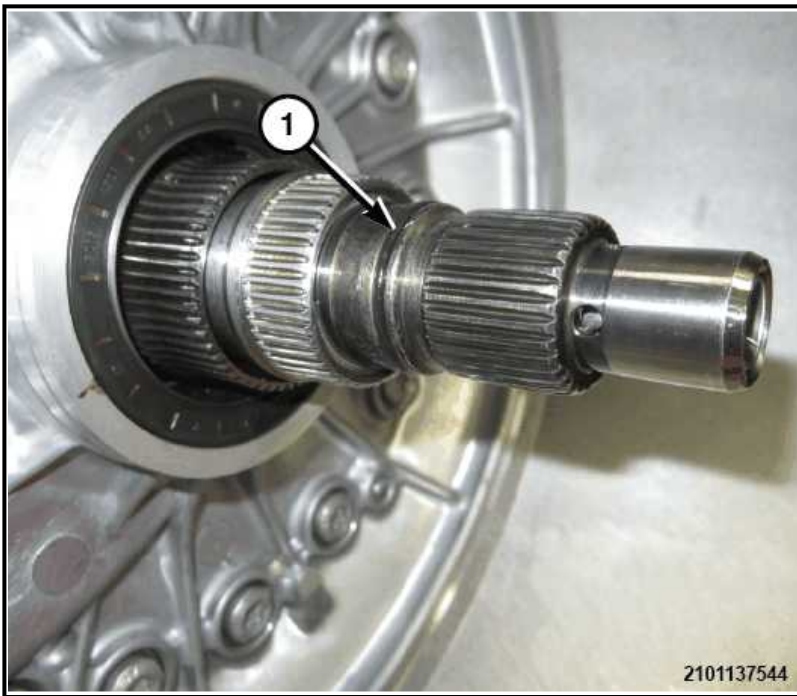
1 - Torque Converter

3. Pull the torque converter forward until the center hub clears the oil pump seal.

INSTALLATION

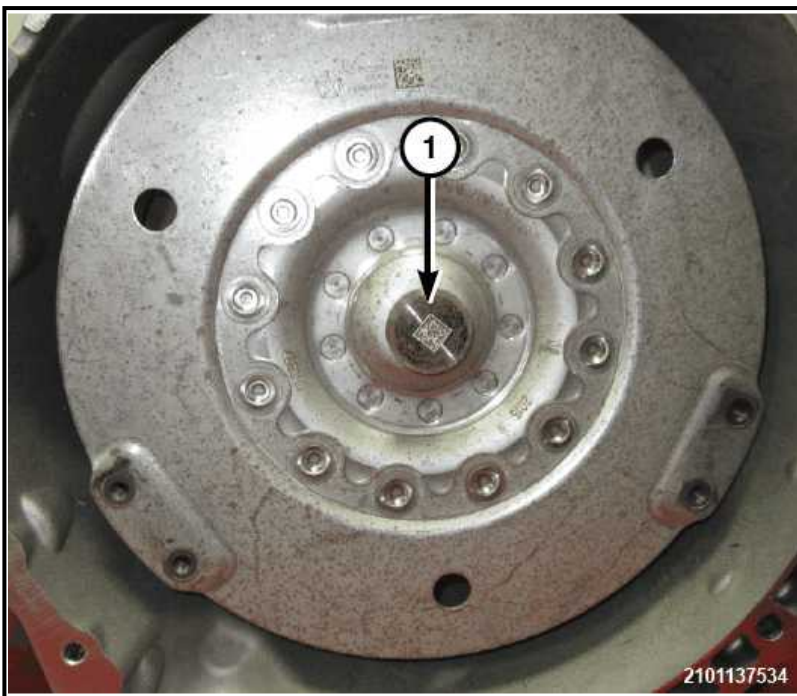
NOTE: Check the torque converter hub for sharp edges, burrs, scratches, or nicks. Polish the hub with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

1. Lubricate the oil pump seal lip with transmission fluid.



1 - Input Shaft O-Ring

2. Check the input shaft O-ring for any damage. Replace if necessary.

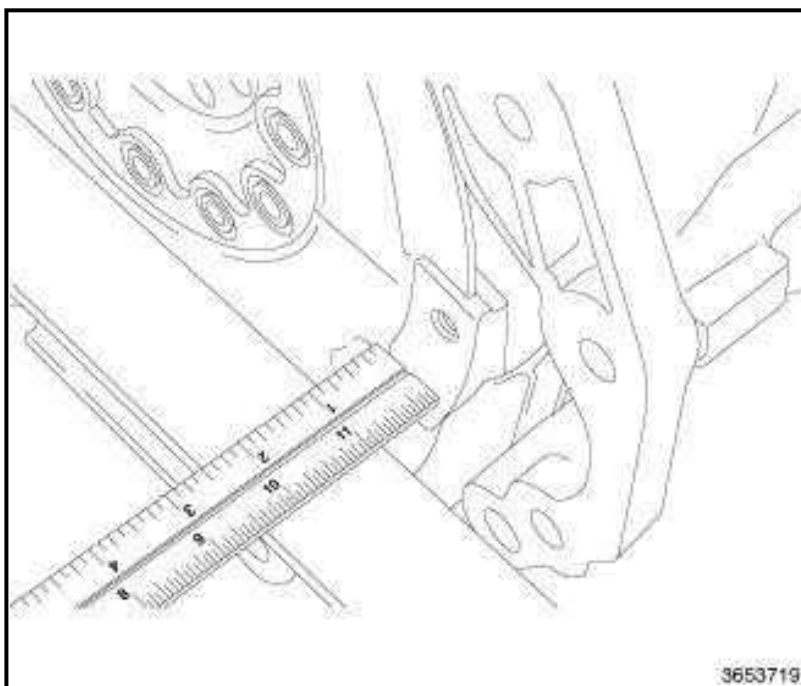


1 - Torque Converter

3. Place the torque converter in position on the transmission.

CAUTION: Do not damage oil pump seal or converter hub while inserting torque converter into the front of the transmission.

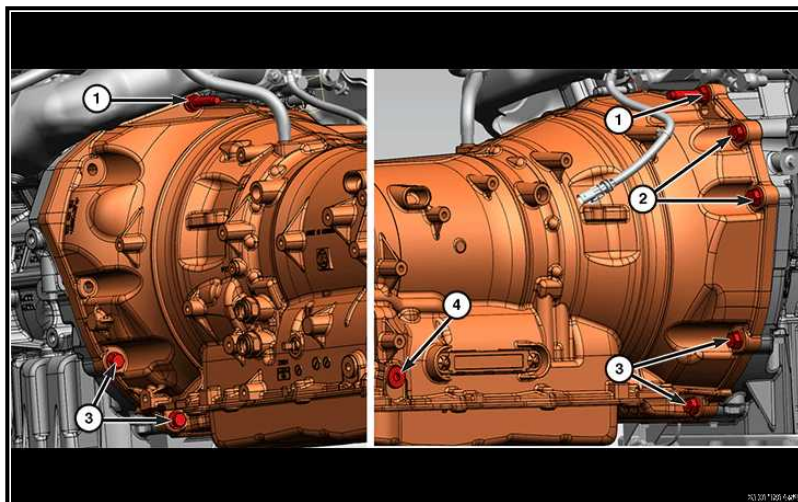
4. Align the torque converter to the oil pump seal opening.
5. Insert the torque converter hub into the oil pump drive gear.
6. While pushing the torque converter inward, rotate the torque converter until the torque converter is fully seated into the oil pump drive gear.



7. Check the torque converter seating with a scale and straightedge. The surface of the torque converter lugs should be at least 19 mm (3/4 in.) to the rear of the straightedge when the torque converter is fully seated.
8. If necessary, temporarily secure the torque converter with a C-clamp attached to the torque converter housing.
9. Install the transmission in the vehicle. Refer to [REMOVAL AND INSTALLATION](#).
10. Fill the transmission. Refer to [FLUID/FILTER SERVICE](#).

TORQUE SPECIFICATIONS

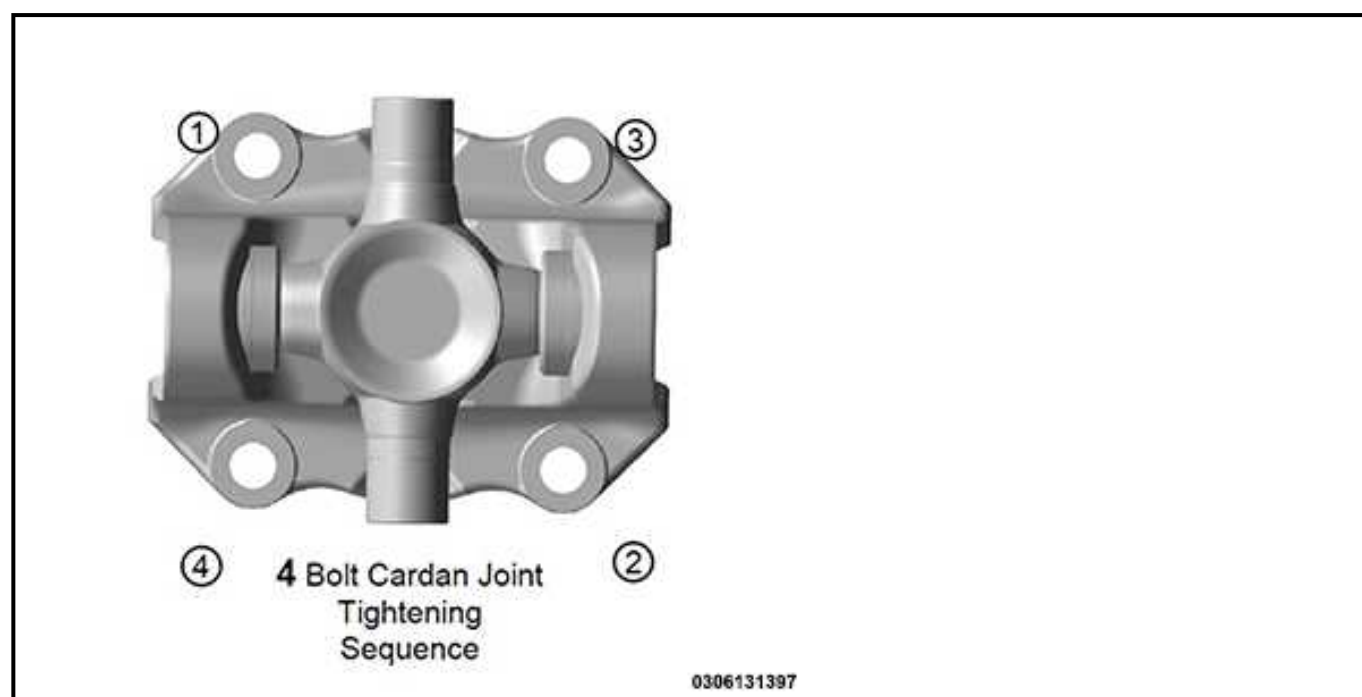
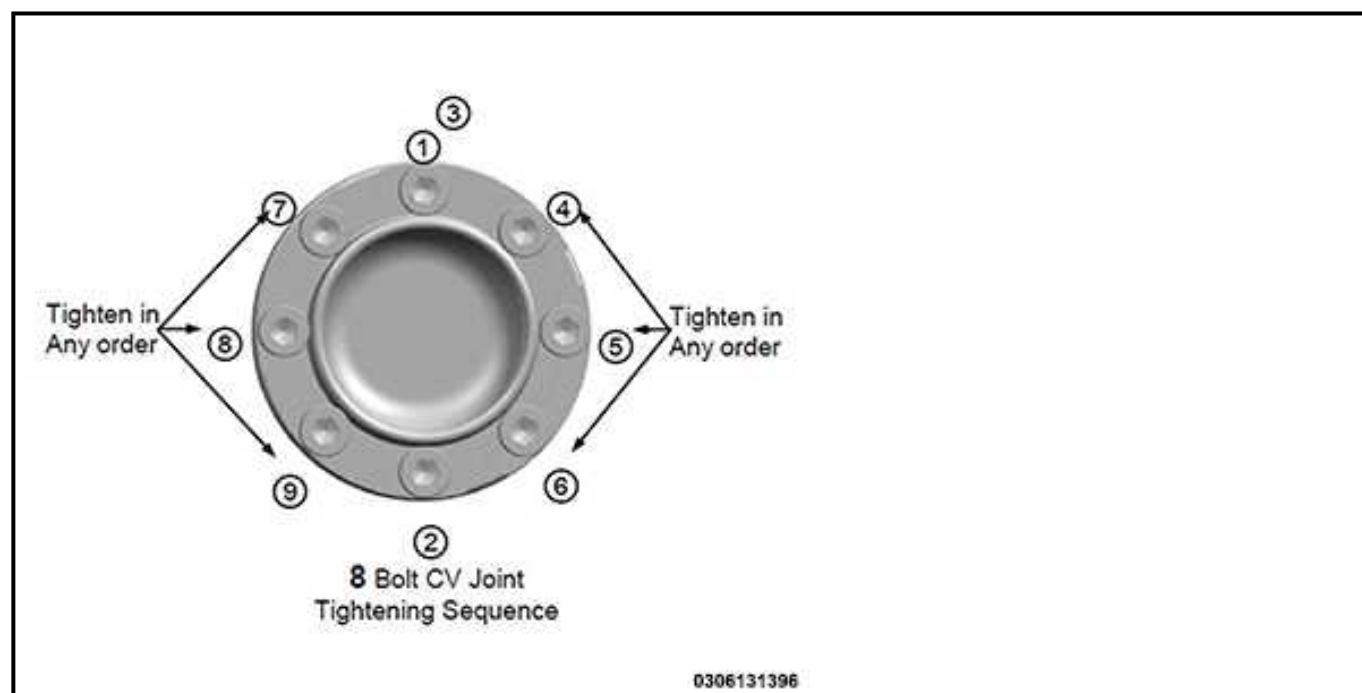
BELLHOUSING AND OIL FILL PLUG



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Double Ended Studs	48 N.m (35 Ft. Lbs.)	-
2	Bellhousing to Engine Bolts	50 N.m (37 Ft. Lbs.)	-
3	Bellhousing To Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
4	Transmission Oil Fill Plug	35 N.m (26 Ft. Lbs.)	Located on right side of transmission case.

DRIVESHAFTS

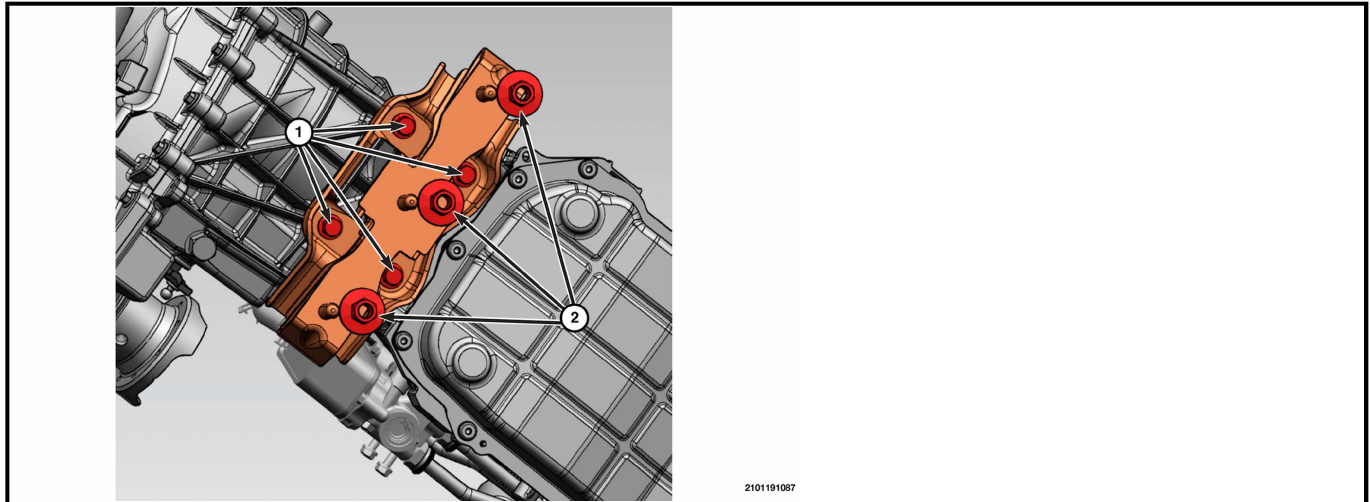
Identify the proper CV joint bolt configuration, four or eight bolts, and begin with the first bolt referred to as "1", follow the torque sequence as indicated. In the case where there are two numbers shown for a given bolt it indicates the bolt is to be torqued again within the sequence.



DESCRIPTION	SPECIFICATION	COMMENT
Front Driveshaft to Front Axle Flange Bolts	121 N.m (89 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Front Driveshaft to Transfer-Case Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft to Transfer-Case Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.

DESCRIPTION	SPECIFICATION	COMMENT
Rear Driveshaft to Rear Axle Flange Bolts	39 N.m (29 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications. Torque and secure in a crisscross pattern.
Rear Driveshaft Carrier Bearing to Frame	62 N.m (46 Ft. Lbs.)	-

TRANSMISSION MOUNT

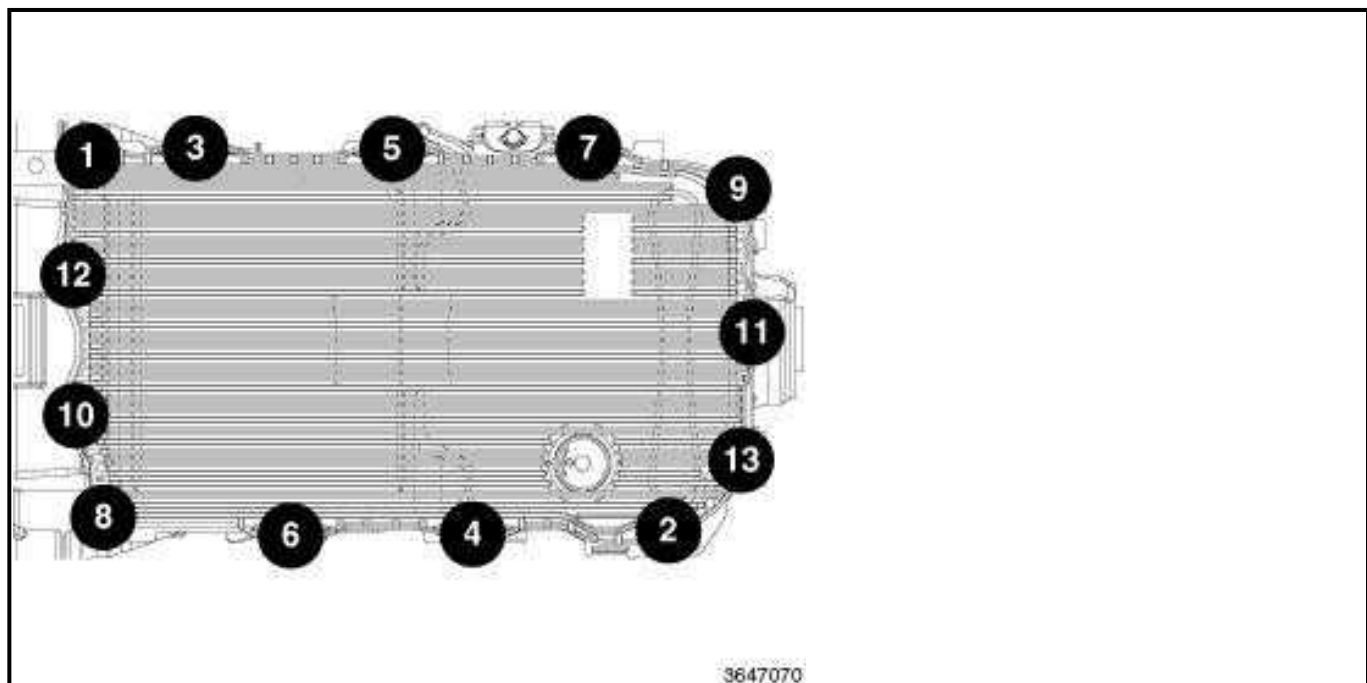


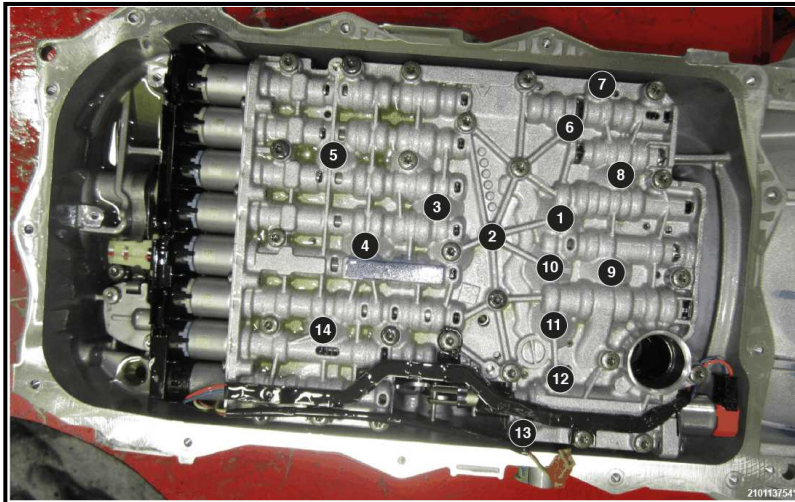
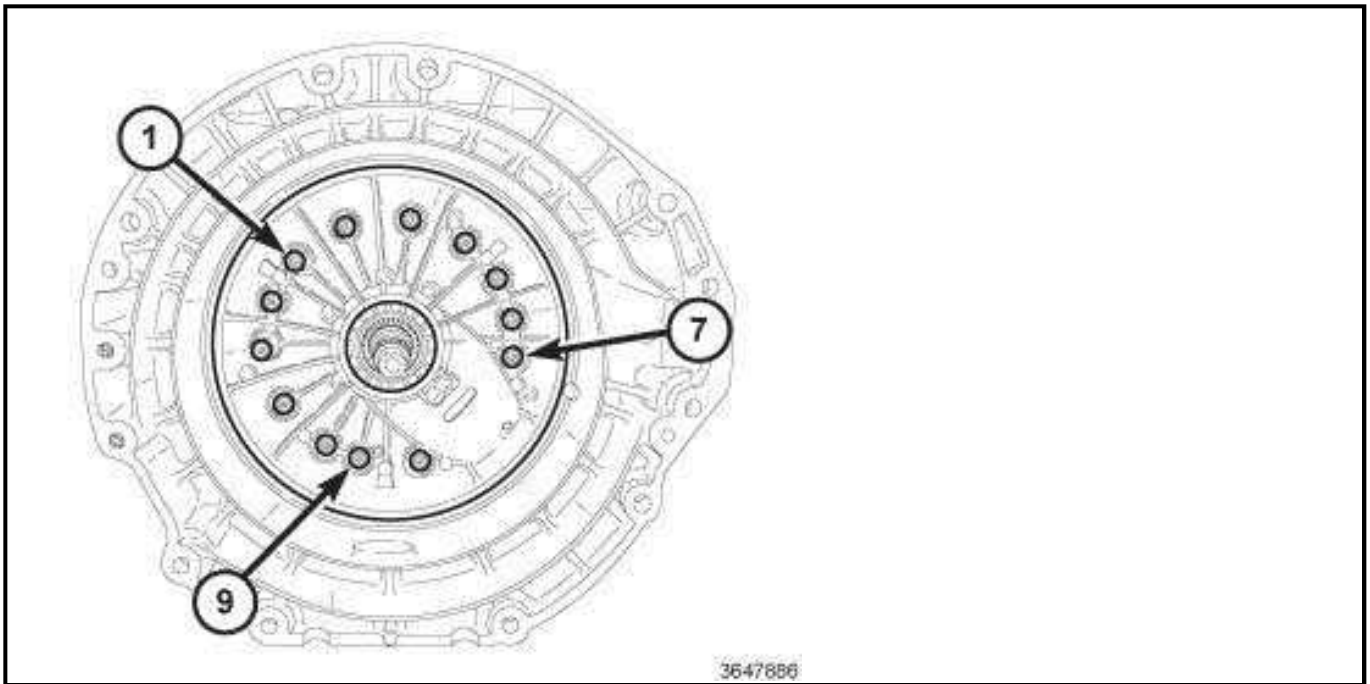
CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-
2	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-

INTERNAL TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Extension Housing to Transmission Bolt	27 N.m (20 Ft. Lbs.)	-
Hydraulic Impulse Solenoid (HIS) Bolts	27 N. m (20 Ft. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	10 N.m (89 In. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	10 N.m (89 In. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: 1. Firmly press the oil pump in place by hand before drawing it in with bolts. 2. In order to seat the oil pump cover properly, pre tighten bolts one,	Tightening Sequence

DESCRIPTION	SPECIFICATION	COMMENTS
	seven and nine to 6 N.m (53 in. lb.) 3. Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise 4. Rotate additional 90B° in sequence starting at bolt 1	
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: 1. Tighten to 5 N.m (44 In. Lbs.) 2. Rotate additional 45B°	-
Valve Body Bolt	8 N.m (71 In. Lbs.)	Tightening Sequence





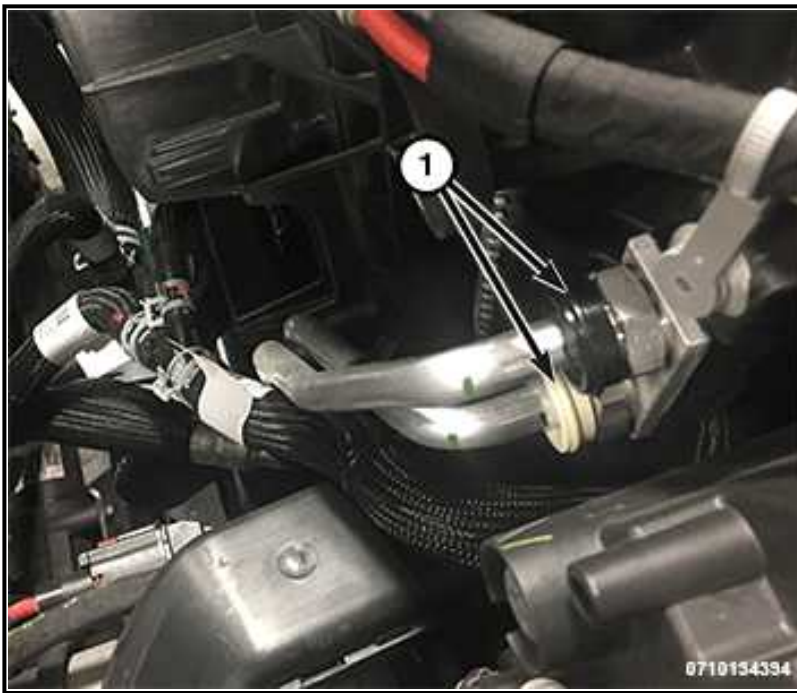
TUBES AND HOSES, TRANSMISSION OIL COOLER

REMOVAL AND INSTALLATION

TRANSMISSION COOLER LINES

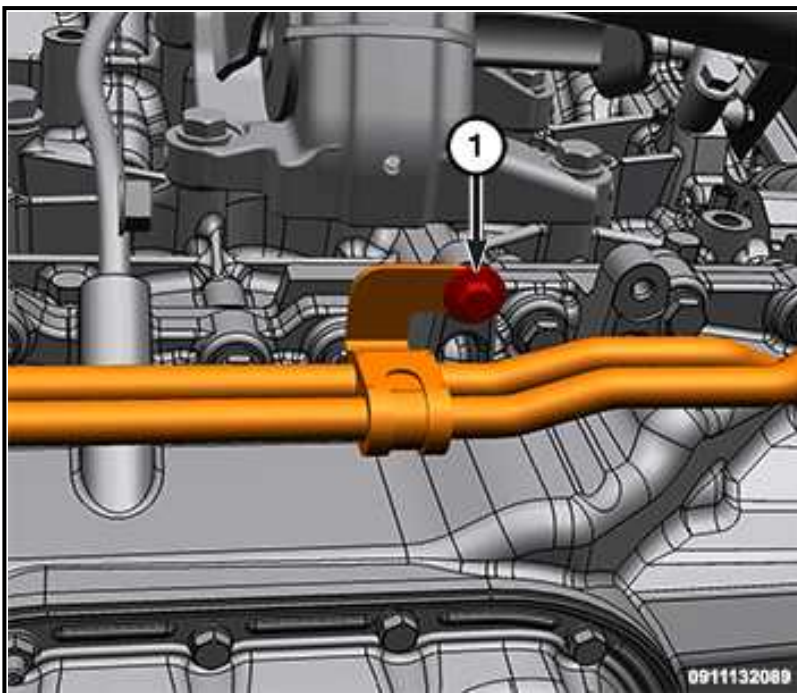
REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the air cleaner assembly Refer to [BODY, AIR CLEANER, REMOVAL AND INSTALLATION](#) .
3. Release the transmission fluid cooler tubes from the routing clip located at the radiator.



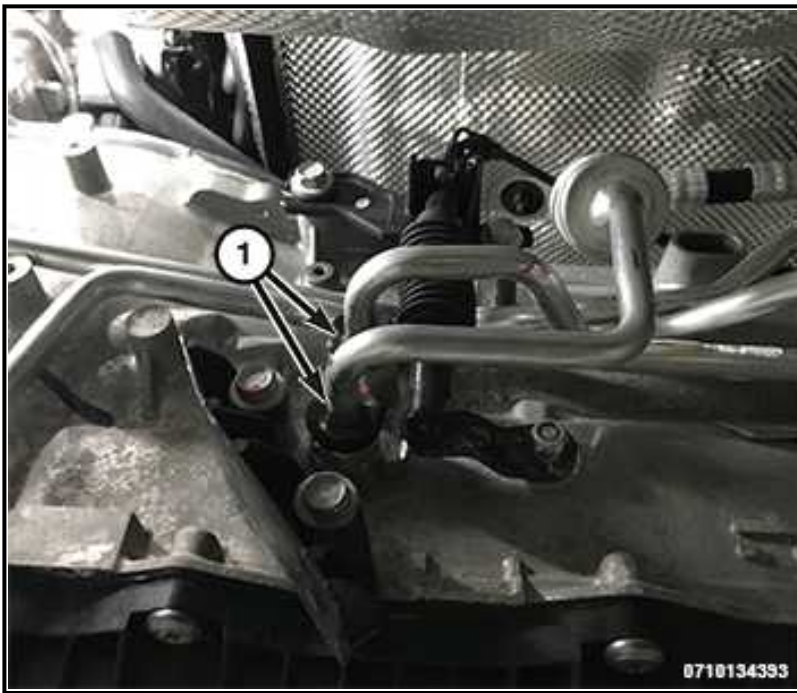
1 - Transmission Cooler Tubes

4. Disconnect the transmission fluid cooler tubes from the transmission fluid cooler.



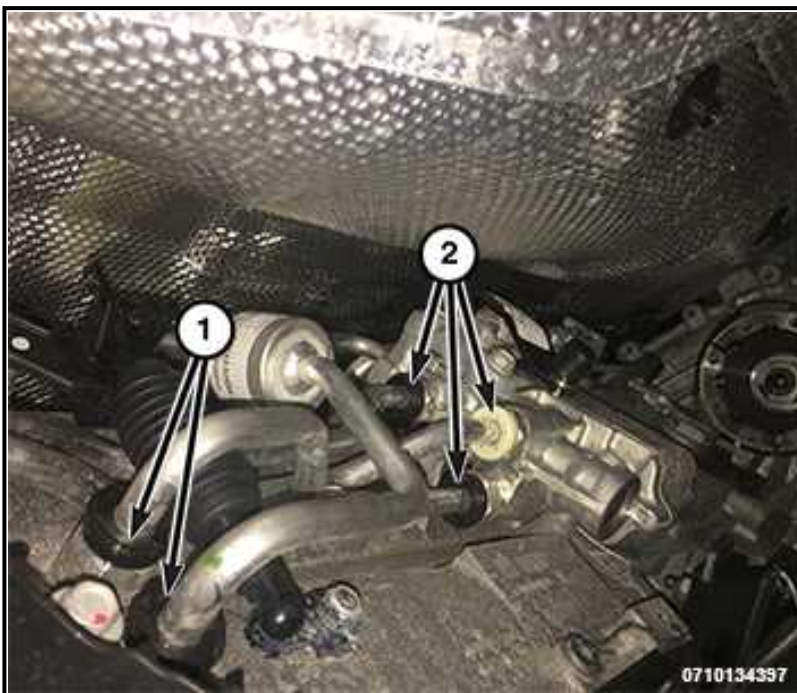
1 - Transmission Cooler Tube Bracket Nut

5. Remove the transmission fluid cooler tube bracket nuts.



1 - Transmission Cooler Tubes

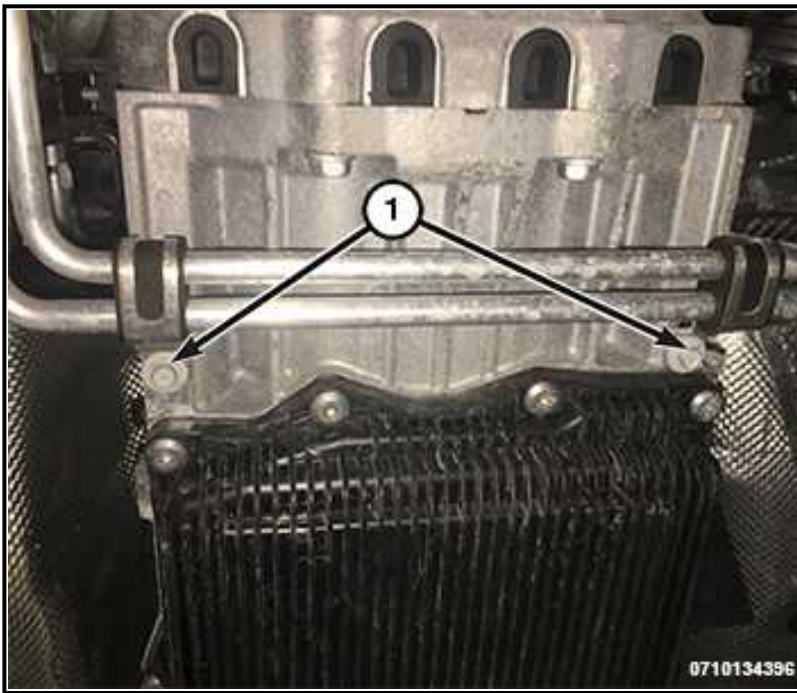
6. Disconnect the transmission fluid cooler tubes from the transmission.



1 - Transmission Cooler Tubes

2 - Transmission Cooler Tubes

7. Remove the transmission fluid cooler tubes from the transmission heater.



1 - Transmission Cooler Tube Bracket Bolts

- 8. Remove the transmission fluid cooler tube bracket bolts.
- 9. Remove the transmission fluid cooler lines from the vehicle.

INSTALLATION

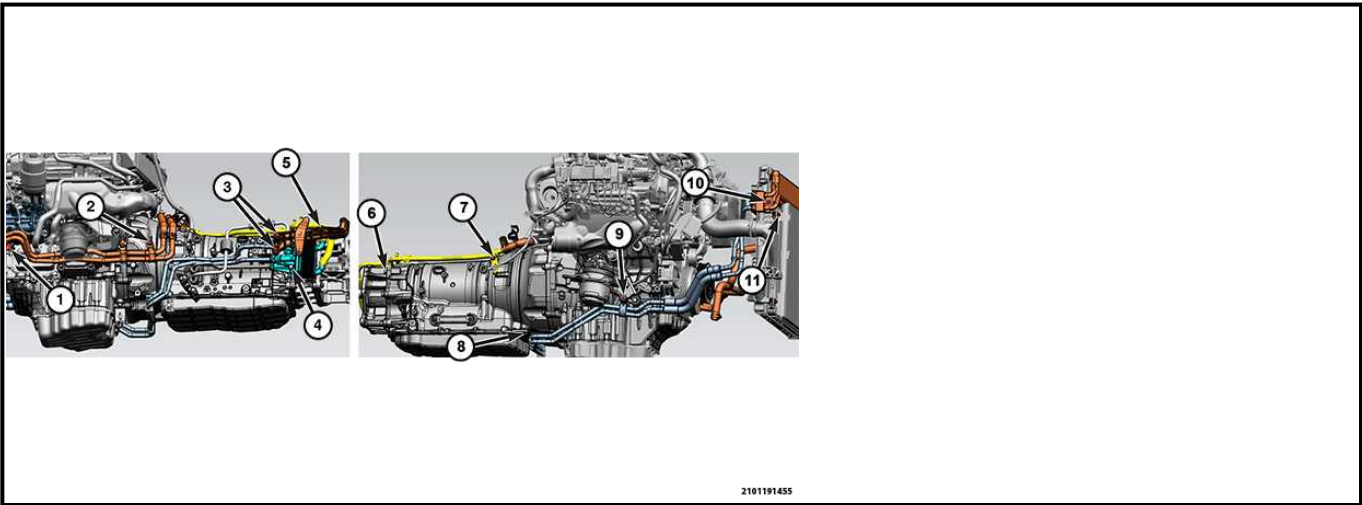
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Verify that the transmission cooler tubes are routed correctly and all of the brackets are fastened properly. Failure to do so can cause the tubes to rub on other components and be damaged.
- Check the transmission fluid level. Refer to [CHECK FLUID LEVEL](#) .

TORQUE SPECIFICATIONS

TRANSMISSION OIL COOLER AND HEATER



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Oil Heater Line Bracket To AC	9 N. m (80 In. Lbs.)	-

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
	Compressor Nut		
2	Transmission Oil Heater Line Bracket To Transmission Bolts	20 N. m (15 Ft. Lbs.)	-
3	Transmission Oil Heater To Transmission Bolts (Passing Through Transfer Case Cable Support Bracket)	23 N. m (17 Ft. Lbs.)	-
4	Transmission Oil Heater To Transmission Bolt	23 N. m (17 Ft. Lbs.)	-
5	Transfer Case Cable Support to Bracket Nut	19 N. m (14 Ft. Lbs.)	-
6	Transmission Oil Heater Line Bracket To Case Bolt	22 N. m (16 Ft. Lbs.)	-
7	Transmission Oil Heater Line Bracket To Transmission Bolt	22 N. m (16 Ft. Lbs.)	-
8	Transmission Oil Cooler Line Bracket To Transmission Bolt	9 N. m (80 In. Lbs.)	-
9	Transmission Oil Cooler Line Bracket To Engine Mount Bracket Bolt	9 N. m (80 In. Lbs.)	-
10	Transmission Oil Cooler Line Manifold To Radiator Bolt	-	Tighten Securely
11	Transmission Oil Cooler Line To Radiator Bolt	-	Tighten Securely

VALVE BODY

DESCRIPTION

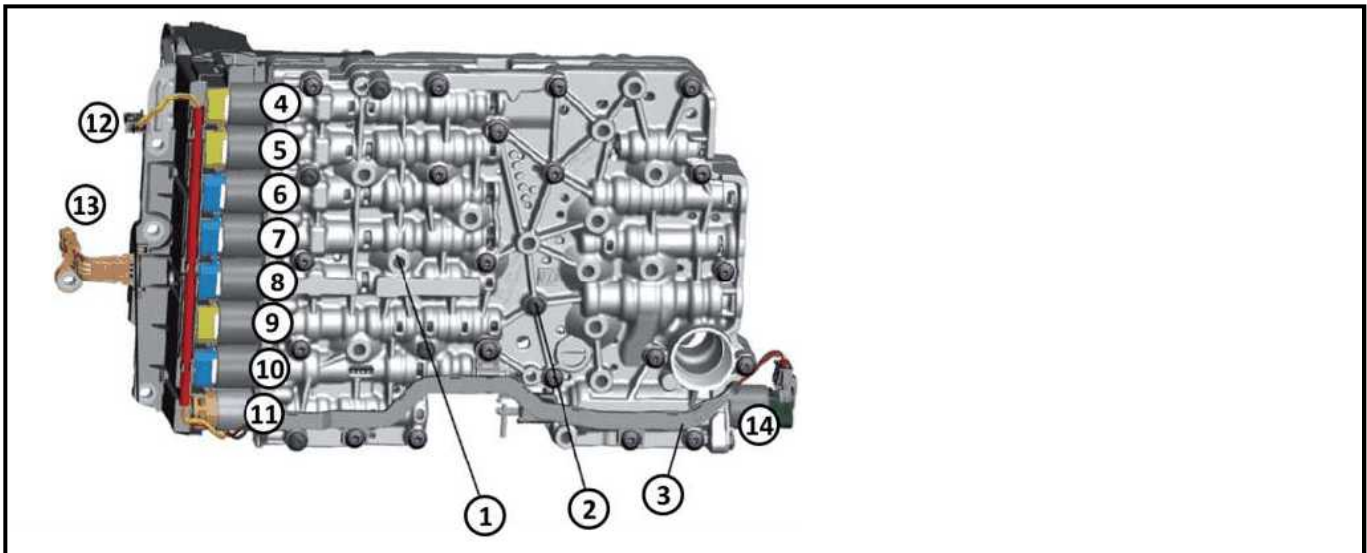
DESCRIPTION AND OPERATION

DESCRIPTION

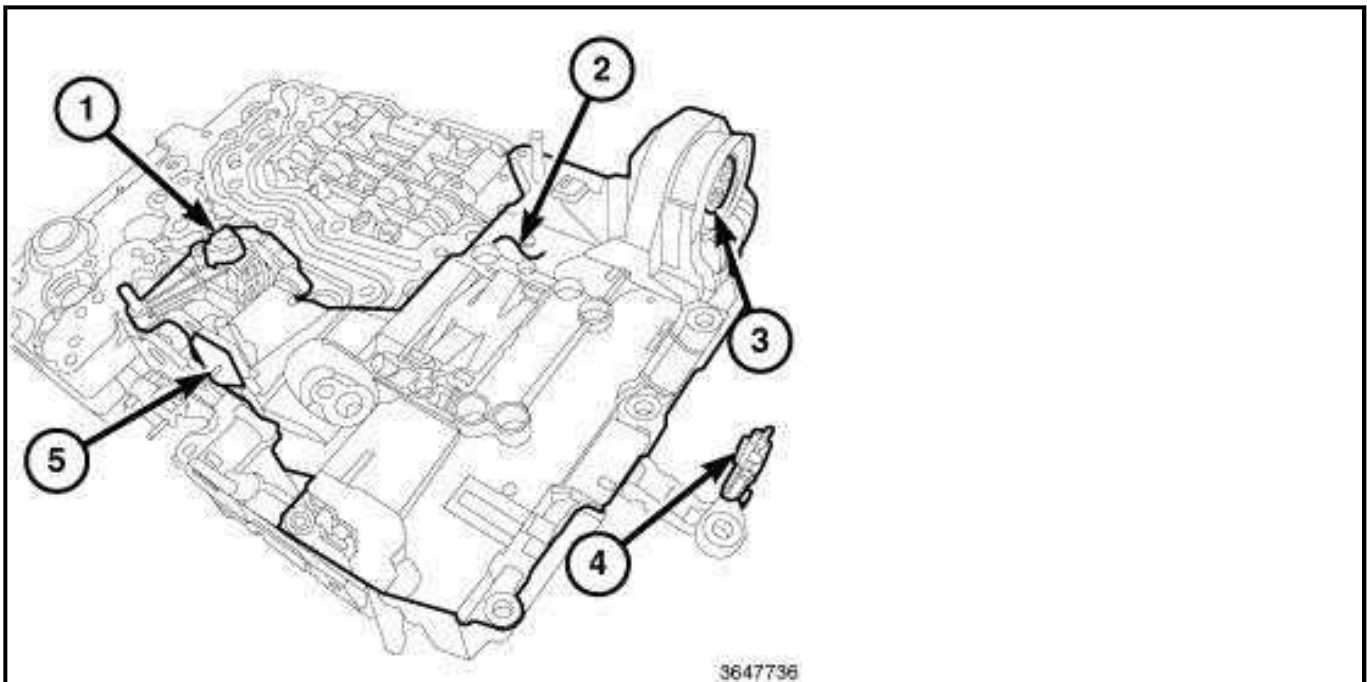
CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

The valve body includes the TCM, all solenoids and sensors, and can be referred to as the TCMA. The TCM is attached to the valve body between the transmission case and the valve body. If any component of the valve body **including the TCM** sensors or solenoids need replaced, the complete TCMA (valve body) must be replaced. For replacement of the TCMA (valve body). Refer to **VALVE BODY, REMOVAL AND INSTALLATION**.

OPERATION



- 1 - M6 Valve Body Bolt Hole
- 8 - Solenoid C
- 2- M5 Valve Body to Solenoid Body Bolt Hole
- 9 - Torque Converter Clutch (TCC) Solenoid
- 3 - Wiring Harness for Park Release Solenoid
- 10 - Line Pressure Solenoid
- 4 - Solenoid A
- 11 - Park Release Solenoid
- 5 - Solenoid D
- 12 - High Impulse Solenoid (HIS) Wire Harness Connector
- 6 - Solenoid B
- 13 - Output Shaft Speed (OSS) Sensor
- 7 - Solenoid E
- 14 - Park Hold Solenoid



- 1 - Input Speed Sensor (ISS)
- 4 - Output Speed Sensor (OSS)
- 2 - Transmission Control Module (TCM) (Includes Transmission Temperature Sensor)
- 5 - Park Position Sensor

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

The valve body, which includes the TCM, controls the delivery and pressure of transmission fluid. The TCM is integrated into the valve body. The TCM regulates the amount of hydraulic pressure used to engage the clutches and the TCC, in addition to directing hydraulic pressure to engage or release any given clutch for any given required gear. The TCM will actuate the valves via solenoids based on the position of the shifter, transmission fluid temperature, engine operating conditions, traction conditions and driver demands. During a shift, the TCM will actuate the solenoids to match the gear ranges to the optimal torque range of the engine based on the position of the accelerator pedal, shifter and vehicle speed as determined by the Powertrain Control Module (PCM) based on input from the Vehicle Speed Sensor (VSS) and Antilock Brake System (ABS) module. Due to the complexity of the 8HP transmission control system, always refer to the transmission electrical/electronic diagnostics in this information when attempting to diagnose transmission problems.

REMOVAL AND INSTALLATION

VALVE BODY

CAUTION: The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

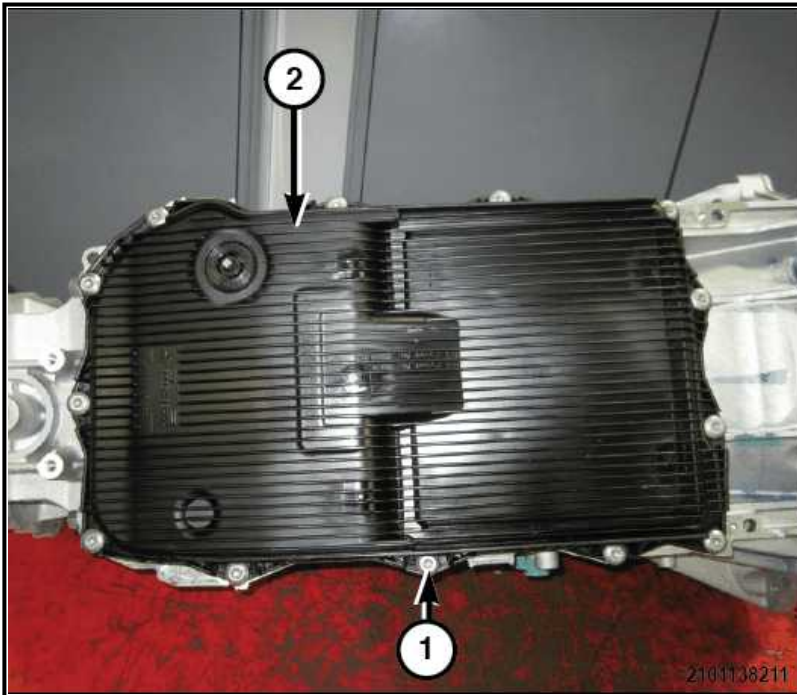
REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Disengage the Manual Park Release on the vehicle to remove the transmission from park. Refer to [MANUAL PARK RELEASE \(MPR\) - DISENGAGE AND ENGAGE](#) .
3. Drain the transmission fluid. Refer to [FLUID/FILTER SERVICE](#) .



1 - Transmission Wire Harness Connector

4. Disconnect the transmission wire harness connector from the transmission by rotating the connector counter-clockwise.

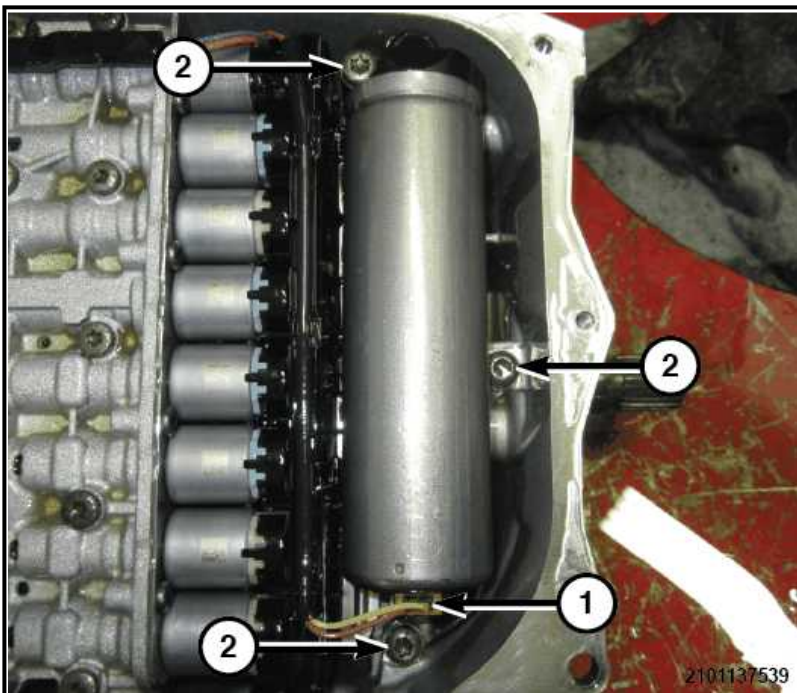


1 - Oil Pan Bolts

2 - Transmission Oil Pan Assembly

NOTE: Inspect the gasket for reuse. If the seal is cut or torn, replace the gasket.

5. Remove the oil pan bolts.
6. Remove the transmission pan assembly and gasket.

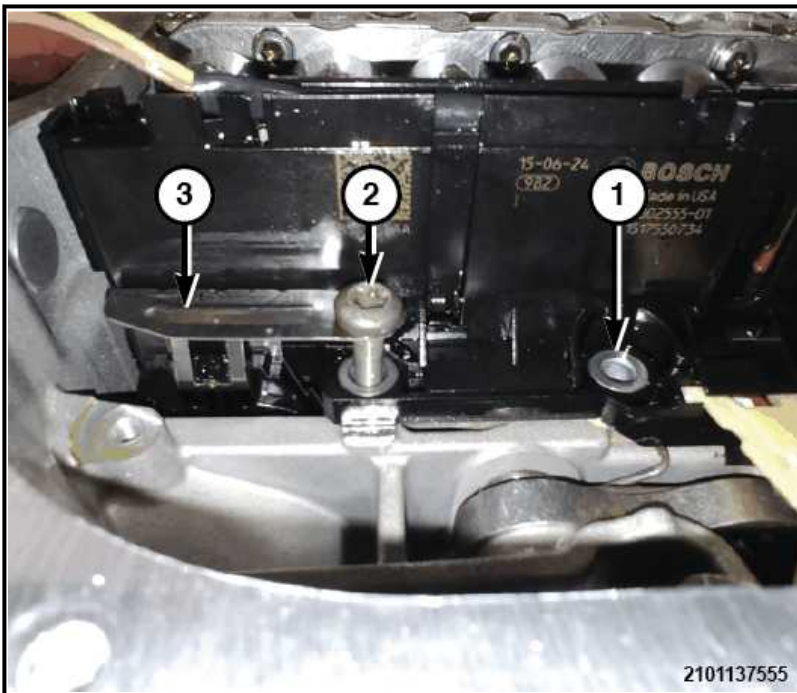


1 - Hydraulic Impulse Solenoid (HIS) Wire Harness Connector

2 - HIS Bolts

7. If equipped, disconnect the Hydraulic Impulse Solenoid (HIS) wire harness connector.

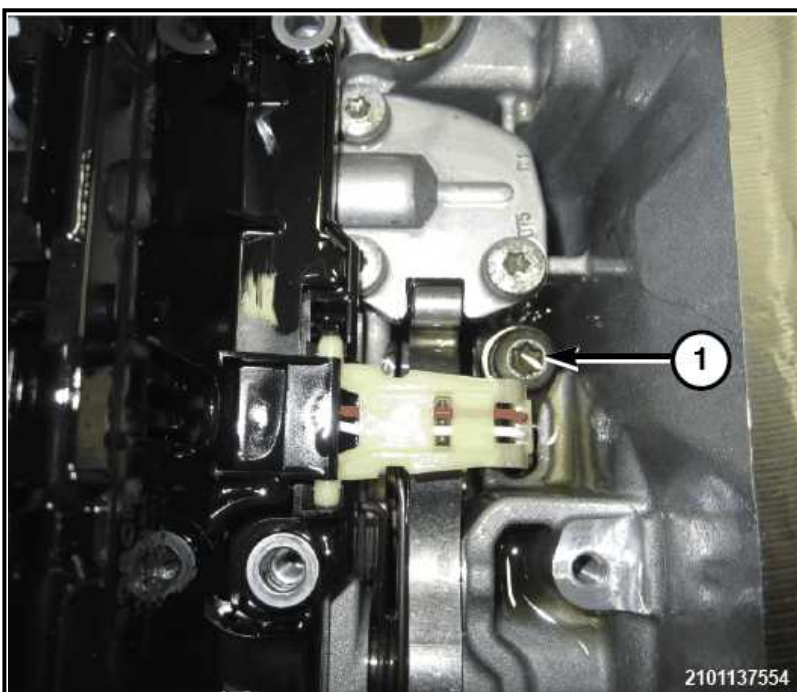
8. Remove the three HIS bolts and remove the HIS accumulator.



1 - Valve Body End Retainer Bolt
2 - Valve Body End Retainer Bolt
3 - Electrical Connector Lock

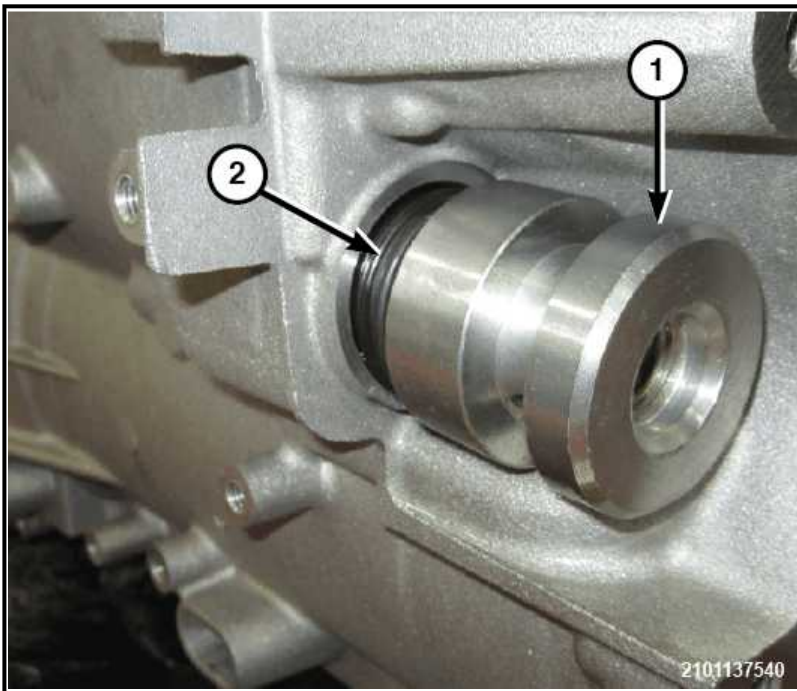
9. Remove the valve body assembly end retainer bolts.

10. Lift the electrical connector lock to release the internal harness end from inside the transmission for valve body assembly removal.



1 - Output Speed Sensor (OSS) Bolt

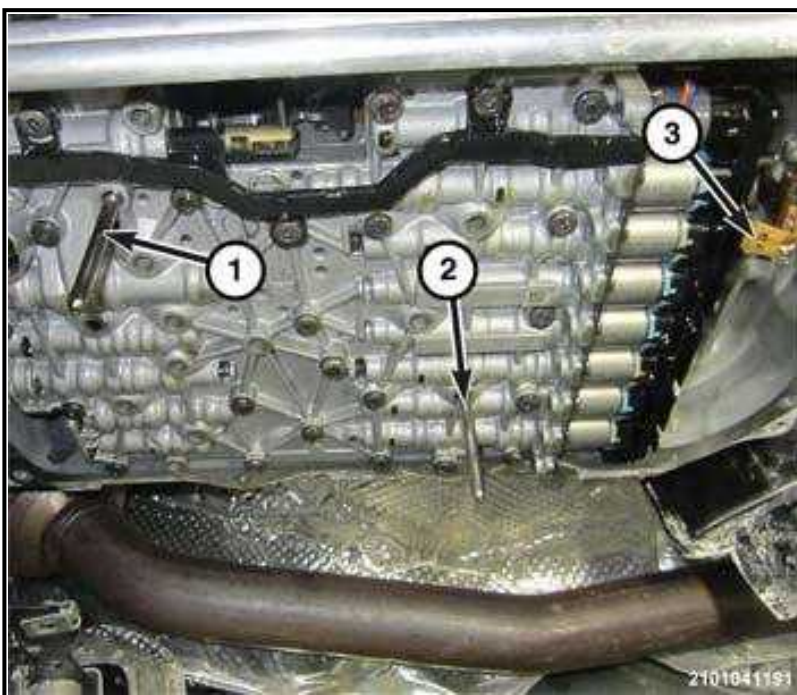
11. Remove the Output Speed Sensor (OSS) retaining bolt and pull the sensor loose from the case.



1 - Remover/Installer Guide

2 - Electrical Harness Insulator

12. Using (special tool #10377, Remover/Installer, Guide Sleeve), pull the electrical harness insulator straight out from the transmission case.

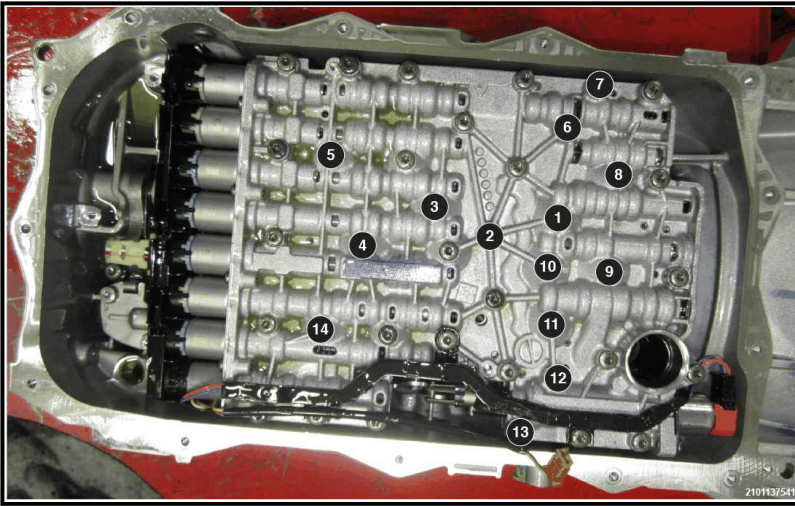


1 - Valve Body Alignment Pin

2 - Valve Body Alignment Pin

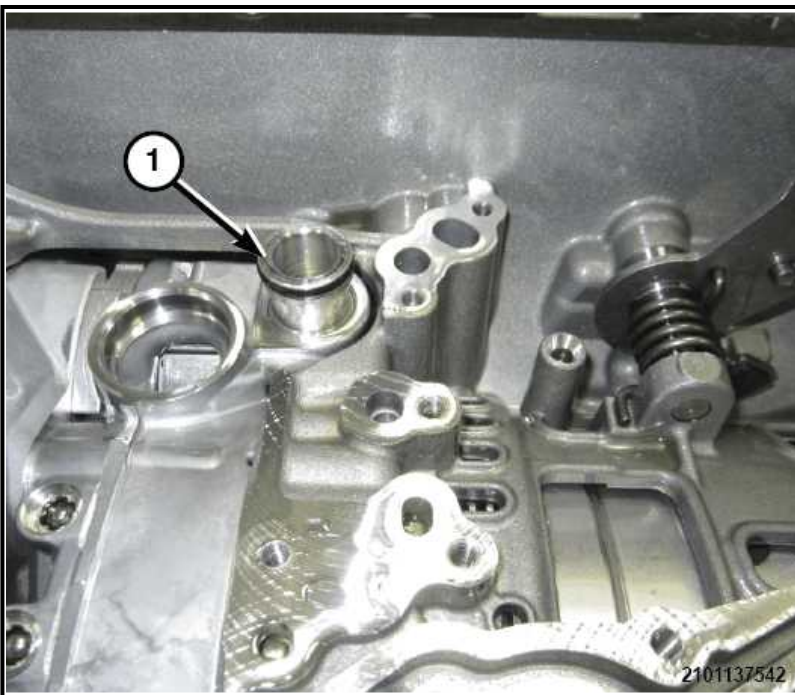
3 - HIS Connector

13. Remove two valve body assembly retaining bolts in the positions shown and install the (special tool #10379, Pins, Valve Body Alignment).
14. Use an appropriate tool on one of the alignment pins to assist in holding the valve body in position while removing the remaining fasteners.



15. Remove remaining valve body assembly retaining bolts in the order shown.
16. Manually rotate the manual park release lever to disengage the valve body from park position and carefully lower the valve body assembly from the transmission.

NOTE: The fluid port may remain in the valve body upon removal.



1 - Transfer Port

17. Remove the fluid transfer port from the transmission.
18. Remove and **DISCARD** the fluid transfer port O-rings.

INSPECTION AND CLEANING

- Inspect the valve body and transmission housing mating surfaces.

INSTALLATION

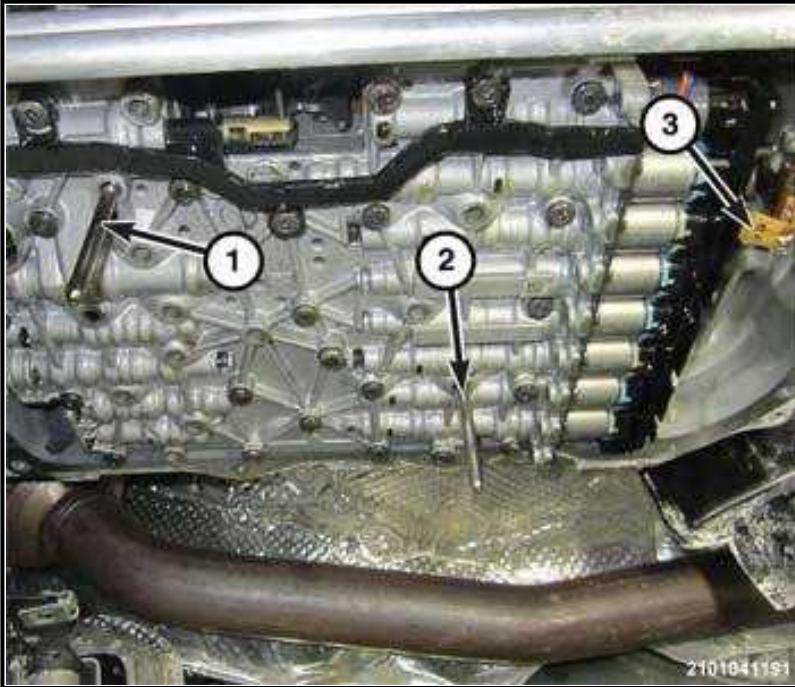
During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

CAUTION:

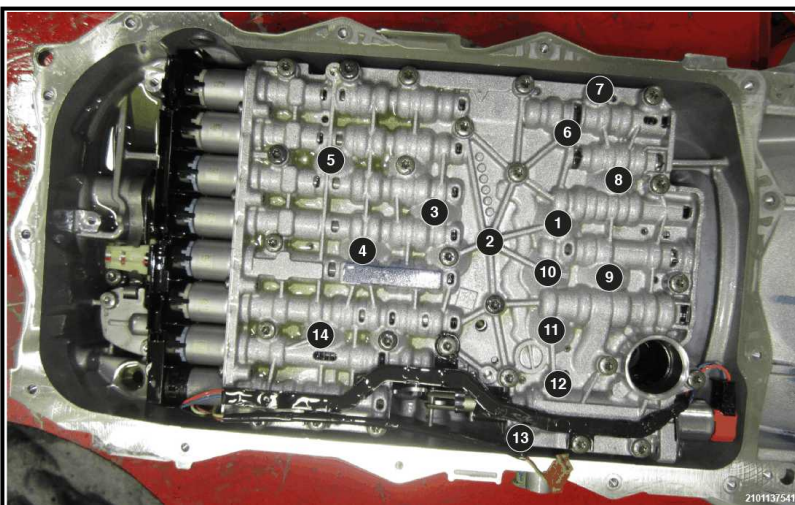
The Transmission Control Module (TCM), or Transmission Control Module Assembly (TCMA) is extremely sensitive to Electrostatic Discharge (ESD). Always use a ground strap and follow the ESD guidelines in **ELECTROSTATIC DISCHARGE SENSITIVE DEVICES**. Failure to follow these instructions may result in damage to the TCM/TCMA.

- If installing a new valve body, check shipping container for any loose shipped parts and install as necessary.

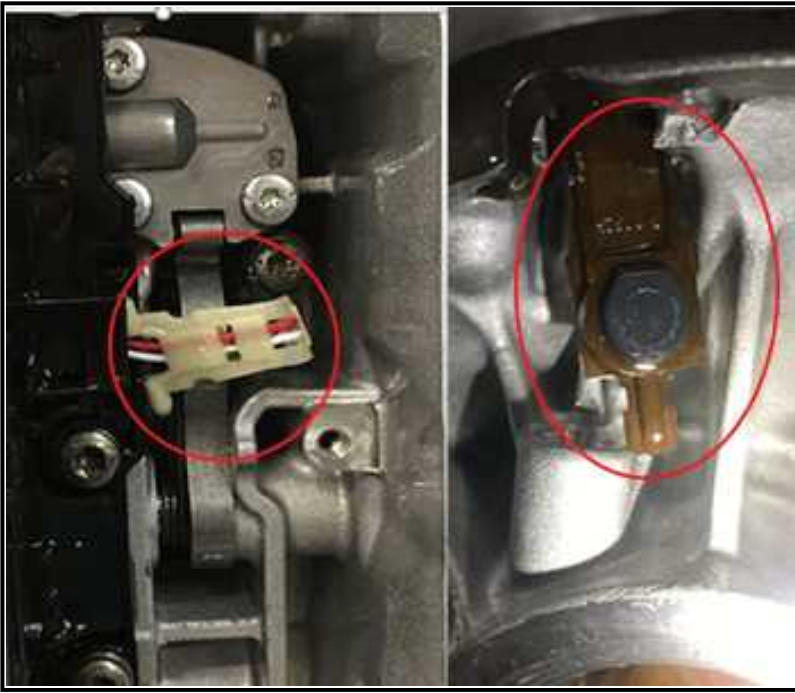


- | |
|------------------------------|
| 1 - Valve Body Alignment Pin |
| 2 - Valve Body Alignment Pin |
| 3 - HIS Connector |

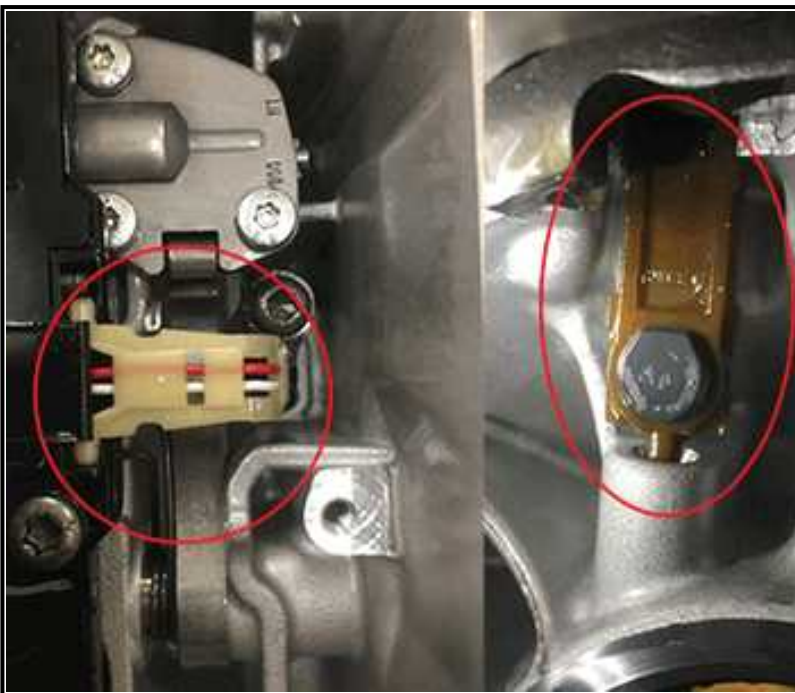
- Install the valve body assembly to the transmission using the previously installed (special tool #10379, Pins, Valve Body Alignment) as a guide.
- Use an appropriate tool on one of the alignment pins to assist in holding the valve body in position while installing the remaining fasteners.



- Install **NEW** valve body assembly retaining bolts 1-14 and hand tighten the valve body bolts.
- Remove the pins and install the remaining bolts.



- When installing the output speed sensor into the case, take care to position the output speed sensor guide pin as shown in the step below or **DAMAGE** to the sensor may result. This is the **INCORRECT** alignment of the pin.



- This is the **CORRECT** installation and pin alignment.
- The valve body bolts must be tightened in the sequence shown in the torque table below.

NOTE: If the transmission was contaminated or the gasket is damaged a **NEW** pan and filter assembly must be installed.

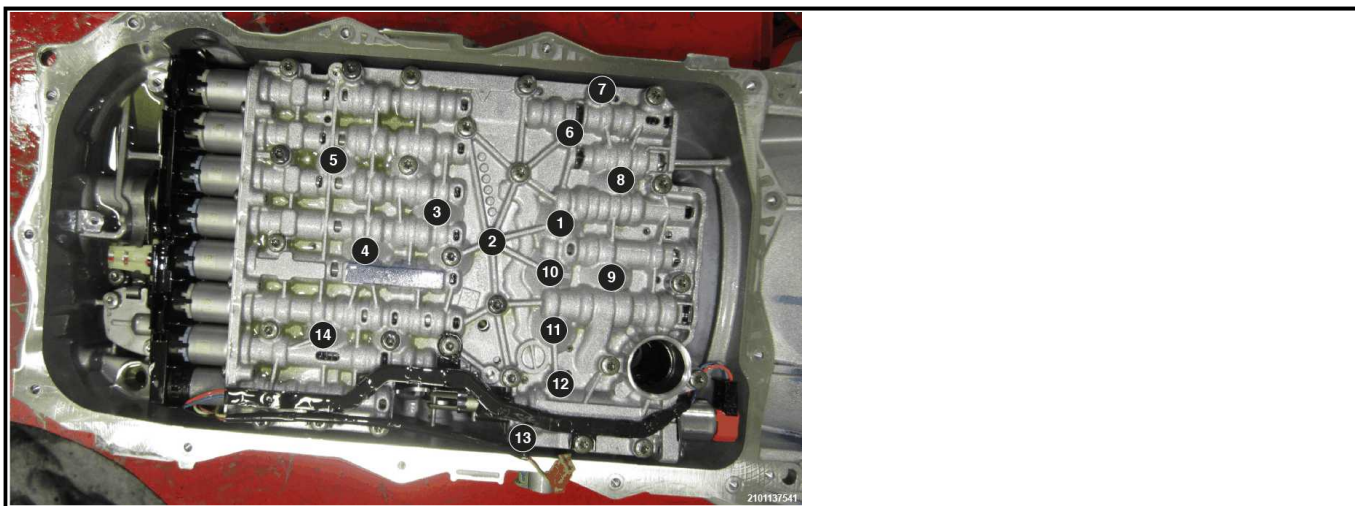
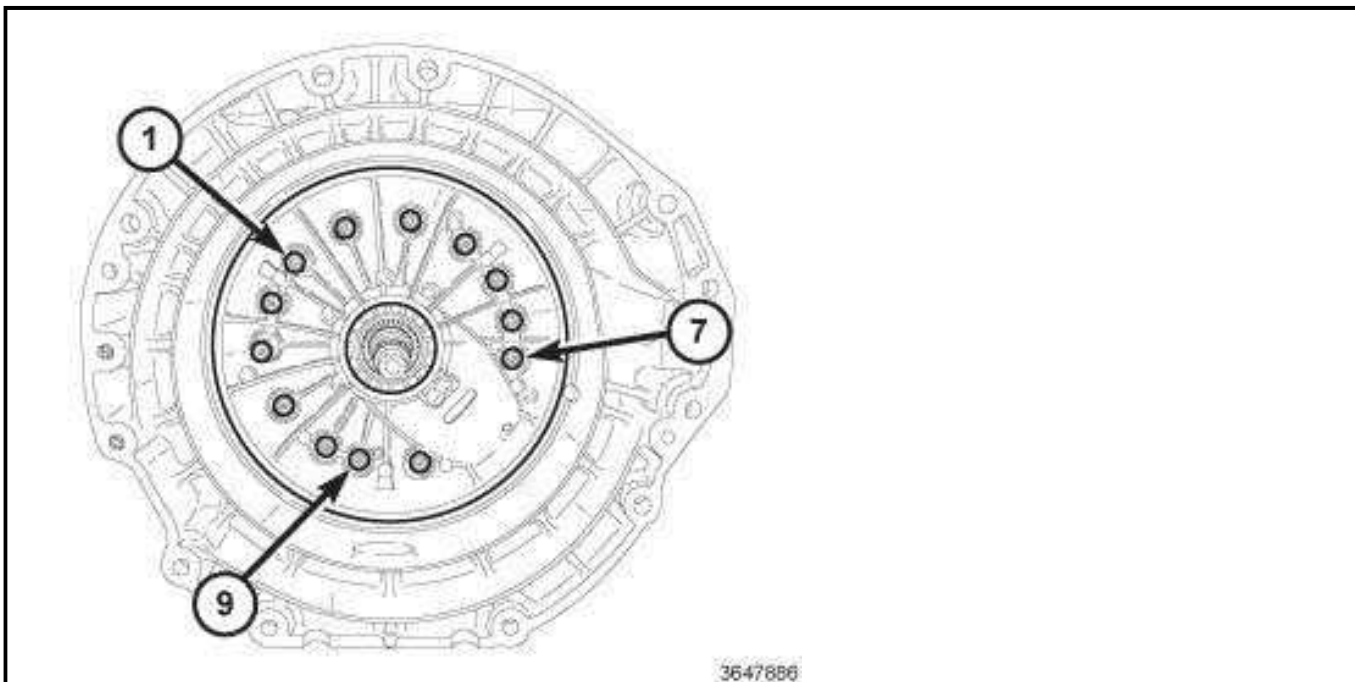
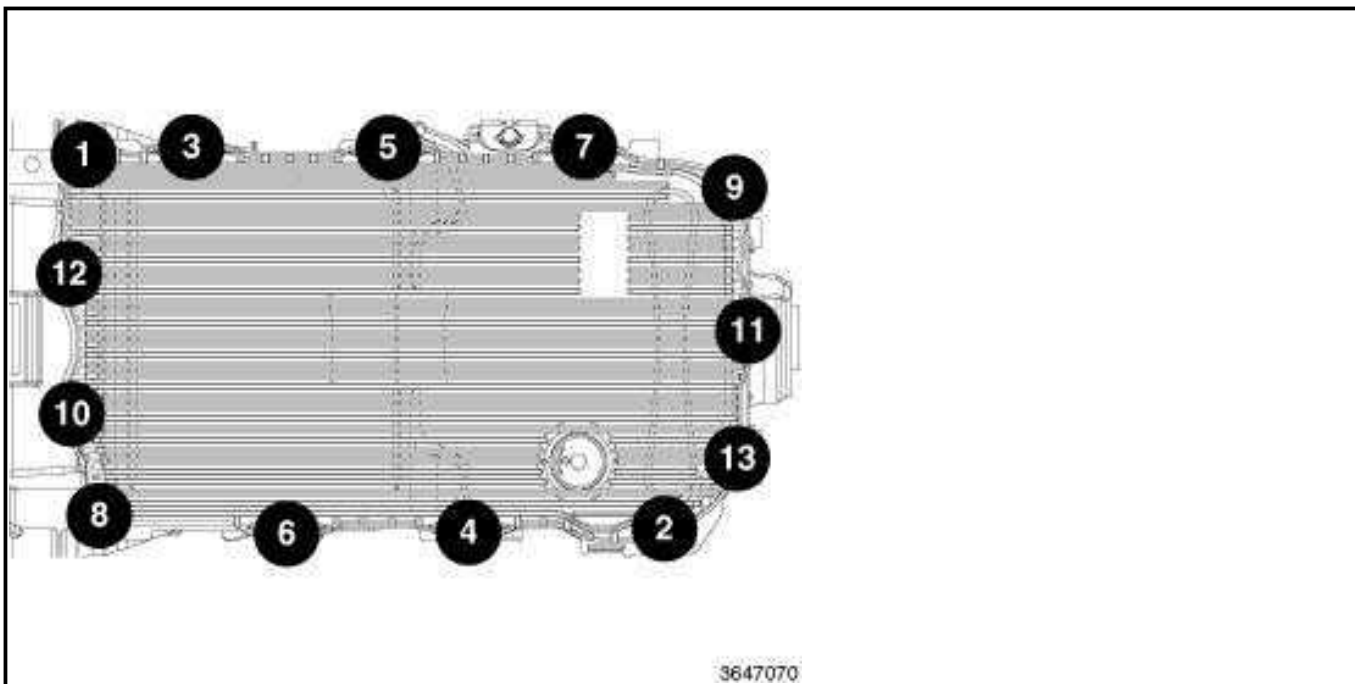
- Install the transmission fluid/filter pan assembly.
- The transmission oil pan assembly bolts must be tightened in the sequence shown in the torque table below.
- If the valve body is replaced, program the TCM. Refer to [MODULE, TRANSMISSION CONTROL \(TCM\), MODULE PROGRAMMING](#).
- Perform the TRANSMISSION FILL AFTER SERVICE procedure. Refer to [TRANSMISSION FILL AFTER SERVICE](#).

- Perform the TRANSMISSION VERIFICATION TEST. Refer to [TRANSMISSION VERIFICATION TEST](#) .

TORQUE SPECIFICATIONS

INTERNAL TRANSMISSION

DESCRIPTION	SPECIFICATION	COMMENTS
Extension Housing to Transmission Bolt	27 N.m (20 Ft. Lbs.)	-
Hydraulic Impulse Solenoid (HIS) Bolts	27 N. m (20 Ft. Lbs.)	-
Output Speed Sensor Bolt	8 N.m (71 In. Lbs.)	-
Park Pawl Lock Rod Guide Plate Bolt	10 N.m (89 In. Lbs.)	-
Park Pawl Shaft Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pan Bolt	10 N.m (89 In. Lbs.)	Tightening Sequence
Transmission Oil Pan Drain Plug	9 N.m (80 In. Lbs.)	-
Transmission Oil fill Plug	35 N.m (26 Ft. Lbs.)	-
Transmission Oil Pump Assembly To Case Bolts	Torque Procedure: Firmly press the oil pump in place by hand before drawing it in with bolts. In order to seat the oil pump cover properly, pre tighten bolts one, seven and nine to 6 N.m (53 in. lb.) Tighten bolts to 10 N.m (89 in. lb.) starting at number one working clockwise Rotate additional 90B° in sequence starting at bolt 1	Tightening Sequence
Transmission Oil Pump Housing To Cover Bolt	Torque Procedure: Tighten to 5 N.m (44 In. Lbs.) Rotate additional 45B°	-
Valve Body Bolt	8 N.m (71 In. Lbs.)	Tightening Sequence



2021 CLUTCH MANUAL AND HYDRAULIC

Clutch System - Gladiator

DESCRIPTION AND OPERATION

CLUTCH INTERLOCK SWITCH

DESCRIPTION

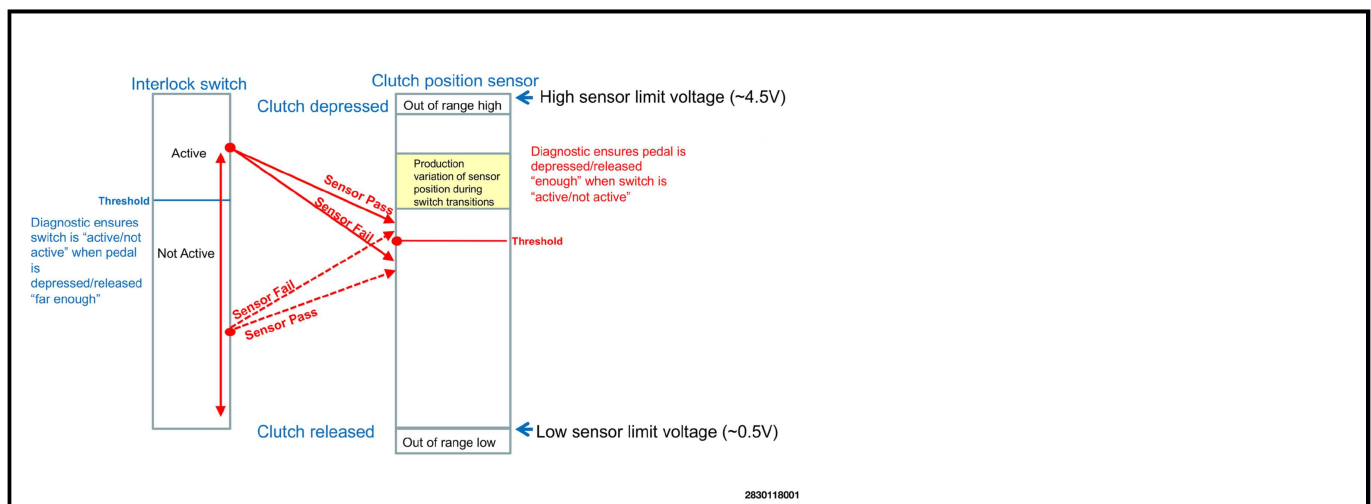
The clutch interlock switch is attached to the side of the clutch master cylinder. The switch is a reed type sealed bulb potted into the switch housing. When the clutch pedal is fully depressed, a magnet on the clutch master cylinder piston closes the switch.

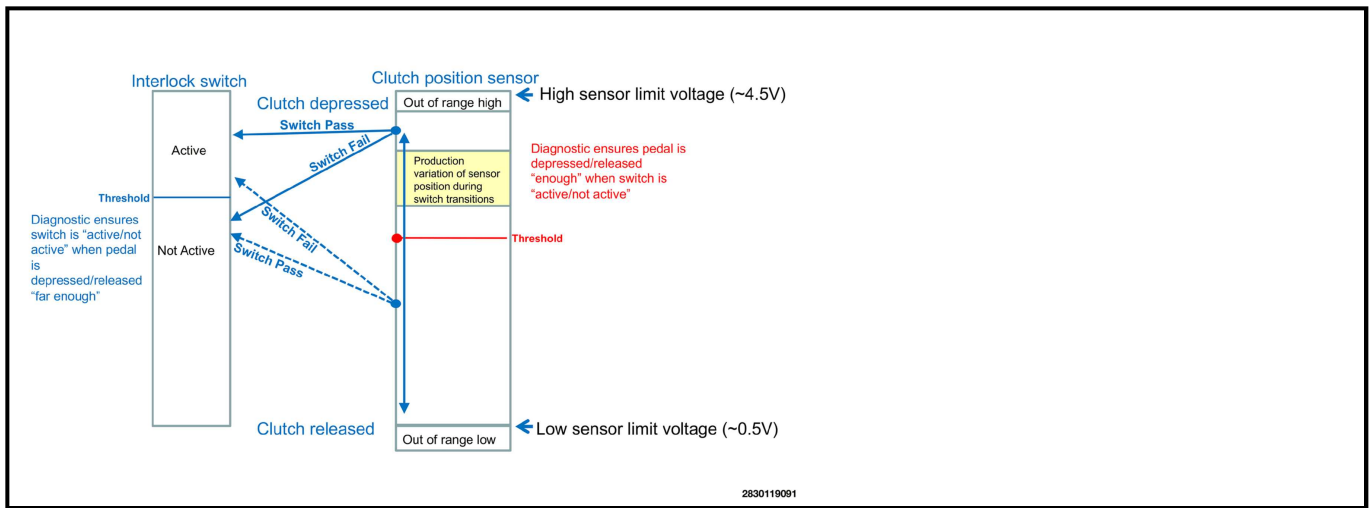
OPERATION

The clutch pedal position switch is used to prevent starter motor engagement until the clutch pedal is fully depressed. When the clutch pedal is fully depressed, a magnet closes the switch. The RF Hub provides a signal to the clutch interlock switch which is grounded when the switch is closed. The PCM receives the clutch interlock switch state from the RF Hub through a dedicated circuit. When the clutch pedal is released, the switch contacts open and will not allow the Powertrain Control Module (PCM) to activate the starter relay to energize the starter motor.

The Clutch Interlock Switch is different than the traditional Clutch Pedal Switches in that it only detects the interlock (pedal depressed) position. The switch input is compared to the Clutch Position Sensor signal for the correlation diagnostic. **The next two graphics illustrate the correlation diagnostic pass/fail.** The threshold values are approximate. The calibrations can vary between vehicles. If a correlation fault sets it will affect the ESS system in one of the following ways:

- If the fault occurs prior to an Auto/Stop, ESS will be disabled and no Auto/Stop will occur.
- If the fault occurs during an Auto/Stop with the Transmission in neutral, the vehicle will Auto/Start and ESS will then be disabled.
- If the fault occurs during an Auto/Stop with the Transmission in gear, Vehicle will not start until the shifter is moved into neutral and then ESS will be disabled.





CLUTCH ASSEMBLY

DESCRIPTION

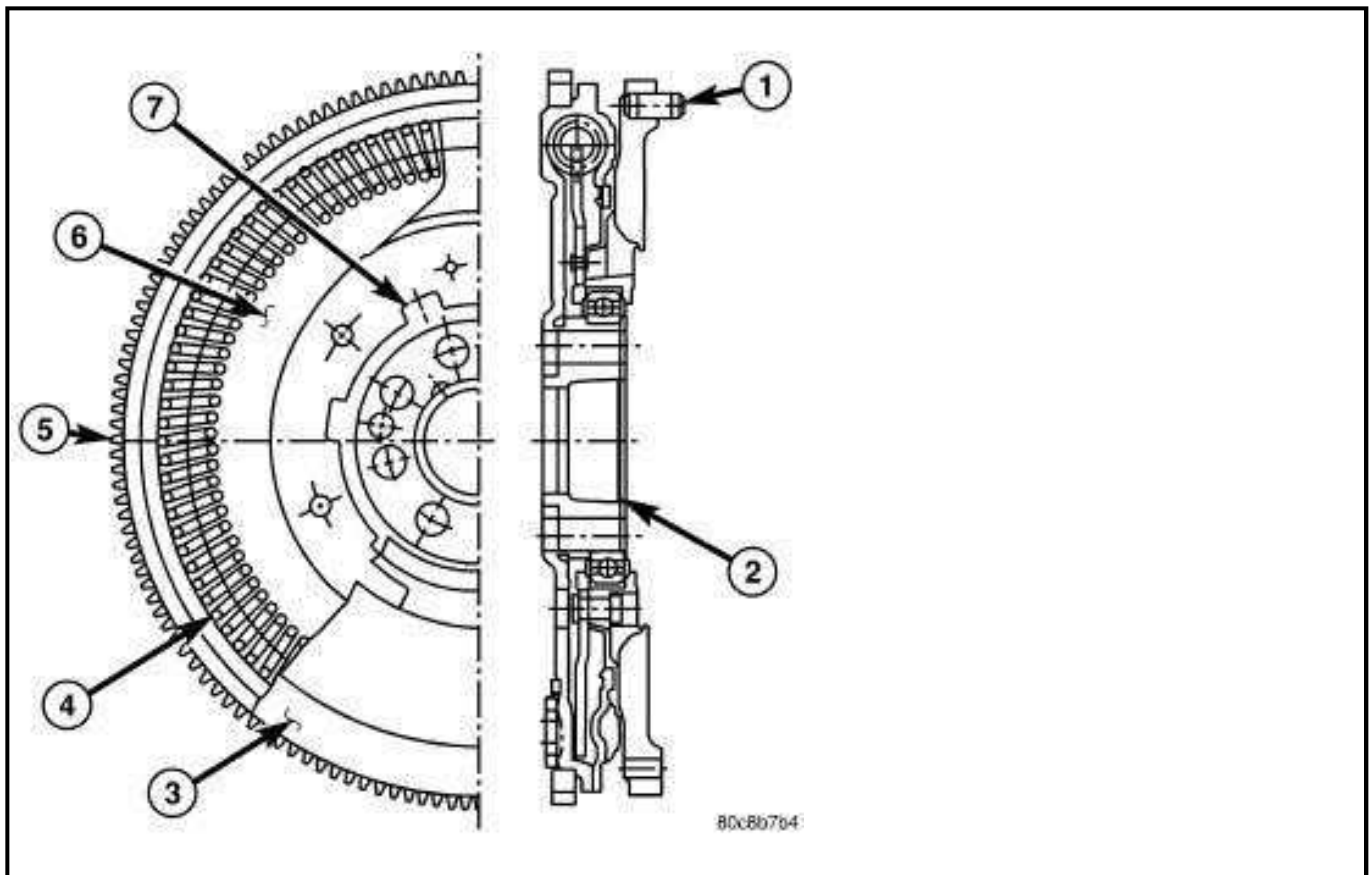
CAUTION: Never use any type of petroleum-based fluid (engine oil, transmission oil, power steering fluid, etc.) in the clutch hydraulic system. Use of such fluids will result in master/slave cylinder seal damage, and cause a failure of the hydraulic clutch release system.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash it off immediately with water.

NOTE: Do not contaminate the friction material with grease or oil since this may cause excessive slippage between the pressure plate and the clutch discs burning the friction material leading to an early failure of the clutch.

CLUTCH

The clutch assembly controls the transfer of torque from the engine flywheel to the manual transmission input shaft. The clutch assembly consists of the two discs, two plates and cover. The clutch disc consists of multiple friction material surfaces positioned on a metal frame and a free floating center hub. The clutch discs may have damping characteristics. The clutch cover assembly consists of 2 cast pressure plates and a heat treated steel spring contained under a stamped steel cover. It is bolted to the engine flywheel and exerts load against the clutch friction discs. The spring is segmented at the inside diameter. These segments (called fingers) are compressed by the clutch release bearing.

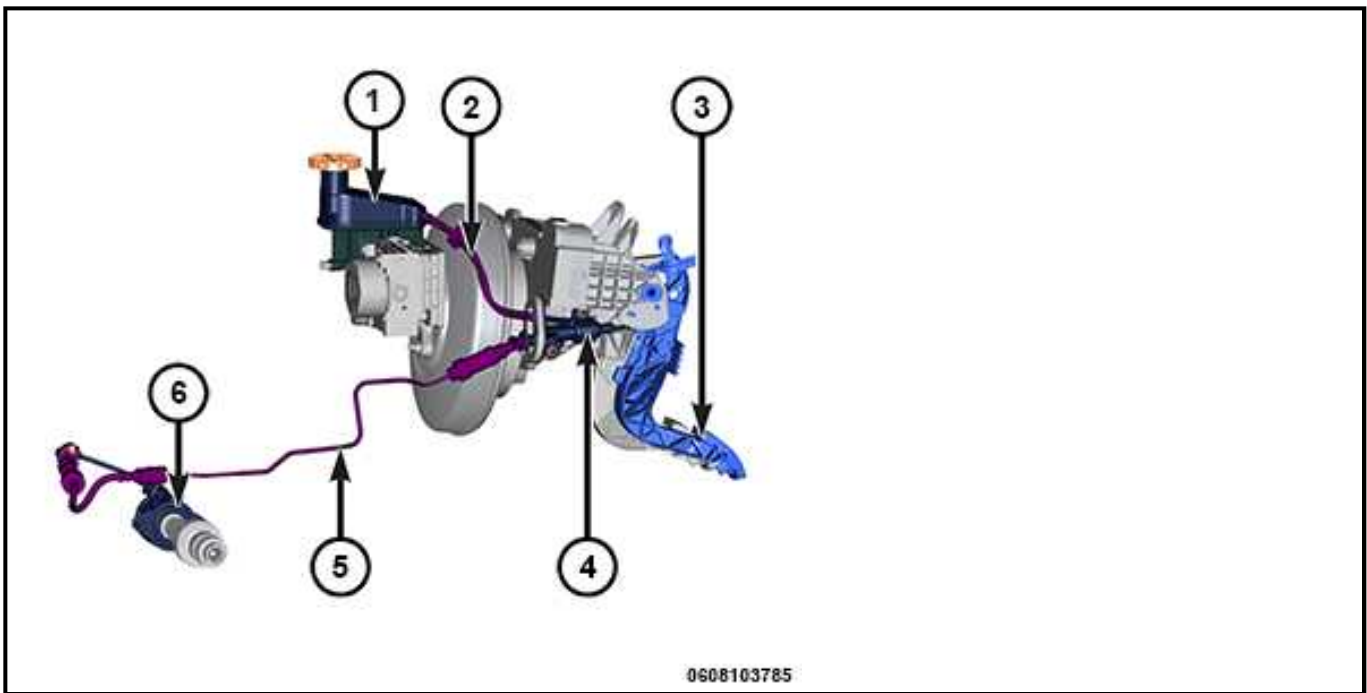


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FLYWHEEL

The Dual Mass Flywheel is used on all engines. The flywheel incorporates the ring gear (5) around the outer circumference to mesh with the starter to permit engine cranking. The primary flywheel (6) side is bolted to the crankshaft. The secondary flywheel (3) side serves as the driving member to the clutch discs. Internal springs (4) between the flywheels are used to dampen energy. The Dual Mass Flywheel is serviced as an assembly only and should never be taken apart.

The flywheel is bolted firmly to the crankshaft which transmits part of the engine torque to the clutch discs. The rest of the torque passes into the cover through the bolts holding the clutch to the flywheel. From there, the straps transfer it to the clutch pressure plates. The diaphragm spring clamps the pressure plates against the clutch discs to achieve positive lock-up with flywheel. The clutch discs transmit the entire engine torque to the transmission via splined connection to the transmission input shaft. When the driver depresses the clutch pedal, the release bearing actuates the diaphragm spring pivots on this fulcrum ring, so that the outside diameter moves away from the pressure plate. This causes the pre-loaded drive straps to pull the pressure plates away from the clutch discs, interrupting torque transmission. When the driver releases the pedal, the outer portion of the diaphragm springs act on both of the pressure plates which clamp both discs with the dual mass flywheel.



CLUTCH HYDRAULIC SYSTEM

The hydraulic clutch system uses brake fluid stored in the brake master cylinder reservoir (1). The clutch supply hose (2) picks up the fluid at a point above the minimum brake fluid level and provides fluid to the clutch master cylinder (4). Because the reservoir contains a protected volume for the clutch, the hydraulic brake system will not lose fluid in the event of a fluid leak in the hydraulic clutch system. The clutch master cylinder (4) is twisted into the dash panel. The input rod of the clutch master cylinder goes through the dash and is snapped onto a pin on the clutch pedal (3). The clutch slave cylinder (6) is mounted outside the bellhousing and has an output rod that sits in the cup of the clutch release fork. It is connected to the clutch master cylinder by a clutch line (5). This allows the brake system to maintain an adequate volume of fluid to operate in the event of a fluid leak in the hydraulic clutch system.

OPERATION

FLYWHEEL

The flywheel serves to dampen the engine firing pulses. The heavy weight of the flywheel relative to the rotating mass of the engine components serves to stabilize the flow of power to the remainder of the drivetrain. The crankshaft has the tendency to attempt to speed up and slowdown in response to the cylinder firing pulses. The flywheel dampens these impulses by absorbing energy when the crankshaft speeds and releasing the energy back into the system when the crankshaft slows down.

CLUTCH OPERATION

The flywheel is bolted firmly to the crankshaft which transmits part of the engine torque to the clutch discs. The rest of the torque passes into the cover through the bolts holding the clutch to the flywheel. From there, the straps transfer it to the clutch pressure plates. The diaphragm spring clamps the pressure plates against the clutch discs to achieve positive lock-up with flywheel. The clutch discs transmits the entire engine torque to the transmission via splined connection to the transmission input shaft. When the driver depresses the clutch pedal, the release bearing actuates the diaphragm spring pivots on this fulcrum ring, so that the outside diameter moves away from the pressure plates. This causes the pre-loaded drive straps to pull the pressure plates away from the clutch discs, interrupting torque transmission. When the driver releases the pedal, the outer portion of the diaphragm springs acts on the pressure plates which in turn clamps the clutch discs between the pressure plates and the flywheel.

CLUTCH PEDAL POSITION SENSOR

DESCRIPTION

The Clutch Pedal Position Sensor detects the actual position of the pedal during the full range of travel. This is necessary for better control of features like Electric Stop/Start (ESS) and Active Cruise Control (ACC). Vehicles equipped with ESS also use an interlock switch for correlation with the sensor to aid in rapid detection of interlock switch or sensor faults. The clutch pedal position sensor is attached to the side of the brake/throttle/clutch pedal armature assembly. It is secured with an integral locking lever. A pin on the clutch pedal lever cycles the switch. A three pin electrical connector plugs into the switch.

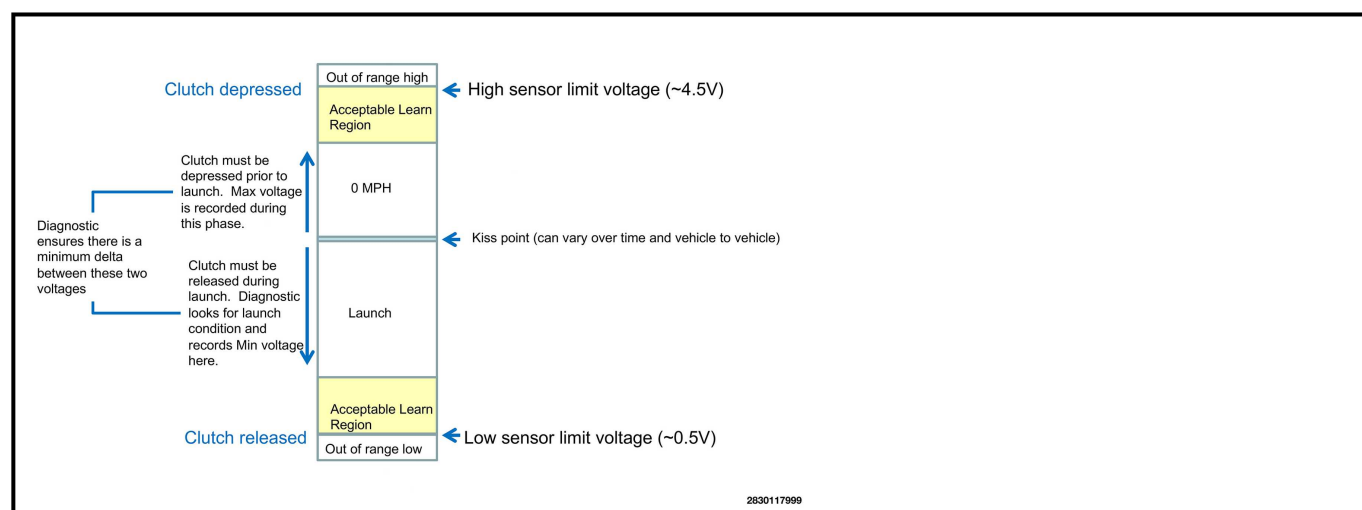
NOTE: If the clutch pedal position sensor is being replaced, use the diagnostic scan tool to perform the clutch pedal position sensor learn procedure in the Powertrain Control Module (PCM) "Misc. functions" menu. This must be performed when the PCM, clutch pedal sensor, or related components are replaced.

OPERATION

Clutch Pedal Position Sensor Operation and Diagnostics: At the plant, a Clutch Position Learn Procedure is performed. The Clutch Position Sensor minimum and maximum voltage readings are programmed into the PCM permanent memory. The Clutch Position Sensor voltage is monitored when the enable conditions are met for a stuck Clutch Position Sensor as follows:

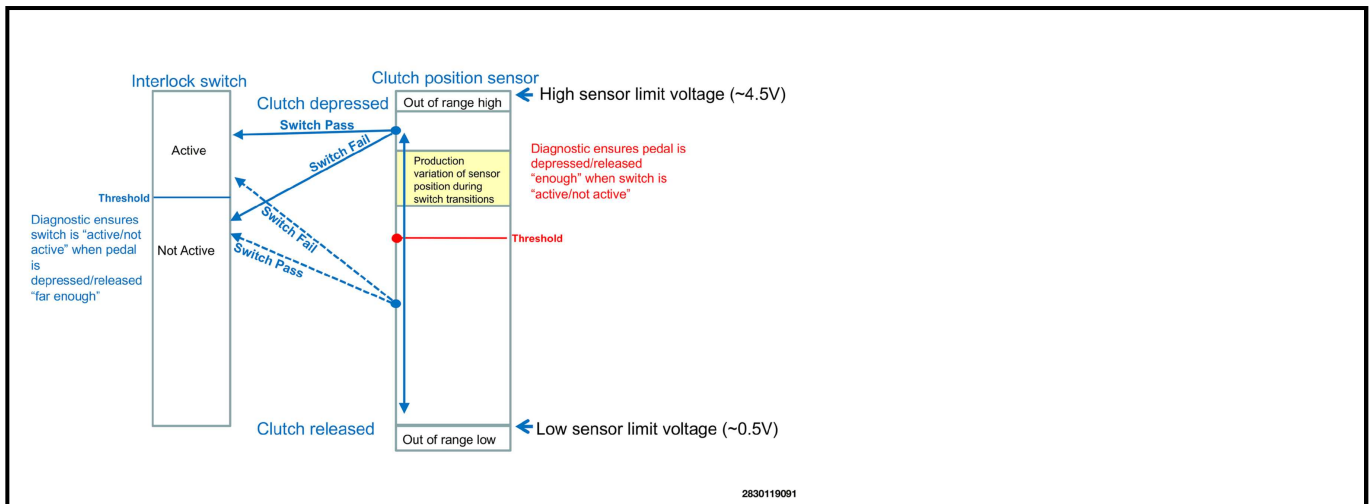
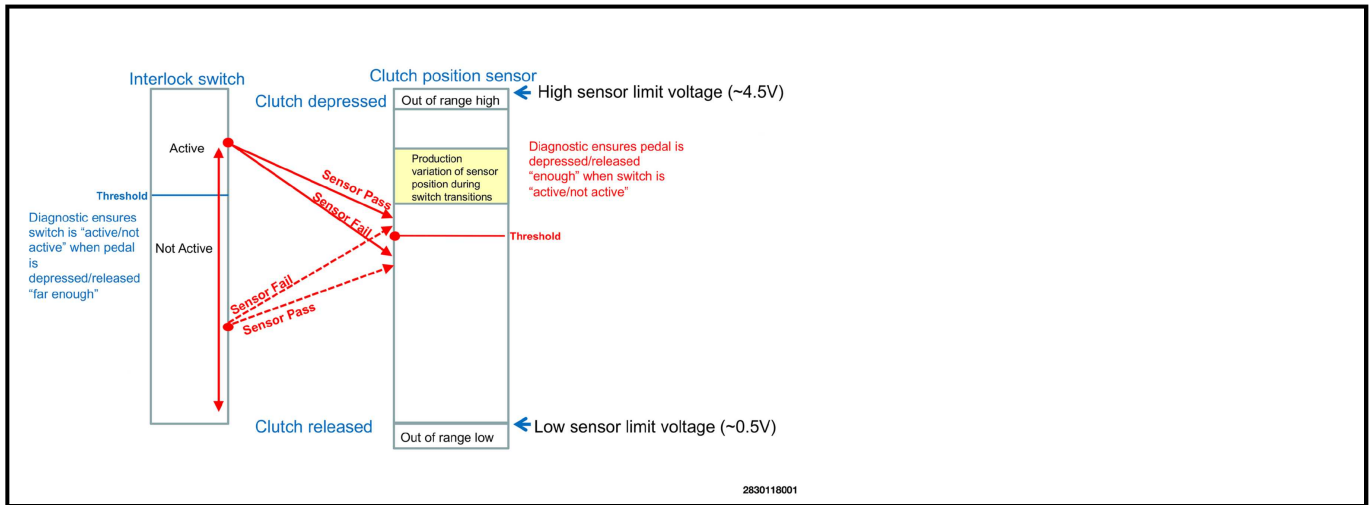
- When the vehicle is not moving, or moving very slowly (below 2 mph), the PCM assumes that the Clutch Pedal is depressed, or must be depressed at some point to put the Transmission in gear, and **the maximum voltage reading is recorded.**
- When the PCM detects a vehicle launch condition, it is assumed that the Clutch pedal is released and **the minimum voltage reading is recorded.** A vehicle launch is determined to be true based on the following conditions:
 - Throttle input is requested
 - Increased engine load
 - Vehicle is accelerating
 - When the vehicle speed reaches a calibrated value, the launch event is considered complete

If the difference between the maximum voltage recorded and the minimum voltage recorded (delta) is not greater than a calibrated threshold, a performance fault is set. **The graphic below illustrates the performance diagnostic.** The threshold values are approximate. The calibrations can vary between vehicles.



Vehicles equipped with ESS will also have a Clutch Interlock Switch. The Clutch Interlock Switch is different than the traditional Clutch Pedal Switches in that it only detects the interlock (pedal depressed) position. The switch input is compared to the Clutch Position Sensor signal for the correlation diagnostic. **The next two graphics illustrate the correlation diagnostic pass/fail.** The threshold values are approximate. The calibrations can vary between vehicles. If a correlation fault sets it will affect the ESS system in one of the following ways:

- If the fault occurs prior to an Auto/Stop, ESS will be disabled and no Auto/Stop will occur.
- If the fault occurs during an Auto/Stop with the Transmission in neutral, the vehicle will Auto/Start and ESS will then be disabled.
- If the fault occurs during an Auto/Stop with the Transmission in gear, Vehicle will not start until the shifter is moved into neutral and then ESS will be disabled.



DIAGNOSIS AND TESTING

CLUTCH ASSEMBLY - DIAGNOSIS AND TESTING

Road test and inspect components to determine a clutch problem. Road test the vehicle at normal speeds. Shift the transmission through all gear ranges and observe clutch action. If clutch chatters, grabs, slips or does not release properly, remove and inspect clutch components. If problem is noise or hard shifting, further diagnosis may be needed to the transmission and driveline component.

CLUTCH CONTAMINATION

Contamination is a frequent cause of clutch malfunctions. Oil, water or clutch fluid on the clutch disc and pressure plate surfaces will cause chatter, slip and grab. Oil contamination indicates a leak at either the rear main seal or transmission input shaft. Clutch fluid leaks are usually from damaged slave cylinder push rod seals. Heat buildup caused by slippage between the pressure plate, disc and flywheel can bake the oil residue onto the components. The glaze-like residue ranges in color from amber to black.

Road splash contamination is dirt/water entering the clutch housing due to loose bolts, housing cracks. Driving through deep water puddles can force water/road splash into the housing through such openings.

IMPROPER RELEASE OR CLUTCH ENGAGEMENT

Clutch release or engagement problems can be caused by worn or damaged clutch components.

Release problems can cause hard shifting and noise. Look for leaks at clutch cylinders, connecting line and loose slave cylinder bolts. Also worn/loose release fork, pivot stud, clutch disc, pressure plate or release bearing.

Engagement problems can cause slip, chatter/shudder and noisy operation. The causes may be clutch disc contamination, wear, distortion or flywheel damage.

CLUTCH MISALIGNMENT

Clutch components must be in proper alignment with the crankshaft and transmission input shaft. Misalignment caused by excessive runout or warpage of any clutch component will cause grab, chatter and improper clutch release.

CLUTCH COVER AND DISC RUNOUT

Check the clutch disc before installation. Axial (face) runout of a **NEW** disc should not exceed 0.50 mm (0.020 in.). Measure the runout about 6 mm (1/4 in.) from the outer edge of the disc facing. Obtain another disc if the runout is excessive.

Visually check the condition of the clutch before installation. Be careful when handling the cover and disc. Impact can distort the cover, diaphragm spring, release fingers and the hub of the clutch disc. If the clutch or disc appears to be damaged, do not install it, obtain a new clutch and disk set.

A frequent cause of clutch cover distortion is improper bolt tightening. Use a star pattern and follow the proper procedure. Refer to **DISC, CLUTCH, REMOVAL AND INSTALLATION**.

FLYWHEEL RUNOUT

Check flywheel runout whenever misalignment is suspected. Measure runout at the outer edge of the flywheel's friction surface with a dial indicator.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Minor flywheel scoring is acceptable. Replace the flywheel if scoring is severe or the flywheel is damaged.

Clean the drive plate surface before mounting the flywheel. Dirt and grease on the drive plate surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar™ Lock And Seal or equivalent. Refer to **FLYWHEEL, REMOVAL AND INSTALLATION**.

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
Disc facing worn out.	1. Normal wear.	2. Replace clutch assembly and the dual mass flywheel. Verify the bearing contact surface with the diaphragm spring, if there are marks of overheating or excessive wear replace the bearing.
	2. Driver frequently rides (slips) the clutch. Results in rapid overheating and wear.	2. Replace clutch assembly and the dual mass flywheel. Verify the bearing contact surface with the diaphragm spring, if there are marks of

CONDITION	POSSIBLE CAUSES	CORRECTION
		overheating or excessive wear replace the bearing.
	3. Insufficient clutch torque capacity.	2. Replace clutch assembly and the dual mass flywheel. Verify the bearing contact surface with the diaphragm spring, if there are marks of overheating or excessive wear replace the bearing.
Clutch disc facing contaminated with oil, grease, or clutch fluid.	1. Leak at rear main engine seal or transmission input shaft seal.	1. Replace appropriate seal. Replace clutch assembly if they have been contaminated. Inspect the dual mass flywheel and replace if contaminated.
	3. Slave Cylinder leaking.	3. Replace the slave cylinder and inspect hydraulic clutch lines. Replace clutch assembly if they have been contaminated.
Clutch is running partially disengaged, or slips while driving.	1. Release bearing sticking or binding and does not return to the normal running position.	1. Verify failure. Replace the release bearing as necessary.
	2. Release lever installed incorrectly.	2. Check for proper installation of release lever.
Facing on flywheel side of disc torn, gouged or worn.	1. Flywheel surface scored or nicked.	1. Correct surface condition if possible. Replace flywheel and clutch assembly as necessary.
	2. Clutch disc sticking or binding on transmission input shaft.	2. Inspect components and correct/replace as necessary.
Clutch disc facing burnt. Flywheel and cover pressure plate surfaces heavily glazed.	1. Frequent operation under high loads or hard acceleration conditions.	1. Replace flywheel and clutch assembly. Check release bearing for heat damage or scoring and replace if necessary. Alert driver to problem cause.
	2. Driver frequently rides (slips) clutch. Results in rapid wear and overheating of disc and cover.	1. Replace flywheel and clutch assembly. Check release bearing for heat damage or scoring and replace if necessary. Alert driver to problem cause.
Clutch discs binds on input shaft splines.	1. Clutch disc hub splines damaged during installation.	1. Replace clutch assembly.
	2. Input shaft splines rough, damaged, or corroded.	2. Clean and lubricate shaft splines if possible. Replace input shaft if necessary.
Clutch discs rusted to flywheel or pressure plate.	1. Clutch not used for an extended period of time (e.g. long term vehicle storage).	1. Replace clutch assembly and flywheel if necessary.
Clutch will not disengage properly.	1. Low hydraulic linkage fluid level.	1. Add hydraulic linkage fluid.
	2. Clutch cover loose.	2. Follow proper bolt tightening procedure.
	3. Clutch discs bent or distorted.	3. Replace clutch assembly. Inspect the dual mass flywheel and bearing, inspect and replace as necessary.
	4. Clutch cover diaphragm spring bent or warped.	3. Replace clutch assembly. Inspect the dual mass flywheel and bearing, inspect and replace as necessary.
	5. Release fork bent or fork pivot loose or damaged.	5. Replace fork or pivot as necessary. Inspect the bearing and diaphragm spring, if necessary replace the clutch assembly and bearing as well.

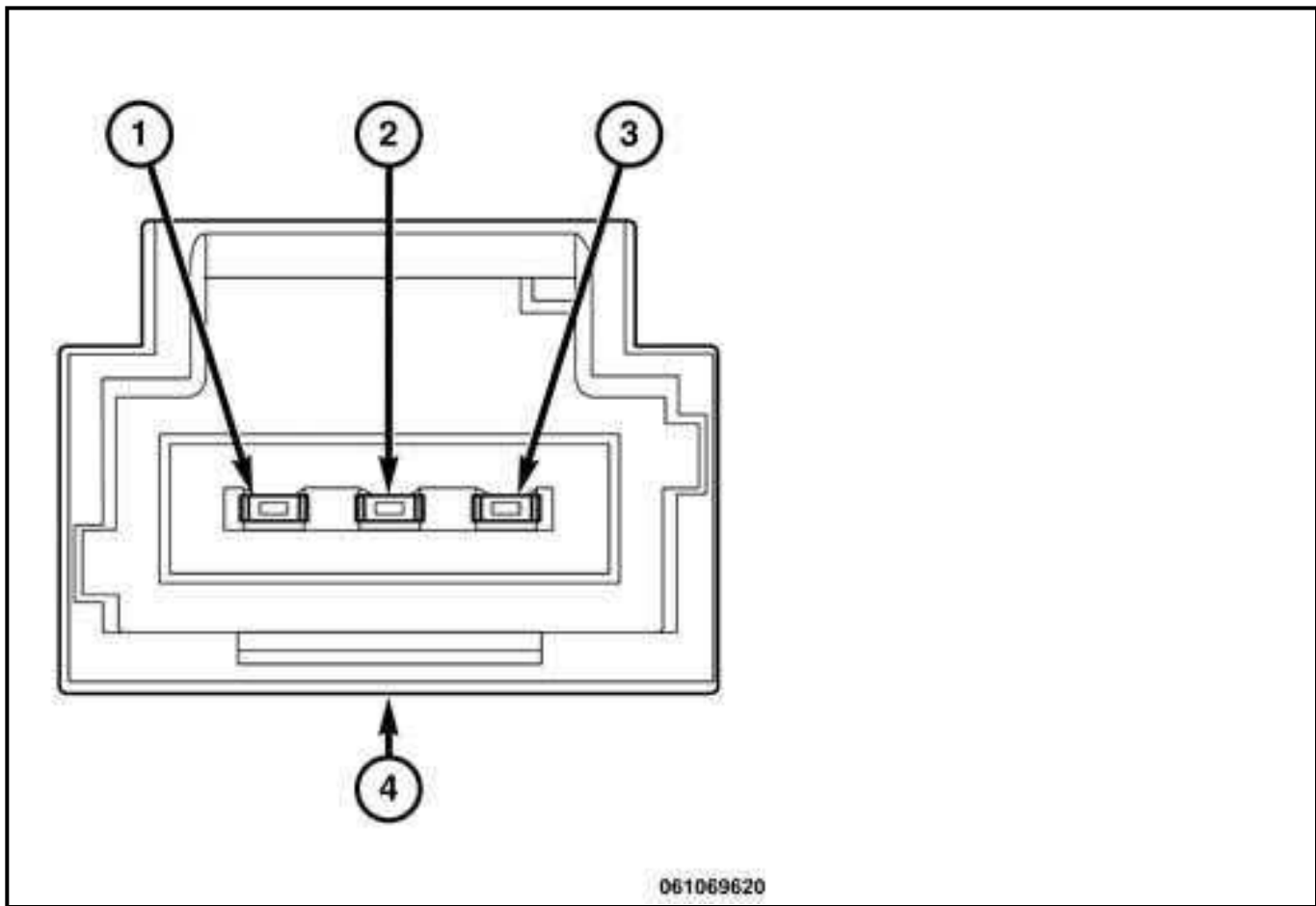
CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Clutch master or slave cylinder failure.	6. Replace hydraulic linkage assembly and inspect clutch disc for contamination. Replace clutch assembly if contaminated by fluid.
	7. Incorrect slave cylinder installed.	7. Install correct slave cylinder.
Clutch pedal squeak.	1. Pivot pin loose.	1. Tighten pivot pin if possible. Replace clutch pedal if necessary.
	2. Master cylinder bushing not lubricated.	2. Lubricate master cylinder bushing.
	3. Pedal bushings worn out or cracked.	3. Replace and lubricate bushings.
	4. Rough surface on front bearing retainer.	4. Replace front bearing retainer.
	5. Release bearing sleeve not lubricated at fork interface.	5. Apply grease to release bearing and fork interface.
	6. Release fork pockets not lubricated.	6. Apply grease to release fork pockets.
Clutch master or slave cylinder plunger dragging or binding	1. Master or slave cylinder components worn or corroded.	1. Replace clutch hydraulic linkage assembly.
Release bearing is noisy.	1. Release bearing defective or damaged.	1. Replace release bearing.
Contact surface of release bearing damaged.	1. Release bearing defective or damaged.	1. Replace the release bearing.
	2. Release bearing misaligned.	2. Check front bearing sleeve for damage/alignment. Repair as necessary.
	3. Wear or discoloration at the bearing to clutch interference is acceptable.	3. Re-install bearing and continue usage.

CLUTCH PEDAL INTERLOCK SWITCH - DIAGNOSIS AND TESTING

The Clutch Pedal Interlock Switch consists of two open or closed style switches.

When the switch lever is at the rearward end of its swing (pedal released) the downstop or interlock switch is open and should not have continuity through the connector pins 1 and 2. The upstop switch is closed and should have continuity between pins 1 and 3.

When the switch lever is at the forward end of its swing (pedal depressed) the downstop or interlock switch is closed and should have continuity through the connector pins 1 and 2. The upstop switch is open and should not have continuity between pins 1 and 3.



To test the switch, unplug the wire harness connector and connect a continuity tester or OHM meter to the pins in the switch connector.

SYMPTOM	TEST RESULT	REPAIR
Engine will not crank with clutch depressed.	1. No continuity is detected from pin 1 to pin 2 or continuity is detected from pin 1 to pin 3 with clutch pedal depressed. 2. If switch tests OK with the clutch pedal depressed.	1. Switch needs to be replaced. 2. Repair electrical fault in system.
Engine cranks with clutch released.	1. Continuity is detected from pin 1 to pin 2 or no continuity is detected from pin 1 to pin 2 with clutch pedal depressed. 2. If switch tests OK with the clutch pedal depressed.	1. Switch needs to be replaced. 2. Repair electrical fault in system.

FLYWHEEL - DIAGNOSIS AND TESTING

Check Dual Mass Flywheel (DMF) runout whenever misalignment is suspected. Measure runout at the outer edge of the flywheel's friction surface with a dial indicator.

Common causes of runout are:

- heat warpage

- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Minor flywheel scoring is acceptable. Replace the flywheel if scoring is severe.

NOTE: DO NOT ATTEMPT TO RESURFACE THE FLYWHEEL FOR ANY REASON. IF FLYWHEEL IS SEVERELY SCORED OR DAMAGED REPLACE IT.

Clean the drive plate surface before mounting the flywheel. Dirt and grease on the drive plate surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar™ Lock And Seal or equivalent. Refer to [FLYWHEEL, REMOVAL AND INSTALLATION](#).

ROAD TEST DIAGNOSIS - Observations/evaluations when the vehicle is still drivable (before repair)

CONDITION	POSSIBLE CAUSES	CORRECTION
There is a rattle noise present while the vehicle is moving	1. There are many factors that can contribute to this noise. 2. The dual mass flywheel is OK and the noise is normal for the application / vehicle. 3. The dual-mass flywheel (DMF) might be damaged.	1. Try to observe where on the vehicle the noise is coming from (consider other systems than only the DMF). 2. A burst of rattle at low gas pedal position and/or during tip-in / back-out of the gas pedal is OK. Do not replace the DMF. 3. Remove the transmission and inspect the DMF according to the procedures below.
Vibration at idle (vehicle not moving)	1. Engine issue. 2. Worn clutch disc (damper internals) or transmission input shaft. 3. Damage to or a foreign object on a rotating part in the bellhousing.	1. Check that service engine or other trouble code is not present. Clear codes if present and ensure they do not return. 2. Push the clutch pedal to the floor and observe if the vibration goes away. Does it return when the pedal is let up? If yes, remove the transmission and check the disc damper for damage and the transmission input shaft for looseness. Replace as necessary. 3. Check the clutch, disc, and DMF for damage or lost parts. Check same for foreign materials present (e.g. mud, grease, debris stuck in one location). Clean or replace parts as necessary.
Vibration during engine start-up or shut-off	1. Normal operation.	1. The nature of a dual mass flywheel can cause a

CONDITION	POSSIBLE CAUSES	CORRECTION
	2. DMF is damaged.	vibration or thump during engine start or stop. So long as the other vehicle functions of the clutch and flywheel are OK, there is no need to change or inspect the DMF. 2. Abnormal noises such as "pots and pans" or what sounds like a hard hit of a hammer on metal are cause for inspection. Remove the transmission and inspect the DMF according to the procedures below.
Noise during engine start-up or shut-off	1. Normal operation. 2. DMF is damaged.	1. The nature of a dual mass flywheel can cause a vibration or thump during engine start or stop. So long as the other vehicle functions of the clutch and flywheel are OK, there is no need to change or inspect the DMF. 2. Abnormal noises such as "pots and pans" or what sounds like a hard hit of a hammer on metal are cause for inspection. Remove the transmission and inspect the DMF according to the procedures below.
Clunk noise during tip-in, back-out of the gas pedal	1. Normal operation. 2. DMF is damaged.	1. Some noise is expected during this maneuver, but should only be once per tip-in or back-out event. Try different gas pedal positions and different vehicle speeds (e.g. parking lot speed, 35mph, 60mpg). If the noise changed at one speed versus another, this is normal. Do not change the DMF. 2. A "crunching" noise which is accompanied by a rattle is not OK. Remove the transmission and inspect the DMF according to the procedures below.

VISUAL INSPECTION - Observations of the DMF only (on the back of the engine or on a bench)

CONDITION	POSSIBLE CAUSES	CORRECTION
Noise when the clutch side is moved relative to the engine side (cha-cha noise).	1. Normal condition. It is by design. 2. Measure the angular free travel. 3. Broken parts inside the flywheel.	1. No correction. DMF is OK. 2. Up to 19mm or 3/4 inch of angular travel at the outer diameter of the clutch-side mass is allowable. If higher, replace the flywheel. 3. Visually inspect through the holes in the flywheel for cracked components. Worn components are OK. Replace flywheel if internal parts are broken.
The DMF is loose. The clutch side can be moved and the engine side does not move.	Measure the angular free travel.	Up to 19mm or 3/4 inch of angular travel at the outer diameter of the clutch-side mass is allowable. If higher, replace the flywheel.
The DMF is locked-up (clutch side does not move by hand relative to the engine side).	1. Broken parts inside the flywheel.	1. Replace flywheel if movement is not possible.
Hot spots on friction surface (leopard or cheetah-like pattern).	Side effect after vehicle use from machining the surface during manufacture of the flywheel.	Vehicle chatter / judder / shudder on launch is not caused by this and presence of the spots is not reason to change the flywheel. Do not replace the flywheel for this condition.
Large hot spots on friction surface (greater than 1 inch in diameter).	Excessive heat / slippage of the clutch.	The actual condition of the spots and overall friction surface must be evaluated to determine if the flywheel should be replaced. 1. Spots are present, but rest of friction surface is still iron-gray or golden colored. Shiny areas may be present. DO NOT replace flywheel 2. Spots are present and the friction surface is blue or purple; the color change is be present at the clutch bolting surface. Replace the flywheel 3. Material smearing is present on the friction surface. Replace the flywheel. 4. Surface cracks are present on the friction surface. Replace the flywheel.
The flywheel is "burnt" or similar.	Excessive heat / slippage of the clutch.	Evaluate the flywheel according to the criteria above for large hot spots.
The flywheel is contaminated (e.g. due to transmission oil leak	Leakage from adjoining system.	Do not replace the flywheel. Using a rag or shop towel, apply a suitable cleaner to the rag and clean the

CONDITION	POSSIBLE CAUSES	CORRECTION
or hydraulic release system leak).		friction surface and clutch mounting surface of the flywheel. Do not spray cleaner directly on the flywheel.

STANDARD PROCEDURE

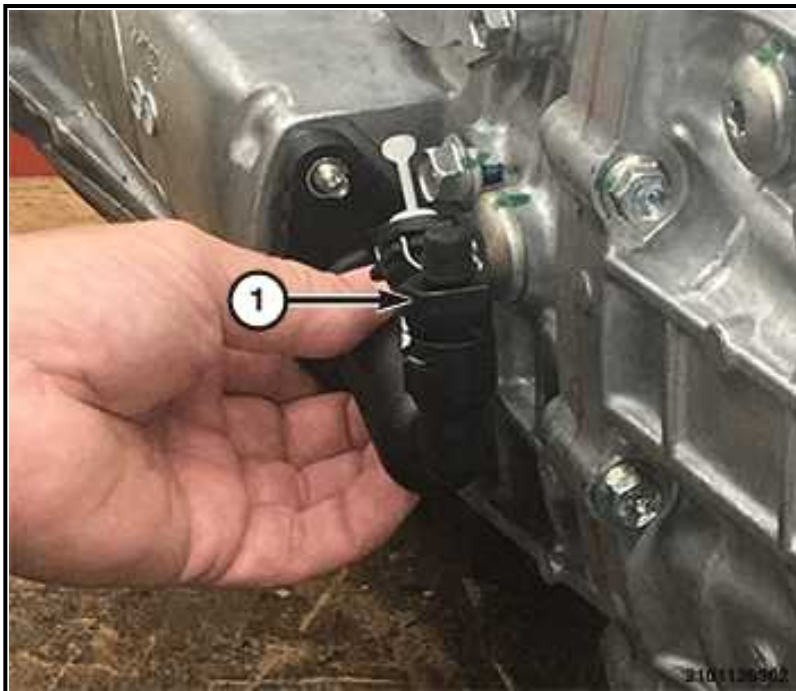
PRESSURE BLEEDING: CLUTCH HYDRAULIC CIRCUIT

Follow manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill bleeder tank with recommended DOT 3 fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter (special tool #6921, Cap, Master Cylinder).

CLUTCH HYDRAULIC CIRCUIT BLEEDING



1. Verify fluid level in brake master cylinder, top off brake fluid as necessary.
2. Install a length of clear hose to divert fluid into suitable container.
3. Push and hold clutch pedal down, open bleeder (1) on slave cylinder, allow fluid to bleed out, then close bleeder. Repeat this step several times until no air is observed coming out of the bleeder. It may be necessary to return the clutch pedal by hand until the air is removed as there is not enough volume fluid displacement to return the clutch master cylinder by itself.
4. Remove drain hose and replace dust cap on bleeder and install slave cylinder on transmission.
5. Actuate clutch pedal 25 times, then start engine and verify clutch operation and pedal feel.

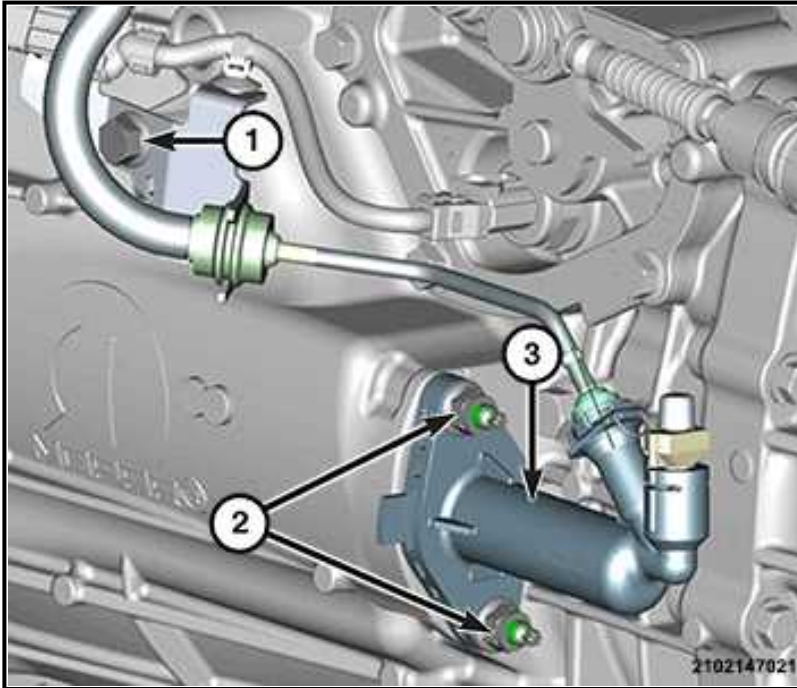
NOTE: If clutch operation and pedal feel concerns are still present after this procedure, air is still trapped in the hydraulic circuit and you must be bleed with the Alternate Clutch Hydraulic System Bleeding Procedure.

ALTERNATE CLUTCH HYDRAULIC SYSTEM BLEEDING PROCEDURE

1. Remove brake fluid reservoir cap.

NOTE: Vacuum bleeding (through the bleeder screw) or pressure bleeding (through the reservoir) is recommended due to the powertrain angle that may trap air in the clutch slave cylinder. Follow equipment manufacturers directions when using either bleeding tool.

2. Verify fluid level in brake master cylinder, top off brake fluid as necessary.



3. Remove the bolt (1) that fastens the Clutch Slave Cylinder hydraulic line bracket to the transmission. Do not remove the hydraulic line or grommet from the bracket.
4. Remove the 2 nuts (2) which fasten the Clutch Slave cylinder (3) to the Transmission case.

NOTE: Do not allow clutch slave cylinder plunger to pivot more than 2° in any direction in the clutch slave cylinder bore. Allowing the plunger to pivot more than 2° in the bore may cause fluid to bypass the seal and result in fluid leakage.

5. Remove the Clutch Slave Cylinder (3) by pulling it straight back.

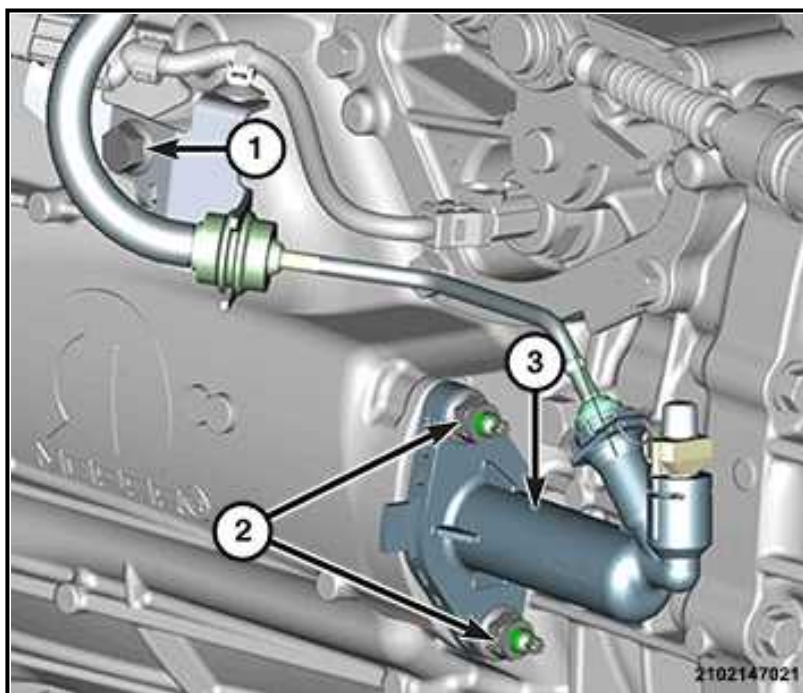
NOTE: If removal of the clutch slave cylinder from the clutch hydraulic line has occurred (or any other depressurization of the clutch hydraulic system), it is best to prefill the clutch slave cylinder with brake fluid by hand prior to bleeding and reinstallation.

6. Install a length of clear hose onto the bleeder screw to divert fluid into suitable container.
7. With the Clutch Slave Cylinder plunger pointed down and the hose end pointed up. Fully open the bleeder screw and fully depress the plunger by hand allowing any air bubbles to escape out of the bleeder screw.
8. Fully close the bleeder screw.
9. Release the Clutch Slave Cylinder plunger making sure that it extends to the end of its stroke.

NOTE: Do not allow clutch slave cylinder plunger to pivot more than 2° in any direction in the slave cylinder bore. Allowing the plunger to pivot more than 2° in the bore may cause fluid to bypass the seal and result in fluid leakage.

10. Repeat steps 7 - 9 at least five more times or until there are no more air bubbles observed through the clear hose.

11. Pull the clutch fork toward the clutch slave cylinder opening to ensure proper seating of the clutch slave cylinder plunger in the clutch fork pocket.
12. Install the clutch slave cylinder (3).



NOTE: Do not allow clutch slave cylinder plunger to pivot more than 2° in any direction in the clutch slave cylinder bore. Allowing the plunger to pivot more than 2° in the bore may cause fluid to bypass the seal and result in fluid leakage.

13. Install the clutch slave cylinder hydraulic line bracket bolt (1) and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#).
14. Install the clutch slave cylinder nuts (2) and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#).
15. Actuate clutch pedal 50 times, making sure the pedal is getting to the top of its return stroke each time (this may require that you lift the pedal to the top of the stroke).

NOTE: If the pedal fails to return after performing step 15 of this procedure, make certain that the push-rod end of the clutch slave cylinder is properly centered and sitting in the clutch fork pocket in the clutch/transmission housing.

16. Engage the parking brake, verify the vehicle is in neutral, start engine, and verify clutch operation and pedal feel.
17. If the clutch pedal is not returning to the top of its stroke, or does not disengage the clutch, repeat the Alternate Clutch Hydraulic System Bleeding Procedure.

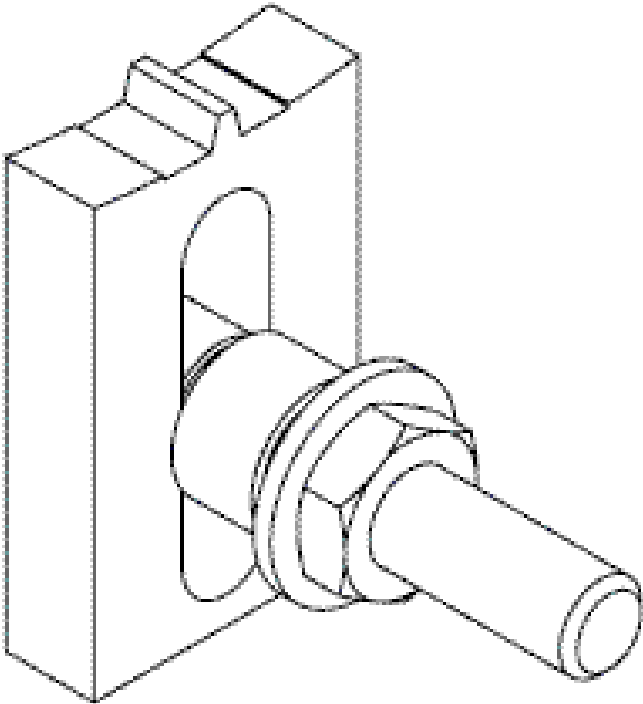
TECHNICAL SPECIFICATIONS

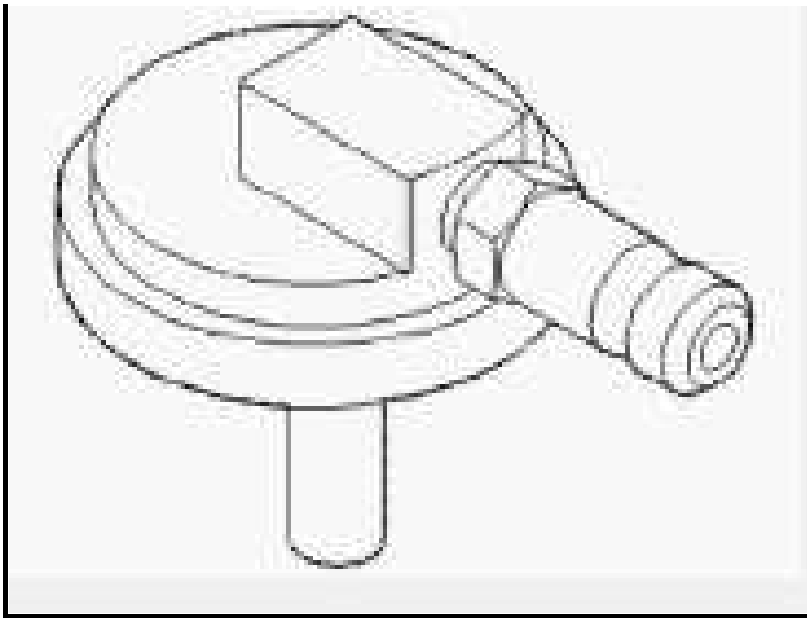
TORQUE SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	COMMENT
Clutch Master Cylinder Nuts	17 N.m (13 Ft. Lbs.)	-
Clutch Pedal Bracket to Dash	20 N.m (15 Ft. Lbs.)	-
Clutch Pipe To Transmission Bolts	18 N.m (13 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENT
Clutch Slave Cylinder	10 N.m (89 In. Lbs.)	-
Flywheel to Crankshaft Bolts	52 N.m (38 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
Pressure Plate to Flywheel Bolts	30 N.m (22 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.

SPECIAL TOOLS

	10272 - Tool, Flywheel Locking
 	2000010500 - Brake Switch Pliers



6921 - Cap, Master Cylinder
(Originally Shipped In Kit Number(s)
6907.)

Self-Adjusting Clutch Assembly Tool - Using a special tool is an absolute must to ensure correct installation of the Self-Adjusting Clutch. No counteracting forces must be applied during installation to prevent early rotation of the adjusting ring in the clutch pressure plate.

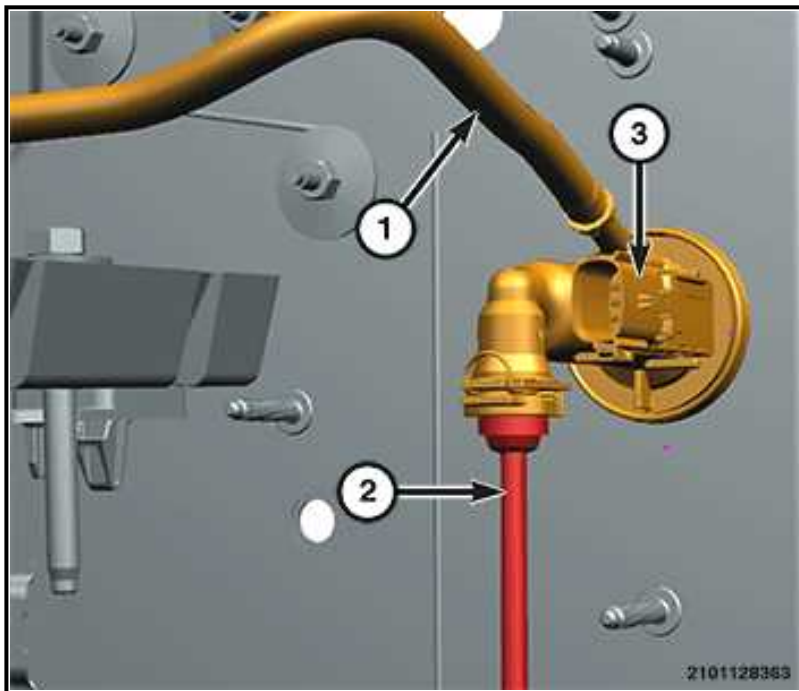
CYLINDER, CLUTCH MASTER

REMOVAL AND INSTALLATION

CLUTCH MASTER CYLINDER

REMOVAL

1. Pry the clutch master cylinder actuator rod off clutch pedal pin.



1 - Brake Hose
2 - Hydraulic Line
3 - Clutch Pedal Position Switch Harness Connector

2. Remove the hose from the brake master cylinder reservoir and plug the hose to prevent fluid loss.

3. Pull the hydraulic line clip and remove the hydraulic line from the bottom of the clutch master cylinder.
4. Disconnect the clutch pedal position switch wire harness connector from the clutch pedal position switch.
5. Turn the clutch master cylinder assembly clockwise a quarter turn and remove the clutch master cylinder from the dash panel.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Verify the O-ring is on the hydraulic line. when installing the clutch master cylinder actuator rod on the clutch pedal pin.
- Bleed the clutch hydraulic circuit. Refer to [CLUTCH HYDRAULIC CIRCUIT BLEEDING](#) .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	COMMENT
Clutch Master Cylinder Nuts	17 N.m (13 Ft. Lbs.)	-
Clutch Pedal Bracket to Dash	20 N.m (15 Ft. Lbs.)	-
Clutch Pipe To Transmission Bolts	18 N.m (13 Ft. Lbs.)	-
Clutch Slave Cylinder	10 N.m (89 In. Lbs.)	-
Flywheel to Crankshaft Bolts	52 N.m (38 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
Pressure Plate to Flywheel Bolts	30 N.m (22 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.

CYLINDER, CLUTCH SLAVE

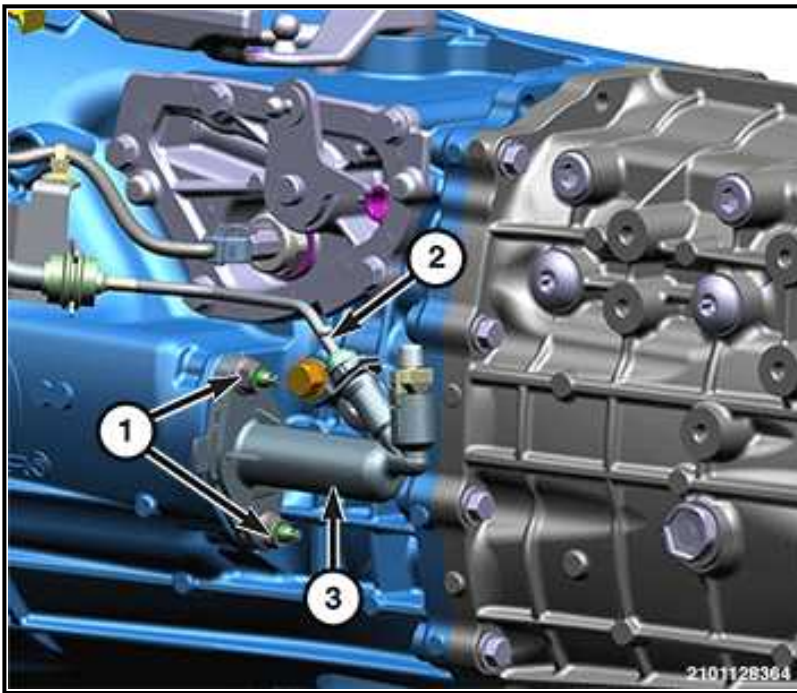
REMOVAL AND INSTALLATION

CLUTCH SLAVE CYLINDER

CAUTION: Bore scope inspection required to ensure clutch fork to slave cylinder alignment. Failure to inspect and verify proper seating of the slave may result in transmission damage or loss of clutch function.

REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



1 - Slave Cylinder Nuts
2 - Hydraulic Line Clip
3 - Slave Cylinder

2. Remove the clutch slave cylinder hydraulic line clip and remove the hydraulic line from the clutch slave cylinder.
3. Remove the clutch slave cylinder nuts from the clutch slave cylinder.

NOTE: Do not allow release lever plunger to pivot more than 2° in either direction in the slave cylinder bore. Allowing the plunger to pivot more than 2° in the bore will cause fluid to bypass the seal and result in fluid leakage.

4. Remove the clutch slave cylinder by pulling it straight back.

INSTALLATION

CAUTION: Bore scope inspection required to ensure clutch fork to slave cylinder alignment. Failure to inspect and verify proper seating of the slave may result in transmission damage or loss of clutch function.

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Do not allow release lever plunger to pivot more than 2° in either direction in the slave cylinder bore. Allowing the plunger to pivot more than 2° in the bore will cause fluid to bypass the seal and result in fluid leakage.
- Pull the clutch release lever toward the clutch slave cylinder opening to insure proper seating of the clutch slave cylinder plunger in the release lever pocket.
- Verify the O-ring is on the clutch slave cylinder hydraulic line before installing.
- Push the grommet from the clutch line back into the bracket.
- Bleed the clutch hydraulic system. Refer to [CLUTCH HYDRAULIC CIRCUIT BLEEDING](#) .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	COMMENT
Clutch Master Cylinder Nuts	17 N.m (13 Ft. Lbs.)	-
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DISC, CLUTCH

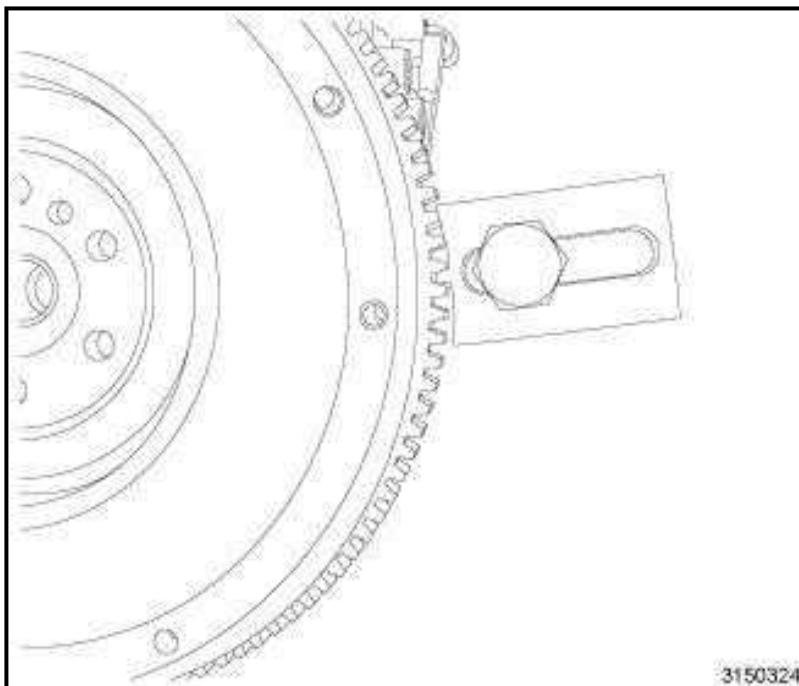
REMOVAL AND INSTALLATION

CLUTCH DISC

REMOVAL

WARNING: FCA US LLC does not manufacture any vehicles or replacement parts that contain asbestos. Aftermarket products may or may not contain asbestos. Refer to aftermarket product packaging for product information. Whether the product contains asbestos or not, dust and dirt can accumulate on manual clutch parts during normal use. Follow practices prescribed by appropriate regulations for the handling, processing and disposing of dust and debris.

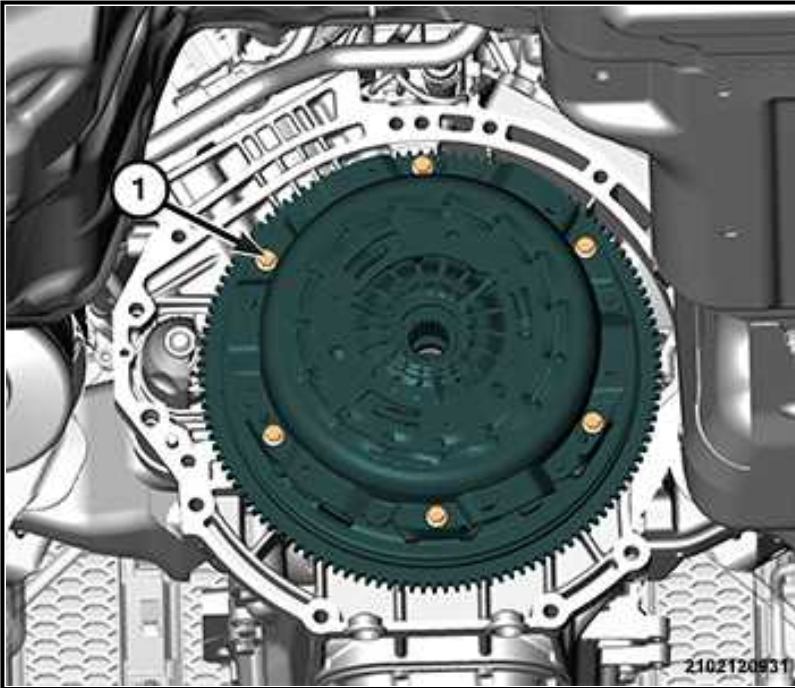
1. Remove the transmission. Refer to [REMOVAL AND INSTALLATION](#) .



2. Install the (special tool #10272, Tool, Flywheel Locking).

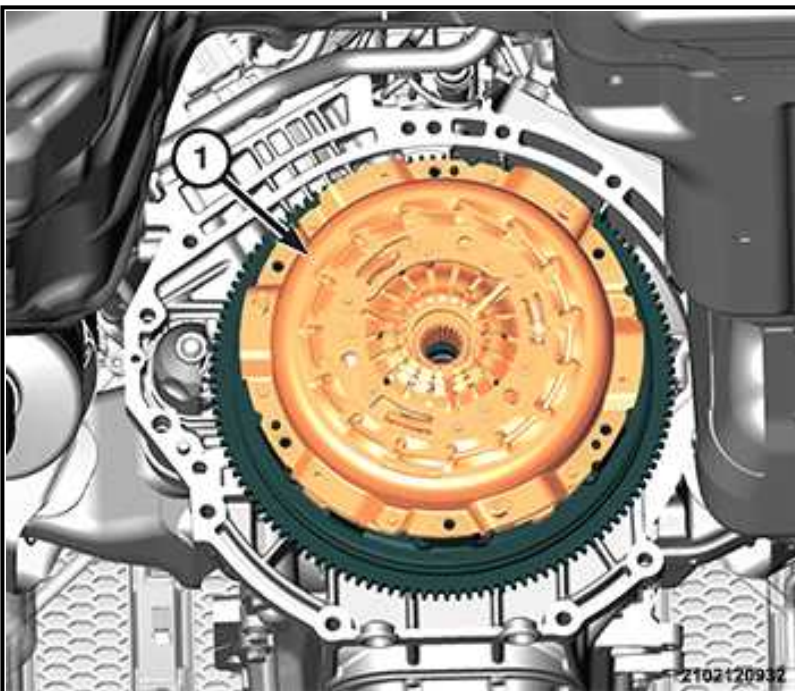
NOTE: It may be necessary to install an appropriate length 10 MM bolt, washer and nut in place of the supplied 12 MM fastener.

3. Prior to removal, mark the position of the pressure plate to the flywheel with paint or scribe line for assembly reference.



1 - Pressure Plate Bolts

4. Loosen pressure plate bolts evenly, a few threads at a time and in a diagonal pattern to prevent warping the plate.
5. While holding the clutch and disc against the flywheel, remove and **DISCARD** the bolts holding the pressure plate to the flywheel.



1 - Clutch Plate

6. While securely holding the disc to the clutch plate, separate the clutch plate from the flywheel.

INSTALLATION

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During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Inspect the clutch release bearing and the slave cylinder for excessive wear and replace if necessary.
- Clean the surfaces of the flywheel and pressure plate to make certain that all oil, grease, and rust have been removed.
- Install the clutch pressure plate to the flywheel and clutch disc and finger tighten the **NEW** pressure plate-to-flywheel bolts. **This clutch disk does not require a clutch alignment tool for installation.**
- Tighten pressure plate bolts evenly and in rotation a few threads at a time. **The bolts must be tightened evenly and to specified torque to avoid distorting the pressure plate.**
- Using a "star" torque pattern, tighten the pressure plate bolts to the proper torque specifications in the torque table below.
- Remove the flywheel locking tool before installing the transmission.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	COMMENT
Clutch Master Cylinder Nuts	17 N.m (13 Ft. Lbs.)	-
Clutch Pedal Bracket to Dash	20 N.m (15 Ft. Lbs.)	-
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Pressure Plate to Flywheel Bolts	30 N.m (22 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.

FLYWHEEL

REMOVAL AND INSTALLATION

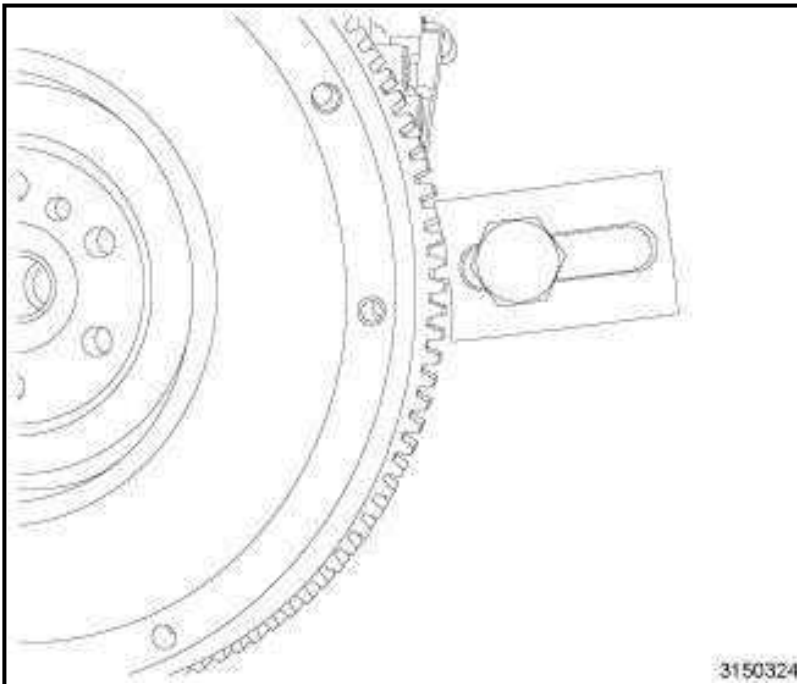
FLYWHEEL

REMOVAL

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clutch parts during normal use. Follow practices prescribed by appropriate regulations for the handling, processing and disposing of dust and debris.

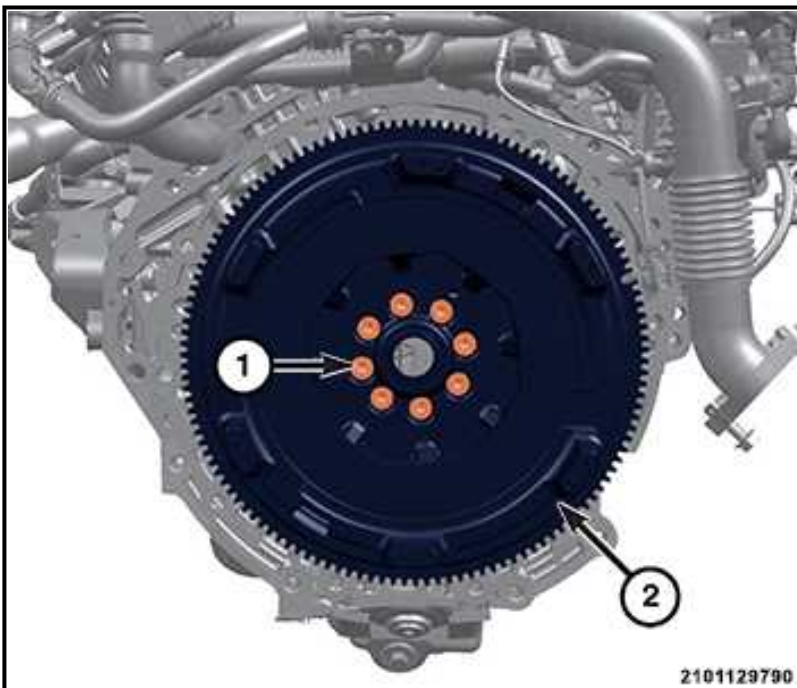
1. Remove clutch pressure plate and disc. Refer to [DISC, CLUTCH, REMOVAL AND INSTALLATION](#).



NOTE: Typical installation of 10272 shown.

2. Install the
(special tool #10272, Tool, Flywheel Locking)

NOTE: It may be necessary to install an appropriate length 10 MM bolt, washer and nut in place of the supplied 12 MM fastener.



1 - Flywheel Bolts
2 - Flywheel

3. While holding the flywheel against the engine, remove and **DISCARD** the bolts holding the flywheel to the crankshaft flange.
4. Remove the flywheel (2) from the crankshaft.

INSTALLATION

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Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Install **NEW** flywheel bolts.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	COMMENT
Clutch Master Cylinder Nuts	17 N.m (13 Ft. Lbs.)	-
Clutch Pedal Bracket to Dash	20 N.m (15 Ft. Lbs.)	-
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PEDAL AND PAD, CLUTCH

REMOVAL AND INSTALLATION

CLUTCH PEDAL

NOTE: If the clutch pedal position sensor is being replaced, use the diagnostic scan tool to perform the Clutch Pedal Position Sensor learn procedure in the Powertrain Control Modules (PCM) "Misc. functions" menu. This must be performed when the PCM, clutch pedal sensor, or related components are replaced.

NOTE: The clutch pedal is serviced as an assembly along with the brake pedal. For more information. Refer to [PEDAL\(S\), BRAKE AND/OR ACCELERATOR, REMOVAL AND INSTALLATION](#) .

SENSOR, CLUTCH PEDAL POSITION

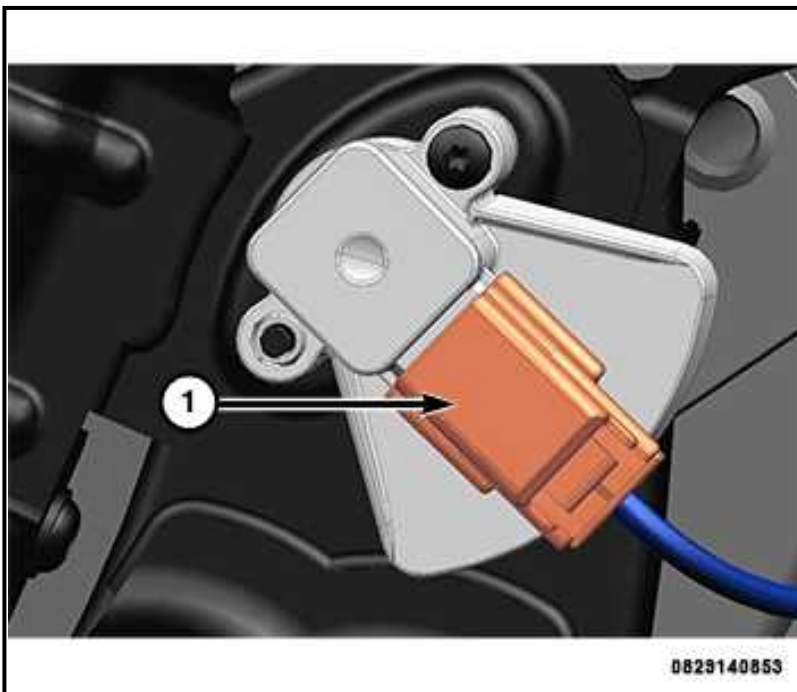
REMOVAL AND INSTALLATION

CLUTCH PEDAL POSITION SENSOR

NOTE: If the clutch pedal position sensor is being replaced, use the diagnostic scan tool to perform the "Clutch pedal position sensor" learn procedure in the Powertrain Control Modules (PCM) "Misc functions" menu. This must be performed when the PCM, clutch pedal sensor, or related components are replaced.

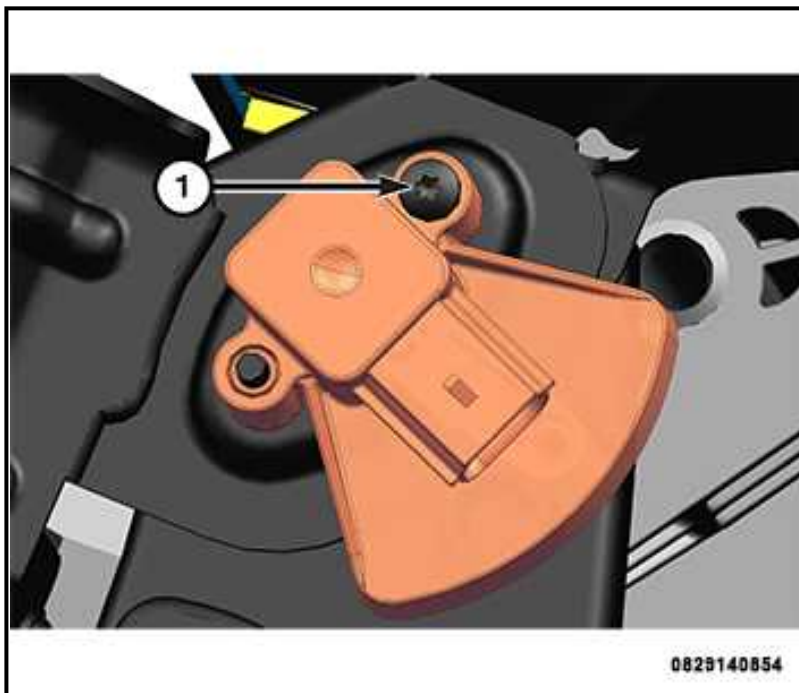
REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Remove the clutch pedal. Refer to [PEDAL AND PAD, CLUTCH, REMOVAL AND INSTALLATION](#).



1 - Wire Harness Connector

3. Working from the outboard side of the clutch pedal, disconnect the wire harness connector from the clutch pedal position sensor.



1 - Clutch Pedal Position Sensor Fasteners
2 - Wire Harness Connector

4. Remove the fastener and remove the clutch pedal position sensor from the clutch pedal bracket.

INSTALLATION

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

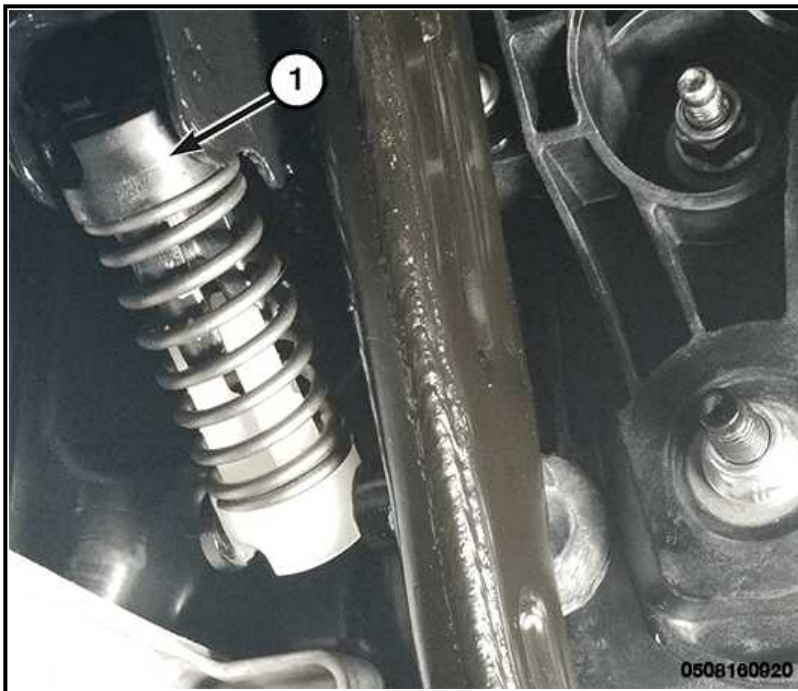
- Tighten the clutch pedal position sensor fastener(s) securely.
- When the clutch pedal position sensor is being replaced, use the diagnostic scan tool to perform the Clutch Pedal Position Sensor learn procedure in the Powertrain Control Modules (PCM) "Misc. functions" menu. This must be performed when the PCM, clutch pedal sensor, or related components are replaced.

SPRING, CLUTCH PEDAL ASSIST

REMOVAL AND INSTALLATION

CLUTCH PEDAL ASSIST SPRING

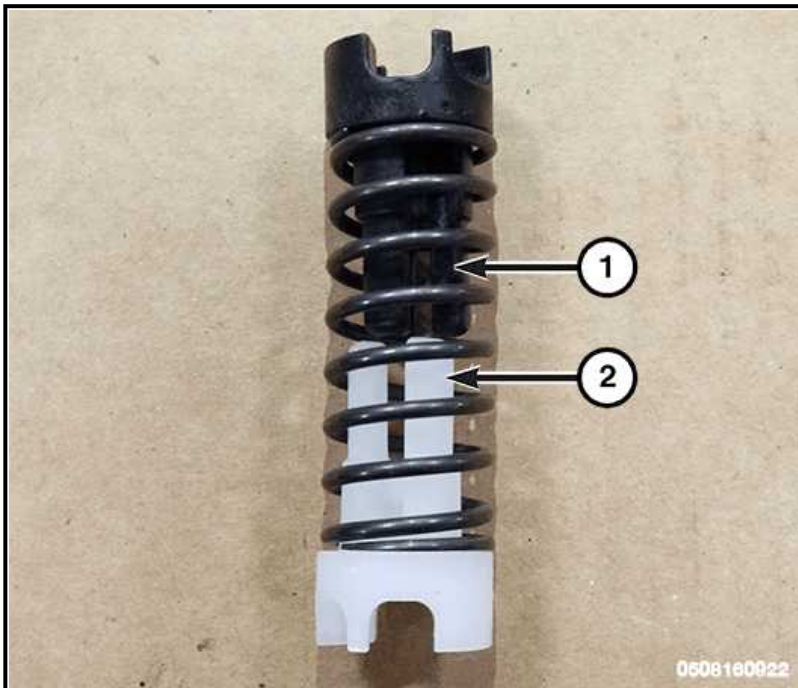
REMOVAL



1 - Clutch Assist Spring

1. Depress the clutch pedal, then gently compress the clutch assist spring and remove the spring assembly from the two pins.

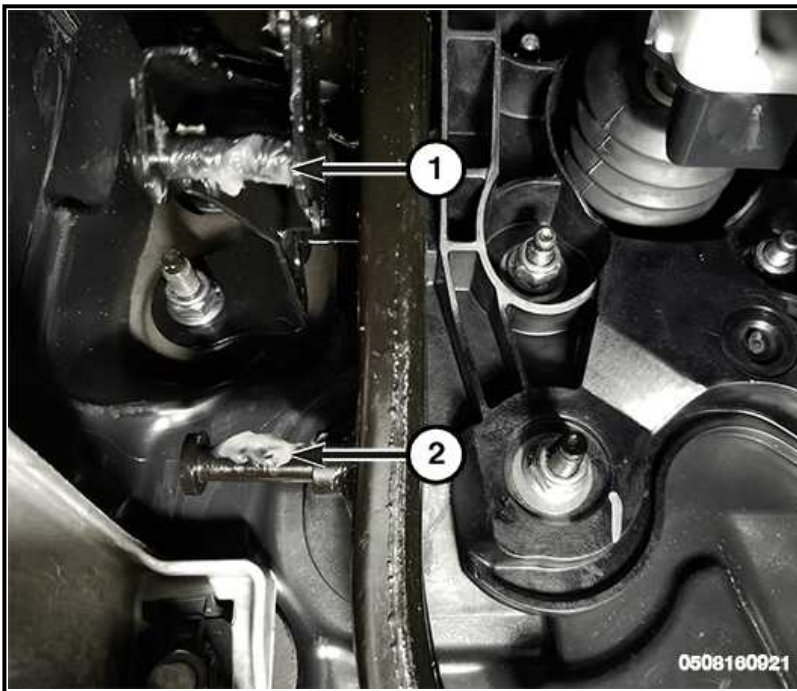
INSTALLATION



1 - Upper Clutch Pedal Assist Spring Seat (Black)

2 - Lower Clutch Pedal Assist Spring Seat (White)

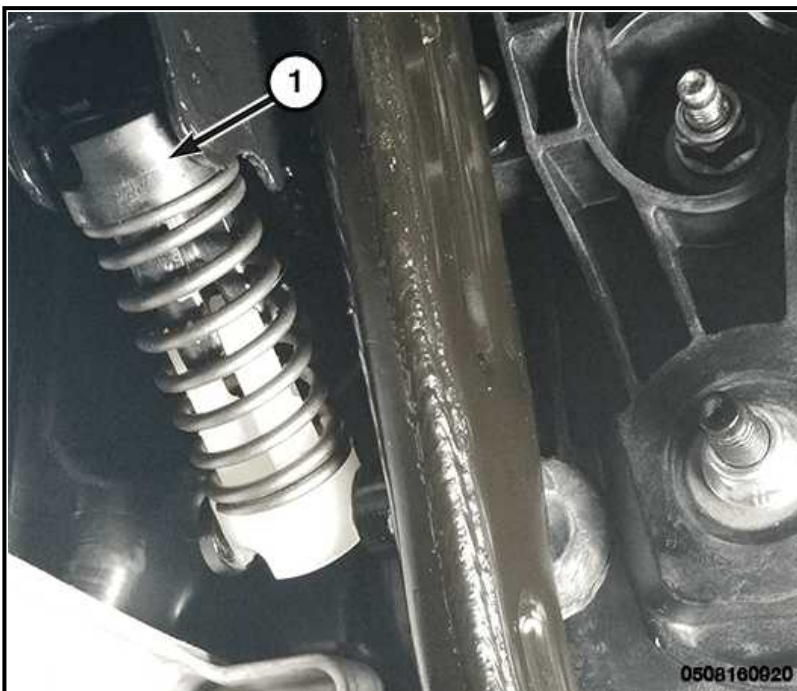
1. Using the supplied grease, lubricate the black upper clutch pedal assist spring seat and the white lower clutch pedal assist spring seat of the clutch pedal assist spring assembly.



1 - Upper Pin

2 - Lower Pin

2. Using the supplied grease, lubricate the upper pin and the lower pin.



1 - Lower Clutch Pedal Assist Spring Seat (White)

NOTE: The clutch assist spring assembly must be installed with the white seat down.

3. Depress the clutch pedal, then gently compress the clutch assist spring and install the spring assembly.

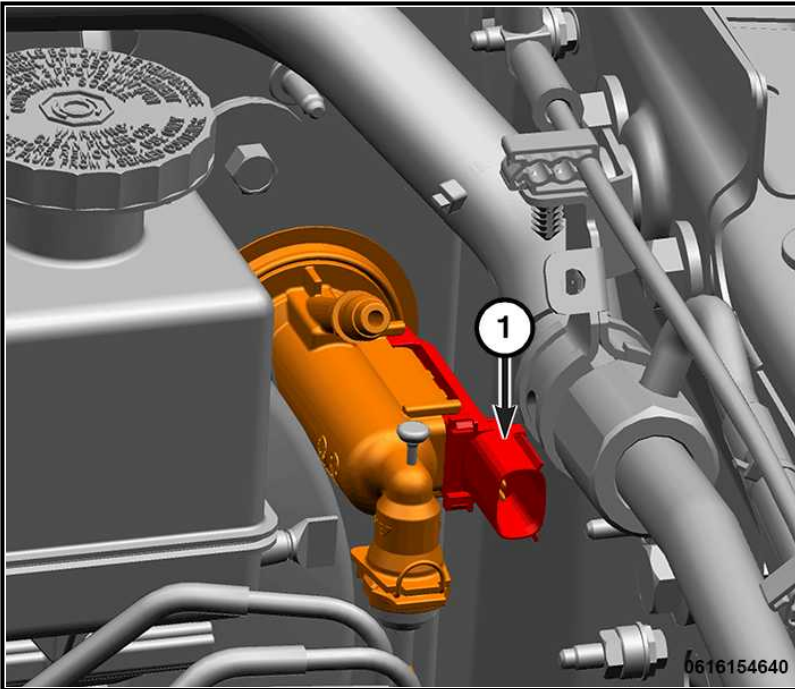
SWITCH, CLUTCH STARTER INTERLOCK

REMOVAL AND INSTALLATION

CLUTCH INTERLOCK SWITCH

REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .



1 - Clutch Pedal Position Switch

2. Disconnect the clutch pedal position switch wire harness connector.
3. Pry the clutch pedal position switch off the clutch master cylinder and remove the clutch pedal position switch from the vehicle.

INSTALLATION

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- If the clutch pedal position sensor is being replaced, use the diagnostic scan tool to perform the "Clutch pedal position sensor" learn procedure in the Powertrain Control Modules (PCM) "Misc. functions" menu. This must be performed when the PCM, clutch pedal sensor, or related components are replaced.
 - Verify the clutch pedal position switch functions correctly.
-

2021 MANUAL TRANSMISSION

Manual Transmission (Service Information) - Gladiator

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

The AL6 6-speed transmission is a constant-mesh transmission that is synchronized in all gear ranges.

The four-plane shift mechanism is cable operated and incorporates a pull-up ring on the shift lever that must be lifted to engage reverse. This prevents unintentional selection of reverse when attempting to select first gear. Rubber isolation of the shift system at the transmission minimizes noise carried along the cables to the passenger compartment.

- Better torque holding capacity in a smaller package
- Decreased Shift Efforts
- External clutch slave cylinder for trail serviceability
- Same overall length as 8HP50 Automatic transmission

GEAR RATIOS 3.6L ENGINE

GEAR	RATIO
FIRST	5.133
SECOND	2.631
THIRD	1.536
FOURTH	1.00
FIFTH	0.811
SIXTH	0.719
REVERSE	4.491

DIAGNOSIS AND TESTING

COMMON PROBLEM CAUSES

PRE-DIAGNOSTIC INSPECTION:

- Verify that the transmission fluid level is at the proper cold fill level.
- Inspect the exterior of the transmission for evidence of fluid leaks.
- Inspect the exterior of the transmission for mechanical issues such as improper shift cable routing, loose transfer case bolts, transmission mounting bolts, or propeller shaft bolts.
- Verify clutch disengagement if the clutch pedal is depressed.
- Verify there is not any unintended wheel rotation:
 1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
 2. Shift into first gear.
 3. Depress the clutch pedal.
 4. Start the engine. The wheels should not rotate.
- Inspect witness marks on bolts and switches for proper orientation.

NOTE: Witness marks that are not oriented properly indicate potential disassembly after the vehicle was released from the plant.

CAUTION: Use only the manufacturer recommended fluid in this transmission, internal component damage will result if other fluids are used.

NOISY OPERATION

Transmission noise is most often a result of:

- Worn or damaged internal components
- Chipped, broken gear or synchronizer teeth, and damaged bearings
- Insufficient lubricant
- Aftermarket additives can damage synchronizers

NOISE IN NEUTRAL

1. With the vehicle stationary, transmission in neutral, engine running, there is a noise at high frequency and low intensity in the transmission area.

PRELIMINARY CHECKS	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
1. Visually check if the noise is accompanied by an oil leak from the gearbox / differential. 2. Depress the clutch pedal and see if the noise increases or decreases. 3. Check the oil level in the gearbox.	Continue to Step 2	1. Oil leak from the gearbox 2. With the clutch depressed: if the noise disappears it is most likely internal transmission noise. If the noise increases it is most likely clutch, dual mass flywheel, or the clutch release bearing. 3. Oil level too low	1. Repair leak and fill transmission to proper fluid level. 2. Remove transmission and replace damaged components. 3. Correct the transmission oil level and perform a road test. Refer to <u>FLUID, STANDARD PROCEDURE</u> . If the fault persists, go to Step 2.

2.	CHECK CLUTCH DISC SPLINES	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check for the presence of excess wear on splines of the clutch disc and transmission input shaft.	Continue to Step 3	Worn or damaged input shaft splines and worn or damaged splines in the clutch disc.	Replace the transmission input shaft and clutch disc. Refer to <u>DISC, CLUTCH, REMOVAL AND INSTALLATION</u> .
	Check the transmission dowel pin hole for damage.	Replace clutch disc and transmission.	Transmission and clutch disk shaft are misaligned.	Replace clutch disc and transmission. Refer to <u>DISC, CLUTCH, REMOVAL AND INSTALLATION</u> .

3.	CHECK SHIFTER CABLE HARDWARE	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check for any obstruction of the shifter. Check the routing of the shifter cables, the attachment to the transmission and the shifter, and shifter cable adjustment.	Continue to Step 4	Cables not properly fitted Cables not properly adjusted	Remove any gear shifter obstructions. Restore the proper routing and attachment of the shifter cables. Refer to <u>CABLE, GEARSHIFT CONTROL, REMOVAL AND</u>

CHECK SHIFTER CABLE HARDWARE	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
			INSTALLATION. Re-adjust the shifter cables. Refer to CABLE, GEARSHIFT CONTROL, ADJUSTMENTS.

4.	CHECK CLUTCH DISC	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Inspection: wear of the clutch disc contamination (oil or grease) of the clutch disc deformation of the clutch disc damage to the diaphragm spring pressure plate	End diagnosis	1. Worn or damaged clutch disc or pressure plate 2. Presence of oil or grease	1. Replace the clutch disc and pressure plate Refer to DISC, CLUTCH, REMOVAL AND INSTALLATION . 2. Also, replace the transmission input shaft seal

NOISE WHILE SHIFTING

1. While driving, a noise is heard in a specific gear from the transmission area. The noise stops when shifted to a different gear.

CHECK THE SYNCHRONIZERS	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
Remove and disassemble transmission to inspect the appropriate synchronizer(s).	Continue to Step 2	Worn or damaged synchronizer components	Replace worn components as necessary.

2.	CHECK THE GEARS	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Remove and disassemble transmission to inspect the appropriate gear(s).	Continue to Step 3	Worn or damaged gears	Replace the gear(s) as necessary.

DIFFICULT SHIFTING

DIFFICULT SHIFTER OPERATION

1. The engagement of the gears is difficult in every condition.

CHECK SHIFTER CABLE HARDWARE	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
Check for any obstruction of the shifter. Check the routing of the shifter cables and the attachment to the transmission and the shifter.	Continue to Step 2	Cables not properly fitted	Remove any gear shifter obstructions. Restore the proper routing and attachment of the shifter cables. Refer to CABLE, GEARSHIFT CONTROL, REMOVAL AND INSTALLATION.

2.	CHECK SHIFTER CABLES	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check for proper shifter cable adjustment.	Check the condition of the shifter cables.	Shifter cables are out of adjustment.	Re-adjust the shifter cables. Refer to <u>CABLE, GEARSHIFT CONTROL, ADJUSTMENTS.</u>
	Check the shifter cables for worn spherical ends or bushings.	Continue to Step 3	Spherical ends worn or damaged.	Replace the shifter cables. Refer to <u>CABLE, GEARSHIFT CONTROL, REMOVAL AND INSTALLATION.</u>

3.	CHECK THE SHIFT LEVER	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check the ball joint of the gear lever: must not be worn out.	End diagnosis	Spherical end worn out	Replace the shifter. Refer to <u>LEVER, SHIFT, REMOVAL AND INSTALLATION.</u>

SHIFTING INTO GEAR DIFFICULT

- Shifting gears is sometimes difficult, gear clash heard when shifting.

	PRELIMINARY CHECKS	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check for proper shift cable adjustment.	Check clutch disengagement	Shifter cables are out of adjustment.	Re-adjust the shifter cables. Refer to <u>CABLE, GEARSHIFT CONTROL, ADJUSTMENTS.</u>
	Check for proper clutch disengagement: with the engine running depress the clutch pedal and engage a gear.	Continue to Step 2	Gear clash when shifting	Diagnose clutch. Refer to <u>DIAGNOSIS AND TESTING .</u>

2.	CHECK SYNCHRONIZER RINGS	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check for proper clutch disengagement. With the engine running, depress the clutch pedal and engage a gear.	Visually inspect the synchronizers	Worn synchronizers	Replace synchronizers
	Inspect the synchronizers. Check the synchronizer rings: must not show signs of wear on the inner surfaces and not show signs of wear or discoloration from heat.	Continue to Step 3	Worn synchronizers	Replace synchronizers

3.	CHECK GEAR SELECTION	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Verify the integrity of the springs and the bearings inside the transmission.	Continue to Step 4	Damaged springs or bearings	Replace damaged components

4.	CHECK GEARS	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Inspect the gears. Check the front teeth of the gears for nicks or excessive wear.	Continue to Step 5	Worn gears	Replace the damaged or worn gears.

5.	CHECK SYNCHRONIZER HUBS AND SLIDING SLEEVES	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Inspect the sliding sleeves and hubs for nicks, wear, or excessive play. Sleeves and hubs must move freely.	End diagnosis	Worn sleeves or hubs	Replace the worn sleeves or hubs.

VAGUE GEAR ENGAGEMENT FEEL

1. The gear selection is not precise. There is excessive play in the gear shifter and an abnormal return of the lever in neutral.

	CHECK GEAR SELECTION	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Verify the shifter assembly is moving freely.	Check condition of springs and bearings	Damaged shifter assembly.	Replace the shifter assembly. Refer to <u>LEVER, SHIFT, REMOVAL AND INSTALLATION.</u>
	Verify the integrity of the springs and the bearing for the transmission.	Continue to Step 2	Damaged springs or bearings	Replace damaged components.

2.	CHECK SHIFTER CABLES	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check for proper shifter cable adjustment.	Check condition of shifter cables	Shift cables are out of adjustment.	Re-adjust the shift cables. Refer to <u>CABLE, GEARSHIFT CONTROL, ADJUSTMENTS.</u>
	Check the shifter cables for worn spherical ends or bushings.	Continue to Step 3	Spherical ends worn or damaged.	Replace the shifter cables. Refer to <u>CABLE, GEARSHIFT CONTROL, REMOVAL AND INSTALLATION.</u>

3.	CHECK THE SHIFT LEVER	EVERYTHING OK	PROBLEMS ENCOUNTERED	RESOLUTION
	Check the ball joint of the gear lever for wear.	End diagnosis	Spherical end worn out	Replace the shifter. Refer to <u>LEVER, SHIFT, REMOVAL AND INSTALLATION.</u>

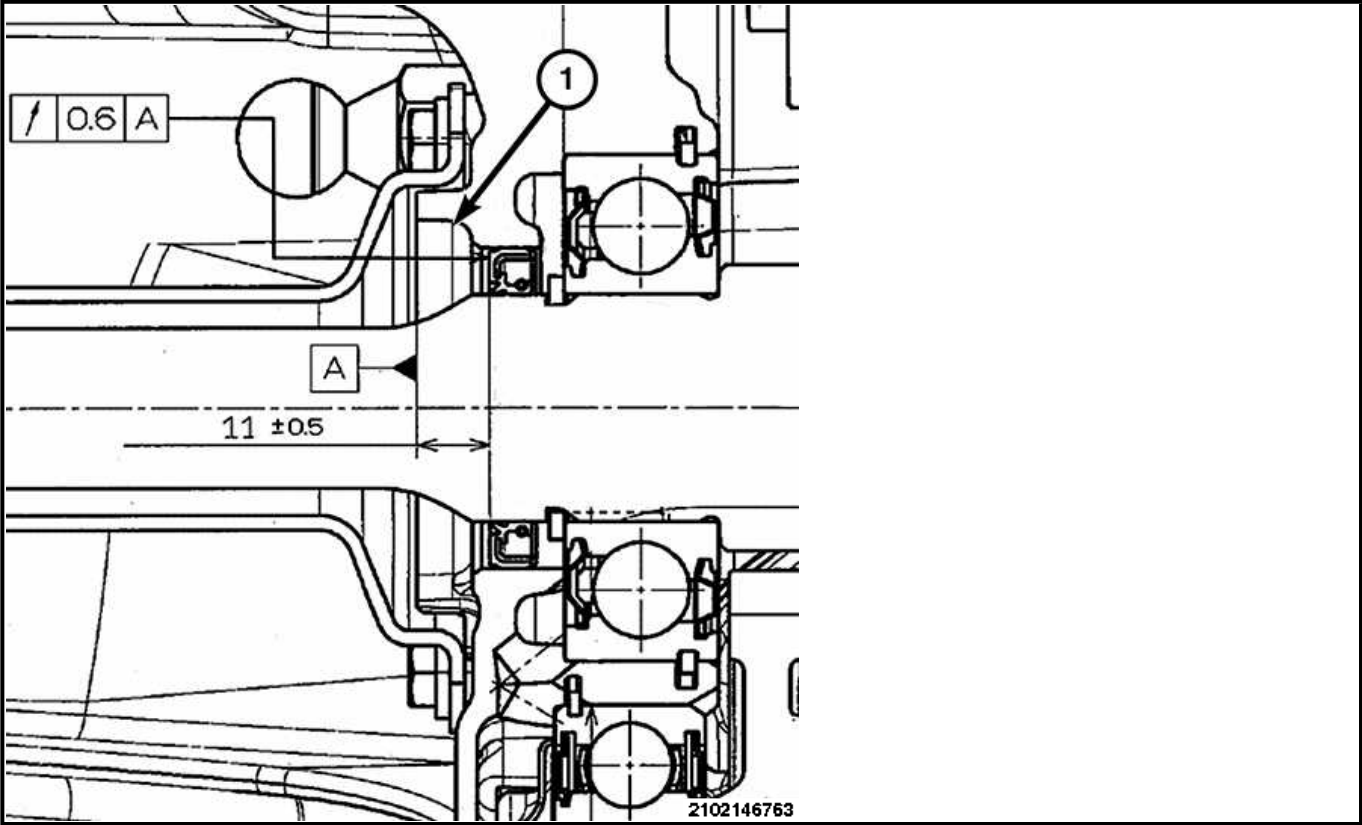
TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS

GEAR RATIOS

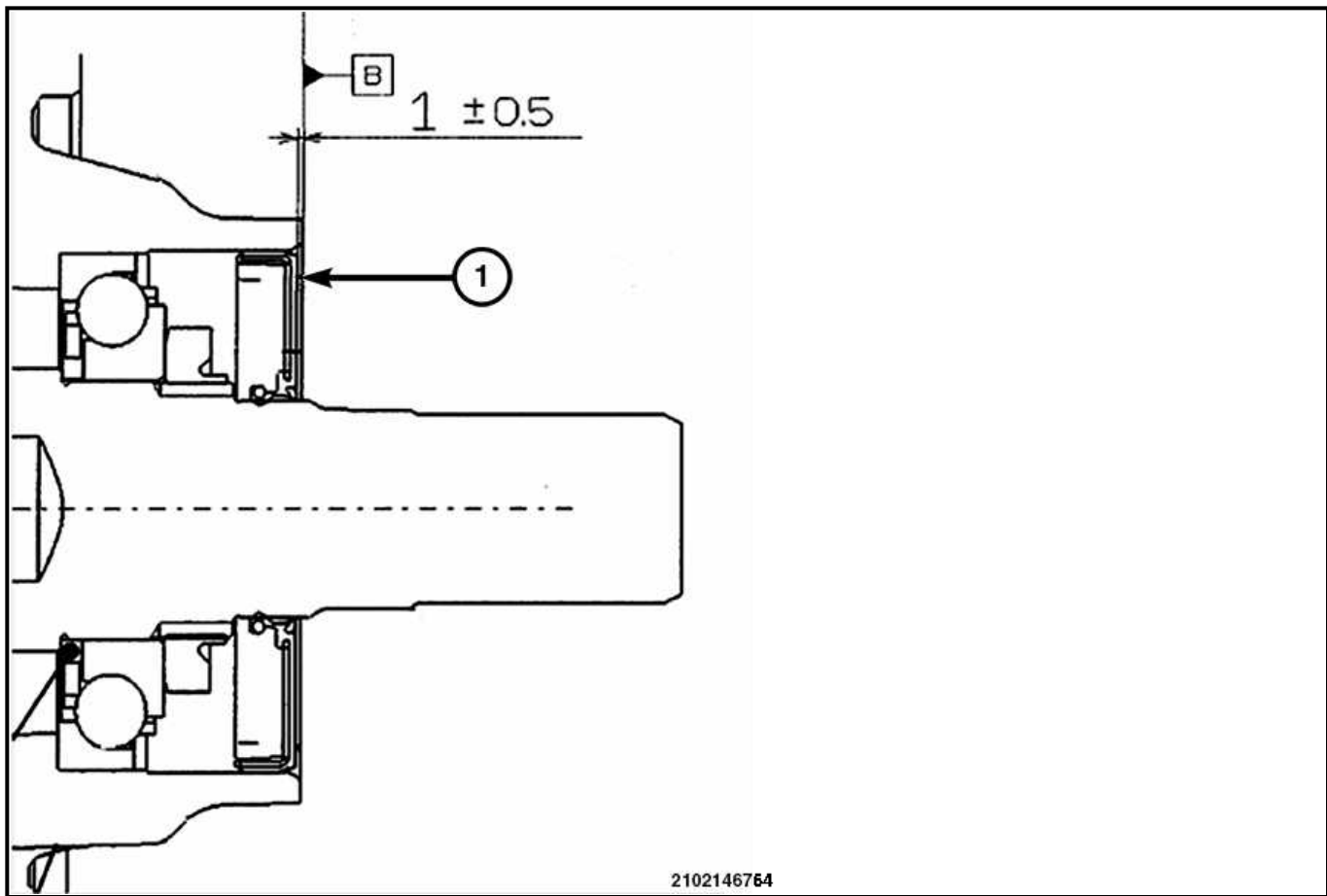
GEAR	RATIO
FIRST	5.133
SECOND	2.631
THIRD	1.536
FOURTH	1.00
FIFTH	0.811
SIXTH	0.719
REVERSE	4.491

INSTALLATION DEPTHS



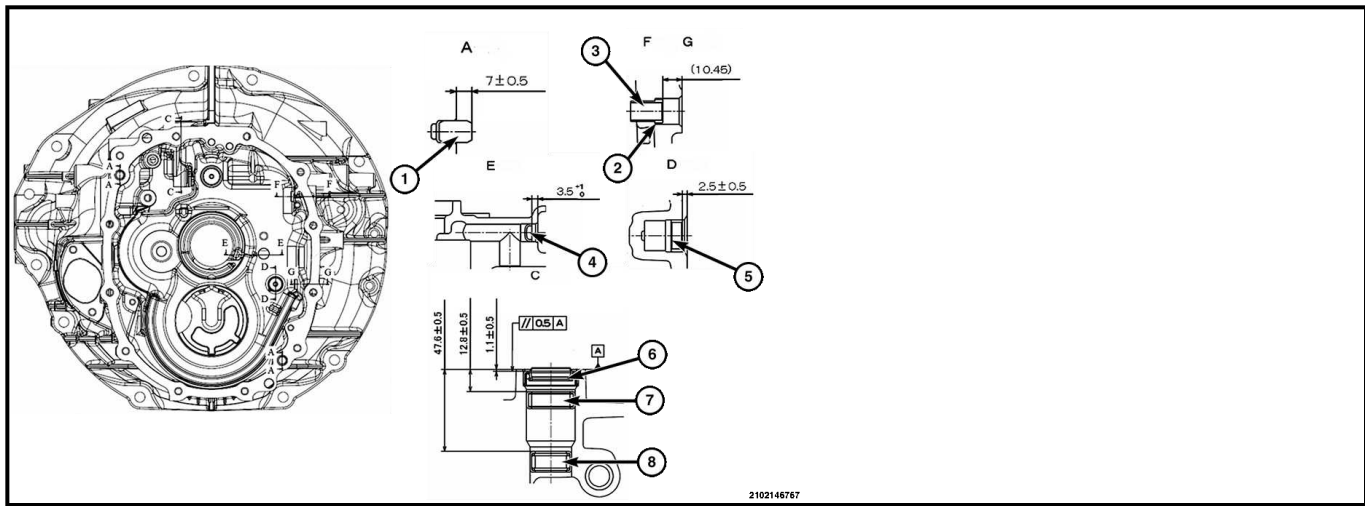
FRONT INPUT SEAL

ITEM	DEPTH
1.	11mm (0.43in)



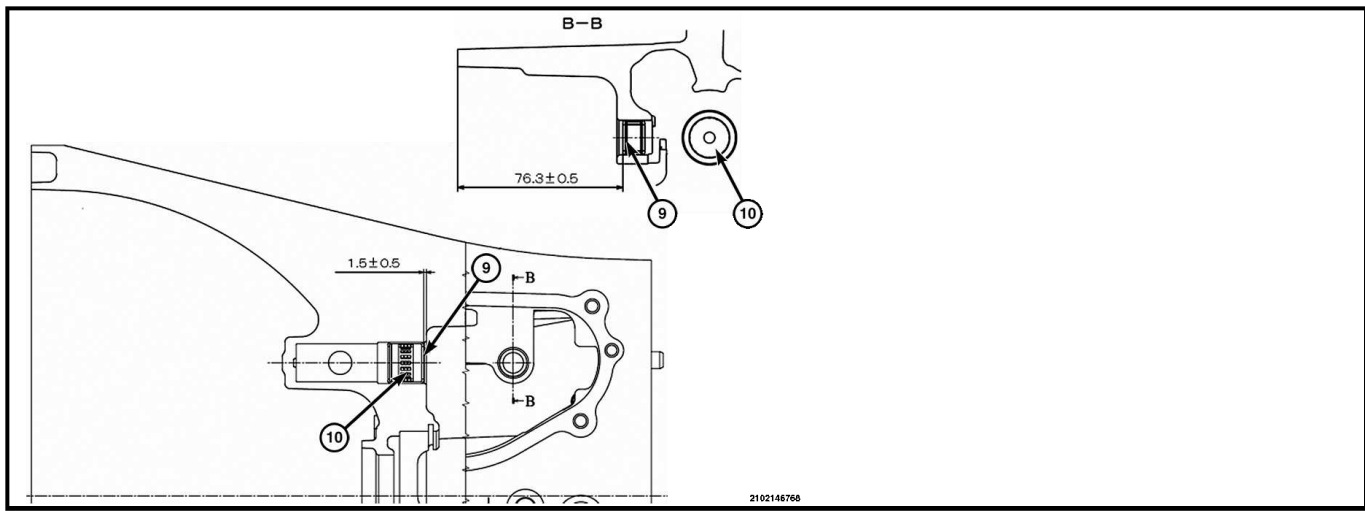
REAR OUTPUT SEAL

ITEM	DEPTH
1.	1mm (0.04in)



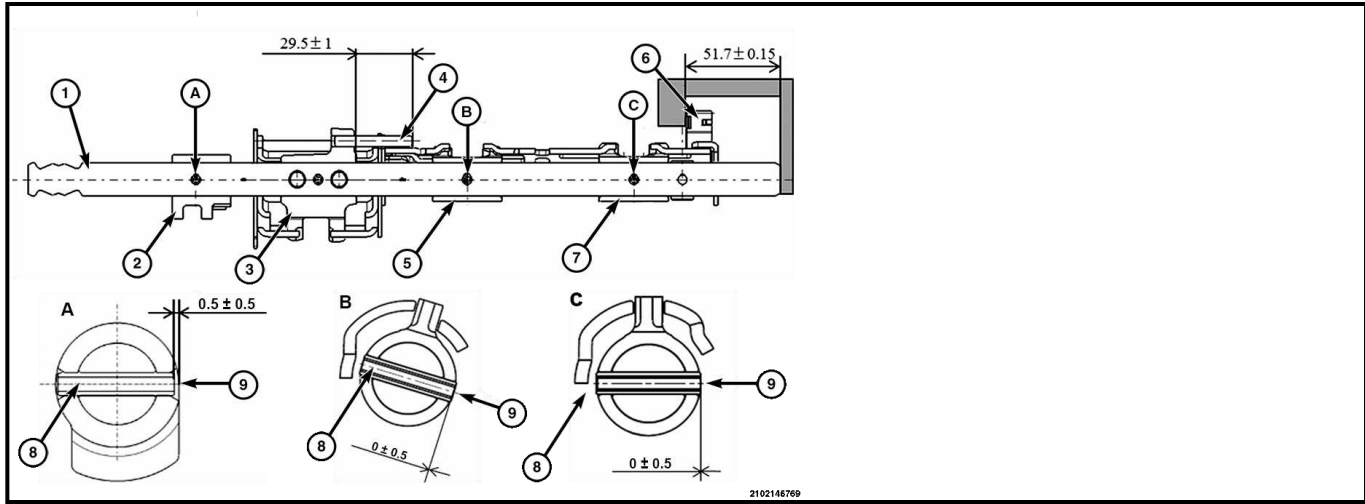
FRONT CASE

ITEM	DEPTH
1.	7mm (0.28in)
2.	10.45mm (0.41in)
3.	-
4.	3.5mm (0.14in)
5.	2.5mm (0.09in)
6.	1.1mm (0.04in)
7.	12.8mm (0.50in)
8.	47.6mm (1.87in)



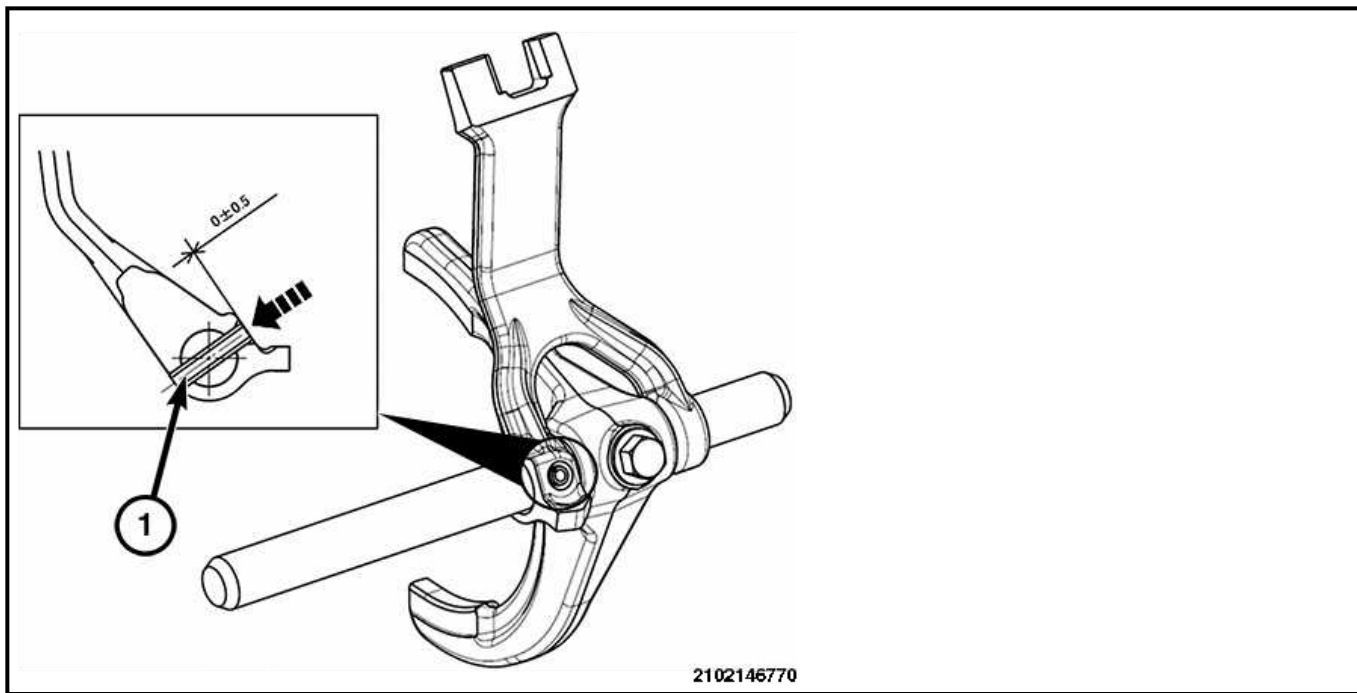
FRONT CASE

ITEM	DEPTH
9.	76.3mm (3.00in)
10.	1.5mm (0.05in)



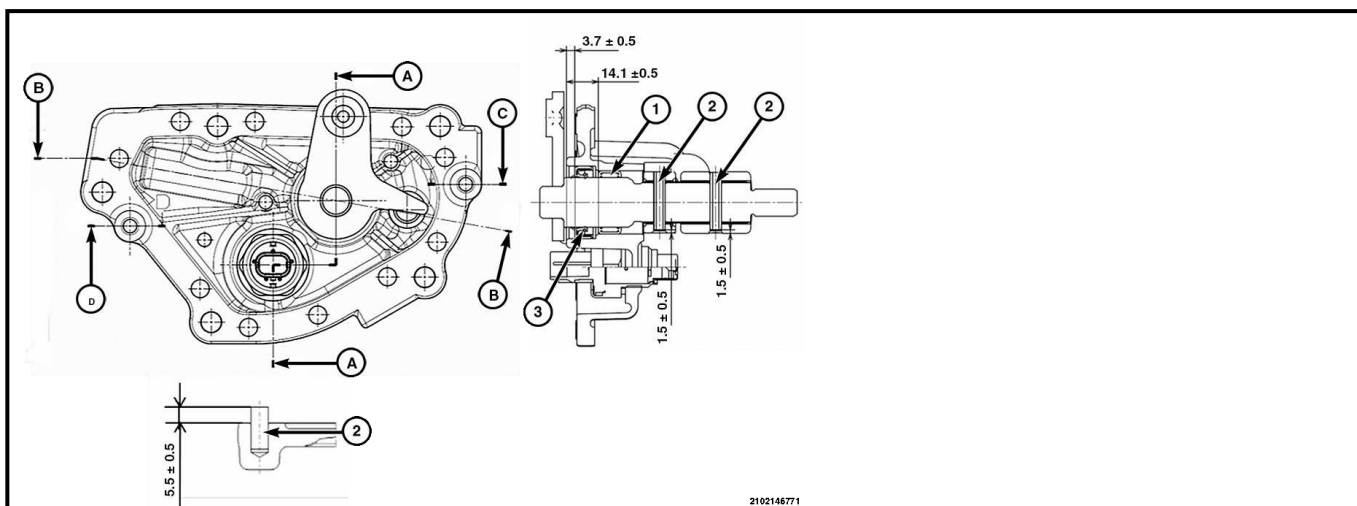
ROLL PINS

INDEX	DEPTH
1. Shift Select Shaft	11mm (0.43in)
2. Reverse Lever	11mm (0.43in)
3. 1st/2nd Lever	11mm (0.43in)
4. Pin	11mm (0.43in)
5. 5th/6th Lever	11mm (0.43in)
6. Magnet	11mm (0.43in)
7. 3rd/4th Lever	11mm (0.43in)
8 A. Pin	0.5mm (0.01in)
8 B. Pin	0mm (0in)
8 C. Pin	0mm (0in)
9. Installation Direction	-



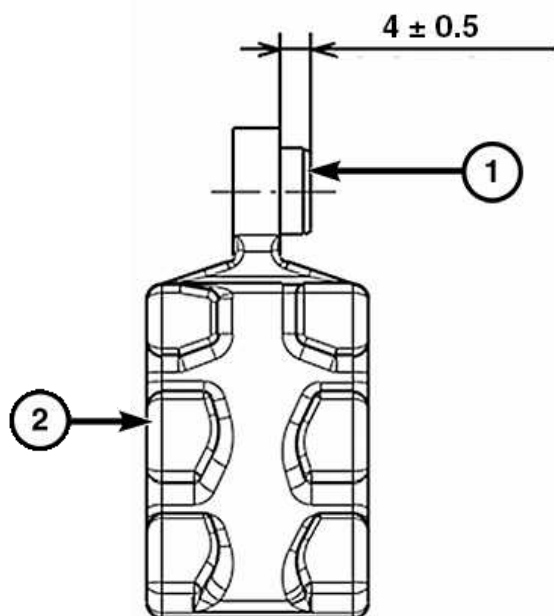
REVERSE FORK PIN

INDEX	DEPTH
1. Shift Select Shaft	0mm (0in)



CONTROL COVER

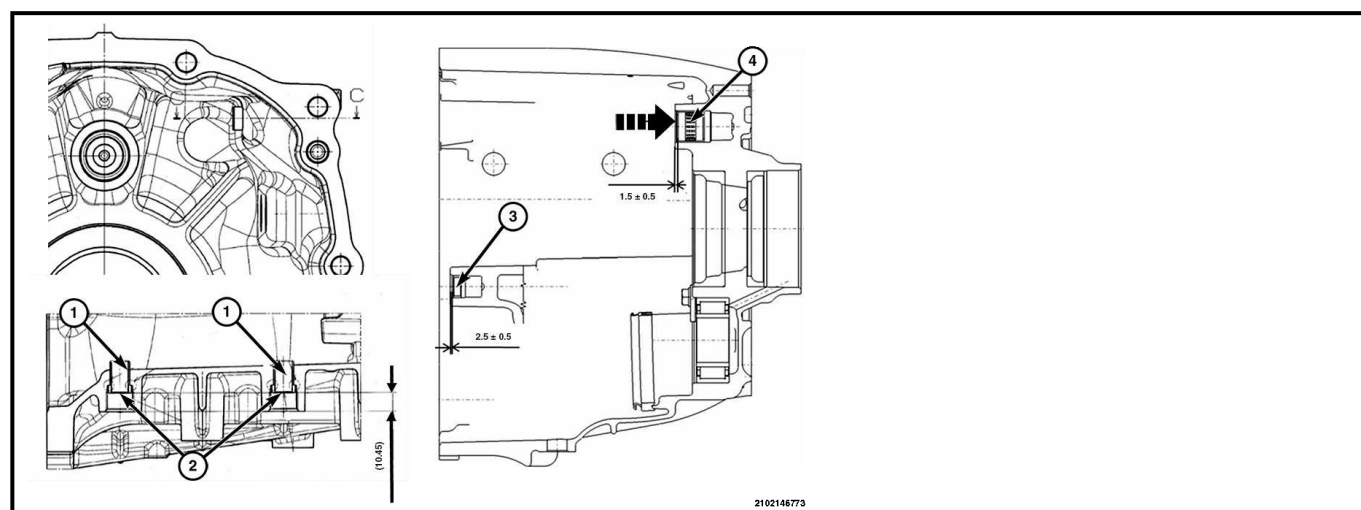
INDEX	DEPTH
1. Bearing	11mm (0.43in)
2. Pin	14.1mm (0.55in)
3. Seal	1.5mm (0.05in)



2102146772

GUIDE PLATE PIN

INDEX	DEPTH
1. Pin	4mm (0.15in)
2. Guide Plate	-

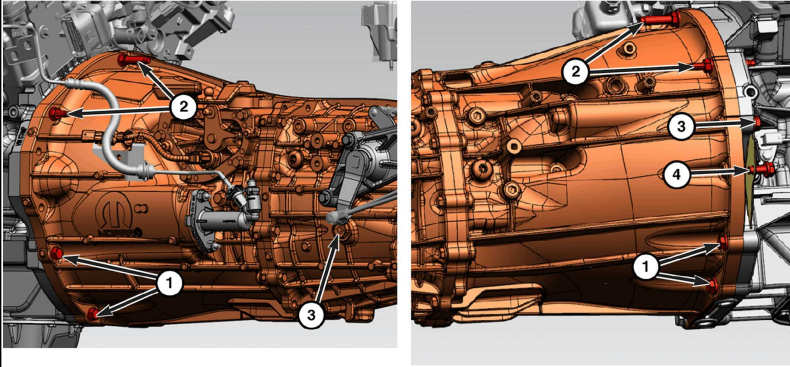


REAR CASE

INDEX	DEPTH
1. Holder	-
2. Contact Point	-
3. Bushing	2.5mm (0.09in)
4. Bearing	1.5mm (0.05in)

TORQUE SPECIFICATIONS

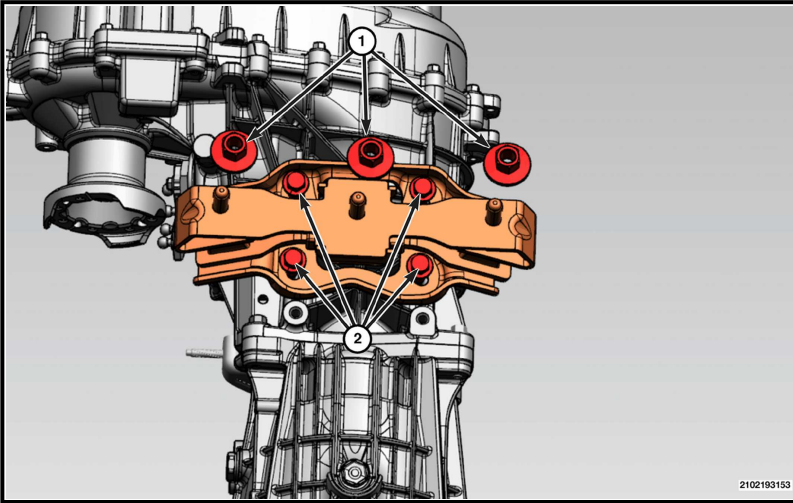
BELLHOUSING AND OIL FILL PLUG



2102193151

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Bellhousing to Engine Oil Pan Bolts	50 N.m (37 Ft. Lbs.)	-
2	Bellhousing to Engine Double Ended Studs	48 N.m (35 Ft. Lbs.)	-
3	Transmission Oil Fill Plug	37 N.m (27 Ft. Lbs.)	-
4	Dust Shield To Bellhousing Bolt	12 N.m (9 Ft. Lbs.)	-

TRANSMISSION MOUNT



2102193153

CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-
2	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-

AL6 MANUAL TRANSMISSION

DESCRIPTION	SPECIFICATIONS	COMMENT
Bell Crank Bracket to Transmission	23 N.m (17 Ft. Lbs.)	-
Cover Plug	19 N.m (14 Ft. Lbs.)	-
Detent Plug	24 N.m (18 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be

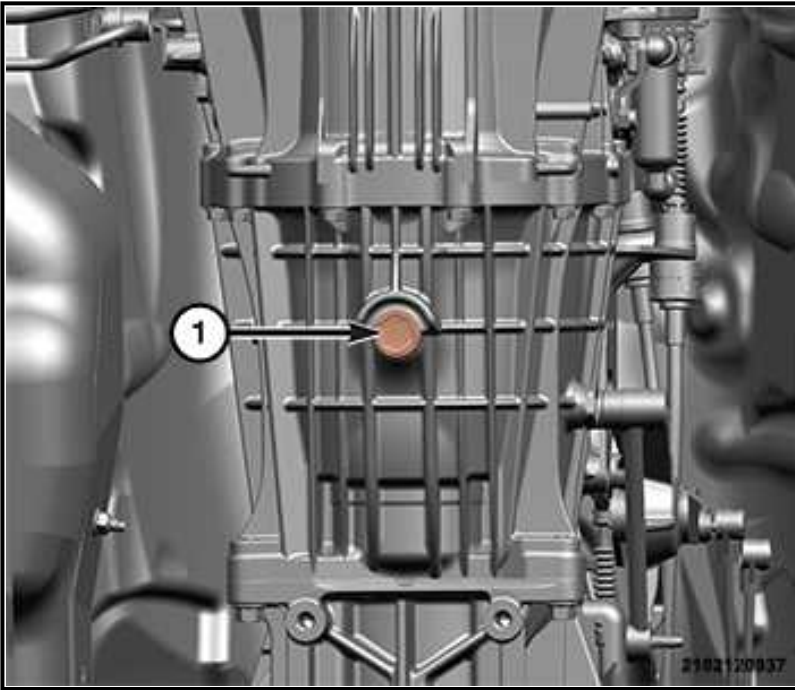
DESCRIPTION	SPECIFICATIONS	COMMENT
		installed and tightened to specifications.
Drain Plug	37 N.m (27 Ft. Lbs.)	-
Fill Plug	37 N.m (27 Ft. Lbs.)	-
Shift Fork Pivot Bolts	42 N.m (31 Ft. Lbs.)	Do not reuse these fasteners. If removed, a NEW fastener must be installed and tightened to specifications.
Reverse Idler Bolts	25 N.m (18 Ft. Lbs.)	-
Shift Lever Bolts	39 N.m (29 Ft. Lbs.)	-
Manual Transmission Shifter Assembly Nuts	8 N.m (80 In. Lbs.)	-
Selector Lever Cover Bolts	20 N.m (15 Ft. Lbs.)	-
Shift Guide Plate Bolts	12 N.m (9 Ft. Lbs.)	-
Oil Separator Bolts	9 N.m (89 In. Lbs.)	-
Rear Case Bolts	29 N.m (21 Ft. Lbs.)	-
Countershaft Bearing Snap Ring Service Plug	39 N.m (29 Ft. Lbs.)	-
Input Shaft Shield Bolts	11 N.m (8 Ft. Lbs.)	-
Output Shaft Locknut	373 N.m (275 Ft. Lbs.)	Do not reuse thks fastener. If removed, a NEW fastener must be installed and tightened to specifications.
Range Position Switch	3 N.m (24 In. Lbs.)	-
Parking Brake Cable Grommet to Floor Nuts	9 N.m (89 In. Lbs.)	-
Shift Cable Bracket to Transmission Bolts	25 N.m (18 Ft. Lbs.)	-
Transmission Support Bracket to Transmission	17 N.m (12 Ft. Lbs.)	-

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect and isolate the negative battery cable(s). Refer to the appropriate service information .
2. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .

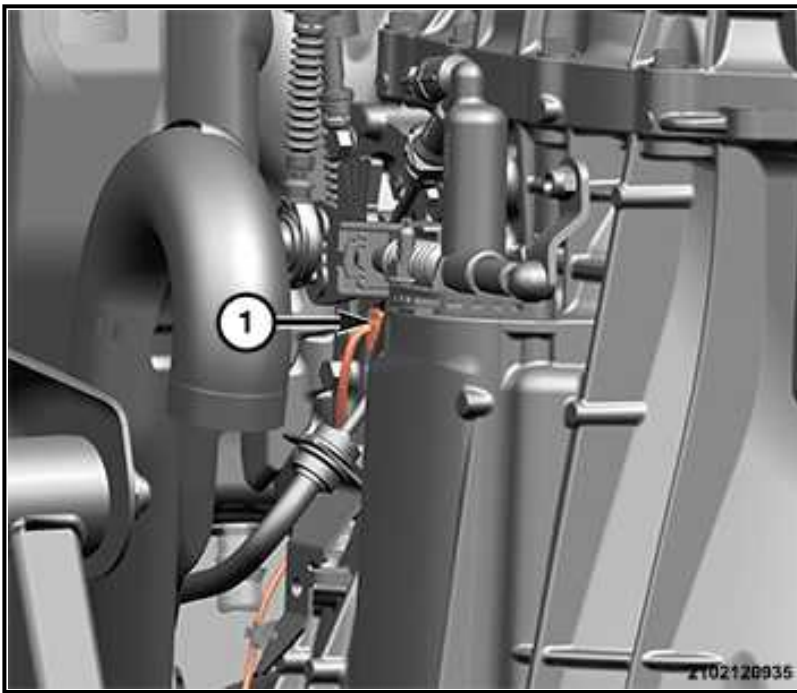


3. Place an oil drain pan under the drain plug, remove the drain plug (1) and drain the transmission fluid.
4. Support the transmission with a suitable transmission jack.
5. Remove the engine mount insulator. Refer to [INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION](#) [INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND INSTALLATION](#) [INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION](#) [INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND INSTALLATION](#) .
6. Remove the catalytic converter assembly. Refer to [CONVERTER, CATALYTIC, REMOVAL AND INSTALLATION](#) .
7. Mark the transfer case flanges and the propeller shafts for installation reference before removing the propeller shafts. Refer to [REMOVAL AND INSTALLATION](#) .
8. Remove the transfer case

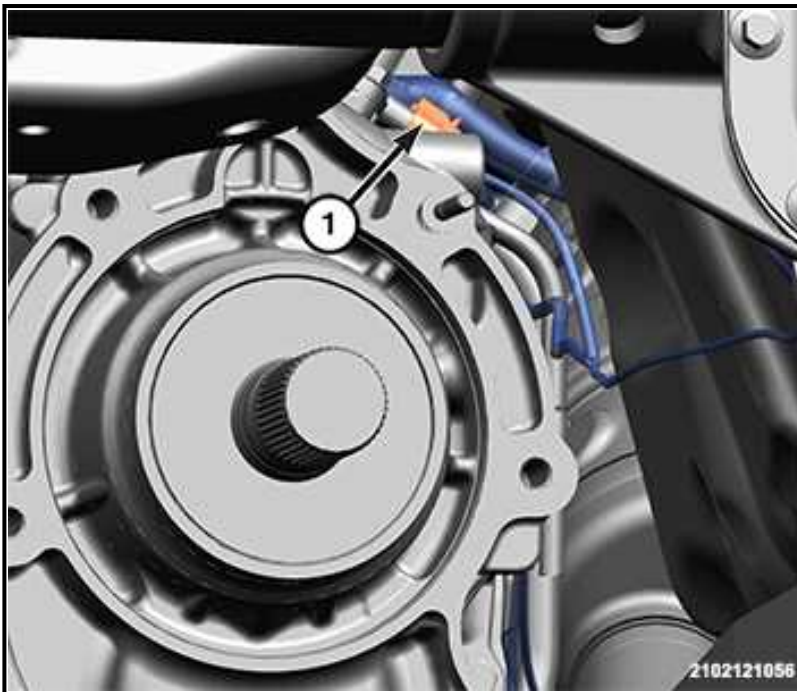
Refer to [REMOVAL AND INSTALLATION](#) [REMOVAL AND INSTALLATION](#) .

CAUTION: Bore scope inspection required to ensure clutch fork to slave cylinder alignment. Failure to inspect and verify proper seating of the slave may result in transmission damage or loss of clutch function.

9. Remove the clutch slave cylinder. Refer to [CYLINDER, CLUTCH SLAVE, REMOVAL AND INSTALLATION](#) .



10. Disconnect the transmission neutral safety switch wire harness connector (1).



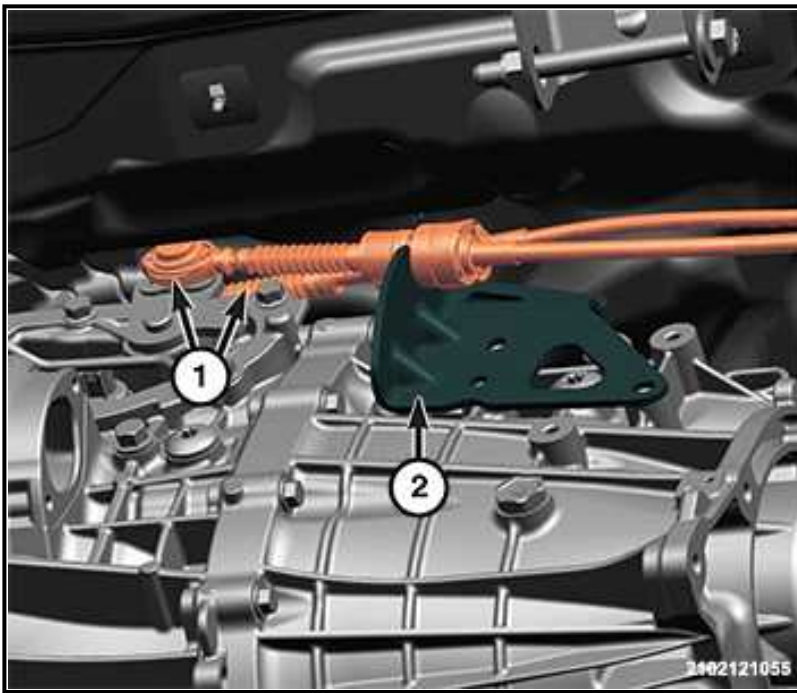
11. Disconnect the transmission range position switch wire harness connector (1).

12. Remove the starter

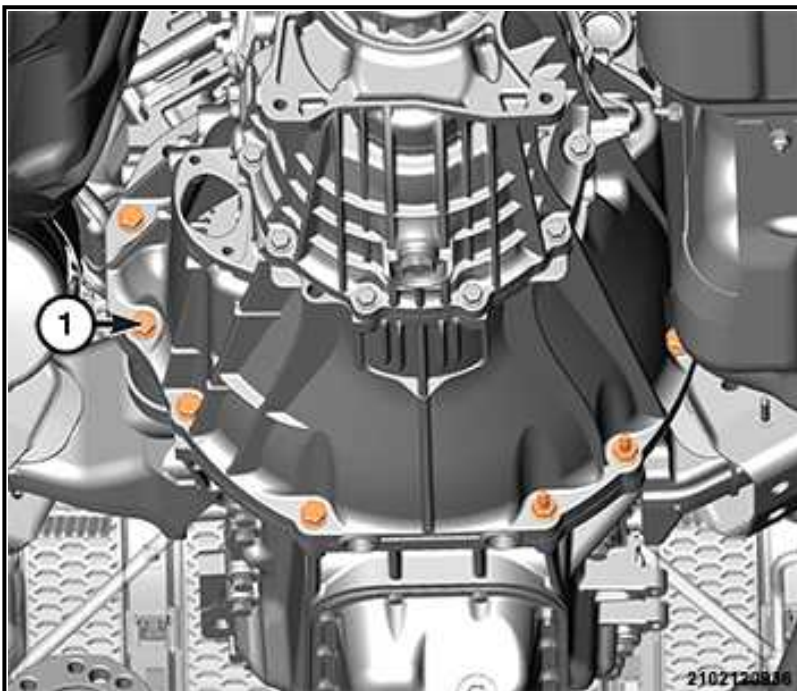
Refer to **STARTER, REMOVAL AND INSTALLATION** **STARTER, REMOVAL AND INSTALLATION** .

CAUTION:

If any of the shift cables or shift cable brackets are removed, the cable adjustment must be checked. This adjustment is critical. If not set correctly, transmission damage is possible.



13. Using a suitable tool, disconnect the shift cables (1) from the outer shift lever ball stud. Mark or scribe the bracket (2) in two places before removing so it can be re-installed in the **EXACT** location in which it was originally mounted. Position the cables (1) away from the transmission with the bracket (2).
14. Remove the RH fuel vapor line fasteners from the vapor line brackets and position the fuel vapor lines aside.
15. Remove the two top fuel vapor line fasteners from the vapor line brackets and position the fuel vapor lines aside.
16. Remove the transmission vent tube and position it aside.

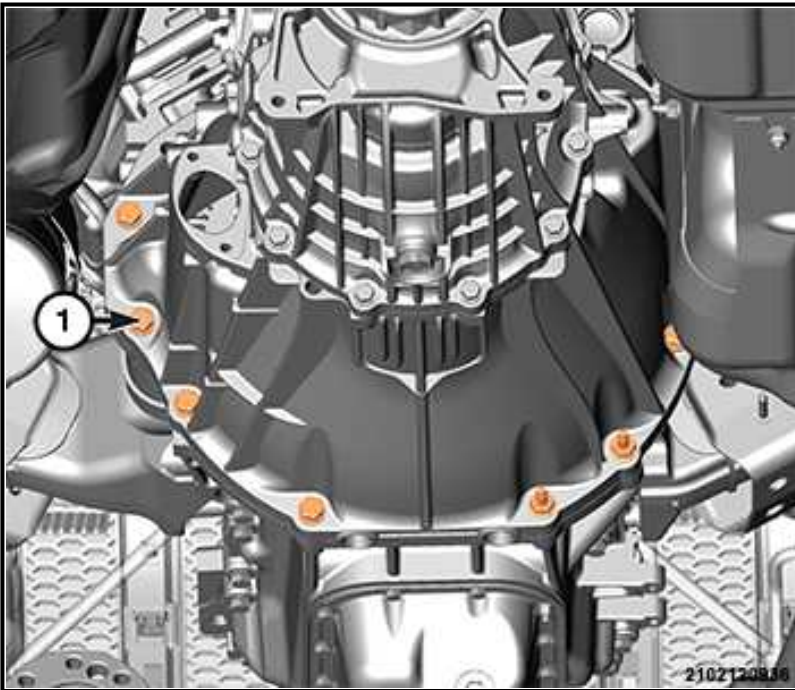


17. Remove the eight transmission to engine mounting bolts (1).
18. Move the transmission rearward until the input shaft is clear of the clutch disc and the pressure plate.
19. Lower the transmission jack and remove the transmission.

INSTALLATION

1. Apply a very light coat of MoparB® high temperature bearing grease or equivalent to the input shaft splines.

2. Clean the transmission front housing mounting surface.
3. Check the alignment of the clutch. Refer to [DISC, CLUTCH, REMOVAL AND INSTALLATION](#) .
4. Support and secure the transmission to the transmission jack.



5. Install the transmission. Tighten the bolts (1) to the proper

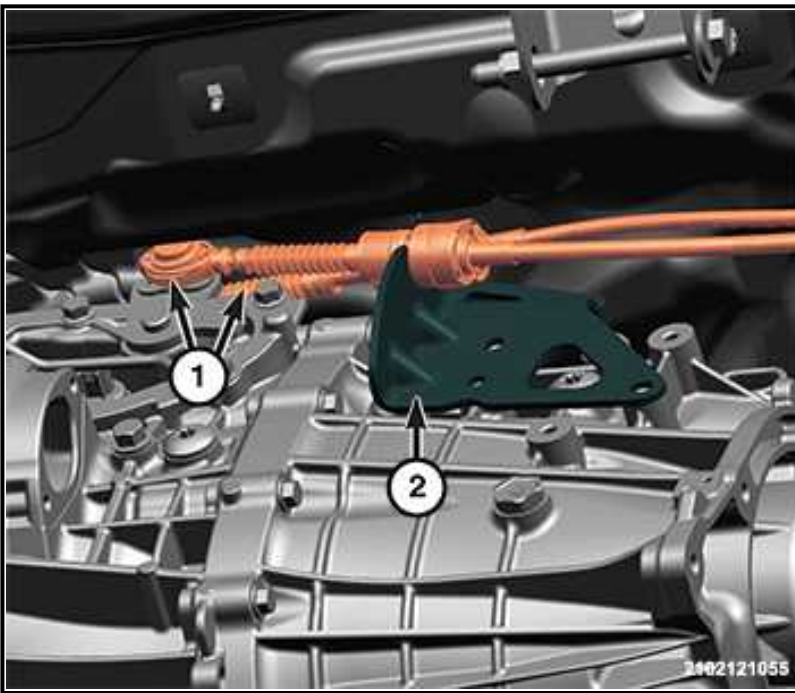
Refer to [TORQUE SPECIFICATIONS](#) .

CAUTION: Bore scope inspection required to ensure clutch fork to slave cylinder alignment. Failure to inspect and verify proper seating of the slave may result in transmission damage or loss of clutch function.

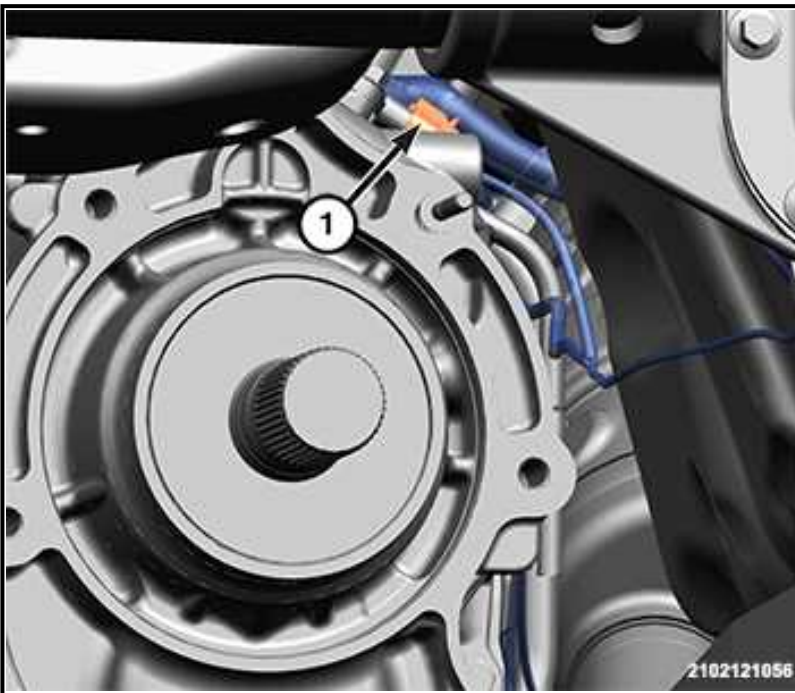
6. Install the RH fuel vapor line fasteners and brackets to the transmission.
7. Install the two top fuel vapor line fasteners and brackets to the transmission.
8. Install the transmission vent tube.
9. Install the clutch slave cylinder. Refer to [CYLINDER, CLUTCH SLAVE, REMOVAL AND INSTALLATION](#) .
10. Install the starter. Refer to [STARTER, REMOVAL AND INSTALLATION STARTER, REMOVAL AND INSTALLATION](#) .
11. Install the transfer case

Refer to [REMOVAL AND INSTALLATION REMOVAL AND INSTALLATION](#) .

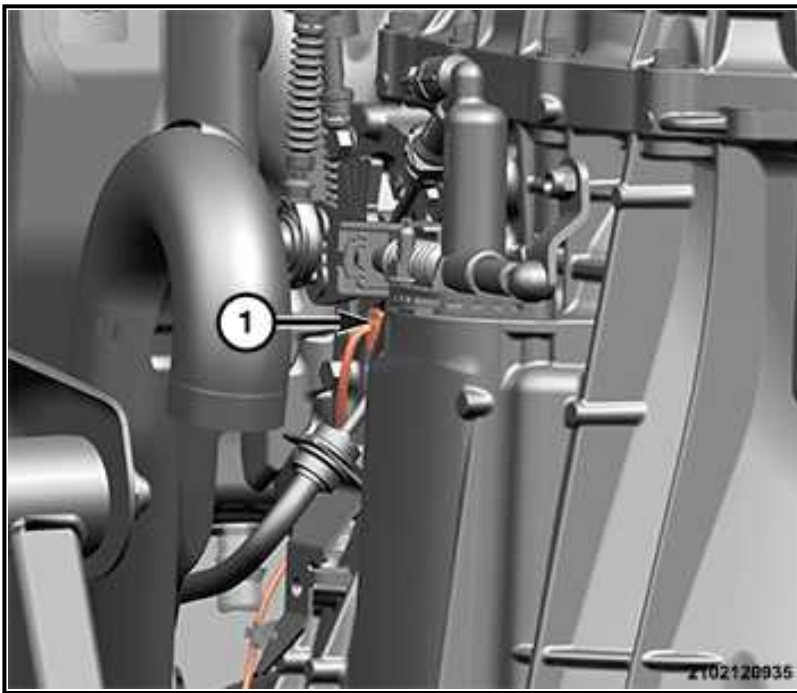
CAUTION: If any of the shift cables or shift cable brackets are removed, the cable adjustment must be checked. This adjustment is critical. If not set correctly, transmission damage is possible.



12. Install the shift cable bracket (2) to the **EXACT** position to which it was originally mounted. Align the marks made on the shift cable bracket from the removal procedure, install the fasteners and tighten to the correct. Refer to [**TORQUE SPECIFICATIONS**](#) . Install the shift cables (1) to the shift cable bracket and connect the cables to the transmission.
13. Route and attach the wiring harnesses to the clips located on the case.



14. Connect the transmission range position switch wire harness connector (1).



15. Connect the transmission neutral safety switch wire harness connector (1).
16. Install the front and rear drive shafts with the reference marks aligned. Refer to [REMOVAL AND INSTALLATION](#) .
17. Install the catalytic converter. Refer to [CONVERTER, CATALYTIC, REMOVAL AND INSTALLATION](#) .
18. Install the engine mount insulator. Refer to [INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION](#) [INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND INSTALLATION](#) [INSULATOR, ENGINE MOUNT, LEFT, REMOVAL AND INSTALLATION](#) [INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL AND INSTALLATION](#) .
19. Perform the transmission fill procedure. Refer to [FLUID, STANDARD PROCEDURE](#).
20. Remove the support and lower the vehicle.
21. If the transmission is being removed and installed, position the shifter in 3rd gear and push the select cable adjustment button. If the transmission is being replaced. Refer to [CABLE, GEARSHIFT CONTROL, ADJUSTMENTS](#).
22. Connect the negative battery cable(s). Refer to the appropriate service information .

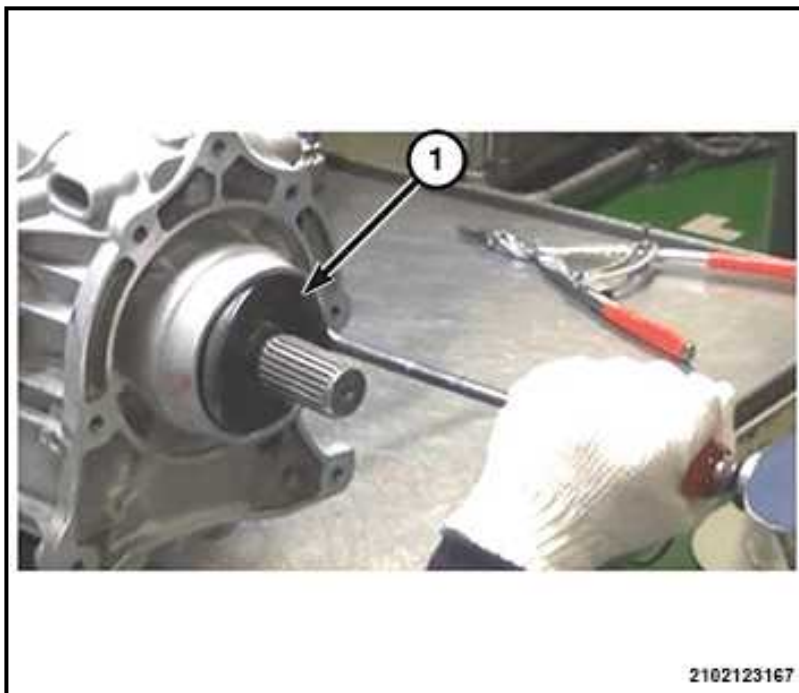
DISASSEMBLY AND ASSEMBLY

AL6

DISASSEMBLY

CAUTION: If any of the shift cables or shift cable brackets are removed, the cable adjustment must be checked. This adjustment is critical. If not set correctly, transmission damage is possible.

1. Place an oil drain pan under the drain plug and drain transmission fluid through the drain plug. Make sure the transmission is in the neutral position.



1 - Rear Output Oil Seal

NOTE: Do not re-use the rear output oil seal, install a new seal if removal is necessary.

NOTE: Do not damage the case surface.

2. Using a suitable tool, remove and discard the rear output oil seal.



1 - Output Shaft Lock Nut Stake

3. Using a suitable tool, carefully open the stakes on the output shaft lock nut. Remove the output shaft lock nut using the input shaft holding tool from (special tool #2051600210, Socket, Spline Input Shaft 21 Teeth) and the output shaft locknut socket (special tool #2051500210, Socket, Output Shaft 60 mm).



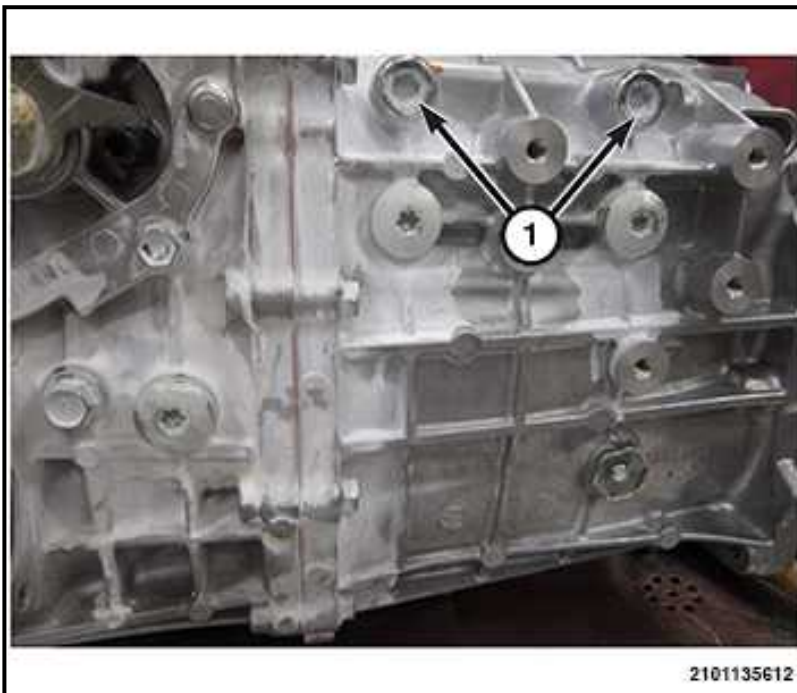
1 - Output Shaft Lock Nut

2 - Rear Output Bearing

4. Remove the range position switch.

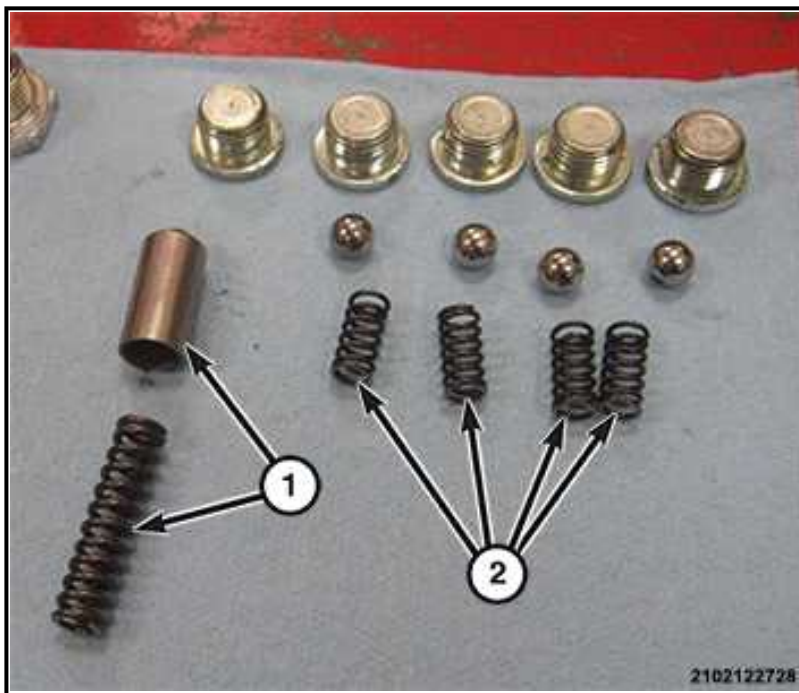
Refer to [**SWITCH, RANGE POSITION, REMOVAL AND INSTALLATION.**](#)

5. Remove the output shaft lock nut and the rear output bearing. **DISCARD** the output shaft lock nut.



1 - Rear Shift Fork Detent Plugs

6. Stand the transmission on the bell housing end. Remove the rear shift fork detent plugs with the balls and springs from the case.

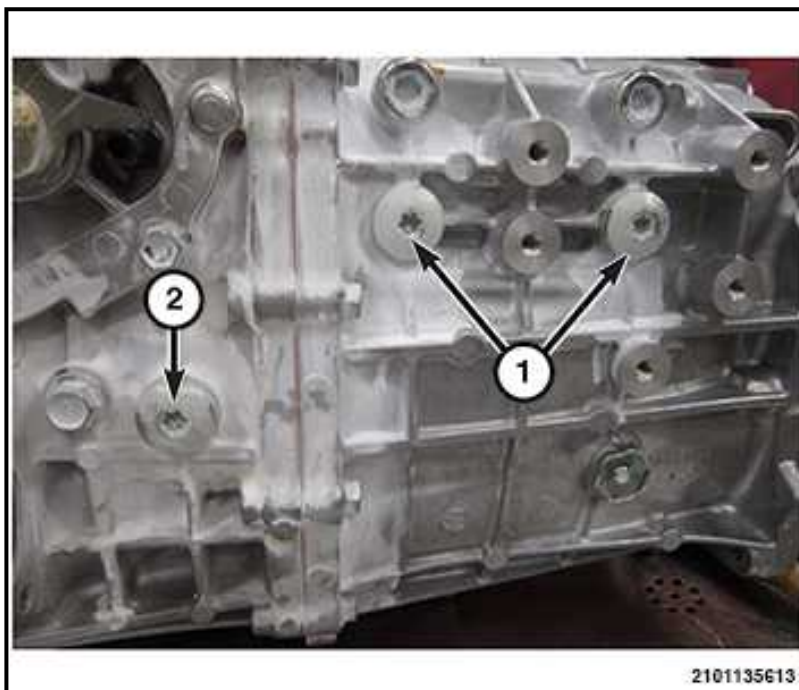


1 - Shift Fork Detent Spring And Sleeve

2 - Shift Fork Detent Springs

7. Remove the shift fork detent springs and shift fork detent balls from the front and rear case.

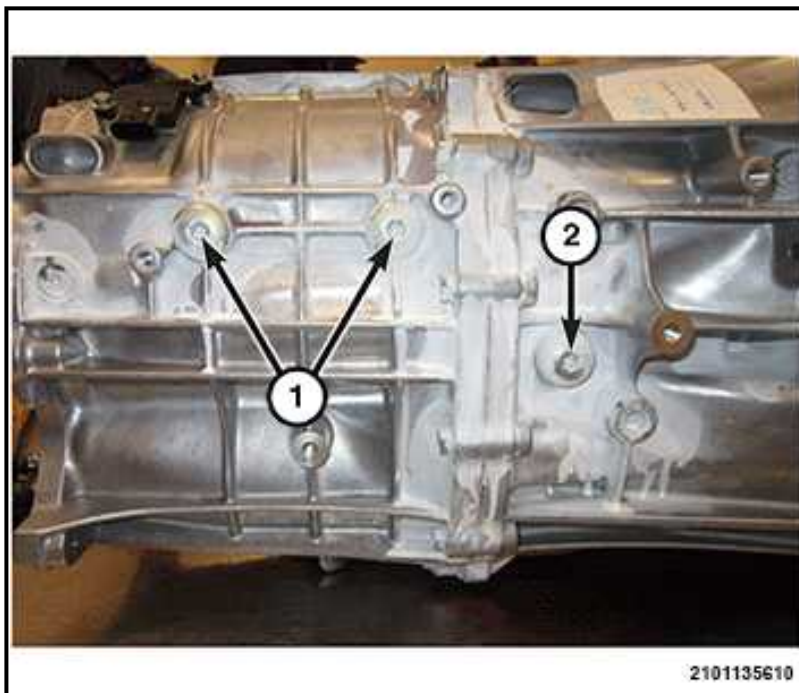
NOTE: The shift fork detent spring and sleeve go to the very front, right side detent. The remaining shift fork detent springs and shift fork detent balls are all the same size and all the springs have the same tension.



1 - Rear Shift Fork Support Bolts

2 - Left Side Front Shift Fork Pivot Bolt

8. Remove the rear shift fork support bolts from the left side of the transmission.



1 - Rear Shift Fork Support Bolts

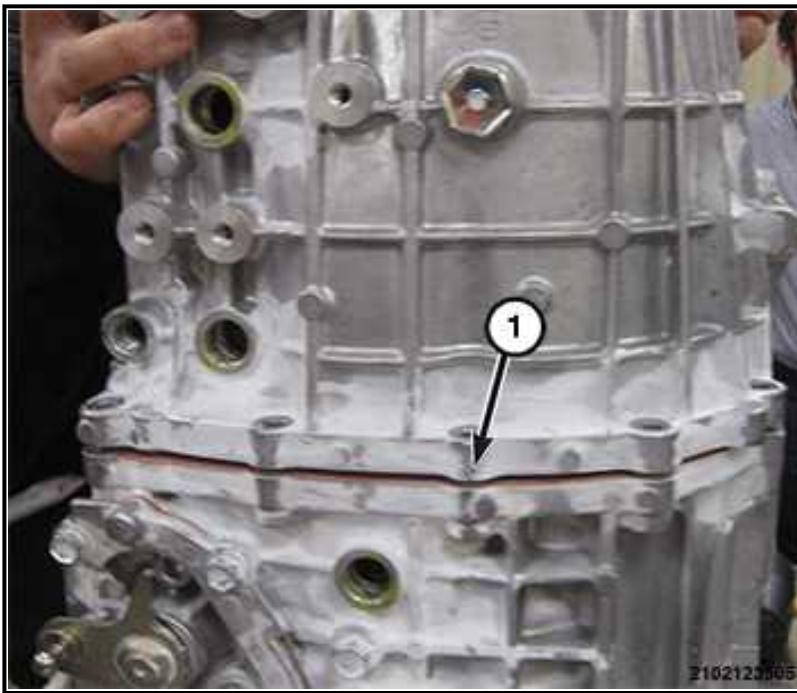
2 - Right Side Front Shift Fork Pivot Bolt

9. Remove the rear shift fork support bolts from the right side of the transmission.



1 - Rear Case Bolts

10. Remove the rear case bolts.



1 - Rear Case

11. Remove the rear case.

NOTE: If necessary, lightly tap the rear case with a soft-faced hammer in the vicinity of the mating surface to separate it from the front case.

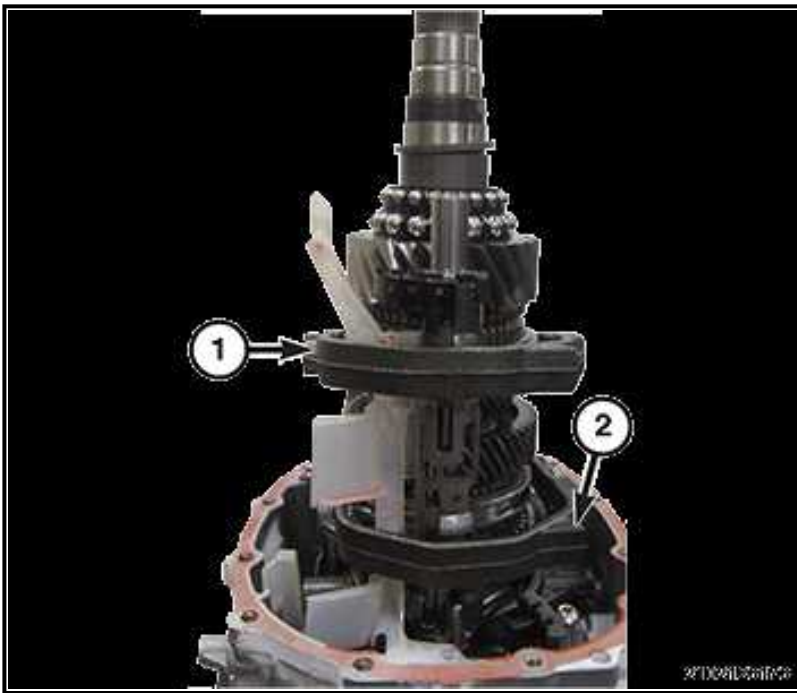


1 - Shim

2 - Mainshaft Output Shaft Bearing

12. Remove the shim from the mainshaft output shaft. If necessary, remove the mainshaft output shaft bearing.

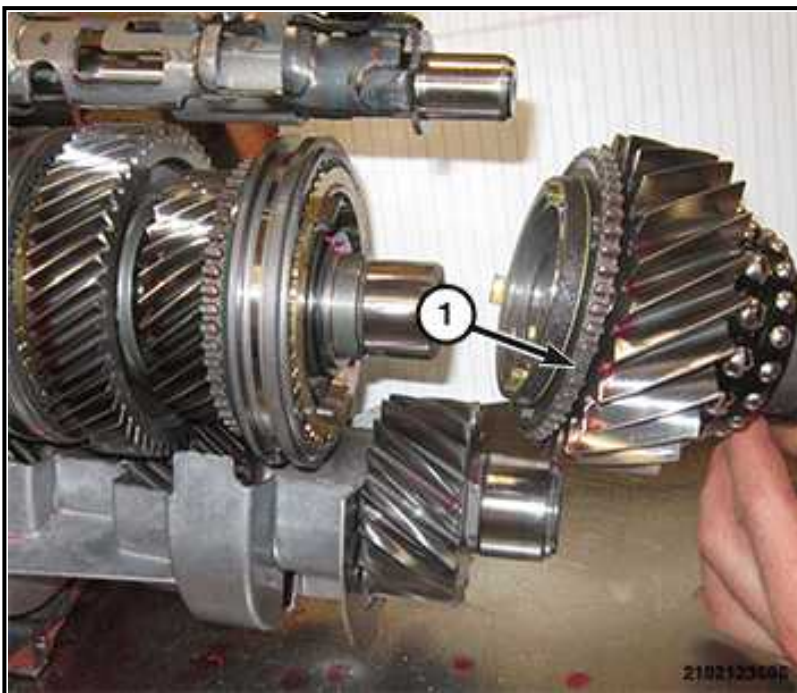
NOTE: Use a press and bearing splitter to remove the mainshaft output shaft bearing from the output shaft, if replacement is necessary.



1 - 3-4 Shift Fork

2 - 5-6 Shift Fork

13. Remove the 3-4 shift fork and the 5-6 shift fork.



1 - Mainshaft Output Shaft

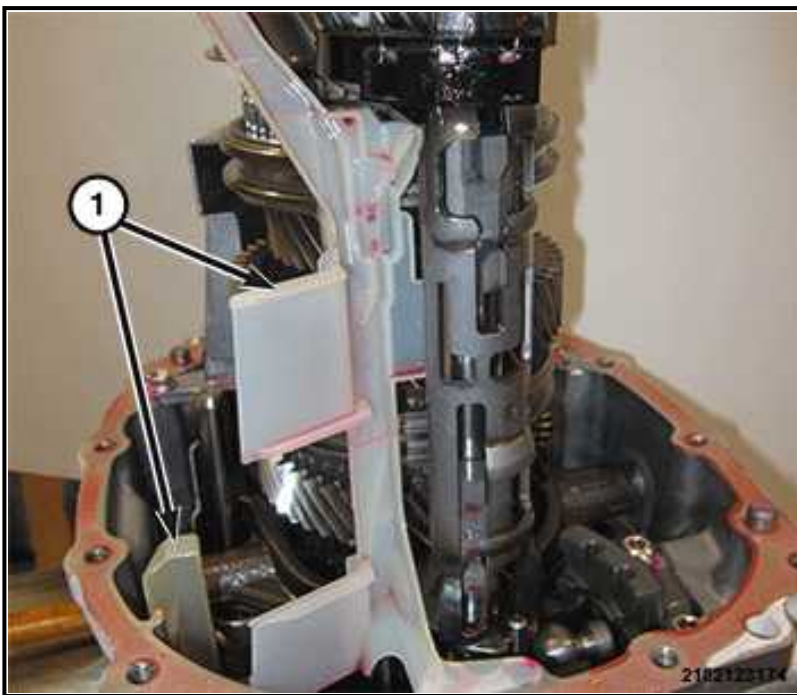
NOTE: When removing the output shaft, the needle bearing may stay inside (as shown) of the mainshaft output shaft.

14. Remove the mainshaft output shaft from the mainshaft.



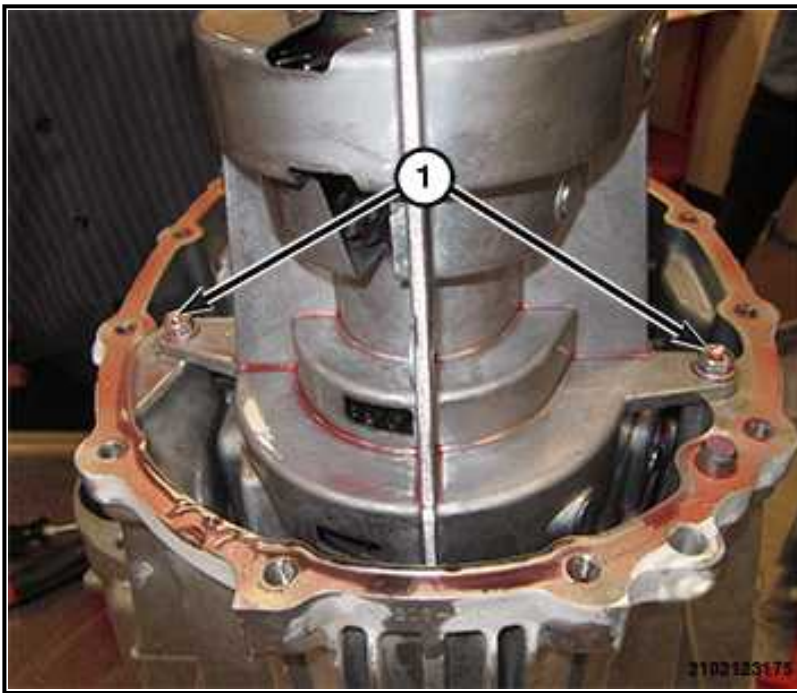
1 - Input Shaft Rear Bearing

15. Remove the input shaft rear bearing.



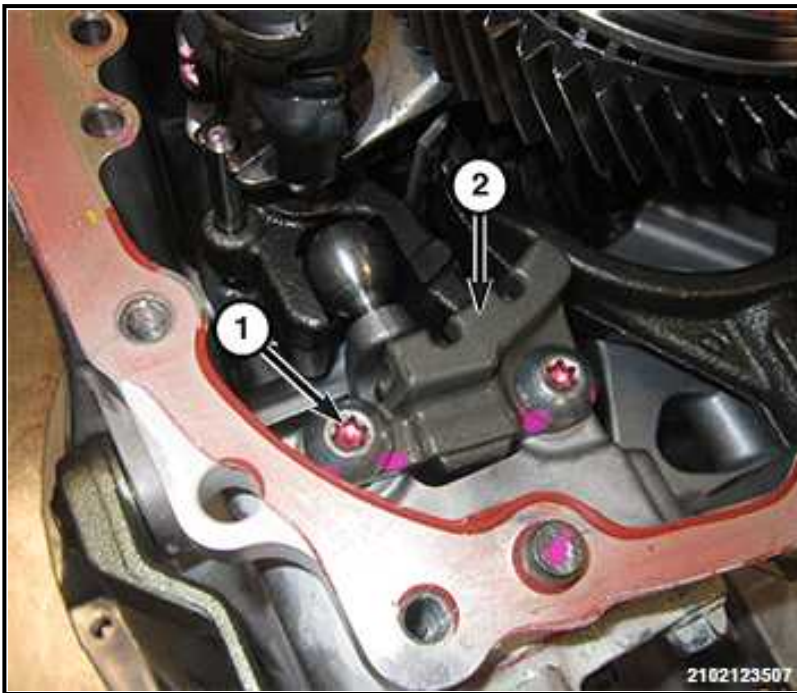
1 - Oil Feed Tubes

16. Remove the plastic oil feed tubes from the case.



1 - Oil Separator Bolts

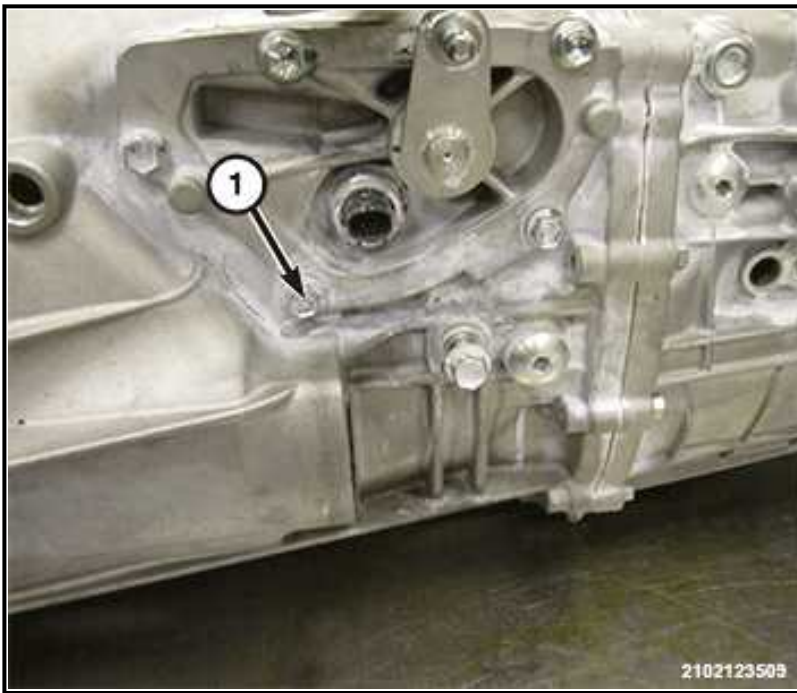
17. Remove the oil separator bolts.



1 - Shift Guide Plate Bolts

2 - Shift Guide Plate

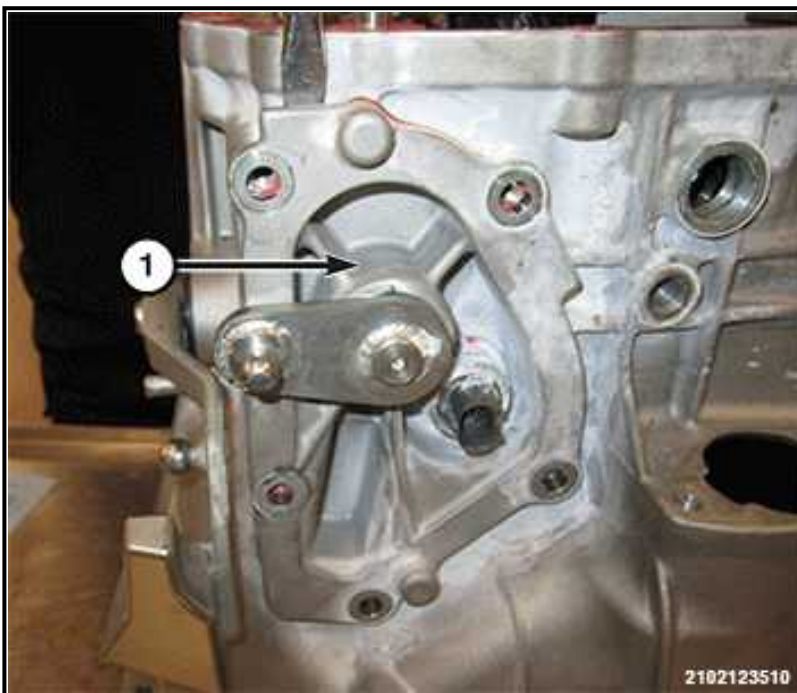
18. Remove the shift guide plate bolts. Remove the shift guide plate.



1 - Selector Lever Cover Assembly Bolts

NOTE: If necessary, lightly pry around the selector lever cover with a suitable screw driver or pry bar in the vicinity of the mating surface to separate the selector lever cover assembly from the case.

19. Remove the selector lever cover assembly bolts.



1 - Selector Lever Cover Assembly

20. Remove the selector lever cover assembly.



1 - Inner Shift Lever Bolt

21. Remove and **DISCARD** the inner shift lever bolt.



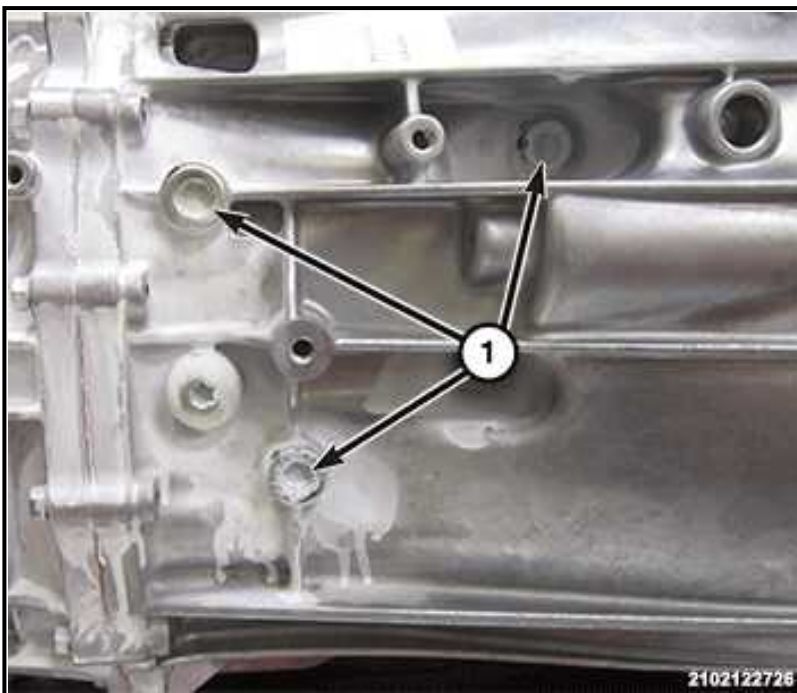
1 - Outer Shift Lever

22. Remove the outer shift lever.



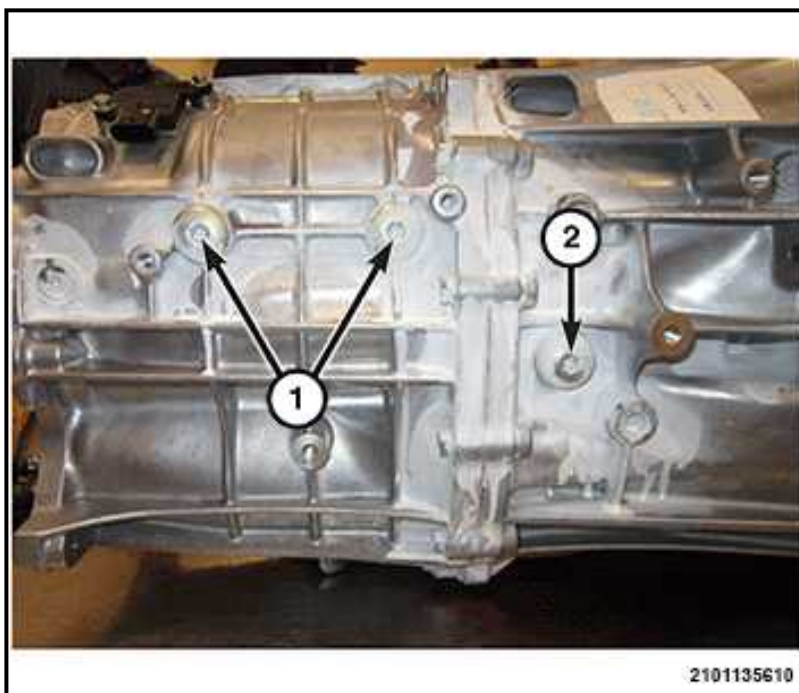
1 - Inner Shift Lever

23. Remove the inner shift lever.



1 - Front Shift Fork Detent Plugs

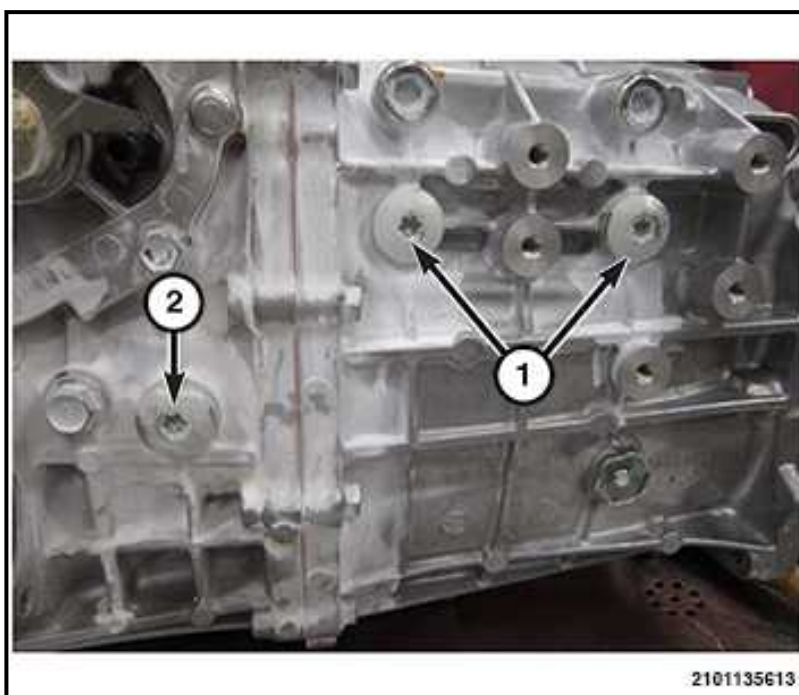
24. Remove the front shift fork detent plugs with the balls and springs. **DISCARD** the front shift fork detent plugs.



1 - Right Side Rear Shift Fork Support Bolts

2 - Right Side Front Shift Fork Pivot Bolt

25. Remove and **DISCARD** the right side front shift fork pivot bolt.



1 - Left Side Rear Shift Fork Support Bolts

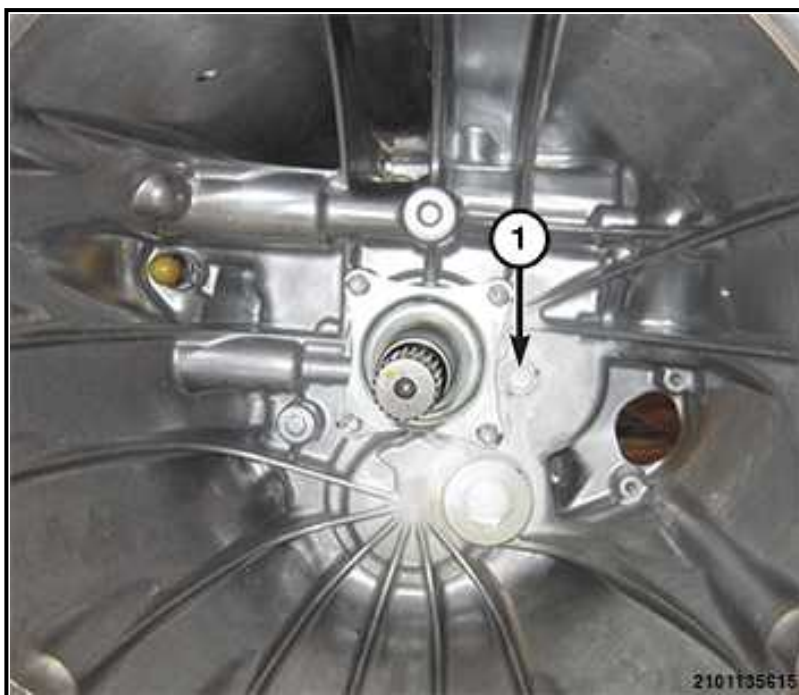
2 - Left Side Front Shift Fork Pivot Bolt

26. Remove and **DISCARD** left side front shift fork pivot bolt.



1 - Reverse Idler Gear Side Bolt

27. Remove the reverse idler gear side bolt.



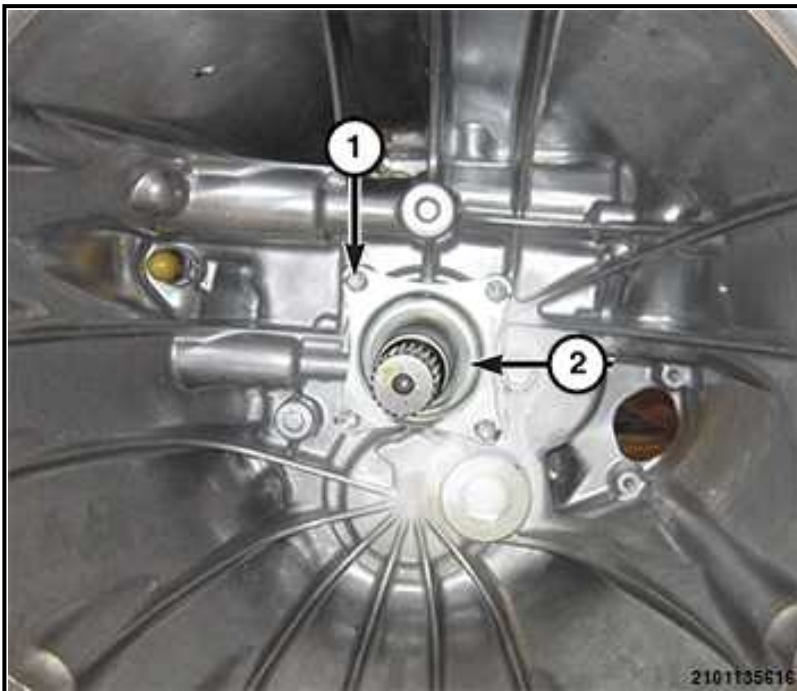
1 - Reverse Idler Gear Front Bolt

28. Remove the reverse idler gear front bolt.



1 - Socket, Allen 27 mm 2051400210

29. Remove the countershaft bearing snap ring service plug using (special tool #2051400210, Socket, Allen 27 mm).



1 - Front Input Shield Bolts

2 - Front Input Shield

30. Remove the front input shield bolts and remove the front input shield.



1 - Countershaft Snap Ring

31. Place the transmission assembly horizontally on the bench. Expand the countershaft snap ring using a suitable pair of snap ring pliers and pull countershaft slightly to the rear to move snap ring from the groove.



1 - Mainshaft Snap Ring

NOTE: Graphic shown without mainshaft installed for clarity.

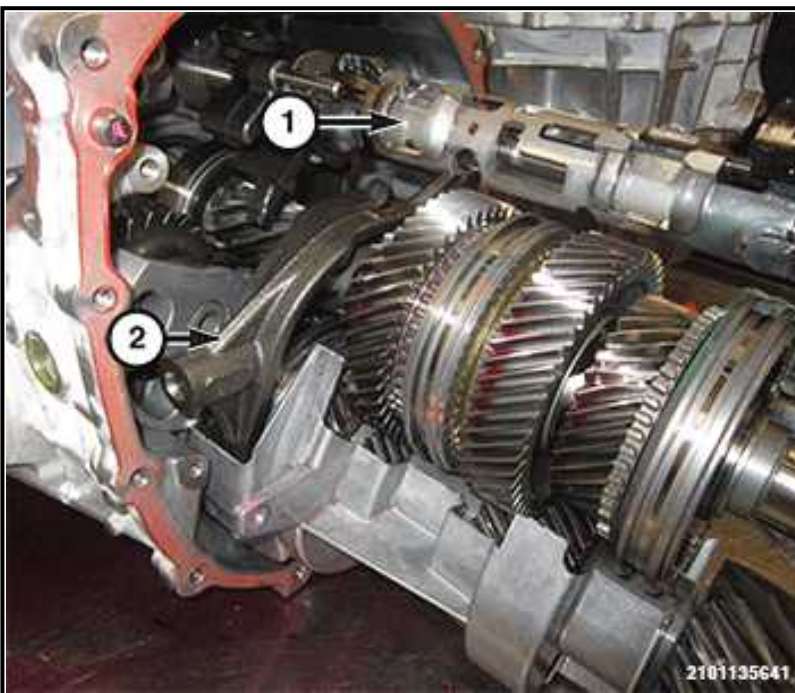
32. Expand the mainshaft snap ring and pull mainshaft slightly to the rear to move the mainshaft snap ring from the groove in the bearing.



Mainshaft And Countershaft Subassembly

NOTE: Hold the mainshaft and countershaft while pulling rearward to keep the snap rings from re-engaging.

33. Remove the mainshaft and countershaft subassembly from the case.

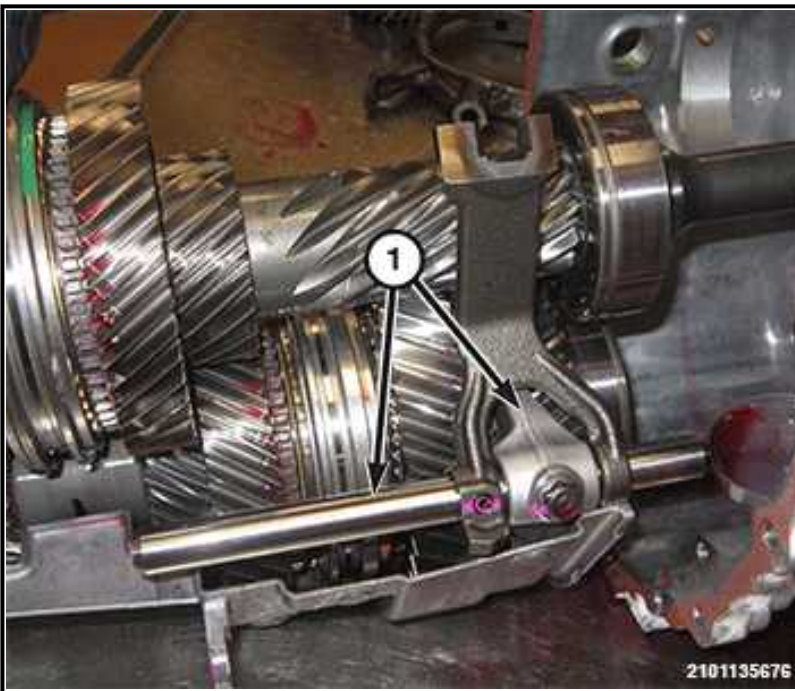


1 - Shift Select Shaft

2 - 1-2 Shift Fork

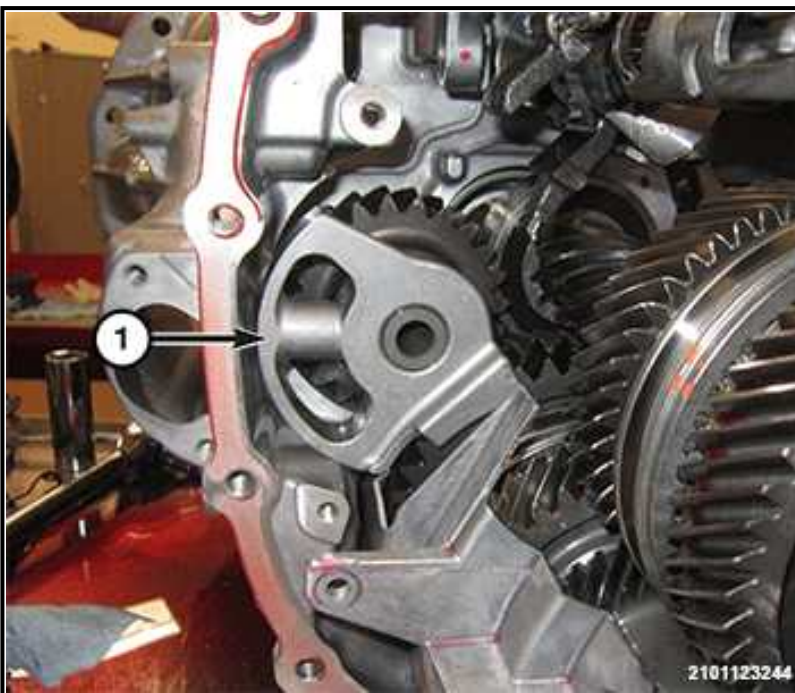
34. Remove the shift select shaft.

35. Remove the 1-2 shift fork.



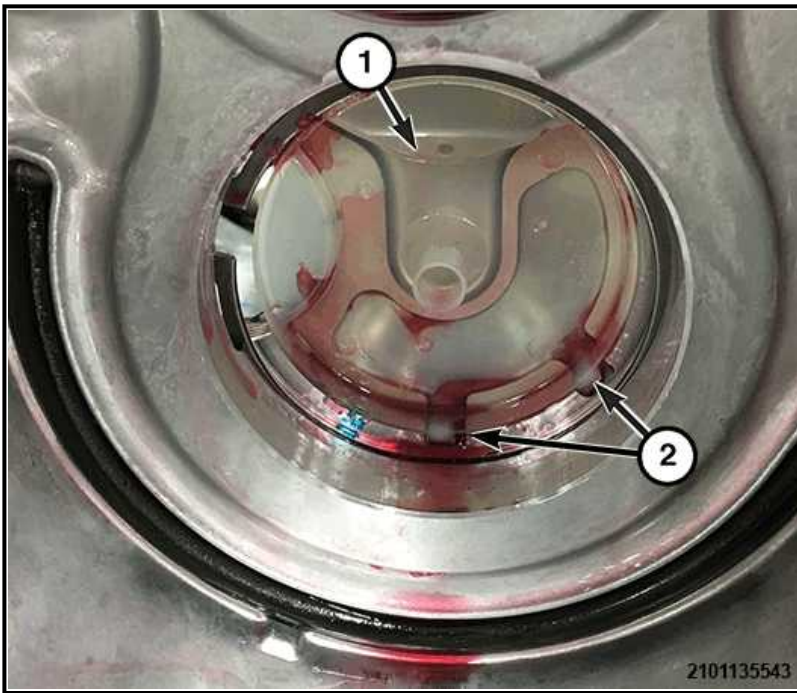
1 - Reverse Shift Fork And Shaft

36. Remove the reverse shift fork and shaft.



1 - Reverse Idler Gear

37. Remove the reverse idler gear.



1 - Oil Slinger

2 - Notches

38. Remove the oil slinger from the front case.



1 - Front Seal

39. Remove the front seal.

40. Remove the front input shaft seal from the case using (special tool #2051800210, Remover, Seal Input Shaft).

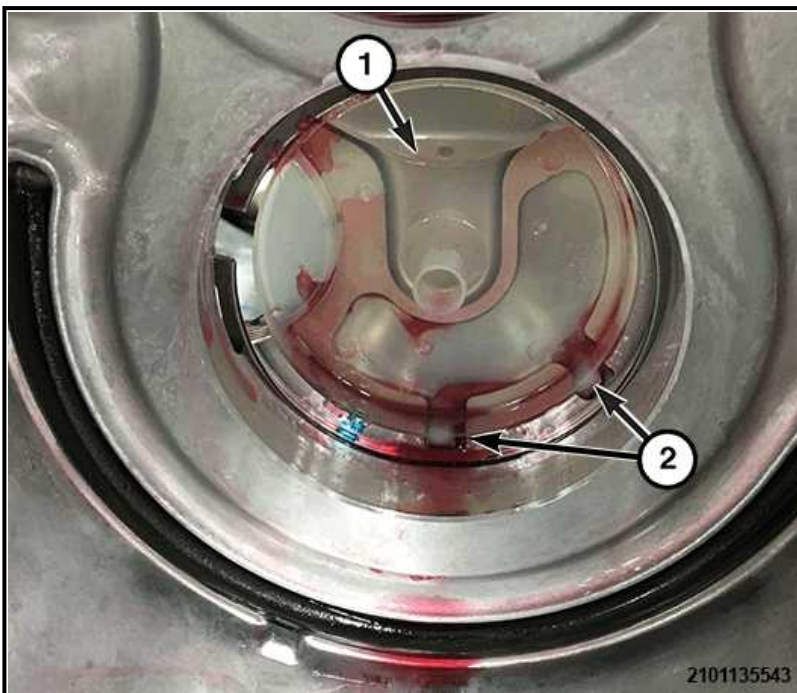
ASSEMBLY

1. Thoroughly clean the case, the case mating surfaces and control cover using parts cleaner or equivalent, then fine scuff the pads.



1 - Front Seal

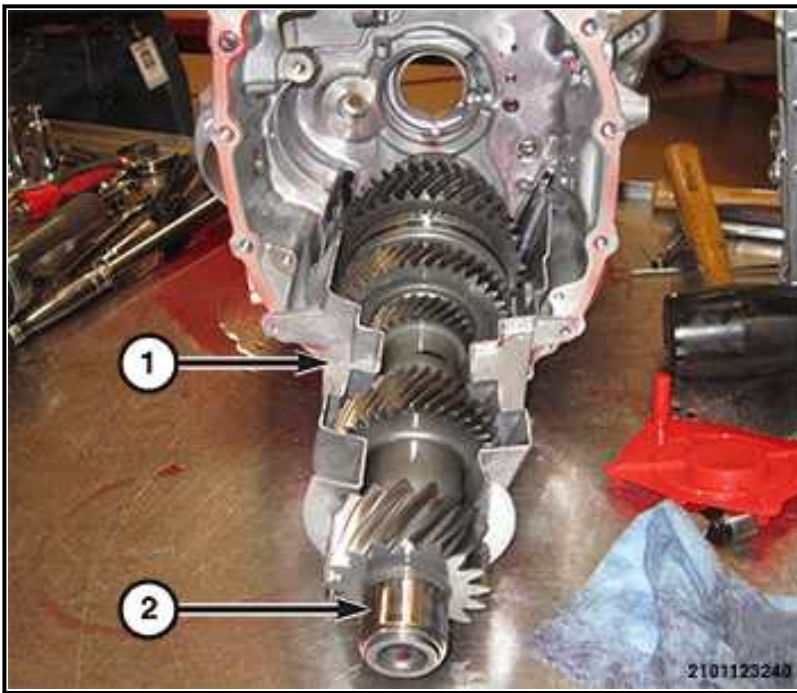
2. Install the front case seal into the groove. Verify the seal is seated in the channel.



1 - Oil Slinger

2 - Notches

3. Install the oil slinger in the case bore using petroleum jelly or transmission assembly lube to hold it in place on the case half. Verify the notches are seated in the relief in the bore.



1 - Oil Separator

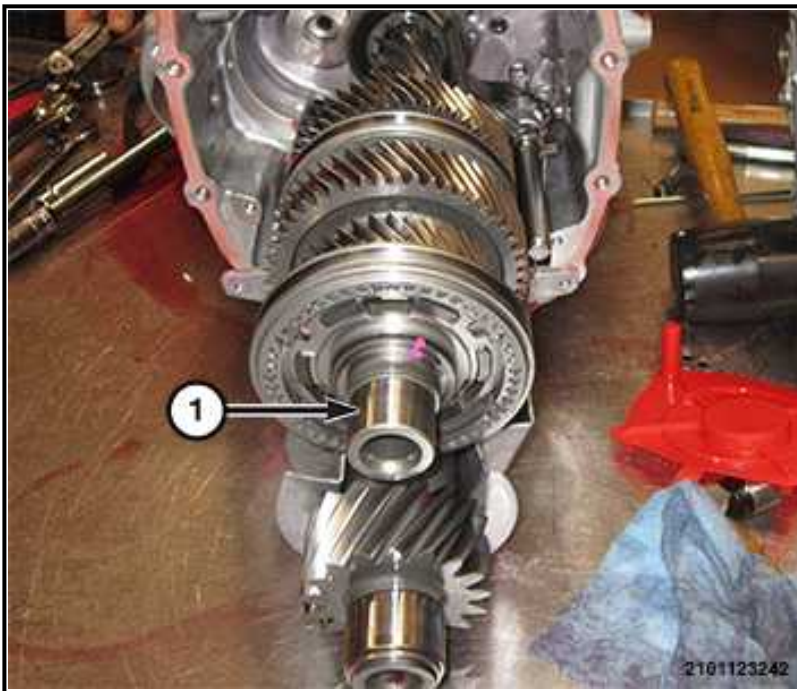
2 - Countershaft

4. Lay the countershaft in the oil separator so it protrudes from the case enough to build the assembly before sliding it in place.



1 - Reverse Shift Fork And Shift Rail

5. Loosely install the reverse shift fork and shift rail into the transmission case. Verify the shift fork is seated in the groove of the sleeve in the correct orientation.



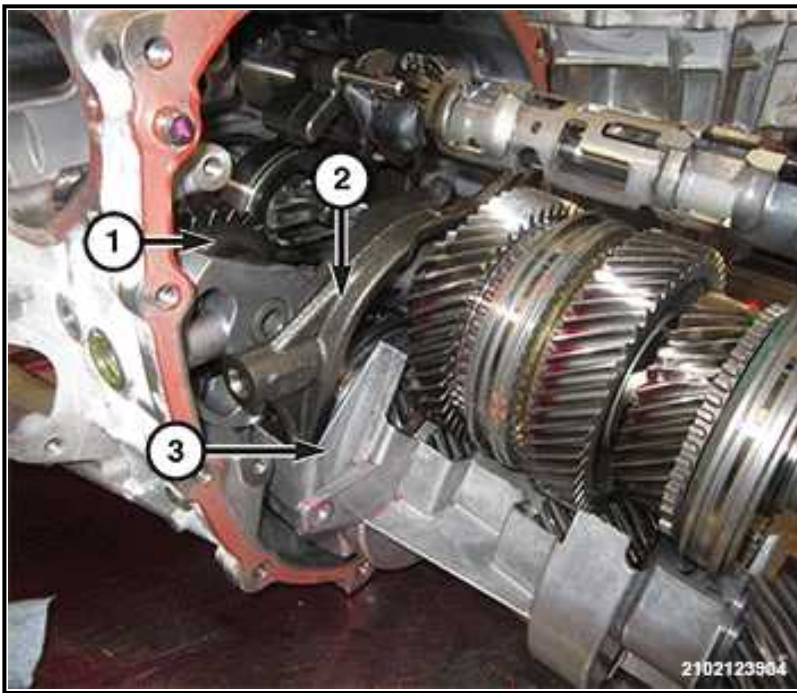
1 - Mainshaft

6. Loosely install the mainshaft on top of the countershaft.



1 - Reverse Idler Gear

7. Install the reverse idler gear loosely in the case.

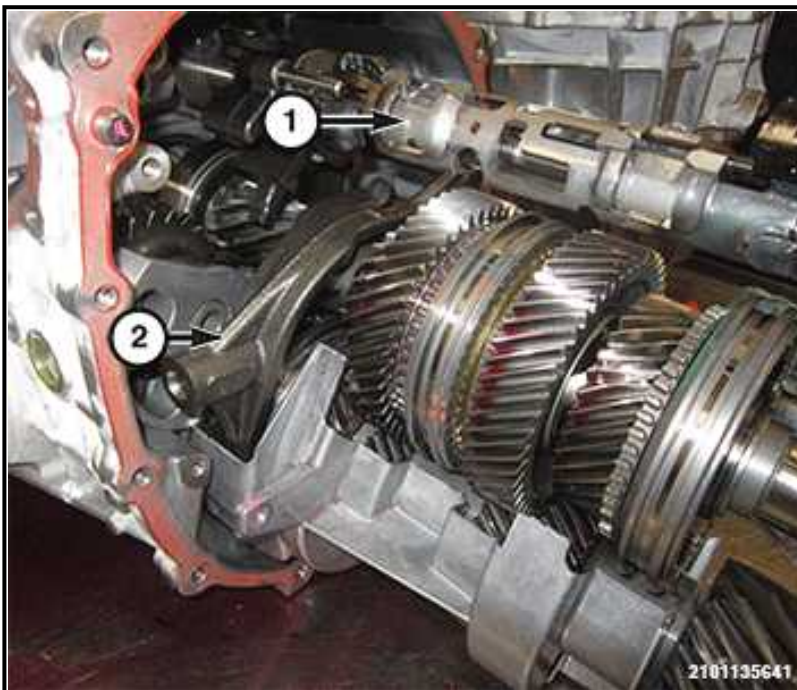


1 - Reverse Idler Gear

2 - 1-2 Shift Fork

3 - Oil Separator

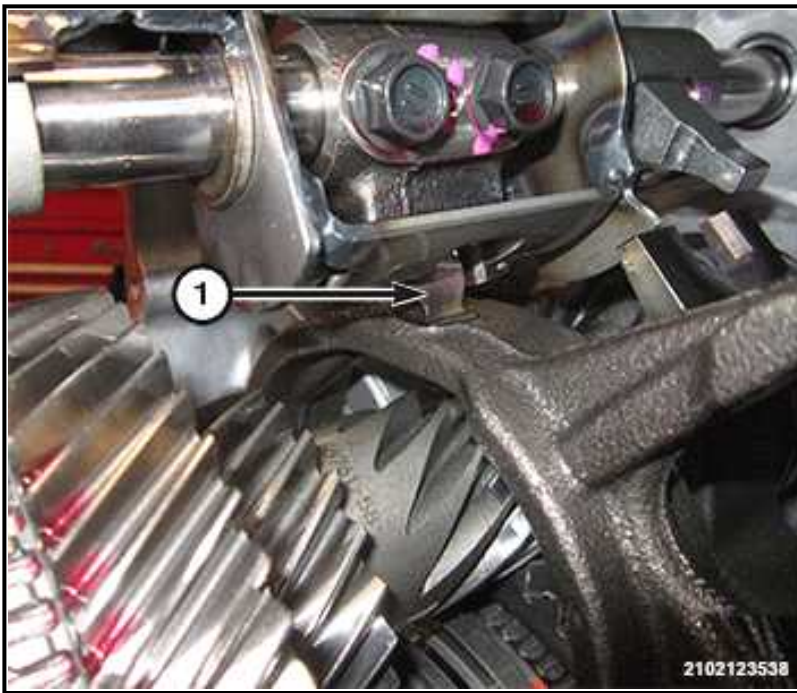
8. Verify that the reverse idler gear is installed prior to installing the 1-2 shift fork. Install the 1-2 shift fork with the shoes oriented in the groove of the sleeve. There should be clearance in the slot on the oil separator for free movement of the shift fork.



1 - Shift Select Shaft

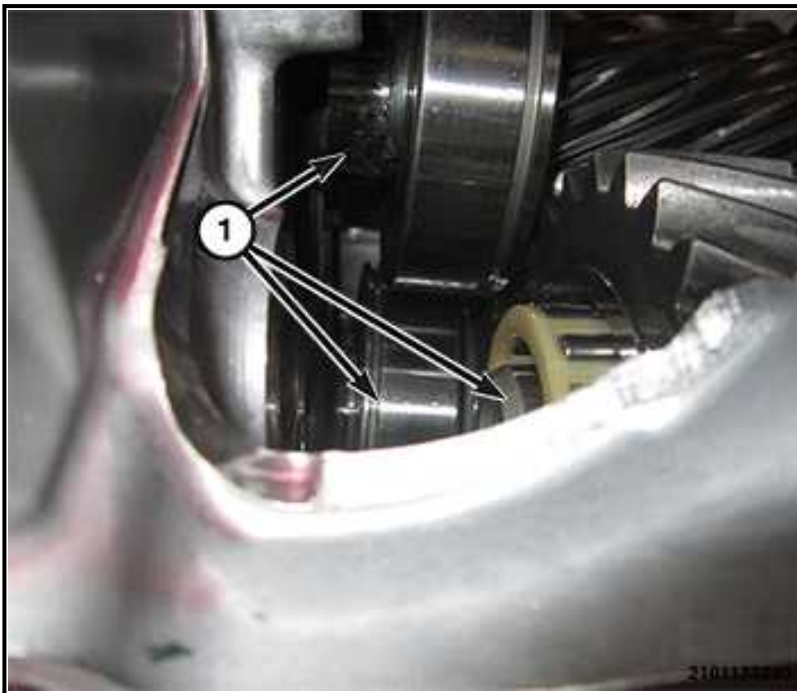
2 - 1-2 Shift Fork

9. Install the shift select shaft (1).



1 - Tabs

10. Make sure the tabs are seated correctly for the 1-2 shift fork.



1 - Shaft Bearings

11. Align the shaft bearings to the bores.



Shaft Installation

12. With the transmission laying on the bench, gently start locating the shafts into the case bores until the bearings are located in their respective bores and pulled up to the snap rings.

NOTE: Verify the shift shaft and shift forks remain aligned while sliding the countershaft and mainshaft into the case bores.



1 - Countershaft Snap Ring

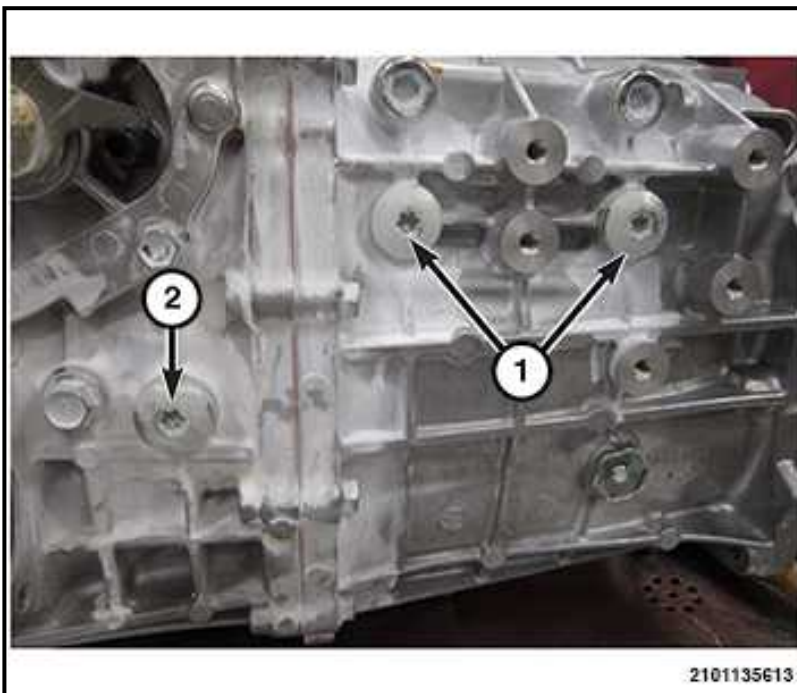
13. Open the countershaft snap ring using a suitable pair of snap ring pliers. Gently slide the countershaft into the snap ring until the snap ring aligns with the groove on the bearing.



1 - Mainshaft Snap Ring

NOTE: Graphic shown without mainshaft installed for clarity.

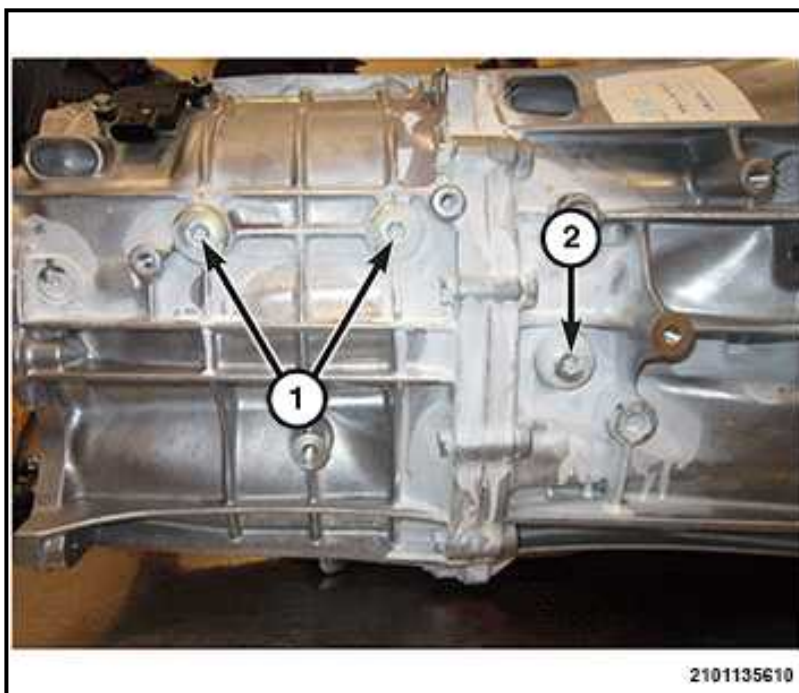
14. Stand the transmission vertically on the bell-housing end while supporting the shafts. Using a suitable pair of snap ring pliers, open the mainshaft snap ring and seat the bearing in the bore with the snap ring in the groove on the bearing.



1 - Left Side Rear Shift Fork Support Bolts

2 - Left Side Front Shift Fork Pivot Bolt

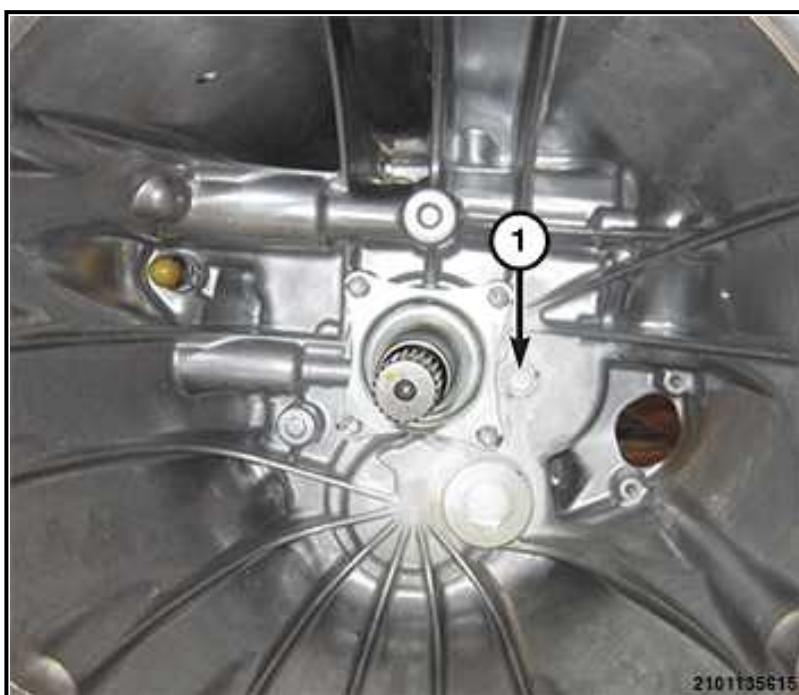
15. Install the **NEW** front left side shift fork pivot bolt.



1 - Right Side Rear Shift Fork Support Bolts

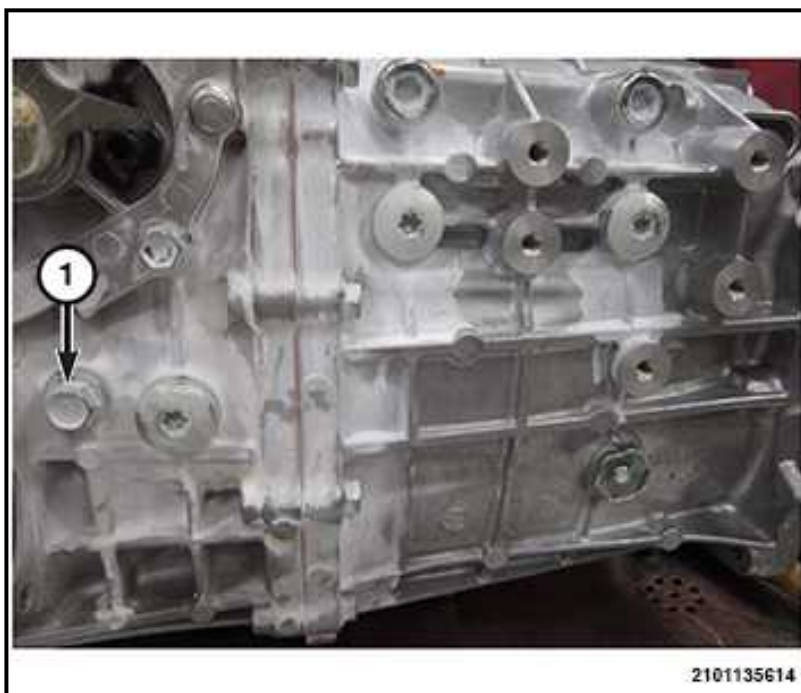
2 - Right Side Front Shift Fork Pivot Bolt

16. Install the **NEW** right side front shift fork pivot bolt and torque both shift fork pivot bolts to the proper. Refer to **TORQUE SPECIFICATIONS** .



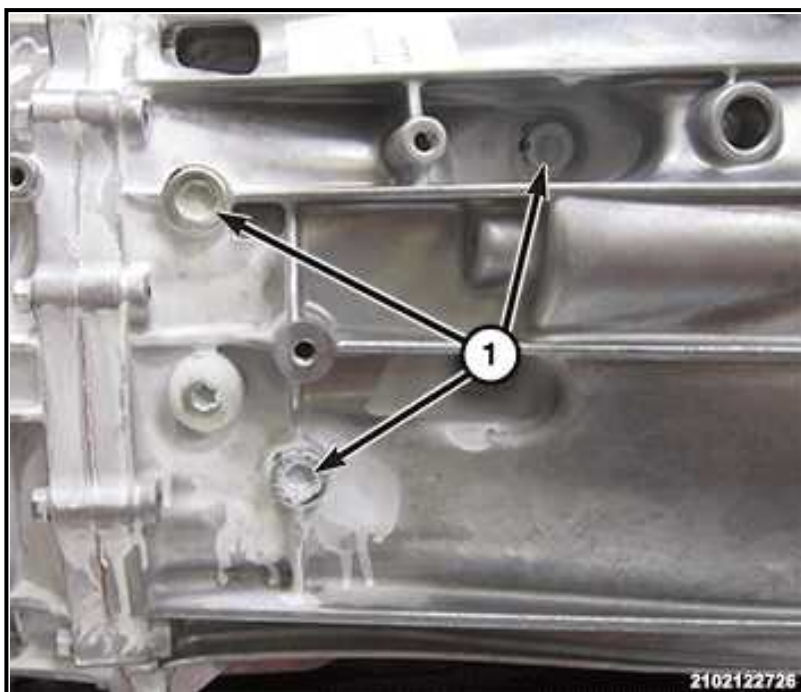
1 - Reverse Idler Gear Front Bolt

17. Install the reverse idler gear front bolt with a **NEW** washer and hand tighten.



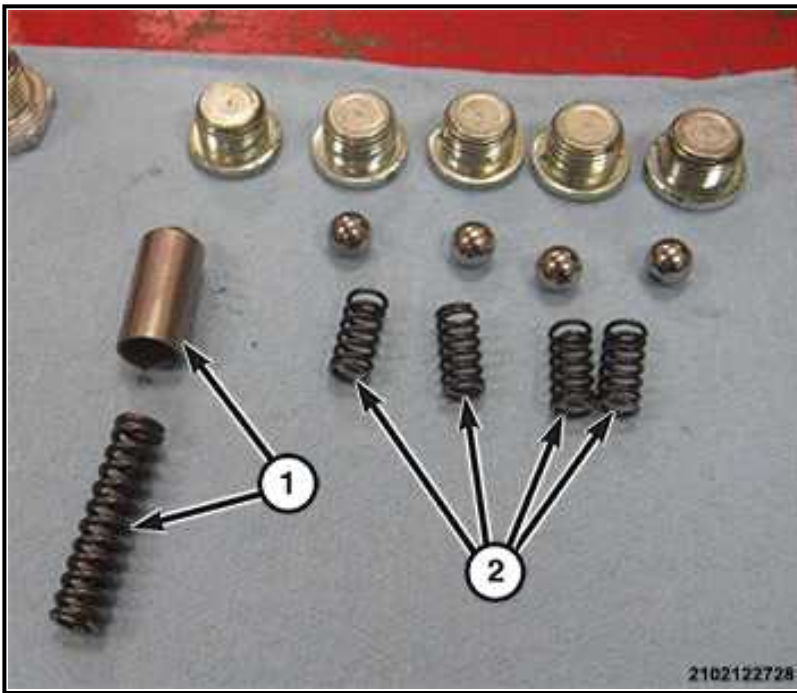
1 - Reverse Idler Gear Side Bolt

18. Install the reverse idler gear side bolt with a **NEW** washer and tighten both reverse idler bolts to the proper. Refer to **TORQUE SPECIFICATIONS** .



1 - Front Shift Fork Detent Plugs

19. Install the front shift fork detent balls, springs and **NEW** plugs into the top 2 bores (case standing on bell housing). Install the long sleeve and spring to the bottom front bore with the **NEW** plug and tighten to the proper. Refer to **TORQUE SPECIFICATIONS** .



1 - Shift Fork Detent Spring And Sleeve

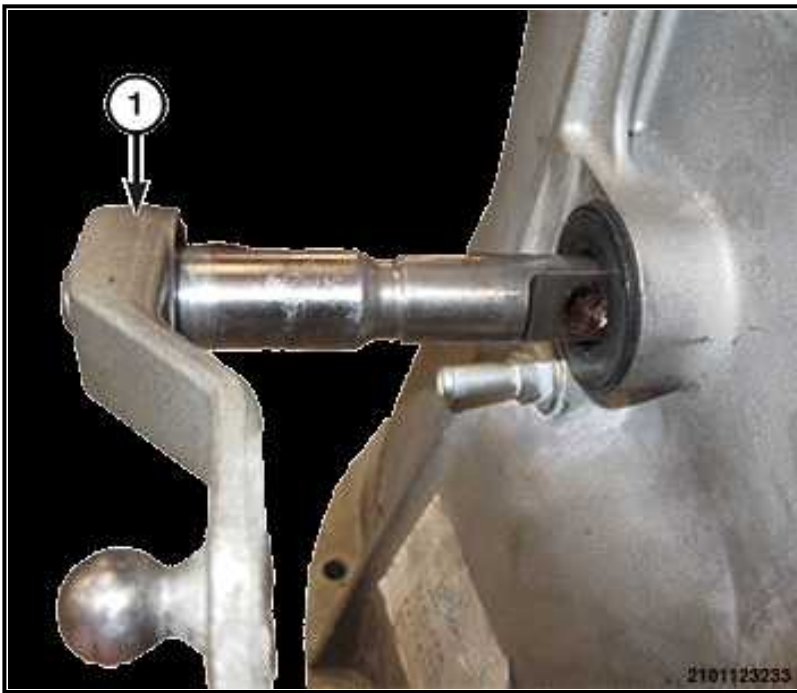
2 - Shift Fork Detent Springs

20. The shift fork detent spring and sleeve go to the very front, right side detent. The remaining shift fork detent springs and shift fork detent balls are all the same size and all the springs have the same tension.



1 - Inner Shift Lever

21. Install the inner shift lever.



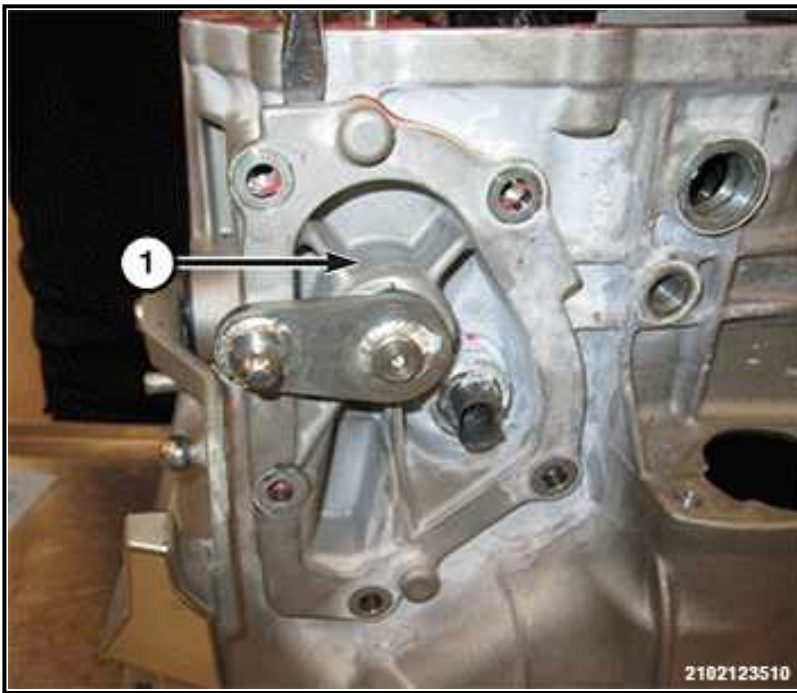
1 - Outer Shift Lever

22. Install the outer shift lever.



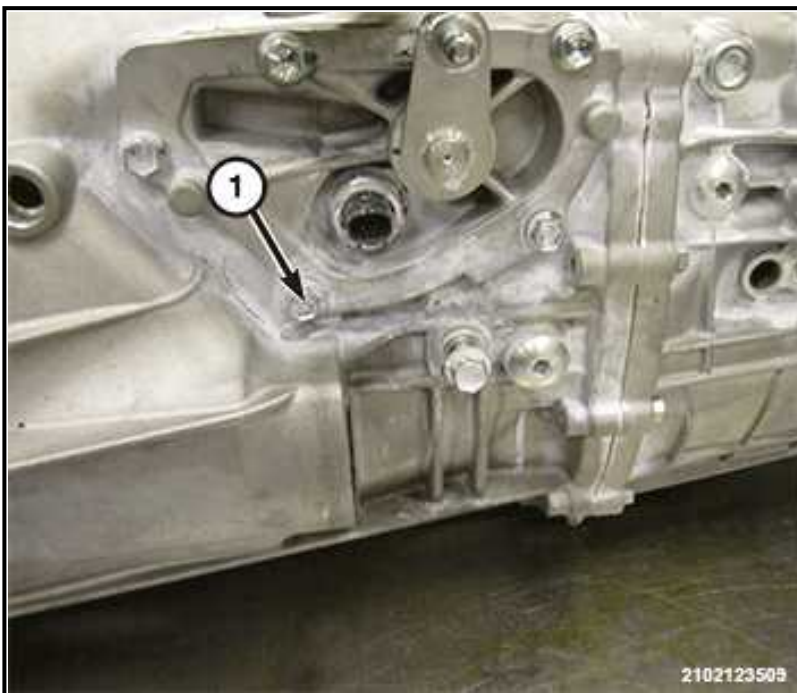
1 - Inner Shift Lever Bolt

23. Install the **NEW** inner shift lever bolt and tighten to the proper. Refer to [**TORQUE SPECIFICATIONS**](#)



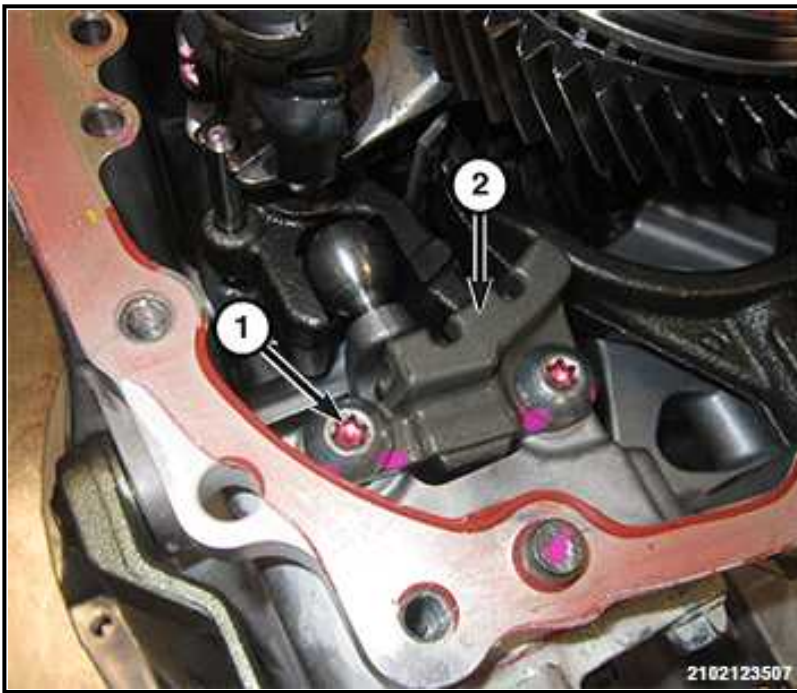
1 - Selector Lever Cover Assembly

24. Clean the selector lever cover assembly and the mating surface on the case using a plastic scraper and brake clean. Apply a 1/8 inch bead of MoparB® orange RTV to the sealing surface of the selector lever cover assembly.



1 - Selector Lever Cover Assembly Bolts

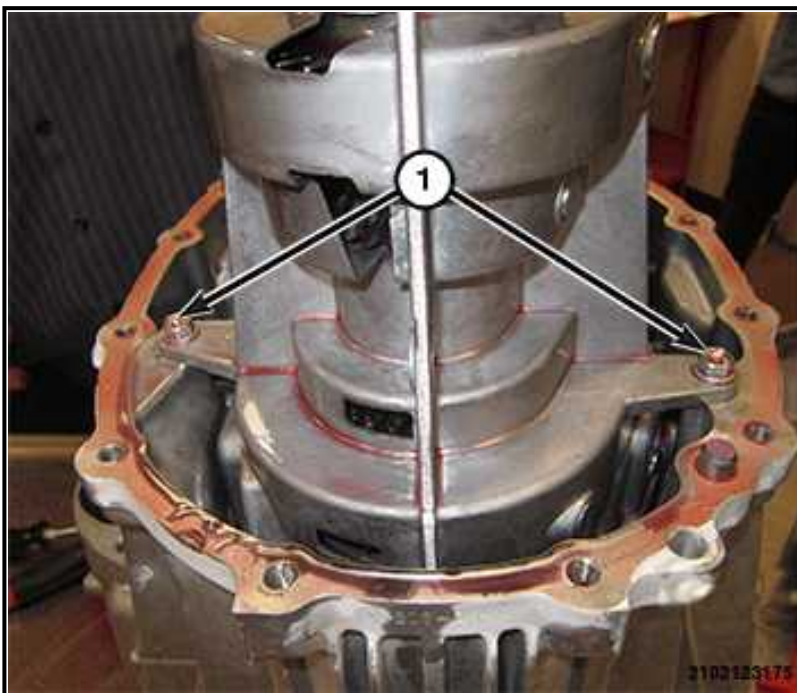
25. Position the select lever cover assembly to the transmission, then install the bolts and tighten to the proper. Refer to [**TORQUE SPECIFICATIONS**](#) .



1 - Shift Guide Plate Bolts

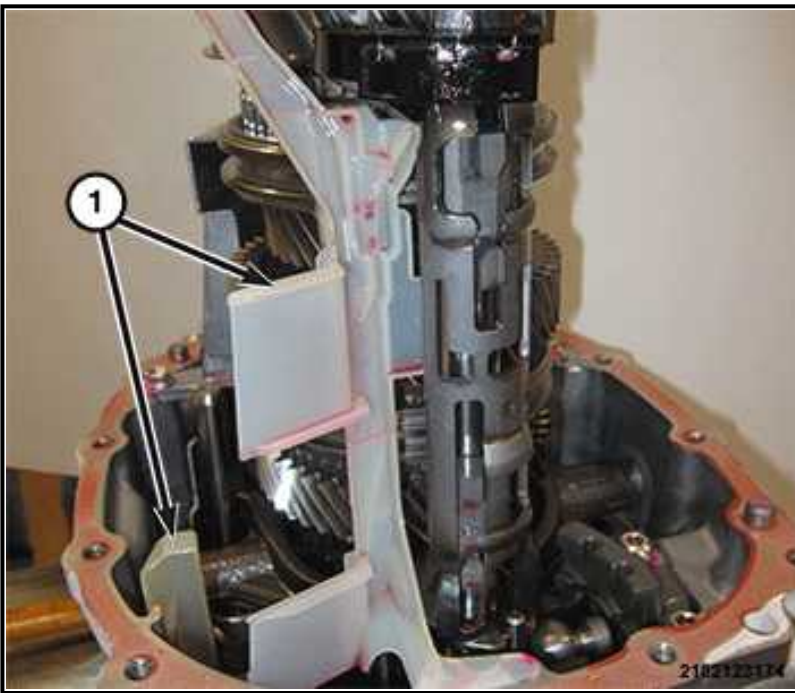
2 - Shift Guide Plate

26. Install the shift guide plate. Install the shift guide plate bolts and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#) .



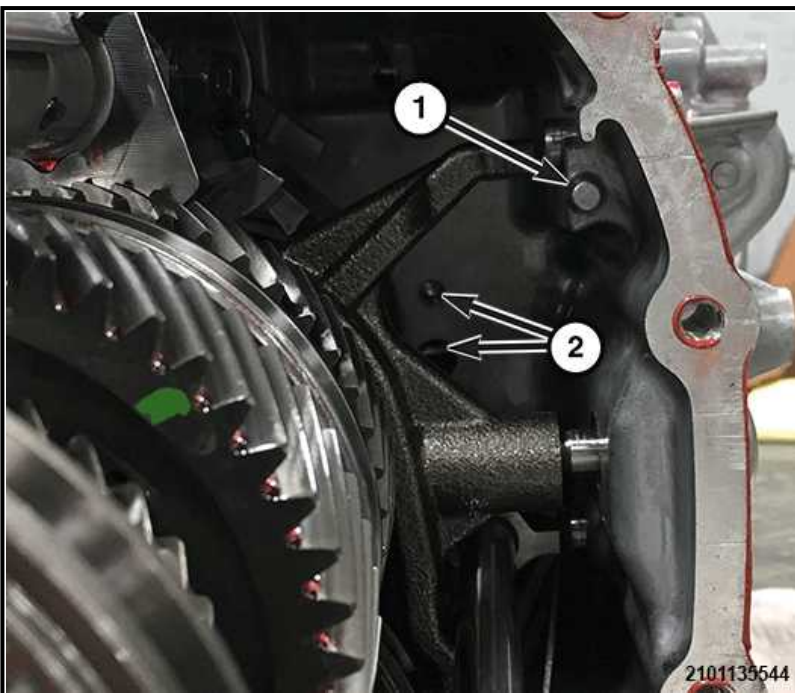
1 - Oil Separator Bolts

27. Install the oil separator bolts and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#) .



1 - Oil Feed Tubes

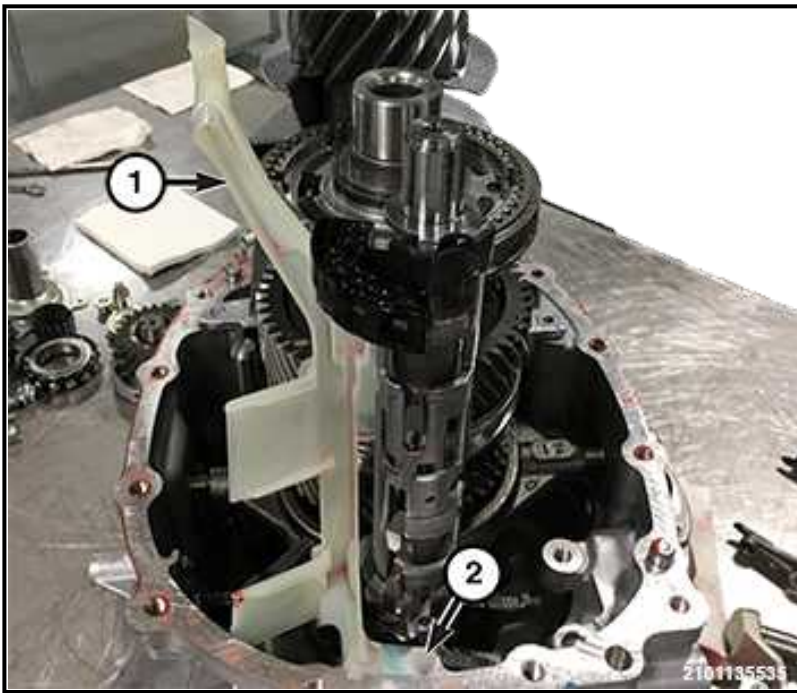
28. Install the plastic oil feed tubes.



1 - Oil Feed Locating Tip

2 - Oil Feed Holes

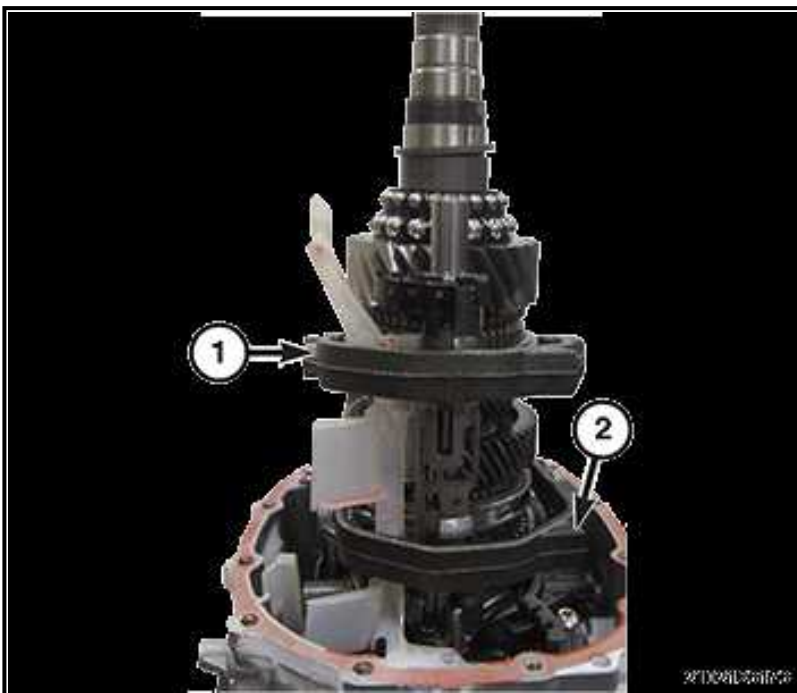
29. Verify the tubes are seated in the oil feed locating tip and holes in the front case half.



1 - Oil Feed Tubes

2 - Oil Feed Tubes Upper Guide Hole

30. Verify the oil feed tube is seated in the upper guide hole.



1 - 3-4 Shift Fork

2 - 5-6 Shift Fork

31. Install the 3-4 shift fork and the 5-6 shift fork on the mainshaft.



1 - Input Shaft Rear Bearing

32. Install the input shaft rear bearing.

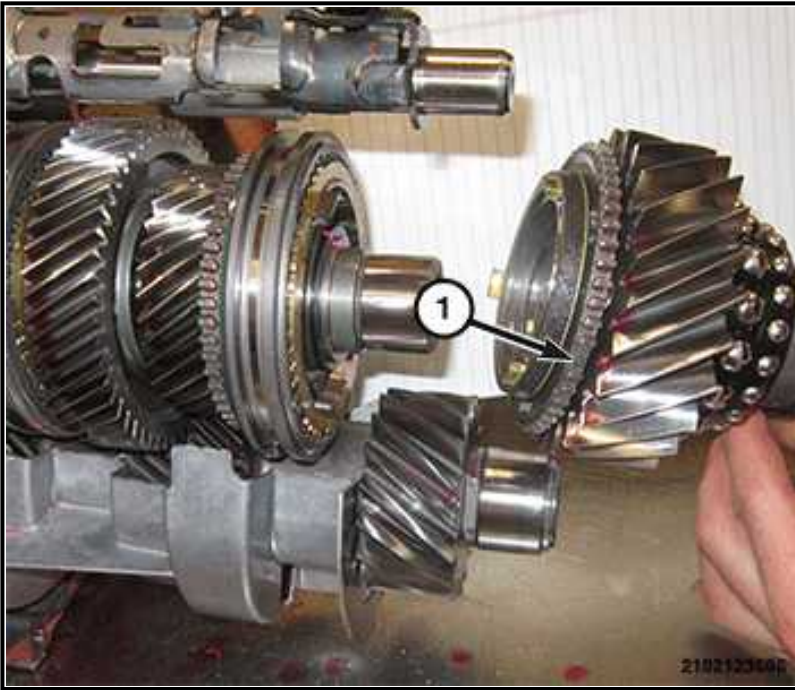


1 - Installer, Bearing Output Shaft 2052300210

2 - Mainshaft Output Shaft Bearing

3 - Mainshaft Output Shaft

33. If replacing the mainshaft output shaft bearing, press the **NEW** mainshaft output shaft bearing on the mainshaft output shaft using (special tool #2052300210, Installer, Bearing Output Shaft).



1 - Mainshaft Output Shaft

34. Install the mainshaft output shaft to the mainshaft. Make sure the synchronizer is fully seated.



1 - Shim

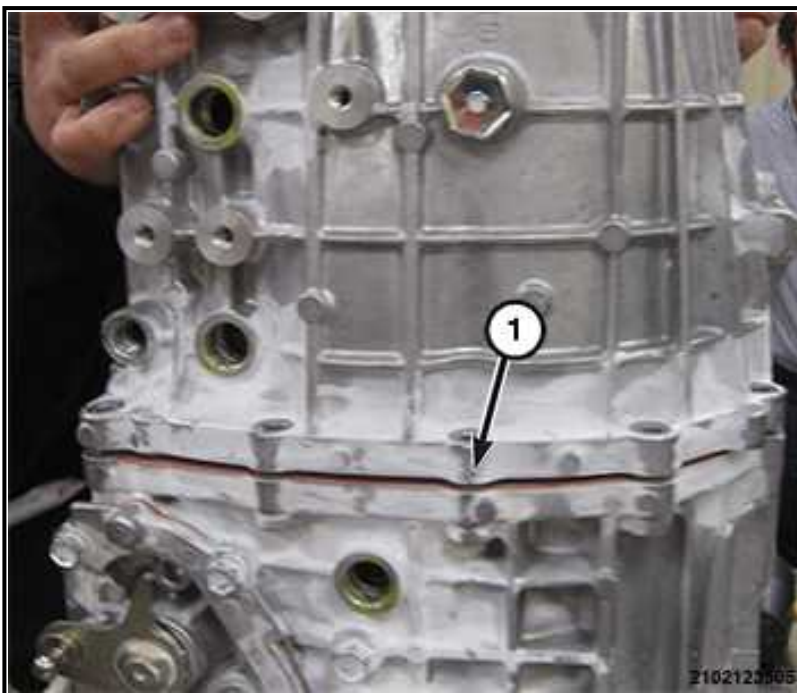
2 - Mainshaft Output Shaft Bearing

35. Install the output shim to the mainshaft output shaft.



1 - Seal

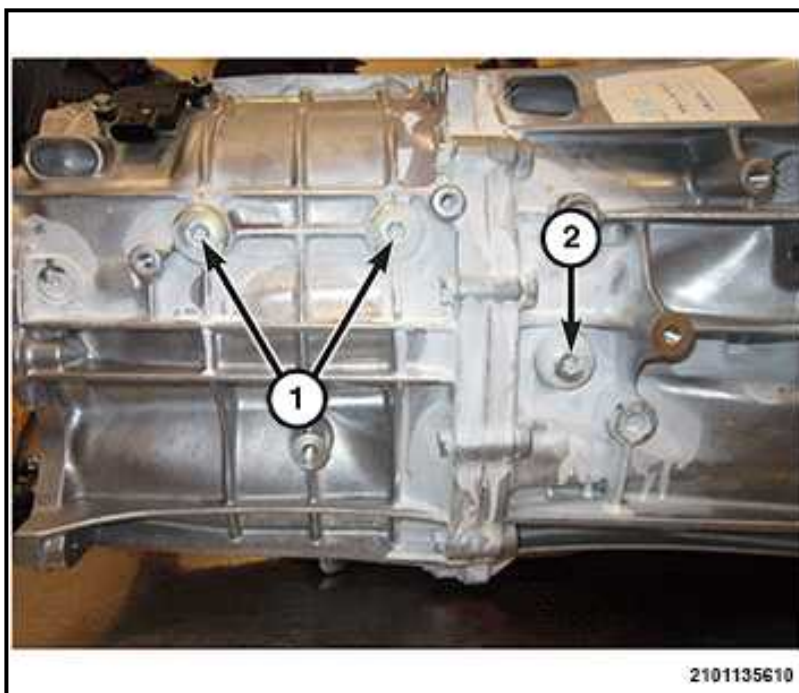
36. Install the seal into the rear case half. Verify the seal is fully seated in the groove.



1 - Rear Case

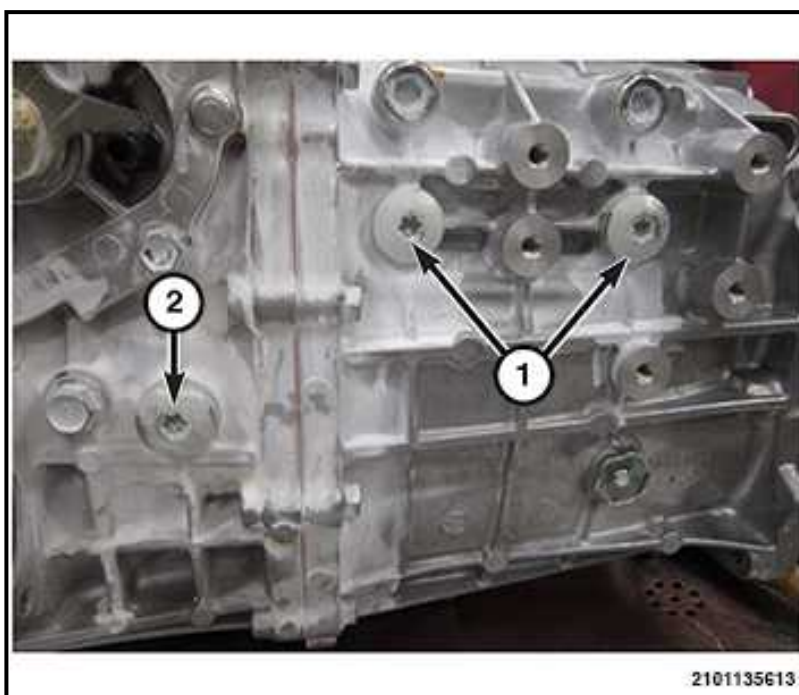
37. Clean both case half mating surfaces. Apply a 1/8 inch bead of MoparB® orange RTV around the stationary case half mating surface. Operate the selector lever and shift into 2nd gear. Install the rear case.

NOTE: Before installing the rear case, verify the shift select shaft and reverse fork shaft are standing vertical. In addition, verify that the 3-4 fork and 5-6 fork are in the correct position.



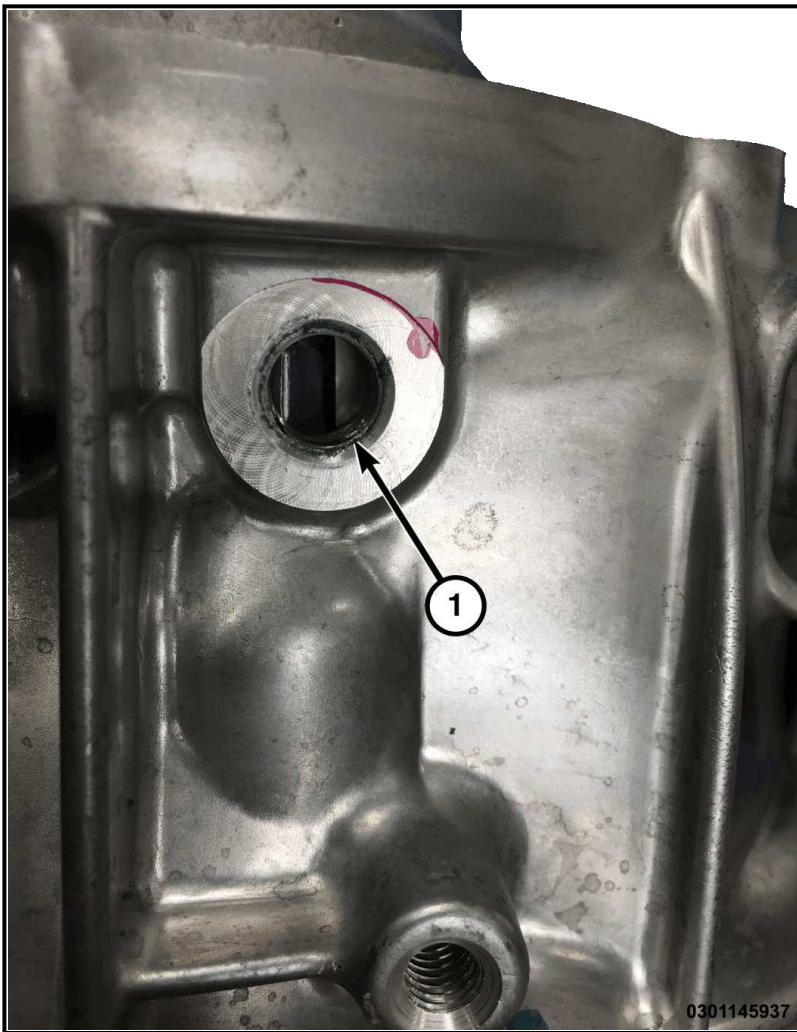
- | |
|--|
| 1 - Rear Shift Fork Support Bolts |
| 2 - Right Side Front Shift Fork Pivot Bolt |

38. Install the right side rear shift fork support bolts.



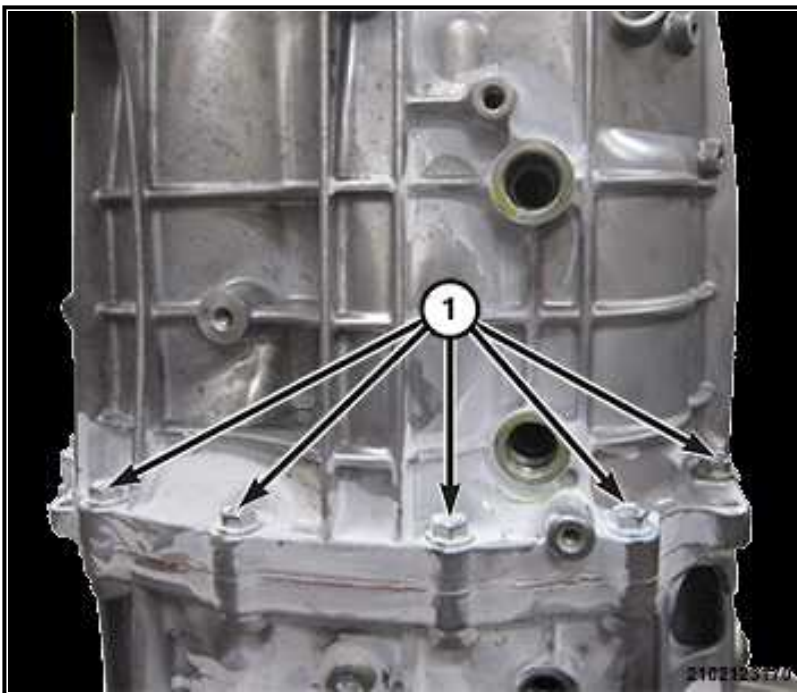
- | |
|---|
| 1 - Rear Shift Fork Support Bolts |
| 2 - Left Side Front Shift Fork Pivot Bolt |

39. Install the left side rear shift fork support bolts and tighten both side shift fork support bolts to the proper. Refer to **TORQUE SPECIFICATIONS** .



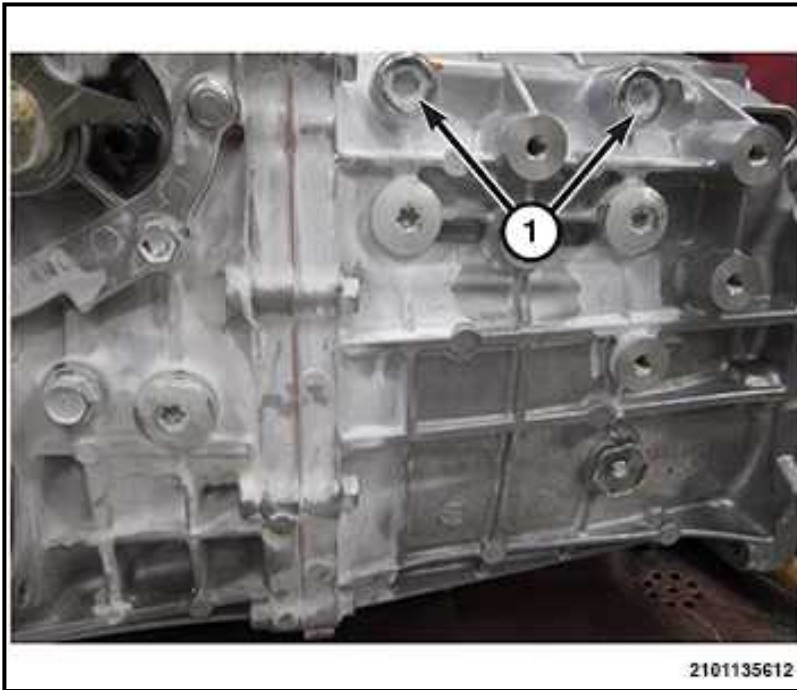
1 - cover plug hole

40. Remove the cover plug and verify the oil feed tube is aligned to the cover plug hole. Reinstall the cover plug and tighten to the proper. Refer to [**TORQUE SPECIFICATIONS**](#) .



1 - Rear Case Bolts

41. Install the rear case bolts and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#) . Tighten the bolts in a crisscross pattern.



1 - Rear Shift Fork Detent Plugs

42. Install the rear shift fork detent balls, springs and plugs to the case and tighten the shift fork detent plugs to the proper. Refer to [TORQUE SPECIFICATIONS](#) .



1 - Socket, Allen 27 mm 2051400210

43. Install the countershaft bearing snap ring service plug using (special tool #2051400210, Socket, Allen 27 mm) and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#) .



1 - Installer, Seal Input Shaft 2052000210

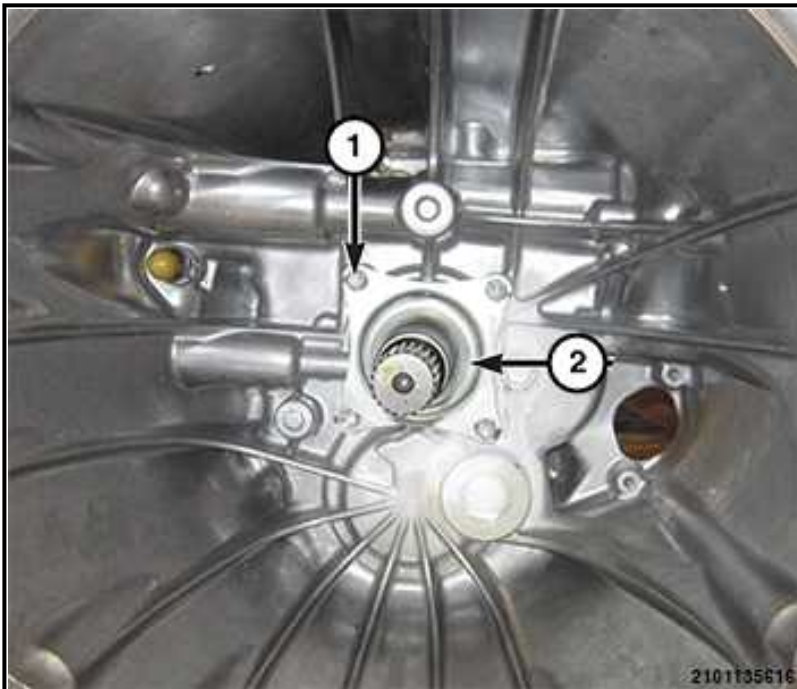
44. Install a

NEW

front input seal using

(special tool #2052000210, Installer, Seal Input Shaft).

NOTE: Verify the front input seal installed depth is within specification. Refer to **TORQUE SPECIFICATIONS** .



1 - Front Input Shield Bolts

2 - Front Input Shield

45. Install the input shaft sleeve and the input shaft sleeve bolts and tighten to the proper. Refer to **TORQUE SPECIFICATIONS** .

46. Install the range position switch.

Refer to [SWITCH, RANGE POSITION, REMOVAL AND INSTALLATION](#).



1 - Output Shaft Lock Nut

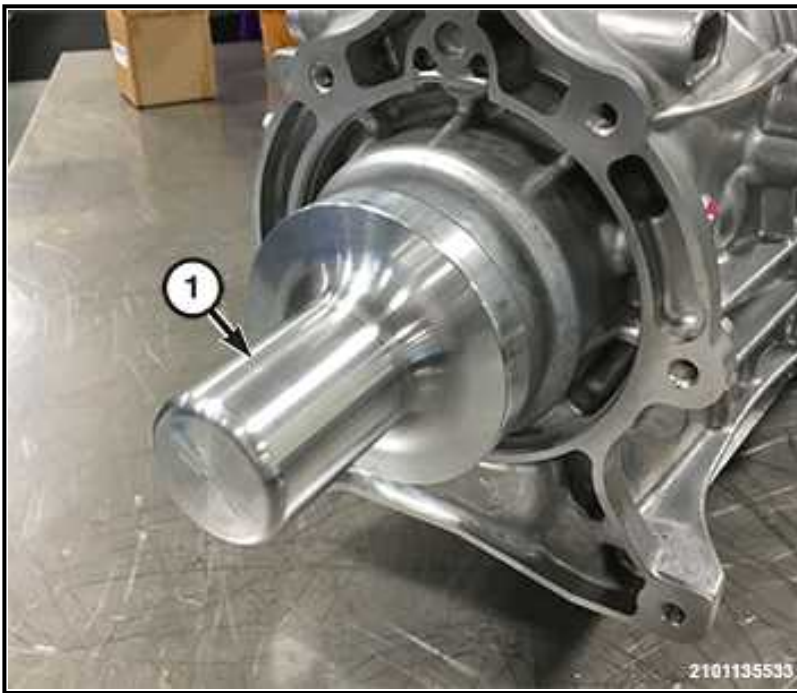
2 - Rear Output Bearing

47. Install the rear output bearing and the **NEW** output shaft lock nut. Use (special tool #2051600210, Socket, Spline Input Shaft 21 Teeth) to hold the input shaft and (special tool #2051500210, Socket, Output Shaft 60 mm) to tighten the nut to the proper. Refer to [TORQUE SPECIFICATIONS](#).



1 - Output Shaft Lock Nut Stake

48. Stake the nut to the locknut groove on the output shaft.



1 - Installer, Seal Output Shaft 2051900210

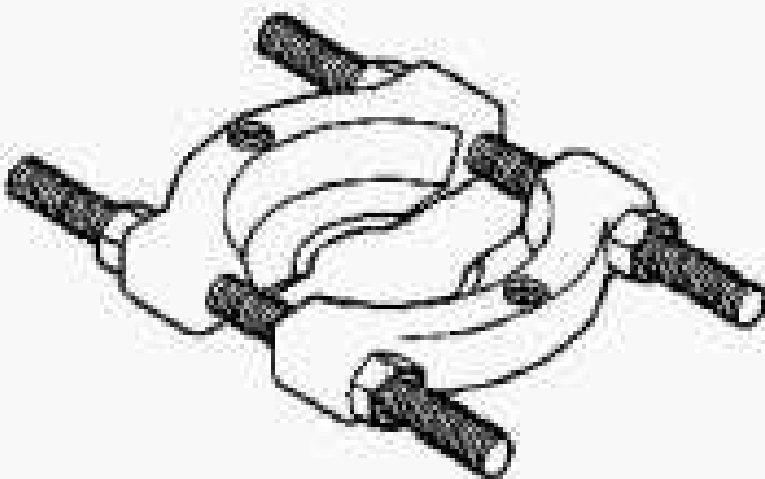
49. Install a **NEW** rear oil seal using (special tool #2051900210, Installer, Seal Output Shaft).

NOTE: **Verify the rear output seal installed depth is within specification. Refer to TORQUE SPECIFICATIONS .**

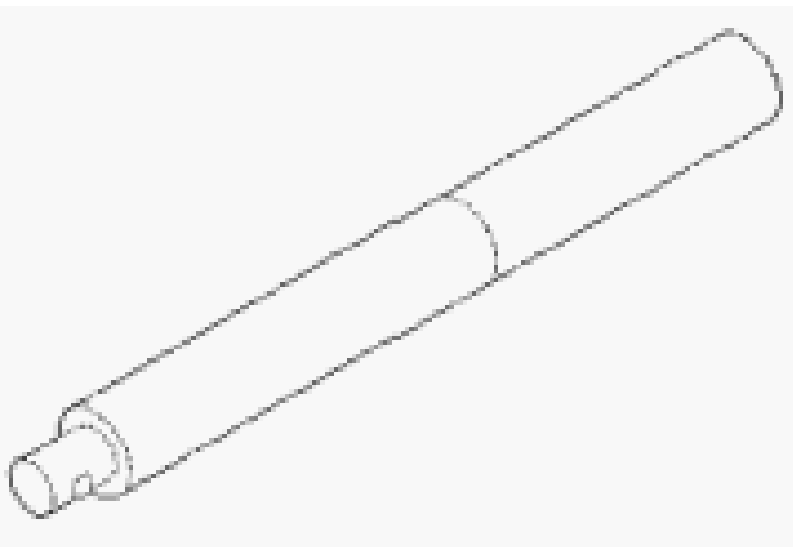
CLEANING

Clean the gears, bearings, shafts, synchronizers, thrust washers, oil feeder, shift mechanism, gear case, and bell housing. Do not use solvent to clean sealed bearings. Dry all parts except the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

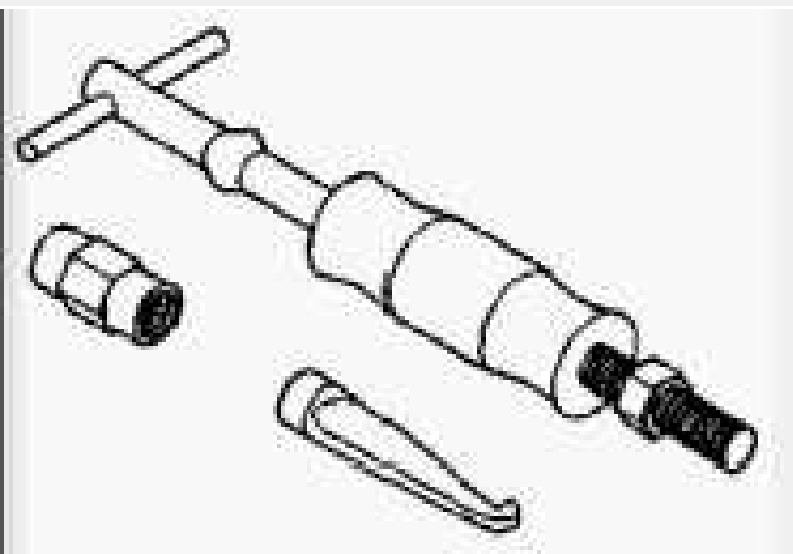
SPECIAL TOOLS



1130 - Splitter, Bearing/Gear
(Originally Shipped In Kit Number(s)
6745, 6947, 6949, 9202, 9202A-CAN,
9202CC, 9299.)



C-4171 - Driver Handle, Universal
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



C-637 - Slide Hammer, Universal
(Originally Shipped In Kit Number(s)
9202.)



2051400210 - Socket, Allen 27 mm



2051500210 - Socket, Output Shaft 60 mm



2051600210 - Socket, Spline Input Shaft 21 Teeth



2051700210 - Socket, Spline Output Shaft 43 Teeth



2051800210 - Remover, Seal Input Shaft



2051900210 - Installer, Seal Output Shaft



2052000210 - Installer, Seal Input Shaft



2052100210 - Installer, Output Shaft
Outer Race



2052200210 - Installer, Bearing
Countershaft



2052300210 - Installer, Bearing Output
Shaft



2052400210 - Installer, Bearing 22 mm



2052500210 - Installer, Bearing 18 mm



2052600210 - Installer, Bearing 12 mm



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2052700210 - Kit, Shifter Bearing Remover



©MoparEssentialTools.com

2052701210 - Collet, 12 mm



©MoparEssentialTools.com

2052702210 - Collet, 18 mm



2052703210 - Collet, 22 mm



2052704210 - Receiver, Small



2052705210 - Receiver, Medium



2052706210 - Receiver, Large



2052707210 - Screw, Collet Forcing



**ESSENTIAL
TOOLS**

2066300210 - Installer, Oil Plug



**ESSENTIAL
TOOLS**

2049201090 - Adapter, Pressure Test
Regulator

BOOT, GEARSHIFT

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION

REMOVAL

1. Remove the gear shift knob. Refer to [KNOB, GEARSHIFT, REMOVAL AND INSTALLATION](#).



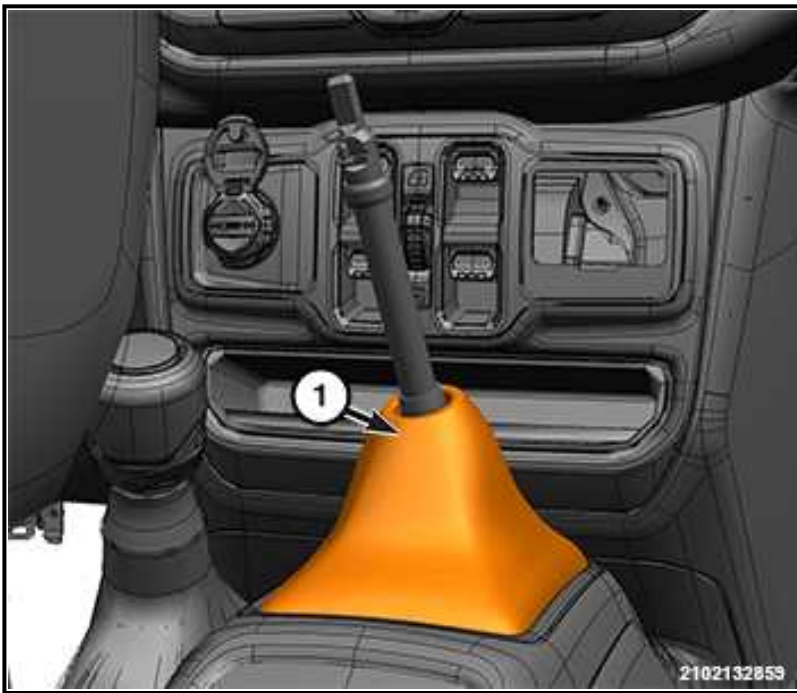
1 - Lift Ring Spring

2. Remove the lift ring spring from on top of the lift ring.



1 - Lift Ring

3. Remove the lift ring.

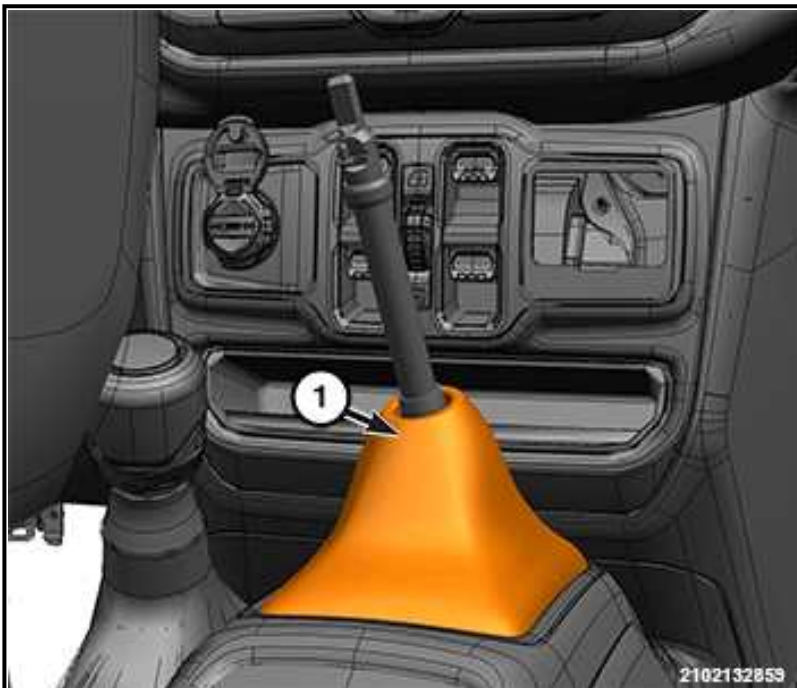


1 - Gearshift Boot

4. Using a trim stick or equivalent, separate the gearshift boot from the floor console while gently pulling up on the boot fabric.
5. Remove the gearshift boot from the shifter.

INSTALLATION

1. With the shift knob removed, place the gearshift boot in position over the shift lever.



1 - Gearshift Boot

2. Install the gearshift boot and press it firmly into the floor console to engage the retention clips.



1 - Lift Ring

3. Install the lift ring.



1 - Lift Ring Spring

4. Install the lift ring spring.

5. Install the shifter knob. Refer to [KNOB, GEARSHIFT, REMOVAL AND INSTALLATION](#).

CABLE, GEARSHIFT CONTROL

ADJUSTMENTS

GEAR SHIFT CABLE ADJUSTMENT

NOTE: The select cable adjustment device is located at the shifter end of the neutral gate cable.

1. From inside the passenger compartment, depress the clutch pedal and move the shift lever to the 3rd gear range position. Jiggle the shifter to either side (left and right) and then release the shift knob and let the spring center the shift lever. Use a scan tool to verify the vehicle is in the 3/4 neutral gate position.
2. Locate the neutral gate select cable to the right side of the shifter assembly.



1 - Locking Tab

3. Release the adjuster by pushing the locking tab outward.
4. Once the cable is adjusted to the desired position, depress the locking tab to lock the adjuster.
5. Verify that the shifter operates properly.

REMOVAL AND INSTALLATION

GEAR SHIFT CABLES

REMOVAL

CAUTION: If any of the shift cables or shift cable brackets are removed, the cable adjustment must be checked. This adjustment is critical. If not set correctly, transmission damage is possible.

NOTE: The transmission shift cables are serviced as a set. The cable ends are too large to be drawn through the holes in the rubber floor plug.

1. Remove the floor console. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#)
[CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Shifter Cable Retainer

2. Disengage the retainers holding the cable housings to the shifter bracket by grabbing the collar on the cable and sliding it forward, while gently lifting up on the cable.



1 - Neutral Gate Cable End

2 - Range Cable End

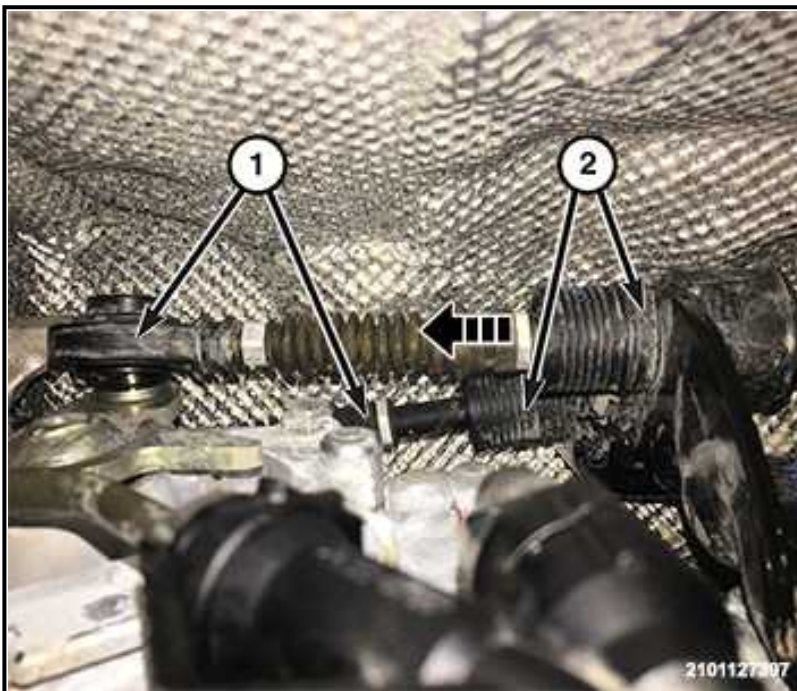
3. Pry the neutral gate cable end to the right toward the passenger seat to disengage the cable end from the shifter pin.
4. Release the spring-clip holding the range cable end to the fulcrum ball under the shifter handle and push the cable end downward to disengage it.



1 - Shifter Cable Grommet Nuts

5. Remove the nuts from the shifter cable grommet, push the shifter cable grommet downward, taking care not to tear the shifter cable grommet.
6. Push the cables down through the shifter cable grommet hole.
7. Raise and support the vehicle

Refer to [**HOISTING, STANDARD PROCEDURE**](#) .



1 - Cable Ends

2 - Retainer

8. Disengage the retainer holding the range cable to the transmission bracket and lift the range cable housing from the bracket.
9. Pry the range cable upward to disengage the cable end (1) from the counterweighted gearshift lever.
10. Disengage the retainer holding the neutral gate cable to the transmission bracket and lift the cable housing from the bracket.

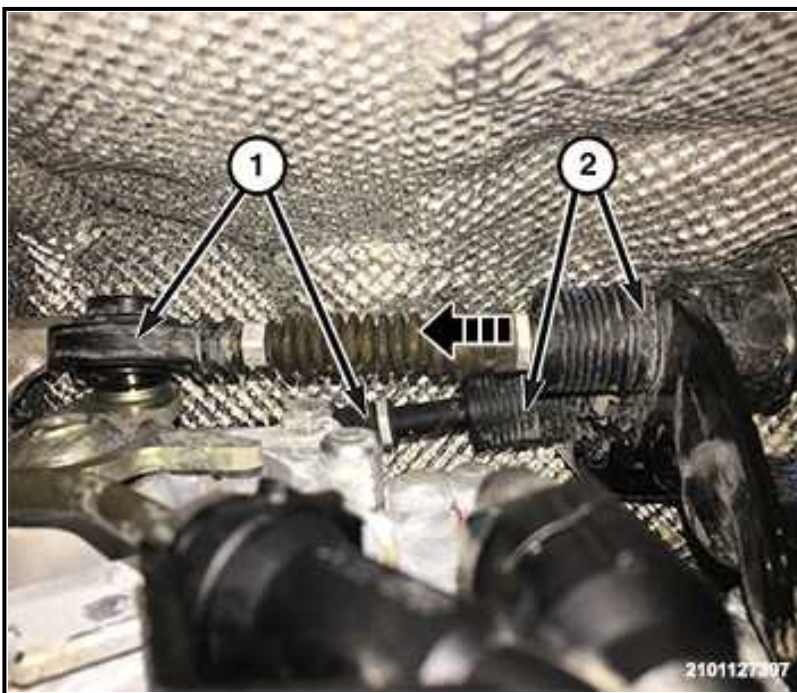
11. Pry the neutral gate cable end to the left (driver side) to disengage the cable end from the shift lever
12. Remove the cables from the vehicle.

INSTALLATION

CAUTION: If any of the shift cables or shift cable brackets are removed, the cable adjustment must be checked. This adjustment is critical. If not set correctly, transmission damage is possible.

NOTE: The transmission shift cables are serviced as a set. The cable ends are too large to be drawn through the holes in the rubber floor plug.

1. Raise and support the vehicle Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Insert the shift cables through the access hole in the floor pan under the vehicle.
3. Push the rubber floor plug upward into the access hole and align the studs to the mounting holes in the underside of the floor pan.



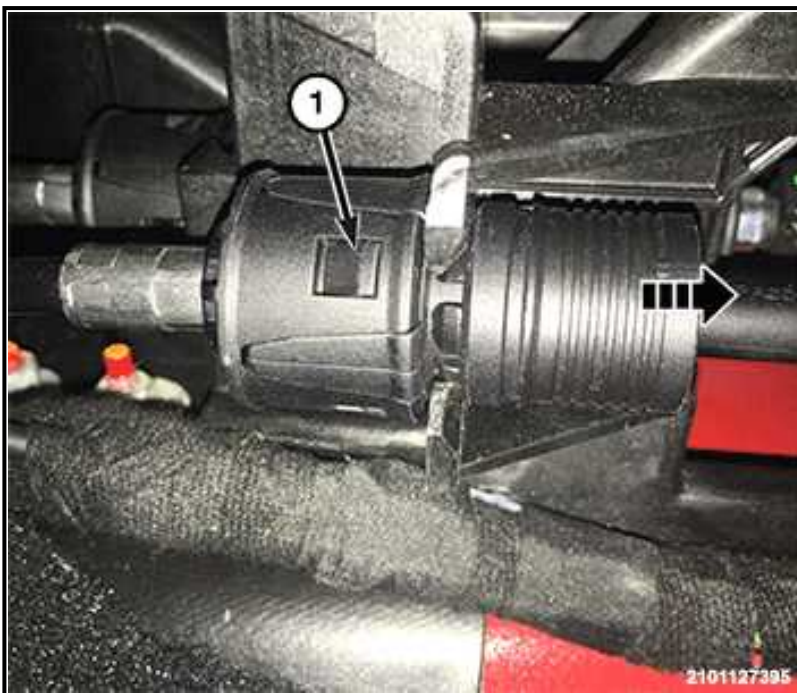
1 - Cable Ends
2 - Retainer

4. Route the cables under the vehicle and position the retainers in the shift cable bracket (range select cable located on top, neutral gate cable located on bottom). Push down on the cable retainers to snap them into place.
5. Connect the cable ends to the shift levers at the transmission (range select the on top, neutral gate on the left side).
6. Remove the support and lower the vehicle.



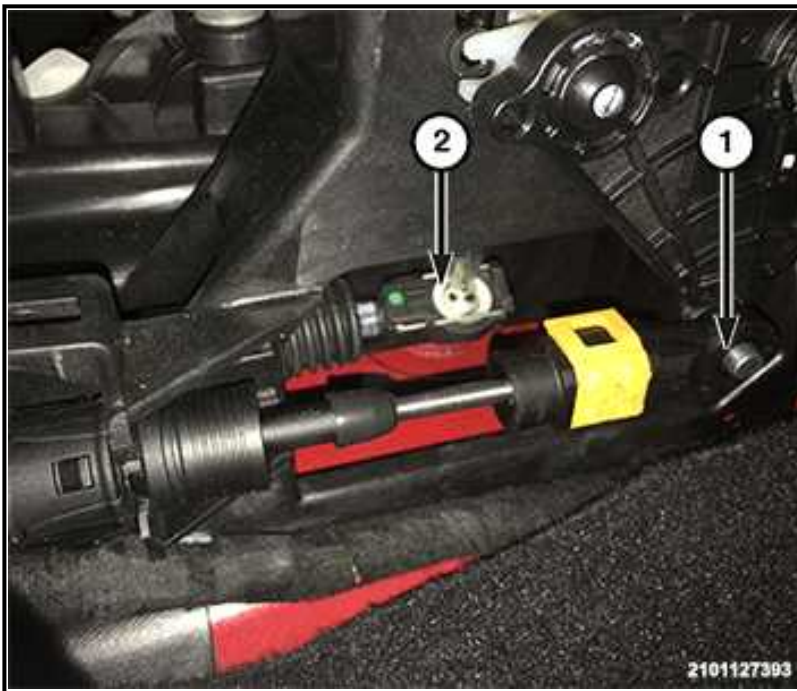
1 - Shifter Cable Grommet Nuts

7. Tighten the shifter cable grommet nuts to the proper. Refer to [TORQUE SPECIFICATIONS](#) .



1 - Shifter Cable Retainer

8. Route the range cable under the shifter and engage the cable housings into position on the shifter bracket. Push to the left to lock the cable housings in place.



1 - Neutral Gate Cable End

2 - Range Cable End

9. Connect the range cable end to the ball end under the shifter, ensuring the retaining clip snaps into place. Position the neutral gate cable end to the shift lever and snap it in place.

NOTE: Do not lock the neutral gate cable adjustment yet.

10. Position the gear shifter in third gear inside the vehicle.



1 - Locking Tab

11. While holding the shifter forward against the blocker in third gear, depress the locking tab to lock the adjuster.
12. Verify the shifter goes into all gears smoothly and there is no resistance or excessive force needed to shift into all gears.
13. Install the floor console assembly

Refer to **CONSOLE, FLOOR, REMOVAL AND INSTALLATION** **CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION** .

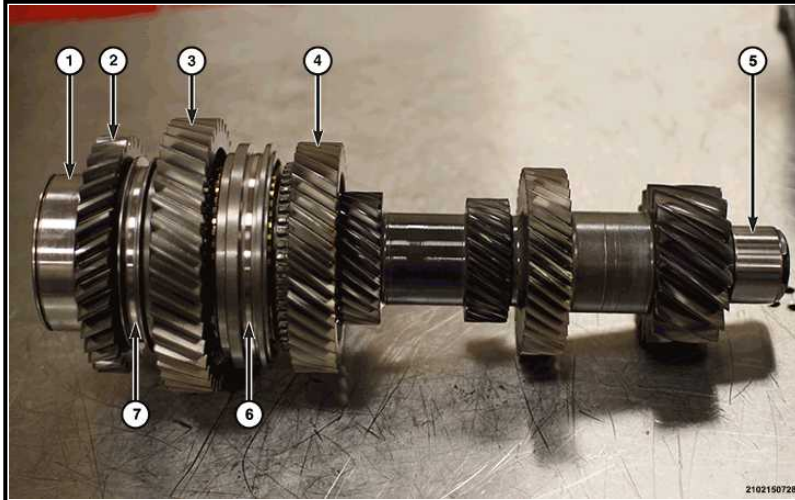
14. Road test the vehicle to verify the repair.

COUNTER SHAFT, TRANSMISSION

DISASSEMBLY AND ASSEMBLY

COUNTERSHAFT

DISASSEMBLY



PART IDENTIFICATION

Callout	Part
1.	Front Bearing
2.	Reverse Gear
3.	First Gear
4.	Second Gear
5.	Rear Bearing Race
6.	1-2 Synchronizer
7.	Reverse Synchronizer



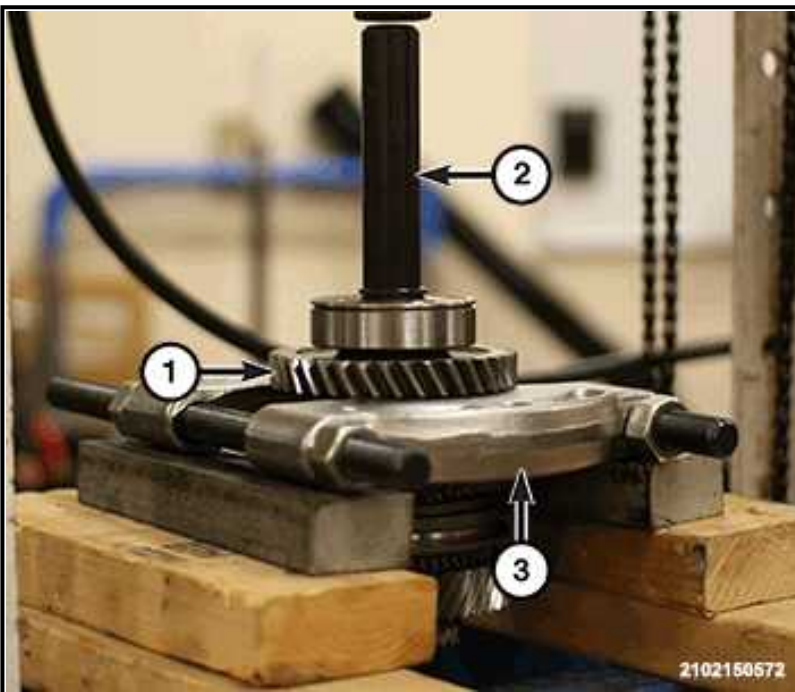
1 - Front Case Bearing Snap Ring

1. Using a suitable tool, remove the snap ring from the shaft holding the front case bearing.



1 - Reverse Synchronizer Sleeve

2. Place the reverse synchronizer sleeve toward the 1st gear to provide space to support the gear for removal.

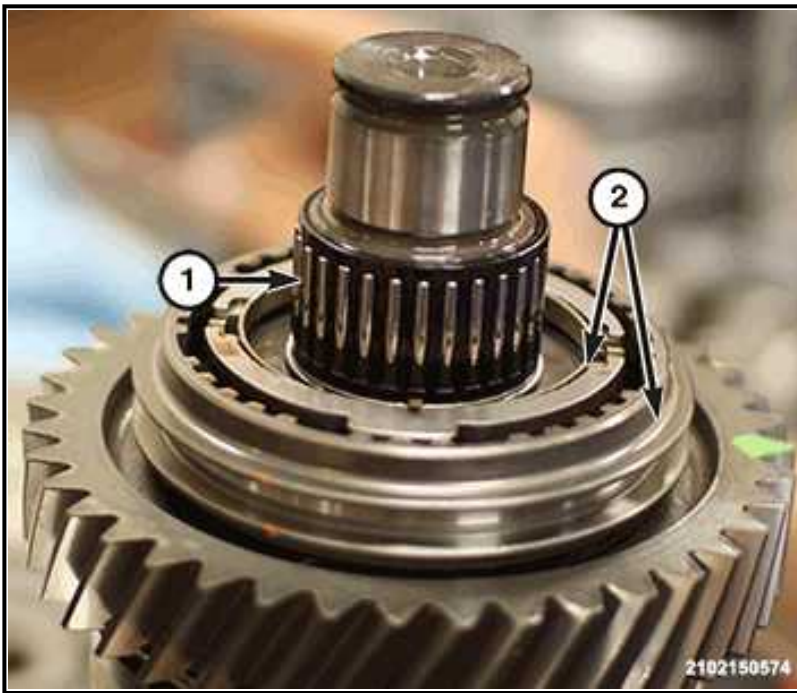


1 - Reverse Gear

2 - Installer, Seal 8253

3 - Splitter, Bearing/Gear 1130

3. Using the puller (special tool #1130, Splitter, Bearing/Gear) and a press, place the splitter under the reverse gear and press the shaft using (special tool #8253, Installer, Seal) to remove the bearing and reverse gear. Be sure to support the countershaft to prevent it from damage when the bearing and reverse gear separate from the countershaft.



1 - Reverse Gear Needle Bearing

2 - Reverse Gear Synchronizer Assembly
--

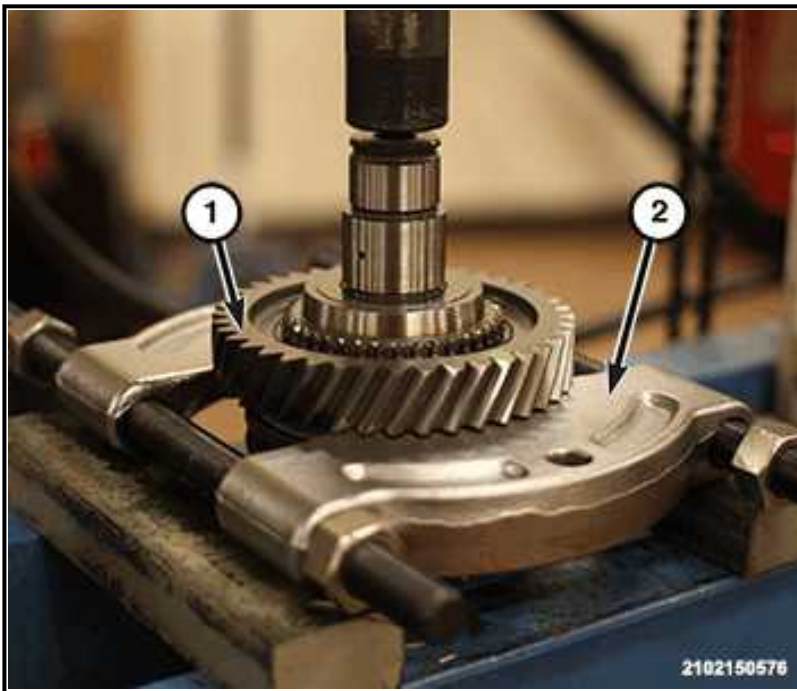
4. Remove the reverse gear needle bearing and the synchronizer assembly from the shaft assembly.



1 - Needle Bearing Spacer

2 - 1st Gear Snap Ring

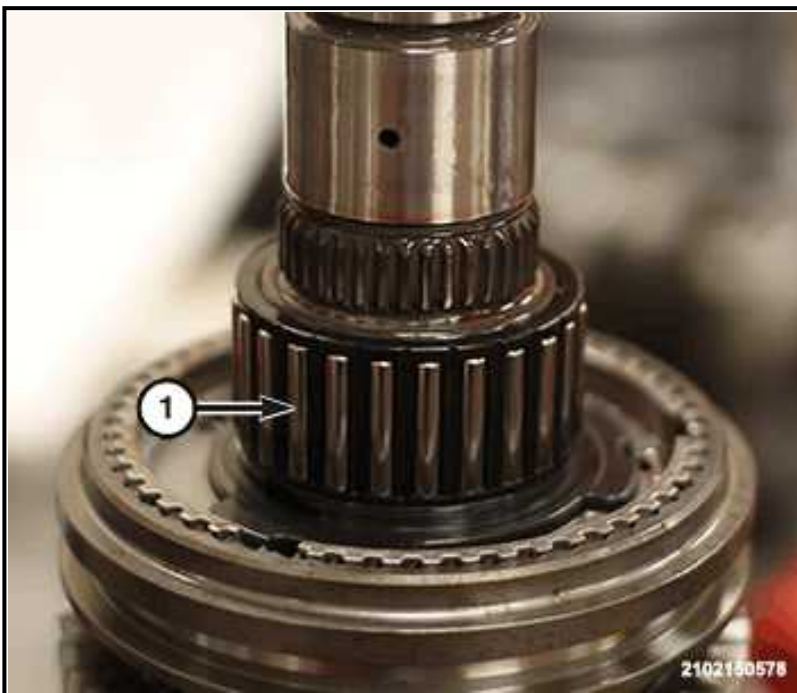
5. Remove the needle bearing spacer and the snap ring retaining 1st gear.



1 - 1st gear

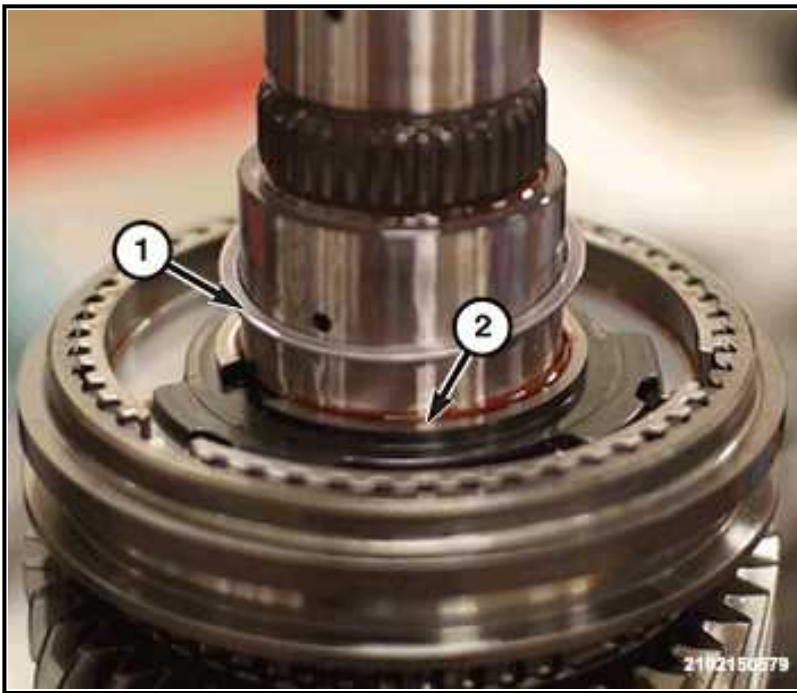
2 - Splitter, Bearing/Gear 1130

6. Using the puller (special tool #1130, Splitter, Bearing/Gear) and a press, support the 1st gear assembly with the bearing splitter and press the shaft to remove the gear.



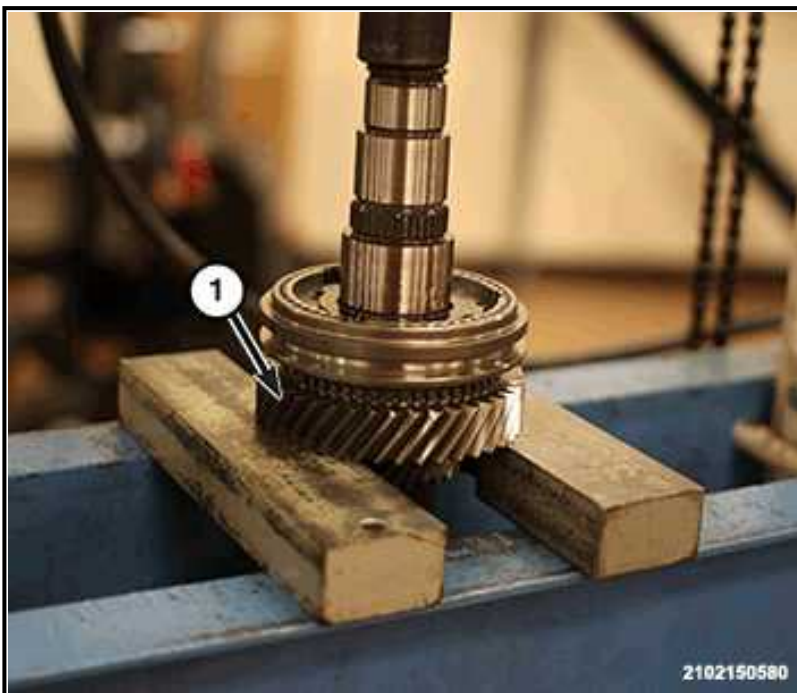
1 - 1st Gear Needle Bearing

7. Remove the 1st gear needle bearing.



- | |
|--------------------------------|
| 1 - Needle Bearing Spacer |
| 2 - 1-2 Synchronizer Snap Ring |

8. Remove the needle bearing spacer and snap ring retaining the 1-2 synchronizer.



- | |
|--------------|
| 1 - 2nd Gear |
|--------------|

9. With a suitable tool supporting 2nd gear and a press, press the shaft to remove the 1-2 synchronizer and 2nd gear assemblies.



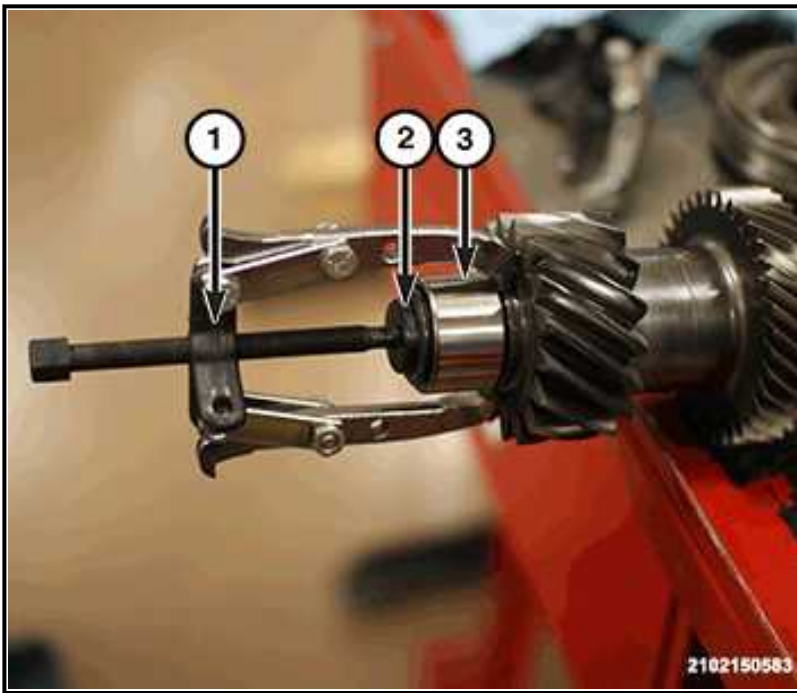
1 - 2nd Gear Needle Bearing

10. Remove the 2nd gear needle bearing from the assembly.



1 - Case Bearing Inner Race Snap Ring

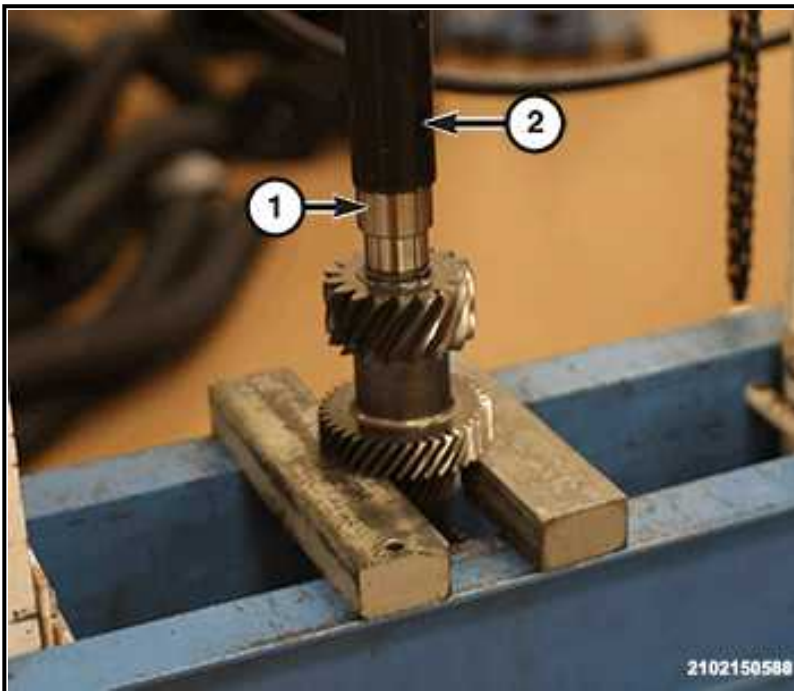
11. Remove the snap ring retaining the case bearing inner race.



1 - Puller 1023
2 - Thrust Button 6055
3 - Case Bearing Inner Race

- Using (special tool #1023, Puller) in the two jaw orientation, press on the (special tool #6055, Thrust Button), to remove the case bearing inner race from the assembly.

ASSEMBLY



1 - Case Bearing Inner Race
2 - Installer, Bearing W-262

- Using a suitable support tool, a press and (special tool #W-262, Installer, Bearing), support the shaft and press case bearing inner race on the countershaft.



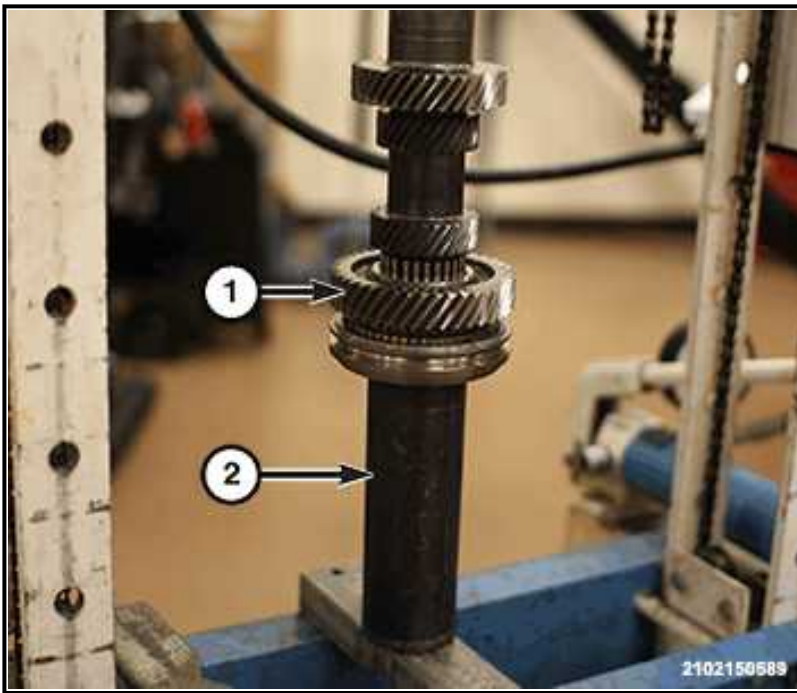
1 - Case Bearing Inner Race Snap Ring (Selective)

2. Due to manufacturing tolerances, install a **NEW , LARGEST** selective snap ring that fits into the groove. Be sure to tap the ends of the snap ring to fully seat.



1 - 2nd Gear Needle Bearing

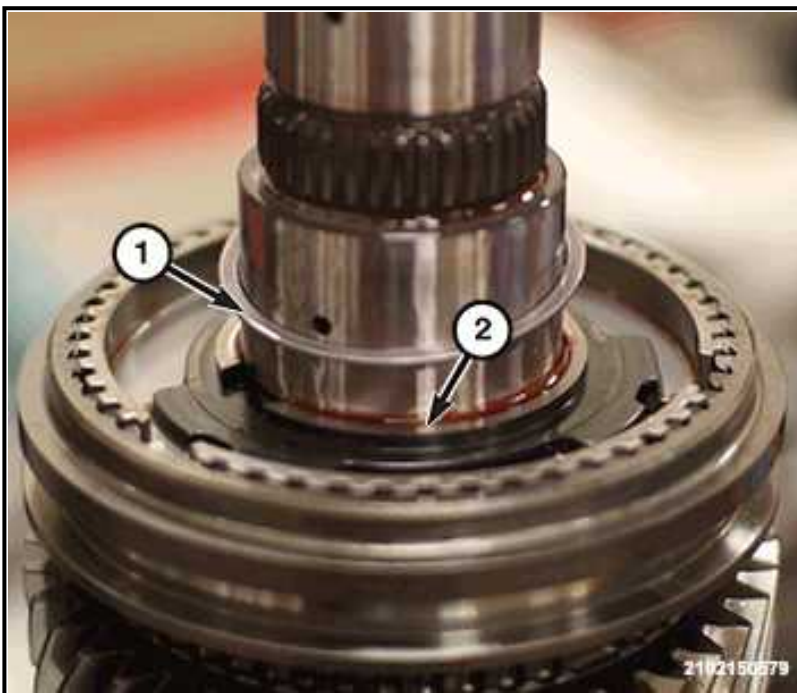
3. Install 2nd gear needle bearing on the shaft.



1 - 2nd Gear

2 - Installer, Bearing D-389

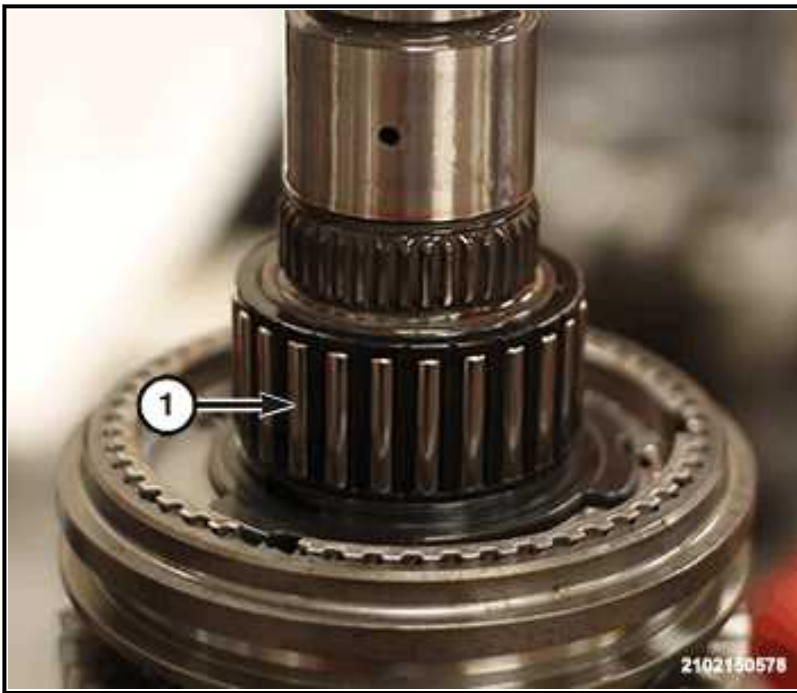
4. Install 2nd gear and 2nd gear synchronizer rings to assembly. Be sure the synchronizer fingers are located properly in the hub and gear to prevent damage. Using the (special tool #D-389, Installer, Bearing) and a press, support the 1-2 synchronizer hub (deep side of hub towards rear, deep step of sleeve towards front), and press the shaft until hub is in place.



1 - Needle Bearing Thrust Washer

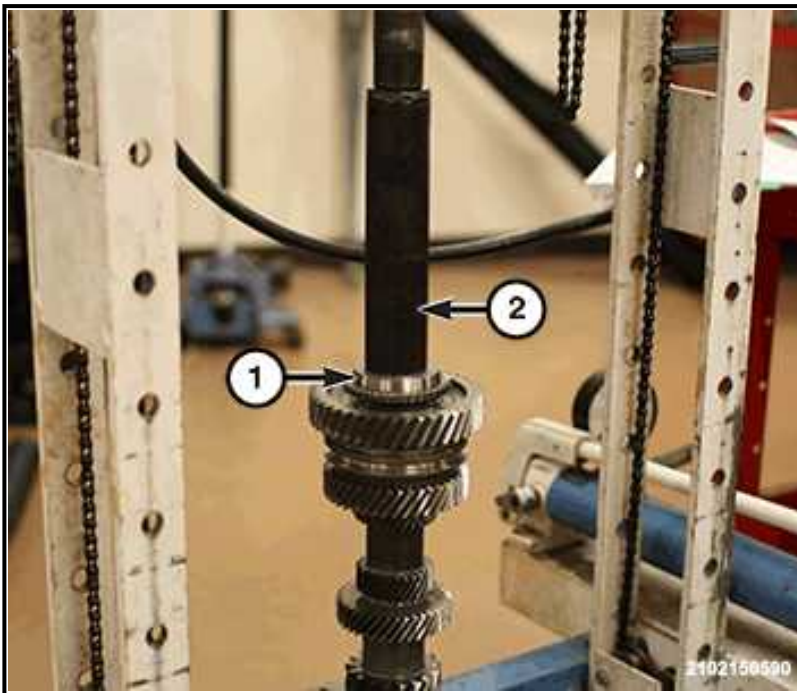
2 - 2nd Gear Snap Ring (Selective)

5. Due to manufacturing tolerances, install a **NEW** , **LARGEST** selective snap ring that fits into the groove. Install the needle bearing thrust washer.



1 - 1st Gear Needle Bearing

6. Install the 1st gear needle bearing. Apply specified oil to needle bearing.



1 - Reverse Hub

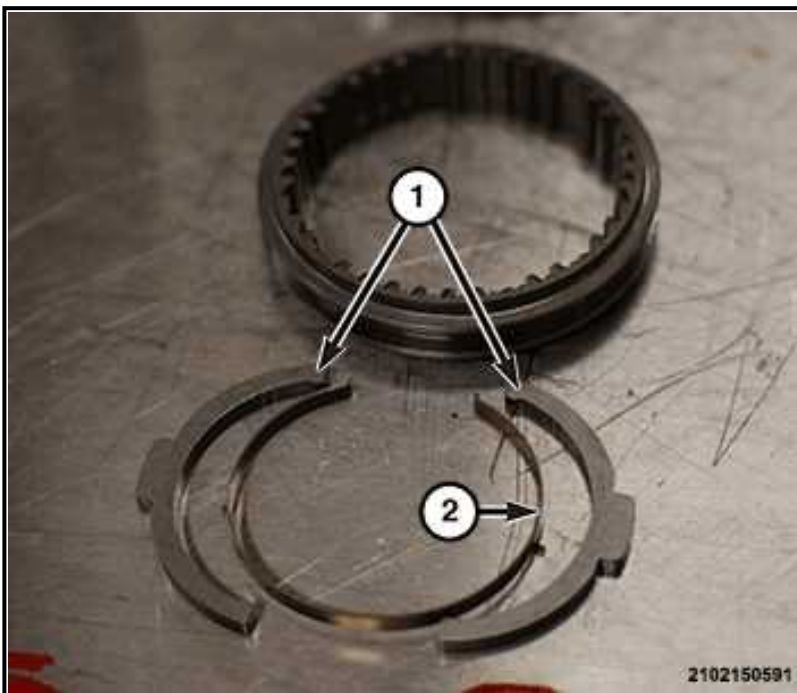
2 - Installer, Bearing W-262

7. Install 1st gear and 1st gear synchronizer rings to assembly. Be sure the synchronizer fingers are located properly to prevent damage. Using (special tool #W-262, Installer, Bearing) and a press, press the reverse hub on the countershaft.



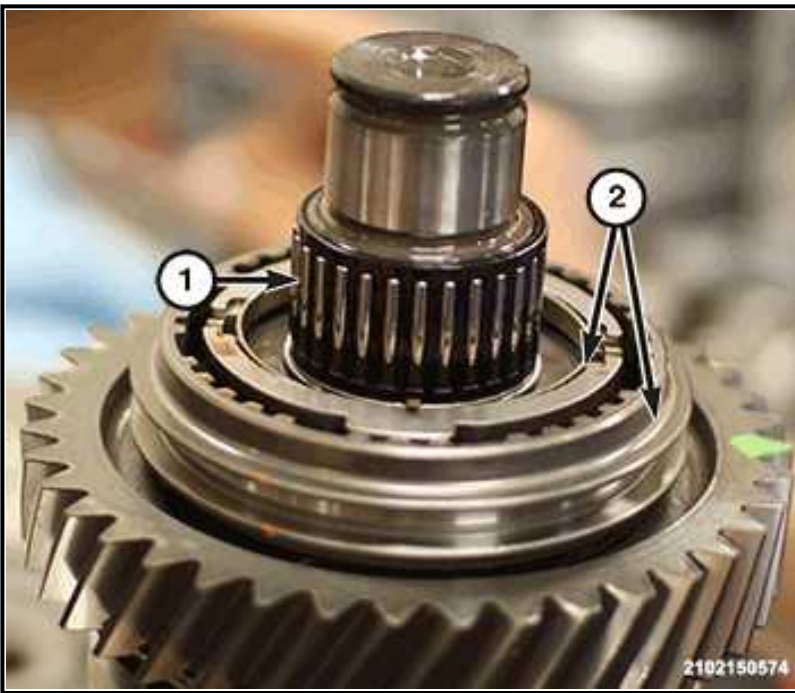
- | |
|---------------------------------------|
| 1 - Needle Bearing Thrust Washer |
| 2 - Reverse Hub Snap Ring (Selective) |

8. Due to manufacturing tolerances, install a **NEW** , **LARGEST** selective snap ring that fits into the groove. Be sure to tap the ends of the snap ring to fully seat. Install the needle bearing thrust washer.



- | |
|-------------------------------------|
| 1 - Reverse Synchronizer Key |
| 2 - Reverse Synchronizer Key Spring |

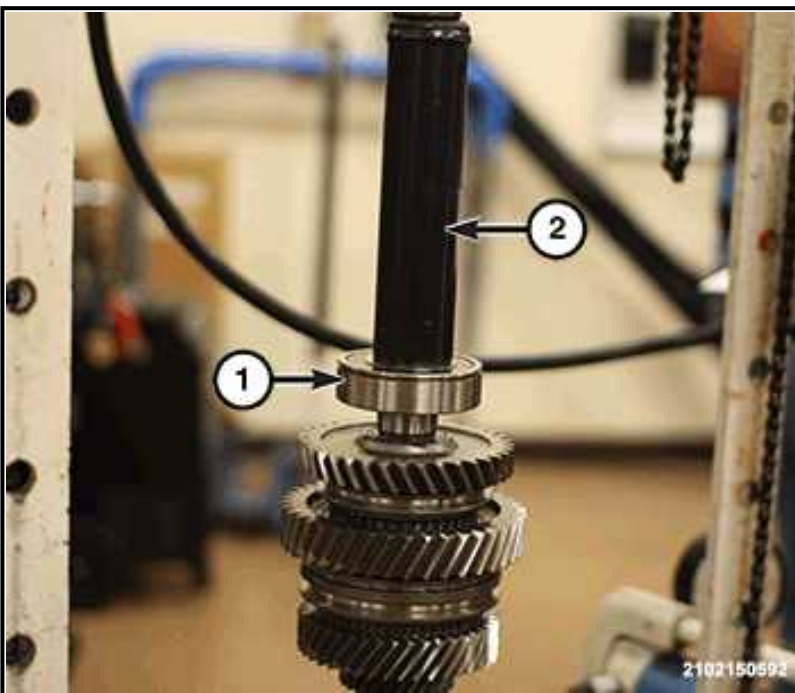
NOTE: Reverse gear synchronizer assembly.



1 - Reverse Gear Needle Bearing

2 - Reverse Synchronizer Ring And Sleeve

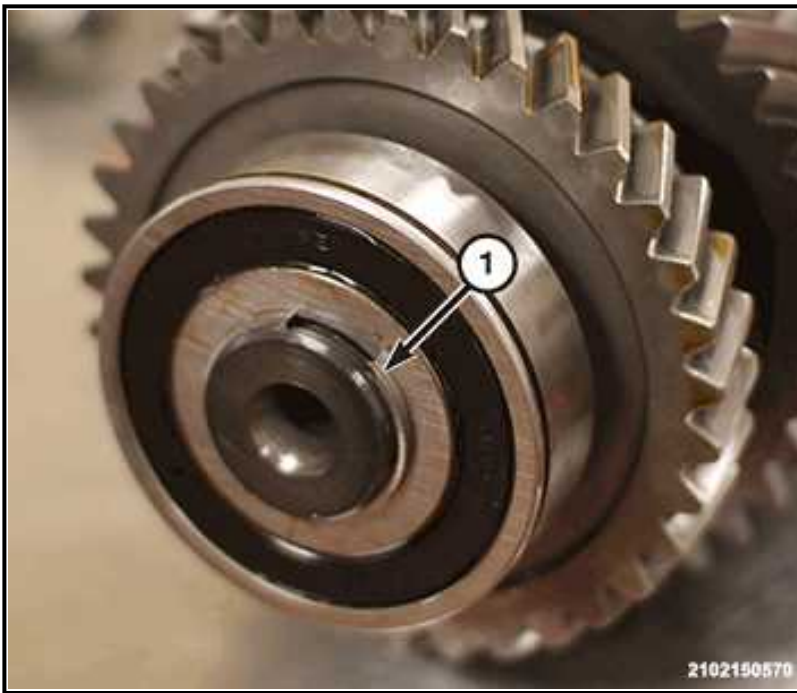
9. Install the reverse gear needle bearing. Apply specified oil to needle bearing. Install reverse synchronizer ring and sleeve to assembly. Be sure the synchronizer fingers are located properly to prevent damage.



1 - Front Case Bearing

2 - Installer, Bearing W-262

10. Using (special tool #W-262, Installer, Bearing) and a press, install the front case bearing (snap ring groove towards the end) to the countershaft. Be sure to push the bearing on by the inner race ONLY to prevent damage to the bearing.



1 - Front Case Bearing Snap Ring (Selective)

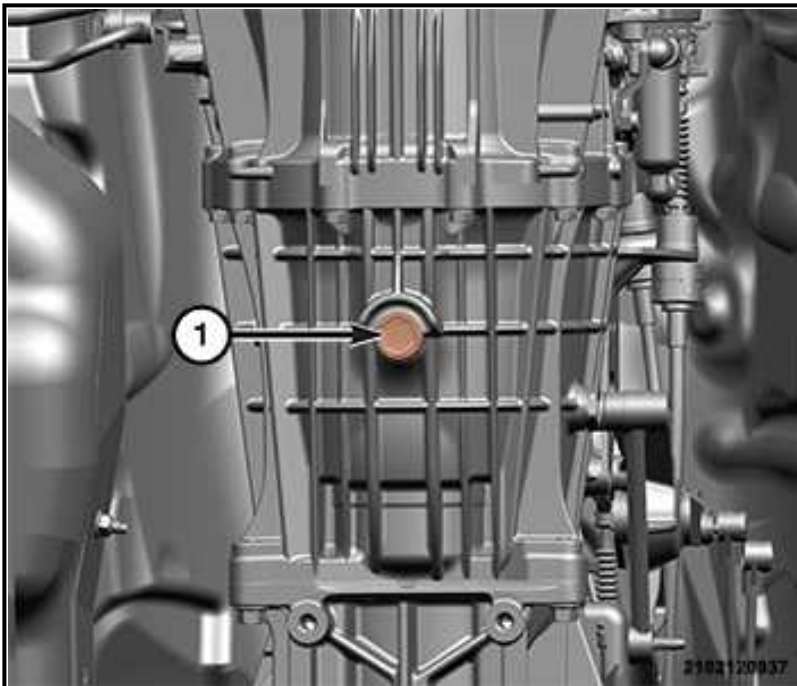
11. Due to manufacturing tolerances, install a **NEW** , **LARGEST** selective snap ring that fits into the groove. Be sure to tap the ends of the snap ring to fully seat.

FLUID

STANDARD PROCEDURE

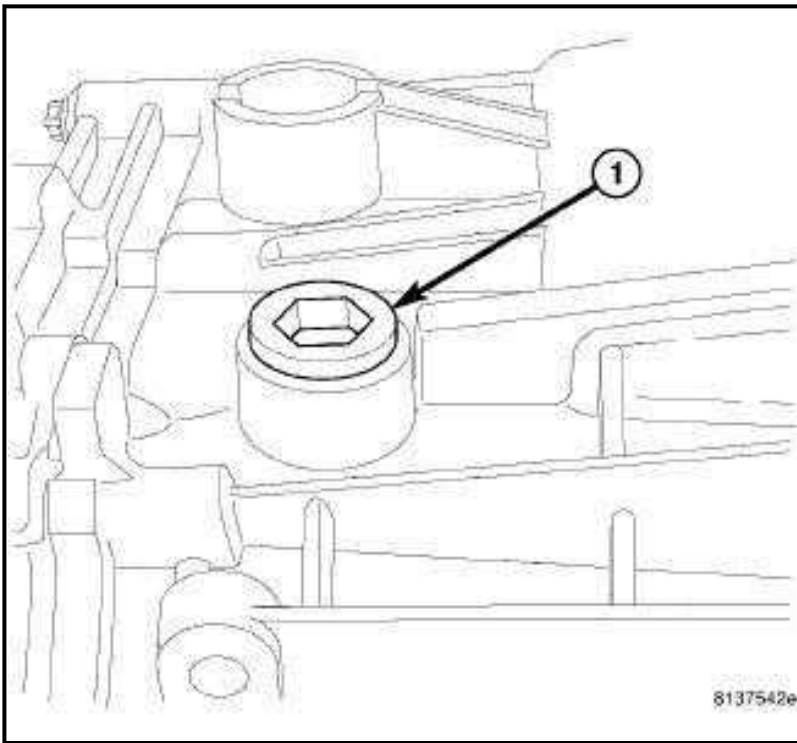
FLUID - DRAIN AND FILL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



1 - Drain Plug

2. Place an oil drain pan under the drain plug. Remove the drain plug and drain the fluid.
3. Install the drain plug and tighten to the proper. Refer to [TORQUE SPECIFICATIONS](#) .



1 - FillPlug

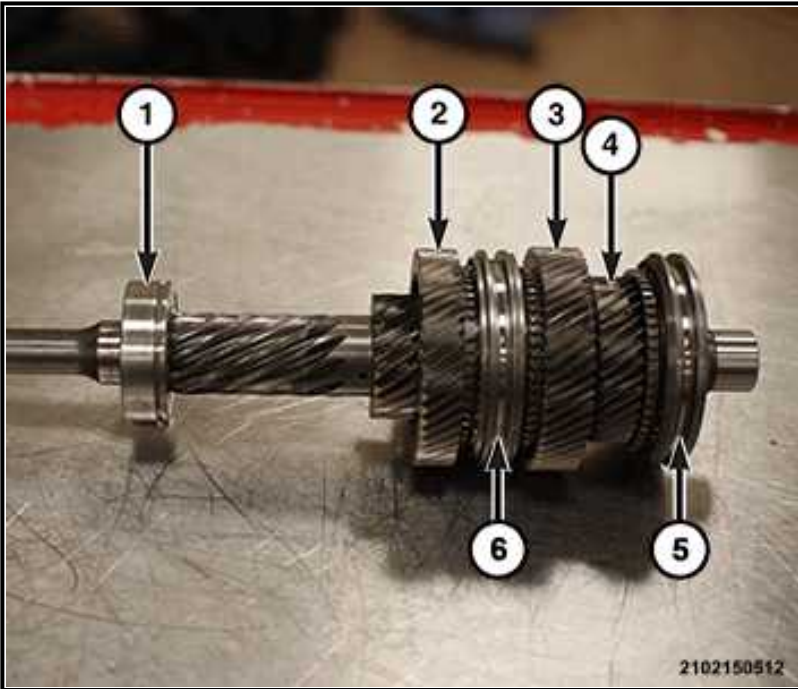
4. Remove the fill plug and fill the transmission to the proper level using the specified fluid. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .
5. Install the fill plug and tighten to the proper. Refer to **TORQUE SPECIFICATIONS** .

INPUT SHAFT, TRANSMISSION

DISASSEMBLY AND ASSEMBLY

INPUT SHAFT

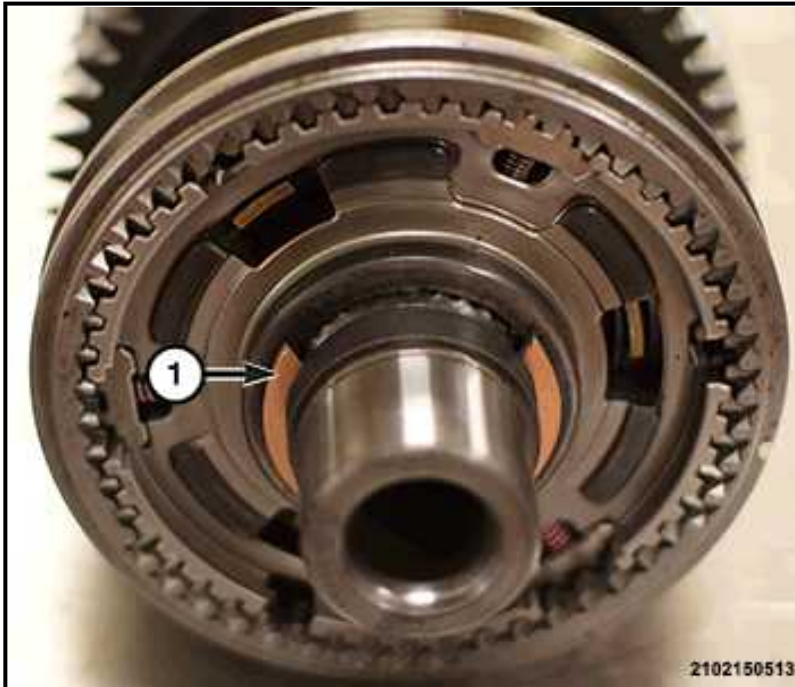
DISASSEMBLY



PART IDENTIFICATION

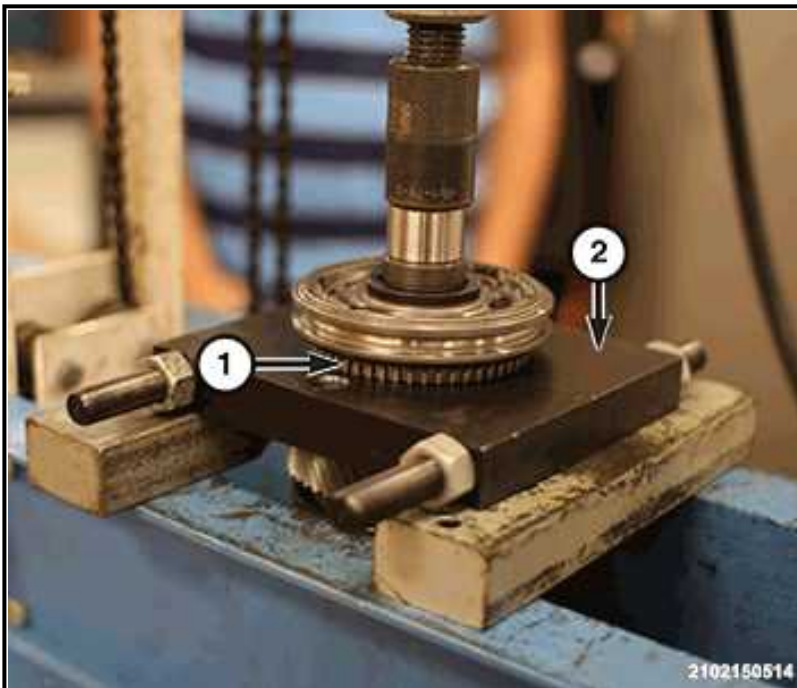
Callout	Part

1.	Front Bearing
2.	Fifth Gear
3.	Sixth Gear
4.	Third Gear
5.	3-4 Synchronizer
6.	5-6 Synchronizer



1 - 3-4 Synchronizer Hub Snap Ring

1. Using a suitable tool, remove snap ring from the rear side of the shaft holding the 3-4 synchronizer hub.



- | |
|-----------------|
| 1 - 3rd Gear |
| 2 - Puller 9647 |

2. Using the (special tool #9647, Puller) and a press, place the puller under the 3rd gear and press the shaft to remove the 3-4 synchronizer assembly.



1 - 3rd Gear Needle Bearing

3. Remove the 3rd gear needle bearing from the shaft assembly.



1 - Needle Bearing Spacer

4. Remove the needle bearing spacer from the shaft assembly.



1 - 3rd Gear Thrust Washer

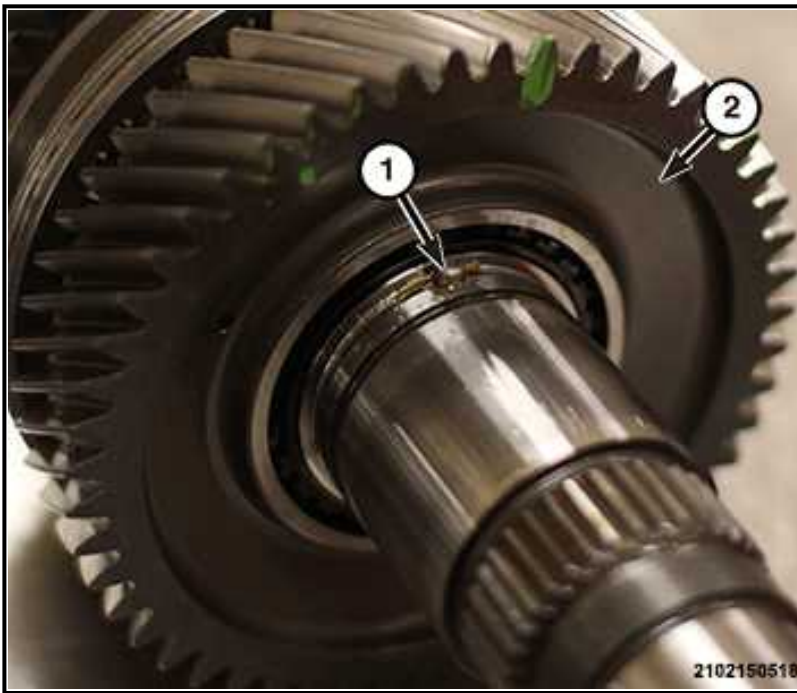
2 - Snap Ring

5. With a suitable tool, remove the snap ring holding the 3rd gear thrust washer.



1 - 3rd Gear Thrust Washer

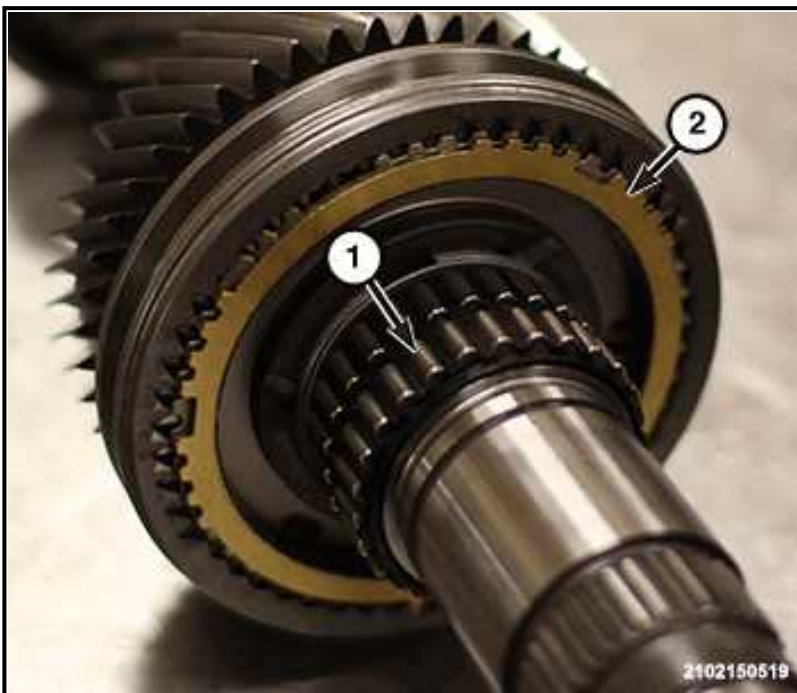
6. Remove the 3rd gear thrust washer.



1 - Indexing Pin

2 - 6th Gear

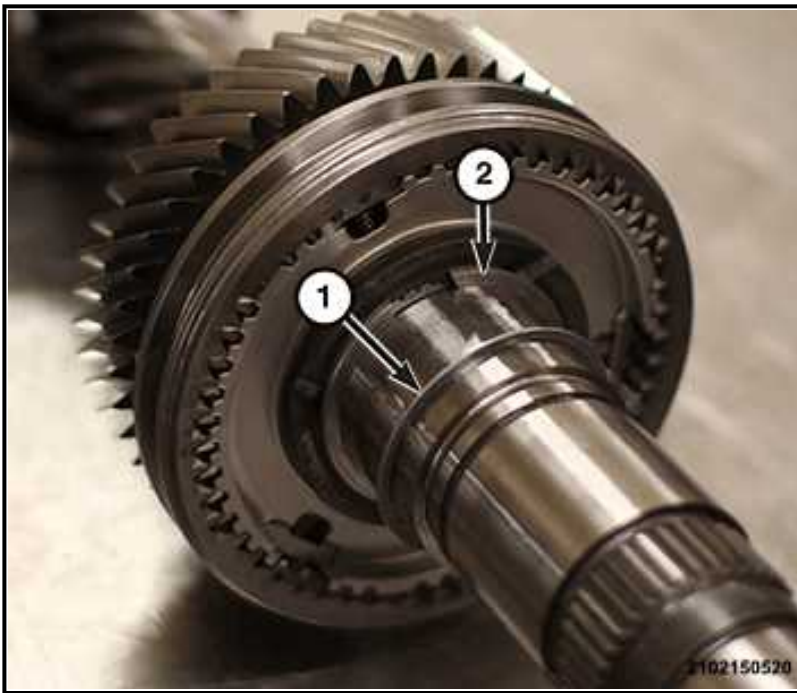
7. Remove the indexing pin from the shaft and remove 6th gear.



1 - 6th Gear Needle Bearing

2 - Synchronizer Ring

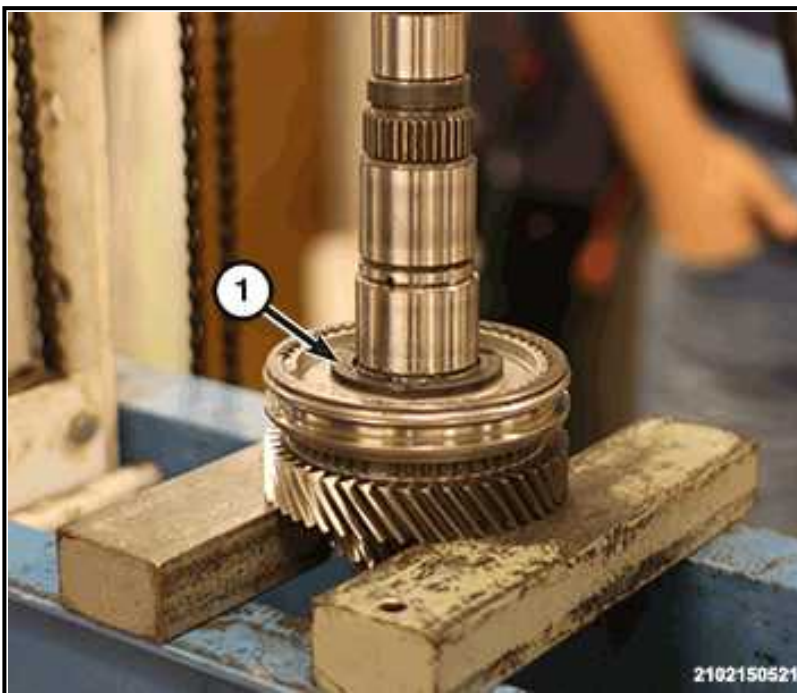
8. Remove the 6th gear needle bearing and synchronizer ring from the assembly.



1 - Needle Bearing Spacer

2 - 5-6 Synchronizer Snap Ring

9. Remove the needle bearing spacer. Using a suitable tool, remove the snap ring retaining the 5-6 synchronizer assembly.



1 - 5-6 Synchronizer Assembly

10. With suitable tool supporting 5th gear and a press, press the shaft to remove the 5-6 synchronizer assembly and the 5th gear.



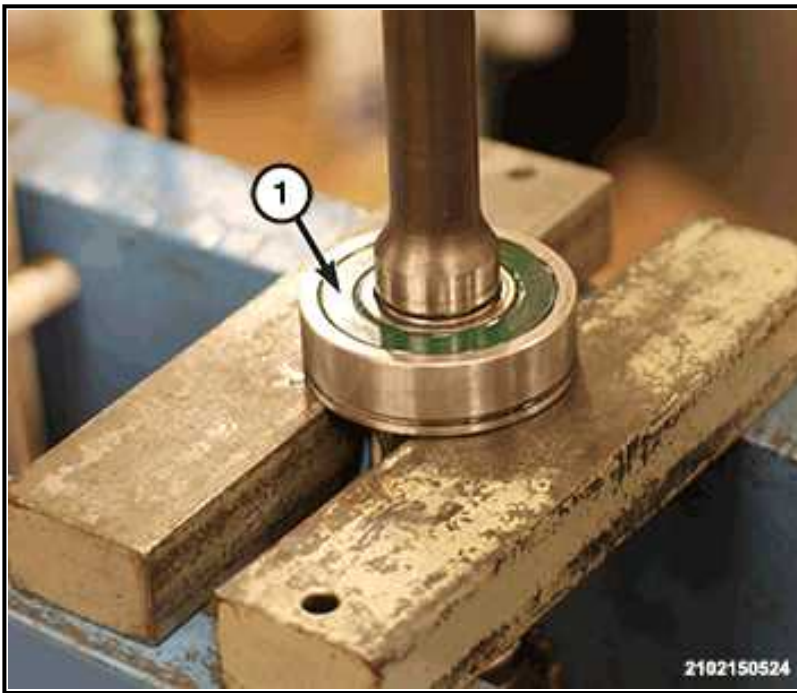
1 - 5th Gear Needle Bearing

11. Remove the 5th gear needle bearing.



1 - Snap Ring

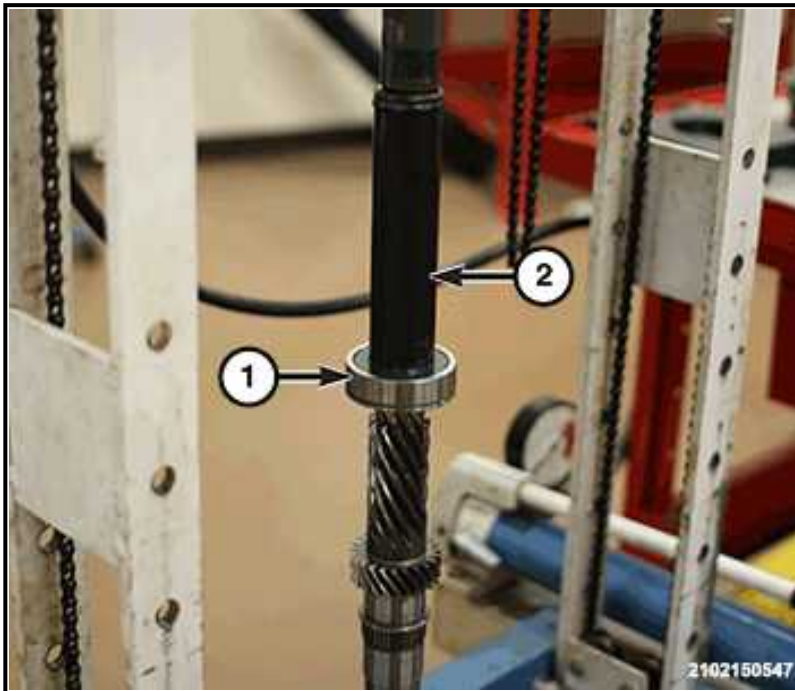
12. With a suitable tool, remove the snap ring retaining the front bearing.



1 - Front Bearing

13. Using a suitable tool and a press, support the inner race of the front bearing and press the shaft to remove the bearing.

ASSEMBLY



1 - Front Bearing

2 - Installer, Bearing W-262

1. Using a press, press the inner race of the input bearing (snap ring groove towards the rear) on the shaft using (special tool #W-262, Installer, Bearing).



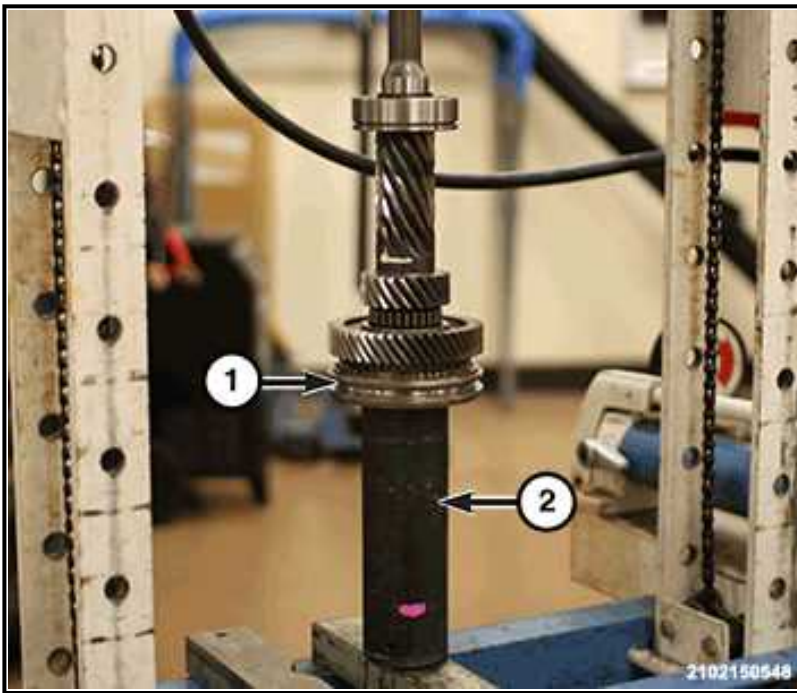
1 - Front Bearing Snap Ring (Selective)

2. Due to manufacturing tolerances, install a **NEW , LARGEST** selective front bearing snap-ring that fits into the groove. Be sure to tap the ends of the snap-ring to fully set the ring.



1 - 5th Gear Needle Bearing

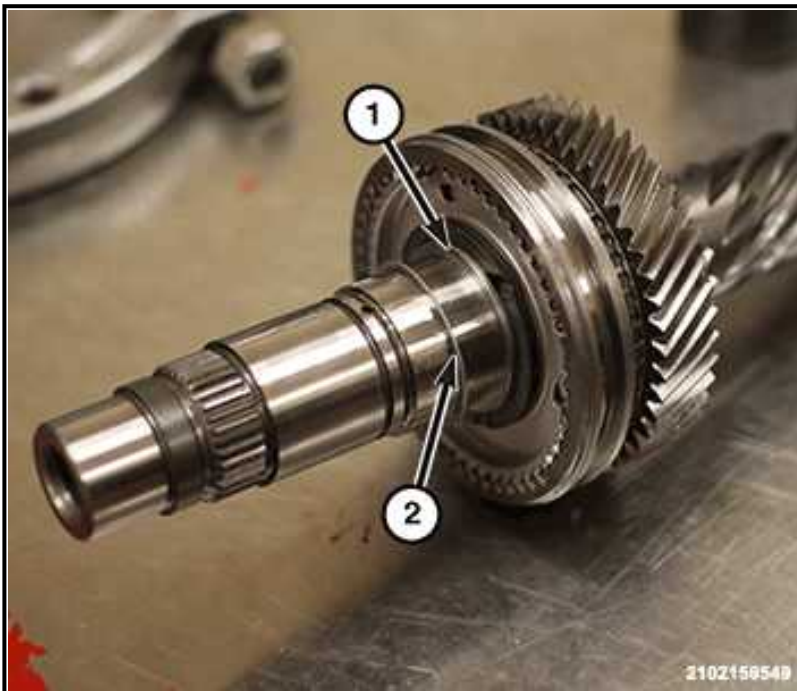
3. Install the 5th gear needle bearing to shaft. Apply specified oil to bearing.



1 - 5-6 Synchronizer Hub

2 - Installer, Bearing D-389

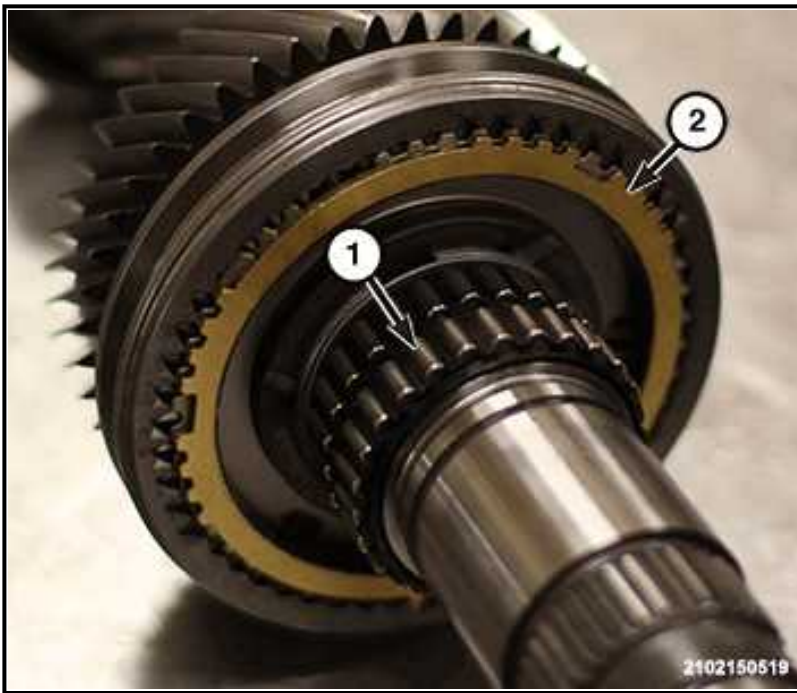
4. Install 5th gear and 5th gear synchronizer ring, be sure ring tabs are indexed to the gear and hub to prevent damage. Using the (special tool #D-389, Installer, Bearing) and a press, support the 5-6 synchronizer hub (dot on hub towards rear of shaft, deep step on sleeve towards front), and press the shaft until the hub is fully seated.



1 - 5-6 Synchronizer Snap Ring (Selective)

2 - needle bearing thrust washer

5. Due to manufacturing tolerances, install a **NEW** , **LARGEST** selective snap-ring that fits into the groove. Install the needle bearing thrust washer.



1 - 6th Gear Needle Bearing

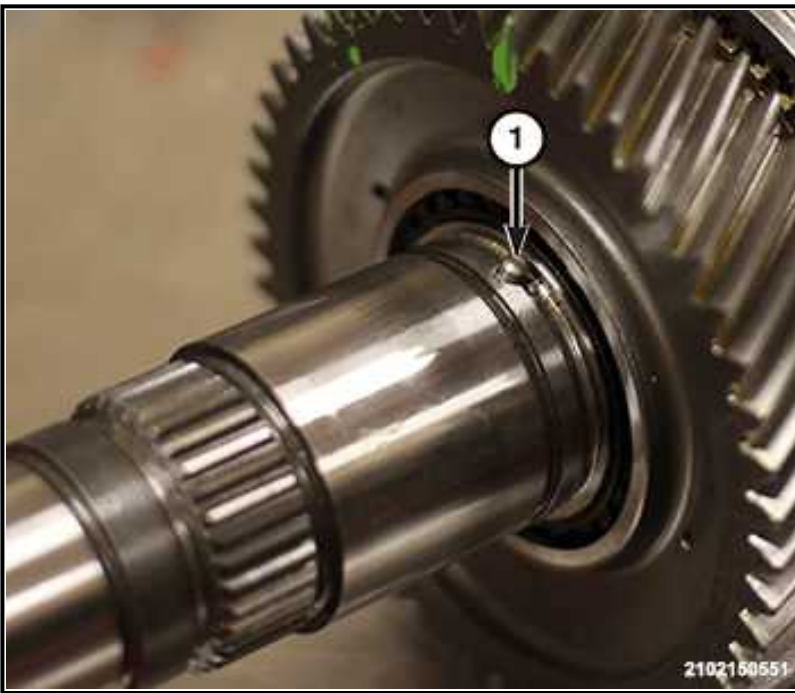
2 - Synchronizer Ring

6. Install the 6th Gear needle bearing and synchronizer ring to the assembly. Apply specified oil to the needle bearing. Be certain that the synchronizer ring fingers are indexed properly to the hub.



1 -6th Gear

7. Install the 6th gear to assembly.



1 - 3rd Gear Thrust Washer Indexing Pin Hole

8. Install the 3rd gear thrust washer indexing pin into the hole in the shaft.



1 - 3rd Gear Thrust Washer Indexing Notch

9. Find the indexing notch in the 3rd gear thrust washer.



1 - 3rd Gear Thrust Washer

2 - Snap Ring (Selective)

10. Align the 3rd gear thrust washer with the pin and retain in place with a **NEW , LARGEST** selective snap ring that fits in the groove. Be sure to tap the ends of the snap-ring to fully set the ring.



1 - 3rd Gear Needle Bearing Spacer

11. Install the 3rd gear needle bearing spacer to the assembly. Apply specified oil to the needle bearing.



1 - 3rd Gear Needle Bearing

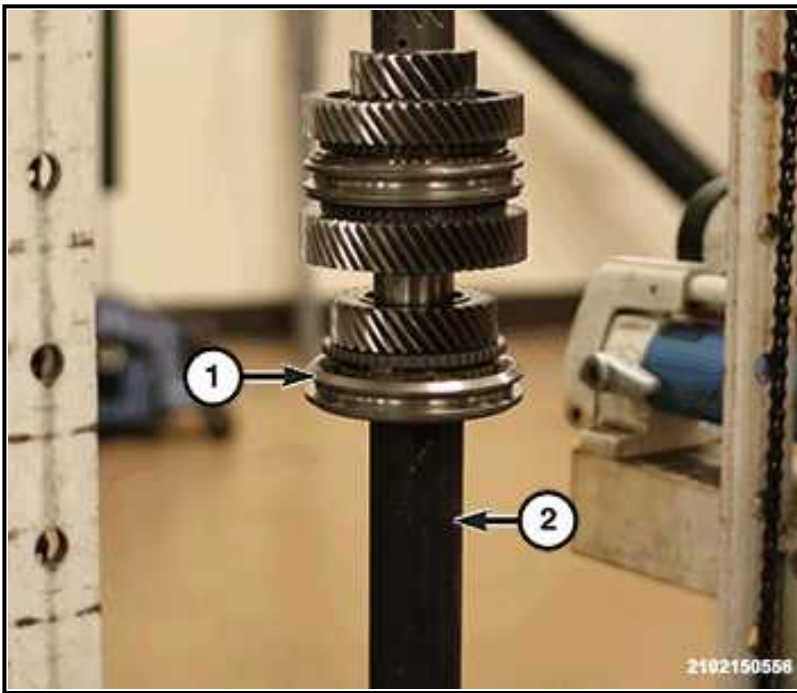
12. Install the 3rd gear needle bearing to the assembly.



1 - 3rd Gear

2 - 3rd Gear Synchronizer Rings

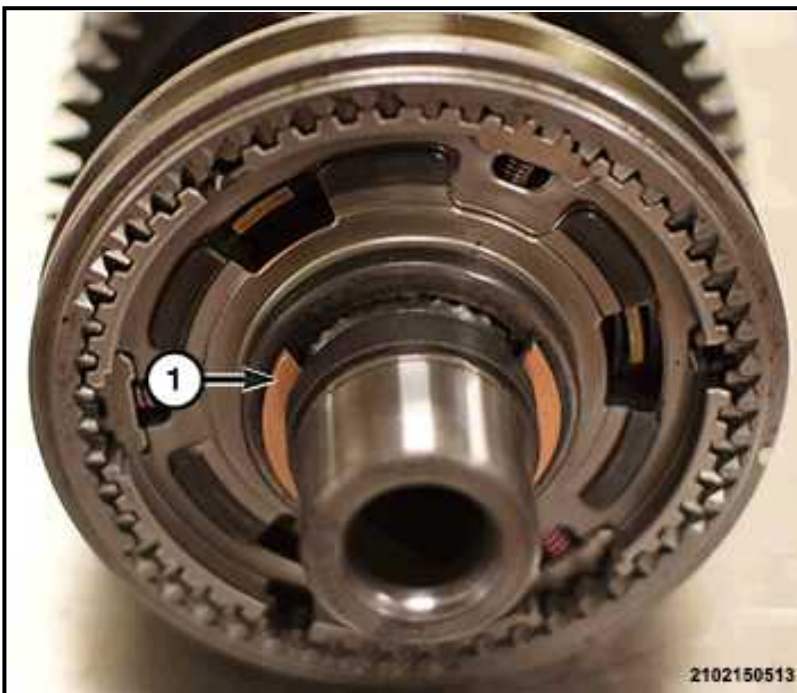
13. Install the 3rd gear assembly and synchronizer rings. Be certain that the synchronizer ring fingers are indexed properly to the gear.



1 - 3-4 Synchronizer

2 - Installer, Bearing/Gear 6448A

14. Align the synchronizer fingers with the hub, place the 3-4 synchronizer (deep part of hub towards the back of shaft, with the stepped edge of sleeve towards the rear) on the assembly. Support the aligned parts with (special tool #6448A, Installer, Bearing/Gear) on a press and press the shaft to install the hub and synchronizer on the shaft assembly.



1 - 3-4 Synchronizer Hub Snap Ring (Selective)

15. Due to manufacturing tolerances, install a **NEW , LARGEST** selective 3-4 synchronizer hub snap-ring that fits in the groove. Be sure to tap the ends of the snap-ring to fully set the ring.

KNOB, GEARSHIFT

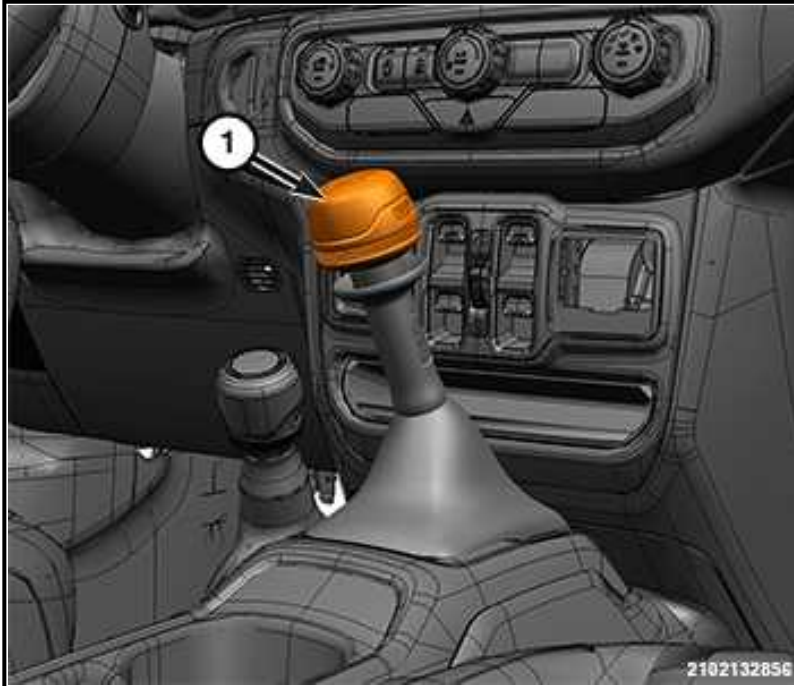
REMOVAL AND INSTALLATION

GEAR SHIFT KNOB

REMOVAL

NOTE: Most shift knobs can be removed by hand. The motion should mimic that of a slide hammer. Constant force does not aid in the removal of the knob.

1. Slide the shift lever back towards the seat and pull the shift knob in an upward motion with a "quick" snap to remove the shift knob from the lever. If removal of the shift knob by hand is not possible, wrap a shop towel or equivalent around the base of the shift knob. Then, using puller (special tool #C-4333A, Puller, Pulley) or equivalent and a slide hammer, remove the shift knob from the shift lever.



1 - Shift Knob

INSTALLATION



1 - Shift Knob

1. Install the shift knob on the shift lever and firmly push the shift knob down. An audible click should be heard when the shift knob is seated in position.

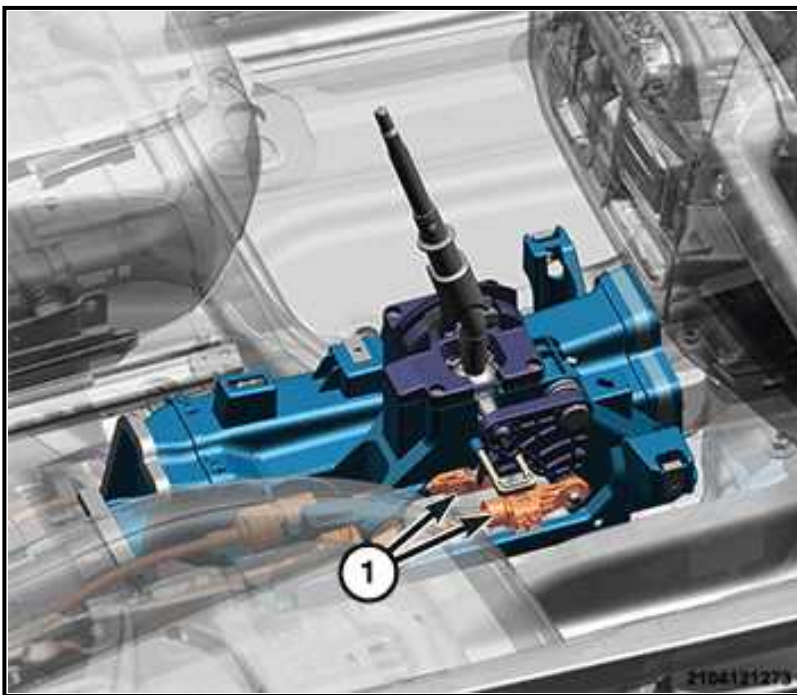
LEVER, SHIFT

REMOVAL AND INSTALLATION

GEAR SHIFT LEVER

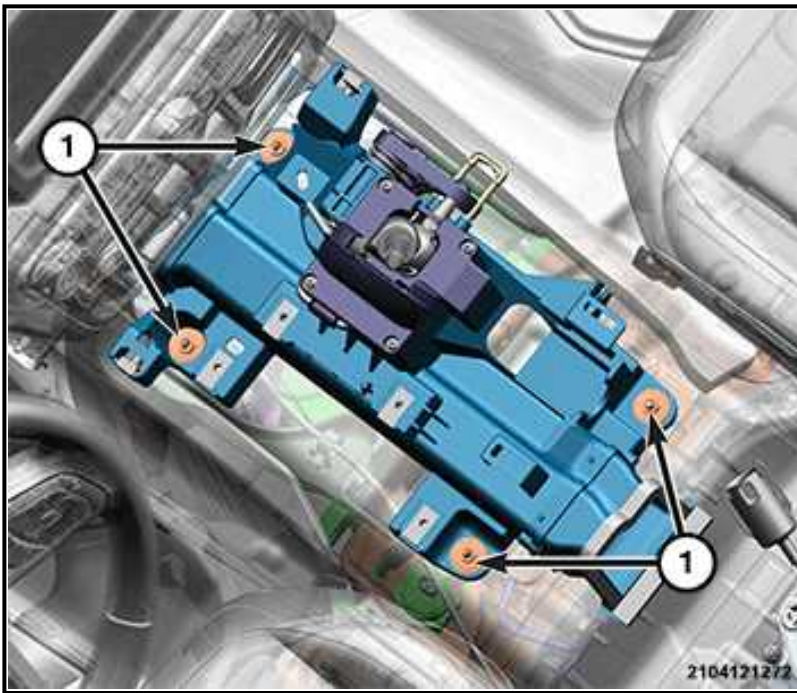
REMOVAL

1. Remove the transfer case lever, Refer to LEVER, TRANSFER CASE, REMOVAL AND INSTALLATION .
2. Remove the shifter boot. Refer to BOOT, GEARSHIFT, REMOVAL AND INSTALLATION.
3. Verify the transmission is in the 3-4 neutral gate.
4. Disconnect the wire harness connector from the top right of the manual transmission shifter assembly.



1 - Shifter Cable

5. Disconnect both manual transmission shifter cables from the manual transmission shifter assembly.

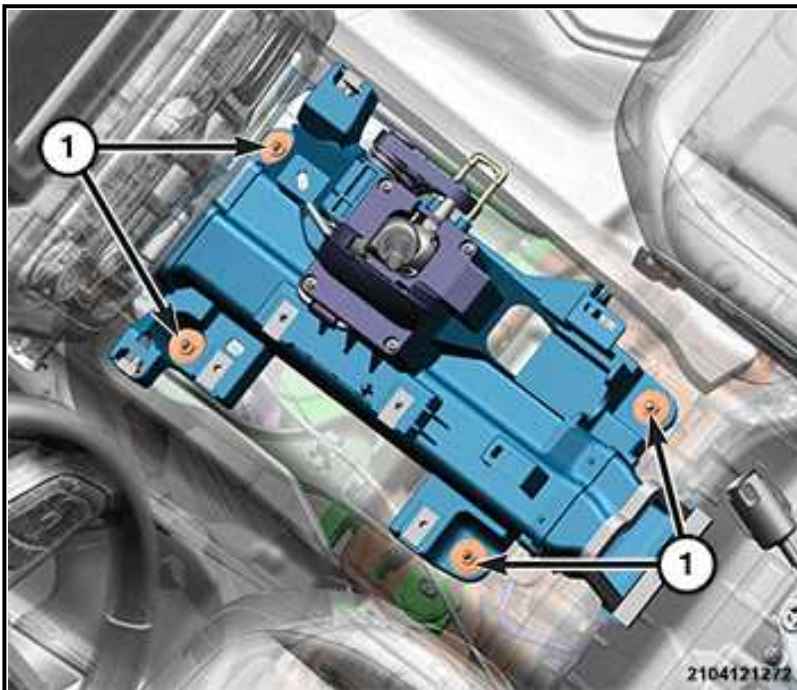


1 - Shifter Assembly Nuts

6. Remove the manual transmission shifter assembly nuts.
7. Remove the manual transmission shifter assembly from the vehicle.

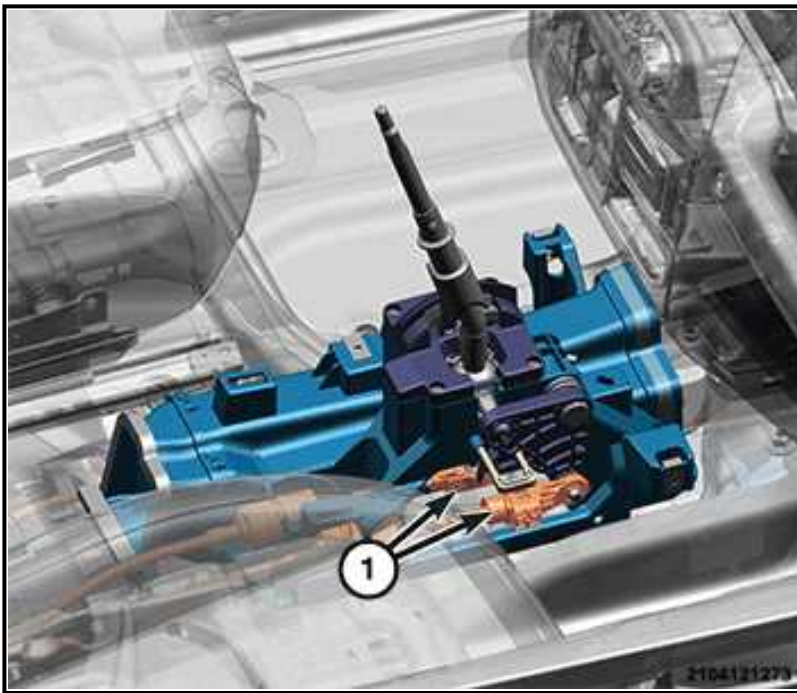
INSTALLATION

1. Position the manual transmission shifter assembly in the vehicle.



1 - Shifter Assembly Nuts

2. Install the manual transmission shifter assembly nuts (1) and tighten them to the proper. Refer to **TORQUE SPECIFICATIONS** .



1 - Shift Cable Ends

3. Connect both shift cables to the manual transmission shifter assembly. Adjust the shift cables. Refer to [CABLE, GEARSHIFT CONTROL, ADJUSTMENTS](#).
4. Install the shifter boot. Refer to [BOOT, GEARSHIFT, REMOVAL AND INSTALLATION](#).
5. Install the transfer case lever, Refer to [LEVER, TRANSFER CASE, REMOVAL AND INSTALLATION](#) [LEVER, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .

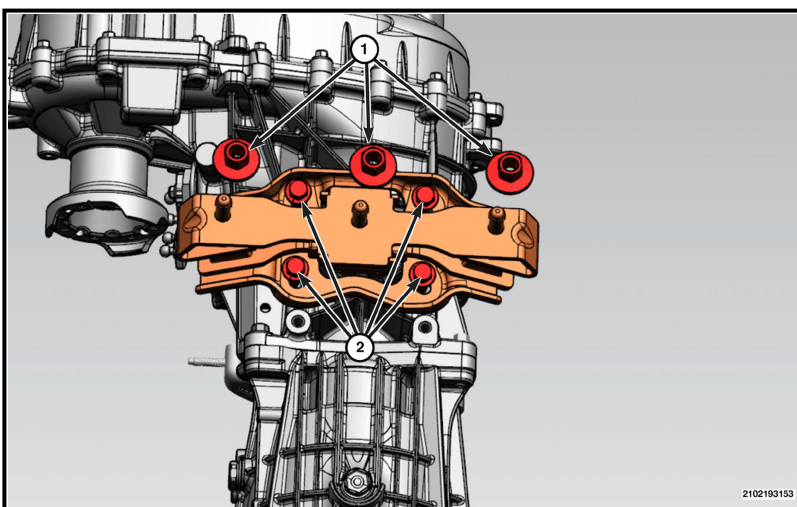
MOUNT, TRANSMISSION

REMOVAL AND INSTALLATION

TRANSMISSION MOUNT

REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Support the powertrain with a suitable jack.



1 - Transmission Isolator To Crossmember Nuts

2 - Transmission Isolator To Transmission Bolts

- 3. Remove the transmission isolator to crossmember nuts.
- 4. Remove the bolts and remove the transmission isolator.

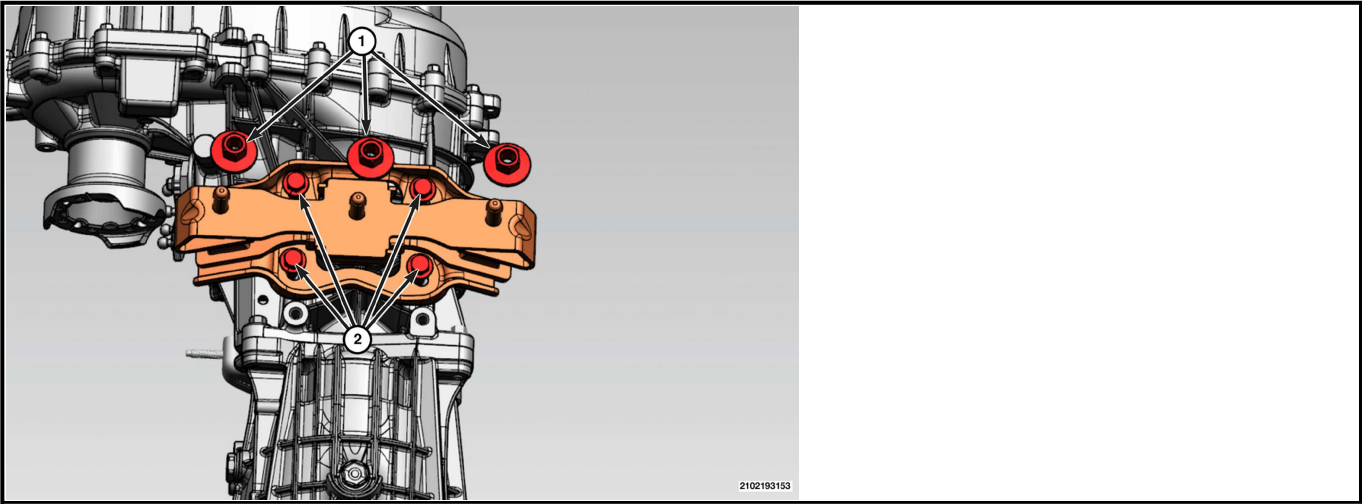
INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS

TRANSMISSION MOUNT



CALLOUT	DESCRIPTION	SPECIFICATION	COMMENT
1	Transmission Isolator to Crossmember Nuts	175 N.m (129 Ft. Lbs.)	-
2	Transmission Isolator to Transmission Bolts	55 N.m (41 Ft. Lbs.)	-

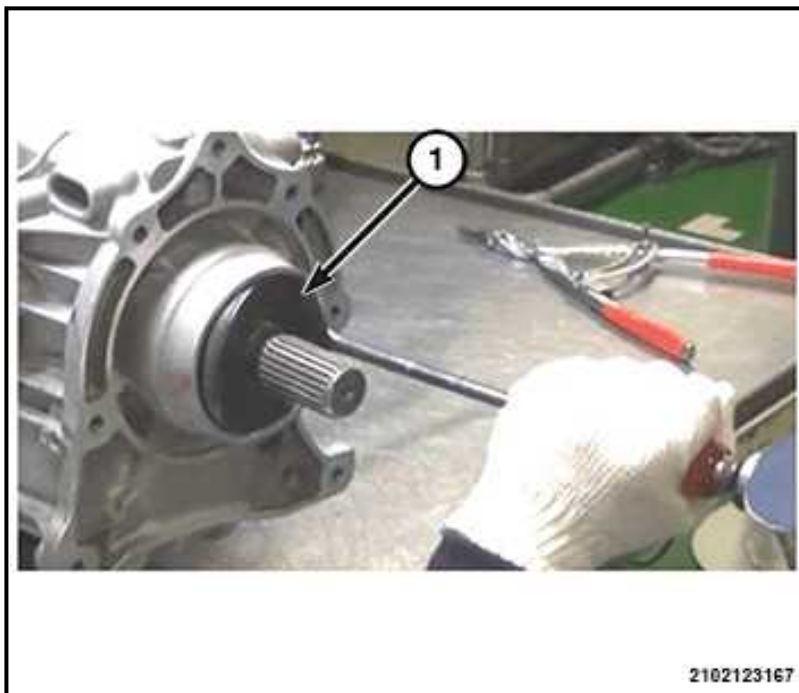
SEAL, EXTENSION HOUSING

REMOVAL AND INSTALLATION

OUTPUT SHAFT SEAL

REMOVAL

- 1. Remove the transfer case. Refer to REMOVAL AND INSTALLATION REMOVAL AND INSTALLATION .



1 - Rear Output Oil Seal

2. Using a suitable tool, remove the seal from the case.

NOTE: Do not damage case sealing surface when removing seal.

INSTALLATION

1. Using (special tool #2051900210, Installer, Seal Output Shaft), install a **NEW** output seal into the case and verify the output seal installed depth is within specification. Refer to [TORQUE SPECIFICATIONS](#).
2. Install the transfer case. Refer to [REMOVAL AND INSTALLATION](#) [REMOVAL AND INSTALLATION](#).
3. Check the transmission fluid level and fill as necessary using the specified fluid. Refer to [FLUID, STANDARD PROCEDURE](#).

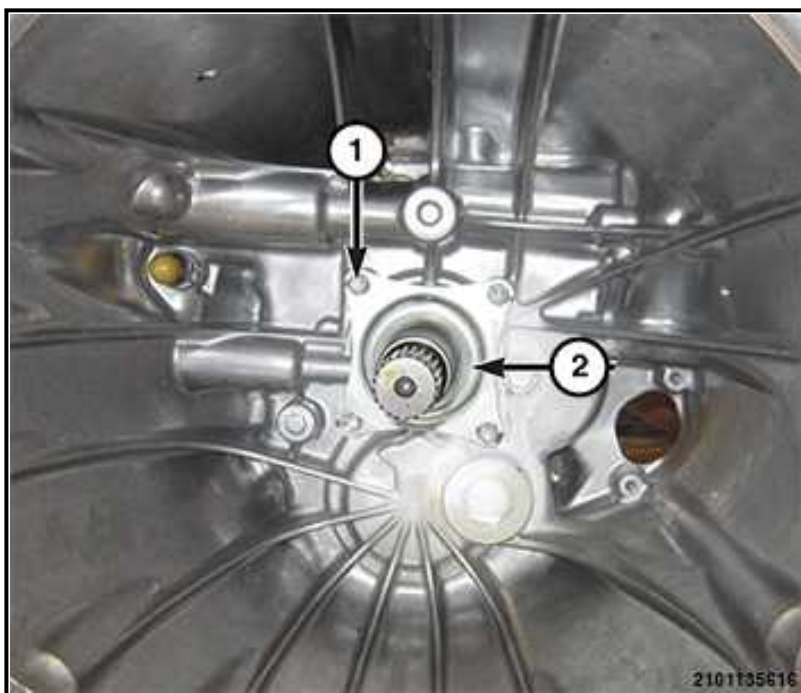
SEAL, INPUT SHAFT

REMOVAL AND INSTALLATION

INPUT SHAFT SEAL

REMOVAL

1. Remove the transmission. Refer to [REMOVAL AND INSTALLATION](#).



1 - Front Input Shield Bolts

2 - Front Input Shield

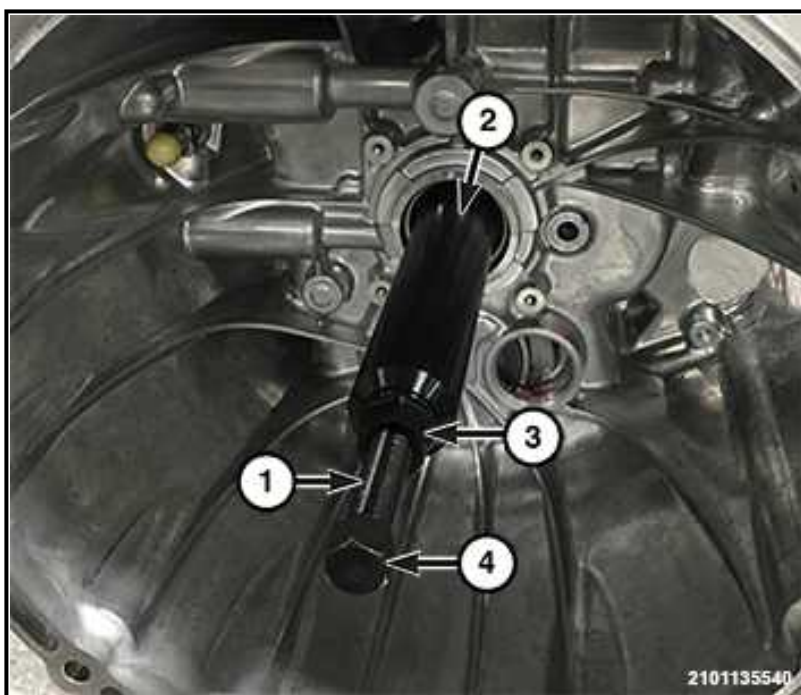
2. Remove the four input shaft shield bolts and the input shaft shield.

3. Using

(special tool #2051800210, Remover, Seal Input Shaft)

, remove the input shaft seal.

NOTE: Be careful not to damage the case when removing the seal. A leak can occur on the outside sealing edge if the aluminum case is compromised during the seal removal.



1 - Forcing Screw

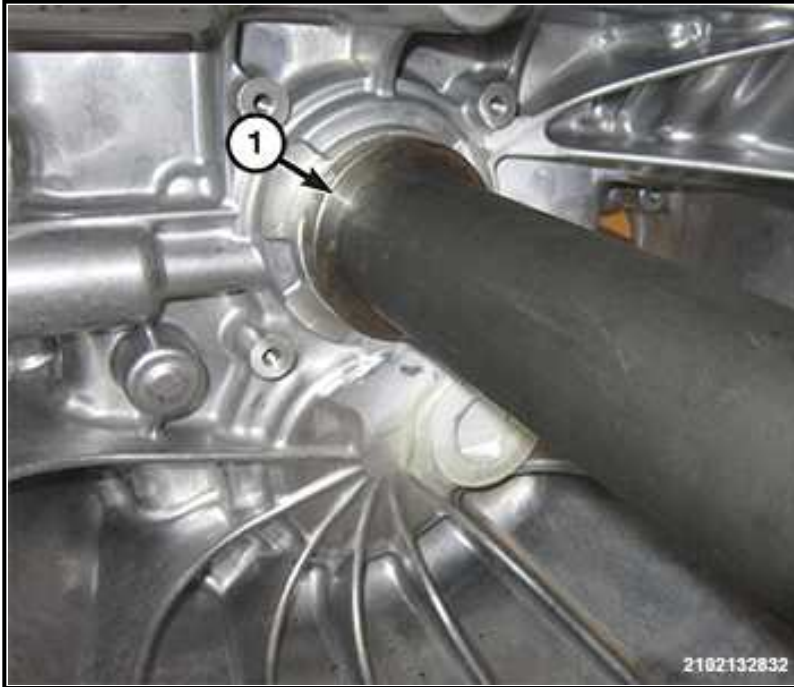
2 - Remover, Seal Input Shaft 2051800210
--

3 - Hex End

4 - Forcing Screw Hex End

4. Remove the forcing screw and thread the large end of the tool tightly into the seal using the hex end and a suitable wrench. Install the forcing screw and, using a wrench to hold the hex end, turn the forcing screw hex end clockwise to pull the seal from the case.
5. Clean the sealing surface with brake clean or a similar parts cleaner.

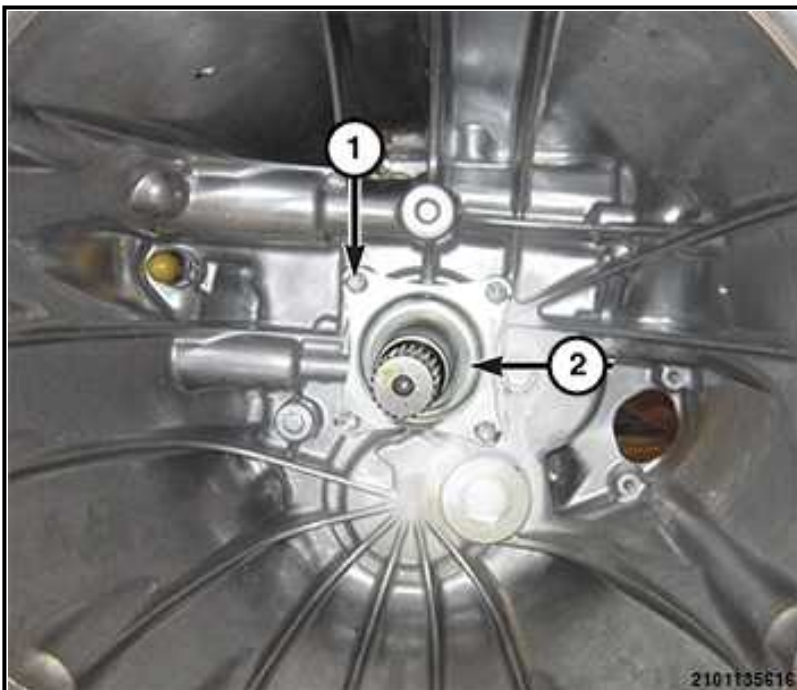
INSTALLATION



1 - Installer, Seal Input Shaft 2052000210

1. Install a **NEW** input shaft seal using the seal installer (special tool #2052000210, Installer, Seal Input Shaft).

NOTE: Verify the input shaft seal installed depth is within specification. Refer to **TORQUE SPECIFICATIONS** .



1 - Front Input Shield Bolts

2 - Front Input Shield

2. Install the input shaft shield and torque the bolts to the proper. Refer to [TORQUE SPECIFICATIONS](#) .
3. Install the transmission. Refer to [REMOVAL AND INSTALLATION](#).

SWITCH, RANGE POSITION

REMOVAL AND INSTALLATION

RANGE POSITION SWITCH

REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Disconnect the transmission range position switch wire harness connector.



1 - Transmission Range Position Switch Bolts
--

3. Remove the bolts from the transmission range position switch and remove the switch.

INSTALLATION



1 - Transmission Range Position Switch Bolts

1. Position the transmission range position switch, then install the transmission range position switch bolts and tighten to the proper. Refer to [**TORQUE SPECIFICATIONS**](#) .

CAUTION: Do not overtighten switch.

2. Connect the transmission range position switch wire harness connector.
 3. Remove the support and lower the vehicle.
 4. Verify Reverse lamp operation.
 5. If the transmission range position switch was replaced with a **NEW** switch, the **LEARN GEAR SHIFT SENSOR** routine must be performed using a scan tool.
-

2021 TRANSFER CASE

Mp1622C Transfer Case (Service Information) - Gladiator

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

The MP1622C transfer case is the heart of the Command-Trac™ and Rock-Trac™ part-time 4WD system. When engaged in 4WD, both front and rear drive shafts are locked by a chain and gearset, which always turn at the same speed, forming a single drive unit. This is a rigid connection that does not allow for any differential action between front and rear drive shafts. Normal front-to-rear differences in the turning radii of the wheels (when cornering) are compensated for only through wheel slippage on driving surfaces. This transfer case allows for 2WD, 4WD High-Range and Low-Range as well as Neutral.

The MP1622 provides the following ranges through a mechanical shifter:

- 2WD HIGH:
 - Front axle spins freely.
 - Power sent to rear wheel.
 - A synchronizer inside the transfer case makes for smoother shifts between 2HI - 4HI and for the Front Axle Disconnect (FAD) Feature
- 4WD HIGH:
 - Shift-on-the-Fly at speeds up to 88 km/h (55 mph). Shift Efforts may increase as vehicle speed increases, due to the need for synchronization.
 - Front and rear drive shafts lock together and rotate at the same speed.
 - Only use on slippery or loose surfaces.
- NEUTRAL:
 - Use for towing your vehicle behind another vehicle.
 - The vehicle may roll while the transfer case is in neutral, even with the transmission in park
 - Does not require uncoupling drive shafts.
- 4WD LOW:
 - Use for severe off-road situations.
 - Increases available engine torque by 2.72:1 (4:1 in Rock-Trac™ equipped vehicles).
 - Slow speed to 3-5 km/h (2-3 mph), put transmission in Neutral, engage 4 LO and return transmission to desired gear.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Transfer case noisy in all drive modes	1) Insufficient or incorrect lubricant 2) Internal transfer case components binding, worn, or damaged	1) Drain and refill the transfer case with the correct quantity of MoparB® ATF +4, Automatic Transmission Fluid. 2) Repair or replace components as necessary. NOTE: Check all case

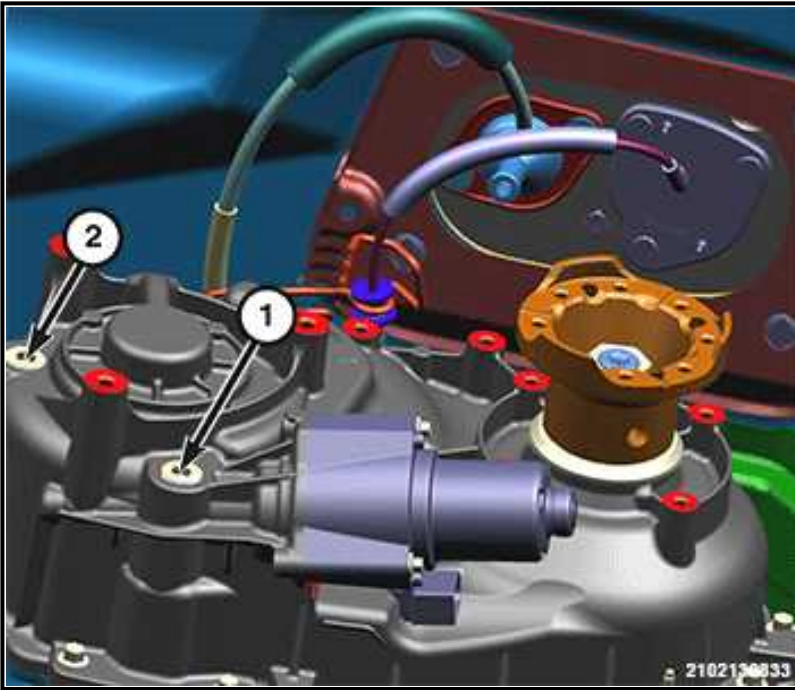
CONDITION	POSSIBLE CAUSE	CORRECTION
		bearings for spalling or rough feel when freely rotated.
Lubricant leaking from transfer case seals or vent	1) Transfer case overfilled 2) Transfer case vent closed or restricted 3) Transfer case seals damaged or installed incorrectly	1) Drain lubricant to the correct level. 2) Clean or replace the vent as necessary. 3) Replace the suspect seal. NOTE: Check the slinger on the seal flange for molded rubber defects. This will cause a seal leak, if the rubber looks to be squeezing out of the slinger, replace the slinger with the seal.

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID DRAIN AND FILL

DRAIN

1. Raise and support the vehicle. Refer to HOISTING, STANDARD PROCEDURE .
2. Remove the skid plate. Refer to PLATE, SKID, REMOVAL AND INSTALLATION PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION .
3. Place drain pan beneath the transfer case.



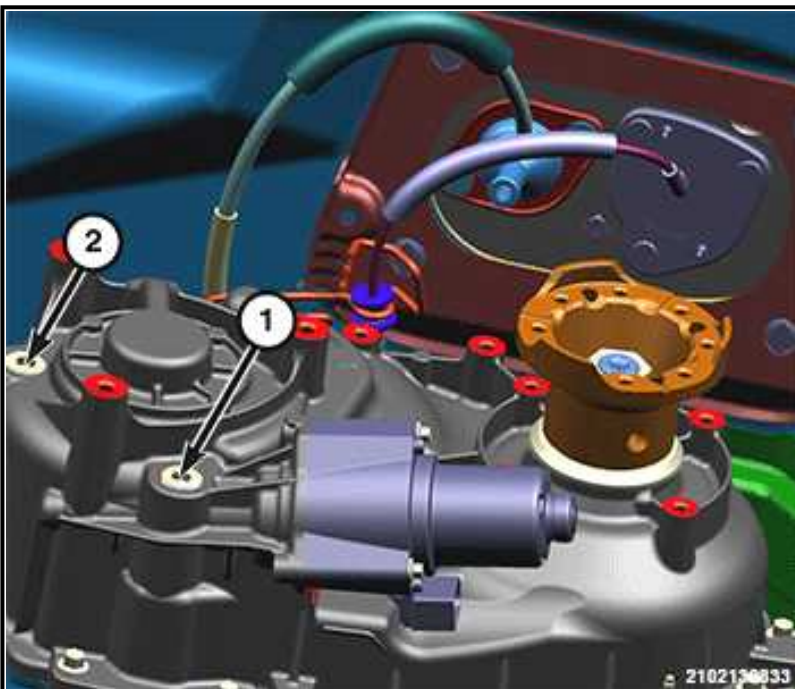
1 - Drain Plug

2 - Fill Plug

4. Remove the fill and drain plugs and allow the fluid to drain.
5. Install the drain plug.

FILL

1. Fill the transfer case to the proper level using the specified fluid. Refer to [CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS](#) .



1 - Drain Plug

2 - Fill Plug

2. Install the fill plug.
3. Install the skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION PLATE, SKID, TRANSFER CASE, REMOVAL](#)

AND INSTALLATION .

4. Remove the support and lower the vehicle.

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

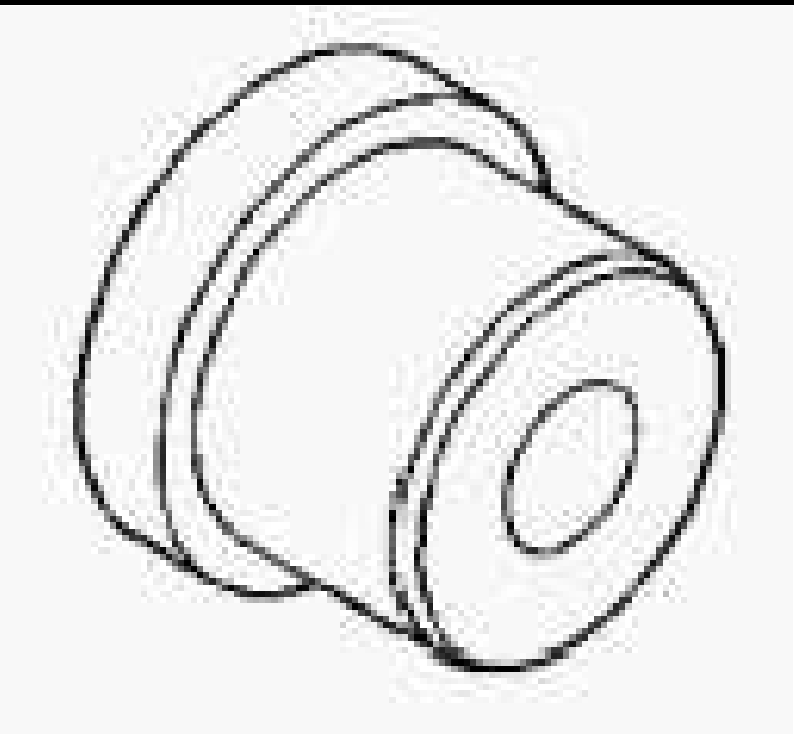
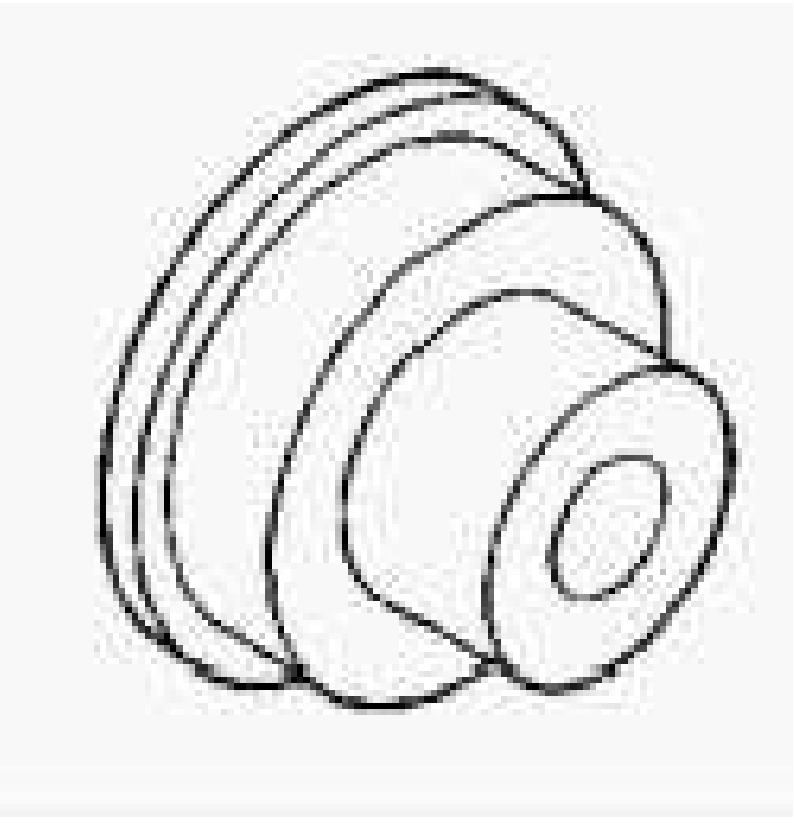
TECHNICAL SPECIFICATIONS

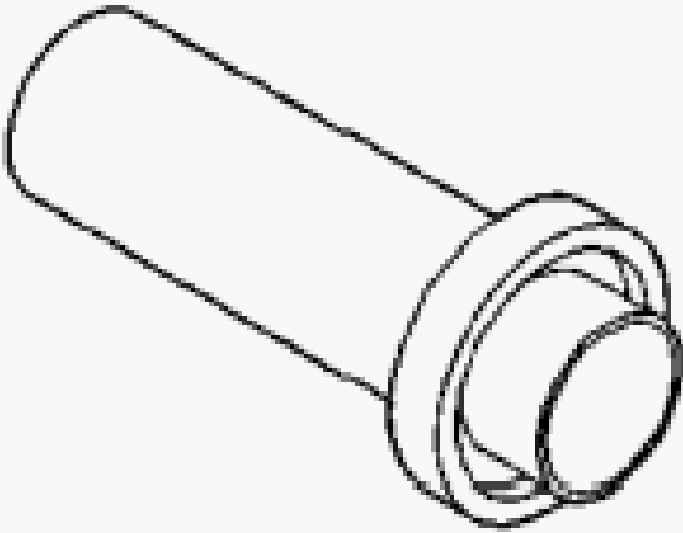
TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
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Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-

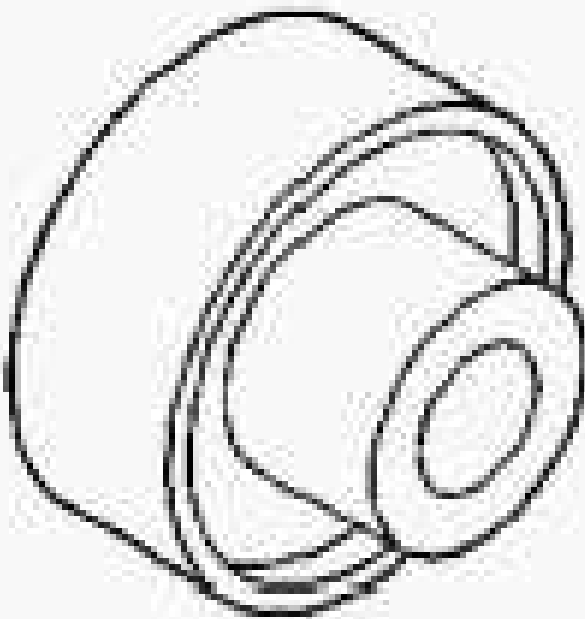
DESCRIPTION	SPECIFICATIONS	COMMENTS
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

SPECIAL TOOLS

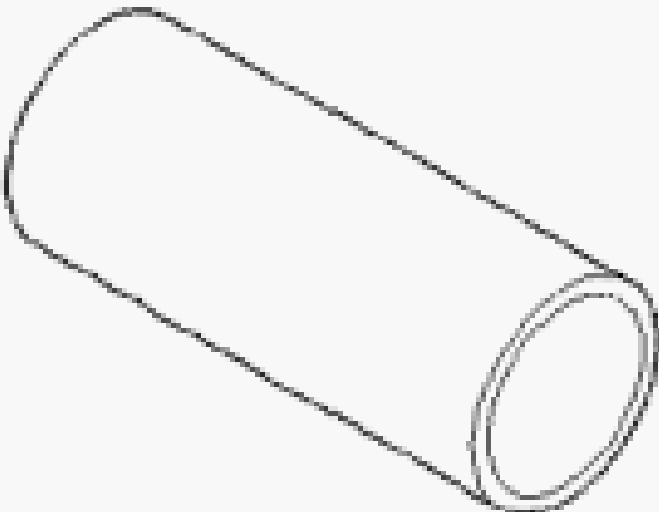
	5066 - Installer, Bushing (Originally Shipped In Kit Number(s) 9975.)
	6436 - Installer, Bearing (Originally Shipped In Kit Number(s) 6472, 9975.)



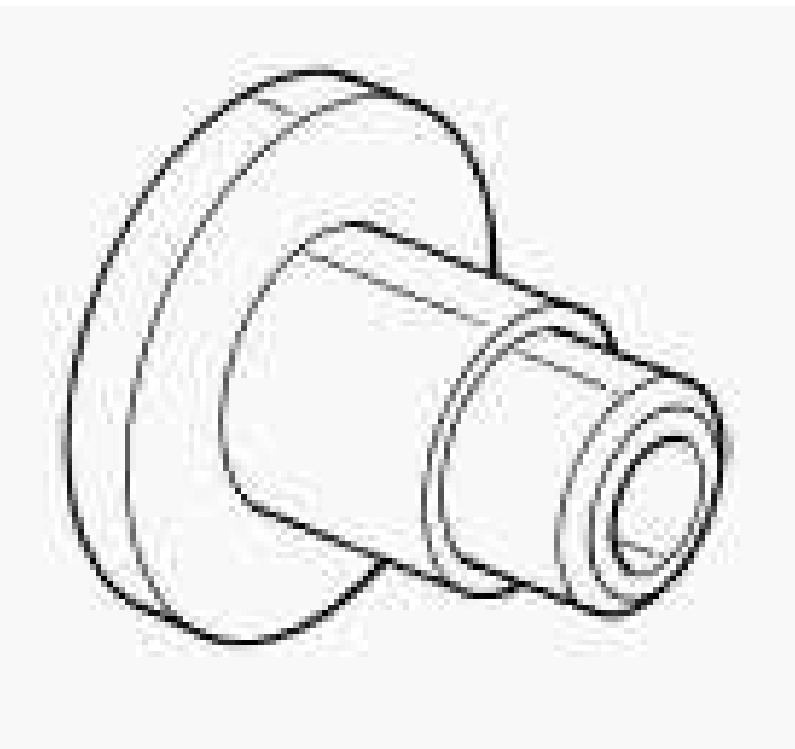
6952A - Installer, Seal
(Originally Shipped In Kit Number(s)
6945, 6947, 6949.)



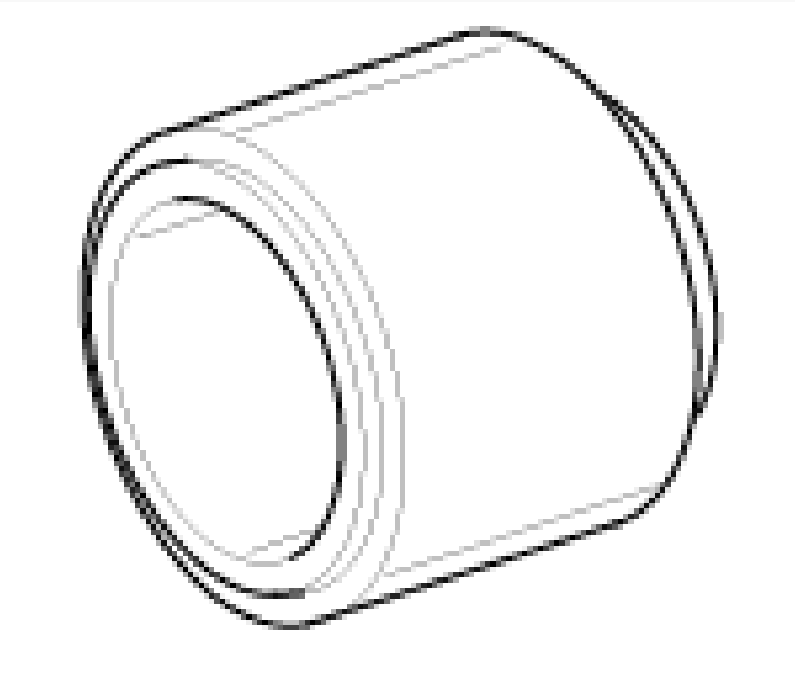
6953 - Remover/Installer, Bearing
(Originally Shipped In Kit Number(s)
6945, 6947, 6949, 9975.)



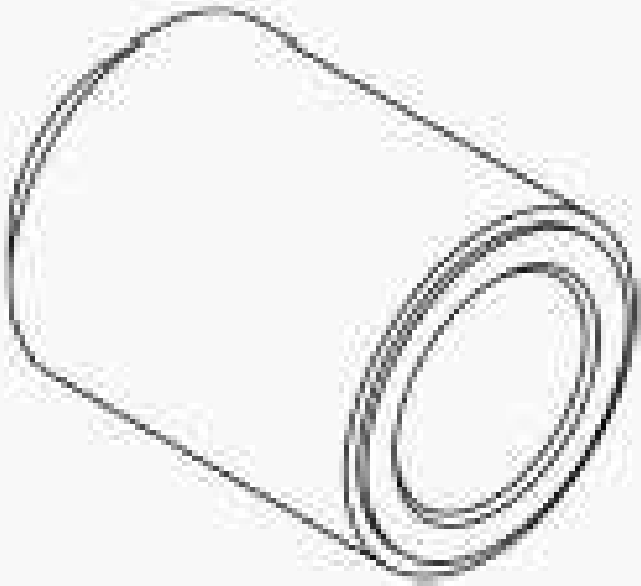
8148 - Cup
(Originally Shipped In Kit Number(s)
8104, 9975.)



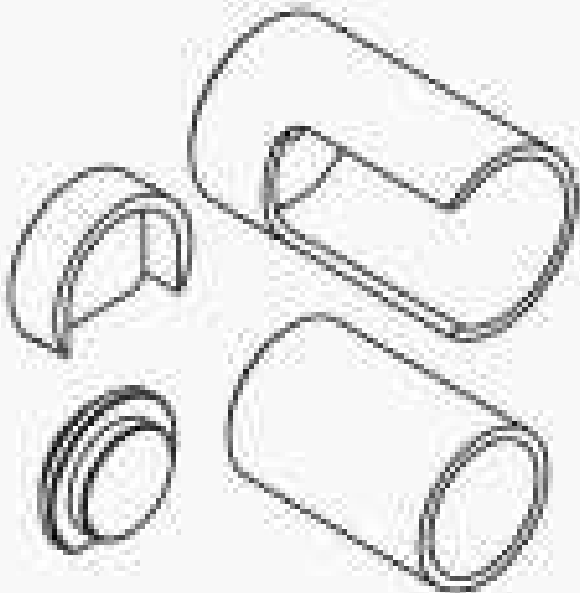
8684 - Installer, Bearing
(Originally Shipped In Kit Number(s)
8685, 8685CC, 8712.)



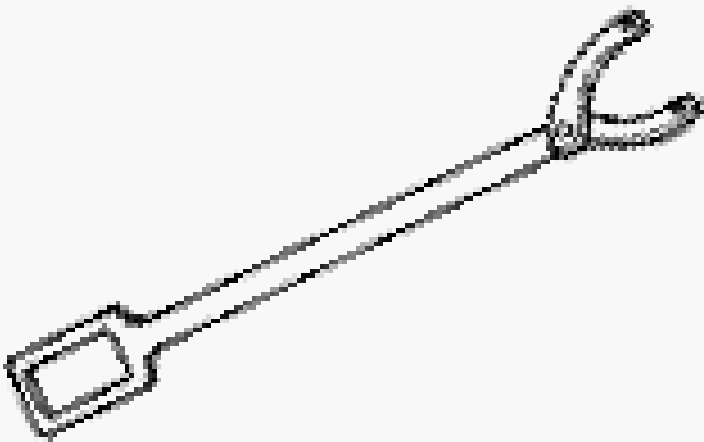
8841 - Installer, Seal
(Originally Shipped In Kit Number(s)
8715, 8719, 8719CC, 9975.)



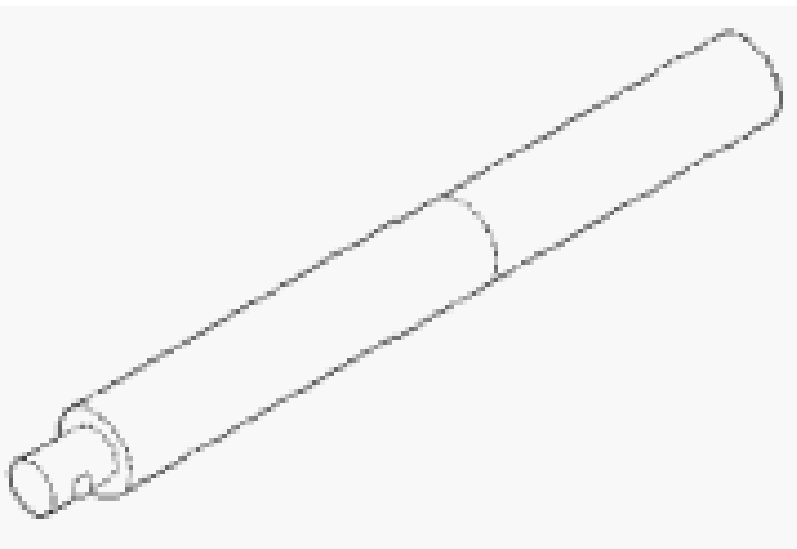
9672 - Installer, Seal
(Originally Shipped In Kit Number(s)
9696, 9697, 9698.)



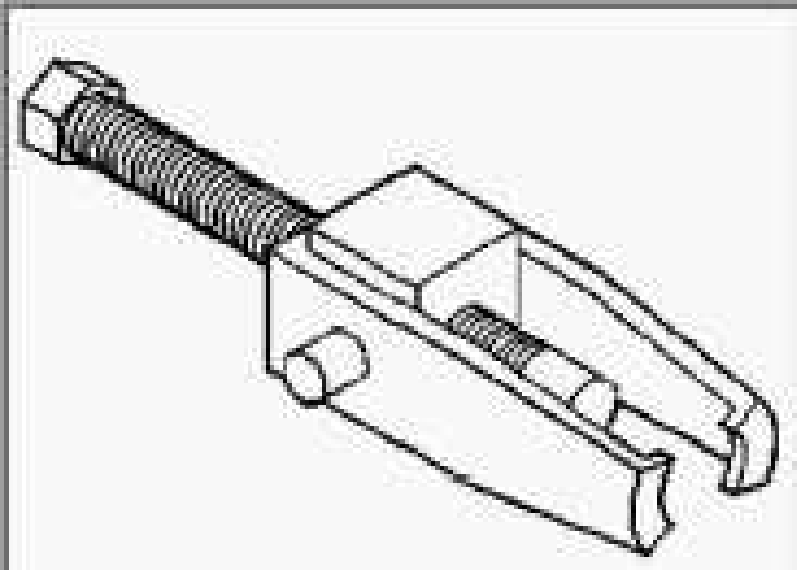
9964 - Remover/Installer, Ball Joint
(Originally Shipped In Kit Number(s)
10015, 10016.)



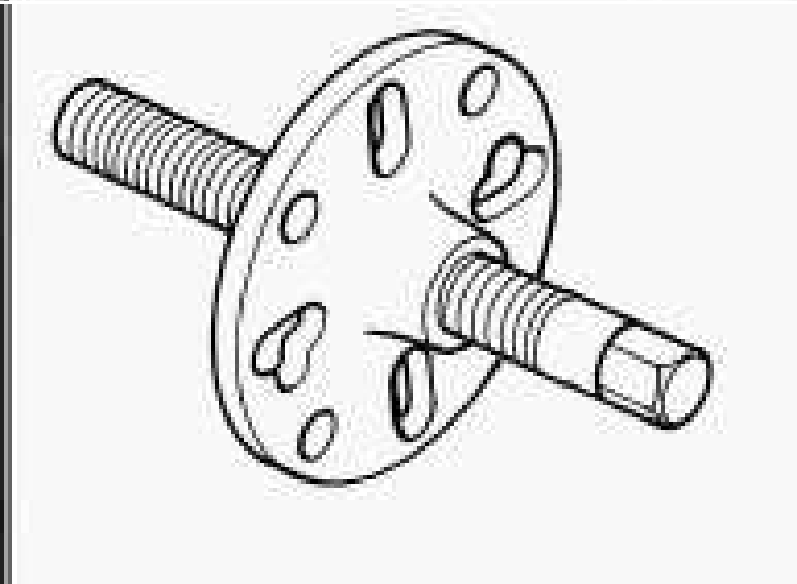
C-3281 - Holder, Flange
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



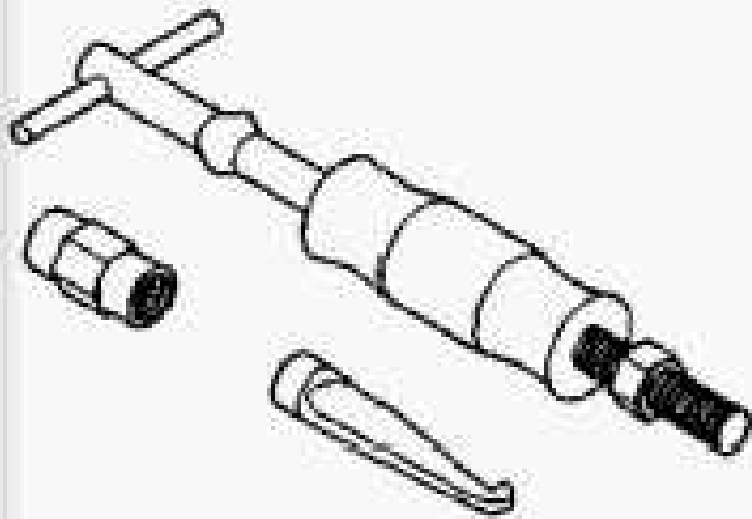
C-4171 - Driver Handle, Universal
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



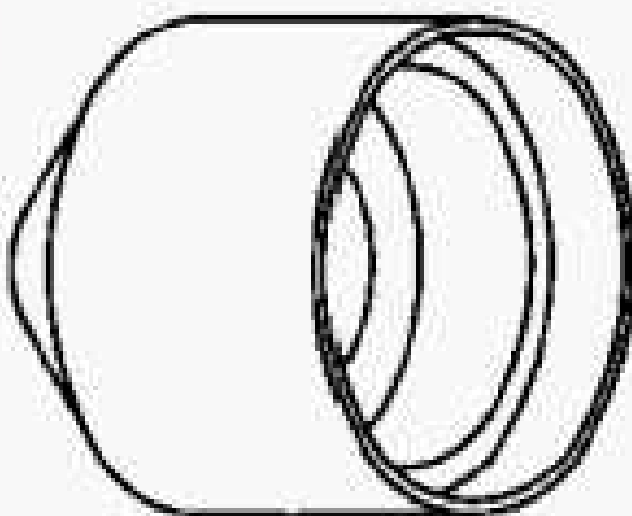
C-4333A - Puller, Pulley



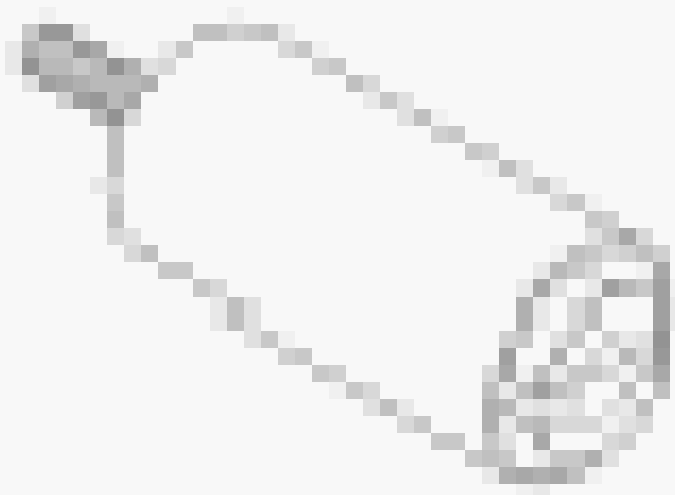
C-452 - Puller, Companion Flange



C-637 - Slide Hammer, Universal
(Originally Shipped In Kit Number(s)
9202.)



D-163 - Installer, Seal
(Originally Shipped In Kit Number(s)
6742, 9975.)



L-4454A - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
9975.)



2053600210 - Installer, Bearing Needle Input Shaft



2053700210 - Installer, Cup Plug input Shaft



2053800210 - Installer, Bearing and Plug Input Shaft



2053900210 - Installer, Seal Input Shaft



2054000210 - Installer, Seal Output Shaft



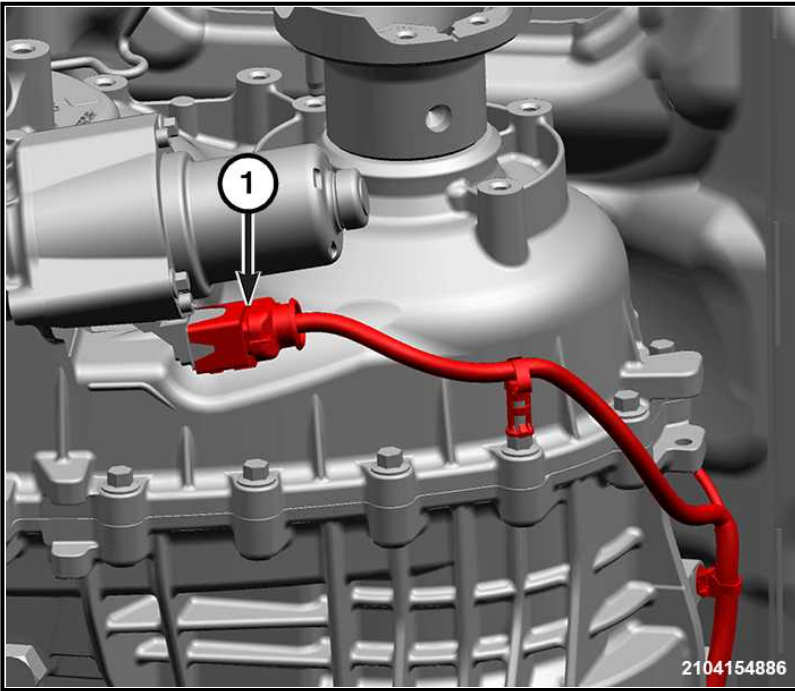
2046100090 - Installer, Transfer Case
Differential Oil Seal

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION

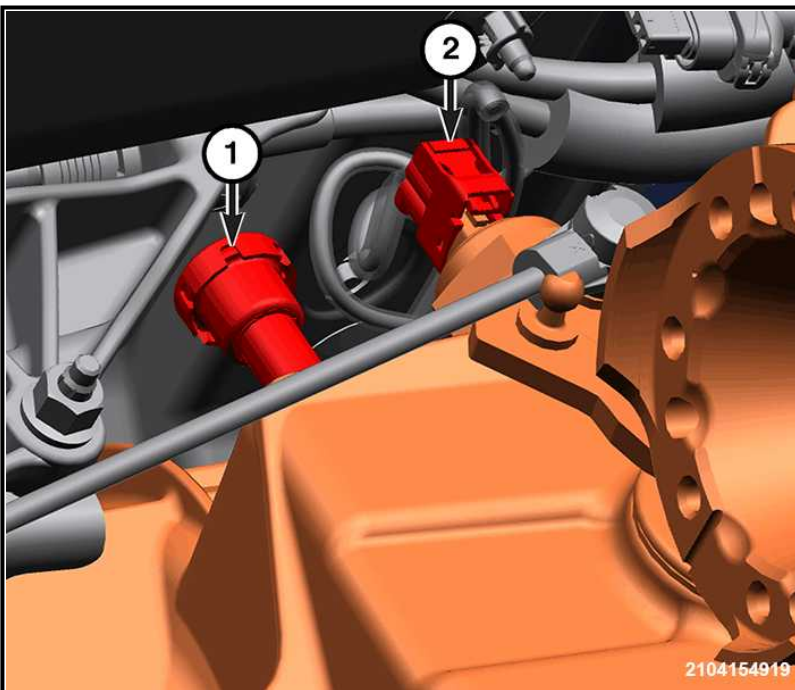
REMOVAL

1. Raise and support vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. If equipped, remove the skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION](#) [PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION](#) [PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .
3. Position a drain pan underneath the transfer case.
4. Remove the transfer case drain plug and drain the lubricant into the drain pan.
5. Remove the front and rear propeller shafts. Refer to [REMOVAL AND INSTALLATION](#) .



1 - Wire Harness Connector

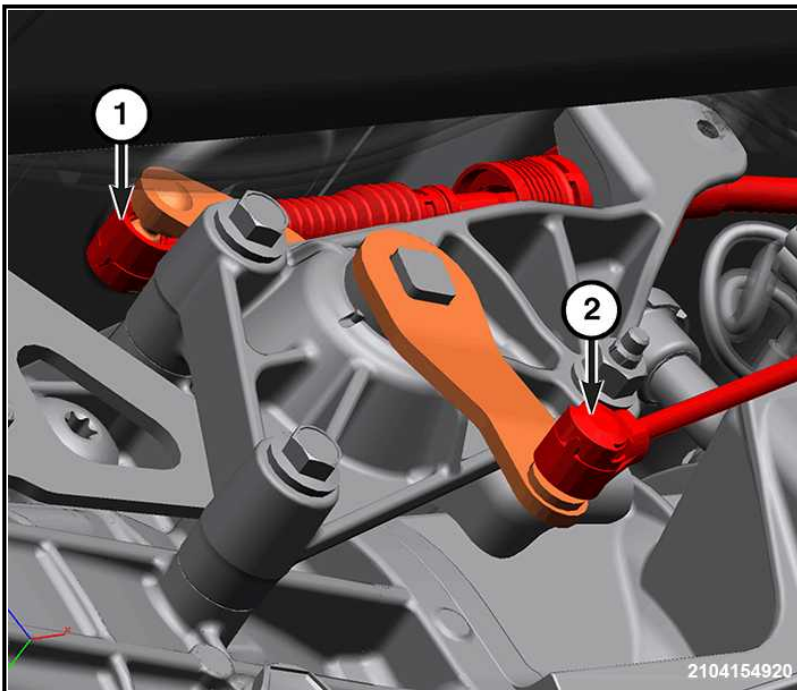
6. Disconnect the wire harness connector from the shift motor.



1 - Vent Tube

2 - Wire Harness Connector

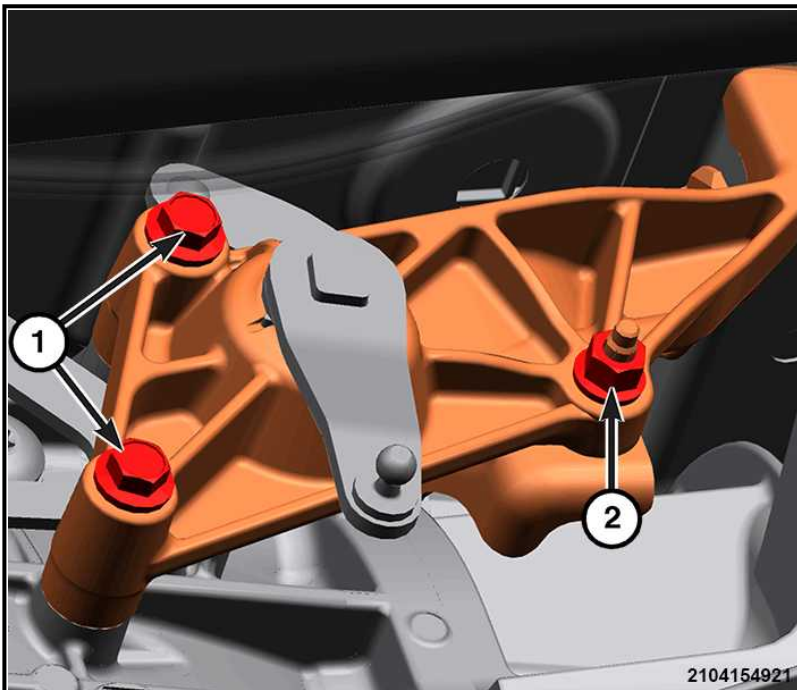
7. Remove the vent tube and the wire harness connector from the neutral safety switch.



1 - Transfer Case Shift Cable

2 - Shift Rod

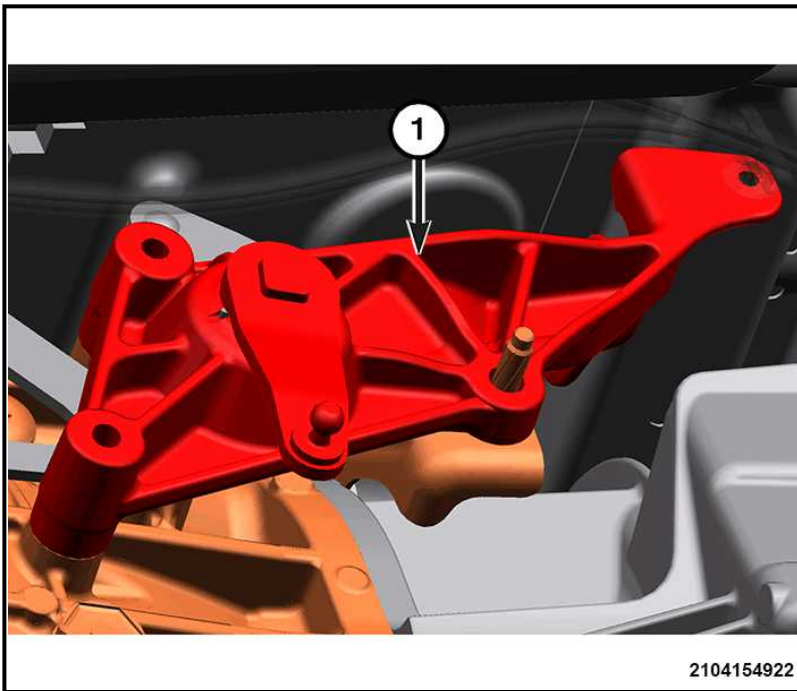
8. Disconnect the transfer case shift cable and the shift rod.



1 - Two Bolts

2 - Nut

9. Remove the two bolts and one nut securing the transfer case shift bracket to the transmission housing.



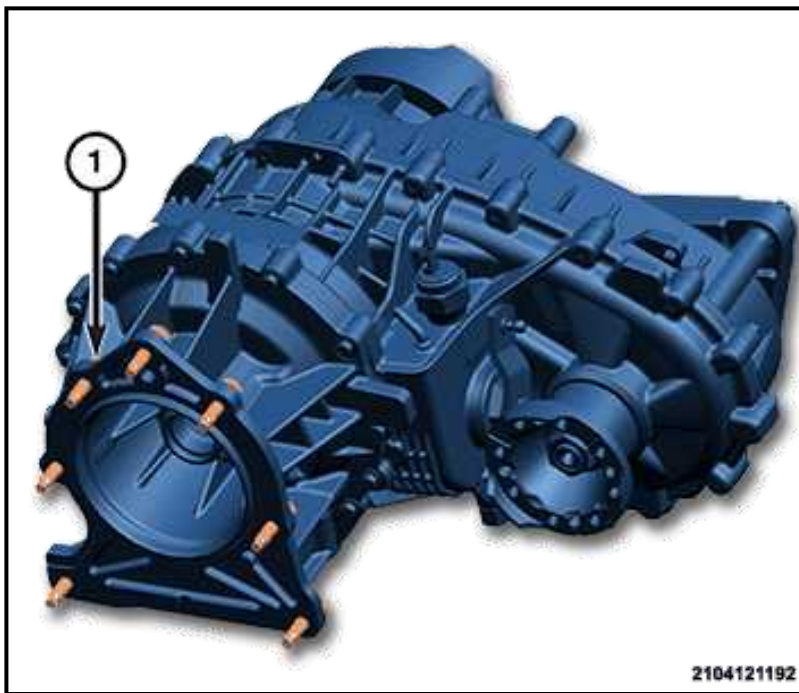
1 - Transfer Case Shift Bracket

10. Remove the transfer case shift bracket.
11. Using a suitable jack stand, support the transmission.
12. Remove the transfer case crossmember. Refer to [CROSSMEMBER, FRONT REINFORCEMENT, REMOVAL AND INSTALLATION](#) [CROSSMEMBER, TRANSMISSION, REMOVAL AND INSTALLATION](#) .



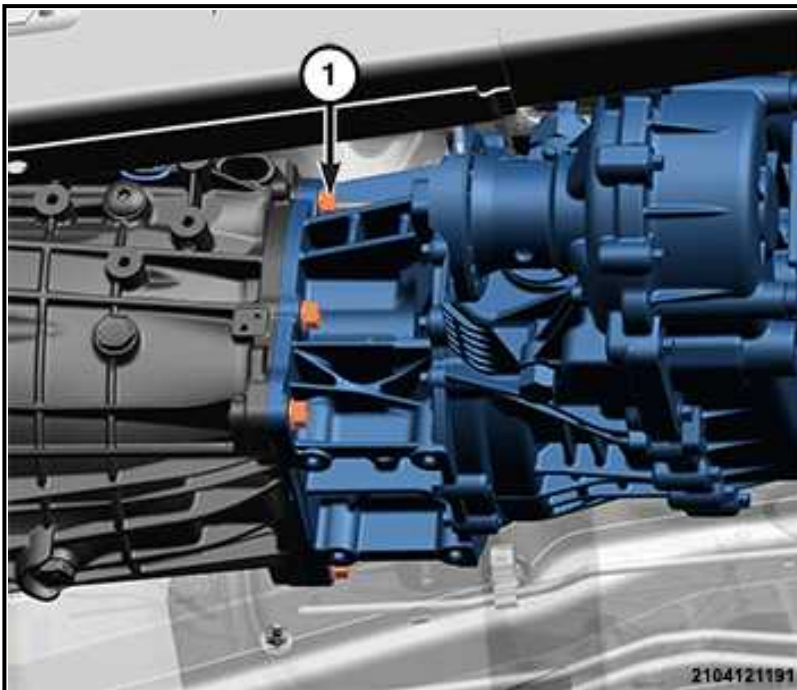
1 - Shift Cable Retaining Bracket Nut

13. Remove the shift cable retaining bracket nut, then remove the shift cable retaining bracket.
14. Using a suitable jack, support the transfer case. Using safety chains, secure transfer case to the jack.



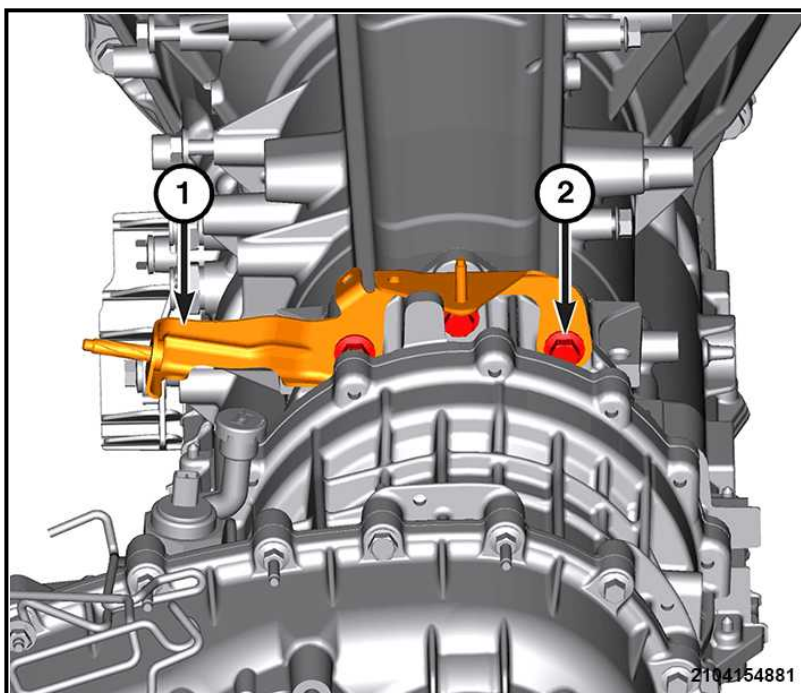
1 - Transfer Case Bolts

NOTE: There are seven bolts securing the transfer case to the transmission.



1 - Transfer Case Bolts

15. Remove the seven bolts securing the transfer case to the transmission assembly.



1 - Transfer Case Shift Bracket
2 - Transfer Case Shift Bracket Bolts

16. Remove the transfer case shift bracket from the top of the transfer case.
17. Move the transfer case assembly rearward until it is free of the transmission output shaft.
18. Lower the jack and remove the transfer case from under the vehicle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Fill the transfer case with the specified fluid. Refer to [**STANDARD PROCEDURE - FLUID DRAIN AND FILL**](#) .

TORQUE SPECIFICATIONS

TRANSFER CASE

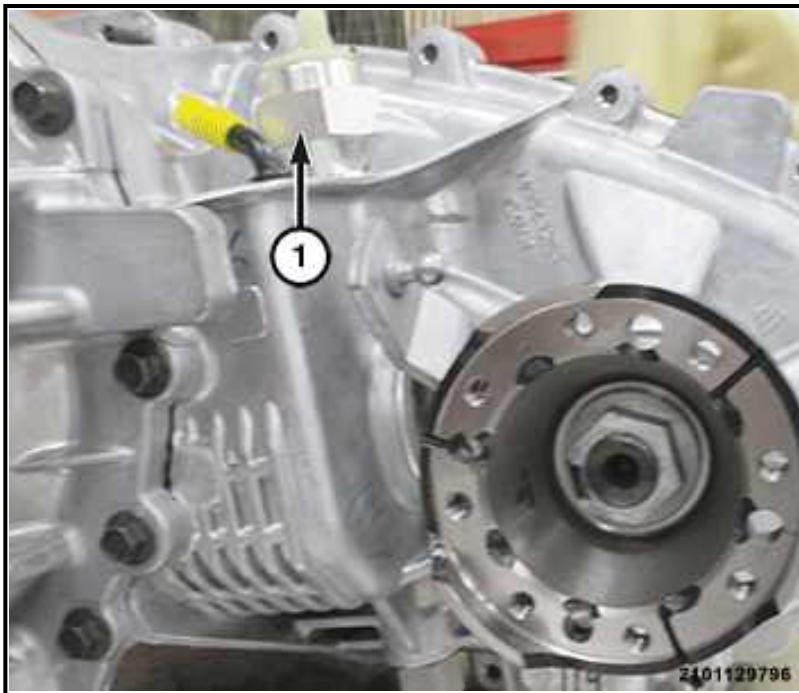
DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

DISASSEMBLY AND ASSEMBLY

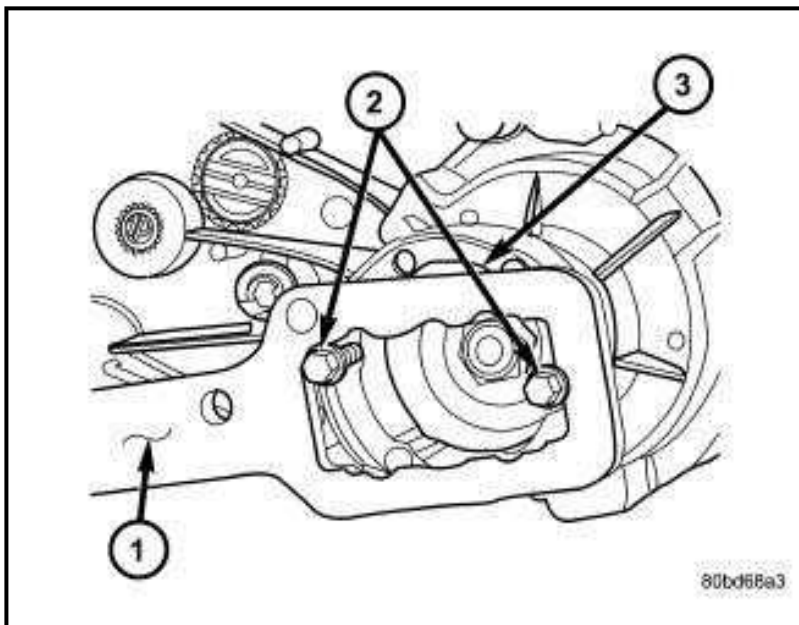
COMMAND-TRAC

DISASSEMBLY



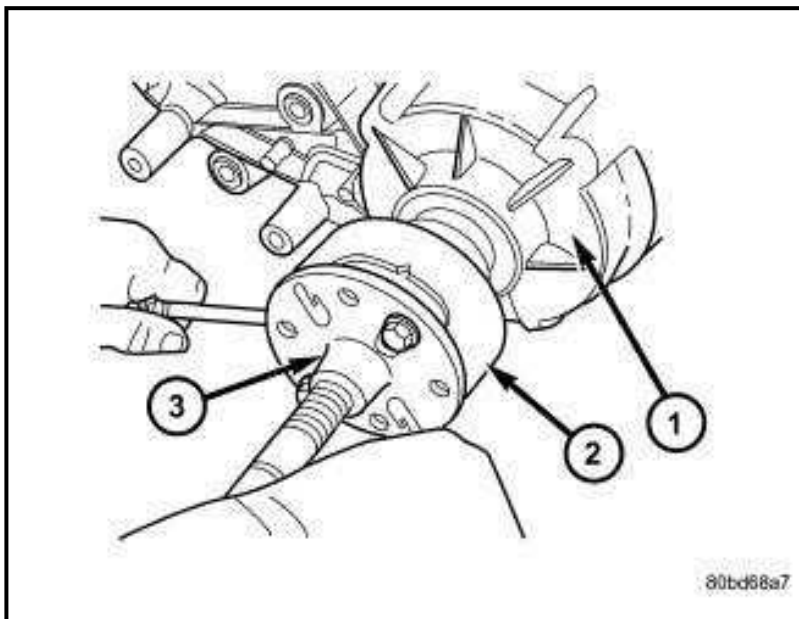
1 - Transfer Case Position Sensor

1. Remove the transfer case position sensor.



1 - Flange Holder Tool
2 - Bolts
3 - Flange

2. Install two bolts partially in the propeller shaft companion flange, 180B° from each other.
3. Install the rectangular end of the (special tool #C-3281, Holder, Flange) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.



1 - Transfer Case
2 - Flange
3 - Flange Puller

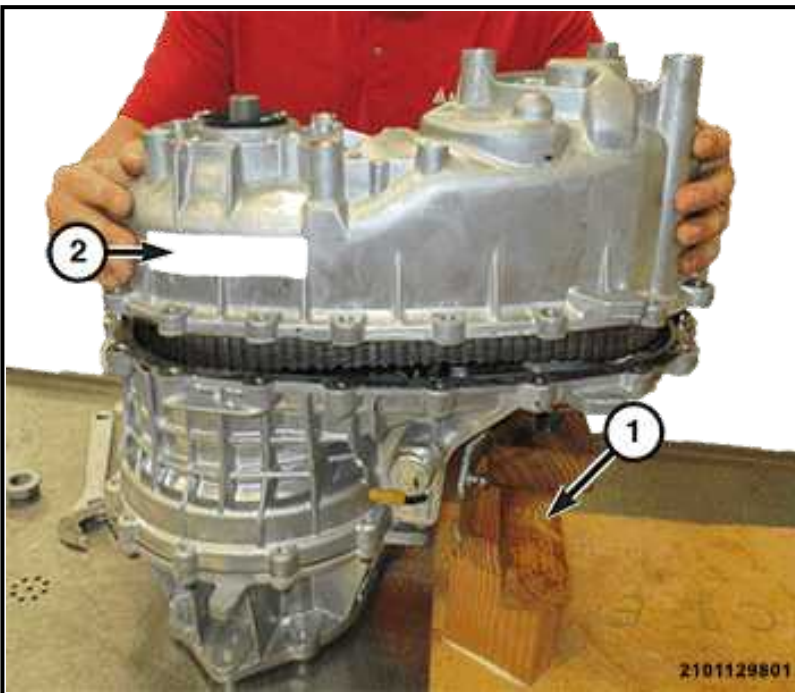
4. Using the (special tool #C-452, Puller, Companion Flange) remove the companion flange from the assembly.
5. Using the same procedure as the companion flange, remove the main shaft output flange.
6. Remove the range lever to selector shaft bolt.

NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.



1 - Transfer Case Bolts

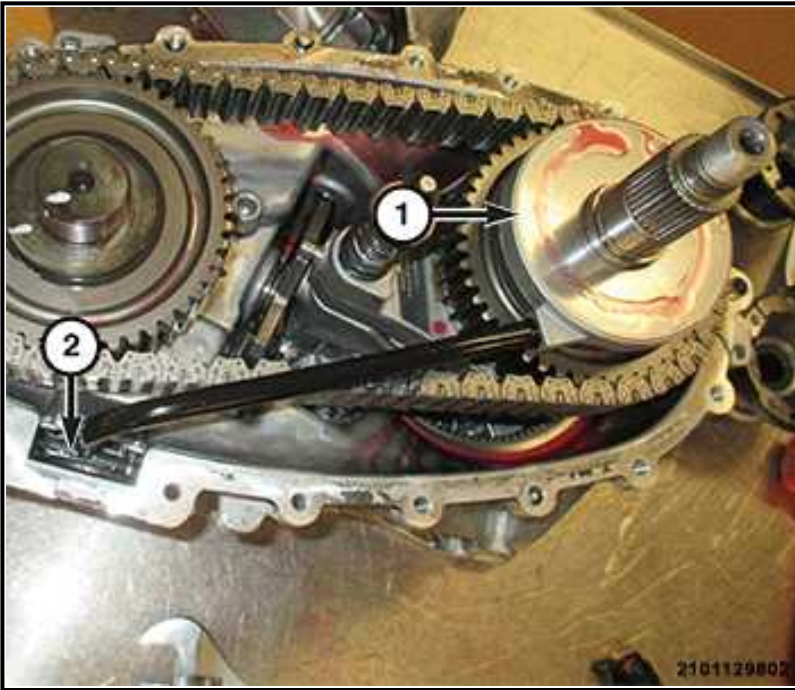
7. Remove the transfer case bolts.
8. Using an acceptable pry tool inserted in the slot at each end of the transfer case, loosen the transfer case halves to break the sealer bead.



1 - Wood Block

2 - Rear Transfer Case Half

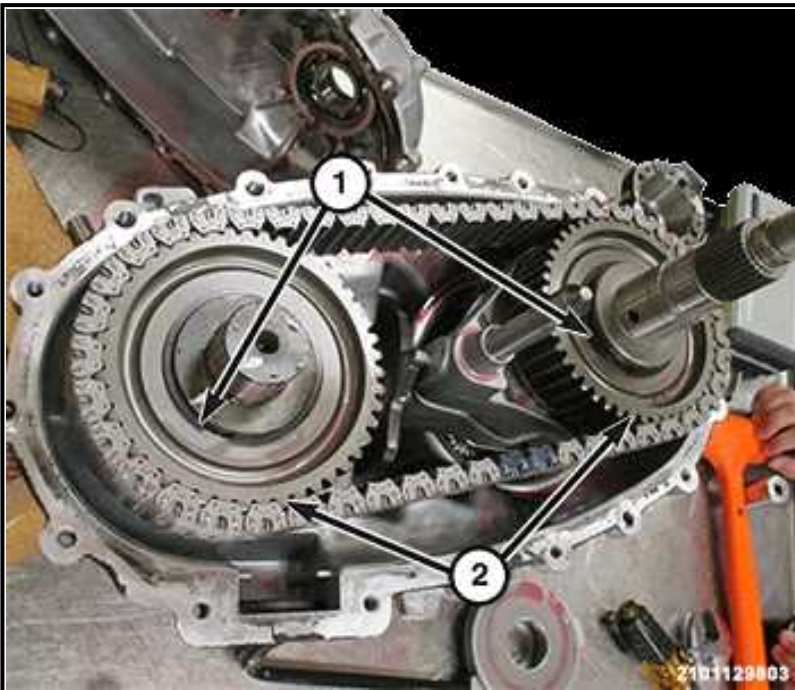
9. Remove the case by disengaging the rear of the case from the alignment dowels.



1 - Oil Pump

2 - Oil Pump Pick-up Tube

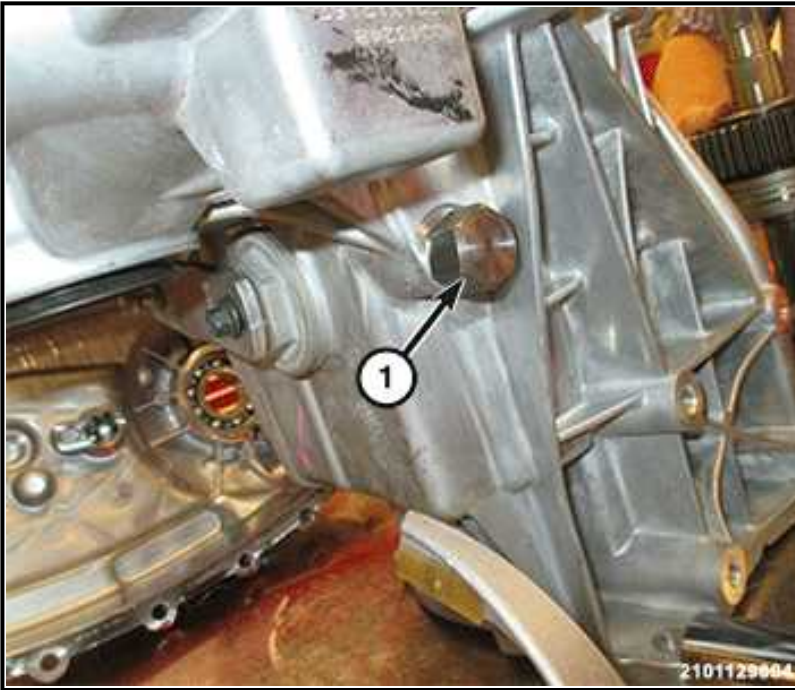
10. Remove the oil pump and the oil pump pick-up tube.



1 - Snap Rings

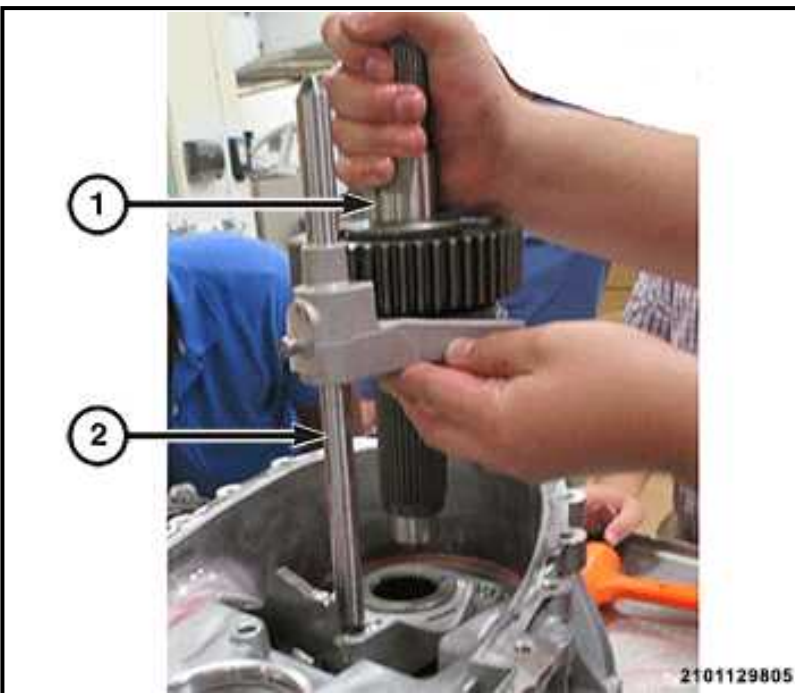
2 - Chain and Sprockets

11. Remove the snap-rings from each sprocket and remove the chain and sprockets by lifting both sprockets off of the shafts equally.



1 - Detent Plug

12. Remove the detent plug with spring and plunger.

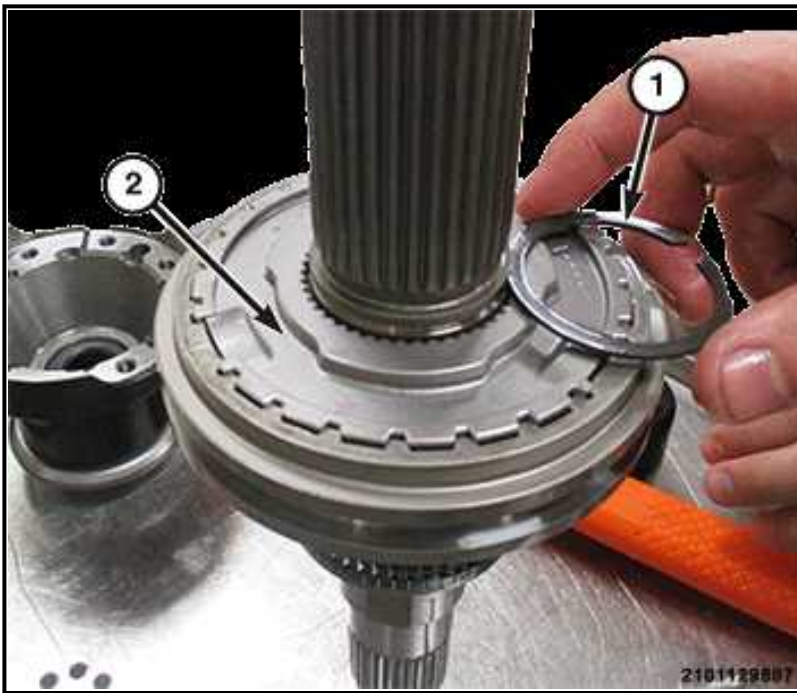


1 - Main Shaft

2 - Shift Fork

13. Remove the main shaft and the shift fork and rail from the transfer case.

14. Remove the output shaft.



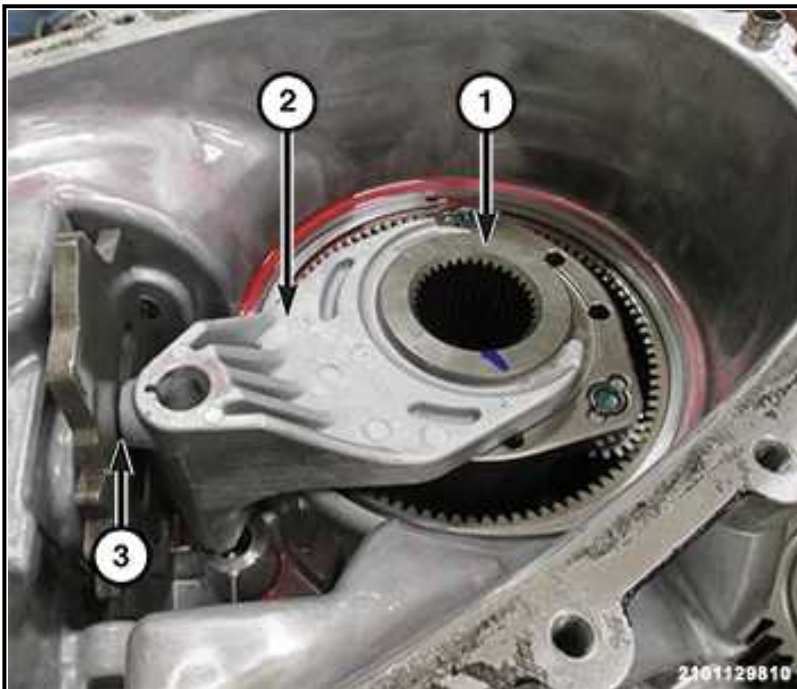
1 - Snap Ring

2 - Synchronizer

15. Remove and **DISCARD** the snap ring and remove the synchronizer from the main shaft.

NOTE:

Grasp the synchronizer at both the top and bottom when installing or removing the synchronizer. Failure to hold the synchronizer together may allow the outer ring of the synchronizer to drop, allowing the small springs, ball bearings, and slides to fall out and scatter.

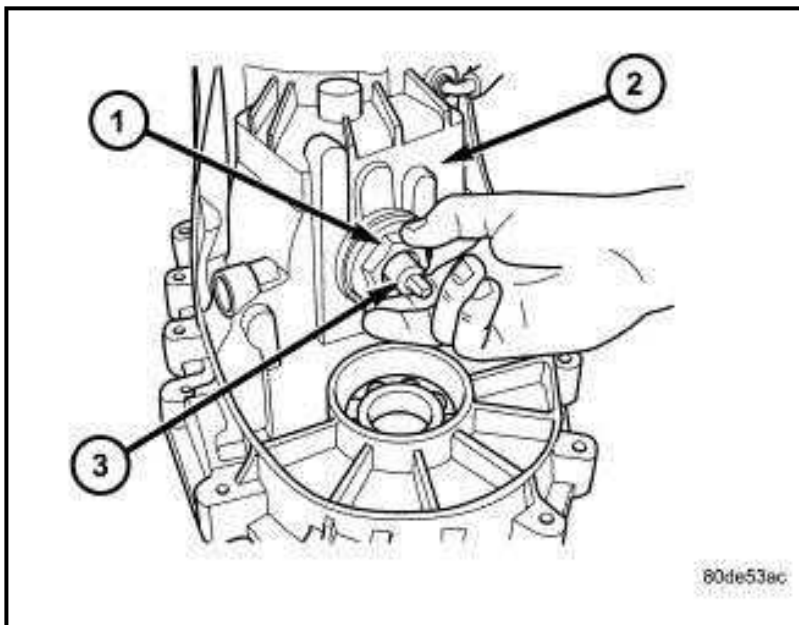


1 - Input Gear

2 - Range Fork

3 - Range Fork Located in Selector Plate

16. Remove the range fork assembly with the input gear.

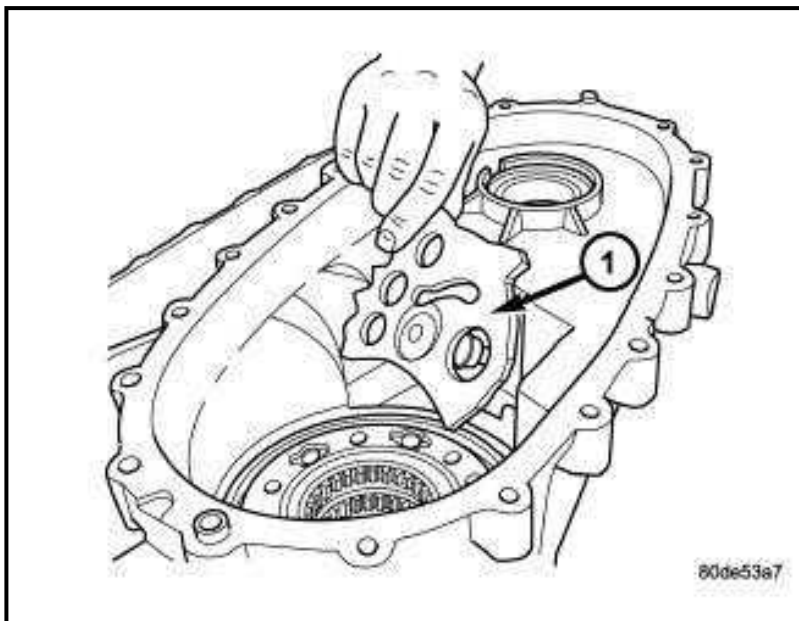


1 - SECTOR SUPPORT

2 - FRONT CASE

3 - SECTOR SHAFT

17. Remove the shift sector support.

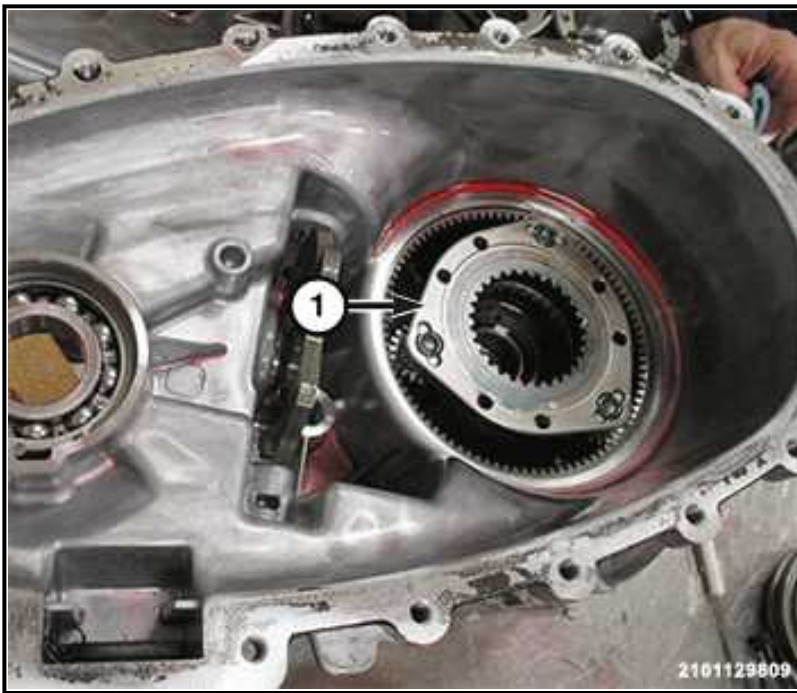


1 - SHIFT SECTOR

18. Remove shift sector.

19. Remove the input shaft seal to access the planetary gear assembly snap ring

20. Remove the snap ring retaining the planetary gear assembly.



1 - Planetary Gear Set

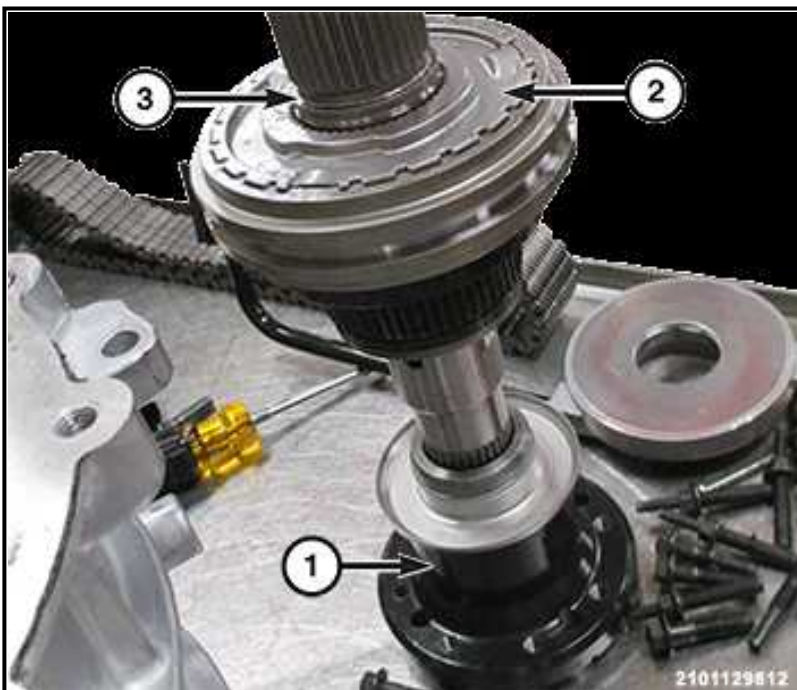
21. Remove the planetary gear set.

NOTE: THE MP1622 ANNULUS RING GEAR IS NOT REPLACEABLE, YOU MUST REPLACE THE CASE HALF. THE MP1622-OR ANNULUS RING GEAR IS REPLACEABLE WITHOUT REPLACING THE CASE HALF.

22. Clean the case halves.

ASSEMBLY

1. Clean both case halves and mating surfaces using brake cleaner or similar. Make sure all of the old sealer is removed and the surface is free of any oils or debris.
2. Replace any bearings in the case halves that are spalled, damaged, or have been subjected to highly contaminated fluid (metal contamination from catastrophic failure).

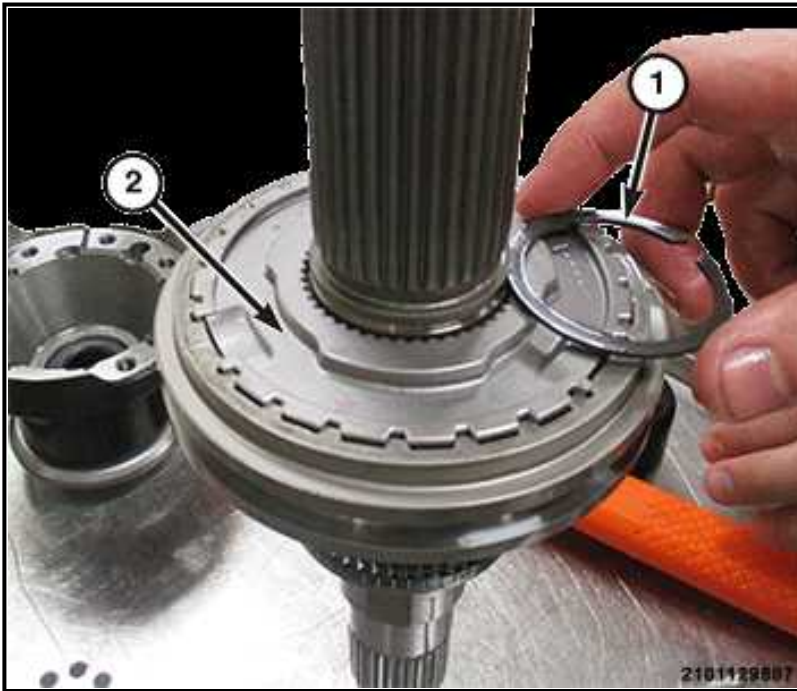


1 - Output Flange

2 - Synchronizer

3 - Main Shaft

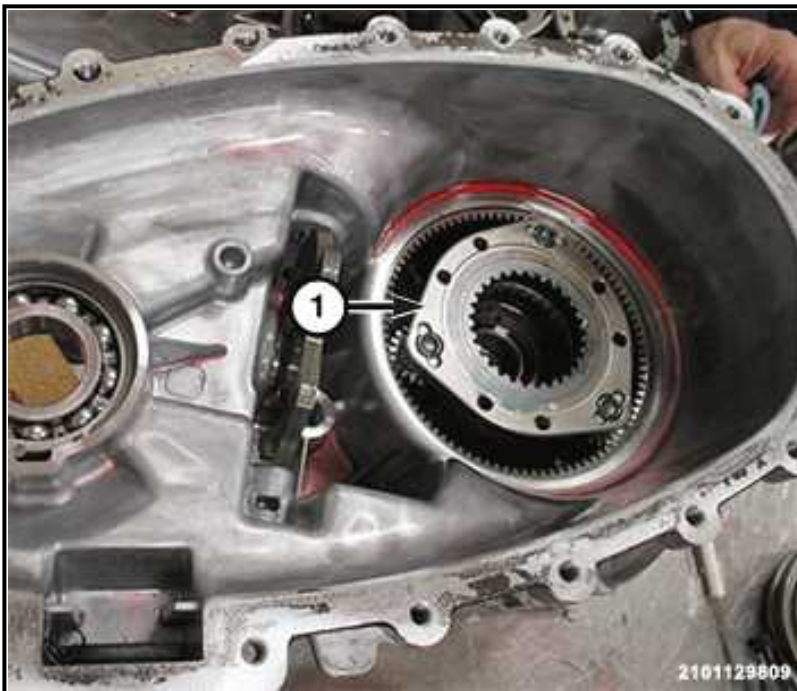
3. Using the output flange as a stand, install the synchronizer onto the main shaft.



1 - Snap Ring

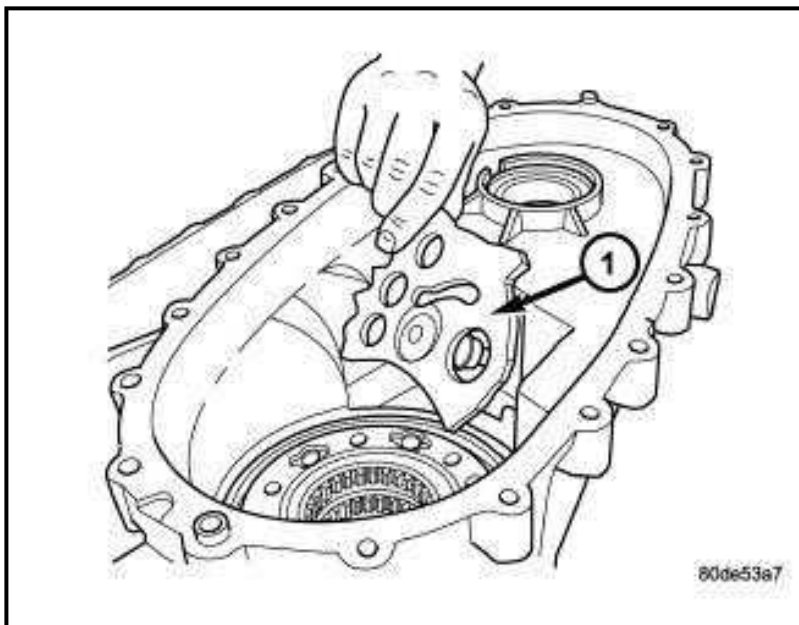
2 - Synchronizer

4. Install the **NEW** snap ring for the synchronizer onto the main shaft.
5. If equipped with removable annulus ring gear, install the annulus ring gear into the case half. Install the annulus ring gear snap ring, be sure to fully seat the snap ring.



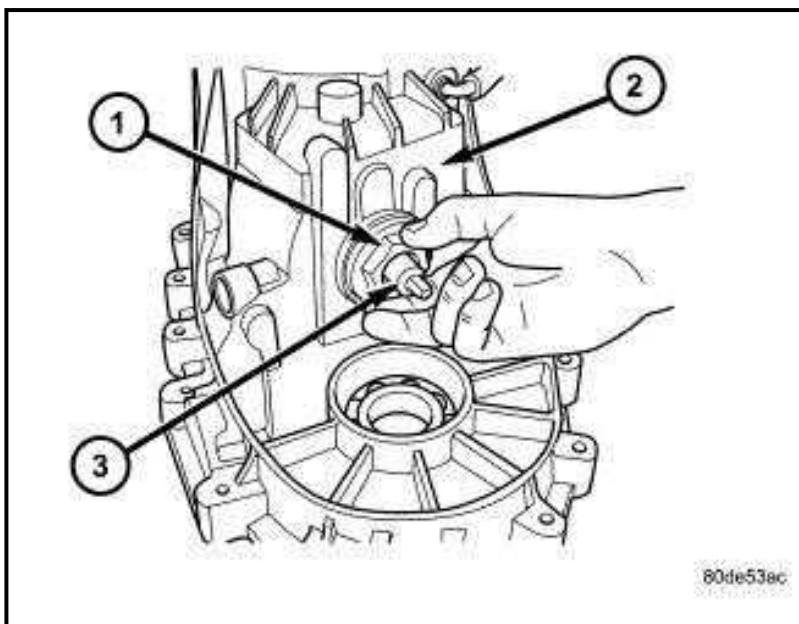
1 - Planetary Gear Set

6. Install the planetary gear set into the annulus gear.
7. Install the snap ring retaining the planetary gear assembly.



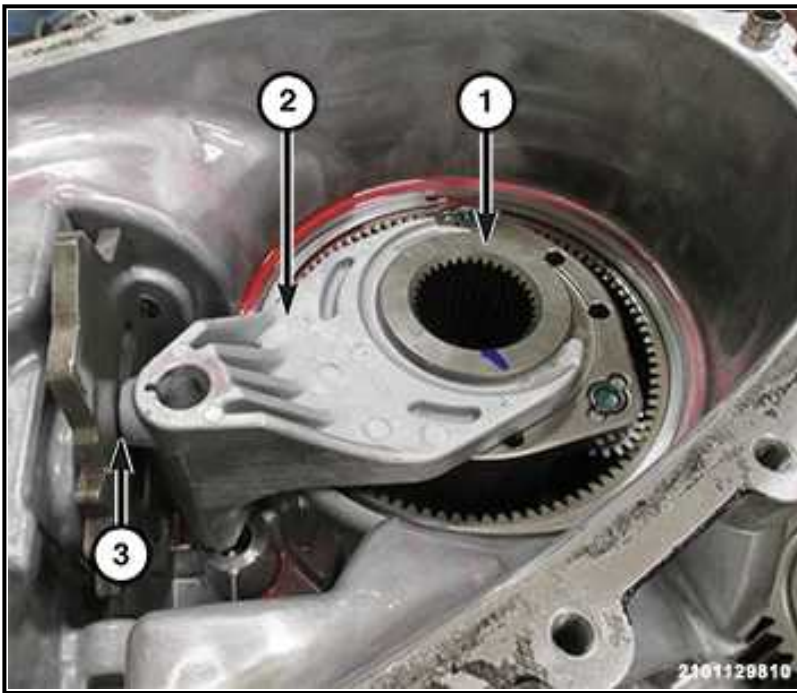
1 - SHIFT SECTOR

8. Lubricate sector shaft with transmission fluid and install shift sector in case. Position slot in sector so it will be aligned with shift fork pin when shift forks are installed.



1 - SECTOR SUPPORT
2 - FRONT CASE
3 - SECTOR SHAFT

9. Install the shift sector support.

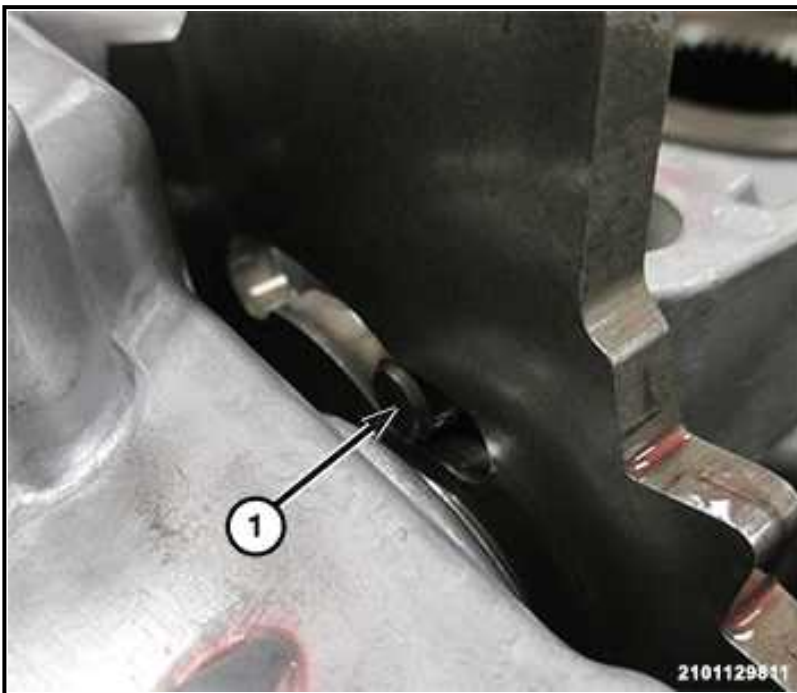


1 - Input Gear

2 - Range Fork

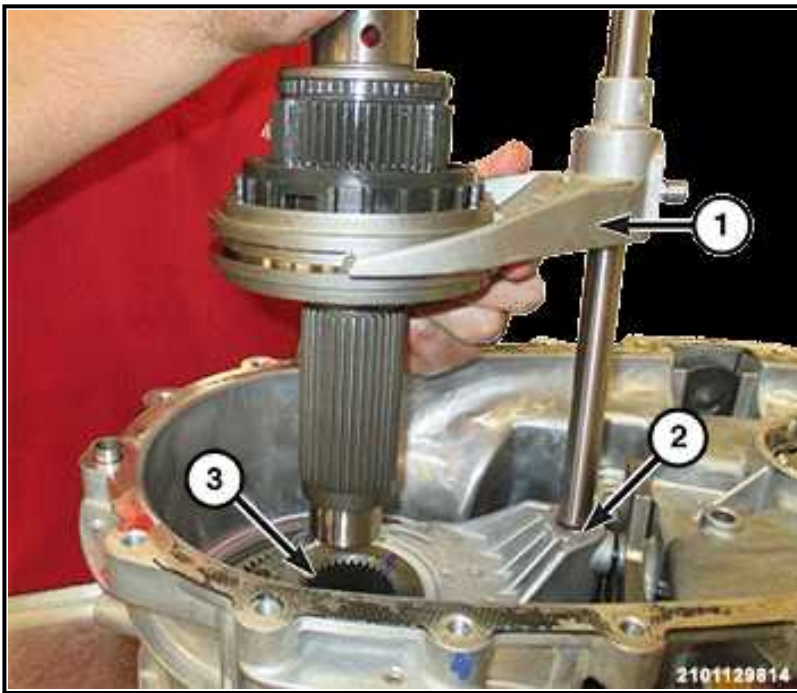
3 - Range Fork Located in Selector Plate

10. Assemble the input gear assembly together with the range fork and install them into the planetary carrier.



1 - Range Fork Located in Selector Plate

11. Make sure the tang on the range fork is seated in the notch on the selector plate.

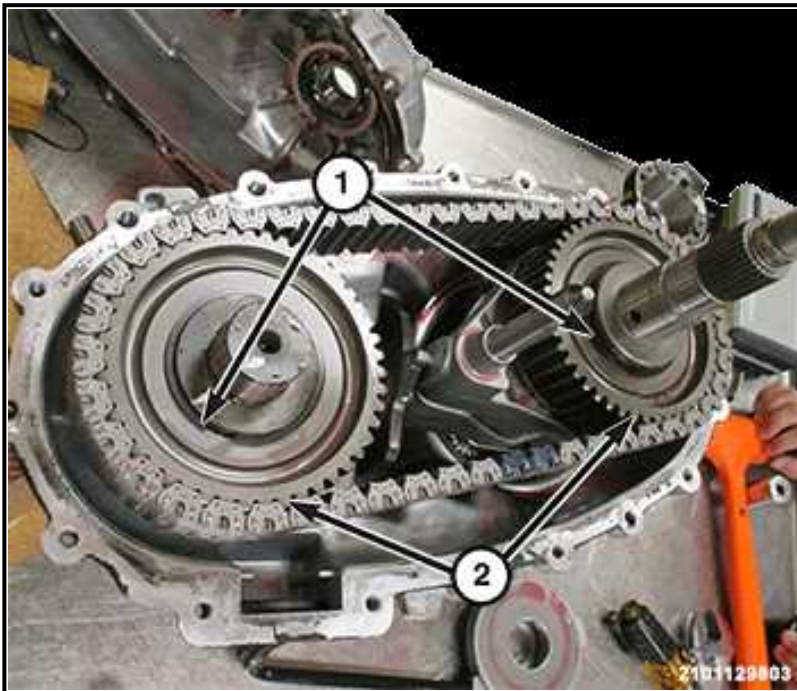


1 - Mode Fork

2 - Shift Rail

3 - Main Shaft

12. Holding the mode fork onto the synchronizer, while supporting the synchronizer from the bottom, guide the shift rail and the main shaft into their respective bores.



1 - Snap Rings

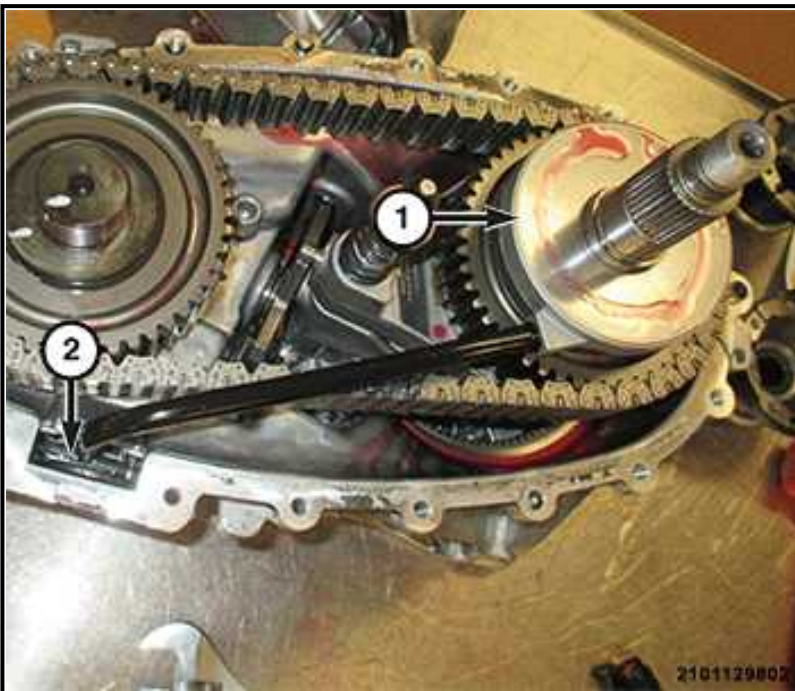
2 - Chain and Sprockets

13. Install the output shaft into the case and install the chain and sprockets with the blue link facing upward.



1 - Snap Rings

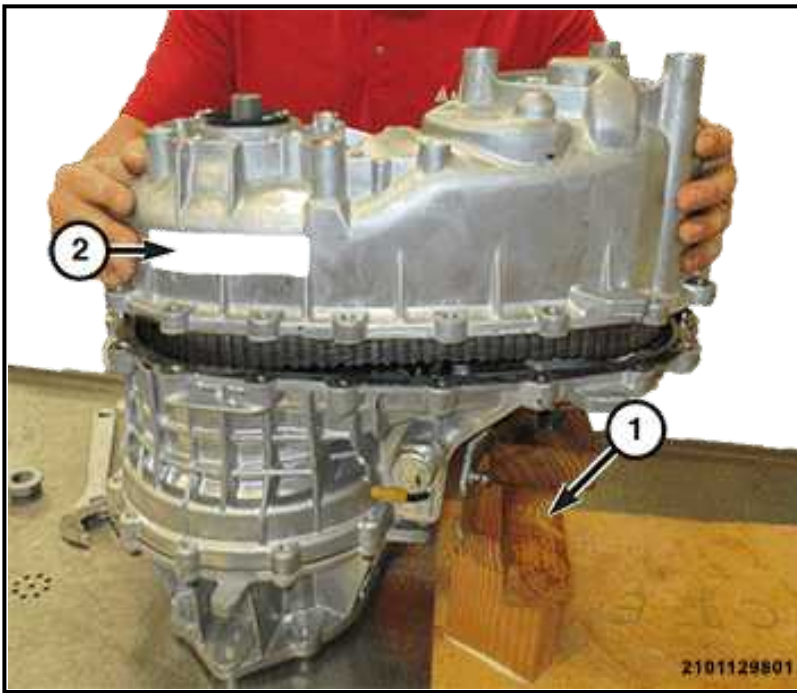
14. Install the snap rings on both sprockets. If the snap rings are over extended or loose, replace them with **NEW** snap rings.



1 - Oil Pump

2 - Oil Pump Pick-up Tube

15. Install the oil pump and pick up tube. Verify the pick up tube is seated in the slot in the case half.
16. Wipe the case half mating surfaces and place a 1/4" bead of MoparB® sealer on one case half.



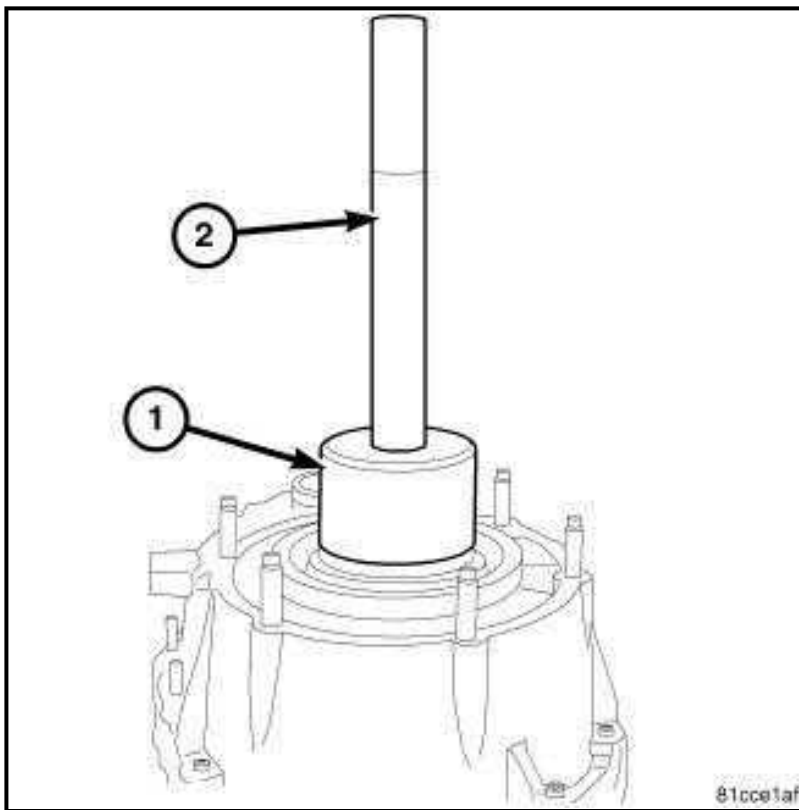
- | |
|-----------------------------|
| 1 - Wood Block |
| 2 - Rear Transfer Case Half |

17. Install the case halves together, ensuring they are fully seated.



- | |
|-------------------------|
| 1 - Transfer Case Bolts |
|-------------------------|

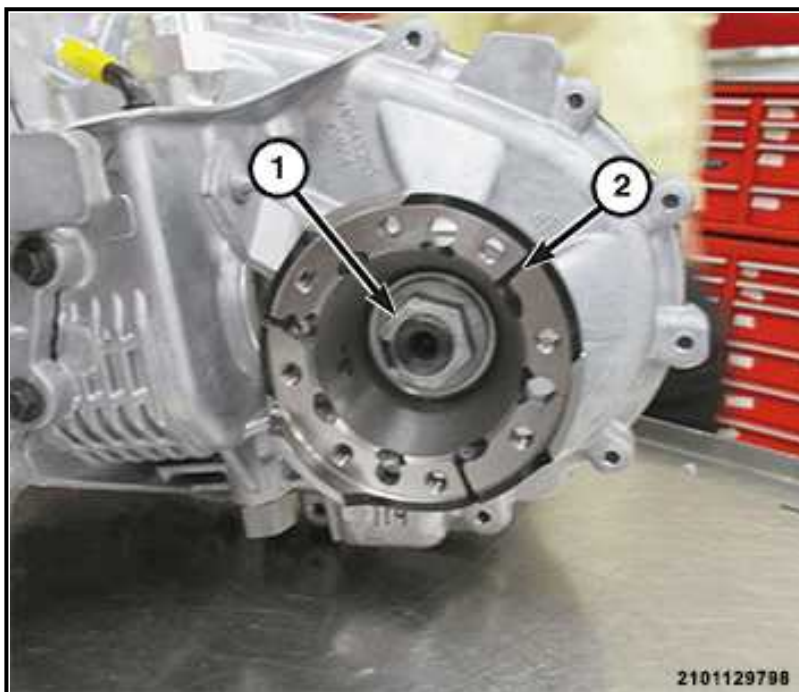
18. Tighten the bolts in a criss-cross pattern to the proper torque specification.



1 - Seal Installer Tool

2 - Driver Handle

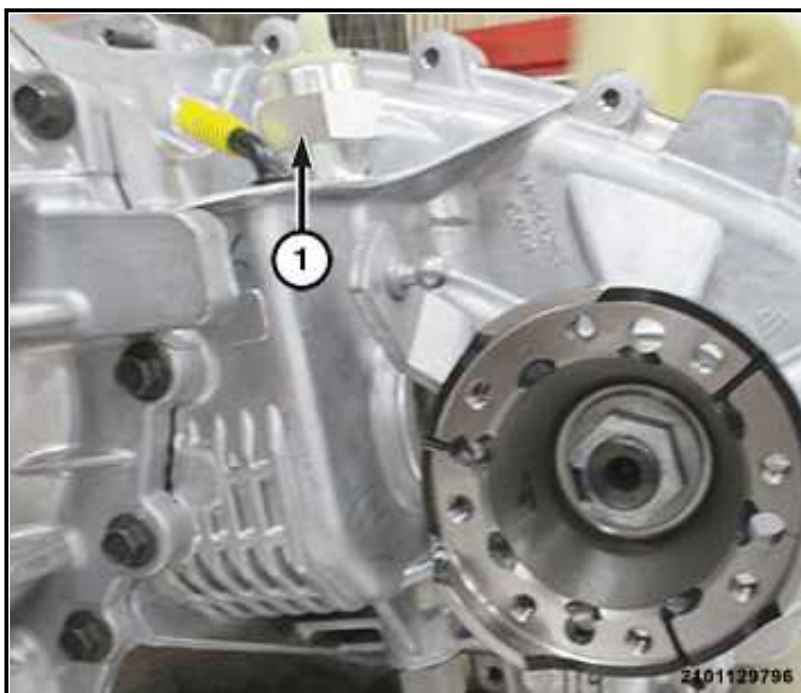
19. Using (special tool #2053900210, Installer, Seal Input Shaft) and (special tool #C-4171, Driver Handle, Universal), install the **NEW** front input shaft seal.



1 - Rear Output Flange Nut

2 - Rear Output Flange

20. Install the front and rear output flange and the flange nuts. Tighten the nuts to the proper torque specification.



1 - Transfer Case Position Sensor

21. Install the transfer case position sensor.

NOTE: Inspect the transfer case position sensor O-ring for damage before installing the transfer case position sensor.

22. Install the transfer case. Refer to [REMOVAL AND INSTALLATION](#) .

TORQUE SPECIFICATIONS

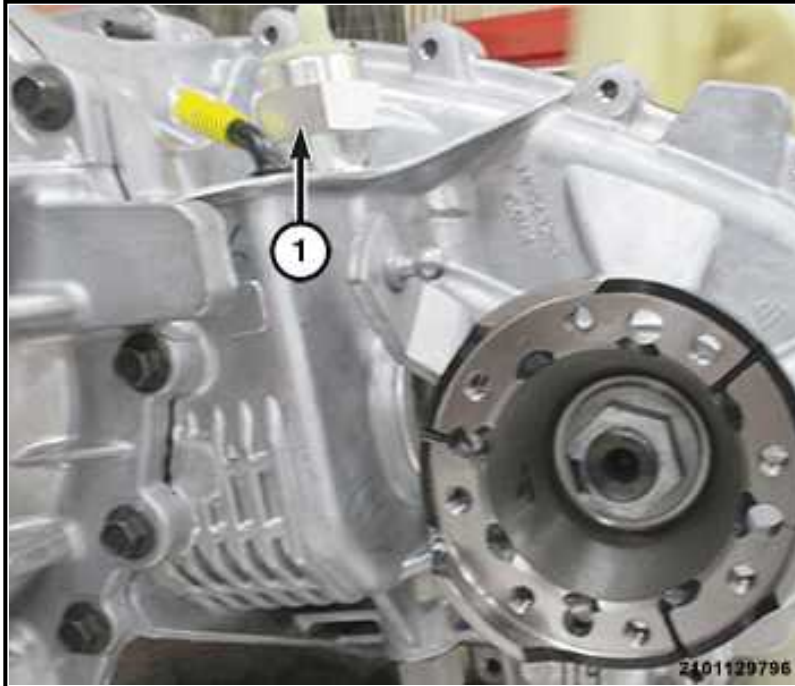
TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

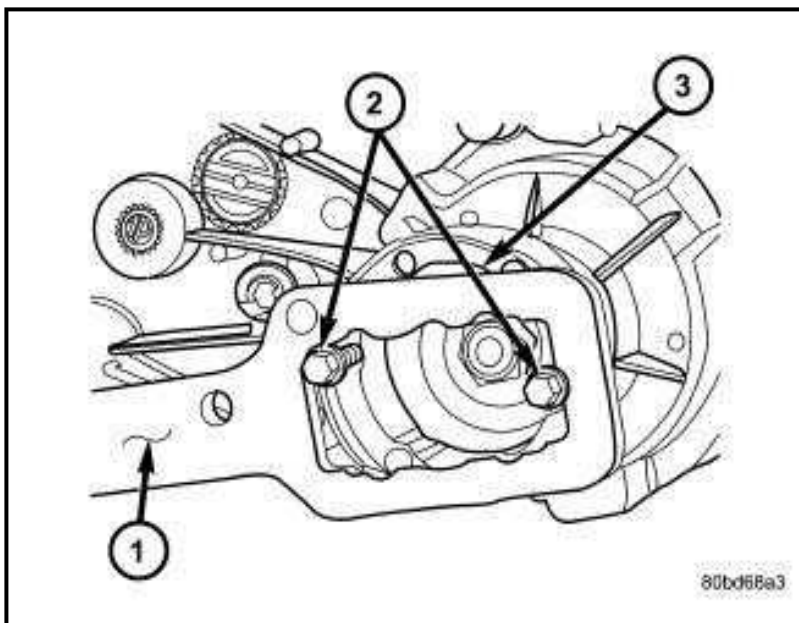
4:1 ROCK-TRAC

DISASSEMBLY



1 - Transfer Case Position Sensor

1. Remove the transfer case position sensor.



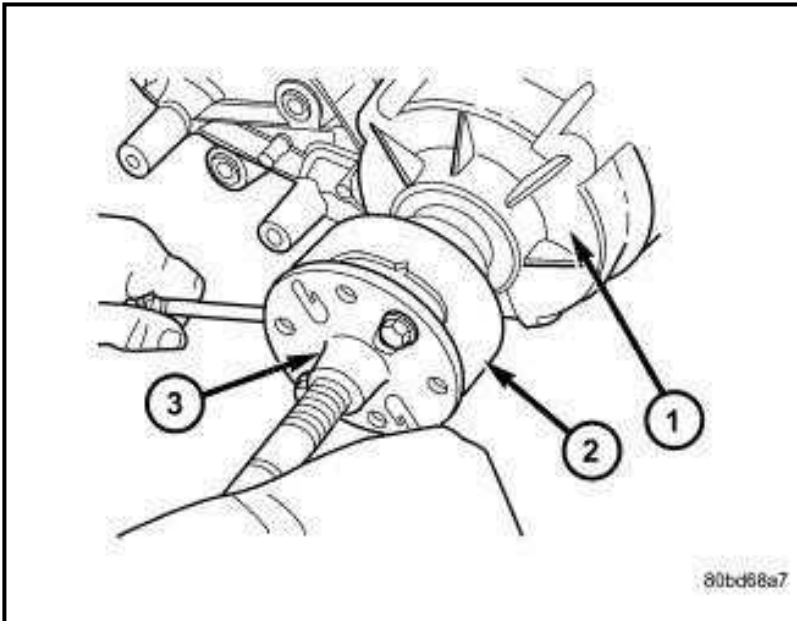
1 - Flange Holder Tool

2 - Bolts

3 - Flange

2. Install two bolts partially in the propeller shaft companion flange, 180B° from each other.

3. Install the rectangular end of the (special tool #C-3281, Holder, Flange) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.



1 - Transfer Case
2 - Flange
3 - Flange Puller

4. Using the (special tool #C-452, Puller, Companion Flange) remove the companion flange from the assembly.
5. Using the same procedure as the companion flange, remove the main shaft output flange.
6. Remove the range lever to selector shaft bolt.

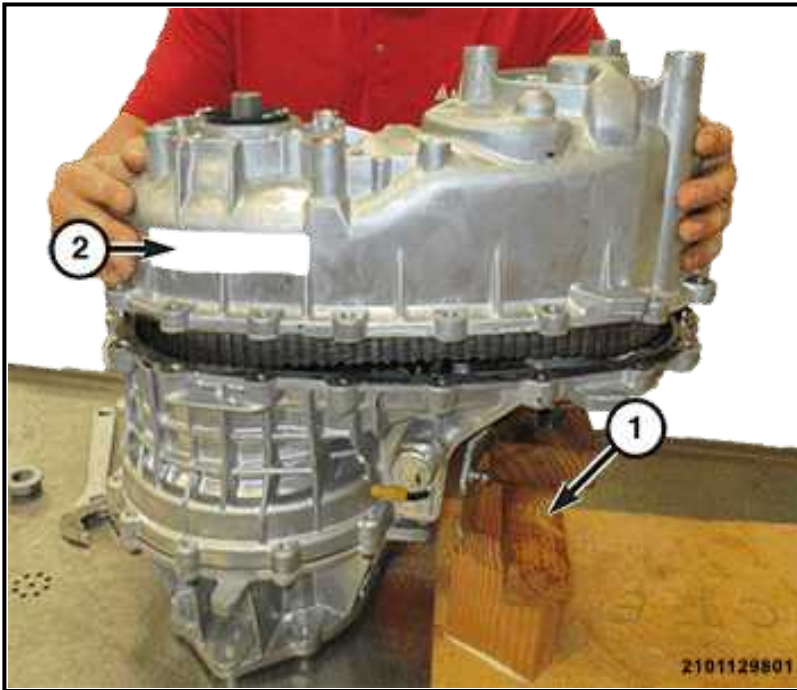
NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.



1 - Transfer Case Bolts

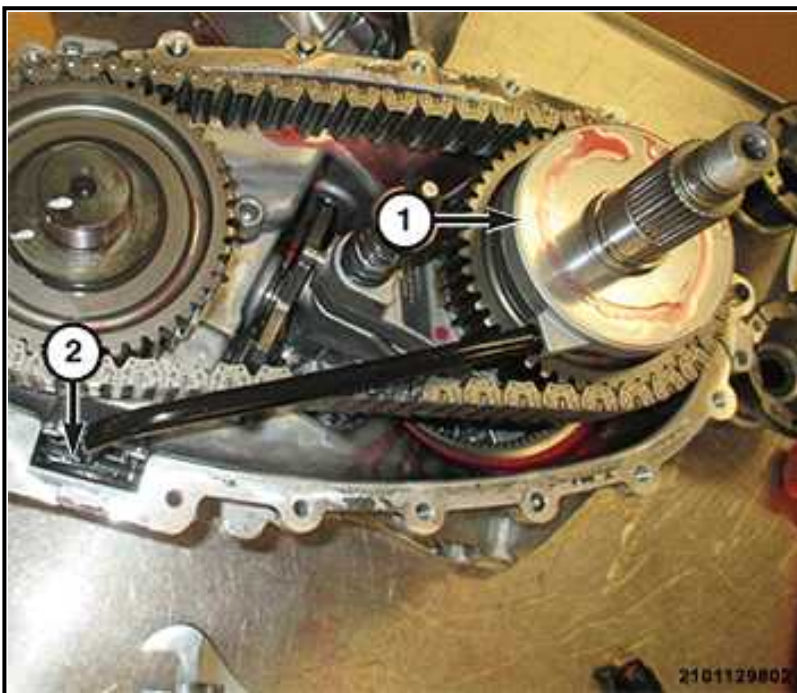
7. Remove the transfer case bolts.

8. Using an acceptable pry tool inserted in the slot at each end of the transfer case, loosen the transfer case halves to break the sealer bead.



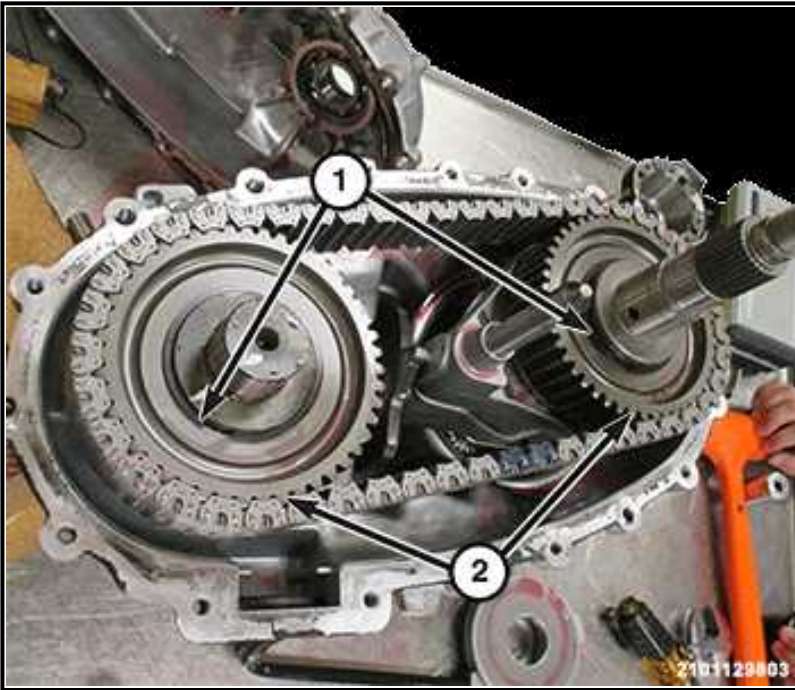
- | |
|-----------------------------|
| 1 - Wood Block |
| 2 - Rear Transfer Case Half |

9. Remove the case by disengaging the rear of the case from the alignment dowels.



- | |
|---------------------------|
| 1 - Oil Pump |
| 2 - Oil Pump Pick-up Tube |

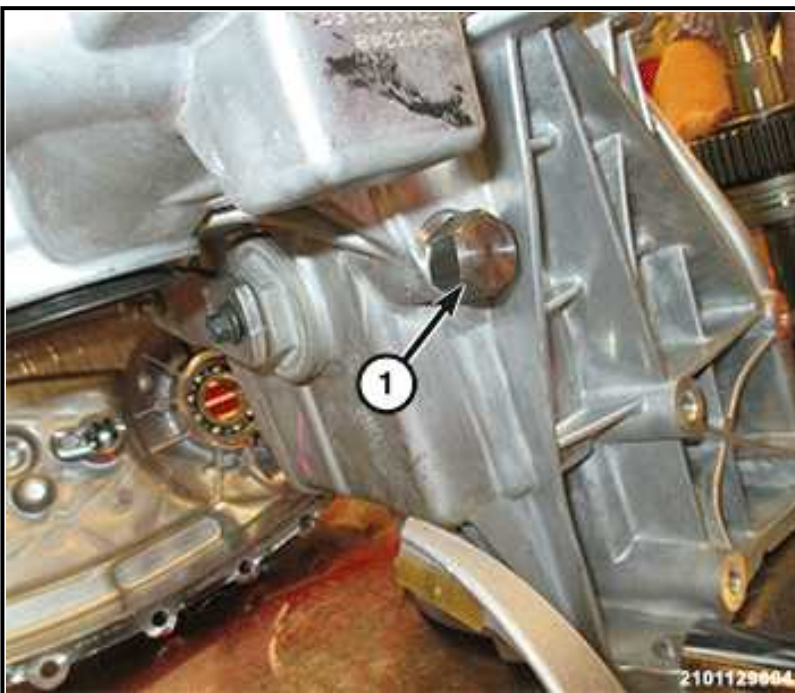
10. Remove the oil pump and the oil pump pick-up tube.



1 - Snap Rings

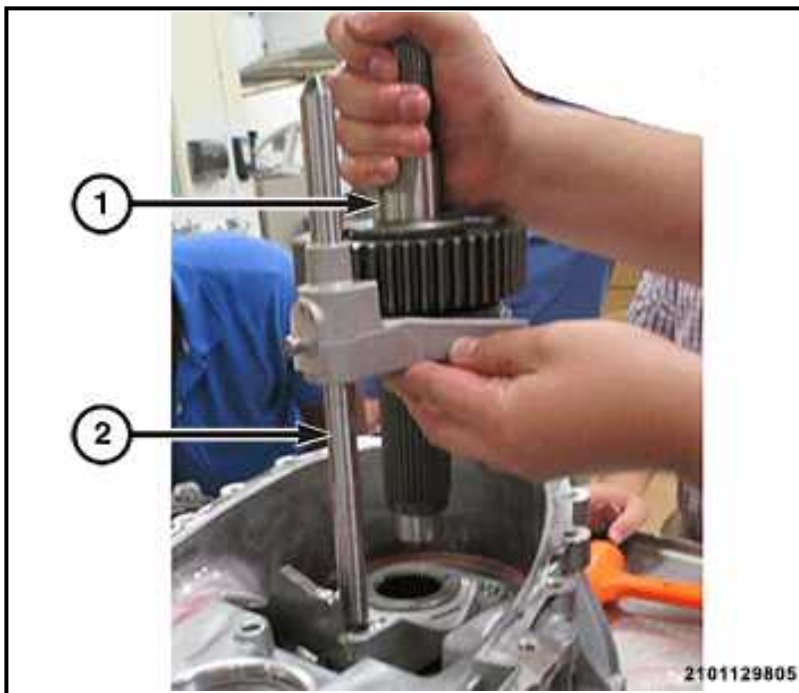
2 - Chain and Sprockets

11. Remove and **DISCARD** the snap-rings from each sprocket and remove the chain and sprockets by lifting both sprockets off of the shafts equally.



1 - Detent Plug

12. Remove the detent plug with spring and plunger.

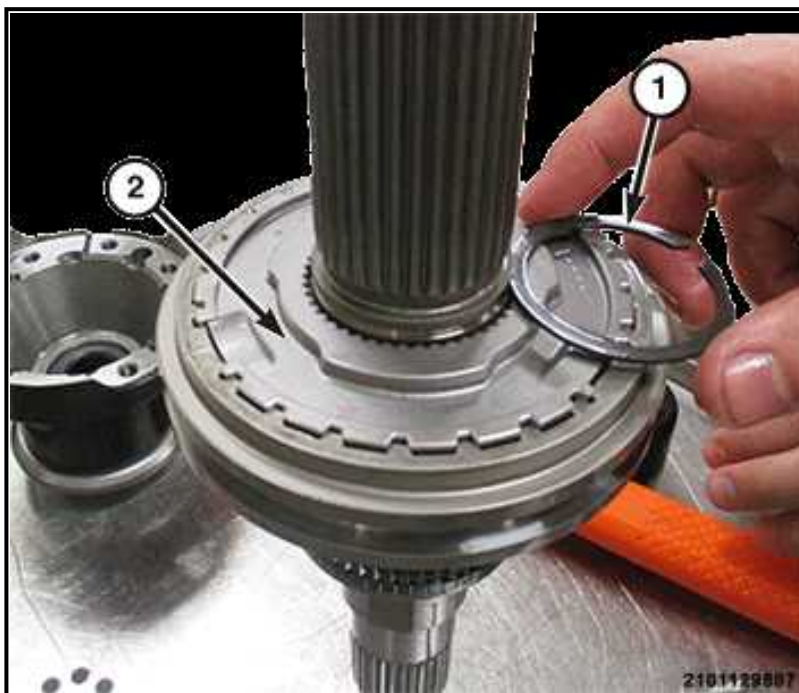


1 - Main Shaft

2 - Shift Fork

13. Remove the main shaft and the shift fork and rail from the transfer case.

14. Remove the output shaft.



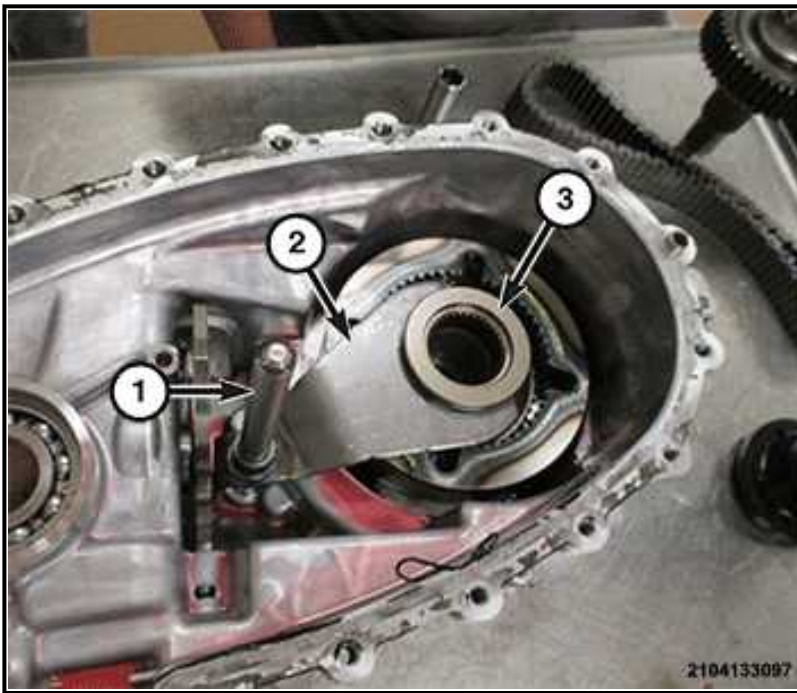
1 - Snap Ring

2 - Synchronizer

15. Remove and **DISCARD** the snap ring and remove the synchronizer from the main shaft.

NOTE:

Grasp the synchronizer at both the top and bottom when installing or removing the synchronizer. Failure to hold the synchronizer together may allow the outer ring of the synchronizer to drop, allowing the small springs, ball bearings, and slides to fall out and scatter.

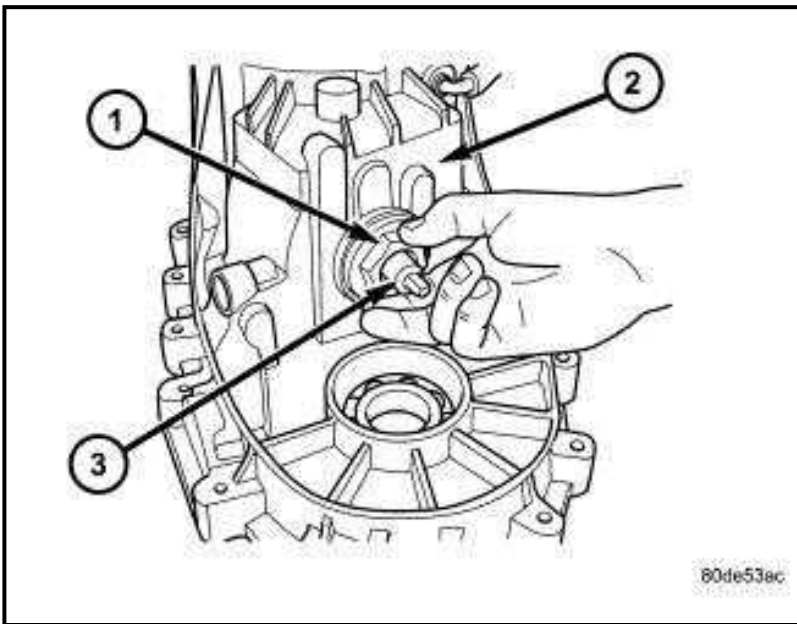


1 - Shift Rail

2 - Range Fork

3 - Input Gear

16. Remove the range fork assembly with the input gear.

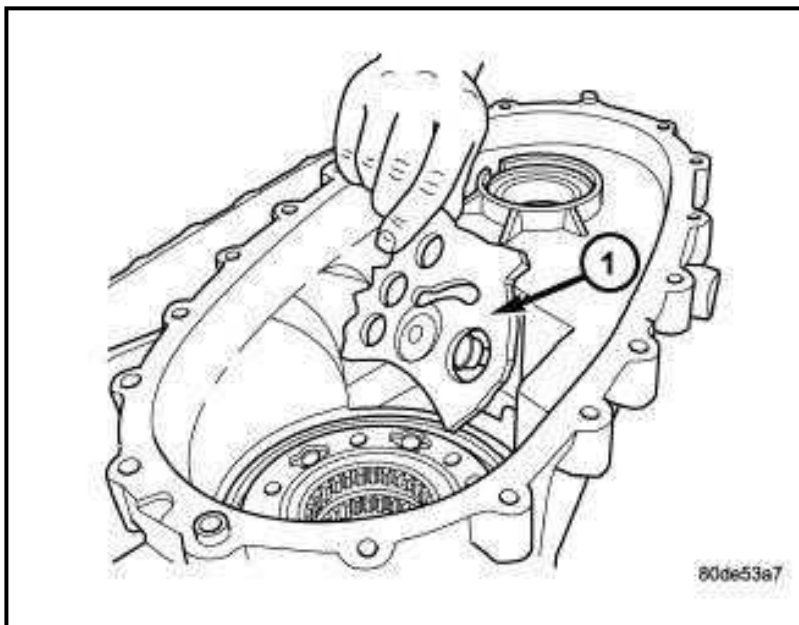


1 - SECTOR SUPPORT

2 - FRONT CASE

3 - SECTOR SHAFT

17. Remove the shift sector support.



1 - SHIFT SECTOR

18. Remove shift sector.



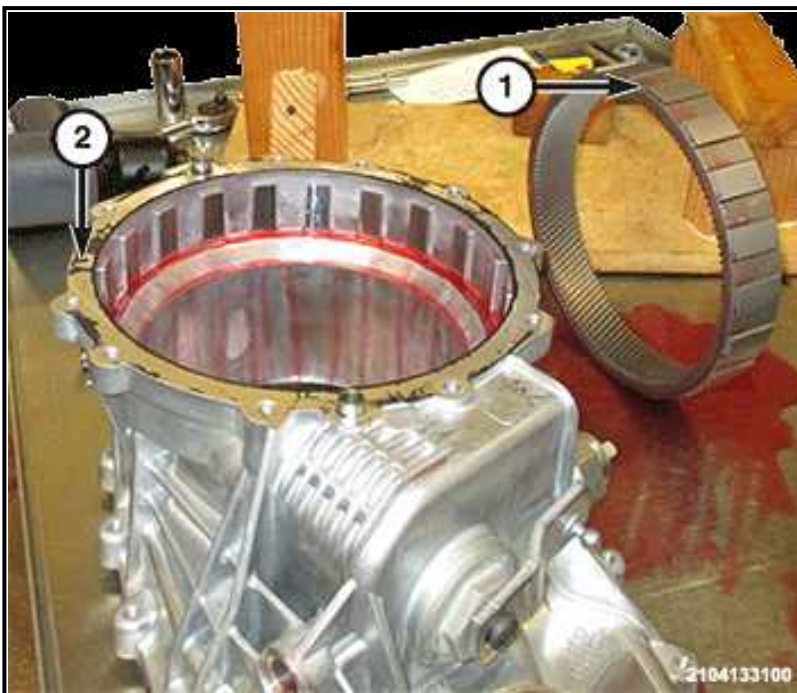
1 - Extension Housing Bolts

19. Remove the extension housing bolts.



1 - Extension Housing

20. Remove the extension housing from the case.



1 - Annulus Ring Gear

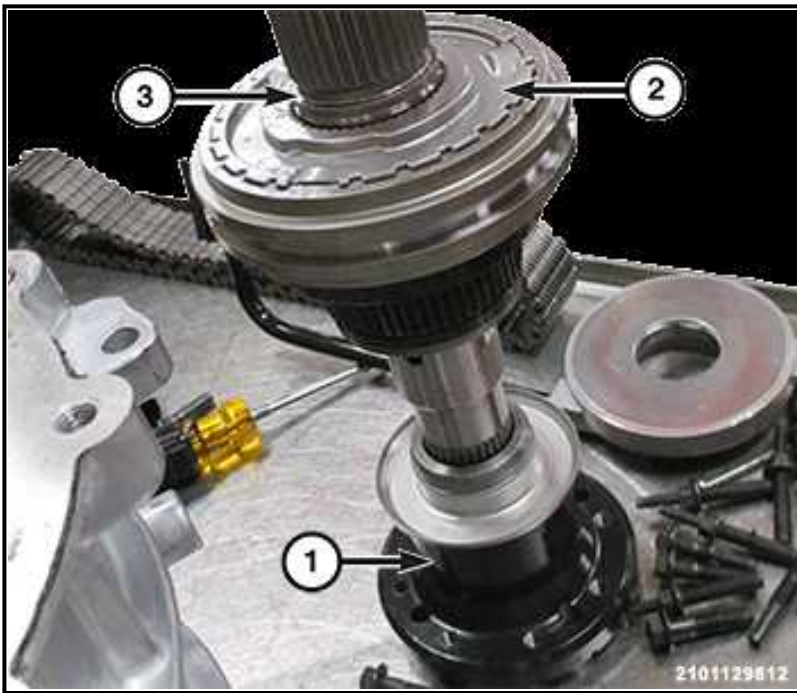
2 - Case

21. Remove the annulus ring gear from the case.

22. Clean the case halves.

ASSEMBLY

1. Clean both case halves and mating surfaces using brake cleaner or similar. Make sure all of the old sealer is removed and the surface is free of any oils or debris.
2. Replace any bearings in the case halves that are spalled, damaged, or have been subjected to highly contaminated fluid (metal contamination from catastrophic failure).

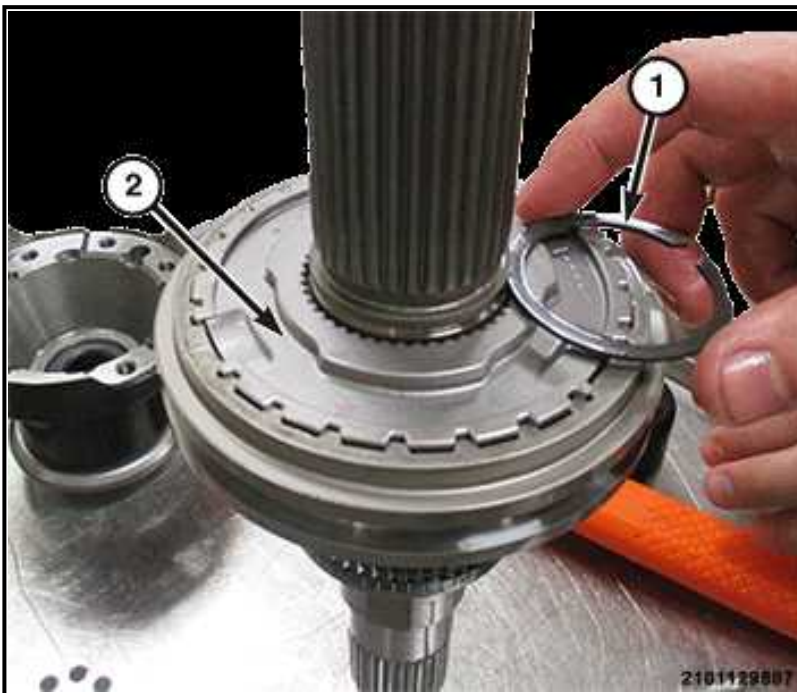


1 - Output Flange

2 - Synchronizer

3 - Main Shaft

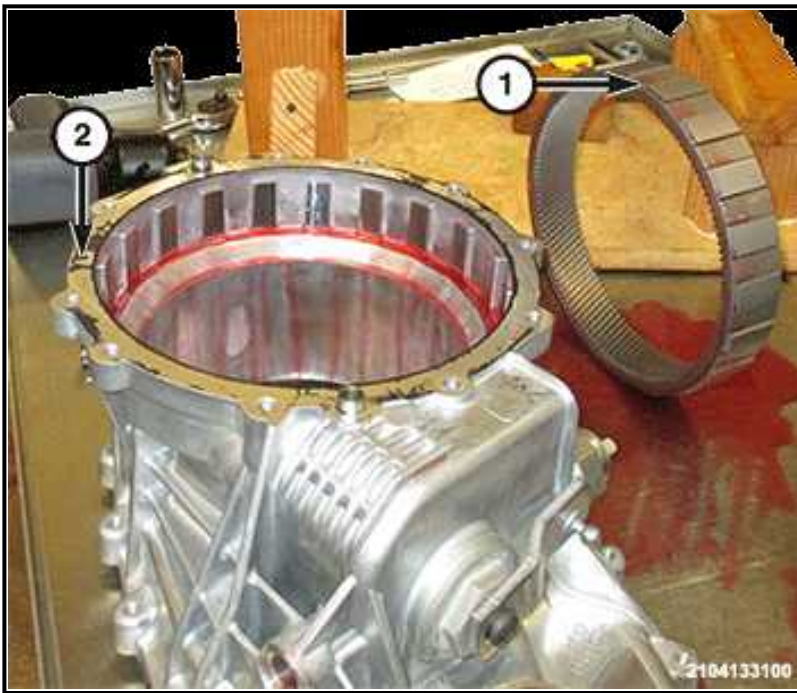
3. Using the output flange as a stand, install the synchronizer onto the main shaft.



1 - Snap Ring

2 - Synchronizer

4. Install the **NEW** snap ring for the synchronizer onto the main shaft.



1 - Annulus Ring Gear

2 - Case

5. Install the annulus ring gear into the case.
6. Clean the extension housing mating surfaces with brake cleaner or equivalent and wipe with a lint free shop cloth.
7. Place a 1/4" bead of MoparB® RTV sealant around the extension housing.



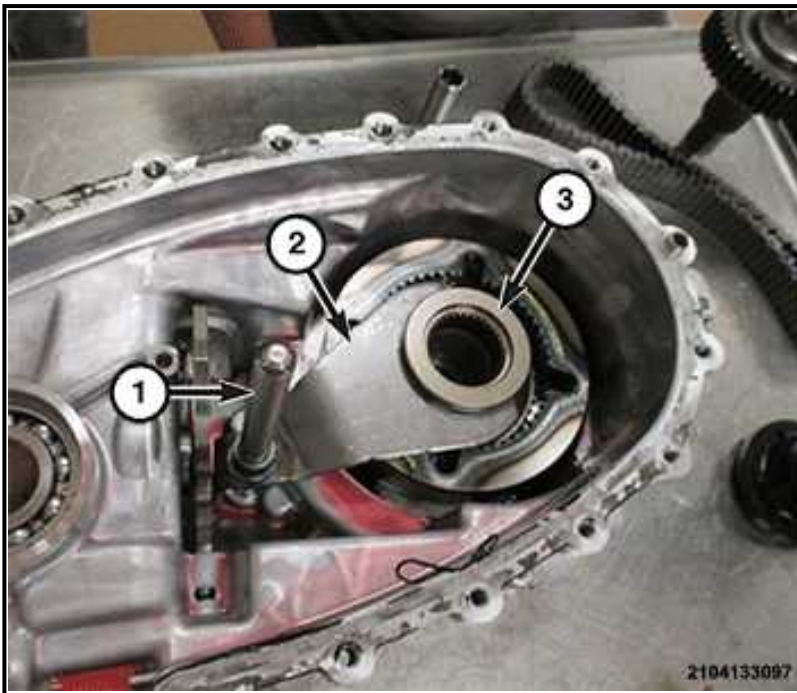
1 - Extension Housing

8. Install the extension housing into the case.



1 - Extension Housing Bolts

9. Install the extension housing bolts in a criss-cross pattern to the proper torque specification.

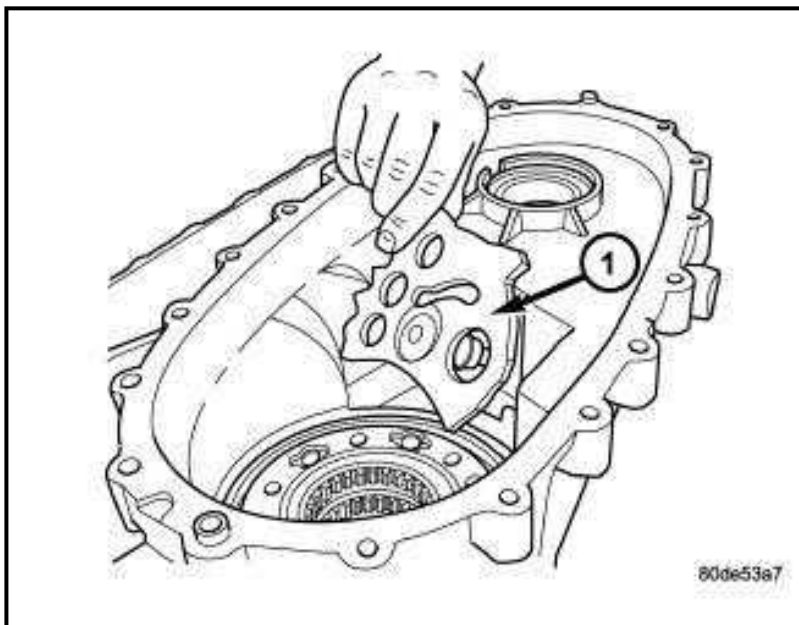


1 - Shift Rail

2 - Range Fork

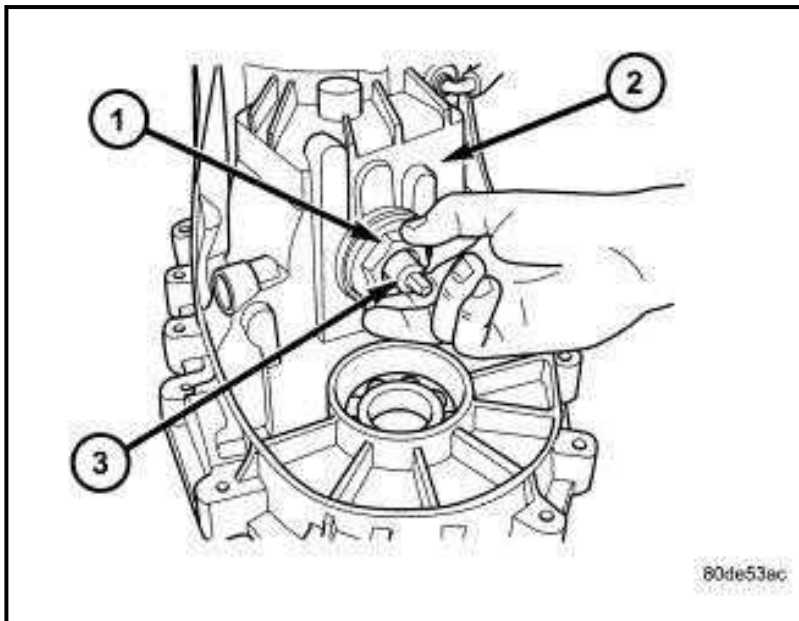
3 - Input Gear

10. Install the range fork, shift rail and the input gear into the case.



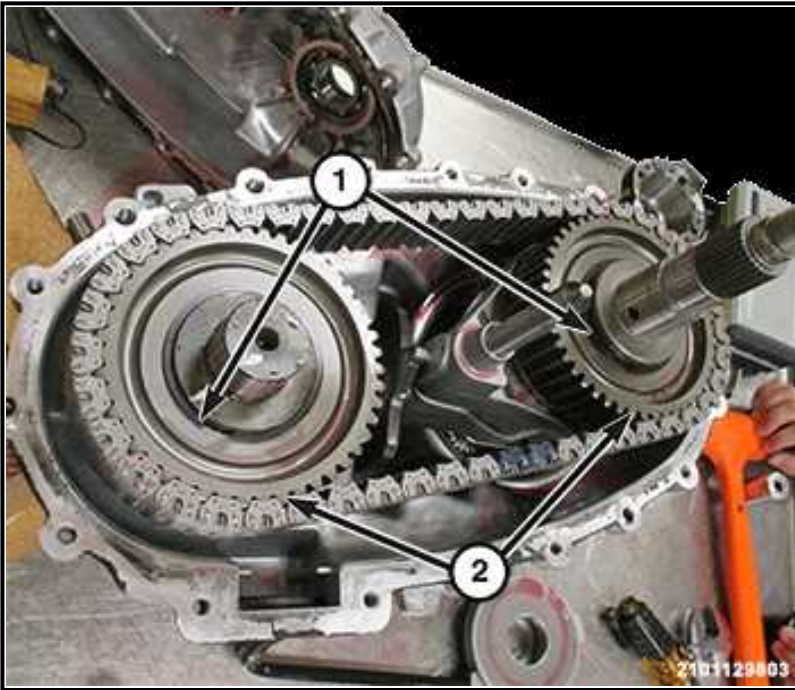
1 - SHIFT SECTOR

11. Lubricate sector shaft with transmission fluid and install shift sector in case. Position slot in sector so it will be aligned with shift fork pin when shift forks are installed.



1 - SECTOR SUPPORT
2 - FRONT CASE
3 - SECTOR SHAFT

12. Install the shift sector support.



1 - Snap Rings

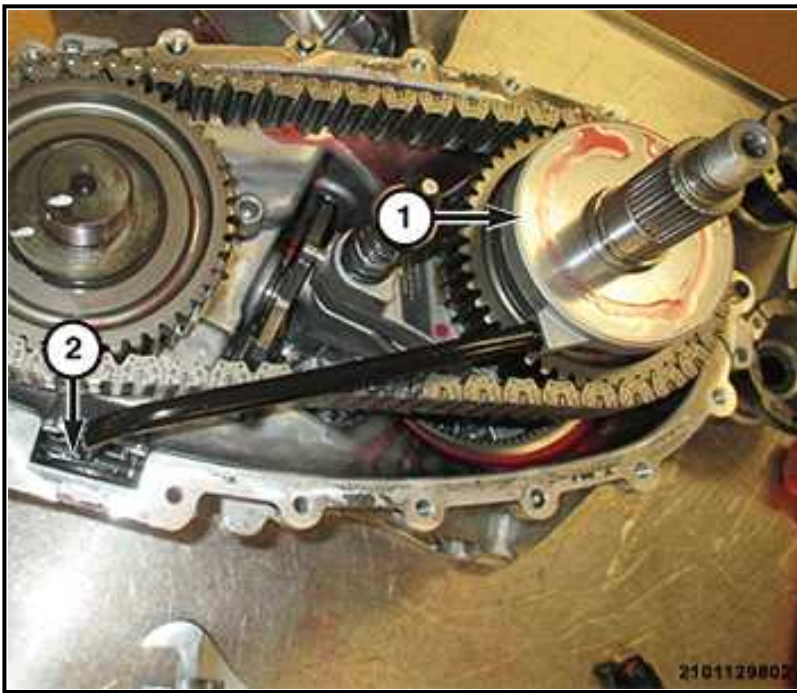
2 - Chain and Sprockets

13. Install the output shaft into the case and install the chain and sprockets with the blue link facing upward.



1 - Snap Rings

14. Install the snap rings on both sprockets. If the snap rings are over extended or loose, replace them with **NEW** snap rings.

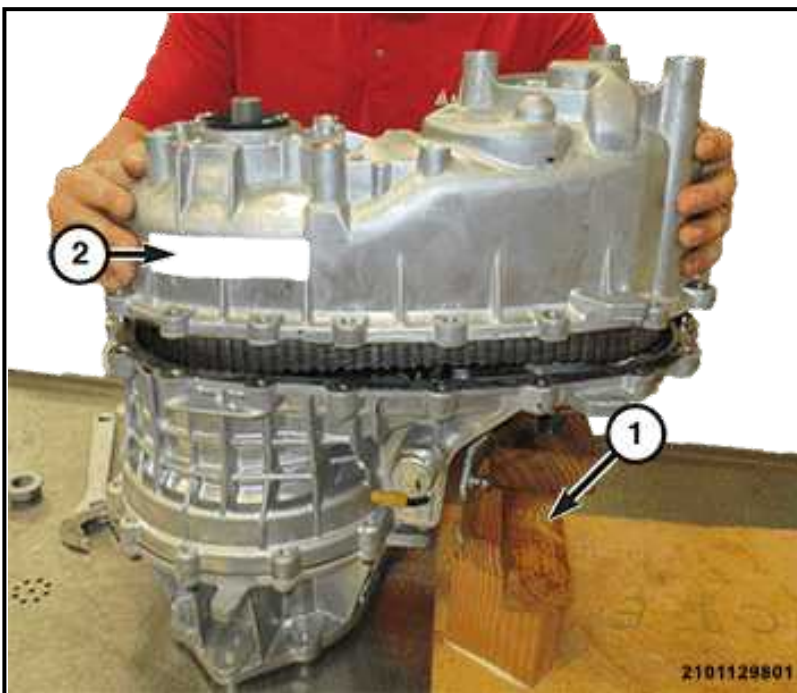


1 - Oil Pump

2 - Oil Pump Pick-up Tube

15. Install the oil pump and pick up tube. Verify the pick up tube is seated in the slot in the case half.

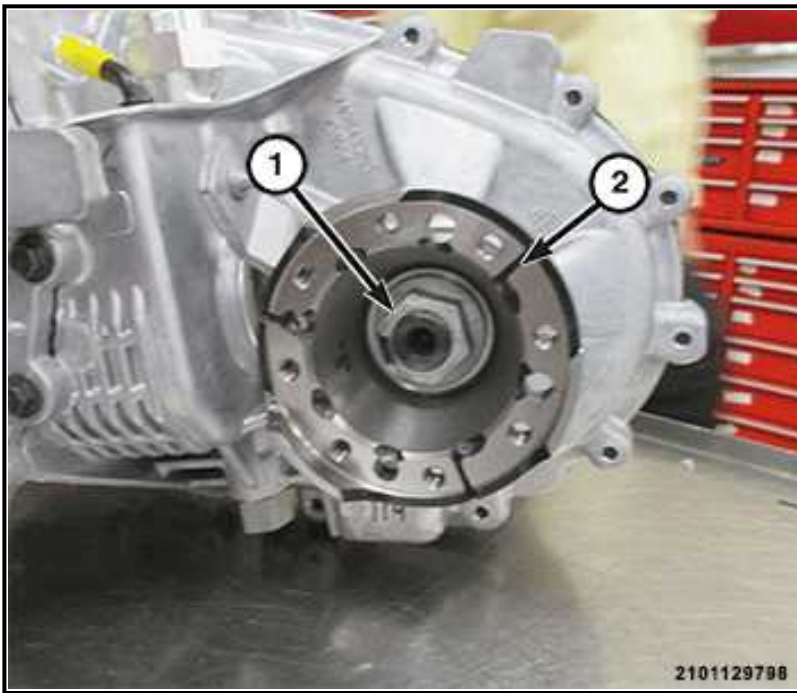
16. Wipe the case half mating surfaces and place a 1/4" bead of MoparB® sealer on one case half.



1 - Wood Block

2 - Rear Transfer Case Half

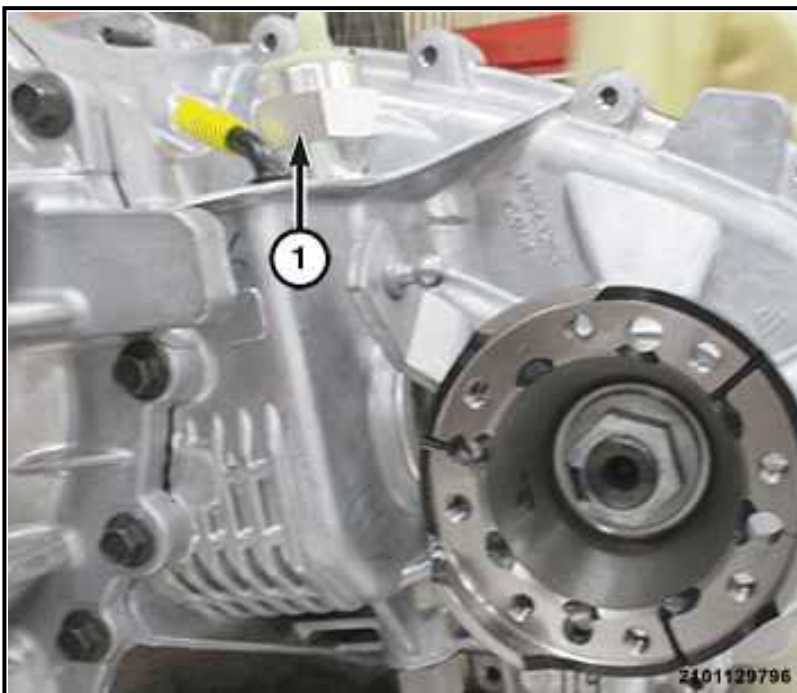
17. Install the case halves together, ensuring they are fully seated. Tighten the bolts in a criss-cross pattern to the proper torque specification.



1 - Rear Output Flange Nut

2 - Rear Output Flange

18. Install the front and rear output flanges and the flange nuts. Tighten the nuts to the proper torque specification.



1 - Transfer Case Position Sensor

19. Install the transfer case position sensor.

NOTE: Inspect the transfer case position sensor O-ring for damage before installing the transfer case position sensor.

20. Install the transfer case. Refer to [REMOVAL AND INSTALLATION](#) .

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

CABLE, SHIFT

REMOVAL AND INSTALLATION

SHIFT CABLE

REMOVAL

NOTE: Transfer Case may not engage or disengage Four Wheel Drive Mode if the transfer case shift cable end bushings are damaged.

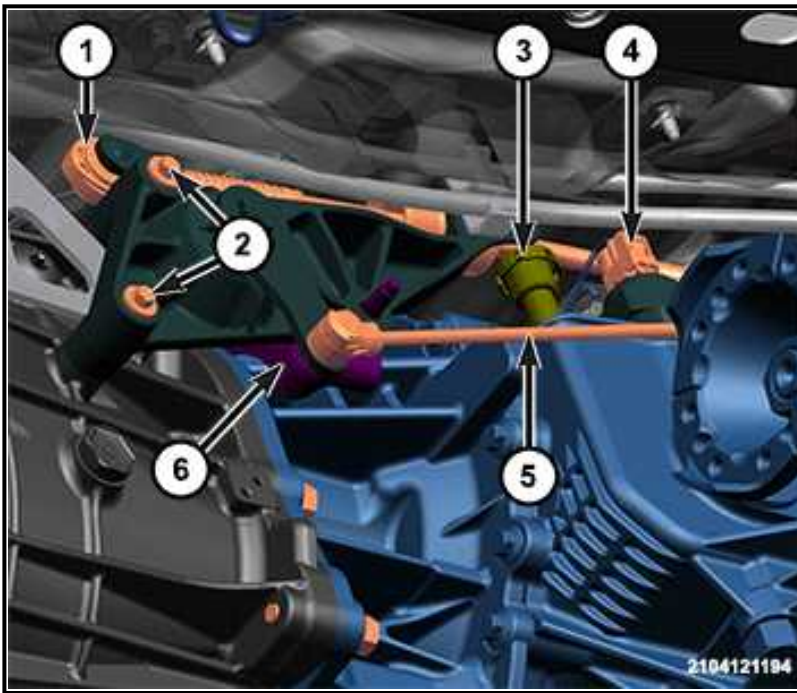
1. Shift the transfer case to 4 HI.
2. Remove the floor console

Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .

3. Insert a dowel pin or 4.9 mm (3/16 in.) drill bit into the alignment hole on the shifter assembly that aligns the shifter assembly and shift lever.

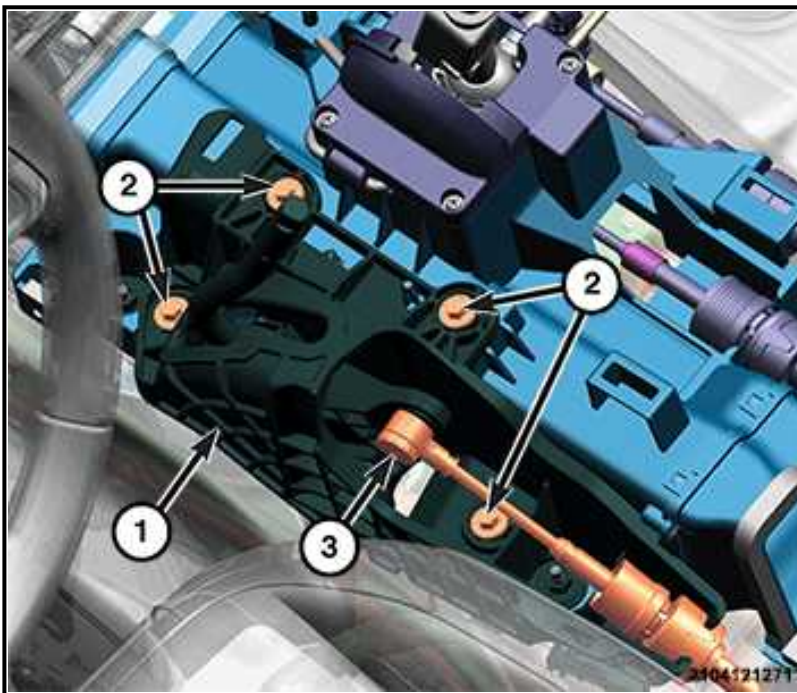
NOTE: The 4.9 mm (3/16 in.) dowel pin prevents fore and aft movement of the shift lever and locks the shift lever in the 4 HI position for easy adjustment.

4. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



1 - Shift Cable

5. Disengage the transfer case shift cable from the transfer case shift lever using a suitable tool.
6. Remove the transfer case shift cable by sliding the lock forward and pushing the cable out of the support bracket.
7. Disengage any additional shift cable routing clips, if necessary.
8. Disengage the shift cable from the transfer case manual lever.
9. If necessary, remove end bushing from shift cable end.
10. Remove the support and lower the vehicle.



1 - Transfer Case Shift Cable Bracket

2 - Transfer Case Shift Cable Fasteners

3 - Transfer Case Shift Cable

11. Disengage the transfer case shift cable from the shift lever ball stud and loosen adjuster nut on cable.
12. Disengage the shift cable grommet from the floor and remove the shift cable from the vehicle.

13. If necessary, remove end bushing from shift cable end.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Verify the floor shifter is in the 4 HI position.
- Route the shift cable the exact way it was removed.
- Adjust the cable at the shifter. Refer to **LEVER, TRANSFER CASE, ADJUSTMENTS** .
- Check for proper transfer case shifter operation.

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

HANDLE

REMOVAL AND INSTALLATION

TRANSFER CASE LEVER

REMOVAL



1 - Floor Console

2 - Shifter Boot

1. Carefully pry upward at base of shifter boot with a suitable trim tool to free boot from floor console.



1 - Shifter Handle Bolt

2. Slide boot upwards to expose the shifter handle bolt. Remove the shifter handle bolt and remove the shifter handle.
3. Grab the shifter handle where it meets the boot and gently twist to unlock the handle. Transfer the boot to the new handle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS

TRANSFER CASE

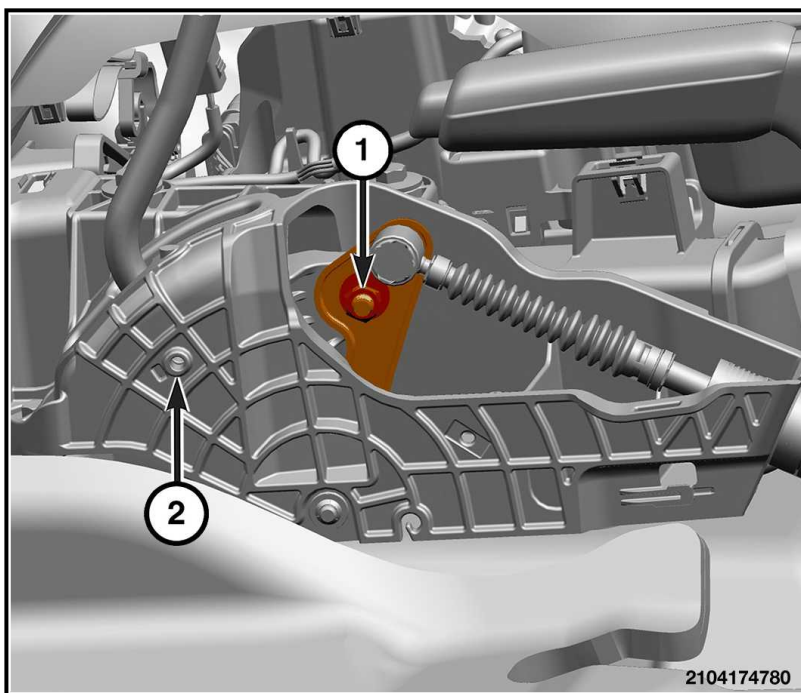
DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
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Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
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Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
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Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

LEVER, TRANSFER CASE

ADJUSTMENTS

1. Shift transfer case into 4 HI.
2. Remove the transfer case shift handle. Refer to [HANDLE, REMOVAL AND INSTALLATION](#) .
3. Remove the floor console. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .
4. Insert a dowel pin or 4.9 mm (3/16 in.) drill bit into the alignment hole on the shifter assembly that aligns the shifter assembly and shift lever.

NOTE: The 4.9 mm (3/16 in.) dowel pin prevents fore and aft movement of the shift lever and locks the shift lever in the 4 HI position for easy adjustment.



1 - Shifter Adjustment Nut

5. Loosen the shifter adjustment nut.
6. Apply rearward pressure to the shift lever and tighten the shifter adjustment nut securely.
7. Verify transfer case operation.
8. Install the floor console. Refer to [**CONSOLE, FLOOR, REMOVAL AND INSTALLATION**](#)
[**CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION**](#) .
9. Install the transfer case shift handle. Refer to [**HANDLE, REMOVAL AND INSTALLATION**](#) .

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
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Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-

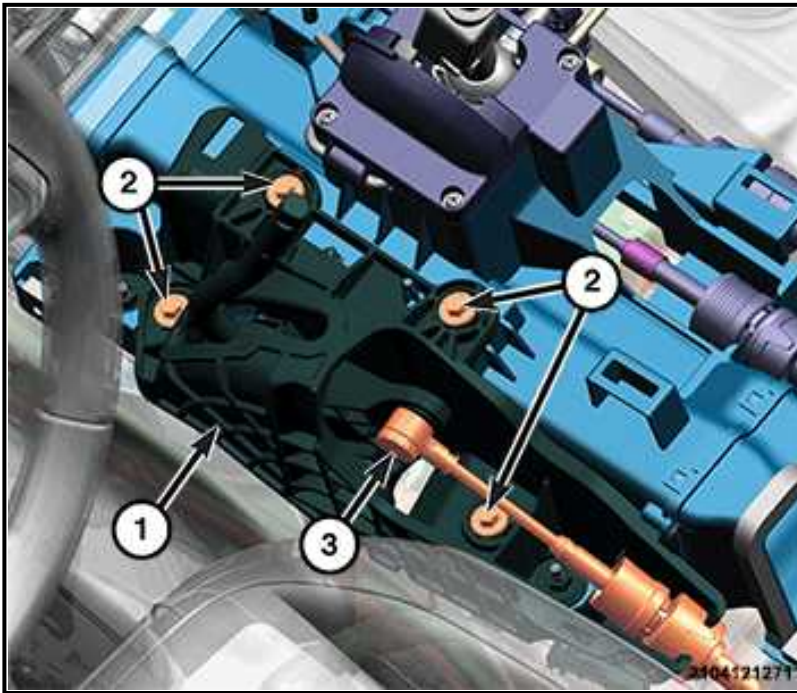
DESCRIPTION	SPECIFICATIONS	COMMENTS
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION

REMOVAL

1. Shift transfer case into 4 HI.
2. Remove the transfer case shift handle. Refer to [HANDLE, REMOVAL AND INSTALLATION](#) .
3. Remove the floor console. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .



1 - Transfer Case Shift Lever
2 - Transfer Case Shift Lever Fasteners
3 - Transfer Case Shift Cable

4. Disengage the transfer case shift cable from the shift lever.
5. Remove the transfer case shift cable by sliding the lock forward and pushing the cable out of the support bracket.
6. Remove the fasteners attaching shifter assembly to floor pan.
7. Remove the shifter assembly from the vehicle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Check for proper transfer case shifter operation, adjust the shift cable if necessary.

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

SEAL, INPUT SHAFT

REMOVAL AND INSTALLATION

INPUT SHAFT SEAL

REMOVAL

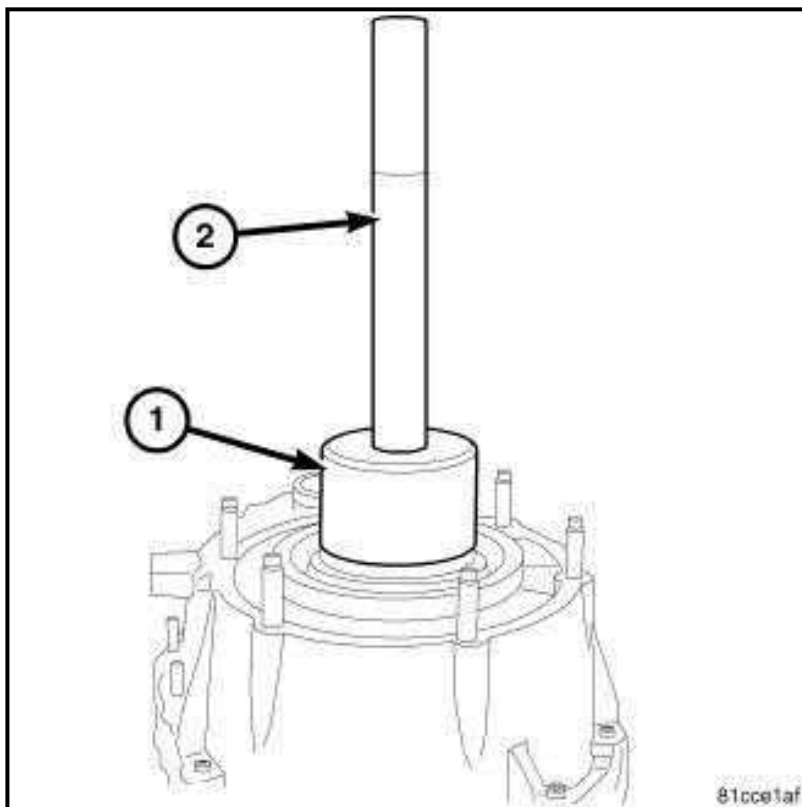
1. Remove the transfer case from the vehicle. Refer to [REMOVAL AND INSTALLATION](#) .
2. Using a suitable pry tool or a screw mounted in a slide hammer, remove the input shaft seal.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Lubricate all seals with MOPARB® ATF+4 prior to installation.



1 - Seal Installer Tool

2 - Driver Handle

1. Using (special tool #2053900210, Installer, Seal Input Shaft) or (special tool #9672, Installer, Seal) and (special tool #C-4171, Driver Handle, Universal), install the **NEW** front input shaft seal.

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

SEAL, OUTPUT SHAFT

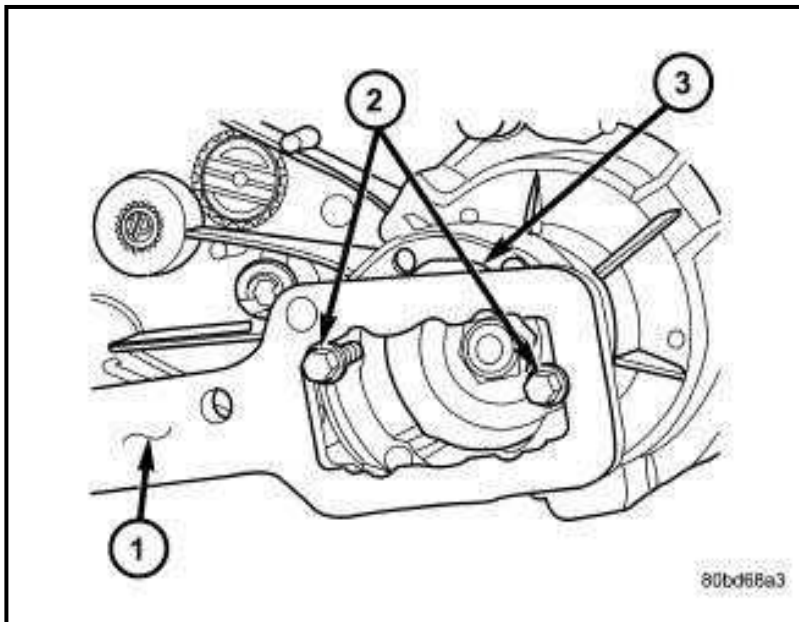
REMOVAL AND INSTALLATION

OUTPUT SHAFT SEAL

REMOVAL

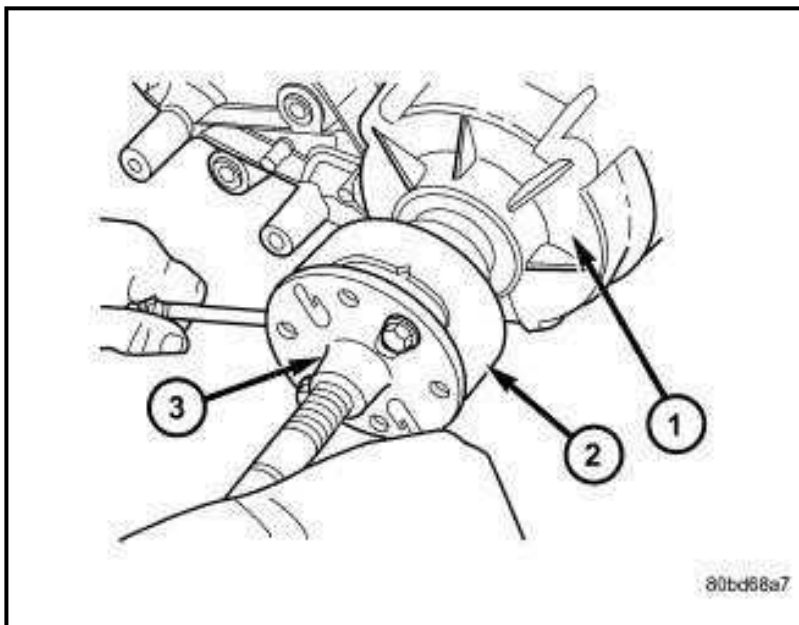
NOTE: Rear output seal as shown in illustration, front output seal similar.

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the appropriate propeller shaft. Refer to [REMOVAL AND INSTALLATION](#) .



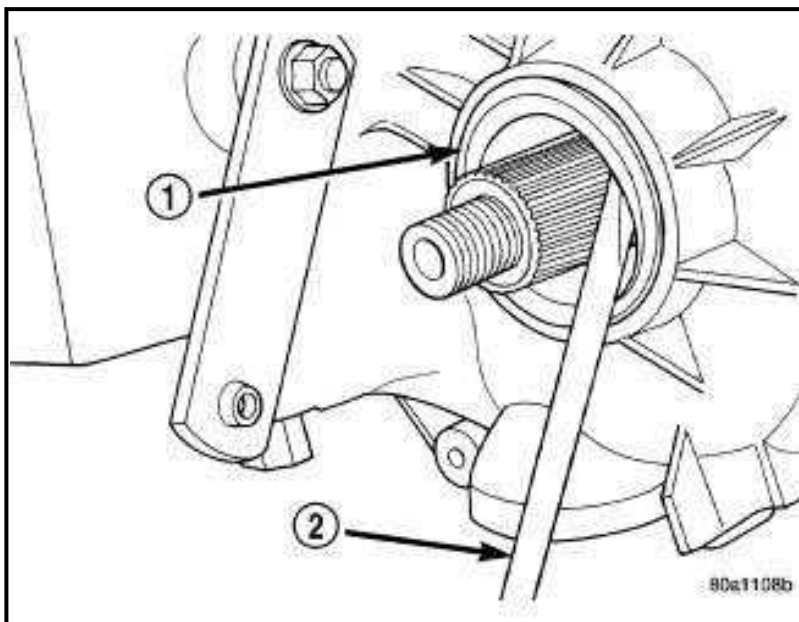
1 - Flange Holder
2 - Bolts
3 - Propeller Shaft Flange

3. Install two bolts partially in the propeller shaft companion flange, 180B° from each other.
4. Install the rectangular end of the (special tool #C-3281, Holder, Flange) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.



1 - Transfer Case Assembly
2 - Companion Flange
3 - Companion Flange Puller

5. Using the (special tool #C-452, Puller, Companion Flange) remove the companion flange from the assembly.



1 - Output shaft seal
2 - Seal Remover Tool

Front output seal as shown in illustration, rear output seal similar.

6. Remove the output shaft seal.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Use (special tool #6952A, Installer, Seal) as follows:

- a. Place a **NEW** seal on the tool. The garter spring on the seal goes toward the interior of the case.
 - b. Start the seal in the bore with light taps from a hammer. Once the seal is started, continue tapping the seal into the bore until the installer tool seats against the case.
- Check the fluid level, if the fluid is low, fill the transfer case with the specified fluid. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

2021 TRANSFER CASE

MP3022C TRANSFER CASE (SERVICE INFORMATION) - Gladiator

DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

DESCRIPTION

The MP3022 is a two-speed, on-demand, active four-wheel drive transfer case that provides optimum traction for a wide range of conditions, while maximizing driver convenience. When operating in 4HI Auto mode, this sophisticated system anticipates and prevents slip by redirecting torque as necessary, up to 50% to the front and rear axle if needed.

For added traction capability when traversing steep grades, rough terrain or extremely poor traction surfaces, the transfer case includes a 4LO mode. This second speed gear multiplies engine torque 2.72 times (4:1 in Rock-TracB® equipped vehicles) and locks the clutch pack for maximum traction.

The MP3022C transfer case provides the following benefits:

- Active, on-demand four-wheel drive requires no driver input
- Instantly anticipates slip and preemptively redirects torque as needed
- Vehicle stability under all conditions because torque is constantly being transferred
- 4LO operation mode provides an advantage over vehicles equipped with a single-speed all-wheel drive transfer case.
- Enhanced traction and stability provided by the Traction Control and Electronic Stability Program (ESP) working in tandem with four-wheel-drive
- A robust design and sealing for reliability
- Maintenance-free
- A neutral mode permits flat towing

OPERATING RANGES

The MP3022 provides the following ranges:

2HI - 4HI Auto - 4HI Part Time - Neutral - 4LO

- 2HI:
 - Front axle spins freely
 - Power sent to rear wheel
 - A synchronizer inside the transfer case makes for smoother shifts between 2HI - 4HI and for the Front Axle Disconnect (FAD) feature.
- 4HI AUTO:
 - Shift-on-the-Fly at speeds up to 88 km/h (55 mph)
 - Front and rear drive shafts are connected through a clutch pack design
 - The system anticipates slip and reacts accordingly
 - This mode can be used on any road surface including dry pavement, unlike a 4WD Lock or Part-Time system.
- 4HI Part Time:
 - This mode is not for use on dry pavement
 - Front and rear drive shafts are connected through a clutch pack design

- The driveline torque is still flowing through the transfer case clutch pack in this mode. However, the clutch is biased towards full compression, and behaves as if it were a part-time transfer case.
- NEUTRAL:
 - Use for towing the vehicle behind another vehicle
 - The vehicle may roll while the transfer case is in neutral, even with the transmission in park.
 - Does not require uncoupling drive shafts
- 4LO:
 - Use for severe off-road situations. This mode is not for use on dry pavement
 - Increases available engine torque by 2.72:1 (4:1 in Rock-TracB® equipped vehicles)
 - The driveline torque is still flowing through the transfer case clutch pack in this mode. However, as in 4HI part-time mode, the clutch is biased towards full compression, and behaves as if it were a part-time transfer case.

OPERATION

Selecting 4HI Auto, via the floor-mounted select lever, this sophisticated system anticipates and prevents slip by redirecting torque as necessary, up to 50% to the front and rear axle if needed

The MP3022C transfer case is a full-time four-wheel drive system - 2HI is the usual driving mode, with the front axle spinning freely and a power directed only to the rear wheels. This is the most fuel-efficient mode. It can however, also drive in 4HI Auto for normal driving. This mode will provide some torque to the front wheels at all times, and preemptively transmit more torque as needed. This is less efficient than 2HI because the full driveline and both axles are in use.

A Neutral mode permits towing without having to disconnect the drive shafts.

For severe off-road situations, shifting from 4HI to 4LO is best engaged by slowing speed to 3-5 km/h (2-3 mph), put transmission in Neutral, engage 4LO and return transmission to desired gear. The front and rear drive shafts are locked together, and a planetary gear set multiplies torque by 2.72:1 (4:1 in Rock-TracB® equipped vehicles), providing an extremely low gear ratio.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Transfer case noisy in all drive modes	1) Insufficient or incorrect lubricant 2) Internal transfer case components binding, worn, or damaged	1) Drain and refill the transfer case with the correct quantity of MoparB® ATF +4, Automatic Transmission Fluid. 2) Repair or replace components as necessary. NOTE: Check all case bearings for spalling or rough feel when freely rotated.
Lubricant leaking from transfer case seals or vent	1) Transfer case overfilled	1) Drain lubricant to the correct level.

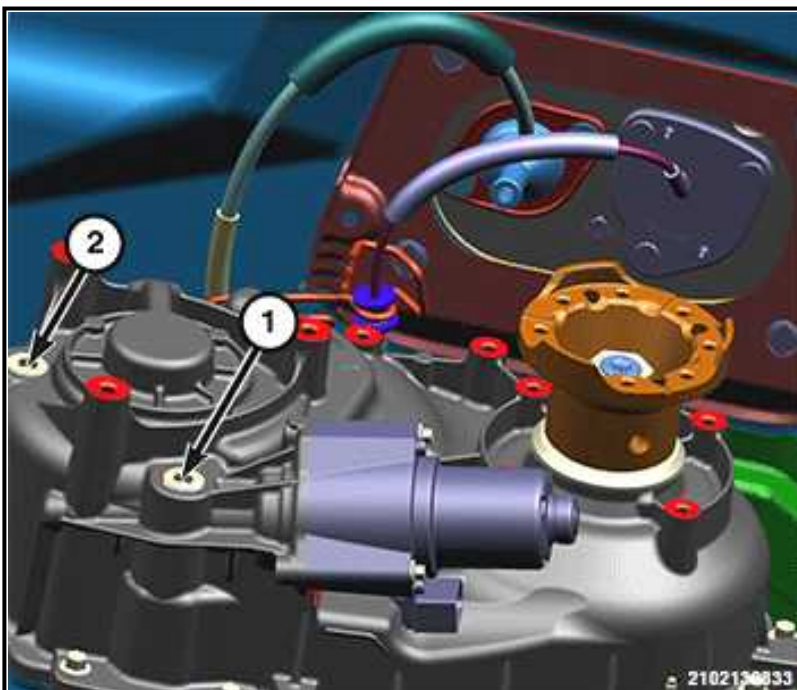
CONDITION	POSSIBLE CAUSE	CORRECTION
	2) Transfer case vent closed or restricted 3) Transfer case seals damaged or installed incorrectly	2) Clean or replace the vent as necessary. 3) Replace the suspect seal. NOTE: Check the slinger on the seal flange for molded rubber defects. This will cause a seal leak, if the rubber looks to be squeezing out of the slinger, replace the slinger with the seal.

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID DRAIN AND FILL

DRAIN

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .
3. Place drain pan beneath the transfer case.

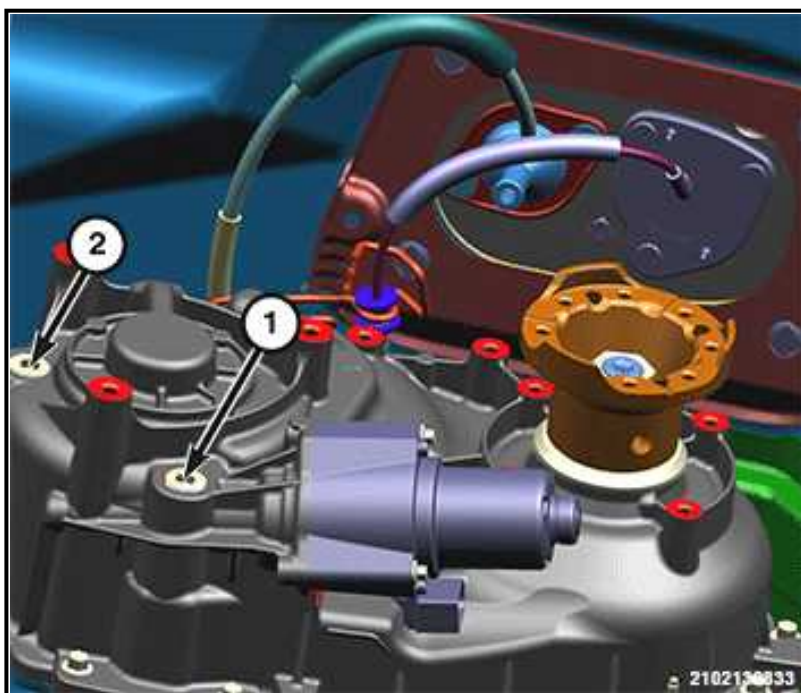


1 - Drain Plug
2 - Fill Plug

4. Remove the fill and drain plugs and allow the fluid to drain.
5. Install the drain plug.

FILL

1. Fill the transfer case to the proper level using the specified fluid. Refer to [CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS](#) .



1 - Drain Plug
2 - Fill Plug

2. Install the fill plug.
3. Install the skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .
4. Remove the support and lower the vehicle.

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-

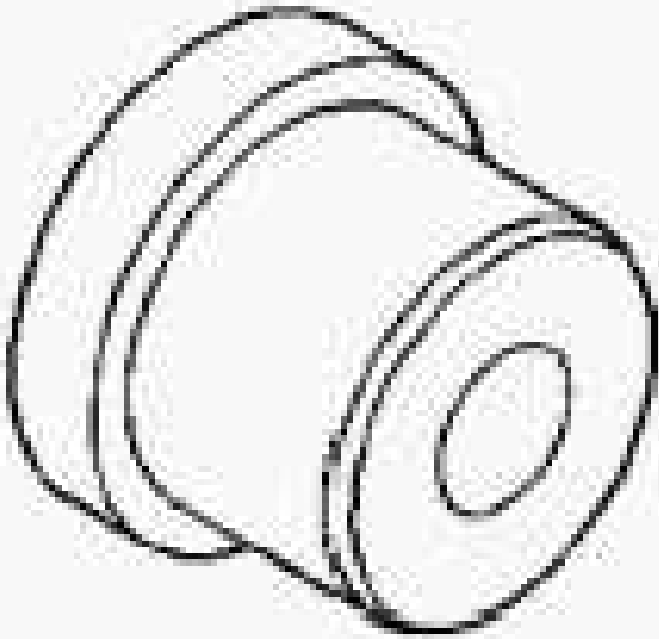
DESCRIPTION	SPECIFICATIONS	COMMENTS
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

TECHNICAL SPECIFICATIONS

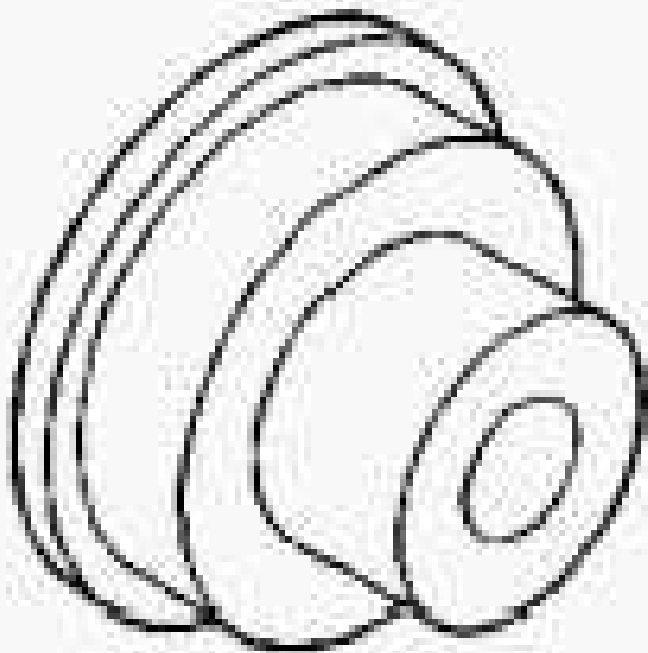
TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

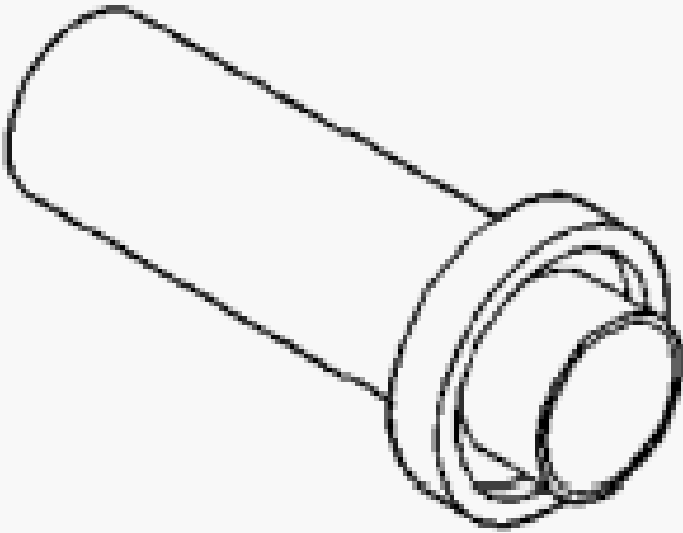
SPECIAL TOOLS



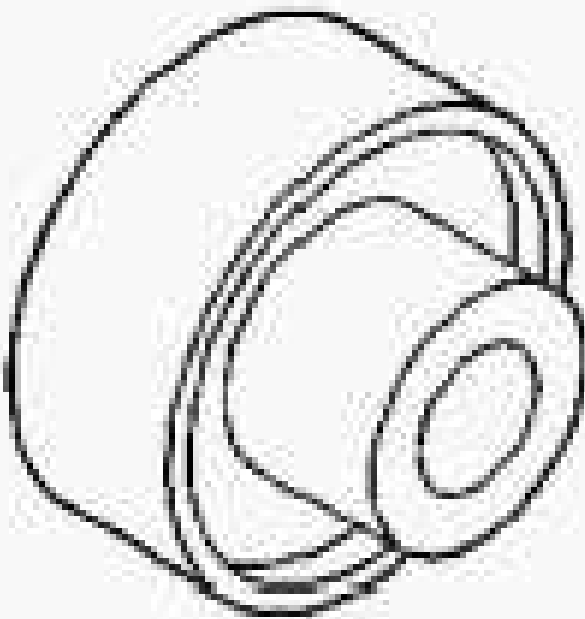
5066 - Installer, Bushing
(Originally Shipped In Kit Number(s)
9975.)



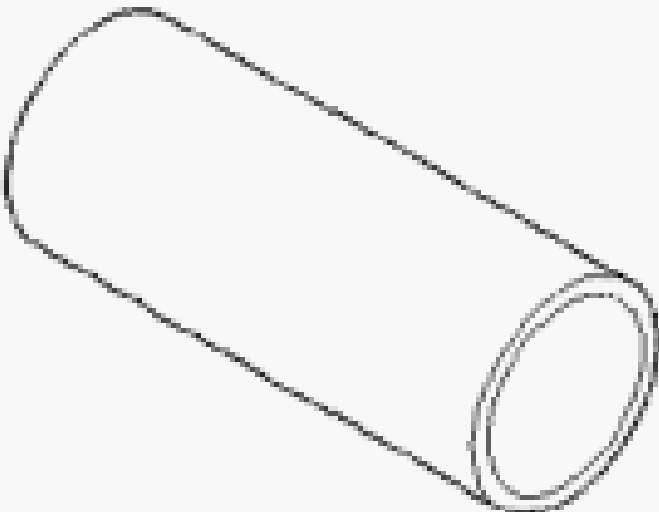
6436 - Installer, Bearing
(Originally Shipped In Kit Number(s)
6472, 9975.)



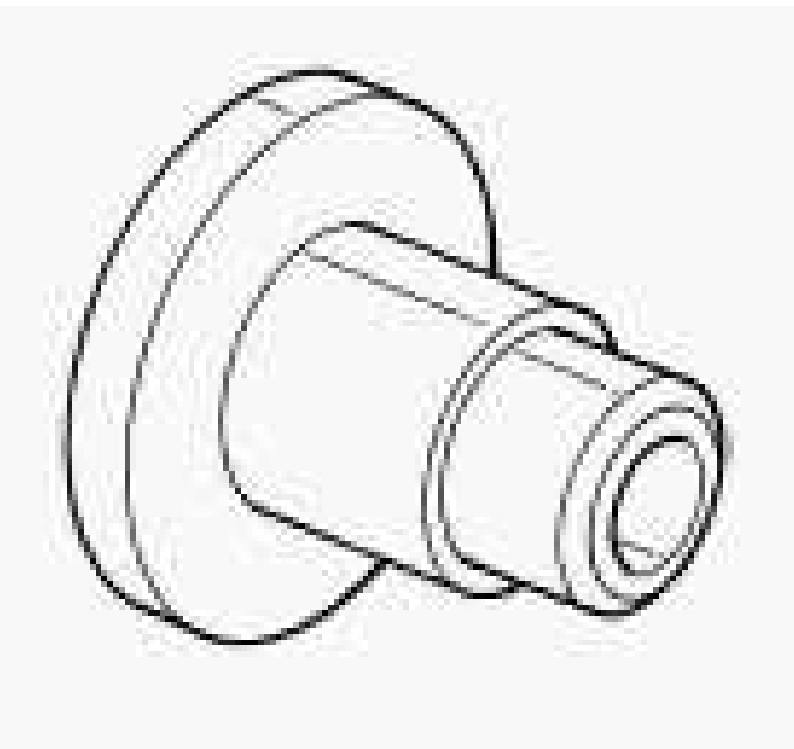
6952A - Installer, Seal
(Originally Shipped In Kit Number(s)
6945, 6947, 6949.)



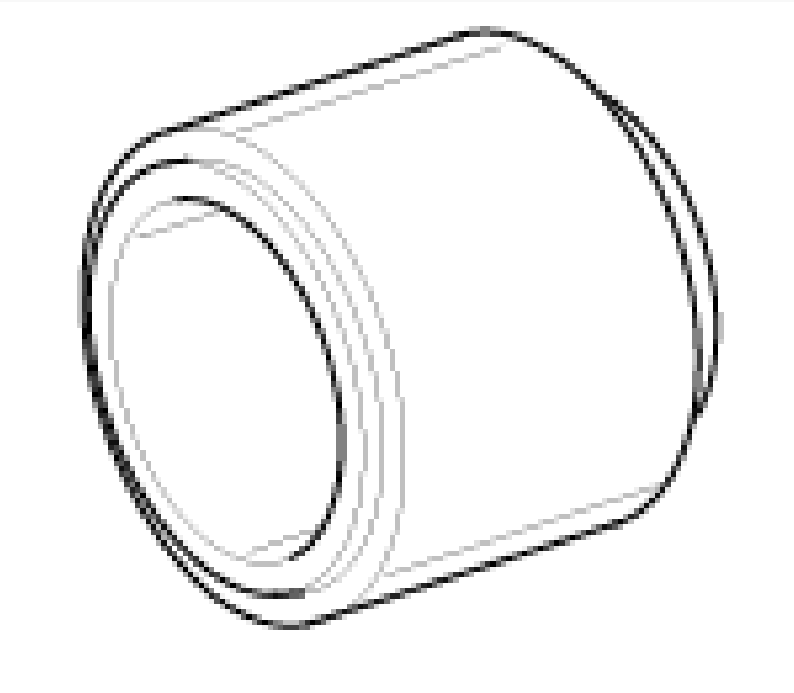
6953 - Remover/Installer, Bearing
(Originally Shipped In Kit Number(s)
6945, 6947, 6949, 9975.)



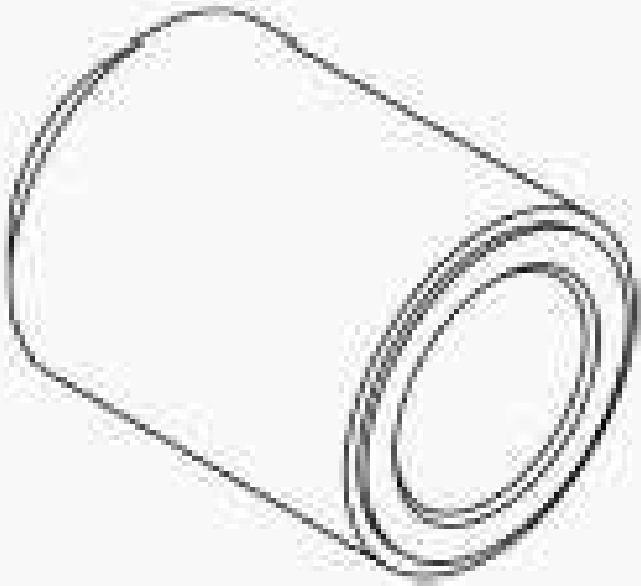
8148 - Cup
(Originally Shipped In Kit Number(s)
8104, 9975.)



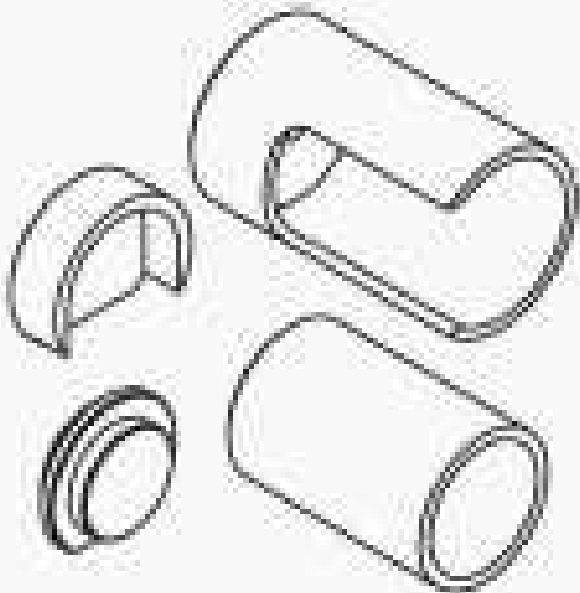
8684 - Installer, Bearing
(Originally Shipped In Kit Number(s)
8685, 8685CC, 8712.)



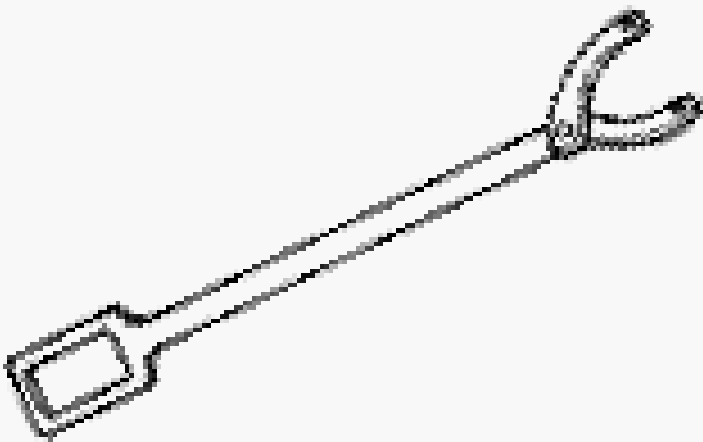
8841 - Installer, Seal
(Originally Shipped In Kit Number(s)
8715, 8719, 8719CC, 9975.)



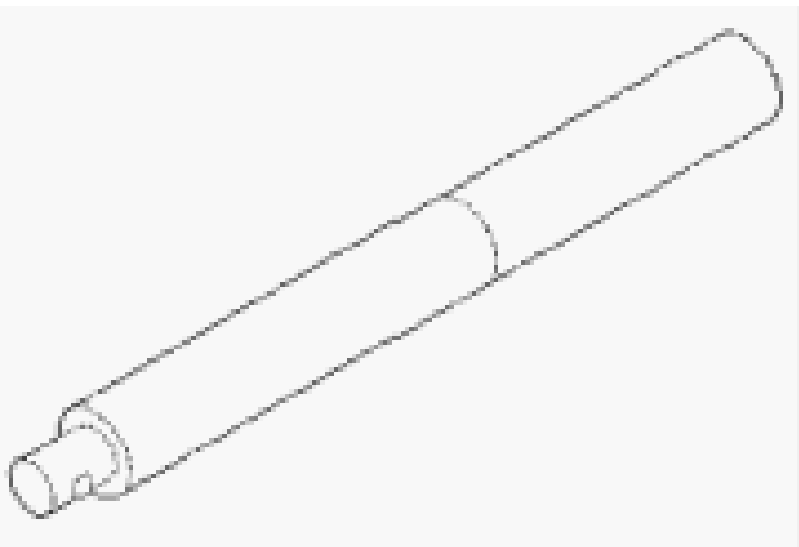
9672 - Installer, Seal
(Originally Shipped In Kit Number(s)
9696, 9697, 9698.)



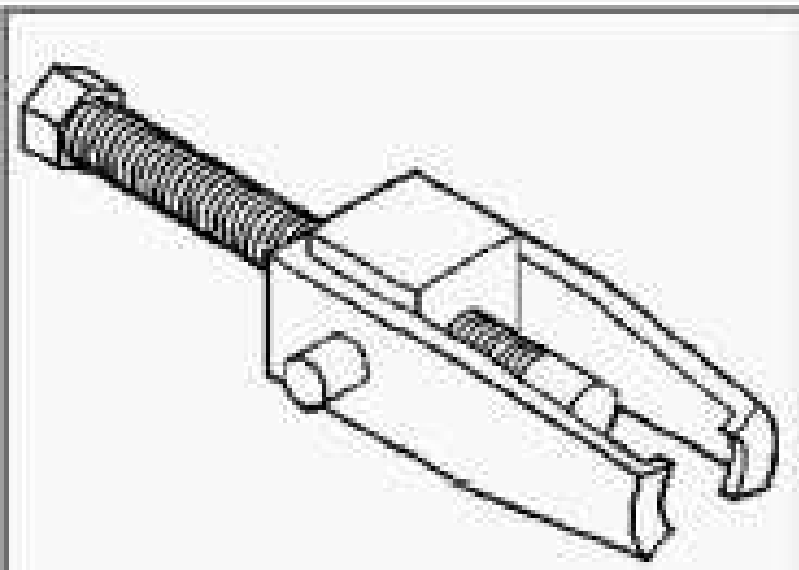
9964 - Remover/Installer, Ball Joint
(Originally Shipped In Kit Number(s)
10015, 10016.)



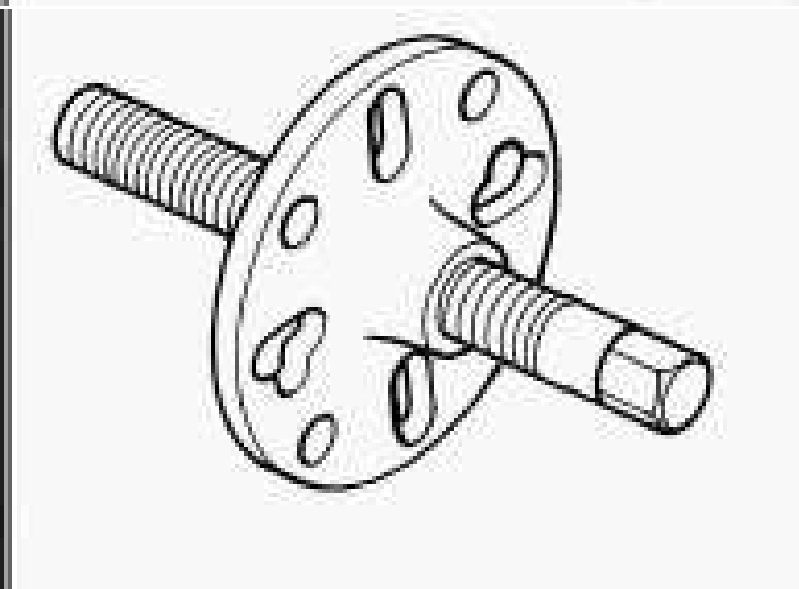
C-3281 - Holder, Flange
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



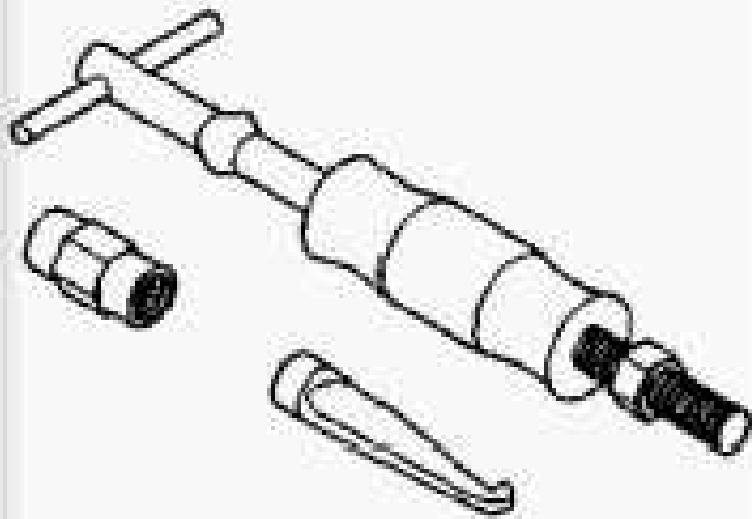
C-4171 - Driver Handle, Universal
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)



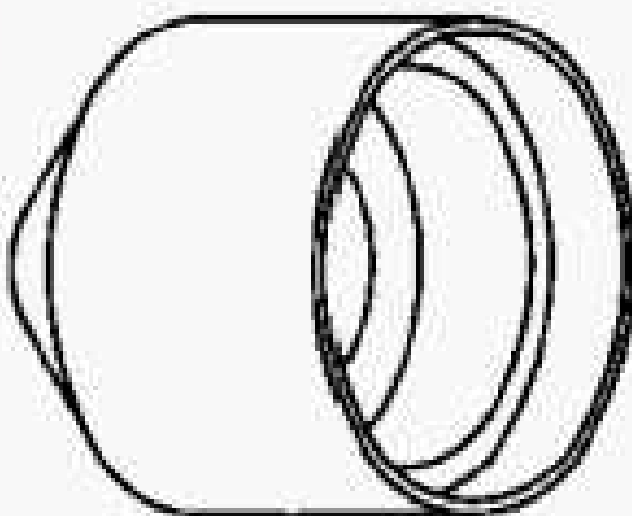
C-4333A - Puller, Pulley



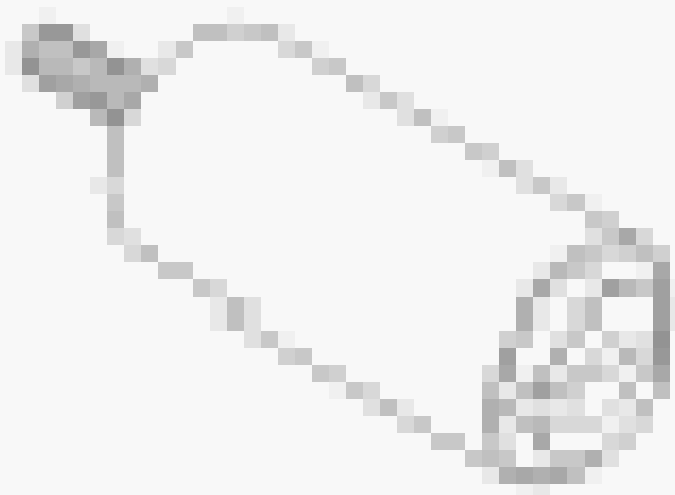
C-452 - Puller, Companion Flange



C-637 - Slide Hammer, Universal
(Originally Shipped In Kit Number(s)
9202.)



D-163 - Installer, Seal
(Originally Shipped In Kit Number(s)
6742, 9975.)



L-4454A - Remover, Bearing Cup
(Originally Shipped In Kit Number(s)
9975.)



2053600210 - Installer, Bearing Needle Input Shaft



2053700210 - Installer, Cup Plug input Shaft



2053800210 - Installer, Bearing and Plug Input Shaft



2053900210 - Installer, Seal Input Shaft



2054000210 - Installer, Seal Output Shaft



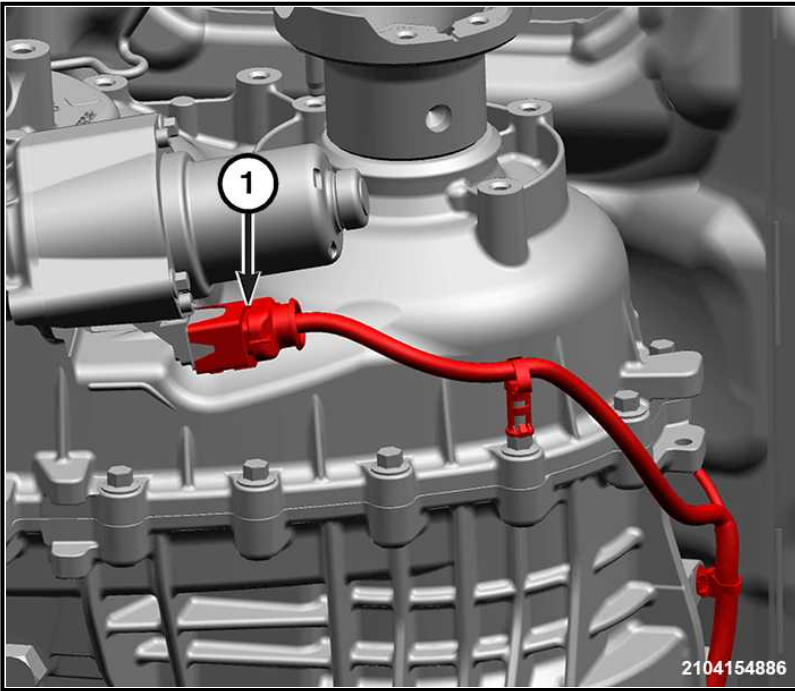
2046100090 - Installer, Transfer Case
Differential Oil Seal

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION

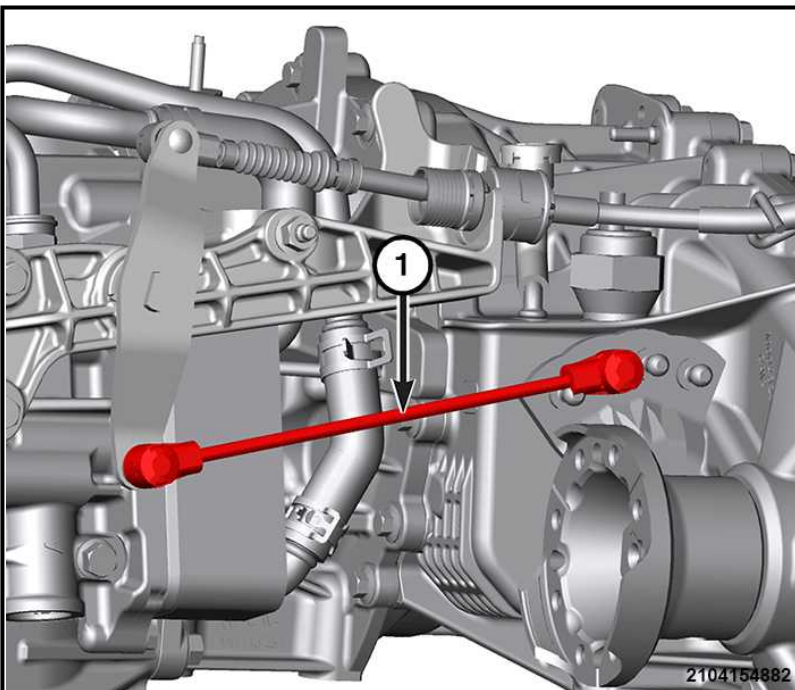
REMOVAL

1. Raise and support vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. If equipped, remove the skid plate. Refer to [PLATE, SKID, REMOVAL AND INSTALLATION](#) [PLATE, SKID, FUEL TANK, REMOVAL AND INSTALLATION](#) [PLATE, SKID, TRANSFER CASE, REMOVAL AND INSTALLATION](#) .
3. Position a drain pan underneath the transfer case.
4. Remove the transfer case drain plug and drain the lubricant into the drain pan.
5. Remove the front and rear propeller shafts. Refer to [REMOVAL AND INSTALLATION](#) .



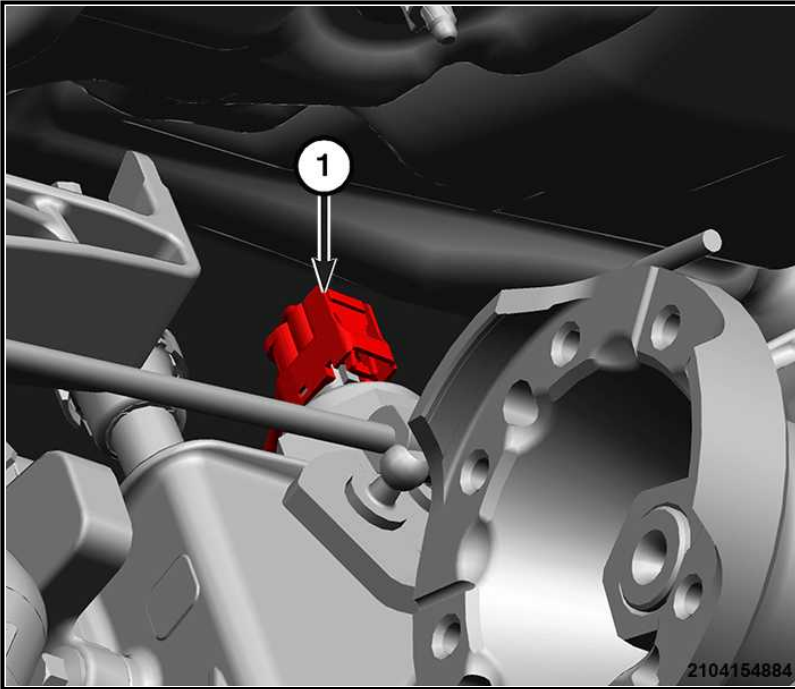
1 - Wire Harness Connector

6. Disconnect the wire harness connector from the shift motor.



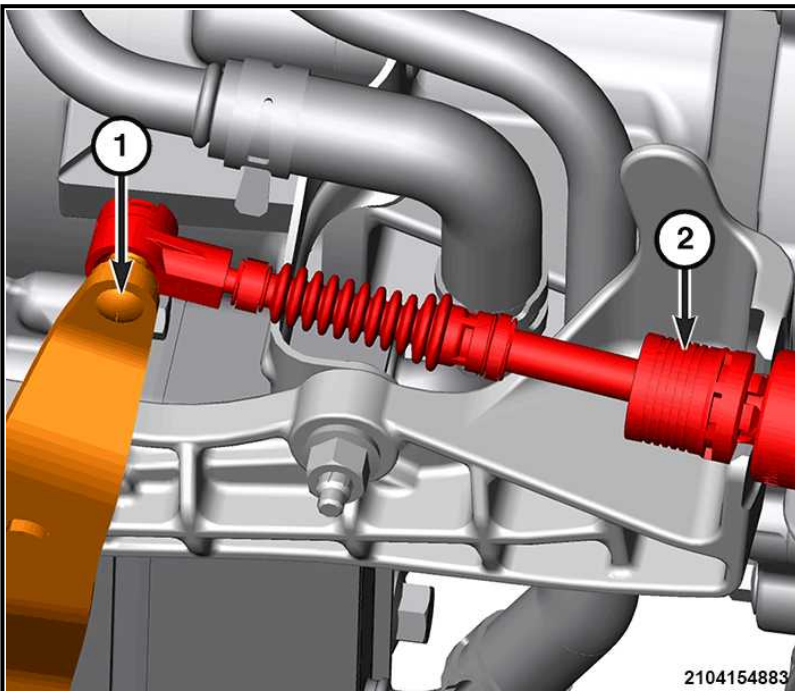
1 - Shift Rod

7. Disconnect the shift rod at the transfer case.



1 - Wire Harness Connector

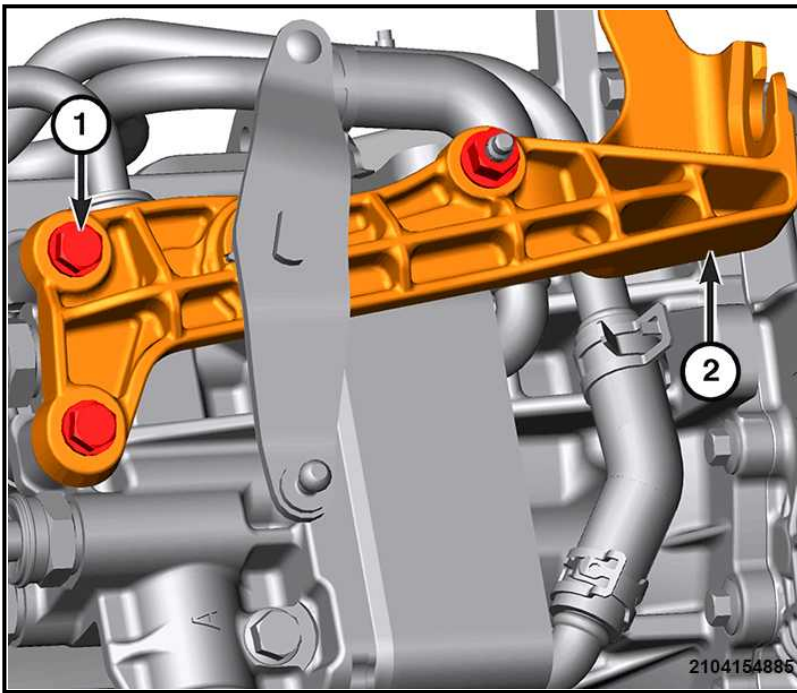
8. Disconnect the wire harness connector from the transfer case position sensor.



1 - Transfer Case Shift Cable

2 - Ball Stud

9. Disconnect the transfer case shift cable from the ball stud.



1- Two Bolts And One Nut

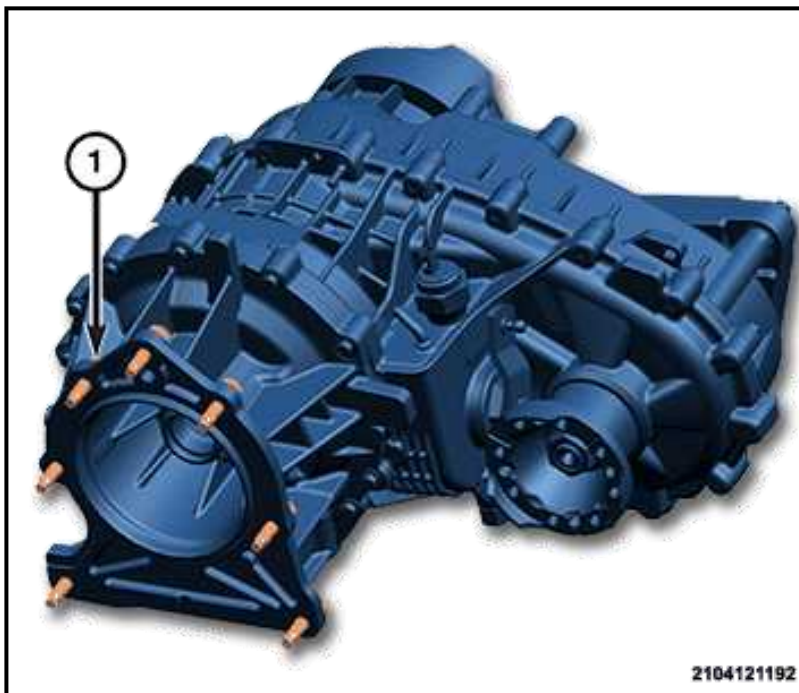
2 - Transfer Case Shift Bracket

10. Remove the two bolts and one nut securing the transfer case shift bracket to the transmission housing.
11. Using a suitable jack stand, support the transmission.
12. Remove the transmission crossmember. Refer to [CROSSMEMBER, TRANSMISSION, REMOVAL AND INSTALLATION](#) .



1 - Shift Cable Retaining Bracket Nut

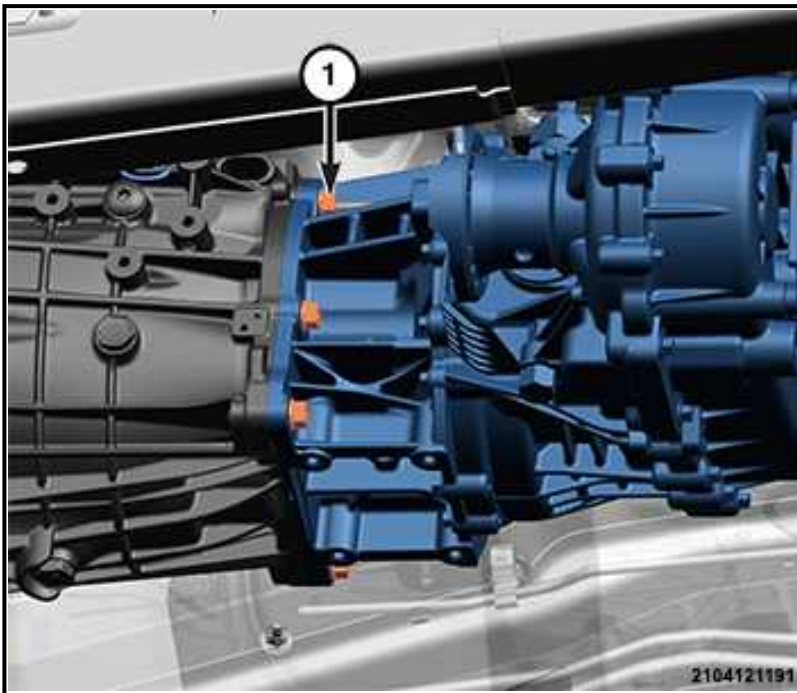
13. Remove the shift cable retaining bracket nut, then remove the shift cable retaining bracket.
14. Using a suitable jack, support the transfer case. Using safety chains, secure transfer case to the jack.



2104121192

1 - Transfer Case Bolts

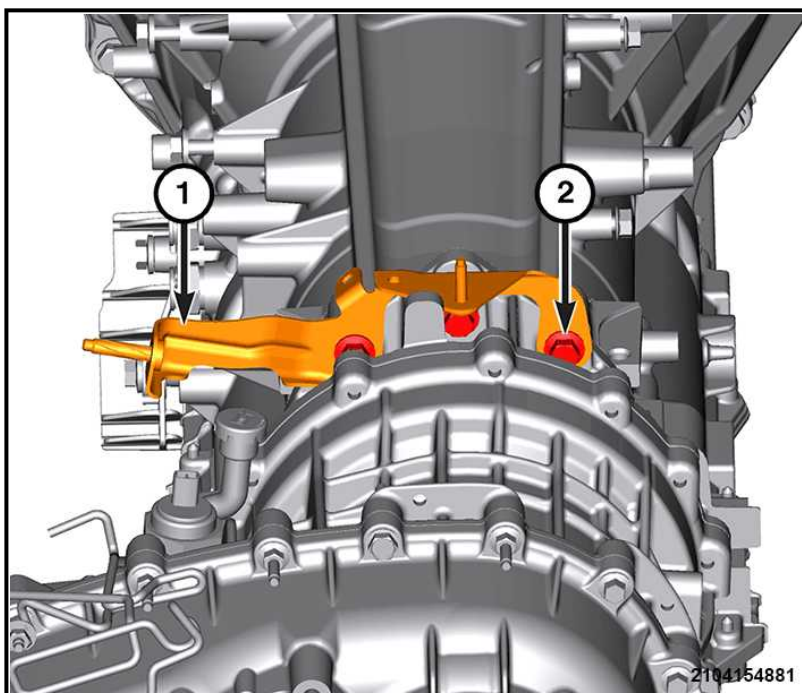
NOTE: There are seven bolts securing the transfer case to the transmission.



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1 - Transfer Case Bolts

15. Remove the seven bolts securing the transfer case to the transmission assembly.



1 - Transfer Case Shift Bracket
2 - Transfer Case Shift Bracket Bolts

16. Remove the transfer case shift bracket from the top of the transfer case.
17. Move the transfer case assembly rearward until it is free of the transmission output shaft.
18. Lower the jack and remove the transfer case from under the vehicle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Fill the transfer case with the specified fluid. Refer to **STANDARD PROCEDURE - FLUID DRAIN AND FILL**.

TORQUE SPECIFICATIONS

TRANSFER CASE

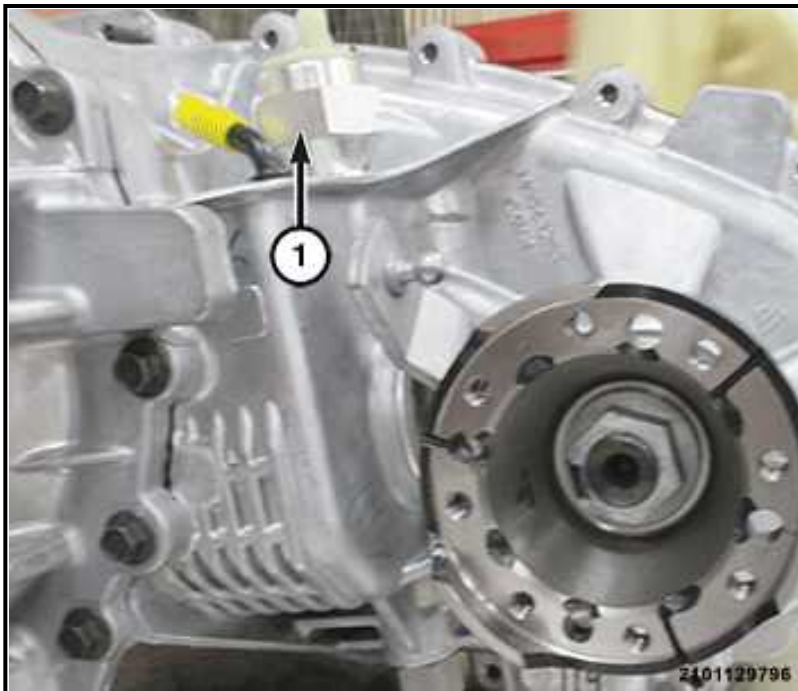
DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

DISASSEMBLY AND ASSEMBLY

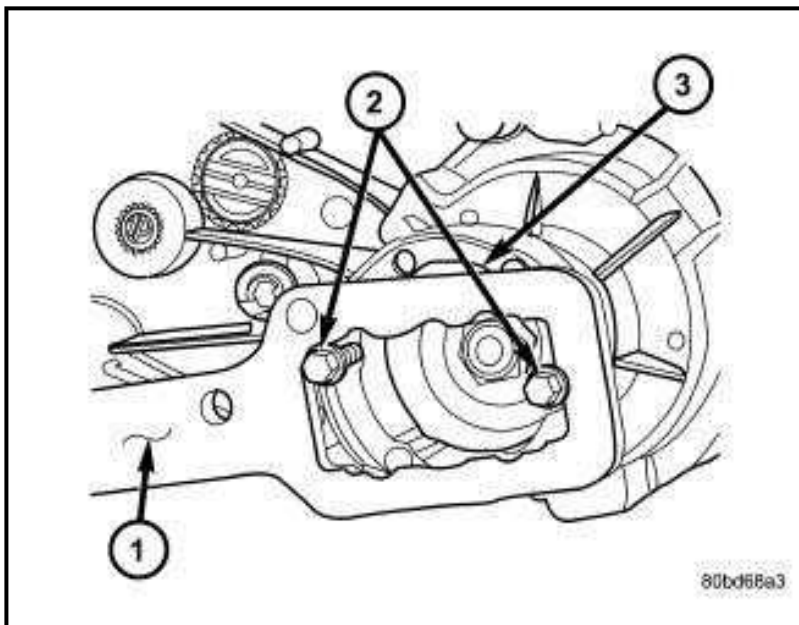
SELECT-TRAC

DISASSEMBLY



1 - Transfer Case Position Sensor

1. Remove the transfer case position sensor.

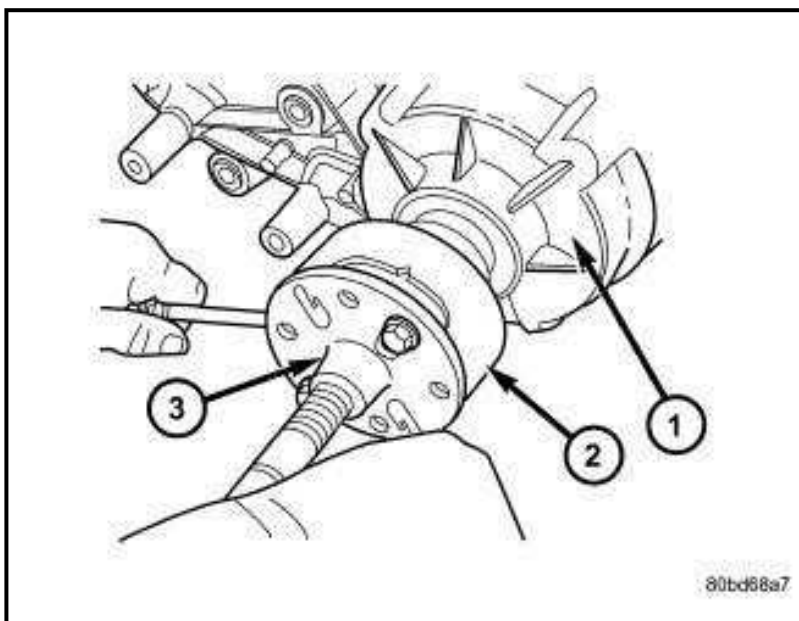


1 - Flange Holder Tool

2 - Bolts

3 - Flange

2. Remove both output flanges. Install two bolts partially into the propeller shaft companion flange, 180B° from each other.
3. Install the rectangular end of Flange Holder (special tool #C-3281, Holder, Flange) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.

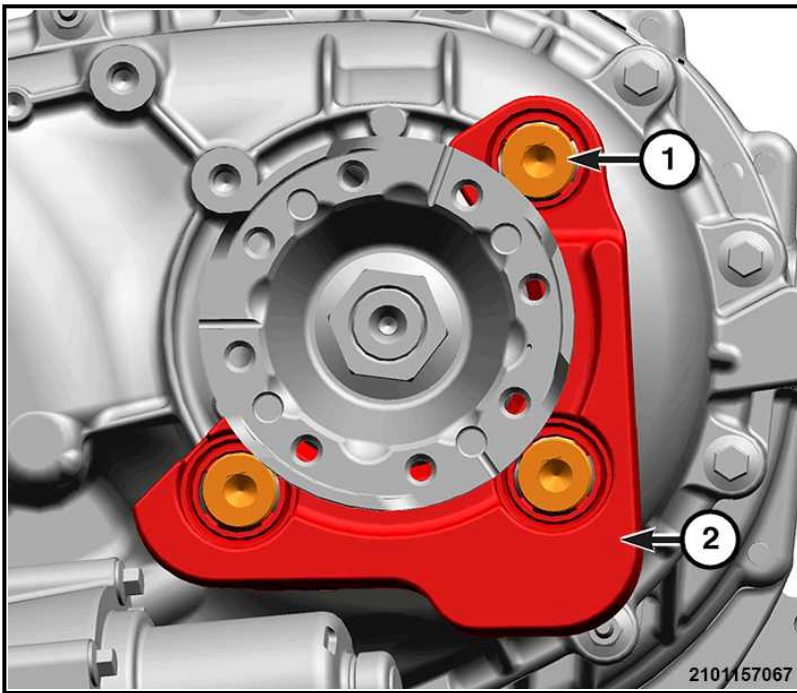


1 - Transfer Case

2 - Flange

3 - Flange Puller

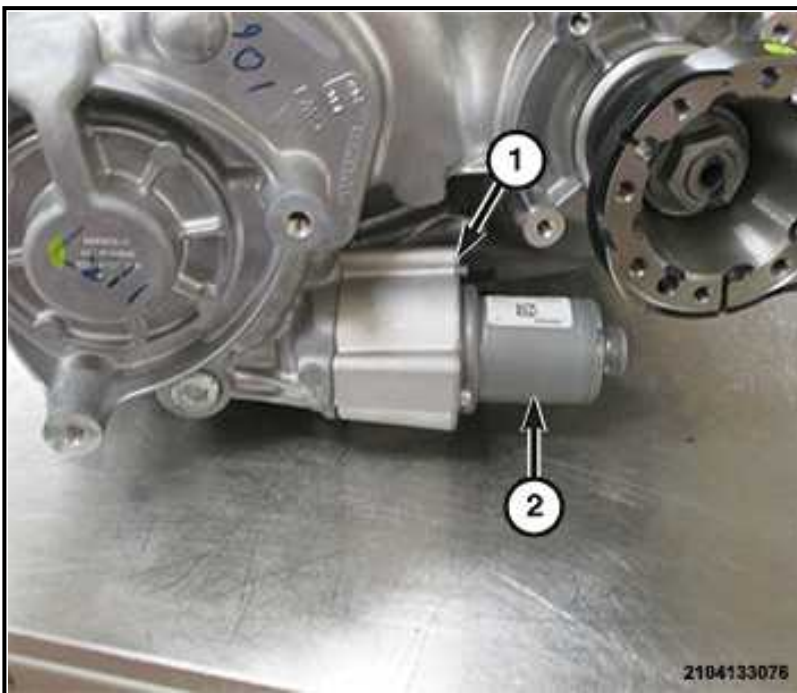
4. Use Remover (special tool #C-452, Puller, Companion Flange) to remove the companion flange.
5. Remove the seal washer from the front output shaft. Discard the washer as it must not be reused.



1 - Harmonics Damper Bolts

2 - Harmonics Damper

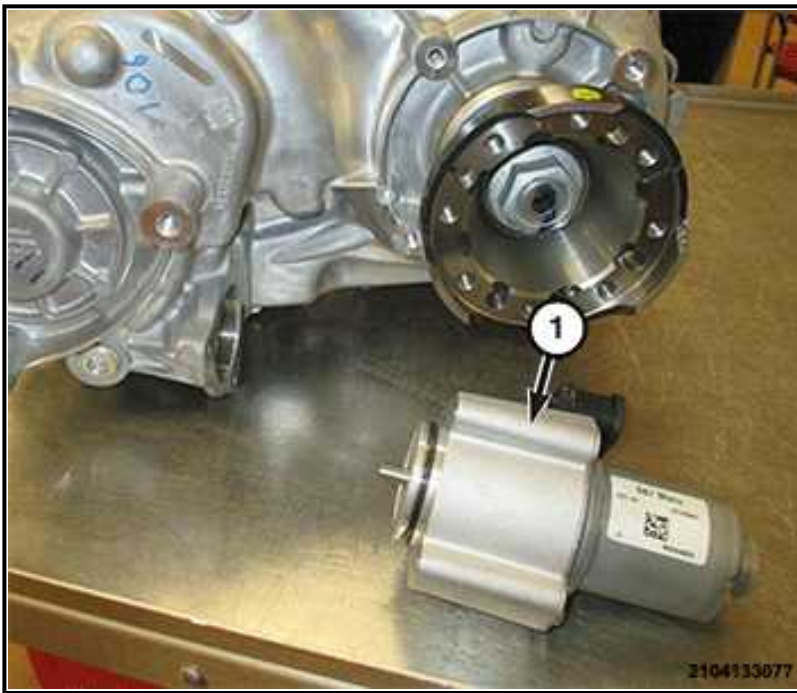
6. If equipped, remove the harmonics damper fasteners and remove the harmonics damper.



1 - Shift Motor

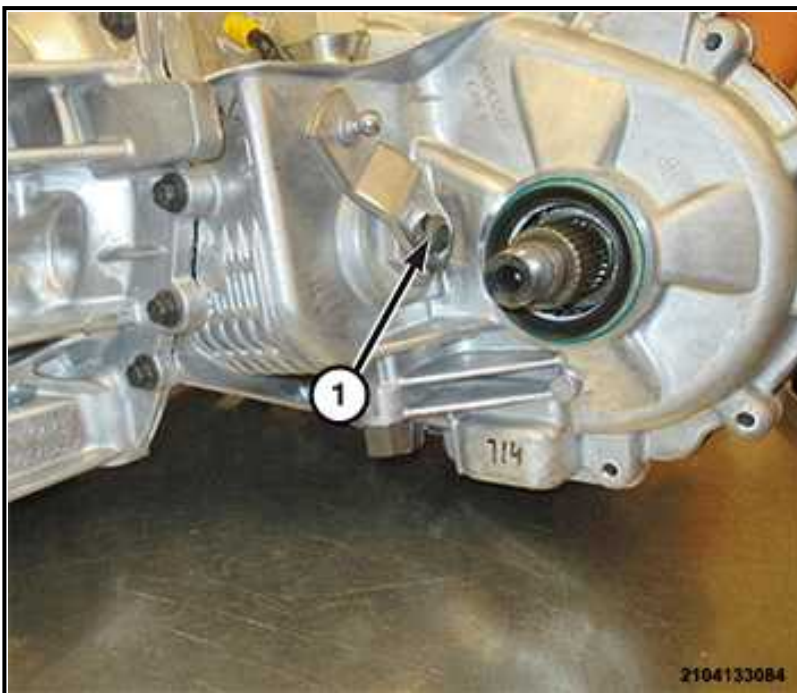
2 - Shift Motor Bolts

7. Remove the three shift motor bolts from the shift motor.



1 - Shift Motor

8. Remove the shift motor.



1 - Range Lever Bolt

9. Remove the bolt that attaches the range lever to the sector shaft. Then move the sector shaft to the neutral position and remove the range lever from the shaft.

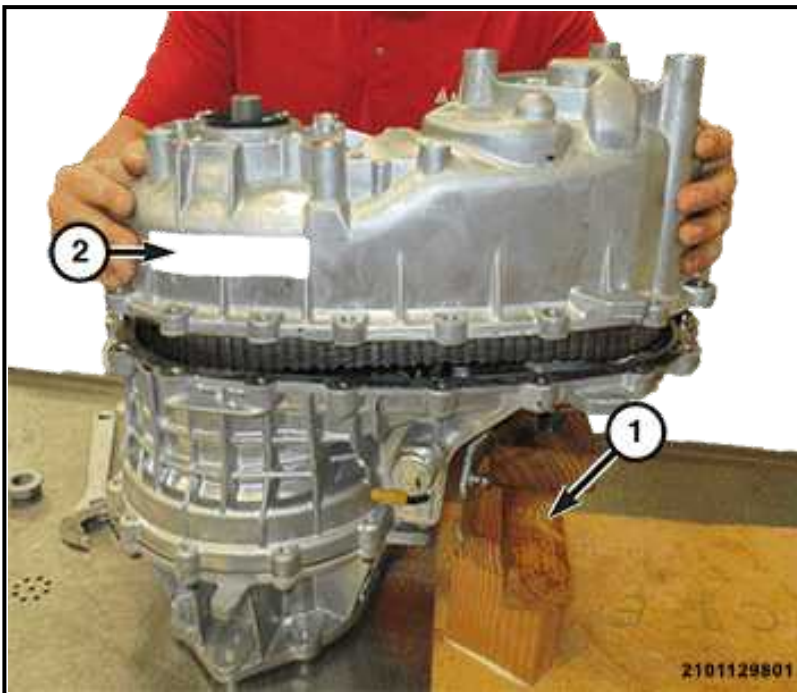
NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.



1 - Transfer Case Bolts

10. Remove the case bolts.

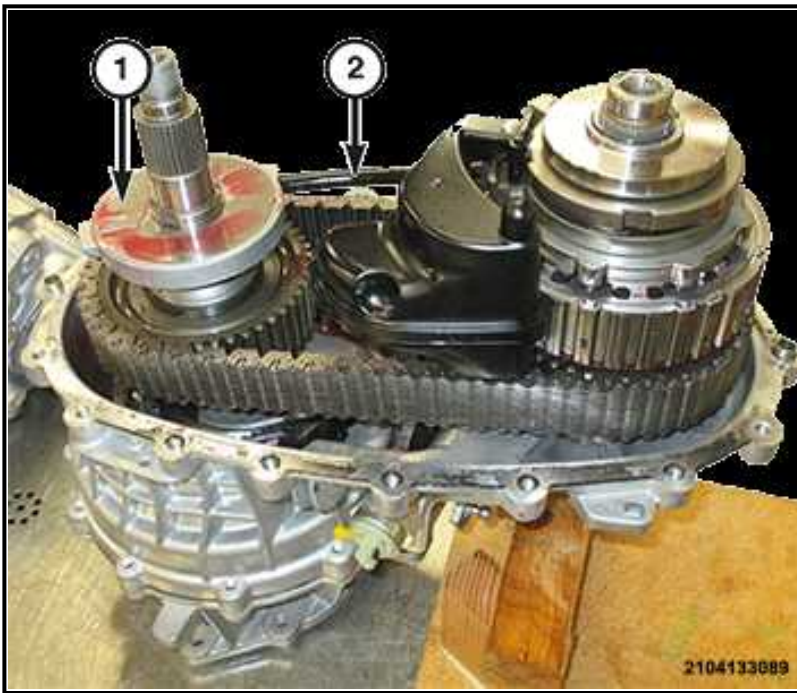
11. Loosen the case halves with pry tool to break the sealer bead. Insert tool in slot at each end of case.



1 - Wood Block

2 - Rear Transfer Case Half

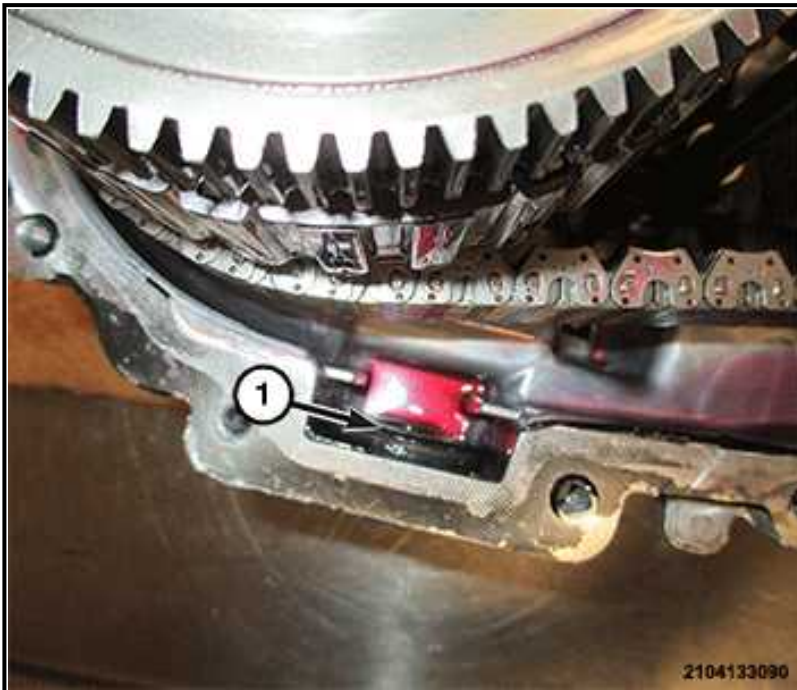
12. Unseat the rear case from the alignment dowels and remove the case.



1 - Oil Pump

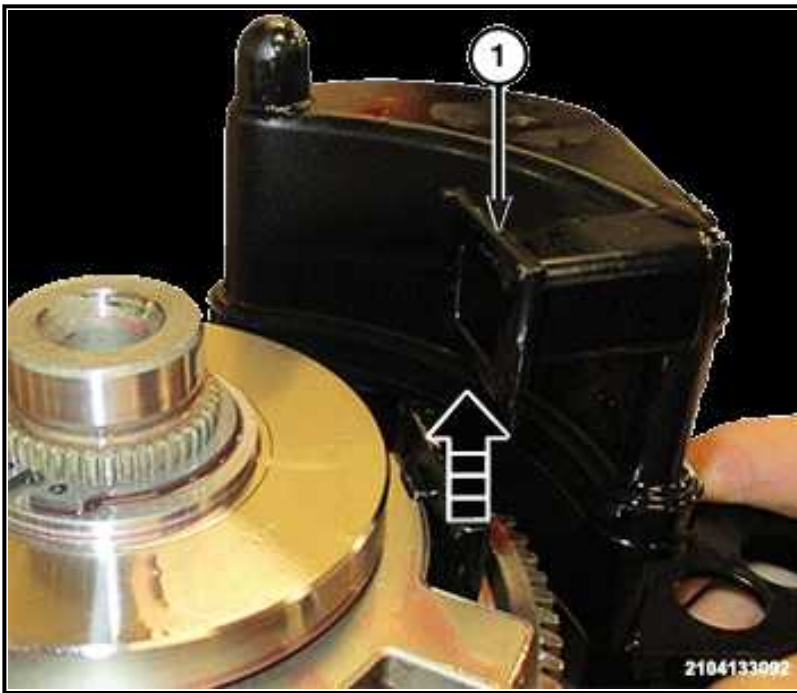
2 - Oil Pump Pick-up Tube

13. Remove the oil pump with the oil pump pick-up tube.



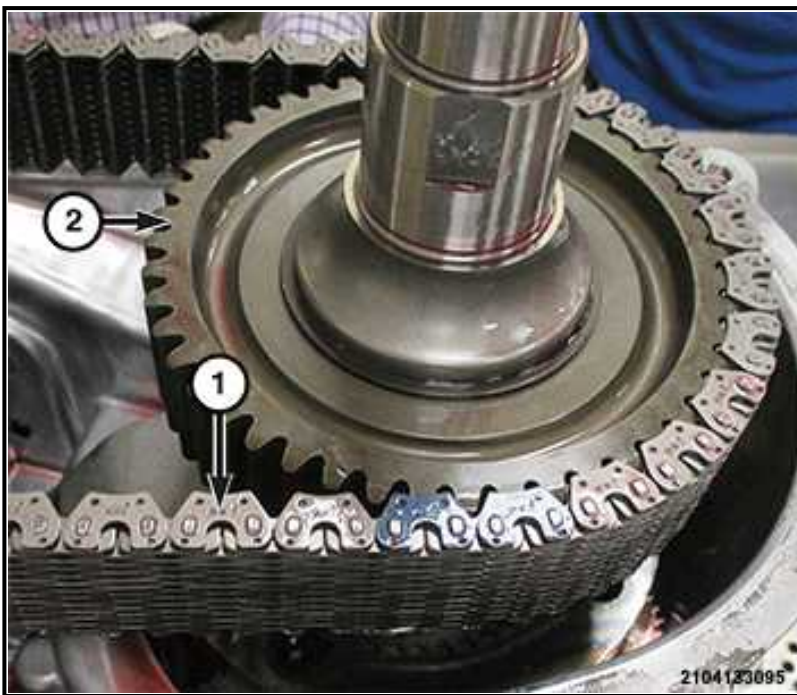
1 - Magnet

14. Remove the magnet from the pocket that the oil pump pickup tube is seated in and thoroughly clean the magnet.



1 - Oil Sump

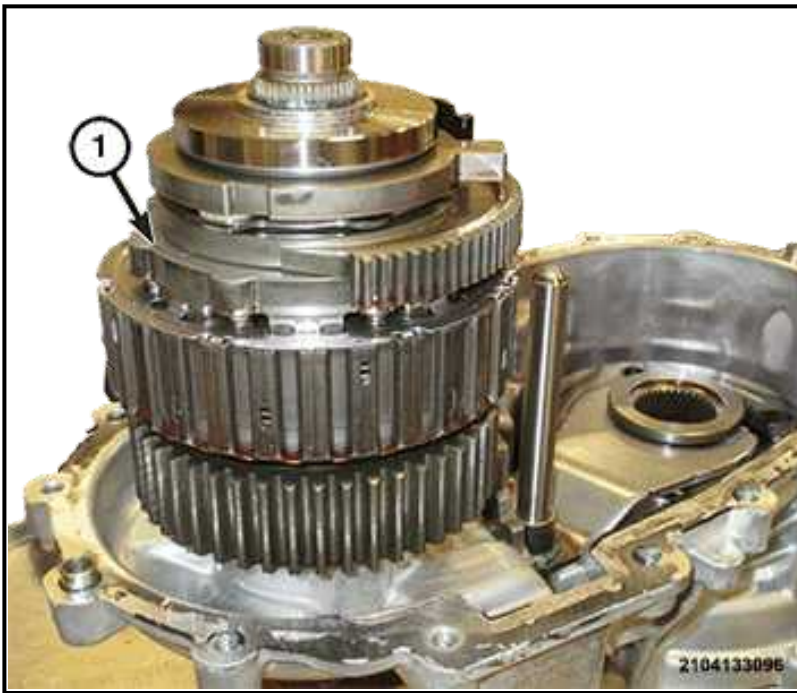
15. Remove the oil sump from the case.



1 - Chain

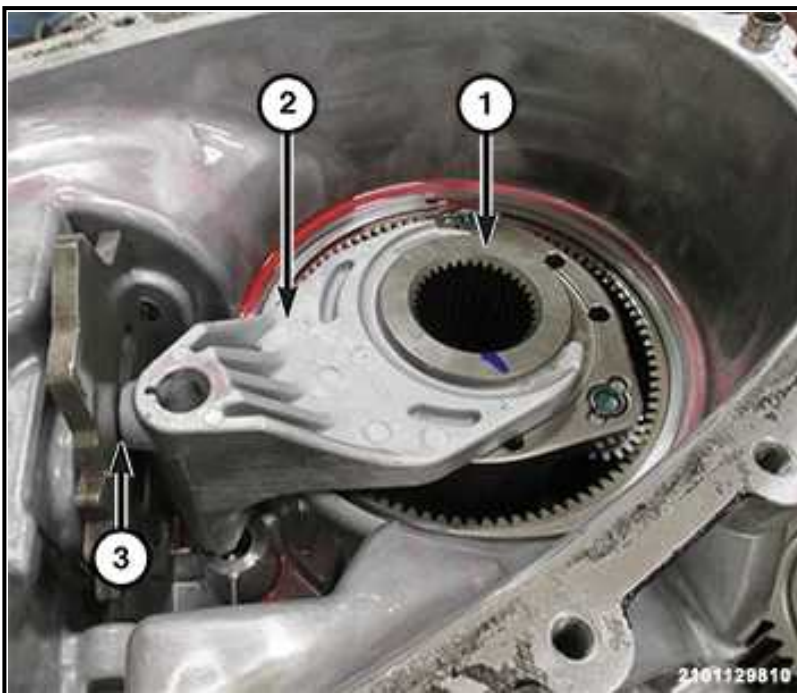
2 - Main Shaft Sprocket Assembly

16. Remove the chain and the main shaft sprocket assembly from the case.



1 - Output Shaft Assembly

17. Remove the output shaft assembly from the case.



1 - Input Gear

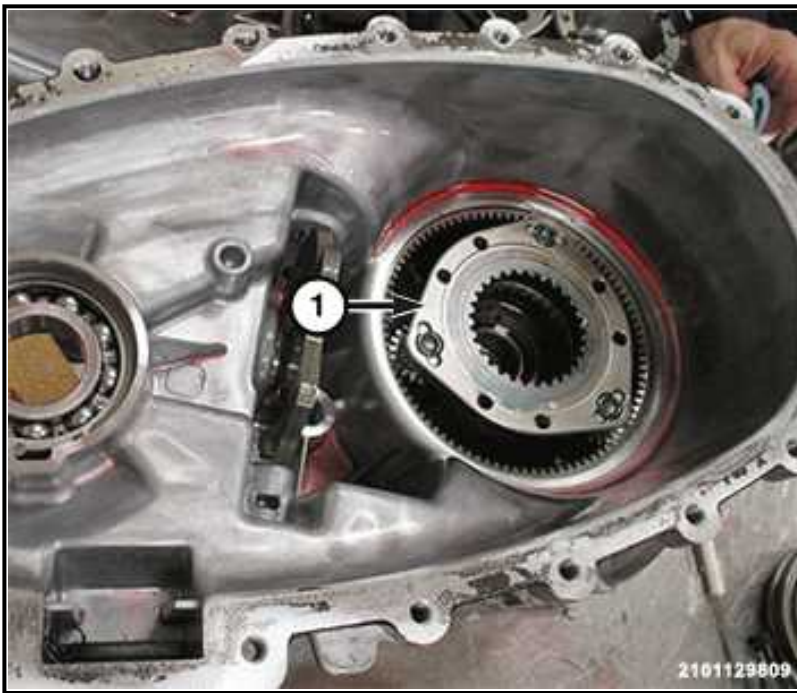
2 - Range Fork

3 - Range Fork Located in Selector Plate
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18. Remove the range fork assembly with the input gear.

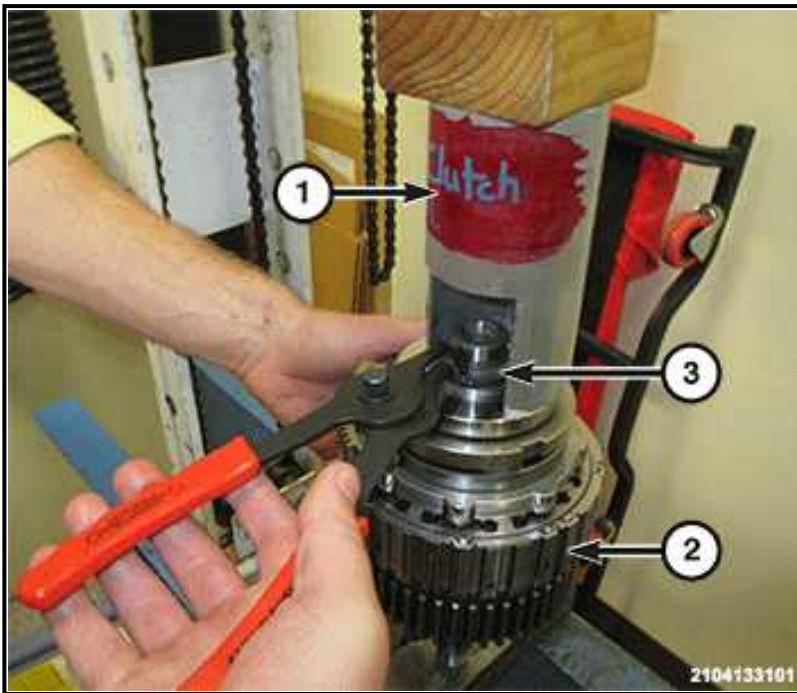
19. Remove the input shaft seal to access the planetary gear assembly snap ring

20. Remove the snap ring retaining the planetary gear assembly.



1 - Planetary Gear Set

21. Remove the planetary gear set.

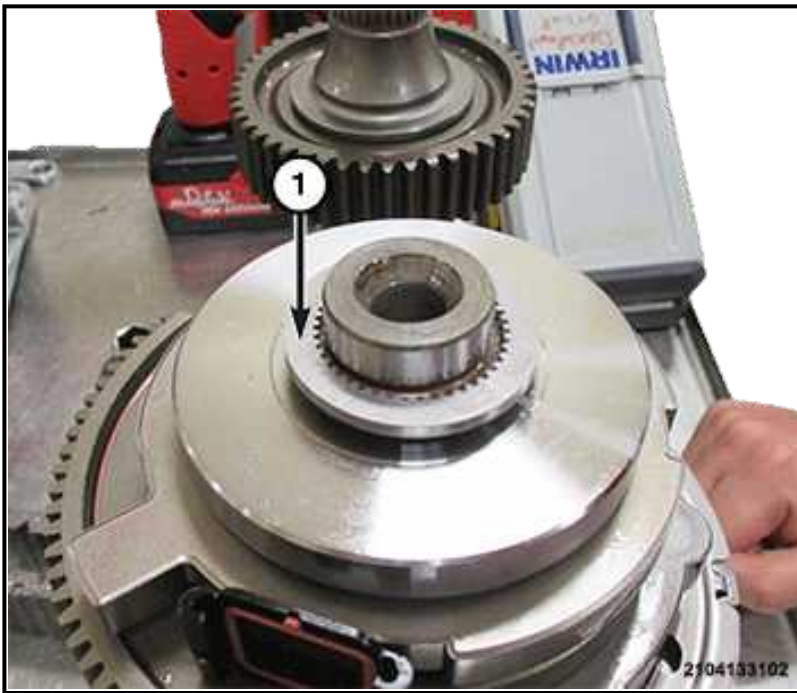


1 - Ball Joint Remover/Installer Tool

2 - Output Shaft Assembly

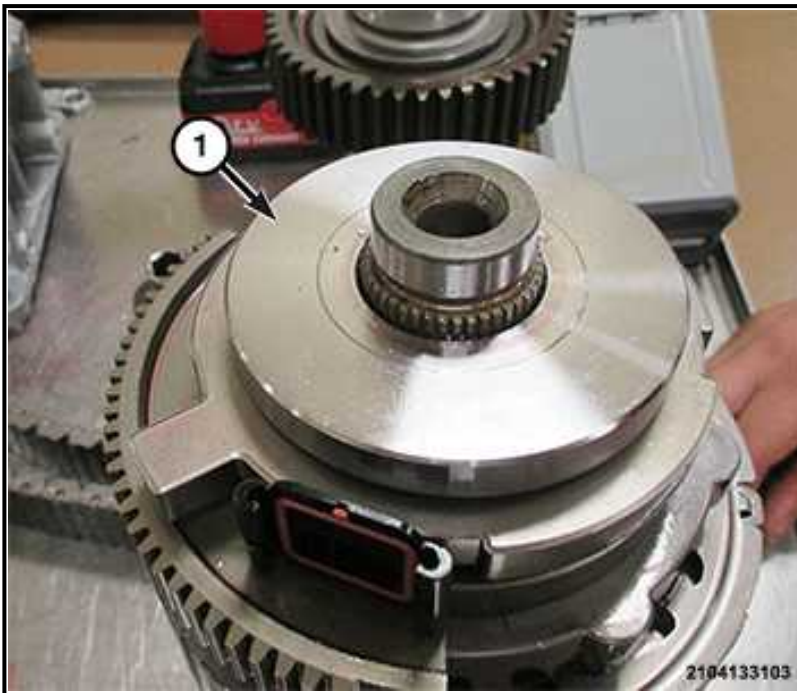
3 - Snap Ring

22. With the output shaft assembly supported in a press, compress the clutch assembly enough using (special tool #9964, Remover/Installer, Ball Joint) to remove the output snap ring.



1 - Shim

23. Remove the transfer case shim from the output thrust washer.



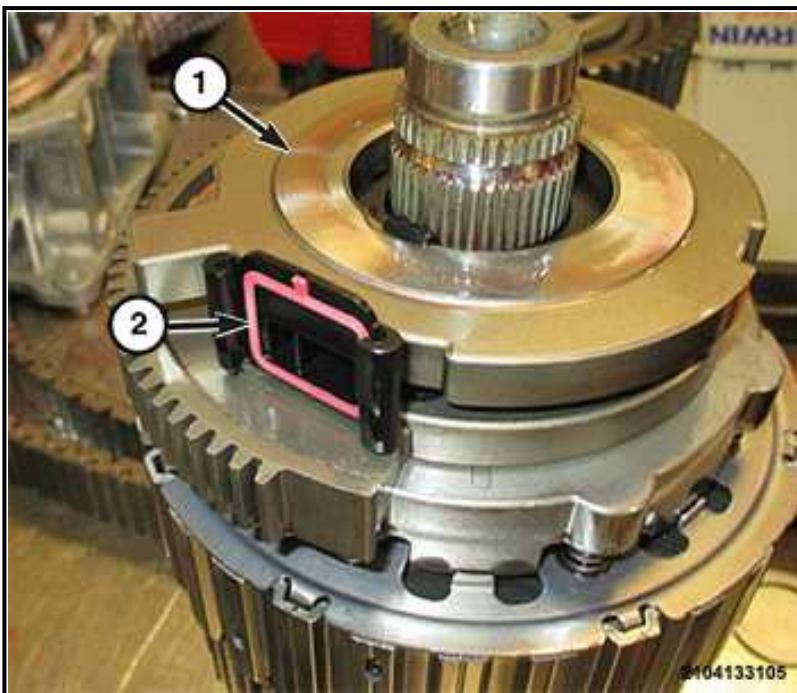
1 - Thrust Washer

24. Remove the thrust washer from the upper apply cam.



1 - Thrust Bearing

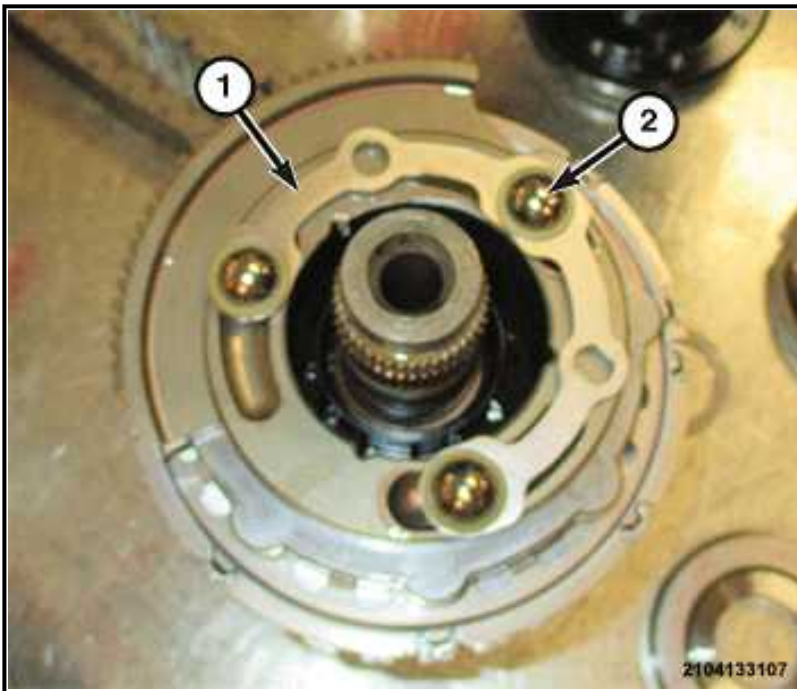
25. Remove the thrust bearing from the upper apply cam.



1 - Upper Apply Cam

2 - Transfer Case Oil Sump Receiving Plate

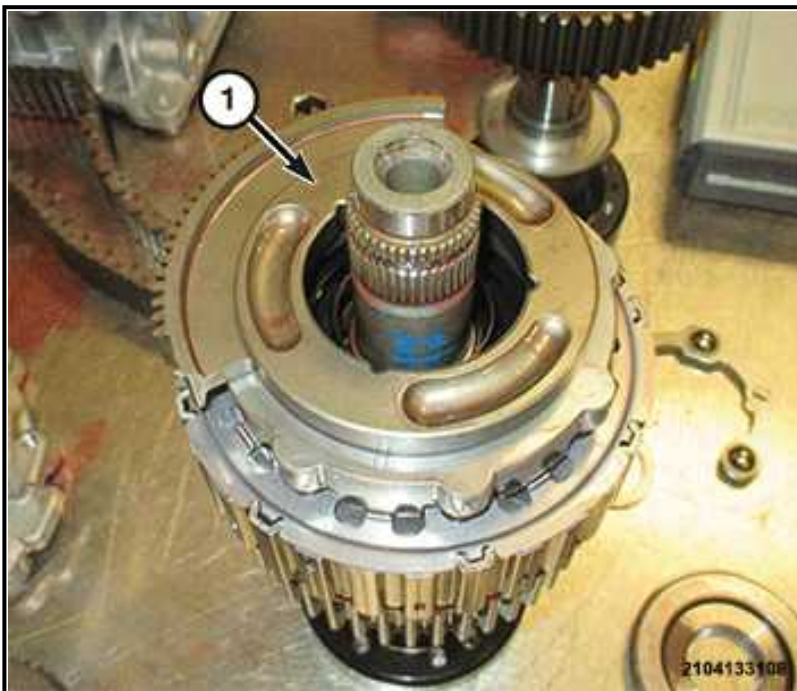
26. Remove the upper apply cam, with the transfer case oil sump receiving plate, from the output shaft.



- | |
|--------------------|
| 1 - Ball Bearings |
| 2 - Retaining Ring |

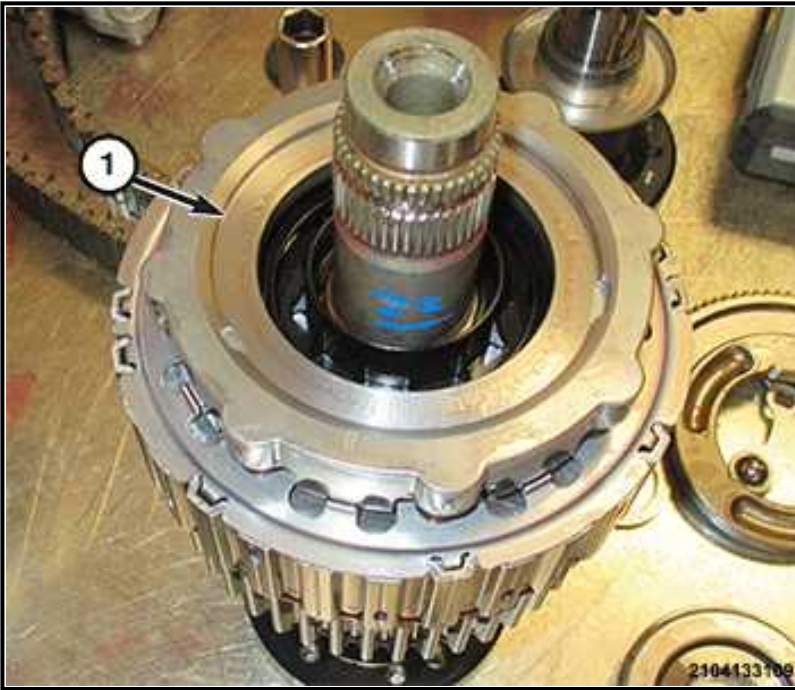
27. Remove the ball bearings with the retaining ring from the apply cam.

NOTE: Note the orientation of the opening on the retaining ring for reassembly.



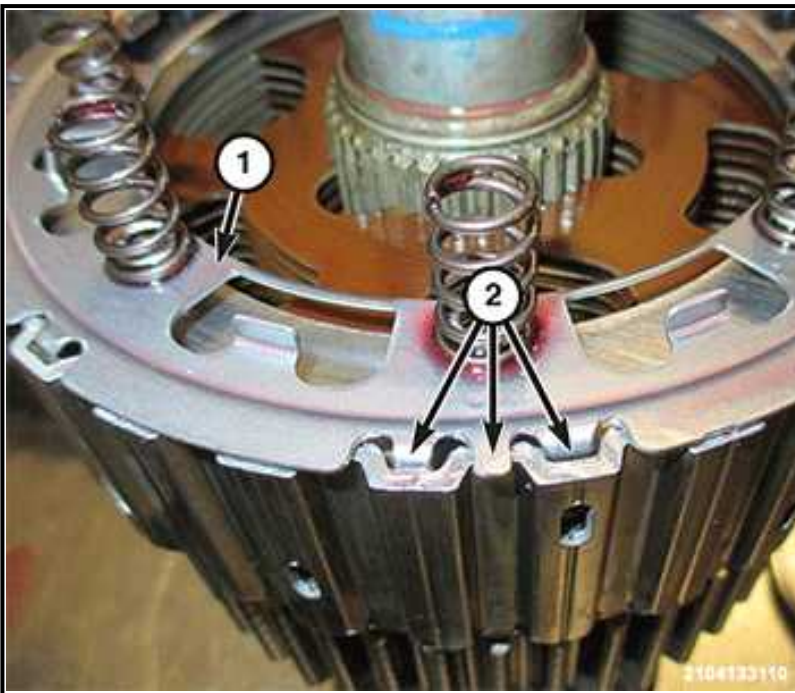
- | |
|---------------------|
| 1 - Lower Apply Cam |
|---------------------|

28. Remove the lower apply cam from the output shaft.



1 - Apply Plate

29. Remove the apply plate from the output shaft.

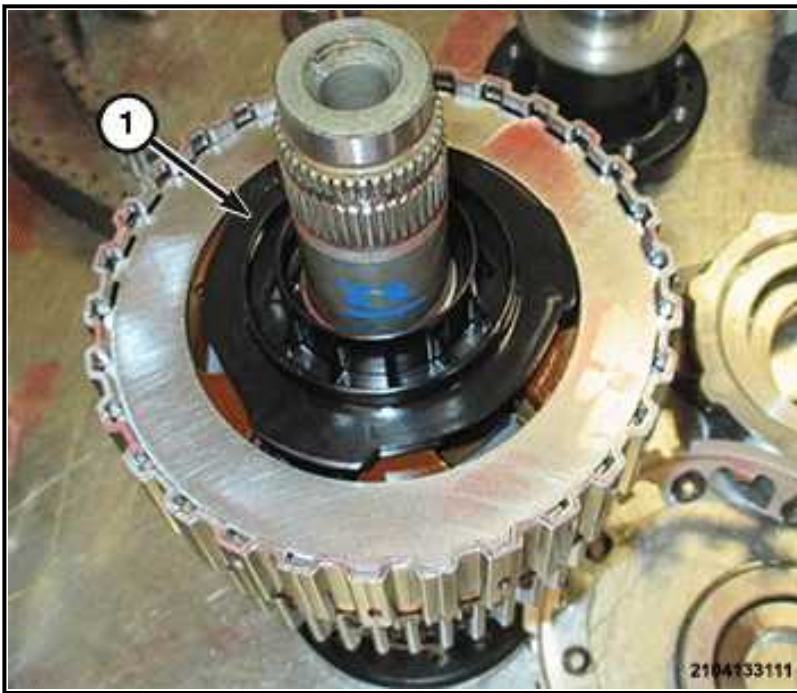


1 - Spring Plate

2 - Tab Orientation

30. Remove the spring plate from the output shaft.

NOTE: Note the orientation of the tabs when removing the spring plate.



1 - Oil Deflector

31. Remove the oil deflector from the output shaft.



1 - Clutch Drum Assembly

32. Remove the clutch drum assembly from the output shaft.



1 - Clutch Drum Spacer

33. Remove the clutch drum spacer from the output shaft.



1 - Driven Sprocket

34. Remove the driven sprocket from the output shaft.



1 - Thrust Bearing

35. Remove the thrust bearing from the output shaft.

ASSEMBLY

1. Thoroughly clean both case halves and the mating surfaces.
2. Replace any bearings in the case halves that are spalled, damaged, or have been subjected to highly contaminated fluid (metal contamination from catastrophic failure).



1 - Thrust Bearing

3. Install the thrust bearing to the output shaft.



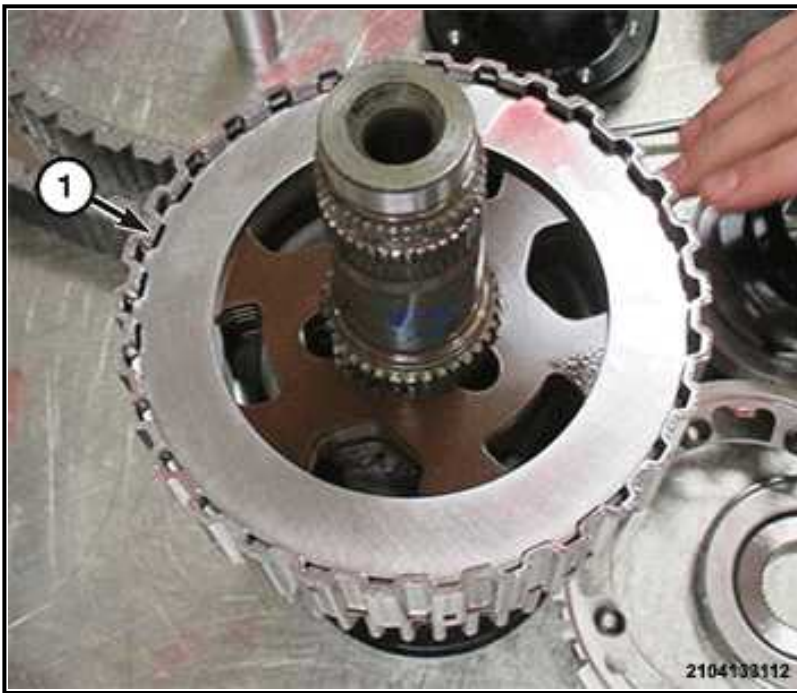
1 - Driven Sprocket

4. Install the driven sprocket to the output shaft.



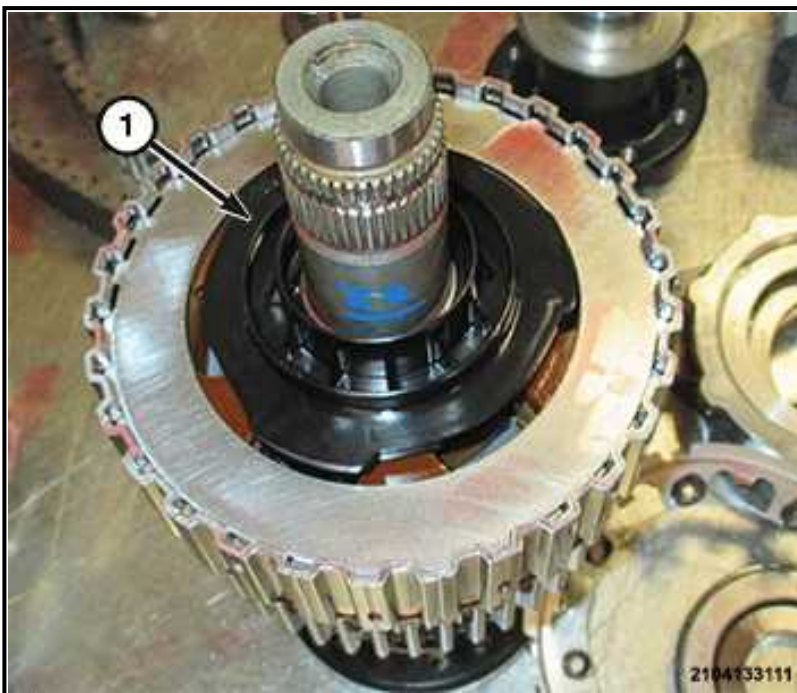
1 - Clutch Drum Spacer

5. Install the clutch drum spacer to the output shaft.



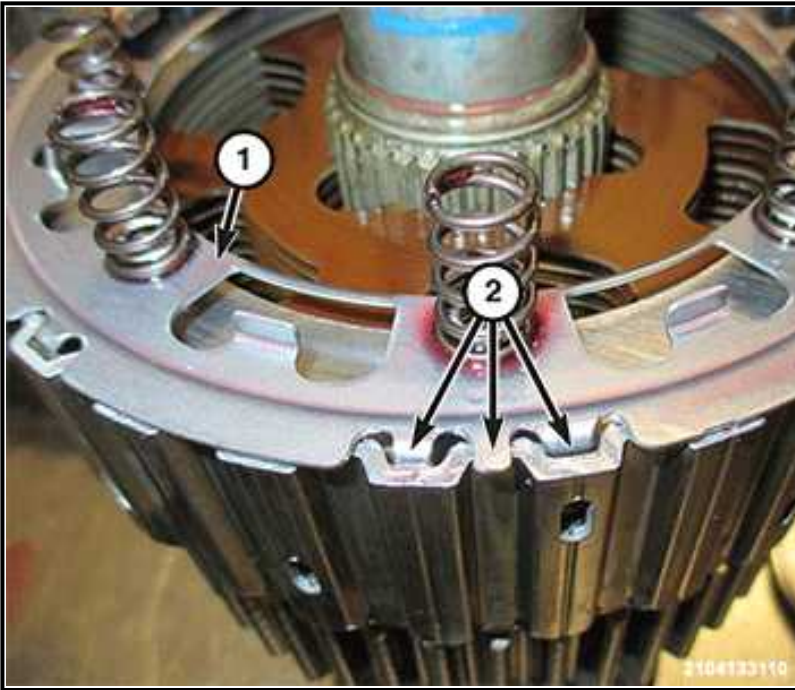
1 - Clutch Drum Assembly

6. Install the clutch drum assembly to the output shaft.



1 - Oil Deflector

7. Install the oil deflector to the output shaft.

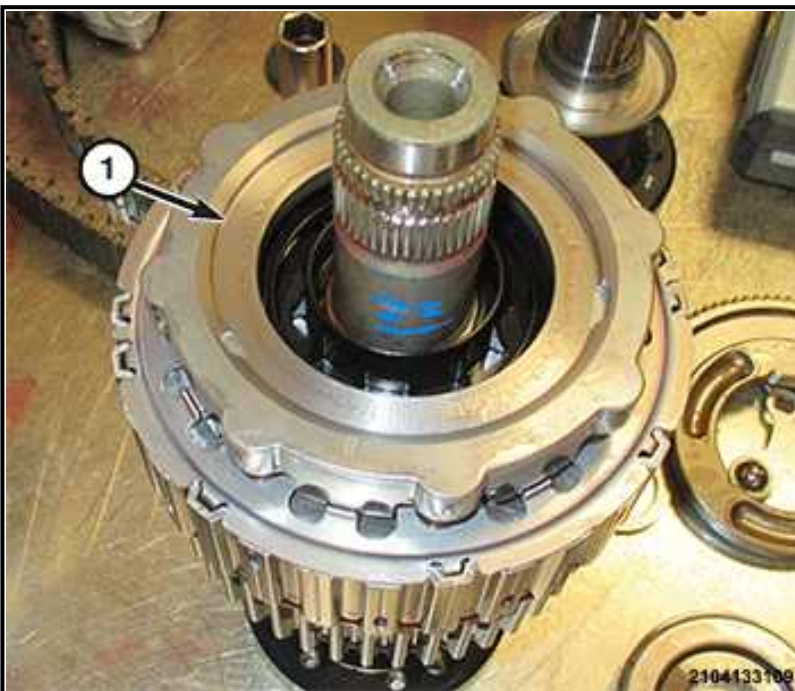


1 - Spring Plate

2 - Tab Orientation

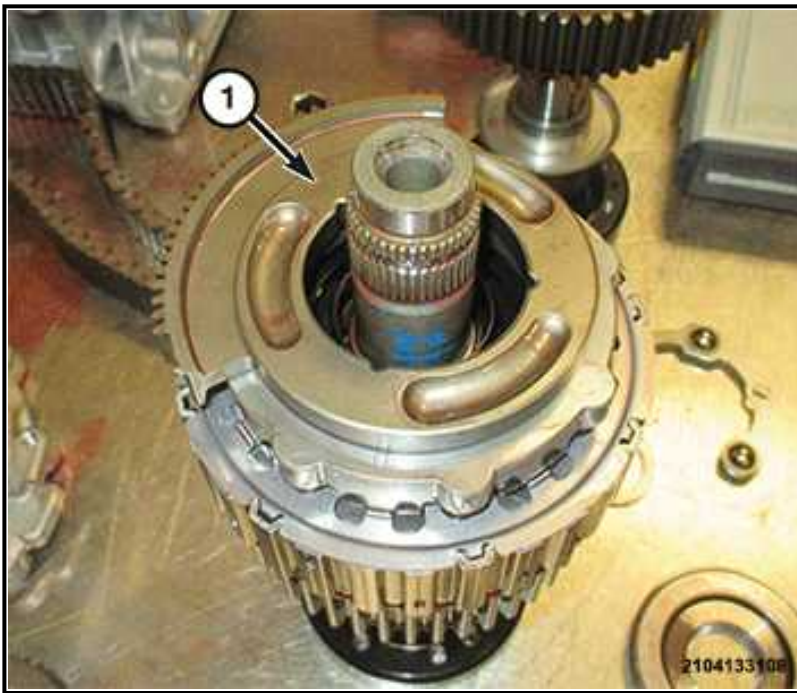
8. Install the spring plate to the output shaft.

NOTE: Note the orientation of the tabs when installing the spring plate.



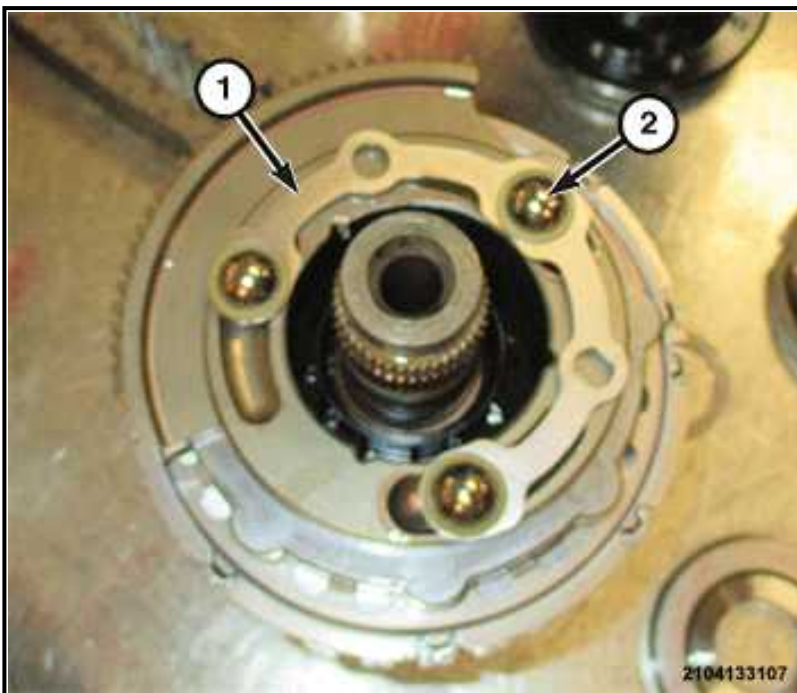
1 - Apply Plate

9. Install the apply plate to the output shaft.



1 - Lower Apply Cam

10. Install the lower apply cam to the output shaft.

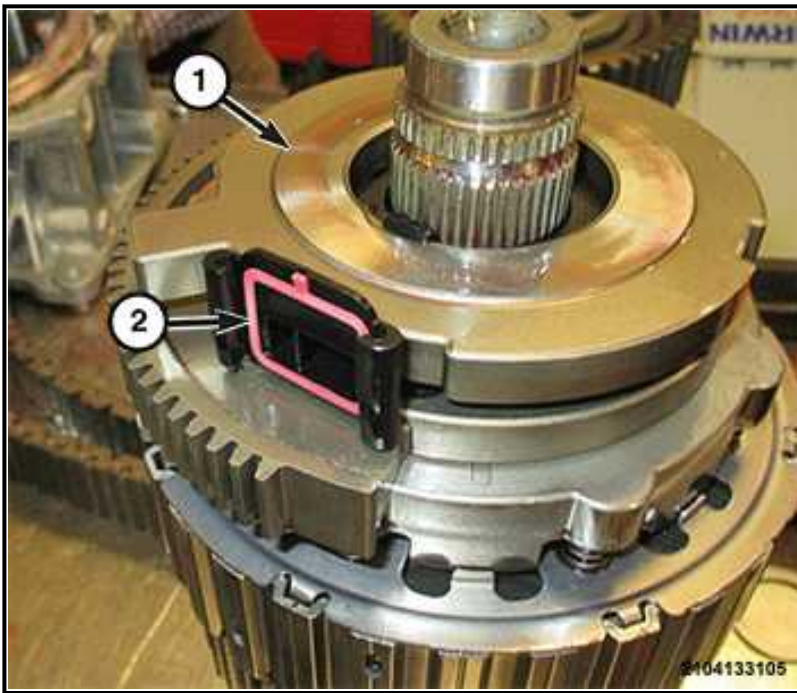


1 - Ball Bearings

2 - Retaining Ring

11. Install the ball bearings with the retaining ring into the lower apply cam.

NOTE: Verify the orientation of the retaining ring to the gear teeth on the apply cam before reassembly. The figure shown is the correct orientation.



1 - Upper Apply Cam

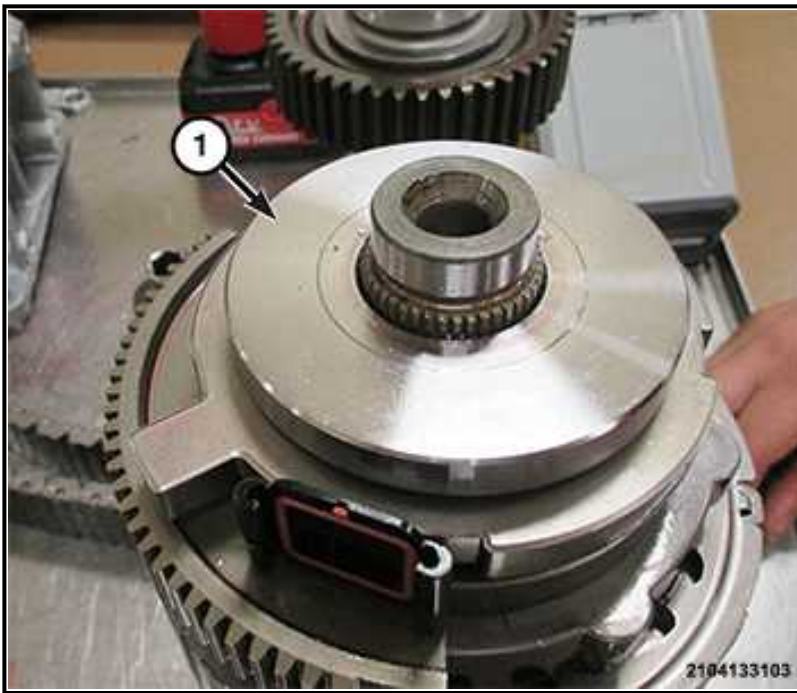
2 - Transfer Case Oil Sump Receiving Plate

12. Install the upper apply cam with the transfer case oil sump receiving plate to the output shaft.



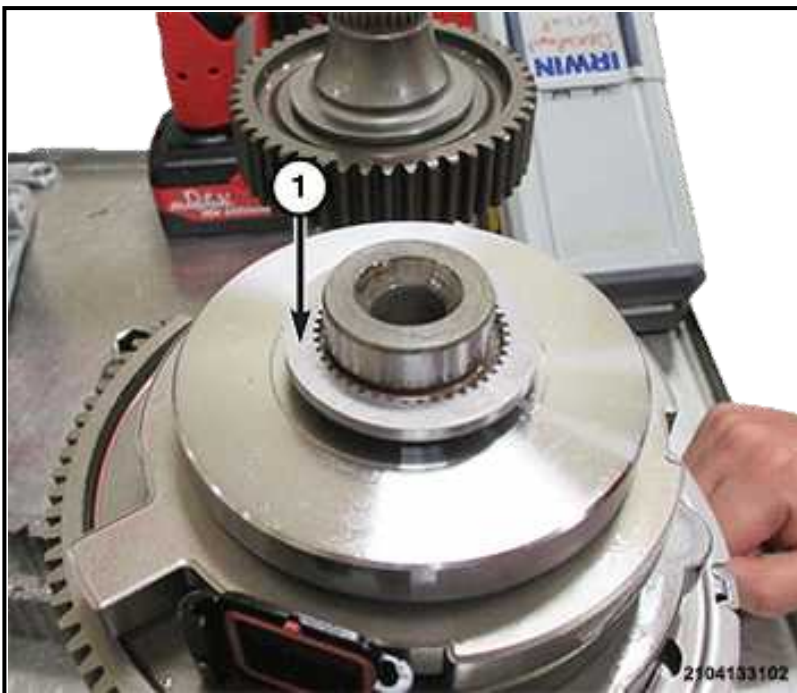
1 - Thrust Bearing

13. Install the thrust bearing to the upper apply cam.



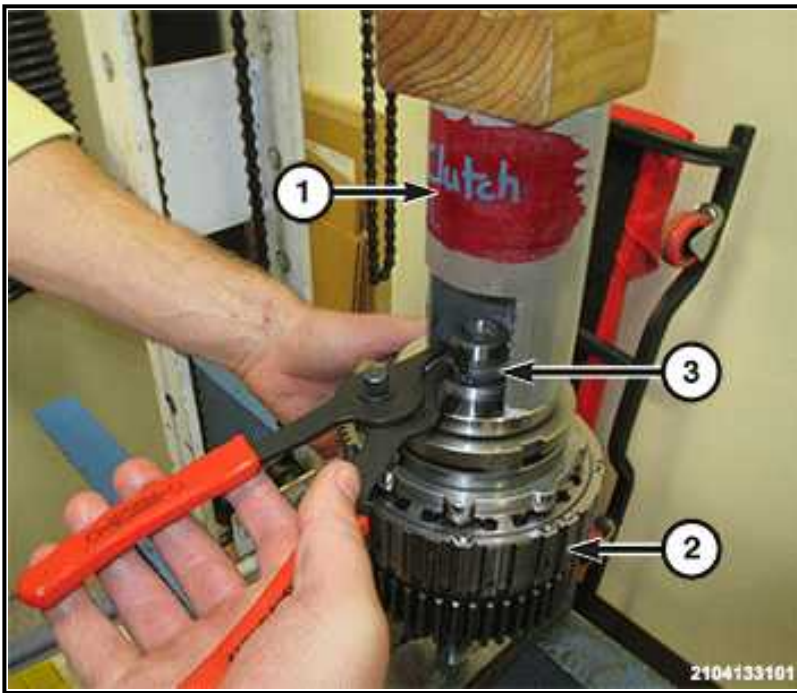
1 - Thrust Washer

14. Install the thrust washer to the upper apply cam.



1 - Shim

15. Install the transfer case shim to the output thrust washer.

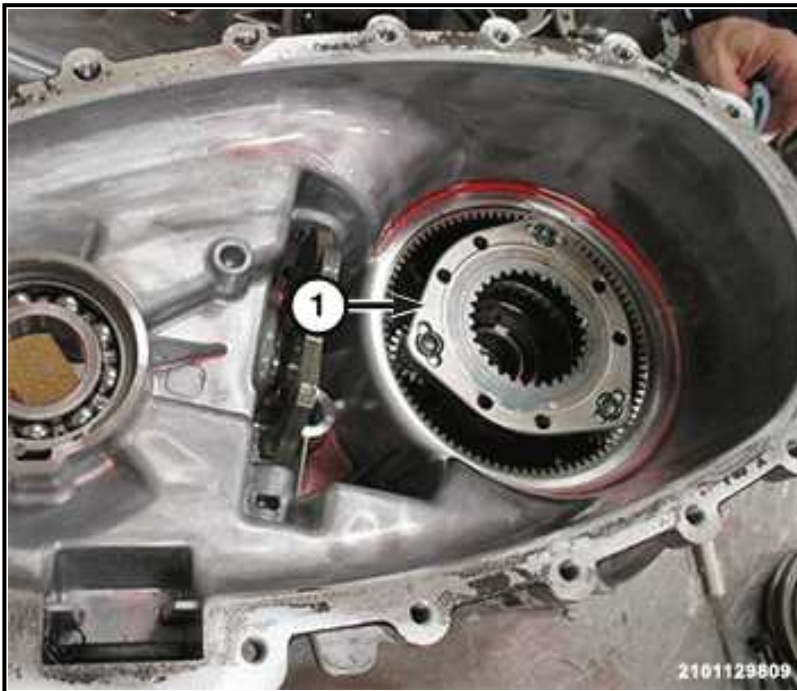


1 - Ball Joint Remover/Installer Tool

2 - Output Shaft Assembly

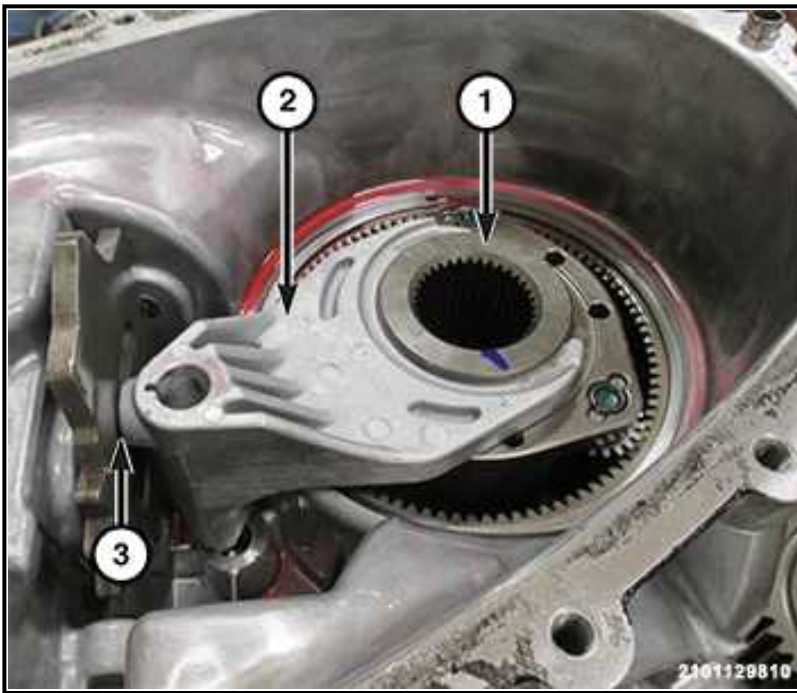
3 - Snap Ring

16. With the output shaft assembly supported in a press, compress the clutch assembly enough using (special tool #9964, Remover/Installer, Ball Joint) to install the output snap ring on the output shaft.



1 - Planetary Gear Set

17. Install the planetary gear set into the annulus gear.

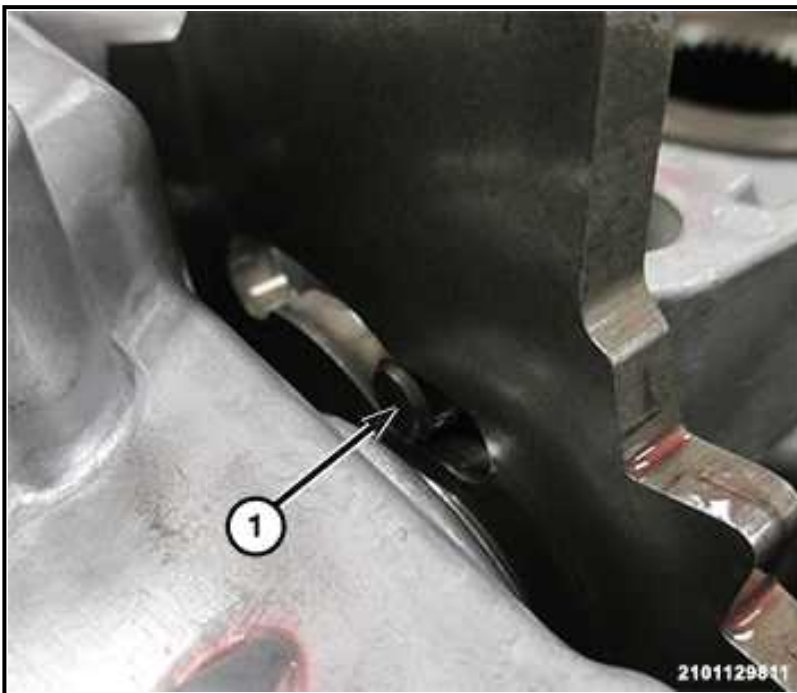


1 - Input Gear

2 - Range Fork

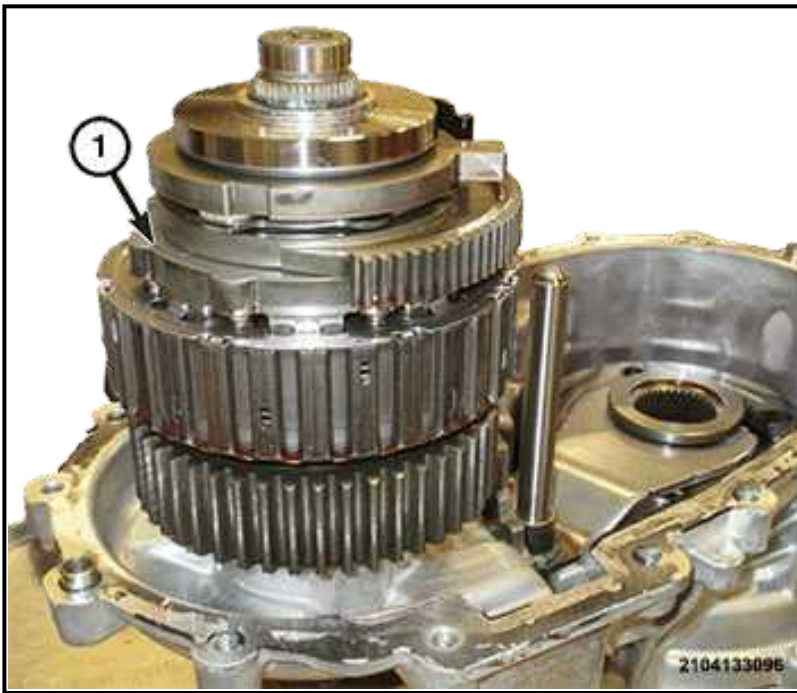
3 - Range Fork Located in Selector Plate

18. Assemble the input gear assembly together with the range fork and install them into the planetary carrier.



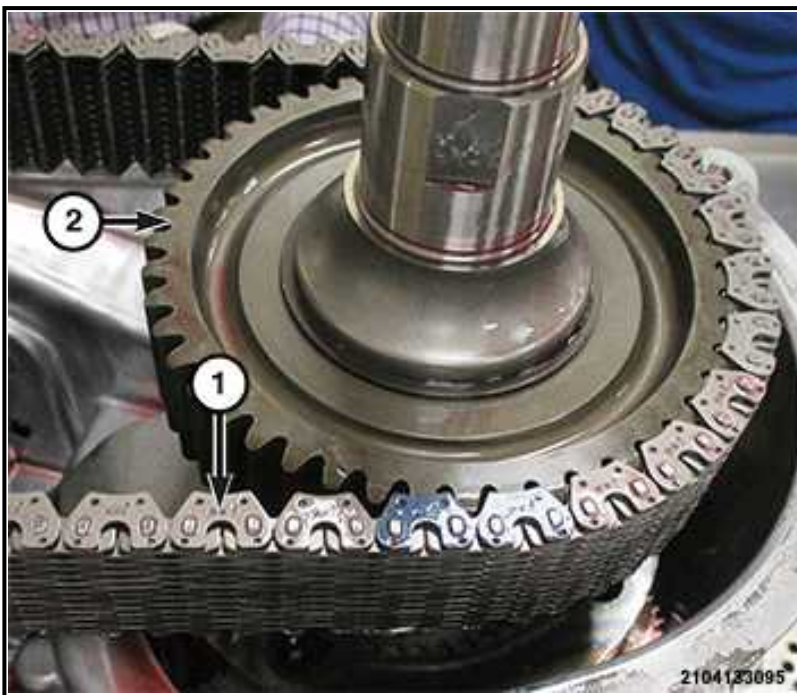
1 - Range Fork Located in Selector Plate

19. Make sure the tang on the range fork is seated in the notch on the selector plate.



1 - Output Shaft Assembly

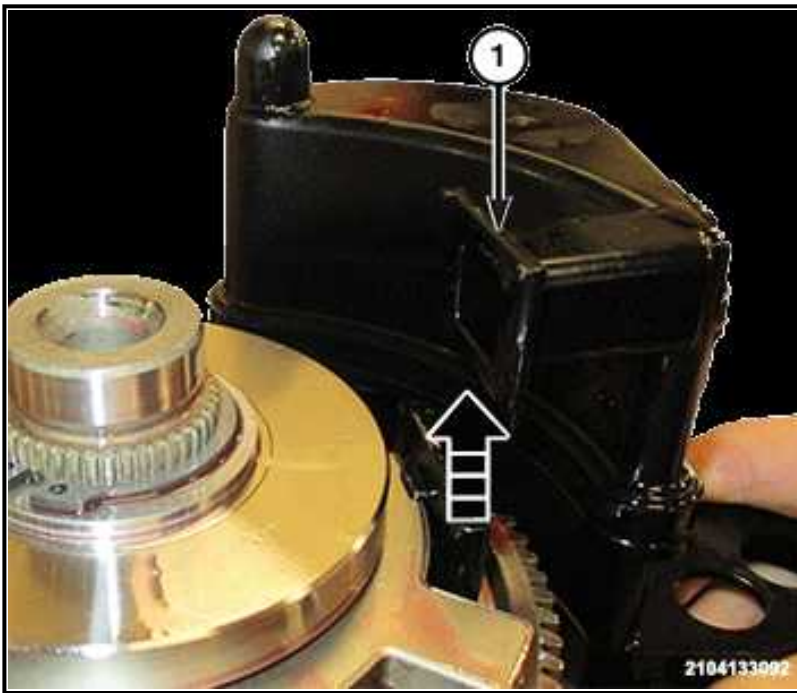
20. Install the output shaft assembly into the case.



1 - Chain

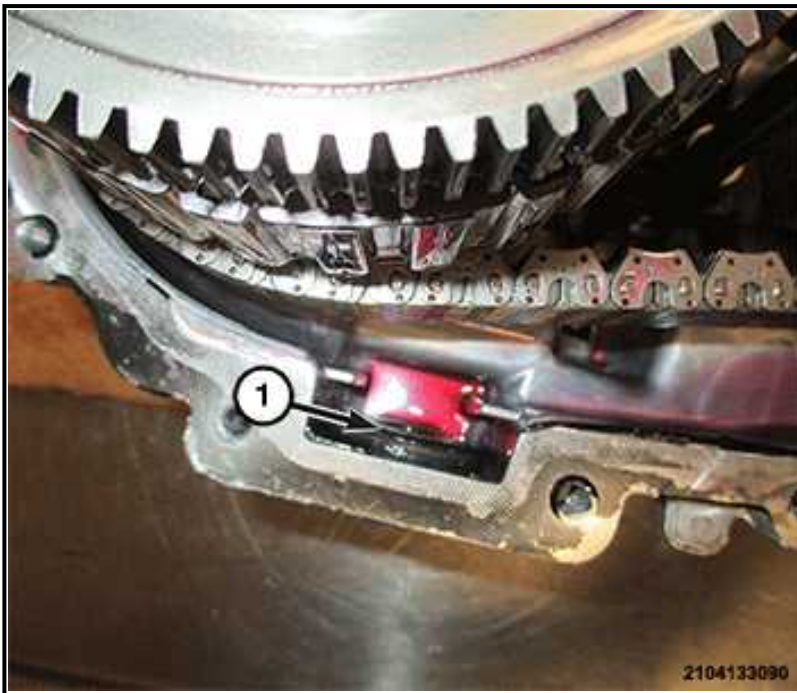
2 - Main Shaft Sprocket Assembly

21. Assemble the chain on the main shaft sprocket with the blue link facing up. Install the chain with the main shaft around the output driven sprocket and into the case.



1 - Oil Sump

22. Install the oil sump into the receiving plate.



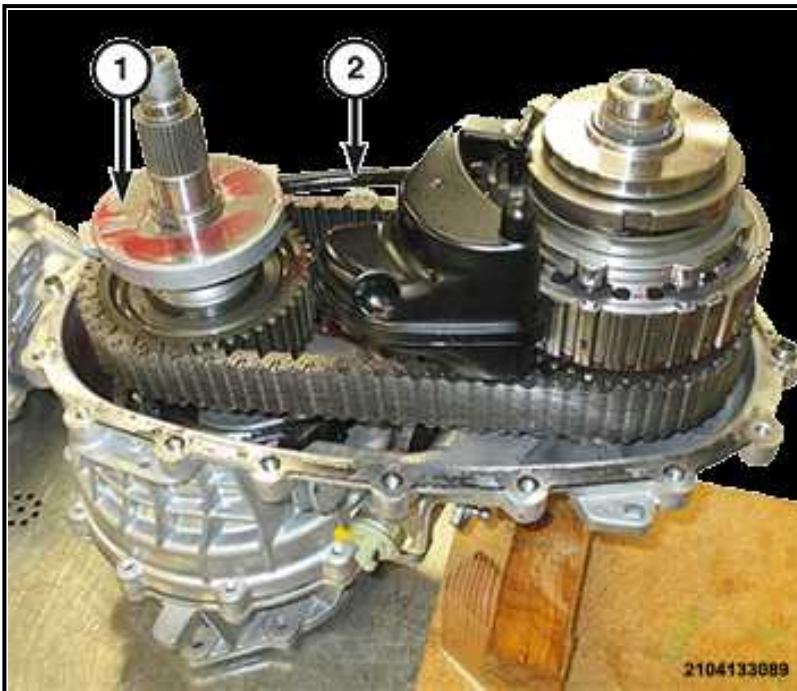
1 - Magnet

23. Install the magnet into the case pocket.



1 - Oil Pump Pick-up Tube O-ring

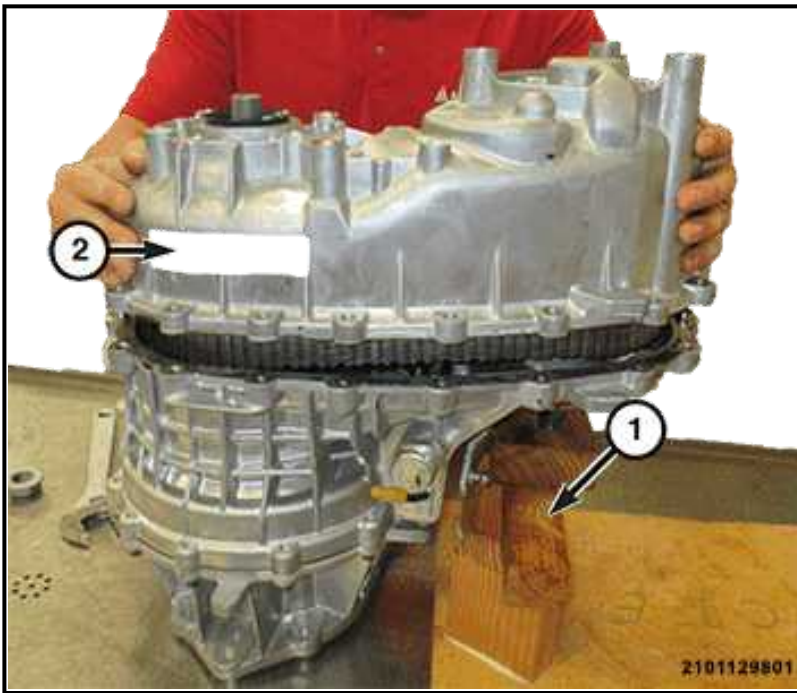
24. Inspect the oil pump pickup tube O-ring for damage, if damaged, replace the O-ring before installing the oil pump.



1 - Oil Pump

2 - Oil Pump Pick-up Tube

25. Install the oil pump with the oil pump pickup tube on the output shaft.
26. Clean both case half mating surfaces using brake cleaner or similar. Make sure all of the old sealer is removed and the surface is free of any oils or debris. Place a 1/4 inch bead of MoparB® sealer on one case half.



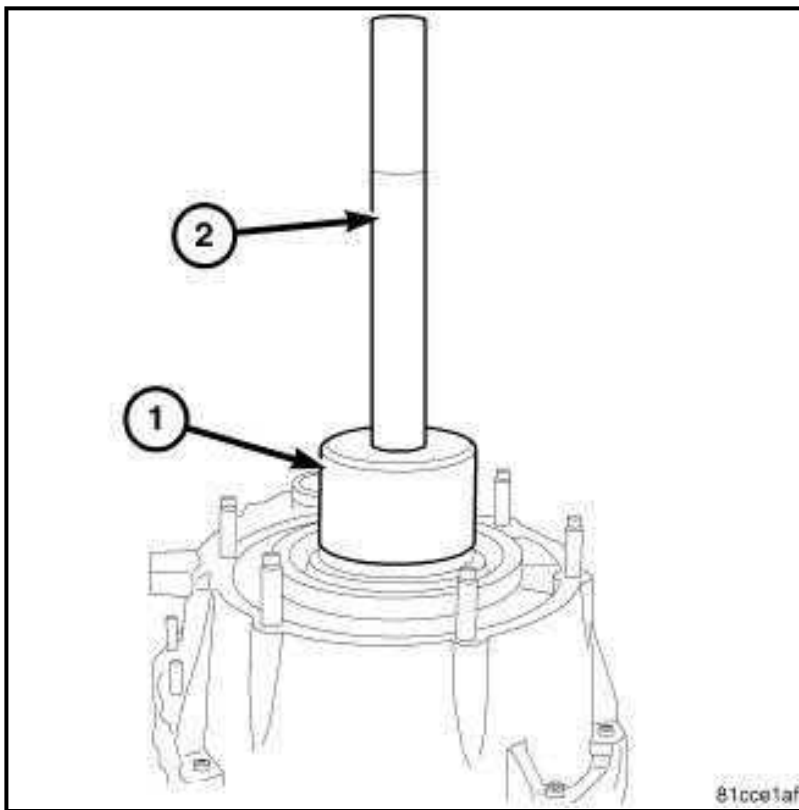
- | |
|-----------------------------|
| 1 - Wood Block |
| 2 - Rear Transfer Case Half |

27. Install the rear case half making sure it is fully seated in the locating pins.



- | |
|-------------------------|
| 1 - Transfer Case Bolts |
|-------------------------|

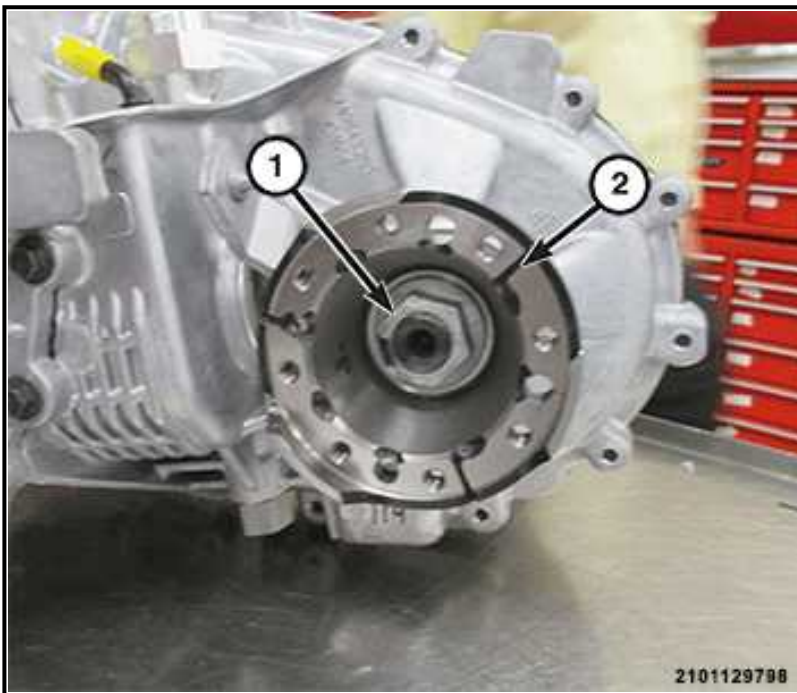
28. Tighten the case bolts in a criss-cross pattern to the proper torque specification.



1 - Seal Installer Tool

2 - Driver Handle

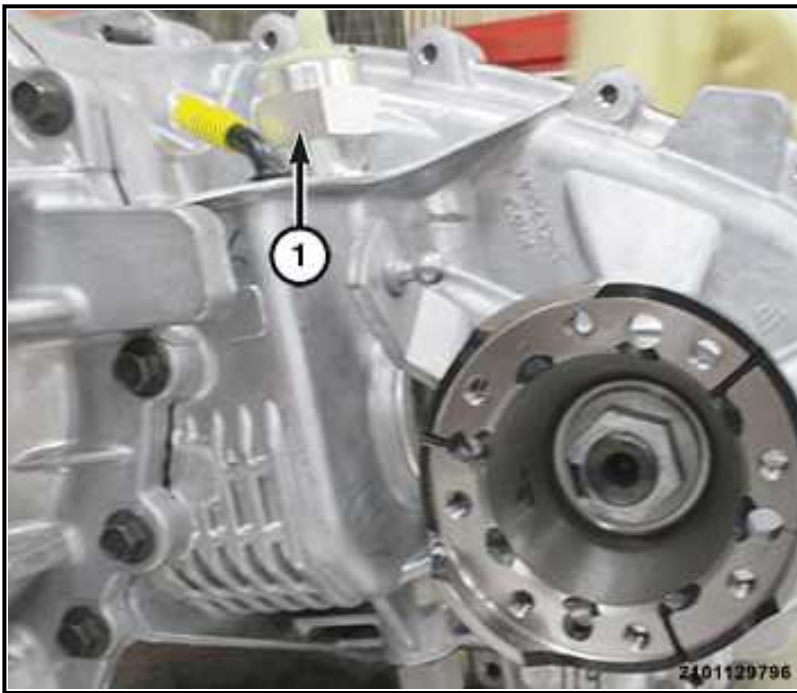
29. Using (special tool #2053900210, Installer, Seal Input Shaft) and (special tool #C-4171, Driver Handle, Universal), install the **NEW** front input shaft seal.



1 - Rear Output Flange Nut

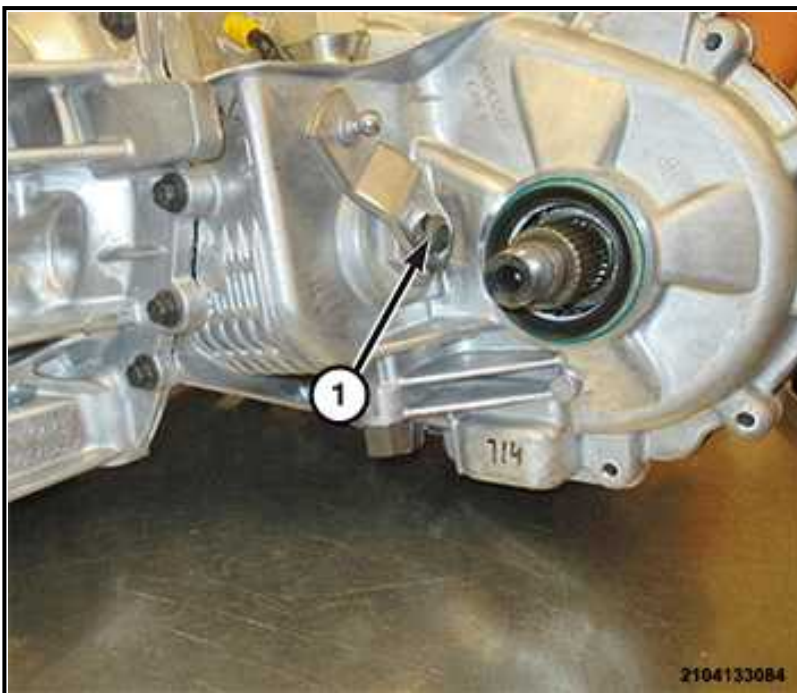
2 - Rear Output Flange

30. Install the front and rear output flanges with **NEW** flange nuts. Tighten the nuts to the proper torque specification.



1 - Transfer Case Position Sensor

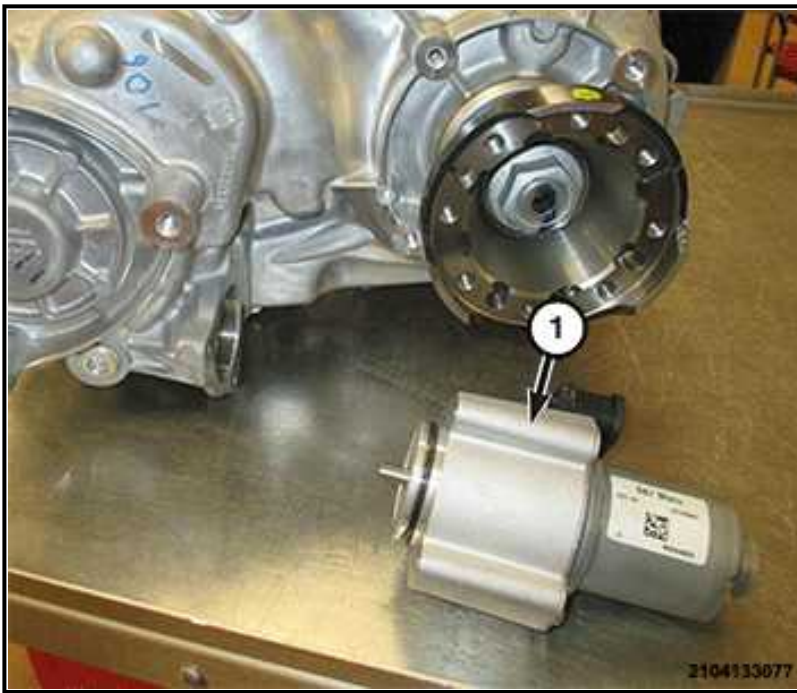
31. Install the transfer case position sensor.



1 - Range Lever Bolt

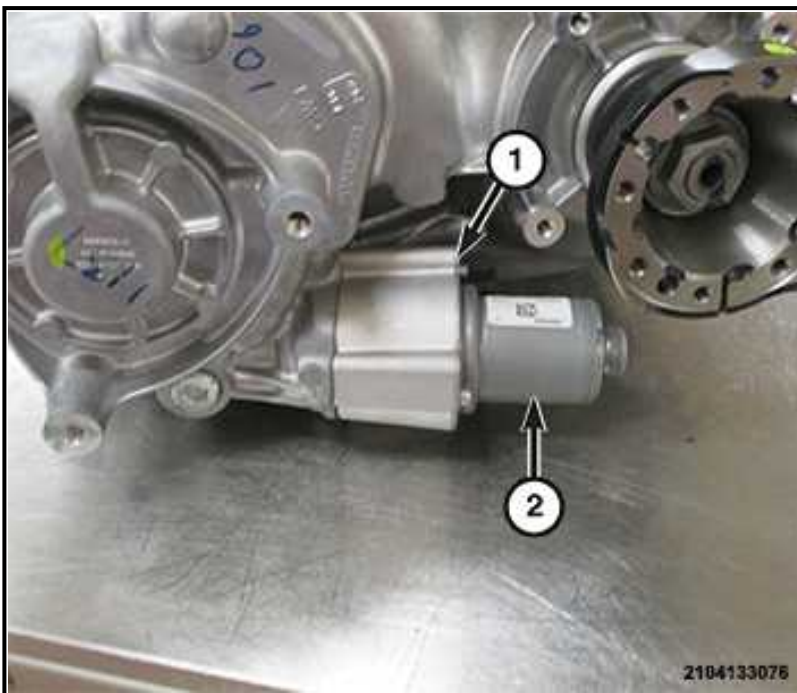
32. Install the range lever bolt into the sector shaft.

NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction as it was removed.



1 - Shift Motor

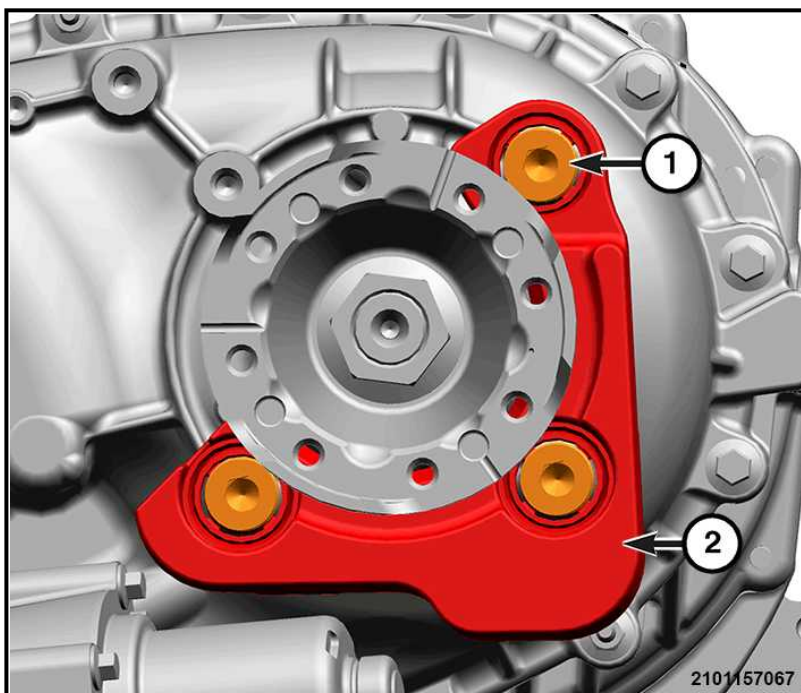
33. Install the shift motor.



1 - Shift Motor

2 - Shift Motor Bolts

34. Install the three shift motor bolts.



1 - Harmonics Damper Bolts

2 - Harmonics Damper

35. If equipped, position the harmonics damper.

TORQUE SPECIFICATIONS

TRANSFER CASE

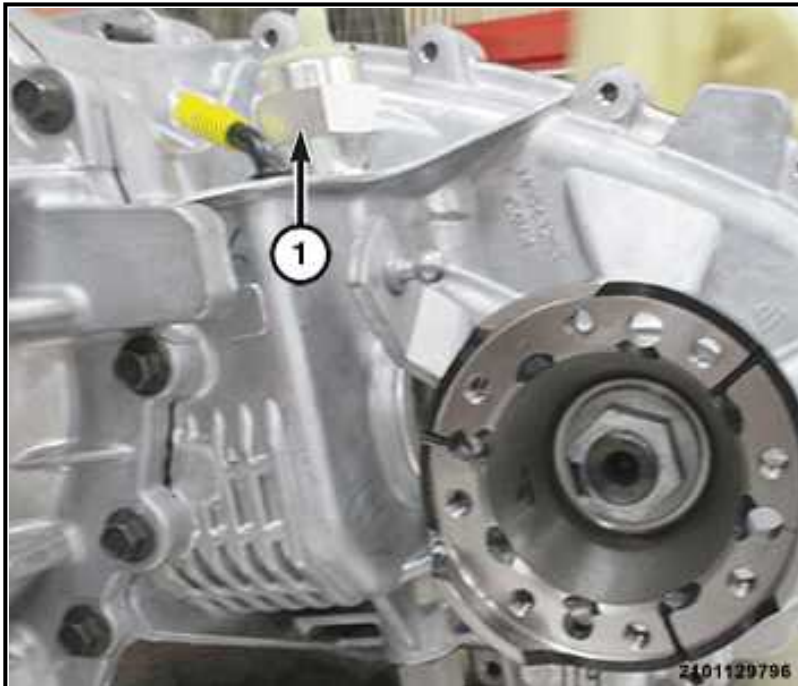
DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
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Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

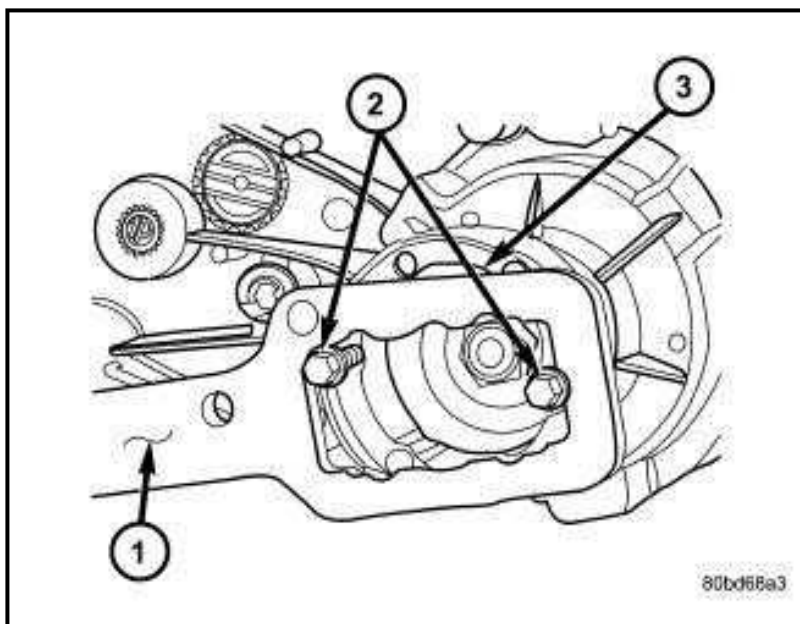
ROCK-TRAC

DISASSEMBLY



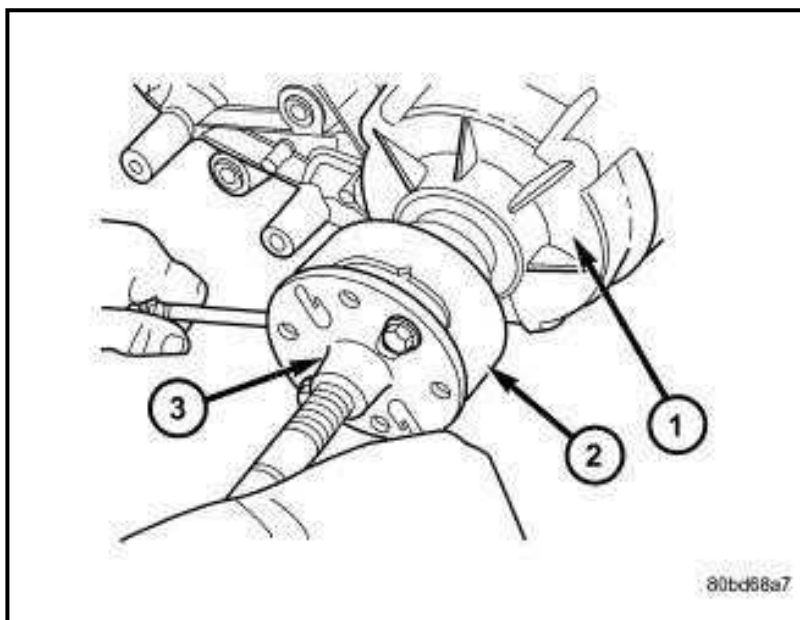
1 - Transfer Case Position Sensor

1. Remove the transfer case position sensor.



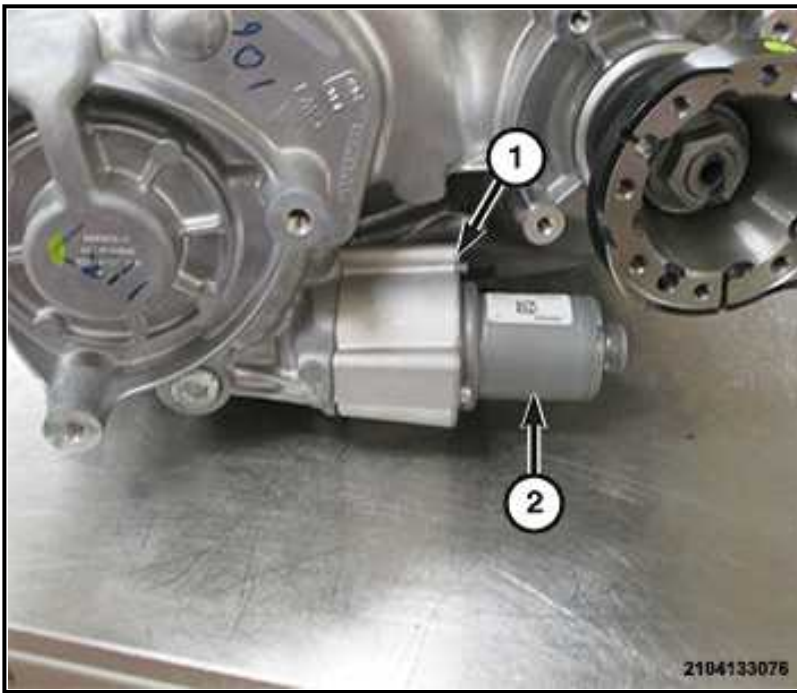
1 - Flange Holder Tool
2 - Bolts
3 - Flange

2. Remove both output flanges. Install two bolts partially into the propeller shaft companion flange, 180B° from each other.
3. Install the rectangular end of Flange Holder (special tool #C-3281, Holder, Flange) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.



1 - Transfer Case
2 - Flange
3 - Flange Puller

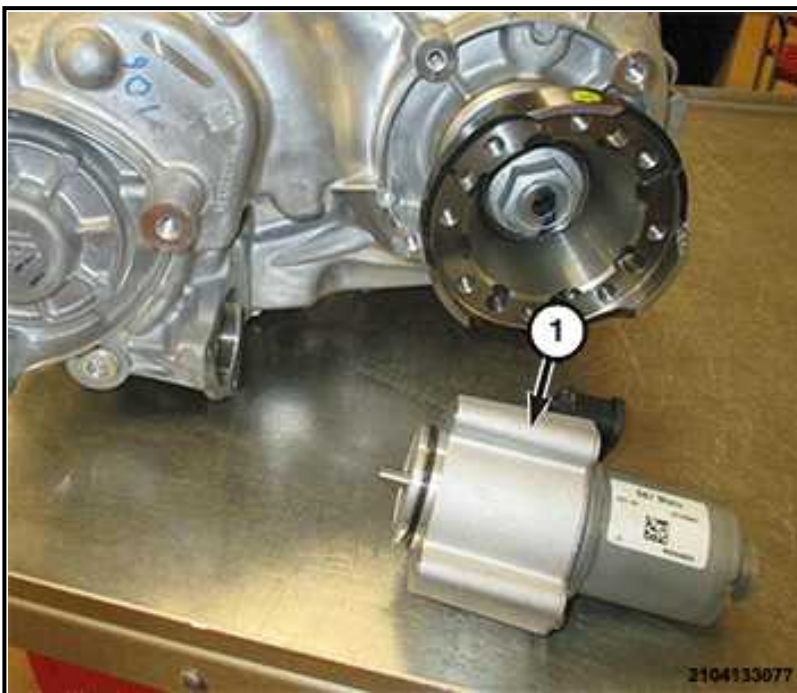
4. Use Remover (special tool #C-452, Puller, Companion Flange) to remove the companion flange.
5. Remove the seal washer from the front output shaft. Discard the washer as it must not be reused.



1 - Shift Motor

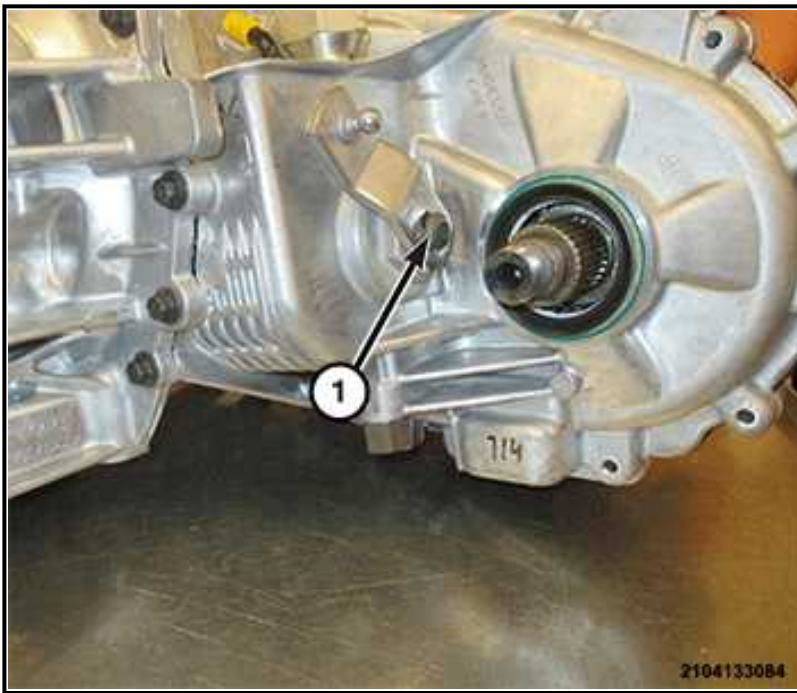
2 - Shift Motor Bolts

6. Remove the three shift motor bolts from the shift motor.



1 - Shift Motor

7. Remove the shift motor.



1 - Range Lever Bolt

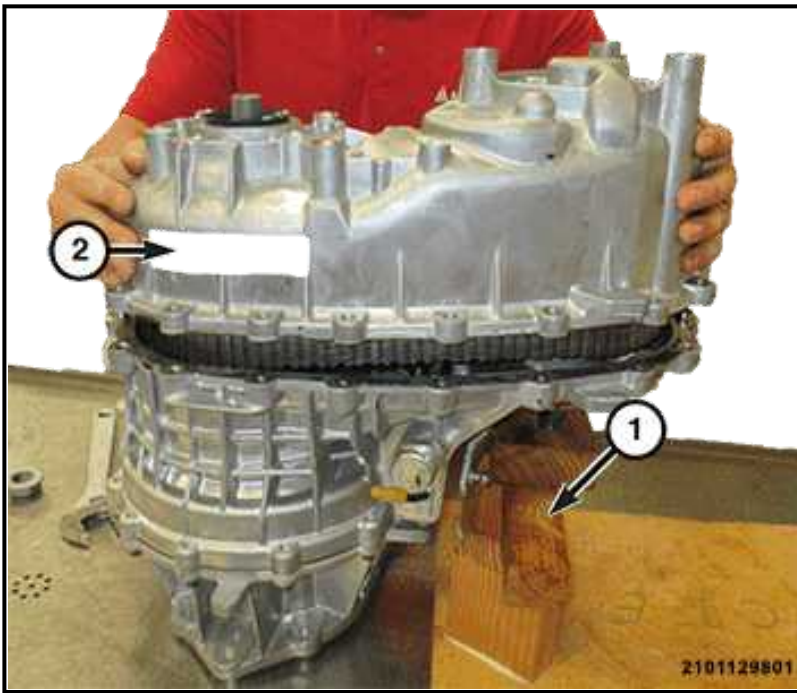
8. Remove the bolt that attaches the range lever to the sector shaft. Then move the sector shaft to the neutral position and remove the range lever from the shaft.

NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction.



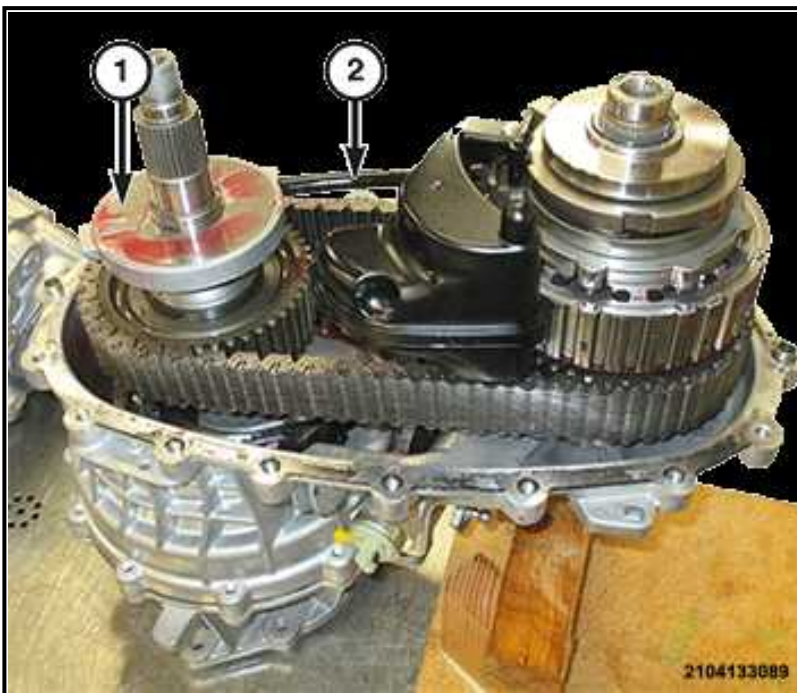
1 - Transfer Case Bolts

9. Remove the case bolts.
10. Loosen the case halves with a pry tool to break the sealer bead. Insert the tool in the slot at each end of the case.



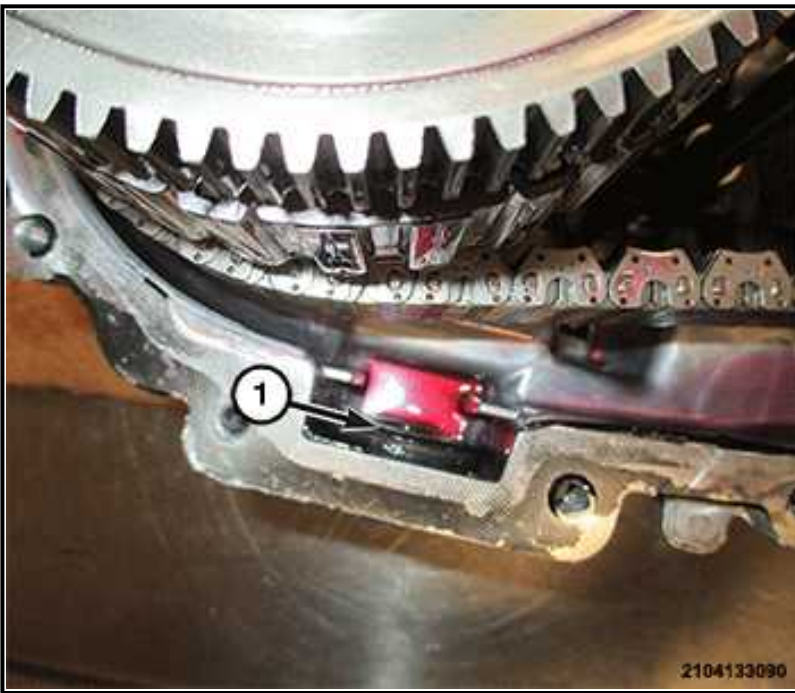
- | |
|-----------------------------|
| 1 - Wood Block |
| 2 - Rear Transfer Case Half |

11. Unseat the rear case from the alignment dowels and remove the case.



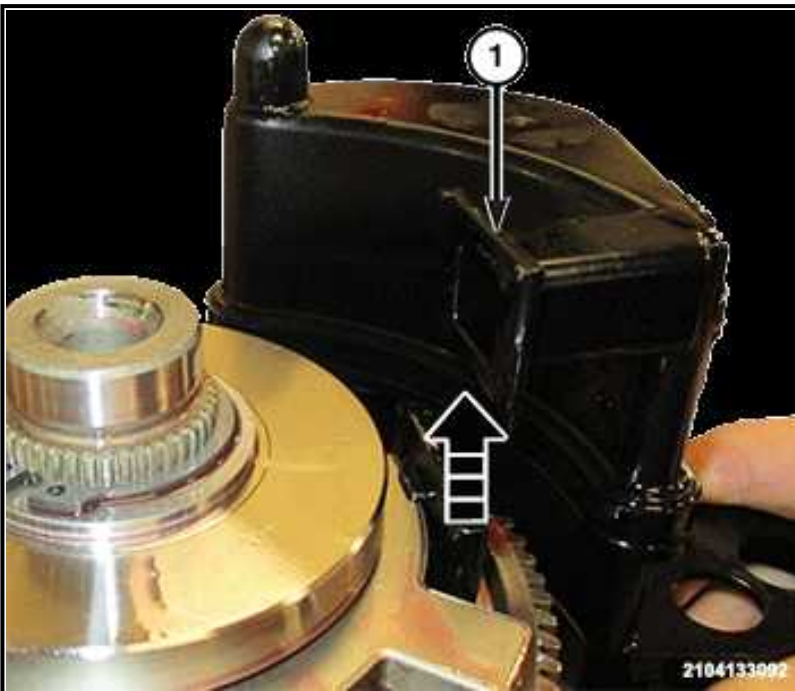
- | |
|---------------------------|
| 1 - Oil Pump |
| 2 - Oil Pump Pick-up Tube |

12. Remove the oil pump with the oil pump pickup tube.



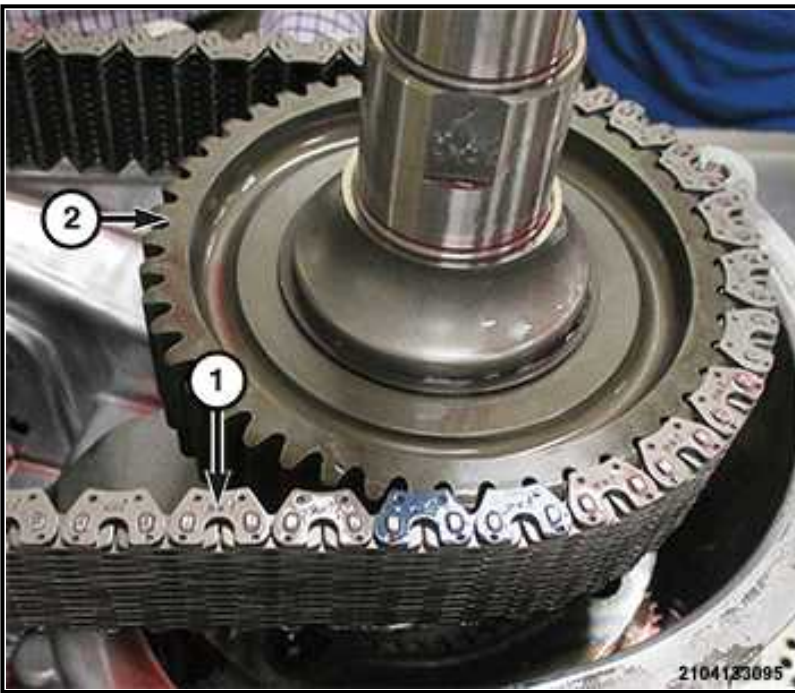
1 - Magnet

13. Remove the magnet from the pocket that the oil pump pickup tube is seated in and thoroughly clean the magnet.



1 - Oil Sump

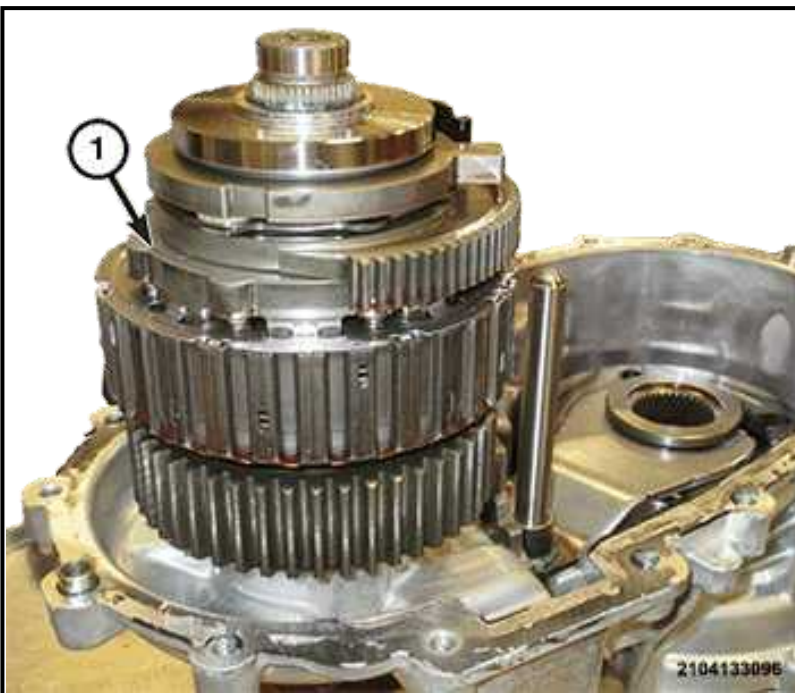
14. Remove the oil sump from the case.



1 - Chain

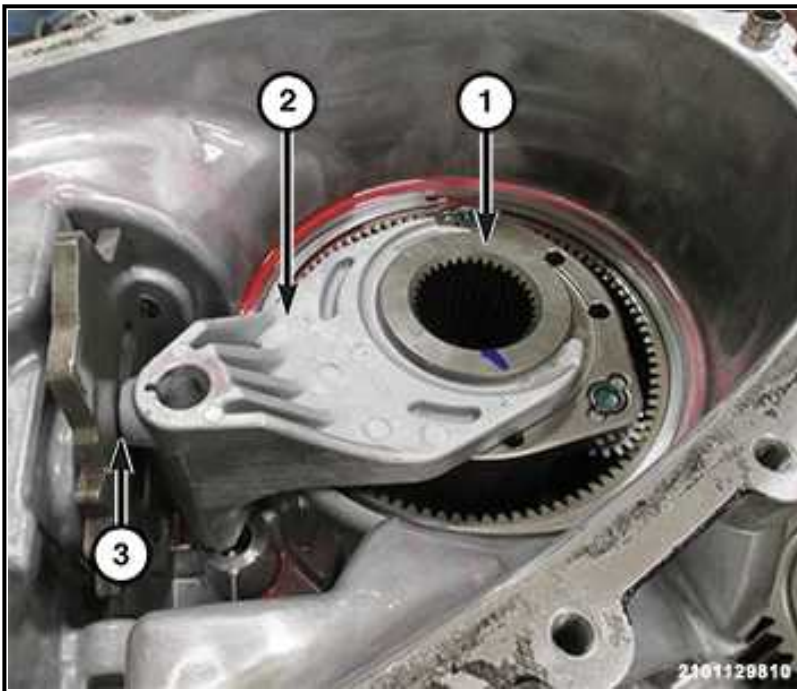
2 - Main Shaft Sprocket Assembly

15. Remove the chain and the main shaft sprocket assembly from the case.



1 - Output Shaft Assembly

16. Remove the output shaft assembly from the case.



1 - Input Gear
2 - Range Fork
3 - Range Fork Located in Selector Plate

17. Remove the range fork assembly with the input gear.
18. Remove the input shaft seal to access the planetary gear assembly snap ring
19. Remove the snap ring retaining the planetary gear assembly.



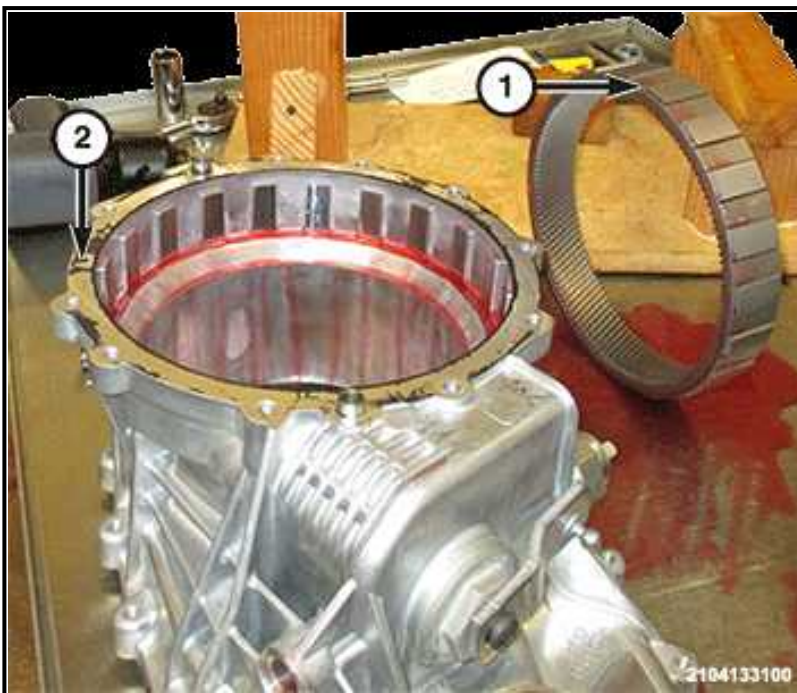
1 - Extension Housing Bolts

20. Remove the extension housing bolts.



1 - Extension Housing

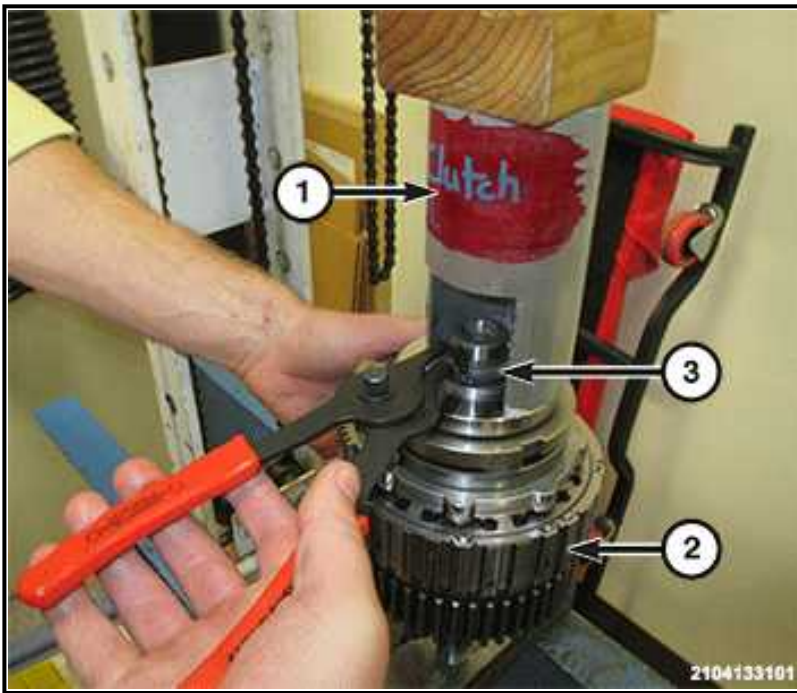
21. Remove the extension housing from the case.



1 - Annulus Ring Gear

2 - Case

22. If equipped with a removable annulus ring gear, remove the annulus ring gear from the case.

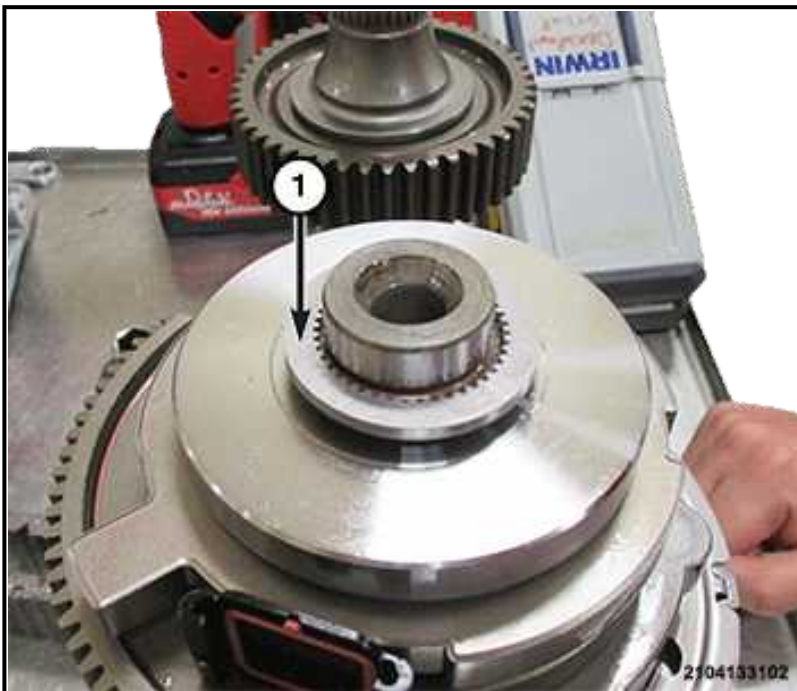


1 - Ball Joint Remover/Installer Tool

2 - Output Shaft Assembly

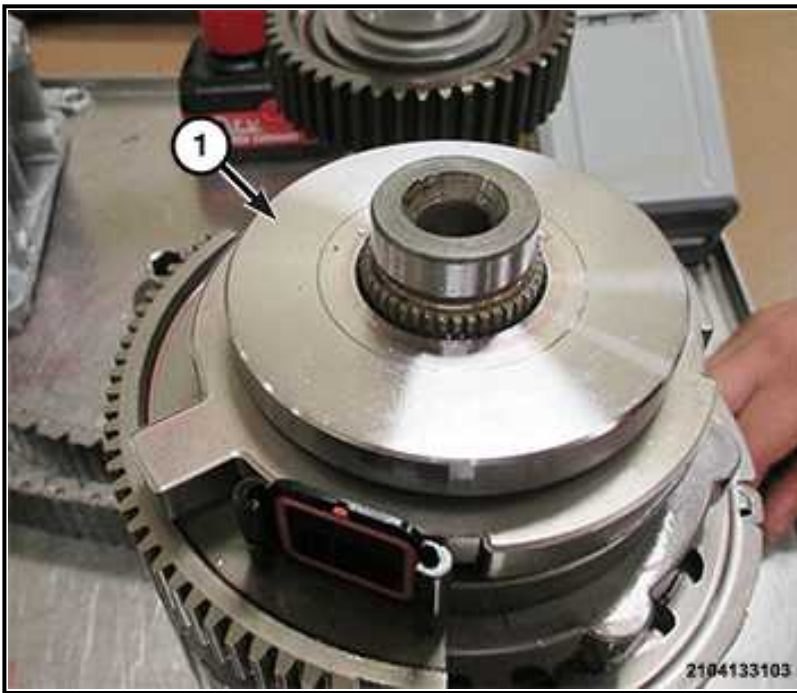
3 - Snap Ring

23. With the output shaft assembly supported in a press, compress the clutch assembly enough using (special tool #9964, Remover/Installer, Ball Joint) to remove the output snap ring.



1 - Shim

24. Remove the transfer case shim from the output thrust washer.



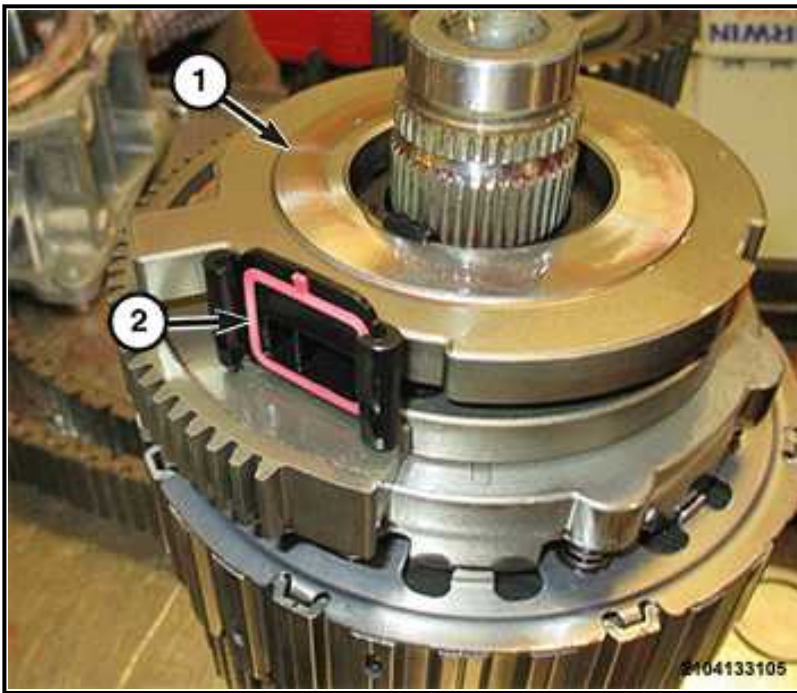
1 - Thrust Washer

25. Remove the thrust washer from the upper apply cam.



1 - Thrust Bearing

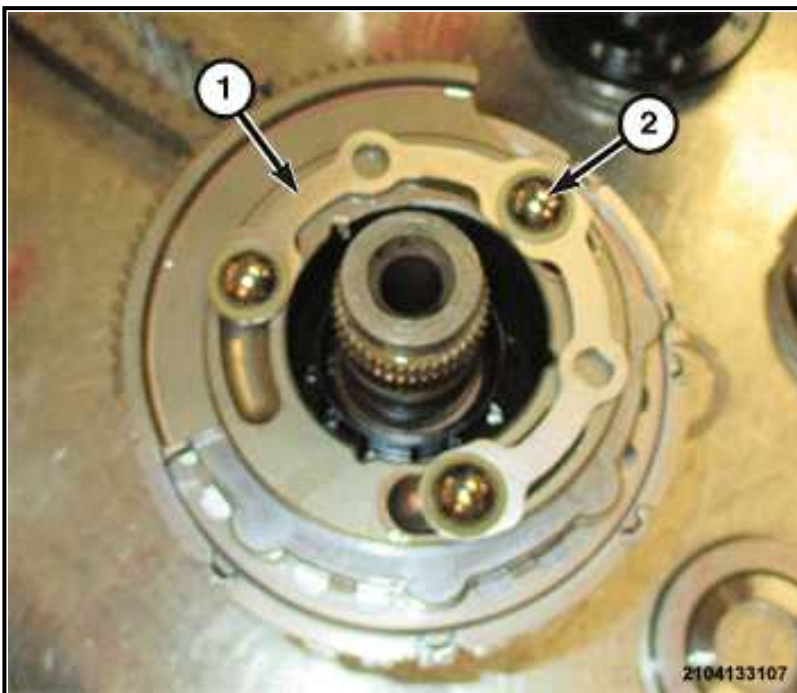
26. Remove the thrust bearing from the upper apply cam.



1 - Upper Apply Cam

2 - Transfer Case Oil Sump Receiving Plate

27. Remove the upper apply cam, with the transfer case oil sump receiving plate, from the output shaft.

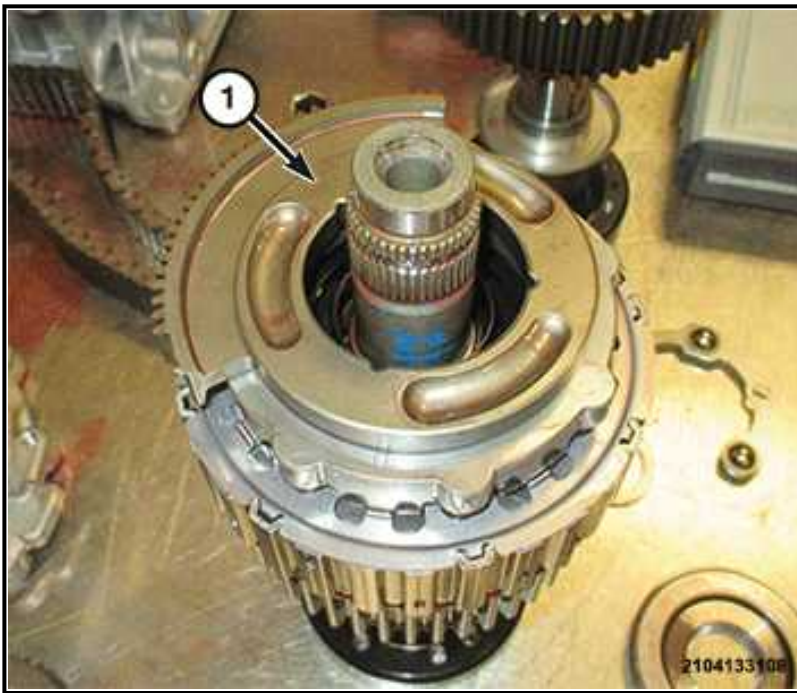


1 - Ball Bearings

2 - Retaining Ring

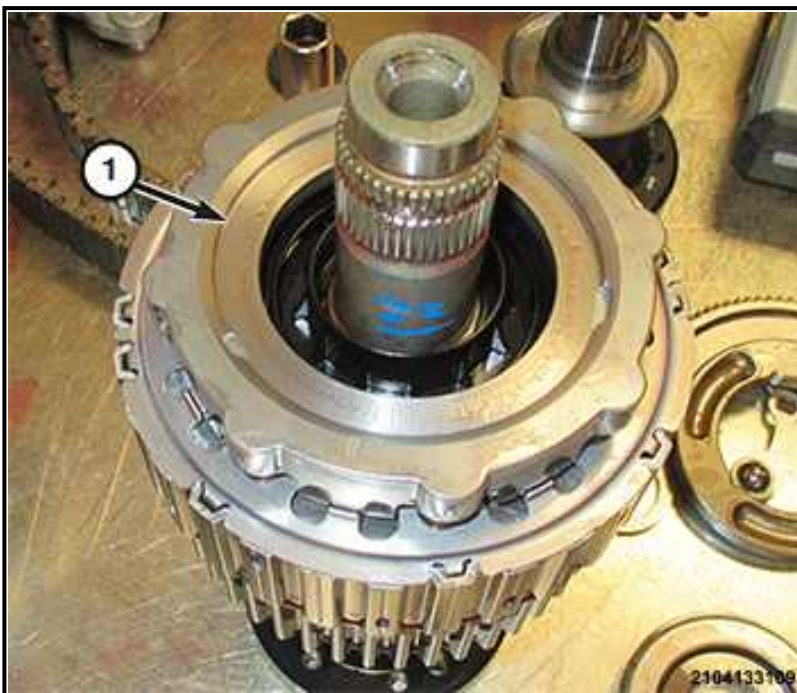
28. Remove the ball bearings with the retaining ring from the apply cam.

NOTE: Note the orientation of the opening on the retaining ring for reassembly.



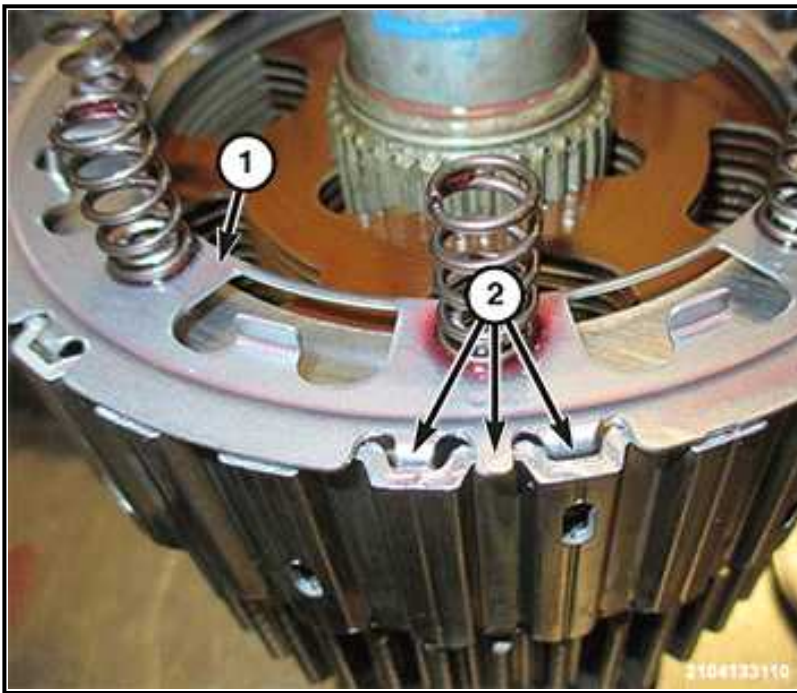
1 - Lower Apply Cam

29. Remove the lower apply cam from the output shaft.



1 - Apply Plate

30. Remove the apply plate from the output shaft.

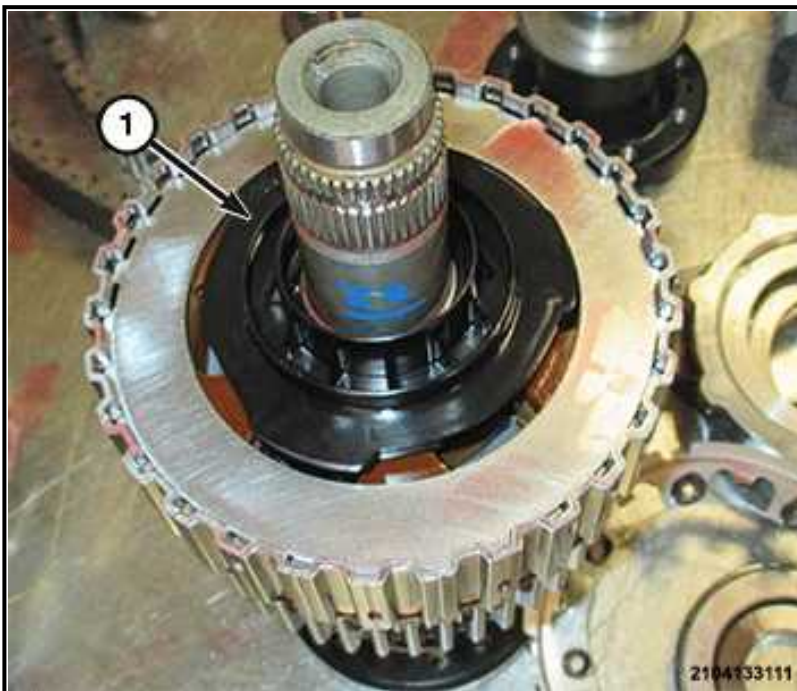


1 - Spring Plate

2 - Tab Orientation

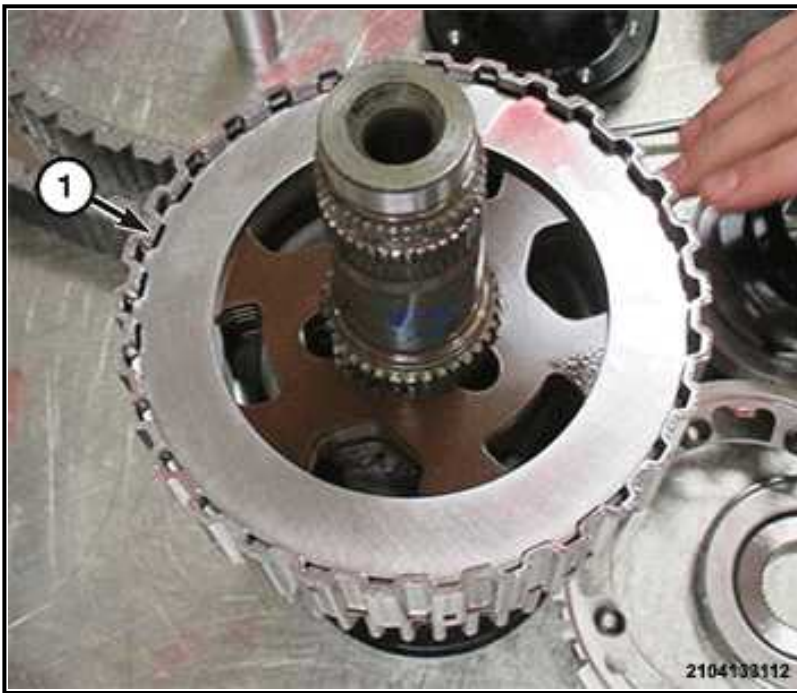
31. Remove the spring plate from the output shaft.

NOTE: Note the orientation of the tabs when removing the spring plate.



1 - Oil Deflector

32. Remove the oil deflector from the output shaft.



1 - Clutch Drum Assembly

33. Remove the clutch drum assembly from the output shaft.



1 - Clutch Drum Spacer

34. Remove the clutch drum spacer from the output shaft.



1 - Driven Sprocket

35. Remove the driven sprocket from the output shaft.



1 - Thrust Bearing

36. Remove the thrust bearing from the output shaft.

ASSEMBLY

1. Thoroughly clean both case halves and the mating surfaces.
2. Replace any bearings in the case halves that are spalled, damaged, or have been subjected to highly contaminated fluid (metal contamination from catastrophic failure).



1 - Thrust Bearing

3. Install the thrust bearing to the output shaft.



1 - Driven Sprocket

4. Install the driven sprocket to the output shaft.



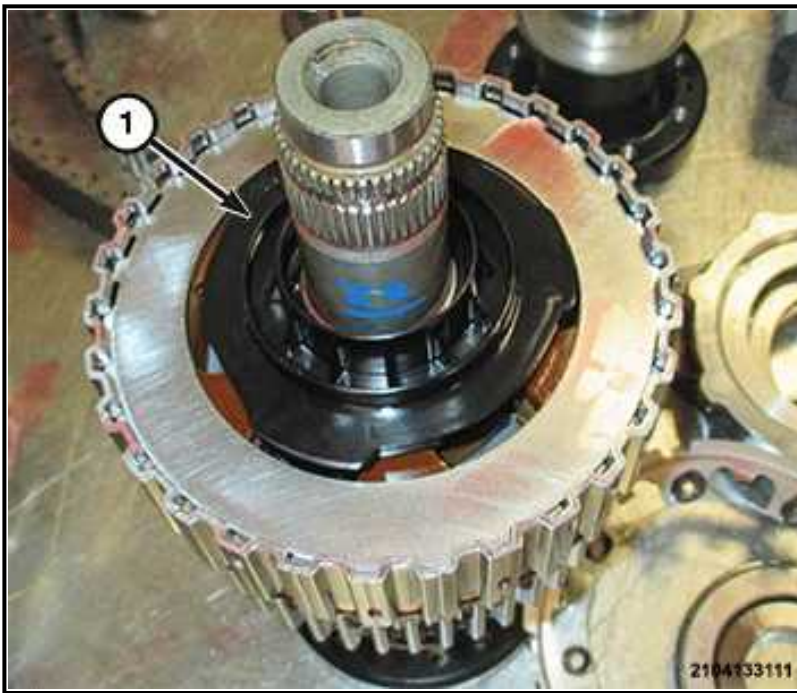
1 - Clutch Drum Spacer

5. Install the clutch drum spacer to the output shaft.



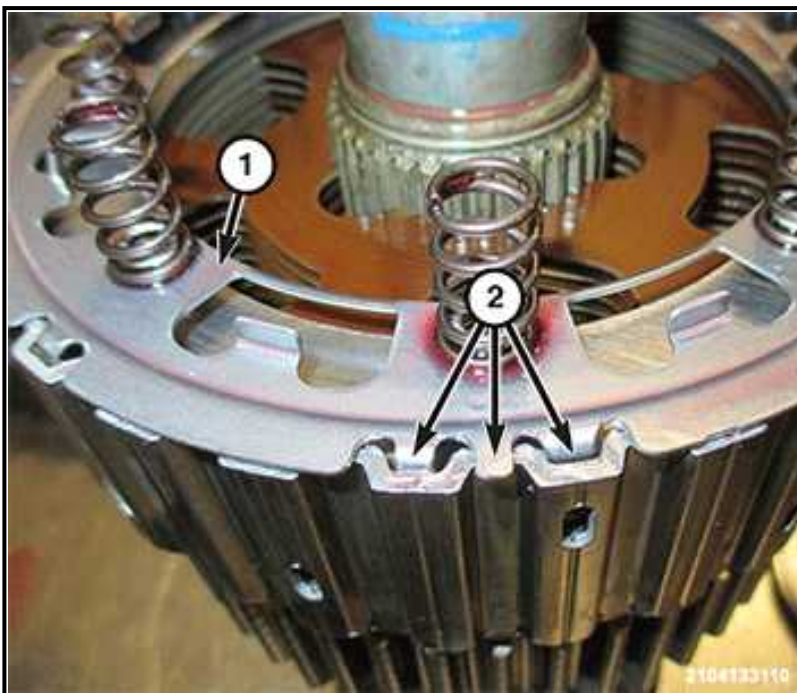
1 - Clutch Drum Assembly

6. Install the clutch drum assembly to the output shaft.



1 - Oil Deflector

7. Install the oil deflector to the output shaft.

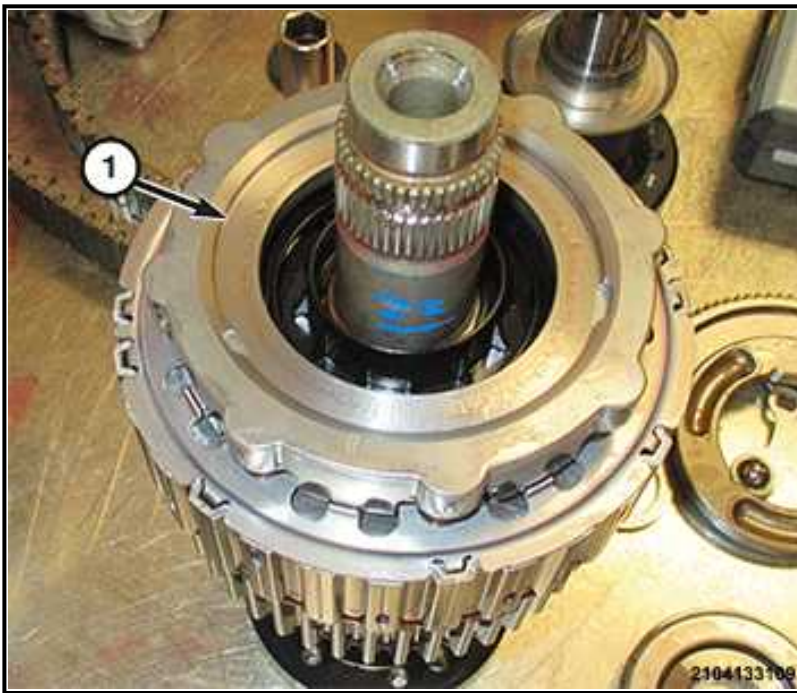


1 - Spring Plate

2 - Tab Orientation

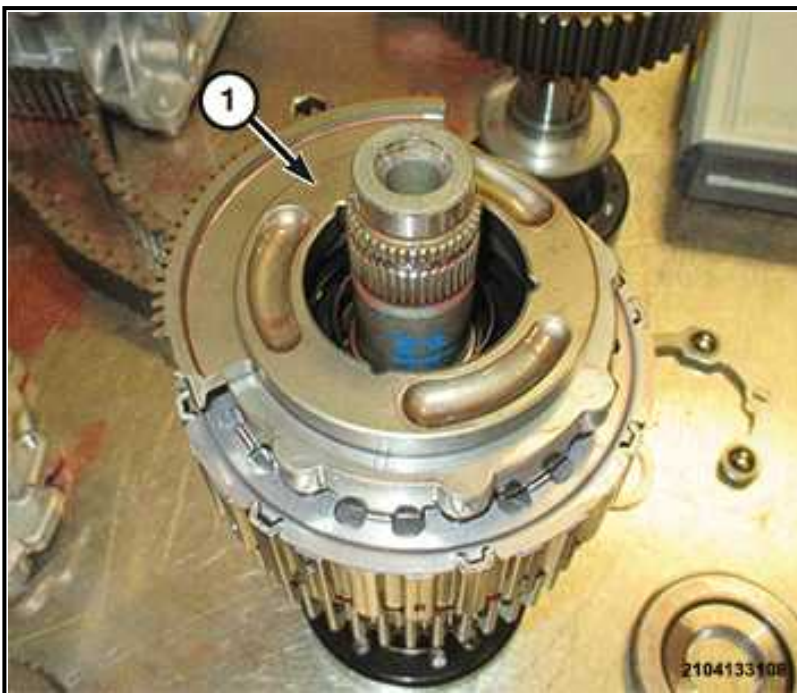
8. Install the spring plate to the output shaft.

NOTE: Note the orientation of the tabs when installing the spring plate.



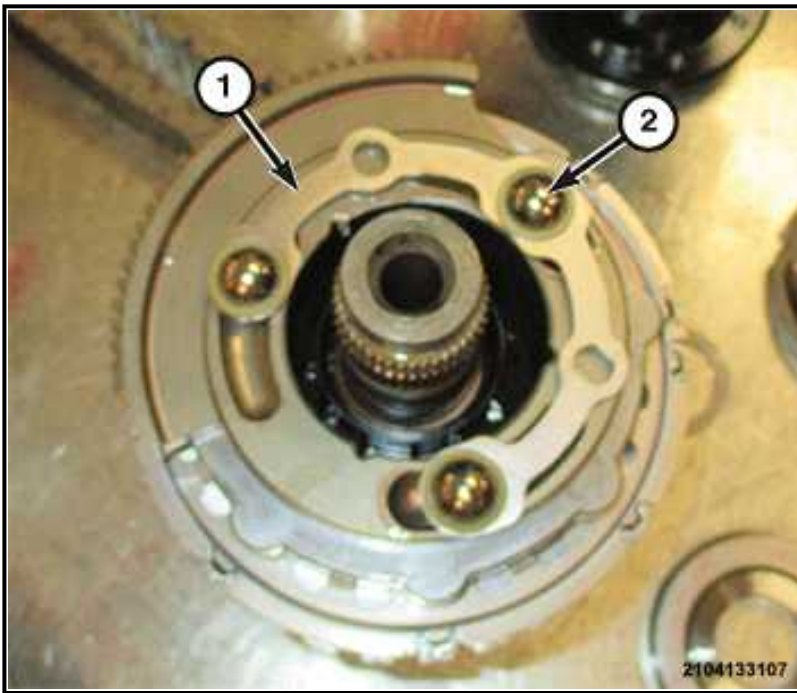
1 - Apply Plate

9. Install the apply plate to the output shaft.



1 - Lower Apply Cam

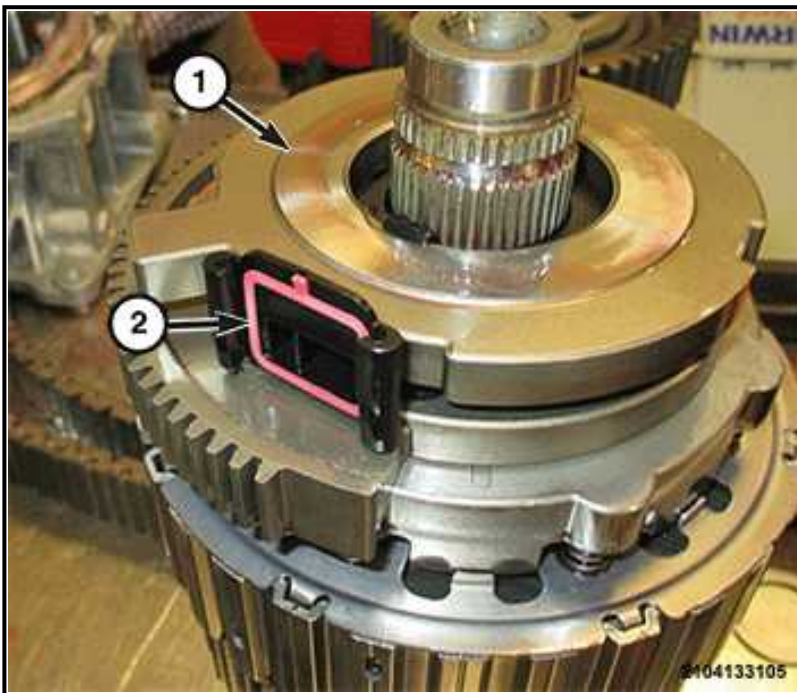
10. Install the lower apply cam to the output shaft.



- | |
|--------------------|
| 1 - Ball Bearings |
| 2 - Retaining Ring |

11. Install the ball bearings with the retaining ring into the lower apply cam.

NOTE: Verify the orientation of the retaining ring to the gear teeth on the apply cam before reassembly.



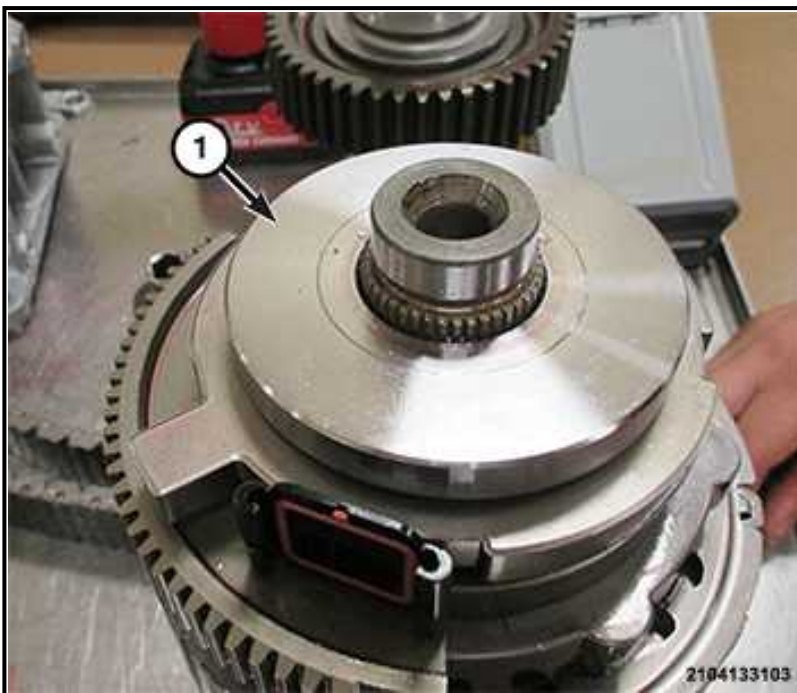
- | |
|--|
| 1 - Upper Apply Cam |
| 2 - Transfer Case Oil Sump Receiving Plate |

12. Install the upper apply cam with the transfer case oil sump receiving plate to the output shaft.



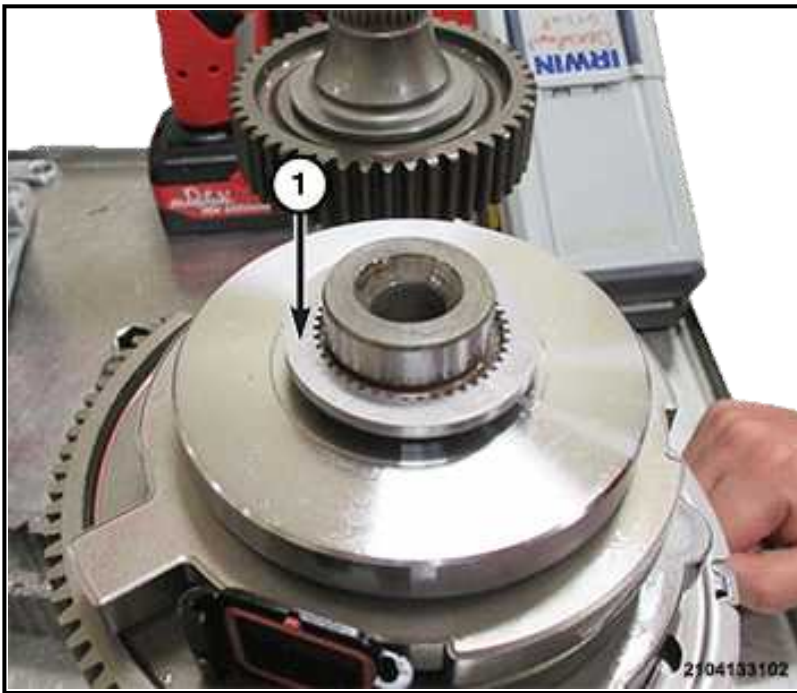
1 - Thrust Bearing

13. Install the thrust bearing to the upper apply cam.



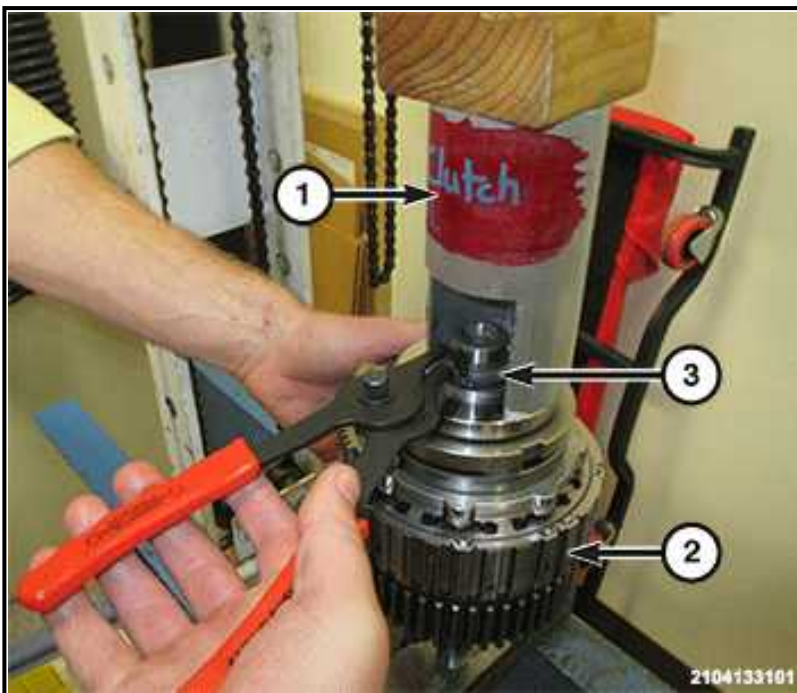
1 - Thrust Washer

14. Install the thrust washer to the upper apply cam.



1 - Shim

15. Install the transfer case shim to the output thrust washer.

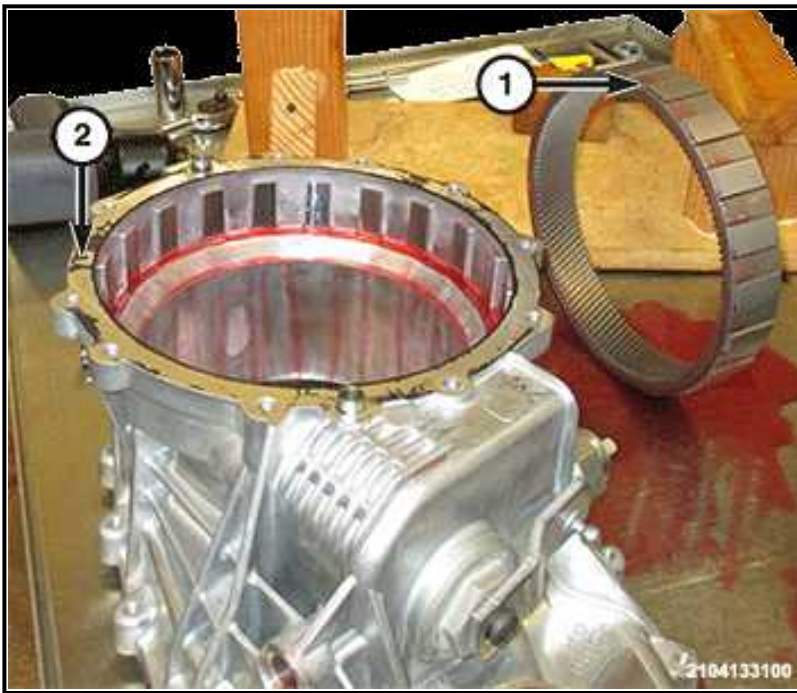


1 - Ball Joint Remover/Installer Tool

2 - Output Shaft Assembly

3 - Snap Ring

16. With the output shaft assembly supported in a press, compress the clutch assembly enough using (special tool #9964, Remover/Installer, Ball Joint) to install the output snap ring on the output shaft.



1 - Annulus Ring Gear

2 - Case

17. If equipped with a removable annulus ring gear, install the annulus ring gear into the case.
18. Clean the extension housing mating surfaces with brake cleaner or equivalent and wipe with a lint free shop cloth.
19. Place a 1/4 inch bead of MoparB® RTV sealant around the extension housing.



1 - Extension Housing

20. Install the extension housing into the case.



1 - Extension Housing Bolts

21. Install the extension housing bolts in a criss-cross pattern to the proper torque specification.

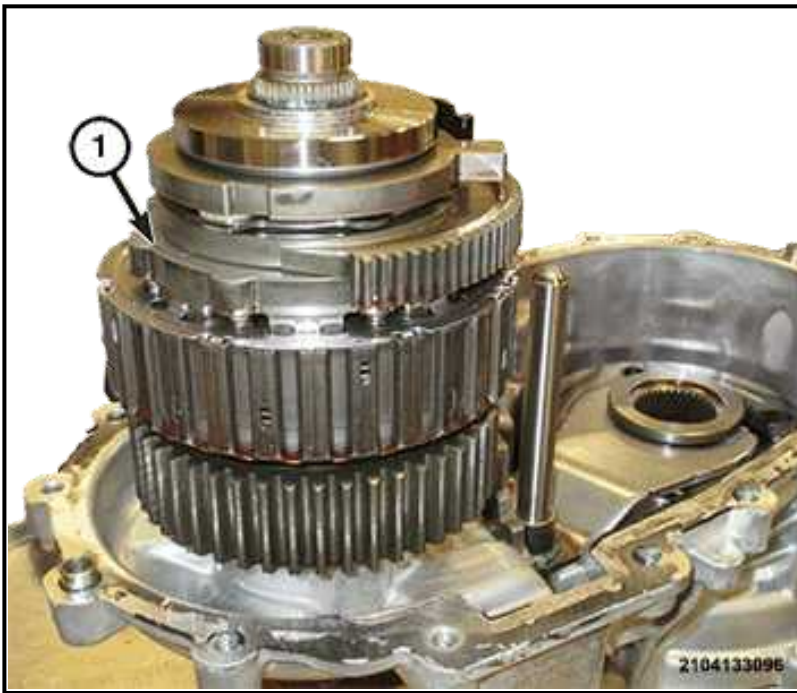


1 - Shift Rail

2 - Range Fork

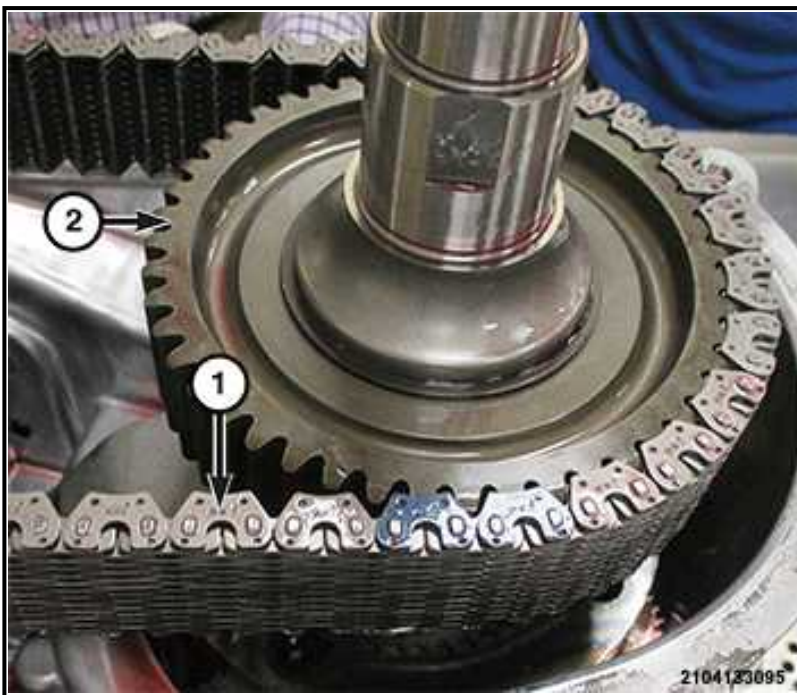
3 - Input Gear

22. Install the range fork, shift rail and the input gear into the case.



1 - Output Shaft Assembly

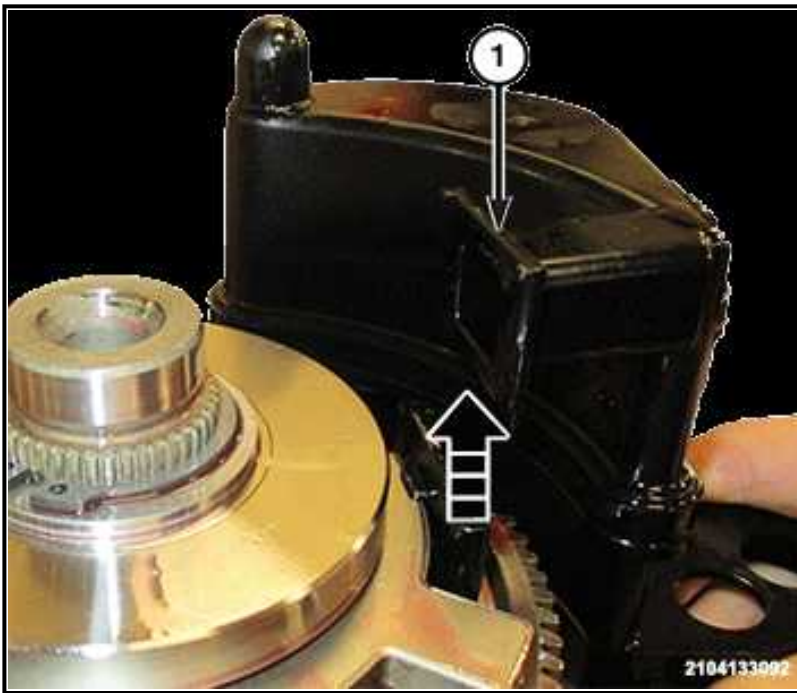
23. Install the output shaft assembly into the case.



1 - Chain

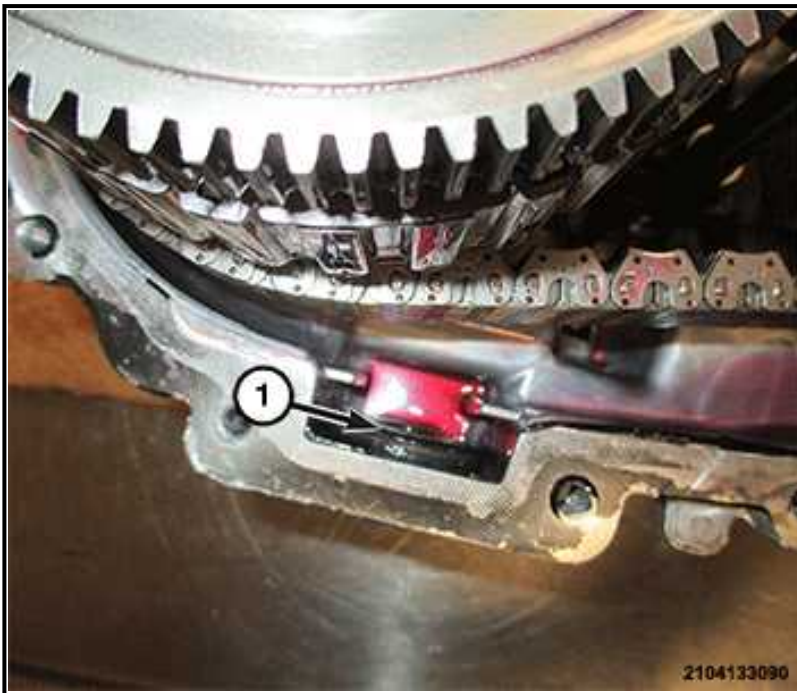
2 - Main Shaft Sprocket Assembly

24. Assemble the chain on the main shaft sprocket with the blue link facing up. Install the chain with the main shaft around the output driven sprocket and into the case.



1 - Oil Sump

25. Install the oil sump into the receiving plate.



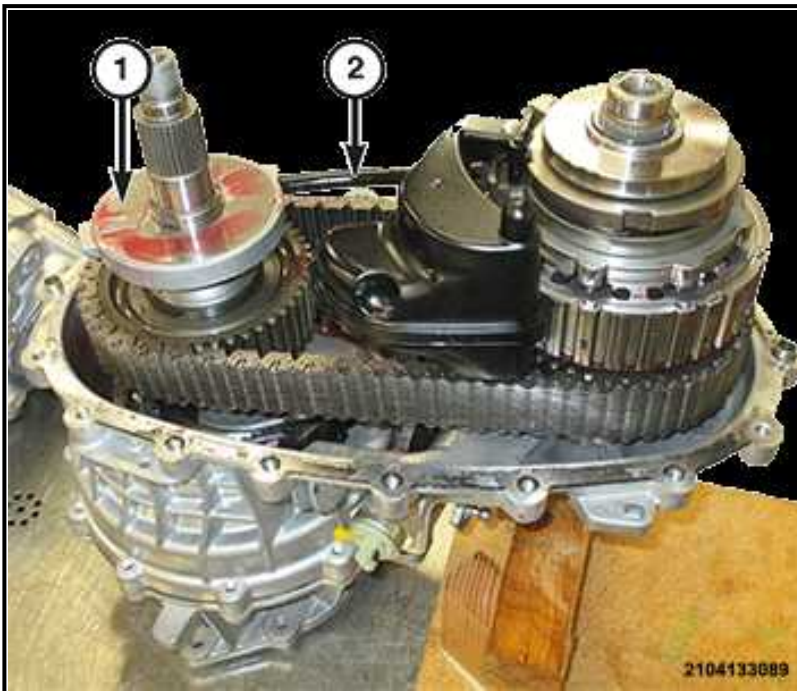
1 - Magnet

26. Install the magnet into the case pocket.



1 - Oil Pump Pick-up Tube O-ring

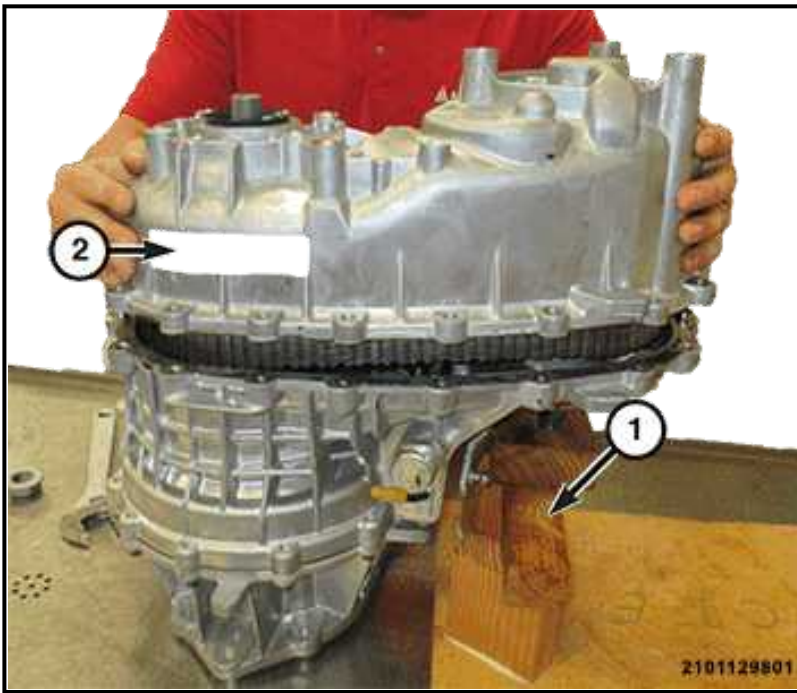
27. Inspect the oil pump pickup tube O-ring for damage, if damaged, replace the O-ring before installing the oil pump.



1 - Oil Pump

2 - Oil Pump Pick-up Tube

28. Install the oil pump with the oil pump pickup tube on the output shaft.
29. Clean both case half mating surfaces using brake cleaner or similar. Make sure all of the old sealer is removed and the surface is free of any oils or debris. Place a 1/4 inch bead of MoparB® sealer on one case half.



1 - Wood Block

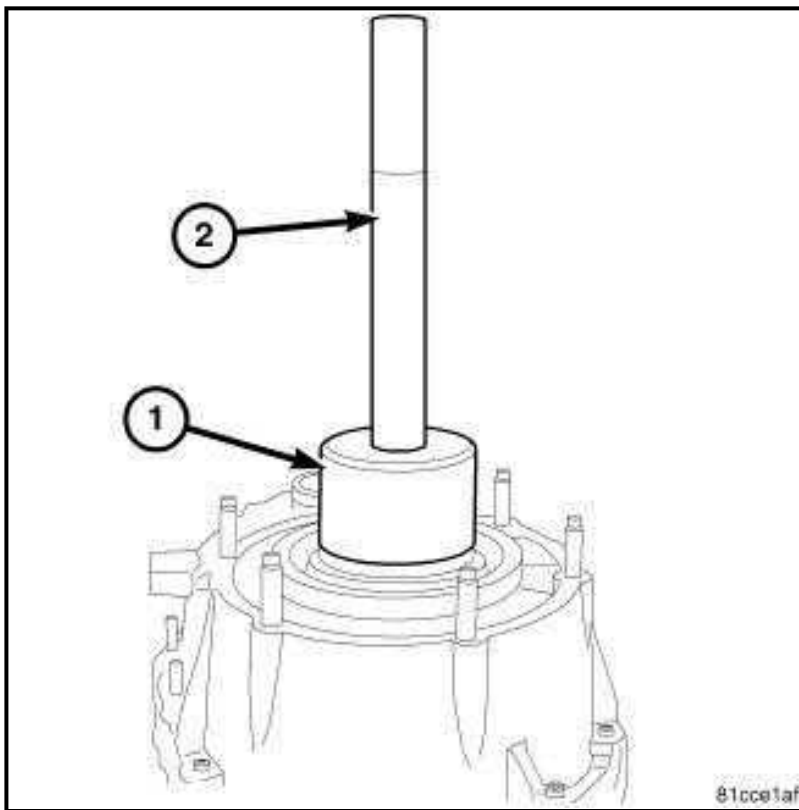
2 - Rear Transfer Case Half

30. Install the case halves together, make sure they are fully seated in the locating pins.



1 - Transfer Case Bolts

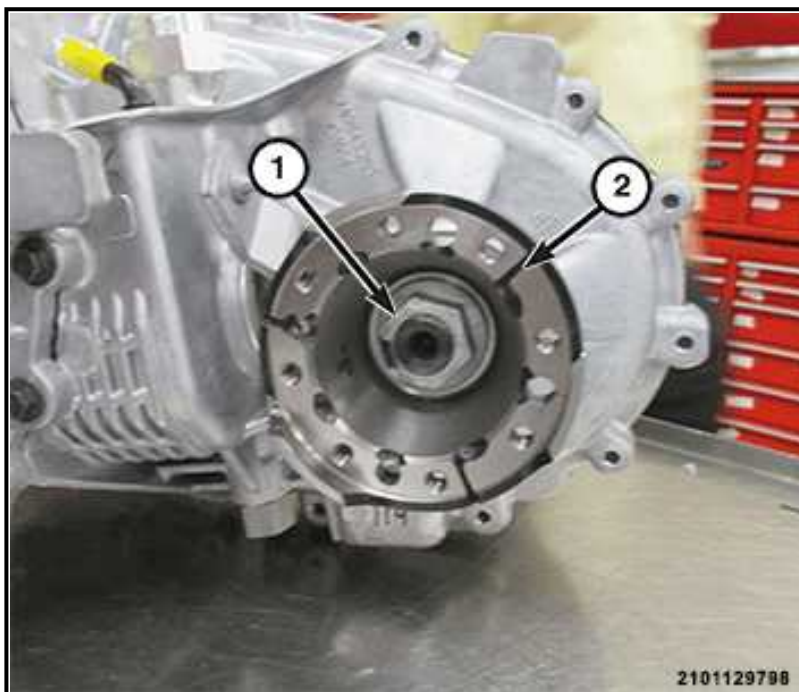
31. Tighten the bolts in a crisscross pattern to the proper torque specification.



1 - Seal Installer Tool

2 - Driver Handle

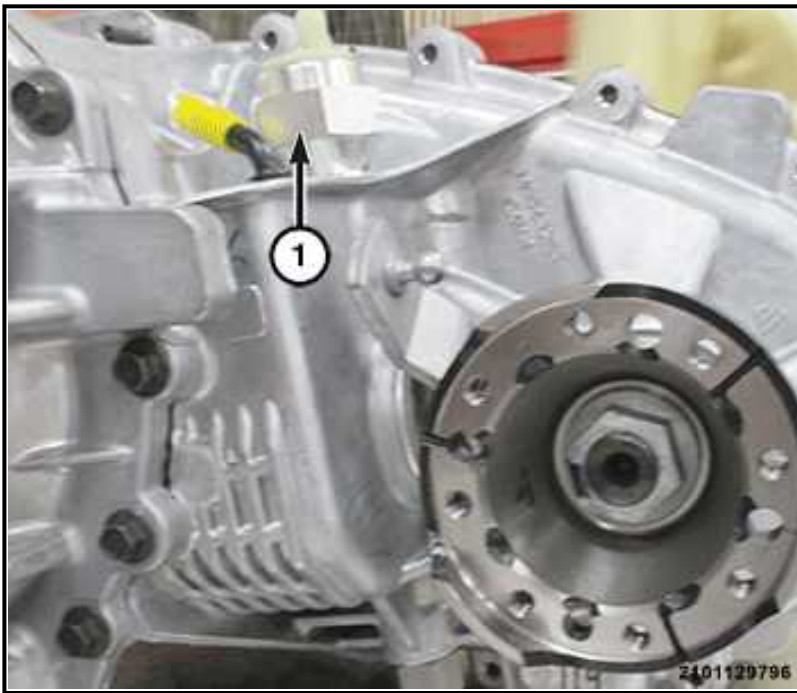
32. Using (special tool #2053900210, Installer, Seal Input Shaft) and (special tool #C-4171, Driver Handle, Universal), install the **NEW** front input shaft seal.



1 - Rear Output Flange Nut

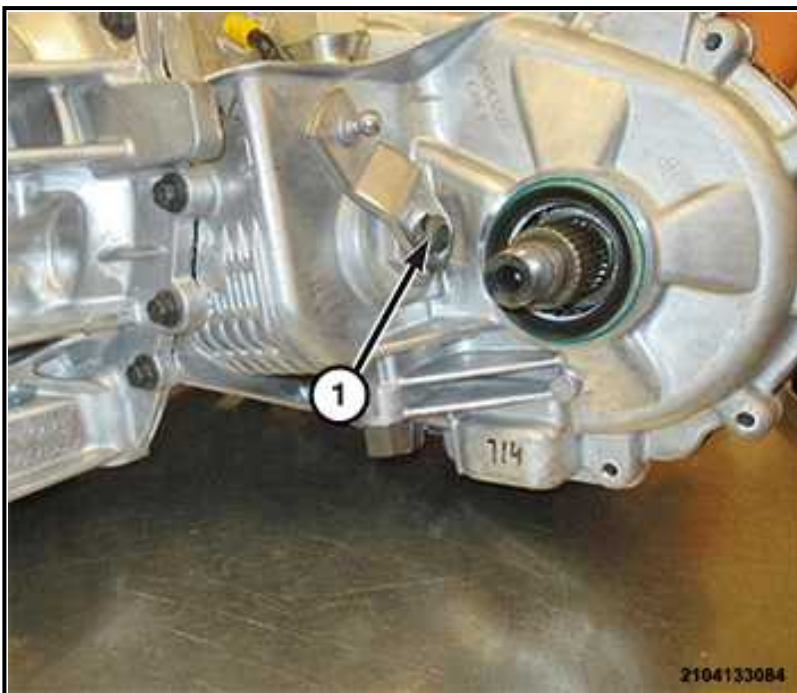
2 - Rear Output Flange

33. Install the front and rear output flanges with **NEW** flange nuts. Tighten the nuts to the proper torque specification.



1 - Transfer Case Position Sensor

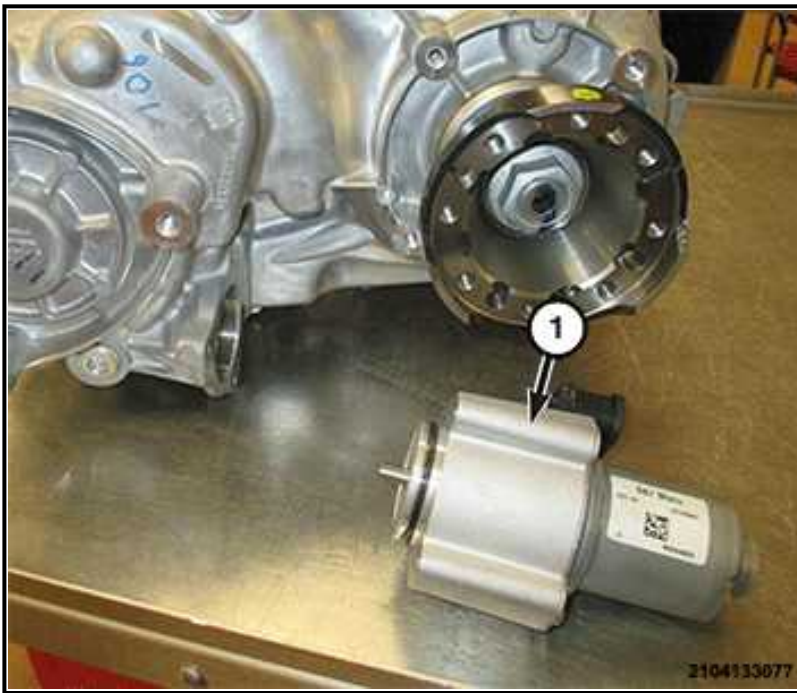
34. Install the transfer case position sensor.



1 - Range Lever Bolt

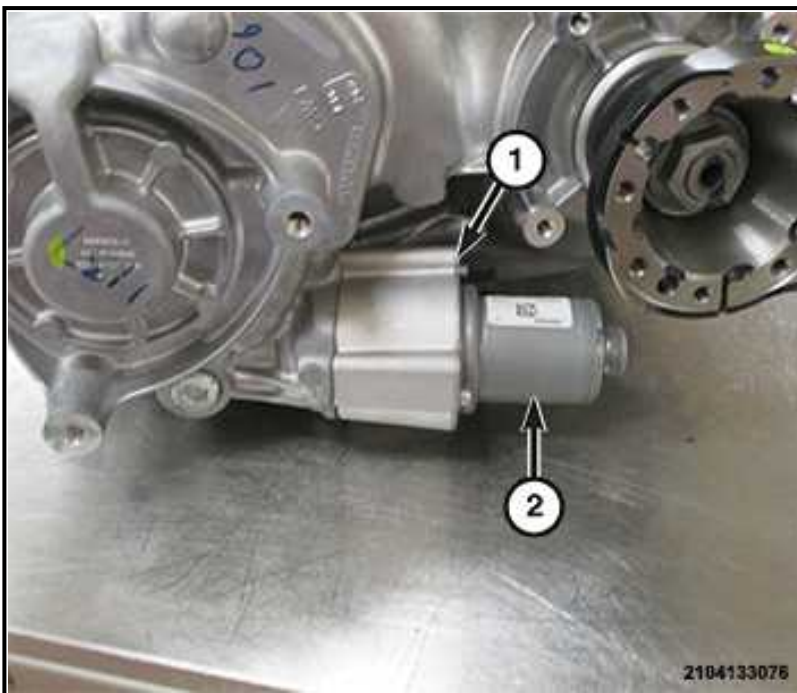
35. Install the range lever bolt into the sector shaft.

NOTE: Be sure to note the orientation of the range lever (lever up or down) so that it may be re-installed in the same direction as it was removed.



1 - Shift Motor

36. Install the shift motor.



1 - Shift Motor

2 - Shift Motor Bolts

37. Install the shift motor bolts.

TORQUE SPECIFICATIONS

CABLE, SHIFT

REMOVAL AND INSTALLATION

SHIFT CABLE

REMOVAL

NOTE: Transfer Case may not engage or disengage Four Wheel Drive Mode if the transfer case shift cable end bushings are damaged.

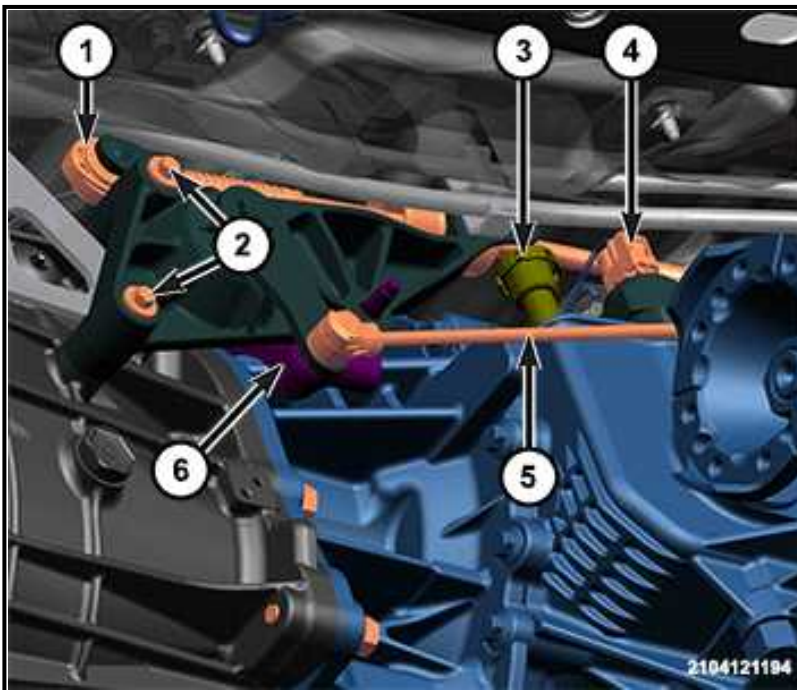
1. Shift the transfer case to 4 HI.
2. Remove the floor console

Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#) [CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#) .

3. Insert a dowel pin or 4.9 mm (3/16 in.) drill bit into the alignment hole on the shifter assembly that aligns the shifter assembly and shift lever.

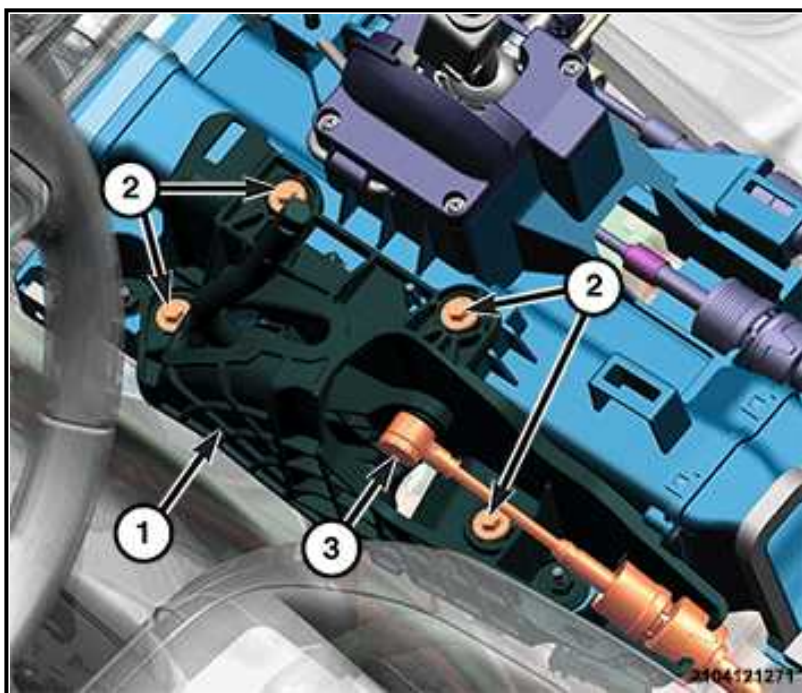
NOTE: The 4.9 mm (3/16 in.) dowel pin prevents fore and aft movement of the shift lever and locks the shift lever in the 4 HI position for easy adjustment.

4. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .



1 - Shift Cable

5. Disengage the transfer case shift cable from the transfer case shift lever using a suitable tool.
6. Remove the transfer case shift cable by sliding the lock forward and pushing the cable out of the support bracket.
7. Disengage any additional shift cable routing clips, if necessary.
8. Disengage the shift cable from the transfer case manual lever.
9. If necessary, remove end bushing from shift cable end.
10. Remove the support and lower the vehicle.



1 - Transfer Case Shift Cable Bracket
2 - Transfer Case Shift Cable Fasteners
3 - Transfer Case Shift Cable

11. Disengage the transfer case shift cable from the shift lever ball stud and loosen adjuster nut on cable.
12. Disengage the shift cable grommet from the floor and remove the shift cable from the vehicle.
13. If necessary, remove end bushing from shift cable end.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Verify the floor shifter is in the 4 HI position.
- Route the shift cable the exact way it was removed.
- Adjust the cable at the shifter. Refer to **LEVER, TRANSFER CASE, ADJUSTMENTS**.
- Check for proper transfer case shifter operation.

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

HANDLE

REMOVAL AND INSTALLATION

TRANSFER CASE LEVER

REMOVAL



1 - Floor Console
2 - Shifter Boot

1. Carefully pry upward at base of shifter boot with a suitable trim tool to free boot from floor console.



1 - Shifter Handle Bolt

2. Slide boot upwards to expose the shifter handle bolt. Remove the shifter handle bolt and remove the shifter handle.
3. Grab the shifter handle where it meets the boot and gently twist to unlock the handle. Transfer the boot to the new handle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle.

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-

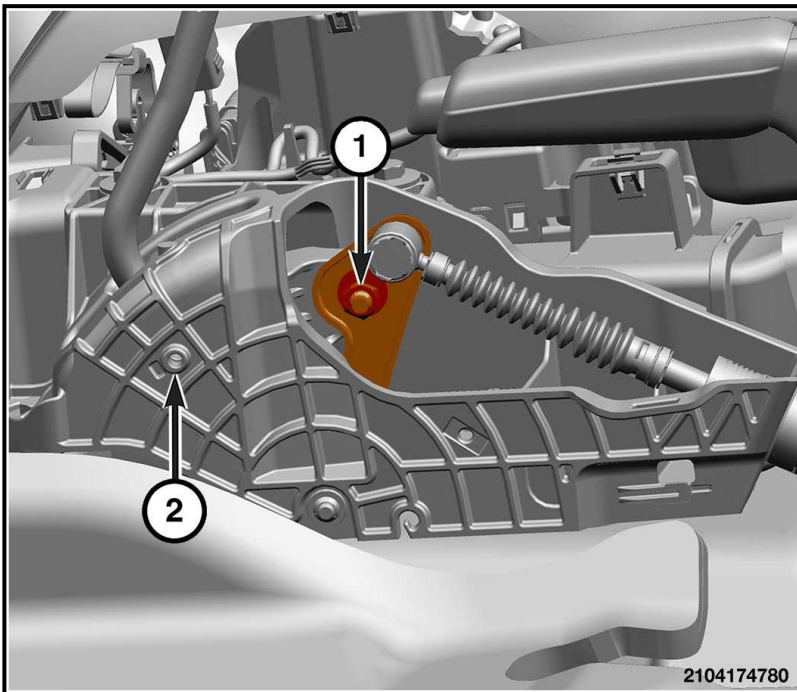
DESCRIPTION	SPECIFICATIONS	COMMENTS
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

LEVER, TRANSFER CASE

ADJUSTMENTS

1. Shift transfer case into 4 HI.
2. Remove the transfer case shift handle. Refer to [HANDLE, REMOVAL AND INSTALLATION](#).
3. Remove the floor console. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#)
[CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#).
4. Insert a dowel pin or 4.9 mm (3/16 in.) drill bit into the alignment hole on the shifter assembly that aligns the shifter assembly and shift lever.

NOTE: The 4.9 mm (3/16 in.) dowel pin prevents fore and aft movement of the shift lever and locks the shift lever in the 4 HI position for easy adjustment.



1 - Shifter Adjustment Nut

5. Loosen the shifter adjustment nut.
6. Apply rearward pressure to the shift lever and tighten the shifter adjustment nut securely.
7. Verify transfer case operation.
8. Install the floor console. Refer to [CONSOLE, FLOOR, REMOVAL AND INSTALLATION](#)
[CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION](#).
9. Install the transfer case shift handle. Refer to [HANDLE, REMOVAL AND INSTALLATION](#).

TRANSFER CASE

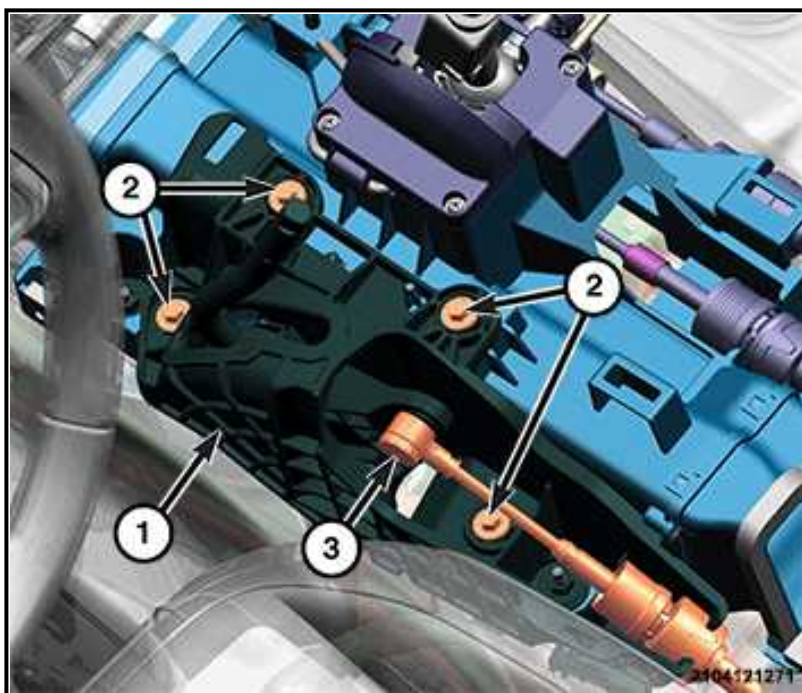
DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

REMOVAL AND INSTALLATION

REMOVAL AND INSTALLATION

REMOVAL

1. Shift transfer case into 4 HI.
2. Remove the transfer case shift handle. Refer to HANDLE, REMOVAL AND INSTALLATION.
3. Remove the floor console. Refer to CONSOLE, FLOOR, REMOVAL AND INSTALLATION
CONSOLE, FLOOR, END CAP, REMOVAL AND INSTALLATION .



1 - Transfer Case Shift Lever
2 - Transfer Case Shift Lever Fasteners
3 - Transfer Case Shift Cable

4. Disengage the transfer case shift cable from the shift lever.
5. Remove the transfer case shift cable by sliding the lock forward and pushing the cable out of the support bracket.
6. Remove the fasteners attaching shifter assembly to floor pan.
7. Remove the shifter assembly from the vehicle.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Check for proper transfer case shifter operation, adjust the shift cable if necessary.

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
Shift Cable Bracket to Support Bracket Nut	19 N.m (14 Ft. Lbs.)	-
Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

MOTOR, SHIFT

REMOVAL AND INSTALLATION

SHIFT MOTOR

REMOVAL

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Disengage the wire harness connector from the shift motor and mode sensor assembly.
3. Remove the shift motor bolts, the mode sensor and the bracket assembly.

NOTE: The shift motor and mode sensor are one piece and should not be disassembled. Do not disassemble the shift motor and sensor as this will effect shift motor and sensor functionality.

4. Remove the shift motor and mode sensor assembly.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Clean the mounting surfaces of the shift motor and the transfer case of any sealer.
- Apply a thin bead of MoparB® ATF RTV to the mounting surface.

NOTE: Verify that the shift motor position and sector shaft orientation are aligned. It may be necessary to manually shift the transfer case if the shift motor and sector shaft are not aligned.

- Fill the transfer case as necessary with the specified fluid. Refer to [CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS](#) .

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
Range Lever Bolt	30 N.m (22 Ft. Lbs.)	-
Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
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Shift Cable Bracket to Transmission	23 N.m (11 Ft. Lbs.)	-
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Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

SEAL, INPUT SHAFT

REMOVAL AND INSTALLATION

INPUT SHAFT SEAL

REMOVAL

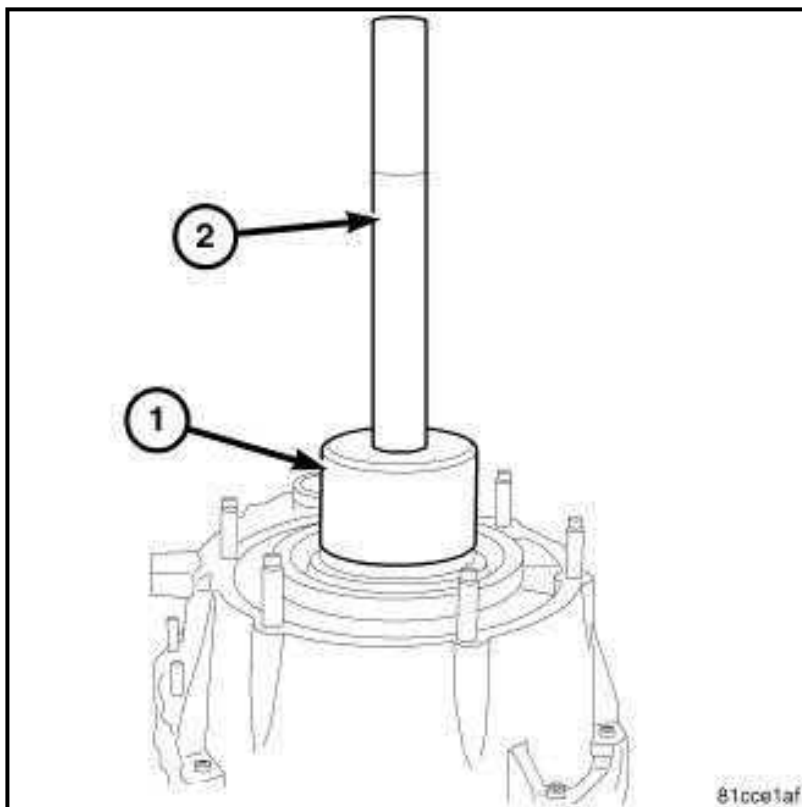
1. Remove the transfer case from the vehicle. Refer to the appropriate service information **REMOVAL AND INSTALLATION**.
2. Using a suitable pry tool or a screw mounted in a slide hammer, remove the input shaft seal.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Lubricate all seals with MOPARB® ATF+4 prior to installation.



1 - Seal Installer Tool

2 - Driver Handle

1. Using (special tool #2053900210, Installer, Seal Input Shaft) or (special tool #9672, Installer, Seal) and (special tool #C-4171, Driver Handle, Universal), install the **NEW** front input shaft seal.

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
Harmonic Damper Bolts	25 N.m (18 Ft. Lbs.)	-
Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
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Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
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Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
Shift Cable Bracket to Floor	7 N.m (62 In. Lbs.)	-
Shift Motor (Actuator) Bolts	12 N.m (9 Ft. Lbs.)	-
Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-

DESCRIPTION	SPECIFICATIONS	COMMENTS
Transfer Case Shift Bracket Nut	21 N.m (14 Ft. Lbs.)	-
Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

SEAL, OUTPUT SHAFT

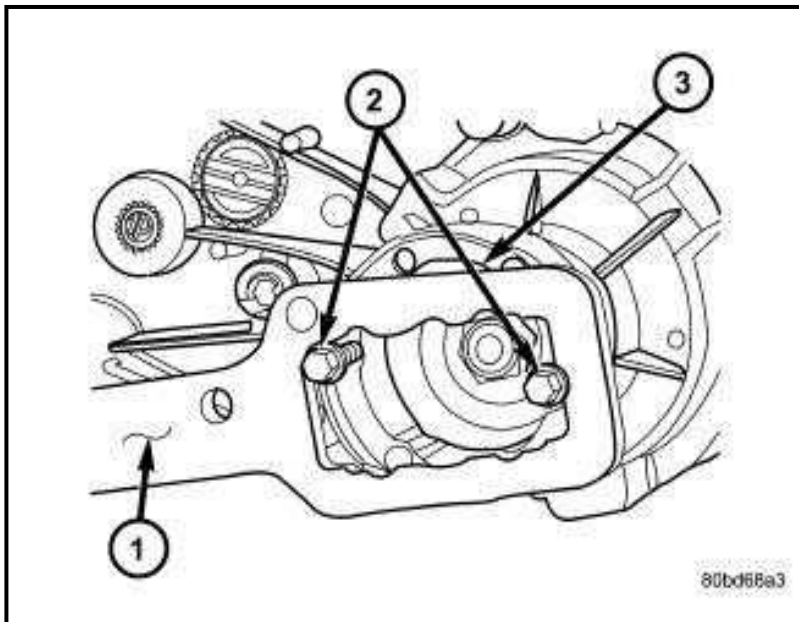
REMOVAL AND INSTALLATION

OUTPUT SHAFT SEAL

REMOVAL

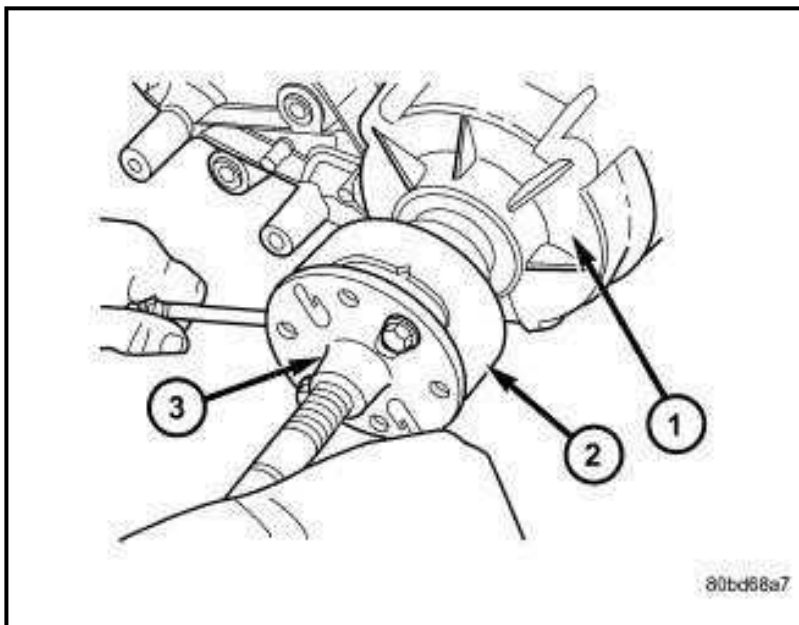
NOTE: Rear output seal as shown in illustration, front output seal similar.

1. Raise and support the vehicle. Refer to [HOISTING, STANDARD PROCEDURE](#) .
2. Remove the appropriate propeller shaft. Refer to [REMOVAL AND INSTALLATION](#) .



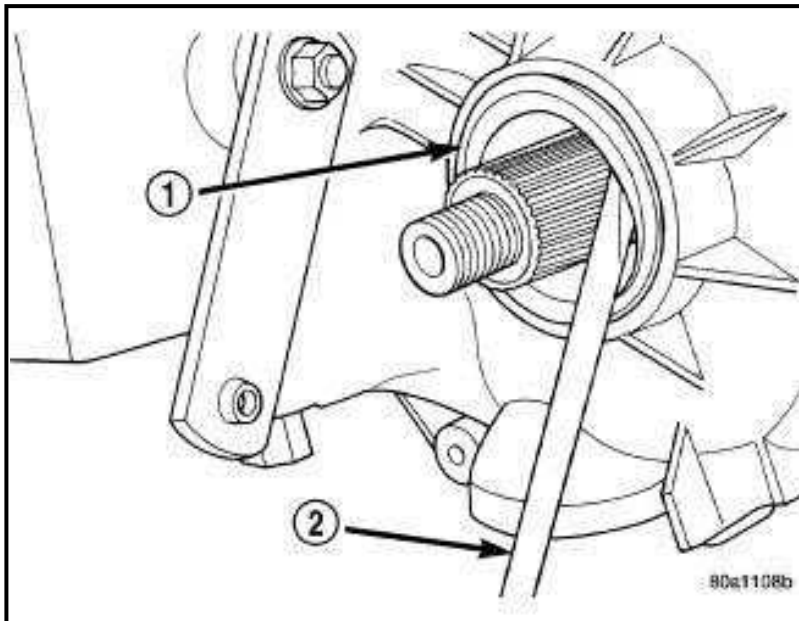
1 - Flange Holder
2 - Bolts
3 - Propeller Shaft Flange

3. Install two bolts partially in the propeller shaft companion flange, 180B° from each other.
4. Install the rectangular end of the (special tool #C-3281, Holder, Flange) over the bolts to hold the companion flange stationary and remove the nut holding the companion flange to the output shaft.



1 - Transfer Case Assembly
2 - Companion Flange
3 - Companion Flange Puller

5. Using the (special tool #C-452, Puller, Companion Flange) remove the companion flange from the assembly.



1 - Output shaft seal
2 - Seal Remover Tool

Front output seal as shown in illustration, rear output seal similar.

6. Remove the output shaft seal.

INSTALLATION

During installation, torque the fasteners to the specifications in the torque table(s) below.

Follow the removal procedure in reverse for general reassembly of the components on the vehicle. The steps listed below are calling out specific procedures that should be followed during installation.

- Use (special tool #6952A, Installer, Seal) as follows:

- a. Place a **NEW** seal on the tool. The garter spring on the seal goes toward the interior of the case.
 - b. Start the seal in the bore with light taps from a hammer. Once the seal is started, continue tapping the seal into the bore until the installer tool seats against the case.
- Check the fluid level, if the fluid is low, fill the transfer case with the specified fluid. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .

TORQUE SPECIFICATIONS

TRANSFER CASE

DESCRIPTION	SPECIFICATIONS	COMMENTS
Case Half Bolts	26 N.m (19 Ft. Lbs.)	-
Drain/Fill Plug	28 N.m (21 Ft. Lbs.)	-
Extension Housing Bolts	26 N.m (19 Ft. Lbs.)	-
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Output Flange Nut	225 N.m (166 Ft. Lbs.)	-
Poppet Plug	20 N.m (15 Ft. Lbs.)	-
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Range Position Switch	27 N.m (20 Ft. Lbs.)	-
Shifter Assembly to Base	8 N.m (71 In. Lbs.)	-
Shifter Adjuster Plate to Handle	20 N.m (15 Ft. Lbs.)	-
Shift Cable Adjustment Nut	20 N.m (15 Ft. Lbs.)	-
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Shift Cable Grommet to Floor	9 N.m (80 In. Lbs.)	-
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Transfer Case Shift Bracket Bolts	23 N.m (11 Ft. Lbs.)	-
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Transfer Case Shift Knob	2 N.m (17 In. Lbs.)	-
Transfer Case to Transmission Bolts	60 N.m (45 Ft. Lbs.)	-

2021 AUTOMATIC TRANSMISSION

Powertrain Control Module (PCM) - Electrical Diagnostics, GPEC 5 - Gladiator [ERC]

DIAGNOSIS AND TESTING

P0171-FUEL SYSTEM 1/1 LEAN

NO TITLE

For a complete CATALYST MONITOR SYSTEM wiring diagram, .

THEORY OF OPERATION

The intent of this diagnostic is to identify rich or lean fuel system abnormalities which would cause vehicle emissions to exceed 1.5 times any of the standards. The base fuel feedback control will maintain the desired fuel/air mixture by modifying the injected fuel quantity according to the oxygen content of the exhaust gas. The Powertrain Control Module (PCM) makes short term and long term fuel corrections based on feedback from the Upstream Oxygen (O2) Sensors. The PCM monitors feedback from the Downstream O2 Sensors to determine and optimize the efficiency of the Catalytic Converters.

The Upstream Fuel System Monitor and Downstream Fuel Trim Diagnostic monitors operate very differently;

- **Upstream Fuel System Monitor**

- The Upstream Fuel System Monitor diagnostic monitors the Upstream O2 Sensor feedback to determine the actual fuel/air ratio, which is then compared to the desired fuel/air ratio. The error between the two is measured and corrected for. This correction happens "live" and the instantaneous value of the correction is stored in short term fuel trim. Short term fuel trim is intended to correct temporary or dynamic errors in the air/fuel ratio. If the value of short term fuel trim is large enough for a sufficient period of time, it is assumed that whatever is causing the error is permanent and not temporary and the value in short term fuel trim is moved to long term fuel trim. When this transfer occurs, the short term fuel trim is re-zeroed and continues to look for temporary errors. If the combined value of the total fuel correction stored in short term and long term fuel trim (rich or lean) exceeds a calibrated threshold, for a calibrated period of time, a fuel system monitor fault is recorded.

- **Downstream Fuel Trim Diagnostic**

- A Downstream O2 Sensor goal voltage is selected to maintain the optimum catalyst efficiency. Corresponding Upstream O2 Sensor rich/lean switching point thresholds for various operating conditions are also selected which normally result in a Downstream O2 Sensor voltage close to this goal voltage. During normal operation, whenever the upstream rich/lean switching point threshold does not result in the desired downstream goal voltage, the downstream fuel trim feature "trims" (adjusts) the upstream rich/lean switching point threshold up or down appropriately until the desired downstream goal voltage is achieved. The amount of trim adjustment that is added or removed is called "downstream fuel trim." If the trim adjustment to the Upstream O2 Sensor goes beyond a calibrated threshold (rich or lean), a fault is set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the engine running in closed loop fuel control.
- Battery voltage above 11.0 volts.
- Barometric pressure (BARO) greater than 75 kPa.
- The Ambient Air Temperature (AAT) Sensor value above -7B°C (20B°F).
- Fuel level greater than 12%.
- Altitude below 2590.8 m (8500 ft.).

SET CONDITION

- When the sum of the short term and long term fuel corrections are greater than a calibrated threshold, generally 133% (100% is nominal), the fail timer will increment. After approximately 30 seconds of fail time the diagnostic fails.

DEFAULT ACTION

- The MIL will illuminate.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
LOW FUEL PRESSURE OR VOLUME/RESTRICTED FUEL INJECTOR
HIGH ETHANOL CONTENT (NON E85 VEHICLE)
ENGINE MECHANICAL - VACUUM LEAK
LEAK IN THE PURGE FLOW SYSTEM
EXHAUST SYSTEM LEAK
FAULTY MAP SENSOR READING
O2 SENSOR WIRING ISSUE
OXYGEN (O2) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

- With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
- For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
- With the scan tool, erase all DTCs.
- Turn the ignition off for a minimum of 10.0 seconds.
- Turn the ignition on.
- Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
- With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

NOTE: While this fault could set due to a faulty O2 Sensor or wiring, it is more likely to set due a mechanical, fuel or air handling issue. If the vehicle

exhibits any fuel system or driveability issues, or has any other fuel or air handling system DTCs (I.E. O2 Sensor circuit, MAP Sensor, Fuel Injector, Ignition Coil, etc.), diagnose and repair those concerns before proceeding with this test.

1. Refer to the recorded DTCs.

Are there any fuel system, air handling system or O2 Sensor DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK THE MAP SENSOR FOR PROPER OPERATION

1. Perform the CHECKING THE MAP SENSOR OPERATION test procedure. Refer to [DIAGNOSIS AND TESTING](#) .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE FUEL DELIVERY SYSTEM FOR PROPER OPERATION

1. Perform the CHECKING THE FUEL DELIVERY SYSTEM test procedure. Refer to [DIAGNOSIS AND TESTING](#) .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE ETHANOL CONTENT IN THE FUEL

1. Perform the CHECKING FOR PROPER ETHANOL LEVEL IN THE GASOLINE test procedure. Refer to [DIAGNOSIS AND TESTING](#) .

Were any issues found with the gasoline?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. CHECK THE ENGINE FOR MECHANICAL CONDITIONS

1. Turn the ignition off.
2. Check for any of the following conditions:
 - AIR INDUCTION SYSTEM - must be free from leaks.
 - ENGINE VACUUM LEAKS- check the entire engine and any vacuum lines/hoses for leaks.
 - POWER BRAKE BOOSTER - check for internal vacuum leaks. Monitor the engine speed and vacuum while pinching the vacuum hose going to the Brake Booster.
 - FUEL INJECTOR - if a Fuel Injector is suspected of being plugged or restricted, remove the fuel rail with the injectors intact. Energize the fuel pump to maintain fuel pressure in the fuel rail. Actuate the suspect Fuel Injector(s) with the scan tool and inspect the fuel spray pattern. Compare with the other injectors.
 - ENGINE PURGE FLOW SYSTEM - must flow freely with no leaks or restrictions. Check the hose and connections between the Purge Solenoid and the Intake Manifold.
 - ENGINE COMPRESSION - must be within specifications.

Are there any engine mechanical problems present?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK THE EXHAUST SYSTEM FOR LEAKS

1. Perform the CHECKING THE EXHAUST SYSTEM FOR LEAKS test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

8. CHECK THE UPSTREAM O2 SENSOR WIRING

1. Disconnect the Upstream O2 Sensor harness connector.
2. Disconnect the PCM C2 harness connector.

CAUTION:

Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic).
4. Check the Upstream O2 Sensor circuits;
 - for a short to ground in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.

- for an open or high resistance in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.

Were any problems found?

Yes

- Perform the appropriate repair.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [9](#)

9. REPLACE THE OXYGEN SENSOR AND RETEST FOR DTC

1. Replace the Upstream O2 Sensor in accordance with the Service Information. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION ENGINE SENSORS, REMOVAL AND INSTALLATION](#) .
2. Connect the Bank 1 Upstream O2 Sensor and PCM harness connectors.
3. Turn the ignition on.
4. With the scan tool, erase DTCs.
5. Using the Freeze Frame Data or When Monitored Conditions above, operate the vehicle within the conditions that set the DTC.

Did the DTC return?

Yes

- Go To [10](#)

No

- Replacing the Upstream O2 Sensor repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

10. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0172-FUEL SYSTEM 1/1 RICH

NO TITLE

For a complete CATALYST MONITOR SYSTEM wiring diagram, .

THEORY OF OPERATION

The intent of this diagnostic is to identify rich or lean fuel system abnormalities which would cause vehicle emissions to exceed 1.5 times any of the standards. The base fuel feedback control will maintain the desired fuel/air mixture by modifying the injected fuel quantity according to the oxygen content of the exhaust gas. The Powertrain Control Module (PCM) makes short term and long term fuel corrections based on feedback from the Upstream Oxygen (O₂) Sensors. The PCM monitors feedback from the Downstream O₂ Sensors to determine and optimize the efficiency of the Catalytic Converters.

The Upstream Fuel System Monitor and Downstream Fuel Trim Diagnostic monitors operate very differently;

- **Upstream Fuel System Monitor**

- The Upstream Fuel System Monitor diagnostic monitors the Upstream O₂ Sensor feedback to determine the actual fuel/air ratio, which is then compared to the desired fuel/air ratio. The error between the two is measured and corrected for. This correction happens "live" and the instantaneous value of the correction is stored in short term fuel trim. Short term fuel trim is intended to correct temporary or dynamic errors in the air/fuel ratio. If the value of short term fuel trim is large enough for a sufficient period of time, it is assumed that whatever is causing the error is permanent and not temporary and the value in short term fuel trim is moved to long term fuel trim. When this transfer occurs, the short term fuel trim is re-zeroed and continues to look for temporary errors. If the combined value of the total fuel correction stored in short term and long term fuel trim (rich or lean) exceeds a calibrated threshold, for a calibrated period of time, a fuel system monitor fault is recorded.

- **Downstream Fuel Trim Diagnostic**

- A Downstream O₂ Sensor goal voltage is selected to maintain the optimum catalyst efficiency. Corresponding Upstream O₂ Sensor rich/lean switching point thresholds for various operating conditions are also selected which normally result in a Downstream O₂ Sensor voltage close to this

goal voltage. During normal operation, whenever the upstream rich/lean switching point threshold does not result in the desired downstream goal voltage, the downstream fuel trim feature "trims" (adjusts) the upstream rich/lean switching point threshold up or down appropriately until the desired downstream goal voltage is achieved. The amount of trim adjustment that is added or removed is called "downstream fuel trim." If the trim adjustment to the Upstream O2 Sensor goes beyond a calibrated threshold (rich or lean), a fault is set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the engine running in closed loop fuel control.
- Battery voltage above 11.0 volts.
- Barometric pressure (BARO) greater than 75 kPa.
- The Ambient Air Temperature (AAT) Sensor value above -7B°C (20B°F).
- Fuel level greater than 12%.
- Altitude below 2590.8 m (8500 ft.).

SET CONDITION

- When the sum of the short term and long term fuel corrections is less than a calibrated threshold, generally 67% (100% is nominal), the fail timer will increment. After 30 seconds of fail time the diagnostic fails.

DEFAULT ACTION

- The MIL will illuminate.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
EXCESSIVE FUEL PRESSURE OR POOR FUEL QUALITY/CONTAMINATION
FUEL INJECTOR LEAKING INTO ENGINE
LEAKING PURGE SOLENOID
ENGINE MECHANICAL - INTAKE SYSTEM RESTRICTED
EXHAUST SYSTEM RESTRICTION
EGR VALVE INTERNAL LEAK
FAULTY MAP SENSOR READING
O2 SENSOR WIRING ISSUE
OXYGEN (O2) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCS.

4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

NOTE: While this fault could set due to a faulty O2 Sensor or wiring, it is more likely to set due a mechanical, fuel or air handling issue. If the vehicle exhibits any fuel system or driveability issues, or has any other fuel or air handling system DTCs (I.E. O2 Sensor circuit, MAP Sensor, Fuel Injector, Ignition Coil, etc.), diagnose and repair those concerns before proceeding with this test.

1. Refer to the recorded DTCs.

Are there any fuel system, air handling system or O2 Sensor DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK THE EXHAUST SYSTEM FOR RESTRICTIONS

1. Start the engine and check for good exhaust flow at the tailpipe.
2. Visually inspect the exhaust system for any damage that could cause a restriction.

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE MAP SENSOR OPERATION

1. Perform the CHECKING THE MAP SENSOR OPERATION test procedure. Refer to [DIAGNOSIS AND TESTING](#) .

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE PURGE SOLENOID OPERATION

1. Turn the ignition off.
2. Disconnect the hoses at the Purge Solenoid.
3. Using a hand vacuum pump, apply 5.0 in. Hg. to the "ENGINE" side of the Purge Solenoid.

NOTE: The solenoid should hold vacuum for a minimum of 15 seconds.

Did the Purge Solenoid hold vacuum?

Yes

- Go To [6](#)

NOTE: Connect the vacuum hoses before continuing.

No

- Verify that there is good pin to terminal contact in the Evap Purge Solenoid and Powertrain Control Module connectors. Replace the Purge Solenoid if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

6. CHECK THE FUEL DELIVERY SYSTEM

1. Perform the CHECKING THE FUEL DELIVERY SYSTEM test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

7. CHECK THE ENGINE MECHANICAL OPERATION

1. Check for any of the following conditions/mechanical problems:
 - AIR INDUCTION SYSTEM - must be free from restrictions.
 - ENGINE VALVE TIMING - must be within specifications.
 - ENGINE COMPRESSION - must be within specifications.
 - FUEL - must be free of contamination.
 - FUEL INJECTOR - if a Fuel Injector is suspected of leaking or abnormal spray pattern, remove the fuel rail with the injectors intact. Energize the fuel pump to maintain fuel pressure in the fuel rail. Check for any fuel leakage before the suspect injector is actuated. Actuate the suspect Fuel Injector(s) with the scan tool and inspect the fuel spray pattern for abnormalities. Compare with the other injectors.

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

8. CHECK THE EGR VALVE OPERATION

1. Turn the ignition off.
2. Block EGR flow to the engine.
3. Turn the ignition on and monitor the short term adaptive reading.
4. Start the engine. Allow the engine to idle and monitor the short term adaptive for up to five minutes.

Did the short term adaptive increase with the EGR flow blocked?

Yes

- Replace the EGR Valve in accordance with the Service Information. Refer to [VALVE, EXHAUST GAS RECIRCULATION \(EGR\), REMOVAL AND INSTALLATION](#) [VALVE, EXHAUST GAS RECIRCULATION \(EGR\), REMOVAL AND INSTALLATION](#) .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [9](#)

9. CHECK THE UPSTREAM O2 SENSOR WIRING

NOTE: While this fault could set due to a faulty O2 Sensor or wiring, it is more likely to set due to poor engine performance. If the vehicle exhibits any fuel system or driveability issues, or has any other fuel or air handling system DTCs (I.E. O2 Sensor circuit, MAP Sensor, Fuel Injector, Ignition Coil, etc.), diagnose and repair those concerns before proceeding with this test.

1. Disconnect the Upstream O2 Sensor harness connector.
2. Disconnect the PCM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic).
4. Check the Upstream O2 Sensor circuits;
 - for a short to ground in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.
 - for an open or high resistance in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.

Were any problems found?

Yes

- Perform the appropriate repair.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [10](#)

10. REPLACE THE OXYGEN SENSOR AND RETEST FOR DTC

1. Replace the Upstream O2 Sensor in accordance with the Service Information. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION ENGINE SENSORS, REMOVAL AND INSTALLATION](#) .
2. Connect the Bank 1 Upstream O2 Sensor and PCM harness connectors.
3. Turn the ignition on.
4. With the scan tool, erase DTCs.
5. Using the Freeze Frame Data or When Monitored Conditions above, operate the vehicle within the conditions that set the DTC.

Did the DTC return?

Yes

- Go To [11](#)

No

- Replacing the Upstream O2 Sensor repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

11. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.

8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0174-FUEL SYSTEM 2/1 LEAN

NO TITLE

For a complete CATALYST MONITOR SYSTEM wiring diagram, .

THEORY OF OPERATION

The intent of this diagnostic is to identify rich or lean fuel system abnormalities which would cause vehicle emissions to exceed 1.5 times any of the standards. The base fuel feedback control will maintain the desired fuel/air mixture by modifying the injected fuel quantity according to the oxygen content of the exhaust gas. The Powertrain Control Module (PCM) makes short term and long term fuel corrections based on feedback from the Upstream Oxygen (O2) Sensors. The PCM monitors feedback from the Downstream O2 Sensors to determine and optimize the efficiency of the Catalytic Converters.

The Upstream Fuel System Monitor and Downstream Fuel Trim Diagnostic monitors operate very differently;

- **Upstream Fuel System Monitor**
 - The Upstream Fuel System Monitor diagnostic monitors the Upstream O2 Sensor feedback to determine the actual fuel/air ratio, which is then compared to the desired fuel/air ratio. The error between the two is measured and corrected for. This correction happens "live" and the instantaneous value of the correction is stored in short term fuel trim. Short term fuel trim is intended to correct temporary or dynamic errors in the air/fuel ratio. If the value of short term fuel trim is large enough for a sufficient period of time, it is assumed that whatever is causing the error is permanent and not temporary and the value in short term fuel trim is moved to long term fuel trim. When this transfer occurs, the short term fuel trim is re-zeroed and continues to look for temporary errors. If the combined value of the total fuel correction stored in short term and long term fuel trim (rich or lean) exceeds a calibrated threshold, for a calibrated period of time, a fuel system monitor fault is recorded.
- **Downstream Fuel Trim Diagnostic**
 - A Downstream O2 Sensor goal voltage is selected to maintain the optimum catalyst efficiency. Corresponding Upstream O2 Sensor rich/lean switching point thresholds for various operating conditions are also selected which normally result in a Downstream O2 Sensor voltage close to this goal voltage. During normal operation, whenever the upstream rich/lean switching point threshold does not result in the desired downstream goal voltage, the downstream fuel trim feature "trims" (adjusts) the upstream rich/lean switching point threshold up or down appropriately until the desired downstream goal voltage is achieved. The amount of trim adjustment that is added or

removed is called "downstream fuel trim." If the trim adjustment to the Upstream O2 Sensor goes beyond a calibrated threshold (rich or lean), a fault is set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the engine running in closed loop fuel control.
- Battery voltage above 11.0 volts.
- Barometric pressure (BARO) greater than 75 kPa.
- The Ambient Air Temperature (AAT) Sensor value above -7B°C (20B°F).
- Fuel level greater than 12%.
- Altitude below 2590.8 m (8500 ft.).

SET CONDITION

- When the sum of the short term and long term fuel corrections are greater than a calibrated threshold, generally 133% (100% is nominal), the fail timer will increment. After approximately 30 seconds of fail time the diagnostic fails.

DEFAULT ACTION

- The MIL will illuminate.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
LOW FUEL PRESSURE OR VOLUME/RESTRICTED FUEL INJECTOR
ENGINE MECHANICAL - VACUUM LEAK
EXHAUST SYSTEM LEAK
LEAK IN THE PURGE FLOW SYSTEM
HIGH ETHANOL CONTENT (NON E85 VEHICLE)
FAULTY MAP SENSOR READING
O2 SENSOR WIRING ISSUE
OXYGEN (O2) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.

7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

NOTE: While this fault could set due to a faulty O2 Sensor or wiring, it is more likely to set due to a mechanical, fuel or air handling issue. If the vehicle exhibits any fuel system or driveability issues, or has any other fuel or air handling system DTCs (I.E. O2 Sensor circuit, MAP Sensor, Fuel Injector, Ignition Coil, etc.), diagnose and repair those concerns before proceeding with this test.

1. Refer to the recorded DTCs.

Are there any fuel system, air handling system or O2 Sensor DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK THE MAP SENSOR OPERATION

1. Perform the CHECKING THE MAP SENSOR OPERATION test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE FUEL DELIVERY SYSTEM

1. Perform the CHECKING THE FUEL DELIVERY SYSTEM test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE ETHANOL CONTENT IN THE FUEL

1. Perform the CHECKING FOR PROPER ETHANOL LEVEL IN THE GASOLINE test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any issues found with the gasoline?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. CHECK THE ENGINE MECHANICAL OPERATION

1. Turn the ignition off.
2. Check for any of the following conditions:
 - AIR INDUCTION SYSTEM - must be free from leaks.
 - ENGINE VACUUM LEAK- check the entire engine and any vacuum lines/hoses for leaks.
 - POWER BRAKE BOOSTER - check for internal vacuum leaks. Monitor the engine speed and vacuum while pinching the vacuum hose going to the Brake Booster.
 - FUEL INJECTOR - if a Fuel Injector is suspected of being plugged or restricted, remove the fuel rail with the injectors intact. Energize the fuel pump to maintain fuel pressure in the fuel rail. Actuate the suspect Fuel Injector(s) with the scan tool and inspect the fuel spray pattern. Compare with the other injectors.
 - ENGINE PURGE FLOW SYSTEM - must flow freely with no leaks or restrictions. Check the hose and connections between the Purge Solenoid and the Intake Manifold.
 - ENGINE COMPRESSION - must be within specifications.

Are there any engine mechanical problems present?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK THE EXHAUST SYSTEM FOR LEAKS

1. Perform the CHECKING THE EXHAUST SYSTEM FOR LEAKS test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

8. CHECK THE UPSTREAM O2 SENSOR WIRING

1. Disconnect the Upstream O2 Sensor harness connector.
2. Disconnect the PCM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic).
4. Check the Upstream O2 Sensor circuits;
 - for a short to ground in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.
 - for an open or high resistance in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.

Were any problems found?

Yes

- Perform the appropriate repair.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [9](#)

9. REPLACE THE OXYGEN SENSOR AND RETEST FOR DTC

1. Replace the Upstream O2 Sensor in accordance with the Service Information. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION ENGINE SENSORS, REMOVAL AND INSTALLATION](#) .
2. Connect the Bank 2 Upstream O2 Sensor and PCM harness connectors.
3. Turn the ignition on.
4. With the scan tool, erase DTCs.
5. Using the Freeze Frame Data or When Monitored Conditions above, operate the vehicle within the conditions that set the DTC.

Did the DTC return?

Yes

- Go To [10](#)

No

- Replacing the Upstream O2 Sensor repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

10. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:

- Proper connector installation.
- Damaged connector locks.
- Corrosion.
- Other signs of water intrusion.
- Weather seal damage (if equipped).
- Bent terminals.
- Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
- Terminals that have been pushed back into the connector cavity.
- Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0175-FUEL SYSTEM 2/1 RICH

NO TITLE

For a complete CATALYST MONITOR SYSTEM wiring diagram, .

THEORY OF OPERATION

The intent of this diagnostic is to identify rich or lean fuel system abnormalities which would cause vehicle emissions to exceed 1.5 times any of the standards. The base fuel feedback control will maintain the desired fuel/air mixture by modifying the injected fuel quantity according to the oxygen content of the exhaust gas. The Powertrain Control Module (PCM) makes short term and long term fuel corrections based on feedback from the Upstream Oxygen (O2) Sensors. The PCM monitors feedback from the Downstream O2 Sensors to determine and optimize the efficiency of the Catalytic Converters.

The Upstream Fuel System Monitor and Downstream Fuel Trim Diagnostic monitors operate very differently;

- **Upstream Fuel System Monitor**

- The Upstream Fuel System Monitor diagnostic monitors the Upstream O2 Sensor feedback to determine the actual fuel/air ratio, which is then compared to the desired fuel/air ratio. The error between the two is measured and corrected for. This correction happens "live" and the instantaneous value of the correction is stored in short term fuel trim. Short term fuel trim is intended to correct temporary or dynamic errors in the air/fuel ratio. If the value of short term fuel trim is large enough for a sufficient period of time, it is assumed that whatever is causing the error is permanent and not temporary and the value in short term fuel trim is moved to long term fuel trim. When this transfer occurs, the short term fuel trim is re-zeroed and continues to look for temporary errors. If the combined value of the total fuel correction stored in short term and long term fuel trim (rich or lean) exceeds a calibrated threshold, for a calibrated period of time, a fuel system monitor fault is recorded.
- **Downstream Fuel Trim Diagnostic**
 - A Downstream O2 Sensor goal voltage is selected to maintain the optimum catalyst efficiency. Corresponding Upstream O2 Sensor rich/lean switching point thresholds for various operating conditions are also selected which normally result in a Downstream O2 Sensor voltage close to this goal voltage. During normal operation, whenever the upstream rich/lean switching point threshold does not result in the desired downstream goal voltage, the downstream fuel trim feature "trims" (adjusts) the upstream rich/lean switching point threshold up or down appropriately until the desired downstream goal voltage is achieved. The amount of trim adjustment that is added or removed is called "downstream fuel trim." If the trim adjustment to the Upstream O2 Sensor goes beyond a calibrated threshold (rich or lean), a fault is set.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the engine running in closed loop fuel control.
- Battery voltage above 11.0 volts.
- Barometric pressure (BARO) greater than 75 kPa.
- The Ambient Air Temperature (AAT) Sensor value above -7B°C (20B°F).
- Fuel level greater than 12%.
- Altitude below 2590.8 m (8500 ft.).

SET CONDITION

- When the sum of the short term and long term fuel corrections is less than a calibrated threshold, generally 67% (100% is nominal), the fail timer will increment. After 30 seconds of fail time the diagnostic fails.

DEFAULT ACTION

- The MIL will illuminate.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
EXCESSIVE FUEL PRESSURE OR POOR FUEL QUALITY/CONTAMINATION
FUEL INJECTOR LEAKING INTO ENGINE
LEAKING EVAP PURGE SOLENOID
ENGINE MECHANICAL - INTAKE SYSTEM RESTRICTED
EXHAUST SYSTEM RESTRICTION
EGR VALVE INTERNAL LEAK
FAULTY MAP SENSOR READING
O2 SENSOR WIRING ISSUE

Possible Causes
OXYGEN (O2) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

NOTE: While this fault could set due to a faulty O2 Sensor or wiring, it is more likely to set due a mechanical, fuel or air handling issue. If the vehicle exhibits any fuel system or driveability issues, or has any other fuel or air handling system DTCs (I.E. O2 Sensor circuit, MAP Sensor, Fuel Injector, Ignition Coil, etc.), diagnose and repair those concerns before proceeding with this test.

1. Refer to the recorded DTCs.

Are there any fuel system, air handling system or O2 Sensor DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK THE EXHAUST SYSTEM FOR RESTRICTIONS

1. Start the engine and check for good exhaust flow at the tailpipe.
2. Visually inspect the exhaust system for any damage that could cause a restriction.

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE MAP SENSOR OPERATION

1. Perform the CHECKING THE MAP SENSOR OPERATION test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. PURGE SOLENOID OPERATION

1. Turn the ignition off.
2. Disconnect the hoses at the Purge Solenoid.
3. Using a hand vacuum pump, apply 5.0 in. Hg. to the "ENGINE" side of the Purge Solenoid.

NOTE: **The solenoid should hold vacuum for a minimum of 15 seconds.**

Did the Purge Solenoid hold vacuum?

Yes

- Go To [6](#)

NOTE: **Connect the vacuum hoses before continuing.**

No

- Verify that there is good pin to terminal contact in the Evap Purge Solenoid and Powertrain Control Module connectors. Replace the Purge Solenoid if no problems were found with the connectors.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

6. CHECK THE FUEL DELIVERY SYSTEM

1. Perform the CHECKING THE FUEL DELIVERY SYSTEM test procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK THE ENGINE MECHANICAL OPERATION

1. Check for any of the following conditions/mechanical problems:

- AIR INDUCTION SYSTEM - must be free from restrictions.
- ENGINE VALVE TIMING - must be within specifications.
- ENGINE COMPRESSION - must be within specifications.
- FUEL - must be free of contamination.
- FUEL INJECTOR - if a Fuel Injector is suspected of leaking or abnormal spray pattern, remove the fuel rail with the injectors intact. Energize the fuel pump to maintain fuel pressure in the fuel rail. Check for any fuel leakage before the suspect injector is actuated. Actuate the suspect Fuel Injector(s) with the scan tool and inspect the fuel spray pattern for abnormalities. Compare with the other injectors.

Are there any engine mechanical problems?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

8. CHECK THE EGR VALVE OPERATION

1. Turn the ignition off.
2. Block EGR flow to the engine.
3. Turn the ignition on and monitor the short term adaptive reading.
4. Start the engine. Allow the engine to idle and monitor the short term adaptive for up to five minutes.

Did the short term adaptive increase with the EGR flow blocked?

Yes

- Replace the EGR Valve in accordance with the Service Information. Refer to [VALVE, EXHAUST GAS RECIRCULATION \(EGR\), REMOVAL AND INSTALLATION](#) [VALVE, EXHAUST GAS RECIRCULATION \(EGR\), REMOVAL AND INSTALLATION](#) .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [9](#)

9. CHECK THE UPSTREAM O2 SENSOR WIRING

NOTE: While this fault could set due to a faulty O2 Sensor or wiring, it is more likely to set due to poor engine performance. If the vehicle exhibits any fuel system or driveability issues, or has any other fuel or air handling system DTCs (I.E. O2 Sensor circuit, MAP Sensor, Fuel Injector, Ignition Coil, etc.), diagnose and repair those concerns before proceeding with this test.

1. Disconnect the Upstream O2 Sensor harness connector.
2. Disconnect the PCM C2 harness connector.

CAUTION:

Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic).

4. Check the Upstream O2 Sensor circuits;

- for a short to ground in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.
- for an open or high resistance in the wiring between the O2 Sensor harness connector and the PCM C2 harness connector.

Were any problems found?

Yes

- Perform the appropriate repair.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [10](#)

10. REPLACE THE OXYGEN SENSOR AND RETEST FOR DTC

1. Replace the Upstream O2 Sensor in accordance with the Service Information. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION](#) [ENGINE SENSORS, REMOVAL AND INSTALLATION](#) .
2. Connect the Bank 2 Upstream O2 Sensor and PCM harness connectors.
3. Turn the ignition on.
4. With the scan tool, erase DTCs.
5. Using the Freeze Frame Data or When Monitored Conditions above, operate the vehicle within the conditions that set the DTC.

Did the DTC return?

Yes

- Go To [11](#)

No

- Replacing the Upstream O2 Sensor repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

11. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.

- Weather seal damage (if equipped).
- Bent terminals.
- Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
- Terminals that have been pushed back into the connector cavity.
- Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P018B-FUEL PRESSURE SENSOR CIRCUIT PERFORMANCE

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

THEORY OF OPERATION

The Powertrain Control Module (PCM) provides a 5-Volt supply to the Fuel Rail Pressure Sensor (FRPS). The PCM also provides a ground on the sensor return circuit. The Fuel Rail Pressure Sensor provides a signal to the PCM on the Fuel Rail Pressure Sensor Signal circuit. This sensor signal voltage changes based on the pressure in the fuel rail. The PCM will detect a low signal voltage at low rail pressures. The PCM will detect a high signal voltage during high rail pressure conditions.

WHEN MONITORED

This diagnostic runs one time during an ignition cycle when the following conditions are met:

- At initial engine start up, the PCM runs a Fuel Pressure Sensor rationality check. For approximately the first 10.0 seconds, the fuel pressure is dynamic. At this time, It will spike above the set point (approximately 5.8-7.25 psi), then drop below the set point (approximately 8.7-10.2 psi), and quickly dampen and settle at the set point (approximately 58.0 psi). At initial engine start up, when the engine speed reaches approximately 500 rpm, the Powertrain Control Module (PCM) measures the delta

pressure change between the high pressure reading and low pressure reading and make determinations about sensor rationality.

SET CONDITION

- If the PCM detects the delta pressure change is above the calibrated threshold, the Fuel Pressure Sensor signal is considered irrational and a fault is set.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
FUEL PRESSURE SENSOR
FUEL PUMP ASSEMBLY

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR THE DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are any Fuel Pressure Sensor circuit DTCs, or 5-Volt Reference DTCs present?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. VISUALLY INSPECT THE FUEL SYSTEM FOR LEAKS OR RESTRICTIONS

1. Visually inspect the fuel system for signs of a leak or restriction.

Were any fuel system leaks or restrictions found?

Yes.

- Perform the appropriate repairs.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No.

- Go To [4](#)

4. CHECK THE FUEL DELIVERY SYSTEM FOR PROPER OPERATION

1. Perform the diagnostic procedure for CHECKING THE FUEL DELIVERY SYSTEM. Refer to [DIAGNOSIS AND TESTING](#) .

Were there any repairs made based on the results of CHECKING THE FUEL DELIVERY SYSTEM?

Yes.

- Repair is complete.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No.

- Go To [5](#)

5. REPLACE THE FUEL PRESSURE SENSOR AND RETEST FOR DTCS

1. Turn the ignition off.
2. Replace the Fuel Pressure Sensor in accordance with the Service Information. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION ENGINE SENSORS, REMOVAL AND INSTALLATION](#) .
3. Connect the component and Electronic Control Unit (ECU) harness connectors.
4. Turn the ignition on.
5. With the scan tool, erase all DTCs.
6. Turn the ignition off for a minimum of 10.0 seconds.
7. Turn the ignition on.
8. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
9. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the Powertrain Control Module in accordance with the Service Information. Refer to [MODULE, POWERTRAIN CONTROL \(PCM\), REMOVAL AND INSTALLATION](#) .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Replacing the faulty component repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P018C-FUEL PRESSURE SENSOR CIRCUIT LOW

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

THEORY OF OPERATION

The Powertrain Control Module (PCM) provides a 5-Volt supply to the Fuel Rail Pressure Sensor (FRPS). The PCM also provides a ground on the sensor return circuit. The Fuel Rail Pressure Sensor provides a signal to the PCM on the Fuel Rail Pressure Sensor Signal circuit. This sensor signal voltage changes based on the pressure in the fuel rail. The PCM will detect a low signal voltage at low rail pressures. The PCM will detect a high signal voltage during high rail pressure conditions.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on
- Battery voltage greater than 10.4 volts

SET CONDITION

- The Fuel Pressure Sensor signal circuit voltage is below 0.25 volts for five seconds.

DEFAULT ACTION

- The MIL is illuminated.

POSSIBLE CAUSES

Possible Causes
FUEL PRESSURE SENSOR PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
FUEL PRESSURE SENSOR PRESSURE SIGNAL CIRCUIT SHORTED TO THE FUEL PRESSURE SENSOR GROUND CIRCUIT
FUEL PRESSURE SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR THE DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCS.

Are there any 5-Volt Reference DTCS present?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. ISOLATE AND CHECK THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT FOR A SHORT TO GROUND

1. The ignition must be off when checking a circuit for continuity to ground.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the negative lead of the DVOM to a known good ground.
4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: There should be no continuity between ground and the circuit being tested.

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. ISOLATE AND CHECK THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT FOR A SHORT TO THE (K917) SENSOR GROUND CIRCUIT

1. The ignition must be off when checking for a short between circuits.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to

follow the path of the circuit.

3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: There should be no continuity between the circuits being tested.

Is there continuity between the circuits?

Yes

- Repair the short between the circuits.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CONNECT A FUSED JUMPER BETWEEN THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT AND THE (K859) 5-VOLT SUPPLY CIRCUIT AT THE FUEL PRESSURE SENSOR HARNESS CONNECTOR - VERIFY ABILITY OF THE PCM TO DETECT THE SENSOR SIGNAL CIRCUIT HIGH DTC

1. The Electronic Control Module (ECU) harness connectors must be connected to the ECU during this test step.
2. Disconnect the sensor harness connector.
3. With the ignition in the off position, connect a fused jumper between the sensor signal circuit and the 5-Volt Supply circuit at the sensor harness connector.
4. Turn the ignition on.
5. With the scan tool, read DTCs.

Does the scan tool display the SENSOR SIGNAL CIRCUIT HIGH DTC with the jumper in place?

Yes

- Replace the faulty sensor in accordance with the Service Information. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION](#) ENGINE SENSORS, REMOVAL AND INSTALLATION .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.

5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
- Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P018D-FUEL PRESSURE SENSOR CIRCUIT HIGH

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

THEORY OF OPERATION

The Powertrain Control Module (PCM) provides a 5-Volt supply to the Fuel Rail Pressure Sensor (FRPS). The PCM also provides a ground on the sensor return circuit. The Fuel Rail Pressure Sensor provides a signal to the PCM on the Fuel Rail Pressure Sensor Signal circuit. This sensor signal voltage changes based on the pressure in the fuel rail. The PCM will detect a low signal voltage at low rail pressures. The PCM will detect a high signal voltage during high rail pressure conditions.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage greater than 10.4 volts.

SET CONDITION

- The Fuel Pressure Sensor signal circuit voltage is above a calibrated threshold for a certain period of time.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
FUEL PRESSURE SENSOR PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE
FUEL PRESSURE SENSOR PRESSURE SIGNAL CIRCUIT SHORTED TO THE 5-VOLT SUPPLY CIRCUIT
FUEL PRESSURE SENSOR PRESSURE SIGNAL CIRCUIT OPEN/HIGH RESISTANCE
SENSOR GROUND OPEN/HIGH RESISTANCE
FUEL PRESSURE SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR THE DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCS.

Are there any 5-Volt Reference DTCS present?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. Disconnect the harness connector at the component of the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Turn the ignition on.
4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

NOTE: The voltage on a 5.0 volt signal or reference circuit should be between approximately 4.8 and 5.2 volts.

Is the voltage above 5.2 volts?

Yes

- Go To [4](#)

No

- Go To [5](#)

4. ISOLATE AND CHECK THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT AT THE PCM HARNESS CONNECTOR

1. The ignition must be off when performing a resistance check to find a short between circuits.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. At this time leave all in-line connectors connected. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect one lead of the DVOM to the circuit being tested at the ECU harness connector.
4. With the other lead of the DVOM probe all other circuits at the ECU harness connector.
1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: With the circuit isolated there should be no continuity between the circuit being tested and any other circuit.

Is there continuity between the circuit being tested and any other circuit?

Yes

- Repair the short between the circuits that have continuity. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors to help isolate the location of the short.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [9](#)

5. ISOLATE AND CHECK THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT FOR A SHORT TO THE (K859) 5-VOLT SUPPLY CIRCUIT

1. The ignition must be off when checking for a short between circuits.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: There should be no continuity between the circuits being tested.

Is there continuity between the circuits?

Yes

- Repair the short between the circuits.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. ISOLATE AND CHECK THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [7](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

7. ISOLATE AND CHECK THE (K917) SENSOR GROUND CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the
(special tool #10436, Adapter, GPEC Diagnostic)
to the appropriate PCM harness connector.

NOTE: The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [8](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

8. CONNECT A FUSED JUMPER BETWEEN THE FUEL PRESSURE SENSOR (K181) PRESSURE SIGNAL CIRCUIT AND THE (K917) GROUND CIRCUIT AT THE FUEL PRESSURE SENSOR HARNESS CONNECTOR - VERIFY ABILITY OF THE PCM TO DETECT THE SENSOR SIGNAL CIRCUIT LOW DTC

1. The Electronic Control Module (ECU) harness connectors must be connected to the ECU during this test step.
2. Disconnect the sensor harness connector.
3. With the ignition in the off position, connect a fused jumper between the sensor signal circuit and the sensor ground circuit at the sensor harness connector.

4. Turn the ignition on.
5. With the scan tool, read DTCs.

Does the scan tool display the SENSOR SIGNAL CIRCUIT LOW DTC with the jumper in place?

Yes

- Replace the faulty sensor in accordance with the Service Information. Refer to **ENGINE SENSORS, REMOVAL AND INSTALLATION ENGINE SENSORS, REMOVAL AND INSTALLATION**.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [2](#)

9. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the Powertrain Control Module in accordance with the Service information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION**.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .
- Test complete.

P0196-ENGINE OIL TEMPERATURE SENSOR PERFORMANCE

NO TITLE

For a complete INTAKE AIR SYSTEM wiring diagram, .

THEORY OF OPERATION

Once the Ambient Air Temperature (AAT), Intake Air Temperature (IAT), and Engine Coolant Temperature (ECT) Sensors have been evaluated the Engine Oil Temperature (EOT) Sensor can be checked. If the ambient, engine coolant, and general temperature sensor rationalities indicate valid sensor readings then the engine oil temperature rationality will assume the AAT and ECT Sensors are correct and therefore can be used to evaluate the EOT Sensor.

To determine failing status, the difference between the starting EOT and starting ECT is compared to a threshold. If the calculated difference is above the threshold, then starting EOT is compared to starting AAT. The diagnostic will check to see if a block heater is being used to determine if larger threshold values are needed. If this rationality test fails, then it is tested again using the updated value of AAT. A failure here will result in a fault being set for EOT sensor.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Engine off time greater than 480 minutes.
- Vehicle operated in closed loop mode at greater than 30 mph for more than 30 seconds.
- Battery voltage greater than 7.5 volts.

SET CONDITION

- The difference between the Engine Oil Temperature (EOT) Sensor value and either the AAT Sensor or ECT Sensor values is greater than 15B°C (27B°F).

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
HIGH RESISTANCE IN THE EOT SENSOR PRESSURE SIGNAL CIRCUIT
HIGH RESISTANCE IN THE SENSOR GROUND CIRCUIT
ENGINE OIL TEMPERATURE (EOT) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding.
Refer to .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition off.

2. Allow the vehicle to sit with the ignition off in an environment where the temperature is consistent and above -7B°C (19.4B°F) until the engine coolant temperature is equal to ambient temperature.
3. Turn the ignition on.
4. With the scan tool, compare the EOT Sensor value to the AAT and ECT Sensor values.

Is the EOT Sensor value within 15B°C (27B°F) of the other sensor values?

Yes

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

No

- Go To [2](#)

2. ISOLATE AND CHECK THE EOT SENSOR (G224) TEMP SIGNAL CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION:

Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the
(special tool #10436, Adapter, GPEC Diagnostic)
to the appropriate PCM harness connector.

NOTE:

The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [3](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

3. ISOLATE AND CHECK THE (K900) SENSOR GROUND CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow

the path of the circuit.

3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [4](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

4. CHECK THE ABILITY OF THE PCM TO READ THE EOT SENSOR SIGNAL

1. Turn the ignition off.
2. Reconnect the PCM C2 harness connector.
3. Turn the ignition on.
4. With the scan tool, read the Engine Oil Temperature Sensor voltage.

NOTE: The P0198-ENGINE OIL TEMPERATURE SENSOR CIRCUIT HIGH DTC should display as active or pending with the harness connector disconnected.

5. Connect a jumper between the EOT (G224) Temp Signal circuit and the Sensor Ground circuit at the Engine Oil Temperature Sensor harness connector.

NOTE: The P0197-ENGINE OIL TEMPERATURE SENSOR CIRCUIT LOW DTC should display as active or pending with the jumper in place.

Does the scan tool display as described above?

Yes

- Verify that there is good pin to terminal contact in the Engine Oil Temperature Sensor and Powertrain Control Module connectors. Replace the Engine Oil Temperature Sensor if no problems were found with the connectors. Refer to [ENGINE SENSORS, REMOVAL AND INSTALLATION](#) ENGINE SENSORS, REMOVAL AND INSTALLATION .

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0197-ENGINE OIL TEMPERATURE SENSOR CIRCUIT LOW

NO TITLE

For a complete INTAKE AIR SYSTEM wiring diagram, .

THEORY OF OPERATION

The Engine Oil Temperature (EOT) Sensor is a variable resistor that measures the temperature of the engine oil. It operates as a typical two wire sensor. The Powertrain Control Module (PCM) supplies the sensor with a 5-Volt reference and a sensor ground circuit. For the EOT Sensor diagnostic, the PCM internally monitors the voltage on the signal circuit, which is converted into a temperature reading. When the oil temperature is low, the sensor resistance is high. When the oil temperature is high, the sensor resistance is low.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage greater than 10.4 volts.

SET CONDITION

- The Engine Oil Temperature (EOT) Sensor circuit voltage is below 0.10 - 0.15 volts depending on calibration for 0.05 seconds.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
EOT SENSOR TEMP SIGNAL CIRCUIT SHORTED TO GROUND
EOT SENSOR TEMP SIGNAL CIRCUIT SHORTED TO THE SENSOR GROUND
ENGINE OIL TEMPERATURE (EOT) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCS in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCS.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCS.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. DISCONNECT THE EOT SENSOR HARNESS CONNECTOR AND VERIFY THE ABILITY OF THE PCM TO READ THE SENSOR SIGNAL HIGH DTC

1. The Electronic Control Unit (ECU) harness connectors must be connected to the ECU during this test step.
2. With the ignition in the off position, disconnect the sensor harness connector.
3. Turn the ignition on.
4. With the scan tool, read DTCs.

Does the scan tool display the SENSOR SIGNAL CIRCUIT HIGH DTC with the connector disconnected?

Yes

- Verify that there is good pin to terminal contact in the Engine Oil Temperature Sensor and Powertrain Control Module connectors. Replace the Engine Oil Temperature Sensor if no problems were found with the connectors. Refer to [ENGINE SENSORS , REMOVAL AND INSTALLATION](#) [ENGINE SENSORS , REMOVAL AND INSTALLATION](#) .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [3](#)

3. ISOLATE AND CHECK THE EOT SENSOR (G224) TEMP SIGNAL CIRCUIT FOR A SHORT TO GROUND

1. The ignition must be off when checking a circuit for continuity to ground.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the negative lead of the DVOM to a known good ground.
4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

CAUTION:

Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE:

There should be no continuity between ground and the circuit being tested.

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. ISOLATE AND CHECK THE EOT SENSOR (G224) TEMP SIGNAL CIRCUIT FOR A SHORT TO THE (K900) SENSOR GROUND CIRCUIT

1. The ignition must be off when checking for a short between circuits.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: There should be no continuity between the circuits being tested.

Is there continuity between the circuits?

Yes

- Repair the short between the circuits.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.

7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0198-ENGINE OIL TEMPERATURE SENSOR CIRCUIT HIGH

NO TITLE

For a complete INTAKE AIR SYSTEM wiring diagram, .

THEORY OF OPERATION

The Engine Oil Temperature (EOT) Sensor is a variable resistor that measures the temperature of the engine oil. It operates as a typical two wire sensor. The Powertrain Control Module (PCM) supplies the sensor with a 5-Volt reference and a sensor ground circuit. For the EOT Sensor diagnostic, the PCM internally monitors the voltage on the signal circuit, which is converted into a temperature reading. When the oil temperature is low, the sensor resistance is high. When the oil temperature is high, the sensor resistance is low.

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage greater than 10.4 volts.

SET CONDITION

- The Engine Oil Temperature (EOT) Sensor circuit voltage is above 4.9 - 4.95 volts depending on calibration for 0.05 seconds.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
EOT SENSOR TEMP SIGNAL CIRCUIT SHORTED TO VOLTAGE
EOT SENSOR TEMP SIGNAL CIRCUIT OPEN/HIGH RESISTANCE
SENSOR GROUND CIRCUIT OPEN/HIGH RESISTANCE

Possible Causes
ENGINE OIL TEMPERATURE (EOT) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK THE EOT SENSOR (G224) TEMP SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. Disconnect the harness connector at the component of the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Turn the ignition on.
4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

NOTE: The voltage on a 5.0 volt signal or reference circuit should be between approximately 4.8 and 5.2 volts.

Is the voltage above 5.2 volts?

Yes

- Go To [3](#)

No

- Go To [4](#)

3. ISOLATE AND CHECK THE EOT SENSOR (G224) TEMP SIGNAL CIRCUIT FOR A SHORT TO ANOTHER CIRCUIT AT THE PCM HARNESS CONNECTOR

1. The ignition must be off when performing a resistance check to find a short between circuits.

2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. At this time leave all in-line connectors connected. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect one lead of the DVOM to the circuit being tested at the ECU harness connector.
4. With the other lead of the DVOM probe all other circuits at the ECU harness connector.
1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: With the circuit isolated there should be no continuity between the circuit being tested and any other circuit.

Is there continuity between the circuit being tested and any other circuit?

Yes

- Repair the short between the circuits that have continuity. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors to help isolate the location of the short.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. ISOLATE AND CHECK THE EOT SENSOR (G224) TEMP SIGNAL CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [5](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

5. ISOLATE AND CHECK THE (K900) SENSOR GROUND CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the
(special tool #10436, Adapter, GPEC Diagnostic)
to the appropriate PCM harness connector.

NOTE: The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [6](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

6. CONNECT A FUSED JUMPER BETWEEN THE EOT SENSOR (G224) TEMP SIGNAL CIRCUIT AND THE (K900) SENSOR GROUND CIRCUIT AT THE EOT SENSOR HARNESS CONNECTOR - VERIFY ABILITY OF THE PCM TO DETECT THE SENSOR SIGNAL CIRCUIT LOW DTC

1. The Electronic Control Unit (ECU) harness connectors must be connected to the ECU during this test step.
2. Disconnect the sensor harness connector.
3. With the ignition in the off position, connect a fused jumper between the sensor signal circuit and the sensor ground circuit at the sensor harness connector.
4. Turn the ignition on.
5. With the scan tool, read DTCs.

Does the scan tool display the SENSOR SIGNAL CIRCUIT LOW DTC with the jumper in place?

Yes

- Verify that there is good pin to terminal contact in the Engine Oil Temperature Sensor and Powertrain Control Module connectors. Replace the Engine Oil Temperature Sensor if no problems were found with the connectors. Refer to **ENGINE SENSORS, REMOVAL AND INSTALLATION ENGINE SENSORS, REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0201-FUEL INJECTOR 1 CIRCUIT/OPEN

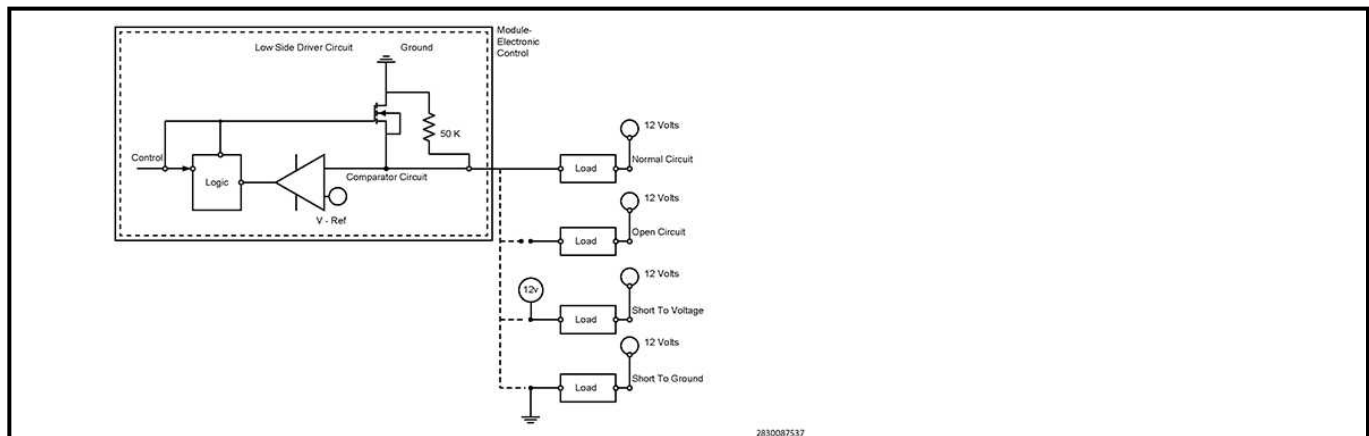
COMPONENT FUNCTIONAL DESCRIPTION-FUEL INJECTORS

The Fuel Injector is a solenoid that is supplied Battery voltage, typically from the Automatic Shut Down (ASD) Relay, and a ground path through a Pulse Width Modulated (PWM) Low Side Driver (LSD) controlled by the Powertrain Control Module (PCM). Each injector receives a unique pulse width based on that cylinder's fuel requirements. The PCM determines this fuel requirement by monitoring engine operating parameters through various sensors and calculating the appropriate amount of fuel to inject. The optimum amount of injected fuel depends on conditions such as engine and ambient temperatures, engine speed and workload, and exhaust gas composition.

Typical Low Side Driver Operation and Fault Detection: This type of driver circuit is generally used for relay control, solenoid control or a similar type of driver device. The PCM provides a ground to operate the device when switched on. The ground could be constant or Pulse Width Modulated (PWM). The PCM also provides fault detection for the device, wiring and internal driver. Fault detection can be done by monitoring voltage on the circuit, current draw, or a combination of both. For diagnostic purposes the PCM uses an internal pull down diagnostic resistor connected in series and a voltage reference (V-Ref) comparator for fault detection:

- **Circuit Open and Circuit Low Detection:** The PCM monitors for an **open circuit** and **short to ground** when the driver is switched off. When switched off, the available voltage passes through the device and the **internal pull down resistor** connected in series. The voltage at the **comparator circuit** should be close to Battery voltage since the majority of the voltage drop occurs through the diagnostic resistor. If the available voltage is less than the V-Ref, a fault is set. In this scenario the V-Ref would be slightly below Battery voltage. **An alternative method of fault detection for an open or short to ground** that is used is to monitor current draw when the internal driver is switched on. If the module does not detect any current draw it determines that the component or circuitry is open. Excessive current draw detected would indicate a short to ground.
- **Circuit High Detection:** The PCM monitors for a **short to voltage** when the driver is switched on. When the driver is switched on providing a path to ground through the transistor, the available voltage should be pulled low, near zero volts since the **comparator circuit** is monitoring the ground side of the device. If the voltage is greater than V-Ref, a fault is detected. In this scenario V-Ref would be slightly above zero volts.

NOTE: A load that has a resistance that is below manufacturer specification, or a second load device shorted to the low side driver circuit can cause excessive current draw on the internal driver. The driver will be switched off to protect against overheating and damaging the driver. In this instance the Circuit High fault may be detected because the available voltage on the comparator circuit is above V-Ref.



TECHNICAL DATA-FUEL INJECTORS

The specifications listed below are for typical Fuel Injectors used on low pressure fuel systems:

FUEL INJECTOR TECHNICAL SPECIFICATIONS	
Fuel Injector resistance	Typically between 9.0 and 18.0 Ohms. The resistance in a winding will vary with temperature. When checking a Fuel Injector coil it is good practice to compare the resistance of the suspect injector with the other known good injectors. Typically, the difference should be less than 10% between the injectors.
Fuel Injector current draw	Peak amperage draw will typically be around 1.0 amp when energized

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage is above 10.9 volts.
- Engine speed is below 3000 rpm.
- The ASD/Main relay is energized supplying power to the Fuel Injector.

SET CONDITION

- The PCM monitors the continuity of the Fuel Injector circuitry as well as the inductive voltage spike created by the collapse of the magnetic field in the coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
OPEN OR HIGH RESISTANCE IN THE 12 VOLT SUPPLY TO THE FUEL INJECTOR OPEN OR HIGH RESISTANCE IN THE FUEL INJECTOR CONTROL CIRCUIT SHORT TO GROUND IN THE FUEL INJECTOR CONTROL CIRCUIT FUEL INJECTOR COIL OPEN OR SHORT ACROSS THE COIL (RESISTANCE TOO HIGH OR TOO LOW) FUEL INJECTOR PINTLE STICKING MECHANICALLY FAULTY DRIVER INSIDE THE PCM

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC OVERVIEW-FUEL INJECTOR

PCM DIAGNOSTIC OVERVIEW: The Powertrain Control Module (PCM) monitors the inductive voltage spike, or fly back voltage created by the collapse of the magnetic field in the injector coil. This allows the Battery supply circuit, injector coil and control circuit to be monitored for electrical faults.

The wiring and components can be tested individually, or the entire system can be tested using a multi-channel scope. Regardless of the chosen test method, the following checks should be performed during diagnostics:

1. Verify that the Battery supply to the Fuel Injector is present and is capable of operating a load.
2. Verify the control circuit is not open or shorted to ground.
3. Verify that the Fuel Injector coil is not open or shorted across the coil. Low resistance in the Fuel Injector coil will cause excessive current draw causing the PCM to turn off the driver for self-protection.
4. Verify that the PCM internal Low Side Driver (LSD) is functioning properly.

COMPONENT RATIONALITY DIAGNOSTIC OVERVIEW: A circuit fault against a component, or a sensor being used to monitor the system should be diagnosed before a rationality fault. Component and system rationality diagnostics are typically designed to detect a mechanical failure in a solenoid, motor, actuator or an overall system performance issue. However, do not assume that the wiring or circuits to the component are always good if you do not have a circuit fault. For example, a few Ohms of resistance in the power supply, control or ground circuit in a harness connector to a component could cause the component not to energize when commanded on and set a rationality or performance fault instead of a circuit fault. Rationality faults are often designed as a catch all for any failure that could be missed in other diagnostics. It is always a good practice to learn and understand how the rationality diagnostics are performed and the faults are detected by the ECU. Then check the connectors and circuits for any wiring issues (opens, resistance or shorted circuits) that could have caused the rationality failure, like a stuck on or stuck off solenoid, before replacing any components.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. The DTC may be stored because the diagnostic has not run during the current ignition cycle. Review the scan tool Freeze Frame Data, along with the When Monitored and Set Conditions, and attempt to operate the vehicle or system in the similar conditions to allow the diagnostic to run. Some diagnostics may not be easily duplicate, such as some temperature sensor rationality diagnostics which require extended cold soaks. Other diagnostics may require several environmental conditions or extensive enable conditions difficult to duplicate. For these cases it may be best to simply check for proper operation of the components or systems to verify if failure mode is present before attempting to diagnose the system.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply check for connection issues by wiggle testing any wiring harness the circuitry passes through. A good practice is to watch for a DTC to become active or scan tool data to change. An even better method is to attach the Mopar Scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor Battery system voltage or poor ground connections can affect systems in different or odd ways. Check the Battery or Batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.
4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving.

Intermittent testing for a sensor circuit low/high fault with the Mopar Scope:

1. Back probe and connect the scope lead to the sensor signal circuit.
2. Monitor the circuit voltage while wiggle testing the wiring harness.
3. If you are not able to monitor the scope signal voltage during wiggle testing, set up a trigger to catch an intermittent condition. Set the trigger for voltage above 4.9 volts for an intermittent circuit high fault or below 0.1 volts for a circuit low fault.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

DIAGNOSTIC TEST-TESTING THE ENTIRE FUEL INJECTOR CIRCUITRY USING A LAB SCOPE (PREFERRED METHOD):

Testing fuel injectors with a lab scope can effectively test the entire electrical path for opens or high resistance. It can also help in determining if the fuel injectors pintle is mechanically sticking and not moving.

CONNECTING THE LAB SCOPE:

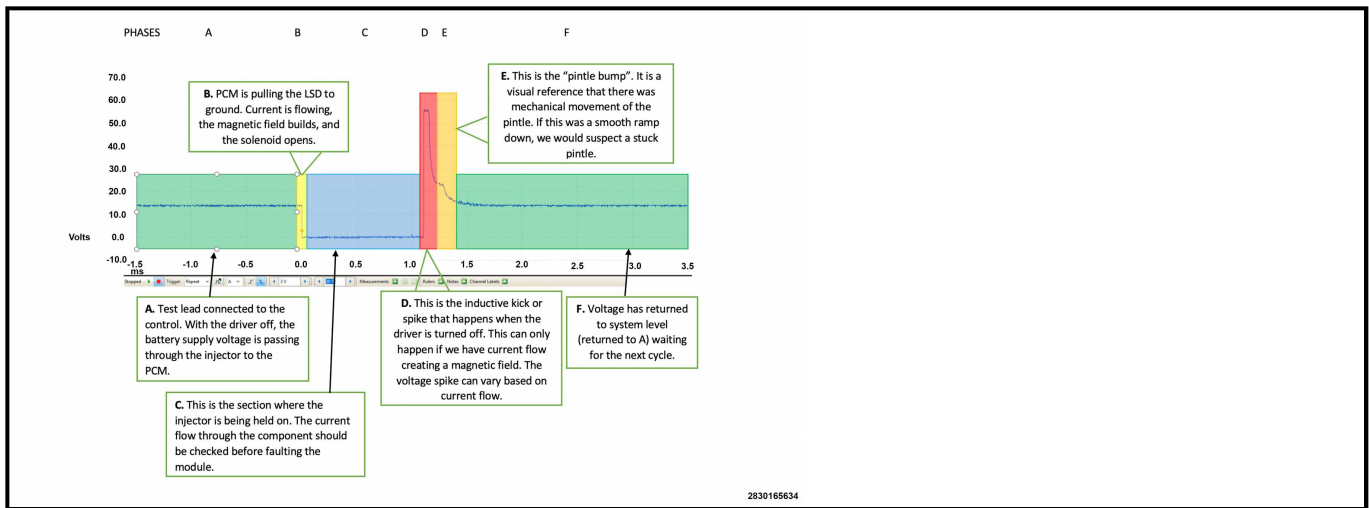
To effectively check the entire path, the scope should be connected to monitor the battery supply circuit voltage, fuel injector control circuit voltage, and current draw.

1. Connect the scope lead from channel A to the battery supply voltage circuit.
2. Connect the scope lead from channel B to the fuel injector control circuit.
3. Connect the amp clamp from channel C to the battery supply voltage circuit.

Shown below is a typical fuel injector cycle broken into phases. It may be helpful to perform the same checks on another fuel injector and record for comparison. This can give a good reference for the expected current draw and inductive spike (kick) voltage range when analyzing the fuel injector being tested.

Below is a description of possible failure modes that can be detected during each phase:

- **PHASE A** - If battery voltage **is not present** on the fuel injector control circuit (channel B) with the fuel injector off it shows that there is a blatant open in the path. If battery voltage **is present** on the battery supply circuit (channel A), it would indicate an open fuel injector coil.
- **PHASE B/C** - This is where the driver is pulled and held low, energizing the fuel injector. If the voltage reading on the control circuit is not pulled near zero it would indicate resistance in the control circuit path (all of the voltage should be used up by the fuel injector). If the voltage drops low and then quickly ramps back toward battery voltage it could indicate that there is too much current flow and the driver was turned off for protection, or the LSD is failing. During phase C the current should build to peak amperage of approximately 1.0 amp if the circuitry is good.
 - The voltage at the battery supply circuit (channel A) should remain constant throughout. If the supply voltage drops when the fuel injector is energized it would indicate resistance in the battery supply circuit.
- **PHASE D** - If resistance is detected in either of the circuits during the previous phases it can impact the inductive voltage spike when the fuel injector is turned off. This can also be seen in the amperage draw on the circuit. Higher resistance will reduce the amperage draw and inductive kick.
- **PHASE E** - If the voltage ramps down smoothly without the pintle bump it would indicate a stuck pintle inside the fuel injector.
- **PHASE F** - This is the same as Phase A. Fuel injector is off waiting for next actuation.



DIAGNOSTIC TEST-TESTING A FUEL INJECTOR USING A DVOM

1. Test methods for checking the Battery supply to the Fuel Injector:

- (Recommended method) The voltage supply to the Fuel Injector can be checked by load testing the circuit using the recommended circuit load test tool or equivalent. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **STANDARD PROCEDURE**.
- Probe the battery supply circuit using 12-volt test light connected to ground.
- Back probe and monitor the voltage on the supply circuit at the Fuel Injector. The meter should read constant battery voltage when the Fuel Injector is being commanded on and off. If there is resistance in the circuit the voltage will drop when the Fuel Injector is energized.

2. Test methods for checking the Fuel Injector Control circuit:

- The control circuit should be isolated and checked for an open and a short to ground. The circuit can be checked using an Ohmmeter to check continuity in the circuit and checking for continuity to ground.
- The circuit can be isolated and checked for resistance or short to ground using the recommended load test tool. Refer to **STANDARD PROCEDURE**.

3. Test method for checking the Fuel Injector:

- The Fuel Injector coil resistance can be measured and compared to the other Fuel Injectors if the technical data is not available. The resistance value should be within 10% of the other Fuel Injector coil resistance values. This only checks the Fuel Injector electrically. It does not verify that the injector is operating mechanically. That can only be checked with the lab scope.

4. Test method for checking the PCM driver:

- If there is an actuator function for the driver circuit on the scan tool, back probe and measure the voltage on the control circuit at the Fuel Injector while actuating the driver circuit. There should be Battery voltage present when the driver is off and no voltage on the control circuit when the driver is on. This should be checked after the rest Battery supply and control circuits both check good. If the circuits tested good, and the voltage is not cycling on and off with the driver actuation, the PCM is most likely faulty.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

- Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
- After repairs are complete, erase all DTCs with the scan tool.
- Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in

the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Marelli Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P0202-FUEL INJECTOR 2 CIRCUIT/OPEN

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

COMPONENT FUNCTIONAL DESCRIPTION-FUEL INJECTORS

The Fuel Injector is a solenoid that is supplied Battery voltage, typically from the Automatic Shut Down (ASD) Relay, and a ground path through a Pulse Width Modulated (PWM) Low Side Driver (LSD) controlled by the Powertrain Control Module (PCM). Each injector receives a unique pulse width based on that cylinder's fuel requirements. The PCM determines this fuel requirement by monitoring engine operating parameters through various sensors and calculating the appropriate amount of fuel to inject. The optimum amount of injected fuel depends on conditions such as engine and ambient temperatures, engine speed and workload, and exhaust gas composition.

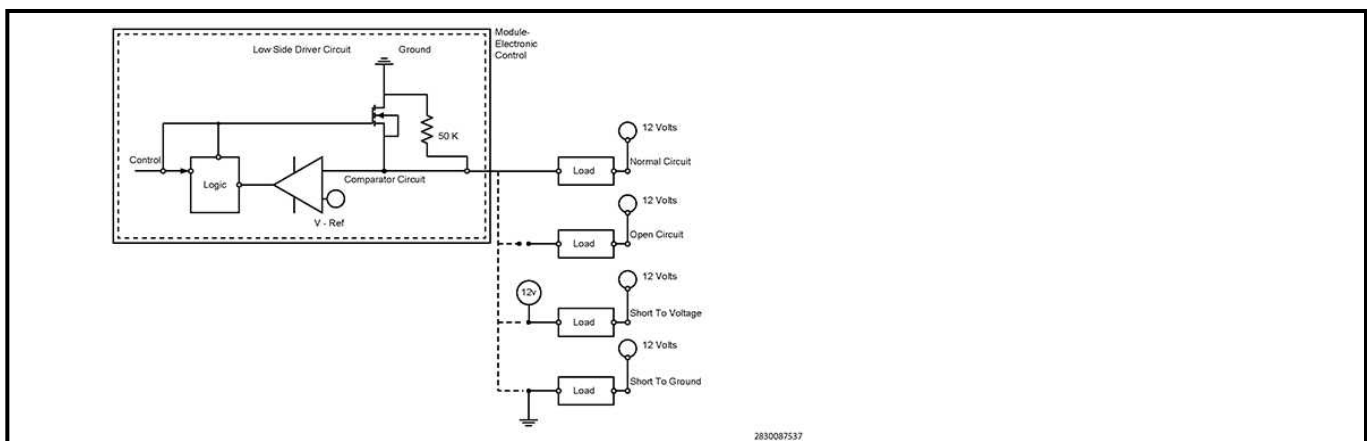
Typical Low Side Driver Operation and Fault Detection: This type of driver circuit is generally used for relay control, solenoid control or a similar type of driver device. The PCM provides a ground to operate the device when switched on. The ground could be constant or Pulse Width Modulated (PWM). The PCM also provides fault detection for the device, wiring and internal driver. Fault detection can be done by monitoring voltage on the circuit, current draw, or a combination of both. For diagnostic purposes the PCM uses an internal pull down diagnostic resistor connected in series and a voltage reference (V-Ref) comparator for fault detection:

- **Circuit Open and Circuit Low Detection:** The PCM monitors for an **open circuit** and **short to ground** when the driver is switched off. When switched off, the available voltage passes through the device and

the **internal pull down resistor** connected in series. The voltage at the **comparator circuit** should be close to Battery voltage since the majority of the voltage drop occurs through the diagnostic resistor. If the available voltage is less than the V-Ref, a fault is set. In this scenario the V-Ref would be slightly below Battery voltage. **An alternative method of fault detection for an open or short to ground** that is used is to monitor current draw when the internal driver is switched on. If the module does not detect any current draw it determines that the component or circuitry is open. Excessive current draw detected would indicate a short to ground.

- **Circuit High Detection:** The PCM monitors for a **short to voltage** when the driver is switched on. When the driver is switched on providing a path to ground through the transistor, the available voltage should be pulled low, near zero volts since the **comparator circuit** is monitoring the ground side of the device. If the voltage is greater than V-Ref, a fault is detected. In this scenario V-Ref would be slightly above zero volts.

NOTE: A load that has a resistance that is below manufacturer specification, or a second load device shorted to the low side driver circuit can cause excessive current draw on the internal driver. The driver will be switched off to protect against overheating and damaging the driver. In this instance the Circuit High fault may be detected because the available voltage on the comparator circuit is above V-Ref.



TECHNICAL DATA-FUEL INJECTORS

The specifications listed below are for typical Fuel Injectors used on low pressure fuel systems:

FUEL INJECTOR TECHNICAL SPECIFICATIONS	
Fuel Injector resistance	Typically between 9.0 and 18.0 Ohms. The resistance in a winding will vary with temperature. When checking a Fuel Injector coil it is good practice to compare the resistance of the suspect injector with the other known good injectors. Typically, the difference should be less than 10% between the injectors.
Fuel Injector current draw	Peak amperage draw will typically be around 1.0 amp when energized

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage is above 10.9 volts.
- Engine speed is below 3000 rpm.
- The ASD/Main relay is energized supplying power to the Fuel Injector.

SET CONDITION

- The PCM monitors the continuity of the Fuel Injector circuitry as well as the inductive voltage spike created by the collapse of the magnetic field in the coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
OPEN OR HIGH RESISTANCE IN THE 12 VOLT SUPPLY TO THE FUEL INJECTOR
OPEN OR HIGH RESISTANCE IN THE FUEL INJECTOR CONTROL CIRCUIT
SHORT TO GROUND IN THE FUEL INJECTOR CONTROL CIRCUIT
FUEL INJECTOR COIL OPEN OR SHORT ACROSS THE COIL (RESISTANCE TOO HIGH OR TOO LOW)
FUEL INJECTOR PINTLE STICKING MECHANICALLY
FAULTY DRIVER INSIDE THE PCM

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC OVERVIEW-FUEL INJECTOR

PCM DIAGNOSTIC OVERVIEW: The Powertrain Control Module (PCM) monitors the inductive voltage spike, or fly back voltage created by the collapse of the magnetic field in the injector coil. This allows the Battery supply circuit, injector coil and control circuit to be monitored for electrical faults.

The wiring and components can be tested individually, or the entire system can be tested using a multi-channel scope. Regardless of the chosen test method, the following checks should be performed during diagnostics:

1. Verify that the Battery supply to the Fuel Injector is present and is capable of operating a load.
2. Verify the control circuit is not open or shorted to ground.
3. Verify that the Fuel Injector coil is not open or shorted across the coil. Low resistance in the Fuel Injector coil will cause excessive current draw causing the PCM to turn off the driver for self-protection.
4. Verify that the PCM internal Low Side Driver (LSD) is functioning properly.

COMPONENT RATIONALITY DIAGNOSTIC OVERVIEW: A circuit fault against a component, or a sensor being used to monitor the system should be diagnosed before a rationality fault. Component and system rationality diagnostics are typically designed to detect a mechanical failure in a solenoid, motor, actuator or an overall system performance issue. However, do not assume that the wiring or circuits to the component are always good if you do not have a circuit fault. For example, a few Ohms of resistance in the power supply, control or ground circuit in a harness connector to a component could cause the component not to energize when commanded on and set a rationality or performance fault instead of a circuit fault. Rationality faults are often designed as a catch all for any failure that could be missed in other diagnostics. It is always a good practice to learn and understand how the rationality diagnostics are performed and the faults are detected by the ECU. Then check the connectors and circuits for any wiring issues (opens, resistance or shorted circuits) that could have caused the rationality failure, like a stuck on or stuck off solenoid, before replacing any components.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. The DTC may be stored because the diagnostic has not run during the current ignition cycle. Review the scan tool Freeze Frame Data, along with the When Monitored and Set Conditions, and attempt to operate the vehicle or system in the similar conditions to allow the diagnostic to run. Some diagnostics may not be easily duplicate, such as some temperature sensor rationality diagnostics which require extended cold soaks. Other diagnostics may require several environmental conditions or extensive enable conditions difficult to duplicate. For these cases it may be best to simply check for proper operation of the components or systems to verify if failure mode is present before attempting to diagnose the system.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply check for connection issues by wiggle testing any wiring harness the circuitry passes through. A good practice is too watch for a DTC to become active or scan tool data to change. An even better method is to attach the Mopar Scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor Battery system voltage or poor ground connections can affect systems in different or odd ways. Check the Battery or Batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.
4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving.

Intermittent testing for a sensor circuit low/high fault with the Mopar Scope:

1. Back probe and connect the scope lead to the sensor signal circuit.
2. Monitor the circuit voltage while wiggle testing the wiring harness.
3. If you are not able to monitor the scope signal voltage during wiggle testing, set up a trigger to catch an intermittent condition. Set the trigger for voltage above 4.9 volts for an intermittent circuit high fault or below 0.1 volts for a circuit low fault.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

DIAGNOSTIC TEST-TESTING THE ENTIRE FUEL INJECTOR CIRCUITRY USING A LAB SCOPE (PREFERRED METHOD):

Testing fuel injectors with a lab scope can effectively test the entire electrical path for opens or high resistance. It can also help in determining if the fuel injectors pintle is mechanically sticking and not moving.

CONNECTING THE LAB SCOPE:

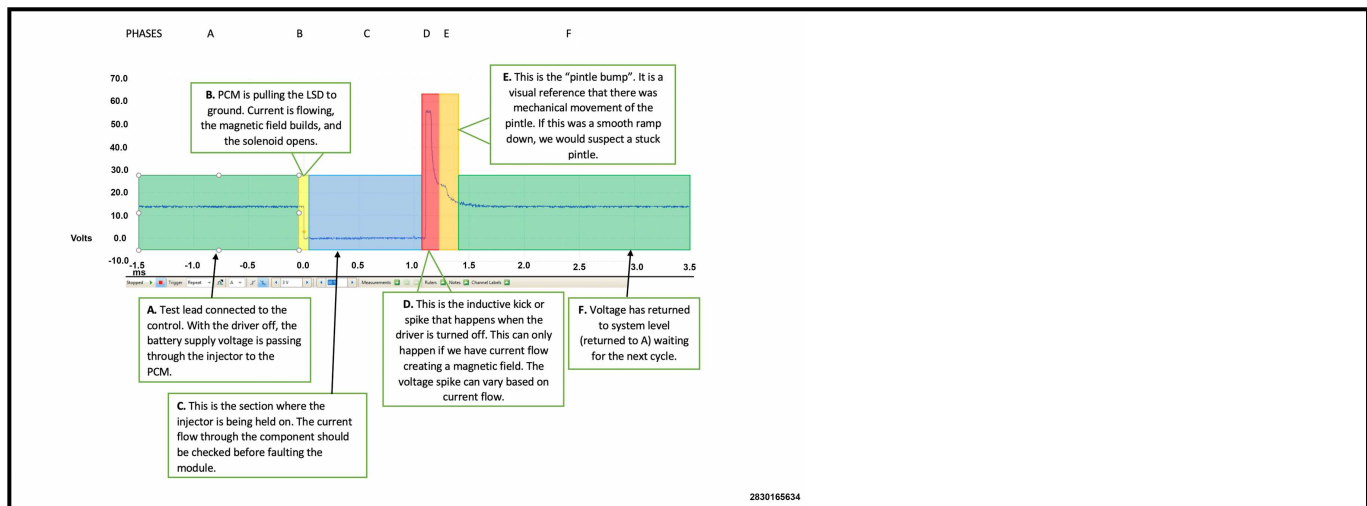
To effectively check the entire path, the scope should be connected to monitor the battery supply circuit voltage, fuel injector control circuit voltage, and current draw.

1. Connect the scope lead from channel A to the battery supply voltage circuit.
2. Connect the scope lead from channel B to the fuel injector control circuit.
3. Connect the amp clamp from channel C to the battery supply voltage circuit.

Shown below is a typical fuel injector cycle broken into phases. It may be helpful to perform the same checks on another fuel injector and record for comparison. This can give a good reference for the expected current draw and inductive spike (kick) voltage range when analyzing the fuel injector being tested.

Below is a description of possible failure modes that can be detected during each phase:

- **PHASE A** - If battery voltage **is not present** on the fuel injector control circuit (channel B) with the fuel injector off it shows that there is a blatant open in the path. If battery voltage **is present** on the battery supply circuit (channel A), it would indicate an open fuel injector coil.
- **PHASE B/C** - This is where the driver is pulled and held low, energizing the fuel injector. If the voltage reading on the control circuit is not pulled near zero it would indicate resistance in the control circuit path (all of the voltage should be used up by the fuel injector). If the voltage drops low and then quickly ramps back toward battery voltage it could indicate that there is too much current flow and the driver was turned off for protection, or the LSD is failing. During phase C the current should build to peak amperage of approximately 1.0 amp if the circuitry is good.
 - The voltage at the battery supply circuit (channel A) should remain constant throughout. If the supply voltage drops when the fuel injector is energized it would indicate resistance in the battery supply circuit.
- **PHASE D** - If resistance is detected in either of the circuits during the previous phases it can impact the inductive voltage spike when the fuel injector is turned off. This can also be seen in the amperage draw on the circuit. Higher resistance will reduce the amperage draw and inductive kick.
- **PHASE E** - If the voltage ramps down smoothly without the pintle bump it would indicate a stuck pintle inside the fuel injector.
- **PHASE F** - This is the same as Phase A. Fuel injector is off waiting for next actuation.



DIAGNOSTIC TEST-TESTING A FUEL INJECTOR USING A DVOM

1. Test methods for checking the Battery supply to the Fuel Injector:

1. (Recommended method) The voltage supply to the Fuel Injector can be checked by load testing the circuit using the recommended circuit load test tool or equivalent. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **STANDARD PROCEDURE**.
2. Probe the battery supply circuit using 12-volt test light connected to ground.
3. Back probe and monitor the voltage on the supply circuit at the Fuel Injector. The meter should read constant battery voltage when the Fuel Injector is being commanded on and off. If there is

resistance in the circuit the voltage will drop when the Fuel Injector is energized.

2. Test methods for checking the Fuel Injector Control circuit:

1. The control circuit should be isolated and checked for an open and a short to ground. The circuit can be checked using an Ohmmeter to check continuity in the circuit and checking for continuity to ground.
2. The circuit can be isolated and checked for resistance or short to ground using the recommended load test tool. Refer to **STANDARD PROCEDURE** .

3. Test method for checking the Fuel Injector:

1. The Fuel Injector coil resistance can be measured and compared to the other Fuel Injectors if the technical data is not available. The resistance value should be within 10% of the other Fuel Injector coil resistance values. This only checks the Fuel Injector electrically. It does not verify that the injector is operating mechanically. That can only be checked with the lab scope.

4. Test method for checking the PCM driver:

1. If there is an actuator function for the driver circuit on the scan tool, back probe and measure the voltage on the control circuit at the Fuel Injector while actuating the driver circuit. There should be Battery voltage present when the driver is off and no voltage on the control circuit when the driver is on. This should be checked after the rest Battery supply and control circuits both check good. If the circuits tested good, and the voltage is not cycling on and off with the driver actuation, the PCM is most likely faulty.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.

5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P0203-FUEL INJECTOR 3 CIRCUIT/OPEN

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

COMPONENT FUNCTIONAL DESCRIPTION-FUEL INJECTORS

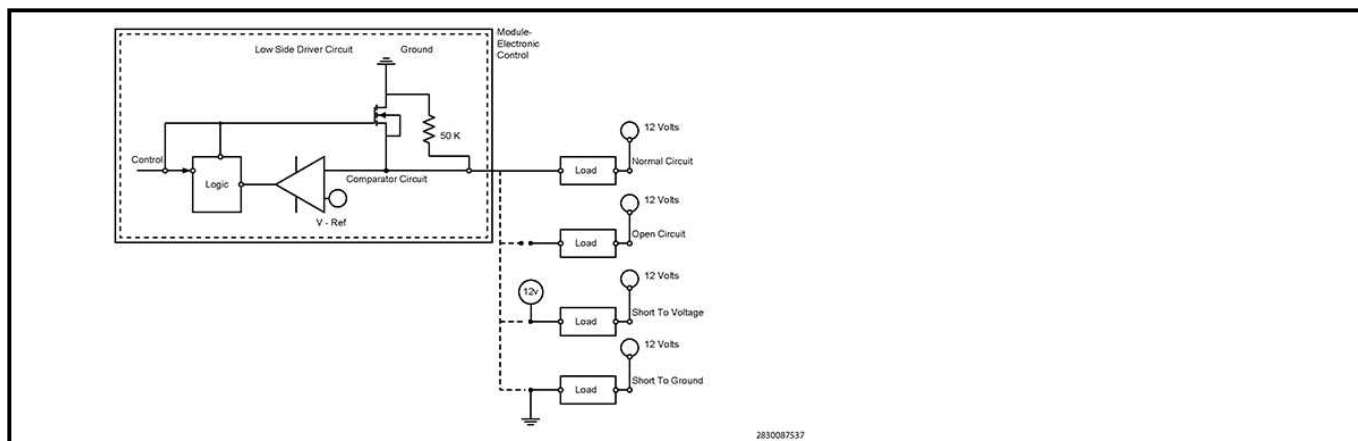
The Fuel Injector is a solenoid that is supplied Battery voltage, typically from the Automatic Shut Down (ASD) Relay, and a ground path through a Pulse Width Modulated (PWM) Low Side Driver (LSD) controlled by the Powertrain Control Module (PCM). Each injector receives a unique pulse width based on that cylinder's fuel requirements. The PCM determines this fuel requirement by monitoring engine operating parameters through various sensors and calculating the appropriate amount of fuel to inject. The optimum amount of injected fuel depends on conditions such as engine and ambient temperatures, engine speed and workload, and exhaust gas composition.

Typical Low Side Driver Operation and Fault Detection: This type of driver circuit is generally used for relay control, solenoid control or a similar type of driver device. The PCM provides a ground to operate the device when switched on. The ground could be constant or Pulse Width Modulated (PWM). The PCM also provides fault detection for the device, wiring and internal driver. Fault detection can be done by monitoring voltage on the circuit, current draw, or a combination of both. For diagnostic purposes the PCM uses an internal pull down diagnostic resistor connected in series and a voltage reference (V-Ref) comparator for fault detection:

- **Circuit Open and Circuit Low Detection:** The PCM monitors for an **open circuit** and **short to ground** when the driver is switched off. When switched off, the available voltage passes through the device and the **internal pull down resistor** connected in series. The voltage at the **comparator circuit** should be close to Battery voltage since the majority of the voltage drop occurs through the diagnostic resistor. If the available voltage is less than the V-Ref, a fault is set. In this scenario the V-Ref would be slightly below Battery voltage. **An alternative method of fault detection for an open or short to ground** that is used is to monitor current draw when the internal driver is switched on. If the module does not detect any current draw it determines that the component or circuitry is open. Excessive current draw detected would indicate a short to ground.
- **Circuit High Detection:** The PCM monitors for a **short to voltage** when the driver is switched on. When the driver is switched on providing a path to ground through the transistor, the available voltage should be pulled low, near zero volts since the **comparator circuit** is monitoring the ground side of the device. If the voltage is greater than V-Ref, a fault is detected. In this scenario V-Ref would be slightly above zero volts.

NOTE:

A load that has a resistance that is below manufacturer specification, or a second load device shorted to the low side driver circuit can cause excessive current draw on the internal driver. The driver will be switched off to protect against overheating and damaging the driver. In this instance the Circuit High fault may be detected because the available voltage on the comparator circuit is above V-Ref.



TECHNICAL DATA-FUEL INJECTORS

The specifications listed below are for typical Fuel Injectors used on low pressure fuel systems:

FUEL INJECTOR TECHNICAL SPECIFICATIONS	
Fuel Injector resistance	Typically between 9.0 and 18.0 Ohms. The resistance in a winding will vary with temperature. When checking a Fuel Injector coil it is good practice to compare the resistance of the suspect injector with the other known good injectors. Typically, the difference should be less than 10% between the injectors.
Fuel Injector current draw	Peak amperage draw will typically be around 1.0 amp when energized

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage is above 10.9 volts.
- Engine speed is below 3000 rpm.
- The ASD/Main relay is energized supplying power to the Fuel Injector.

SET CONDITION

- The PCM monitors the continuity of the Fuel Injector circuitry as well as the inductive voltage spike created by the collapse of the magnetic field in the coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
OPEN OR HIGH RESISTANCE IN THE 12 VOLT SUPPLY TO THE FUEL INJECTOR
OPEN OR HIGH RESISTANCE IN THE FUEL INJECTOR CONTROL CIRCUIT
SHORT TO GROUND IN THE FUEL INJECTOR CONTROL CIRCUIT
FUEL INJECTOR COIL OPEN OR SHORT ACROSS THE COIL (RESISTANCE TOO HIGH OR TOO LOW)
FUEL INJECTOR PINTLE STICKING MECHANICALLY
FAULTY DRIVER INSIDE THE PCM

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to .

DIAGNOSTIC OVERVIEW-FUEL INJECTOR

PCM DIAGNOSTIC OVERVIEW: The Powertrain Control Module (PCM) monitors the inductive voltage spike, or fly back voltage created by the collapse of the magnetic field in the injector coil. This allows the Battery supply circuit, injector coil and control circuit to be monitored for electrical faults.

The wiring and components can be tested individually, or the entire system can be tested using a multi-channel scope. Regardless of the chosen test method, the following checks should be performed during diagnostics:

1. Verify that the Battery supply to the Fuel Injector is present and is capable of operating a load.
2. Verify the control circuit is not open or shorted to ground.
3. Verify that the Fuel Injector coil is not open or shorted across the coil. Low resistance in the Fuel Injector coil will cause excessive current draw causing the PCM to turn off the driver for self-protection.
4. Verify that the PCM internal Low Side Driver (LSD) is functioning properly.

COMPONENT RATIONALITY DIAGNOSTIC OVERVIEW: A circuit fault against a component, or a sensor being used to monitor the system should be diagnosed before a rationality fault. Component and system rationality diagnostics are typically designed to detect a mechanical failure in a solenoid, motor, actuator or an overall system performance issue. However, do not assume that the wiring or circuits to the component are always good if you do not have a circuit fault. For example, a few Ohms of resistance in the power supply, control or ground circuit in a harness connector to a component could cause the component not to energize when commanded on and set a rationality or performance fault instead of a circuit fault. Rationality faults are often designed as a catch all for any failure that could be missed in other diagnostics. It is always a good practice to learn and understand how the rationality diagnostics are performed and the faults are detected by the ECU. Then check the connectors and circuits for any wiring issues (opens, resistance or shorted circuits) that could have caused the rationality failure, like a stuck on or stuck off solenoid, before replacing any components.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. The DTC may be stored because the diagnostic has not run during the current ignition cycle. Review the scan tool Freeze Frame Data, along with the When Monitored and Set Conditions, and attempt to operate the vehicle or system in the similar conditions to allow the diagnostic to run. Some diagnostics may not be easily duplicate, such as some temperature sensor rationality diagnostics which require extended cold soaks. Other diagnostics may require several environmental conditions or extensive enable conditions difficult to duplicate. For these cases it may be best to simply check for proper operation of the components or systems to verify if failure mode is present before attempting to diagnose the system.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply check for connection issues by wiggle testing any wiring harness the circuitry passes through. A good practice is to watch for a DTC to become active or scan tool data to change. An even better method is to attach the Mopar Scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor Battery system voltage or poor ground connections can affect systems in different or odd ways. Check the Battery or Batteries for proper charge and operation along with proper connections. Use the

wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.

4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving.

Intermittent testing for a sensor circuit low/high fault with the Mopar Scope:

1. Back probe and connect the scope lead to the sensor signal circuit.
2. Monitor the circuit voltage while wiggle testing the wiring harness.
3. If you are not able to monitor the scope signal voltage during wiggle testing, set up a trigger to catch an intermittent condition. Set the trigger for voltage above 4.9 volts for an intermittent circuit high fault or below 0.1 volts for a circuit low fault.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

DIAGNOSTIC TEST-TESTING THE ENTIRE FUEL INJECTOR CIRCUITRY USING A LAB SCOPE (PREFERRED METHOD):

Testing fuel injectors with a lab scope can effectively test the entire electrical path for opens or high resistance. It can also help in determining if the fuel injectors pintle is mechanically sticking and not moving.

CONNECTING THE LAB SCOPE:

To effectively check the entire path, the scope should be connected to monitor the battery supply circuit voltage, fuel injector control circuit voltage, and current draw.

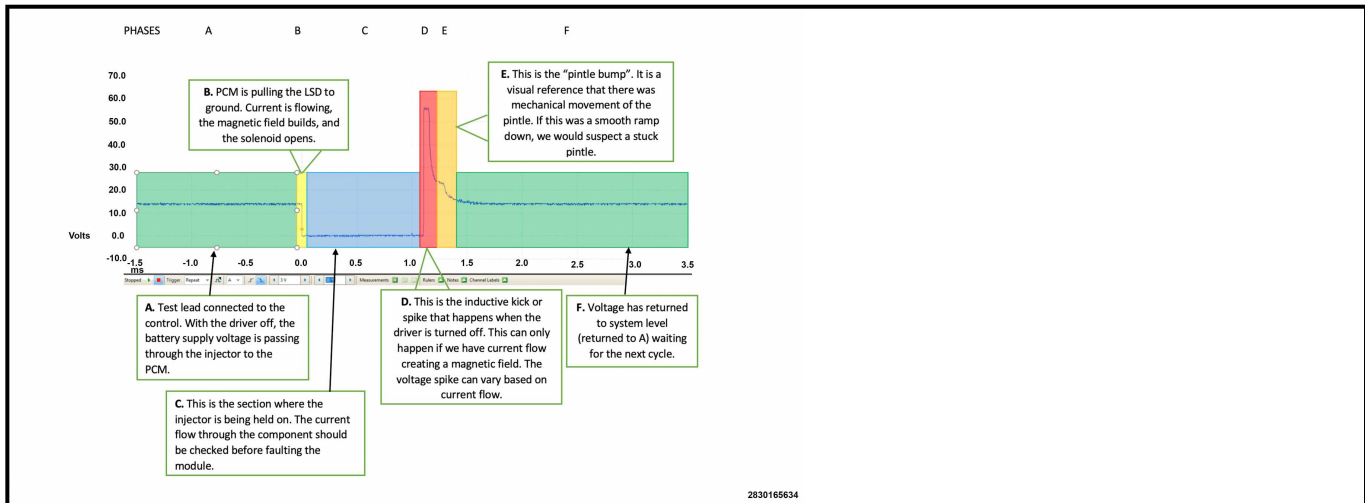
1. Connect the scope lead from channel A to the battery supply voltage circuit.
2. Connect the scope lead from channel B to the fuel injector control circuit.
3. Connect the amp clamp from channel C to the battery supply voltage circuit.

Shown below is a typical fuel injector cycle broken into phases. It may be helpful to perform the same checks on another fuel injector and record for comparison. This can give a good reference for the expected current draw and inductive spike (kick) voltage range when analyzing the fuel injector being tested.

Below is a description of possible failure modes that can be detected during each phase:

- **PHASE A** - If battery voltage **is not present** on the fuel injector control circuit (channel B) with the fuel injector off it shows that there is a blatant open in the path. If battery voltage **is present** on the battery supply circuit (channel A), it would indicate an open fuel injector coil.
- **PHASE B/C** - This is where the driver is pulled and held low, energizing the fuel injector. If the voltage reading on the control circuit is not pulled near zero it would indicate resistance in the control circuit path (all of the voltage should be used up by the fuel injector). If the voltage drops low and then quickly ramps back toward battery voltage it could indicate that there is too much current flow and the driver was turned off for protection, or the LSD is failing. During phase C the current should build to peak amperage of approximately 1.0 amp if the circuitry is good.

- The voltage at the battery supply circuit (channel A) should remain constant throughout. If the supply voltage drops when the fuel injector is energized it would indicate resistance in the battery supply circuit.
- **PHASE D** - If resistance is detected in either of the circuits during the previous phases it can impact the inductive voltage spike when the fuel injector is turned off. This can also be seen in the amperage draw on the circuit. Higher resistance will reduce the amperage draw and inductive kick.
- **PHASE E** - If the voltage ramps down smoothly without the pintle bump it would indicate a stuck pintle inside the fuel injector.
- **PHASE F** - This is the same as Phase A. Fuel injector is off waiting for next actuation.



DIAGNOSTIC TEST-TESTING A FUEL INJECTOR USING A DVOM

1. Test methods for checking the Battery supply to the Fuel Injector:

1. (Recommended method) The voltage supply to the Fuel Injector can be checked by load testing the circuit using the recommended circuit load test tool or equivalent. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **STANDARD PROCEDURE**.
2. Probe the battery supply circuit using 12-volt test light connected to ground.
3. Back probe and monitor the voltage on the supply circuit at the Fuel Injector. The meter should read constant battery voltage when the Fuel Injector is being commanded on and off. If there is resistance in the circuit the voltage will drop when the Fuel Injector is energized.

2. Test methods for checking the Fuel Injector Control circuit:

1. The control circuit should be isolated and checked for an open and a short to ground. The circuit can be checked using an Ohmmeter to check continuity in the circuit and checking for continuity to ground.
2. The circuit can be isolated and checked for resistance or short to ground using the recommended load test tool. Refer to **STANDARD PROCEDURE**.

3. Test method for checking the Fuel Injector:

1. The Fuel Injector coil resistance can be measured and compared to the other Fuel Injectors if the technical data is not available. The resistance value should be within 10% of the other Fuel Injector coil resistance values. This only checks the Fuel Injector electrically. It does not verify that the injector is operating mechanically. That can only be checked with the lab scope.

4. Test method for checking the PCM driver:

1. If there is an actuator function for the driver circuit on the scan tool, back probe and measure the voltage on the control circuit at the Fuel Injector while actuating the driver circuit. There should be Battery voltage present when the driver is off and no voltage on the control circuit when the driver is on. This should be checked after the rest Battery supply and control circuits both check good. If

the circuits tested good, and the voltage is not cycling on and off with the driver actuation, the PCM is most likely faulty.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P0204-FUEL INJECTOR 4 CIRCUIT/OPEN

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

COMPONENT FUNCTIONAL DESCRIPTION-FUEL INJECTORS

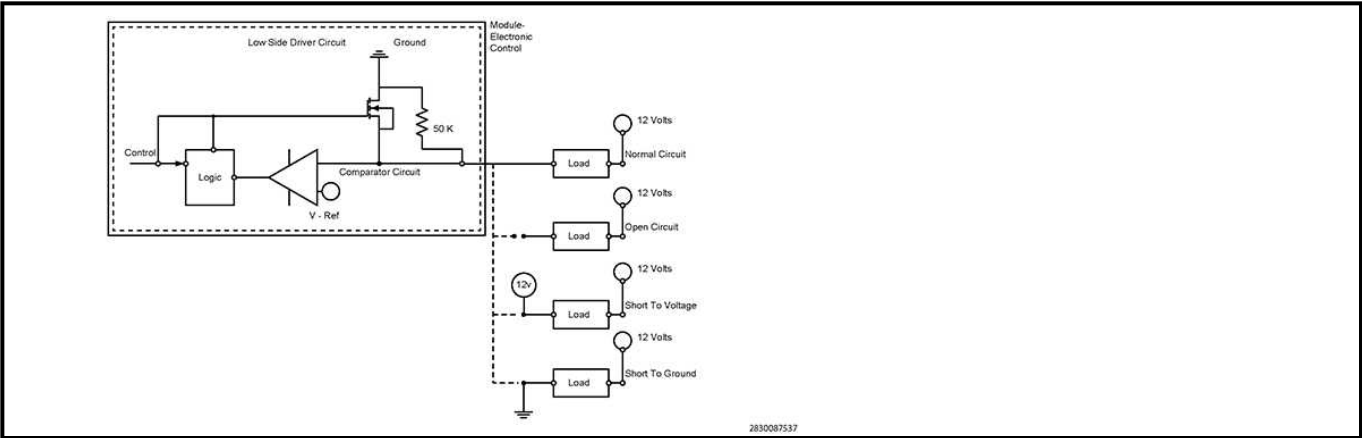
The Fuel Injector is a solenoid that is supplied Battery voltage, typically from the Automatic Shut Down (ASD) Relay, and a ground path through a Pulse Width Modulated (PWM) Low Side Driver (LSD) controlled by the Powertrain Control Module (PCM). Each injector receives a unique pulse width based on that cylinder's fuel requirements. The PCM determines this fuel requirement by monitoring engine operating parameters through various sensors and calculating the appropriate amount of fuel to inject. The optimum amount of injected fuel

depends on conditions such as engine and ambient temperatures, engine speed and workload, and exhaust gas composition.

Typical Low Side Driver Operation and Fault Detection: This type of driver circuit is generally used for relay control, solenoid control or a similar type of driver device. The PCM provides a ground to operate the device when switched on. The ground could be constant or Pulse Width Modulated (PWM). The PCM also provides fault detection for the device, wiring and internal driver. Fault detection can be done by monitoring voltage on the circuit, current draw, or a combination of both. For diagnostic purposes the PCM uses an internal pull down diagnostic resistor connected in series and a voltage reference (V-Ref) comparator for fault detection:

- **Circuit Open and Circuit Low Detection:** The PCM monitors for an **open circuit** and **short to ground** when the driver is switched off. When switched off, the available voltage passes through the device and the **internal pull down resistor** connected in series. The voltage at the **comparator circuit** should be close to Battery voltage since the majority of the voltage drop occurs through the diagnostic resistor. If the available voltage is less than the V-Ref, a fault is set. In this scenario the V-Ref would be slightly below Battery voltage. **An alternative method of fault detection for an open or short to ground** that is used is to monitor current draw when the internal driver is switched on. If the module does not detect any current draw it determines that the component or circuitry is open. Excessive current draw detected would indicate a short to ground.
- **Circuit High Detection:** The PCM monitors for a **short to voltage** when the driver is switched on. When the driver is switched on providing a path to ground through the transistor, the available voltage should be pulled low, near zero volts since the **comparator circuit** is monitoring the ground side of the device. If the voltage is greater than V-Ref, a fault is detected. In this scenario V-Ref would be slightly above zero volts.

NOTE: A load that has a resistance that is below manufacturer specification, or a second load device shorted to the low side driver circuit can cause excessive current draw on the internal driver. The driver will be switched off to protect against overheating and damaging the driver. In this instance the Circuit High fault may be detected because the available voltage on the comparator circuit is above V-Ref.



TECHNICAL DATA-FUEL INJECTORS

The specifications listed below are for typical Fuel Injectors used on low pressure fuel systems:

FUEL INJECTOR TECHNICAL SPECIFICATIONS	
Fuel Injector resistance	Typically between 9.0 and 18.0 Ohms. The resistance in a winding will vary with temperature. When checking a Fuel Injector coil it is good practice to compare the resistance of the suspect injector with the other known good injectors. Typically, the difference should be less than 10% between the injectors.
Fuel Injector current draw	Peak amperage draw will typically be around 1.0 amp when energized

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage is above 10.9 volts.
- Engine speed is below 3000 rpm.
- The ASD/Main relay is energized supplying power to the Fuel Injector.

SET CONDITION

- The PCM monitors the continuity of the Fuel Injector circuitry as well as the inductive voltage spike created by the collapse of the magnetic field in the coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
OPEN OR HIGH RESISTANCE IN THE 12 VOLT SUPPLY TO THE FUEL INJECTOR
OPEN OR HIGH RESISTANCE IN THE FUEL INJECTOR CONTROL CIRCUIT
SHORT TO GROUND IN THE FUEL INJECTOR CONTROL CIRCUIT
FUEL INJECTOR COIL OPEN OR SHORT ACROSS THE COIL (RESISTANCE TOO HIGH OR TOO LOW)
FUEL INJECTOR PINTLE STICKING MECHANICALLY
FAULTY DRIVER INSIDE THE PCM

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to .

DIAGNOSTIC OVERVIEW-FUEL INJECTOR

PCM DIAGNOSTIC OVERVIEW: The Powertrain Control Module (PCM) monitors the inductive voltage spike, or fly back voltage created by the collapse of the magnetic field in the injector coil. This allows the Battery supply circuit, injector coil and control circuit to be monitored for electrical faults.

The wiring and components can be tested individually, or the entire system can be tested using a multi-channel scope. Regardless of the chosen test method, the following checks should be performed during diagnostics:

1. Verify that the Battery supply to the Fuel Injector is present and is capable of operating a load.
2. Verify the control circuit is not open or shorted to ground.
3. Verify that the Fuel Injector coil is not open or shorted across the coil. Low resistance in the Fuel Injector coil will cause excessive current draw causing the PCM to turn off the driver for self-protection.
4. Verify that the PCM internal Low Side Driver (LSD) is functioning properly.

COMPONENT RATIONALITY DIAGNOSTIC OVERVIEW: A circuit fault against a component, or a sensor being used to monitor the system should be diagnosed before a rationality fault. Component and system rationality diagnostics are typically designed to detect a mechanical failure in a solenoid, motor, actuator or an overall system performance issue. However, do not assume that the wiring or circuits to the component are always good if you do not have a circuit fault. For example, a few Ohms of resistance in the power supply, control or ground circuit in a harness connector to a component could cause the component not to energize when commanded on and set a rationality or performance fault instead of a circuit fault. Rationality faults are often designed as a catch all for any failure that could be missed in other diagnostics. It is always a good practice to learn and understand how the rationality diagnostics are performed and the faults are detected by the

ECU. Then check the connectors and circuits for any wiring issues (opens, resistance or shorted circuits) that could have caused the rationality failure, like a stuck on or stuck off solenoid, before replacing any components.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. The DTC may be stored because the diagnostic has not run during the current ignition cycle. Review the scan tool Freeze Frame Data, along with the When Monitored and Set Conditions, and attempt to operate the vehicle or system in the similar conditions to allow the diagnostic to run. Some diagnostics may not be easily duplicate, such as some temperature sensor rationality diagnostics which require extended cold soaks. Other diagnostics may require several environmental conditions or extensive enable conditions difficult to duplicate. For these cases it may be best to simply check for proper operation of the components or systems to verify if failure mode is present before attempting to diagnose the system.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply check for connection issues by wiggle testing any wiring harness the circuitry passes through. A good practice is to watch for a DTC to become active or scan tool data to change. An even better method is to attach the Mopar Scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor Battery system voltage or poor ground connections can affect systems in different or odd ways. Check the Battery or Batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.
4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving.

Intermittent testing for a sensor circuit low/high fault with the Mopar Scope:

1. Back probe and connect the scope lead to the sensor signal circuit.
2. Monitor the circuit voltage while wiggle testing the wiring harness.
3. If you are not able to monitor the scope signal voltage during wiggle testing, set up a trigger to catch an intermittent condition. Set the trigger for voltage above 4.9 volts for an intermittent circuit high fault or below 0.1 volts for a circuit low fault.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the

component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

DIAGNOSTIC TEST-TESTING THE ENTIRE FUEL INJECTOR CIRCUITRY USING A LAB SCOPE (PREFERRED METHOD):

Testing fuel injectors with a lab scope can effectively test the entire electrical path for opens or high resistance. It can also help in determining if the fuel injector's pintle is mechanically sticking and not moving.

CONNECTING THE LAB SCOPE:

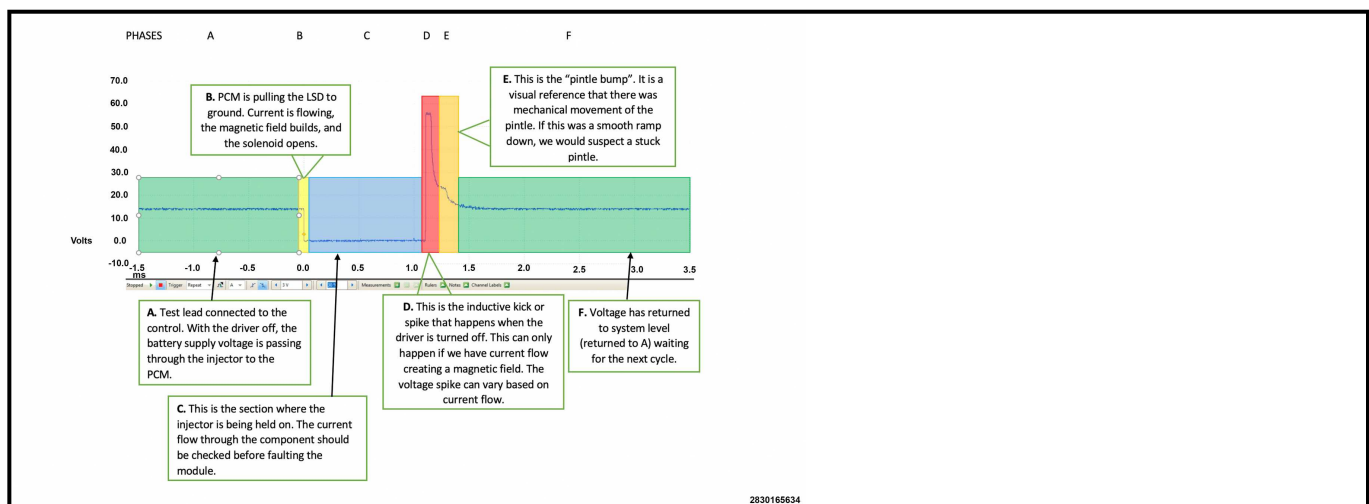
To effectively check the entire path, the scope should be connected to monitor the battery supply circuit voltage, fuel injector control circuit voltage, and current draw.

1. Connect the scope lead from channel A to the battery supply voltage circuit.
2. Connect the scope lead from channel B to the fuel injector control circuit.
3. Connect the amp clamp from channel C to the battery supply voltage circuit.

Shown below is a typical fuel injector cycle broken into phases. It may be helpful to perform the same checks on another fuel injector and record for comparison. This can give a good reference for the expected current draw and inductive spike (kick) voltage range when analyzing the fuel injector being tested.

Below is a description of possible failure modes that can be detected during each phase:

- **PHASE A** - If battery voltage **is not present** on the fuel injector control circuit (channel B) with the fuel injector off it shows that there is a blatant open in the path. If battery voltage **is present** on the battery supply circuit (channel A), it would indicate an open fuel injector coil.
- **PHASE B/C** - This is where the driver is pulled and held low, energizing the fuel injector. If the voltage reading on the control circuit is not pulled near zero it would indicate resistance in the control circuit path (all of the voltage should be used up by the fuel injector). If the voltage drops low and then quickly ramps back toward battery voltage it could indicate that there is too much current flow and the driver was turned off for protection, or the LSD is failing. During phase C the current should build to peak amperage of approximately 1.0 amp if the circuitry is good.
 - The voltage at the battery supply circuit (channel A) should remain constant throughout. If the supply voltage drops when the fuel injector is energized it would indicate resistance in the battery supply circuit.
- **PHASE D** - If resistance is detected in either of the circuits during the previous phases it can impact the inductive voltage spike when the fuel injector is turned off. This can also be seen in the amperage draw on the circuit. Higher resistance will reduce the amperage draw and inductive kick.
- **PHASE E** - If the voltage ramps down smoothly without the pintle bump it would indicate a stuck pintle inside the fuel injector.
- **PHASE F** - This is the same as Phase A. Fuel injector is off waiting for next actuation.



DIAGNOSTIC TEST-TESTING A FUEL INJECTOR USING A DVOM

1. Test methods for checking the Battery supply to the Fuel Injector:

1. (Recommended method) The voltage supply to the Fuel Injector can be checked by load testing the circuit using the recommended circuit load test tool or equivalent. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **STANDARD PROCEDURE**.
2. Probe the battery supply circuit using 12-volt test light connected to ground.
3. Back probe and monitor the voltage on the supply circuit at the Fuel Injector. The meter should read constant battery voltage when the Fuel Injector is being commanded on and off. If there is resistance in the circuit the voltage will drop when the Fuel Injector is energized.

2. Test methods for checking the Fuel Injector Control circuit:

1. The control circuit should be isolated and checked for an open and a short to ground. The circuit can be checked using an Ohmmeter to check continuity in the circuit and checking for continuity to ground.
2. The circuit can be isolated and checked for resistance or short to ground using the recommended load test tool. Refer to **STANDARD PROCEDURE**.

3. Test method for checking the Fuel Injector:

1. The Fuel Injector coil resistance can be measured and compared to the other Fuel Injectors if the technical data is not available. The resistance value should be within 10% of the other Fuel Injector coil resistance values. This only checks the Fuel Injector electrically. It does not verify that the injector is operating mechanically. That can only be checked with the lab scope.

4. Test method for checking the PCM driver:

1. If there is an actuator function for the driver circuit on the scan tool, back probe and measure the voltage on the control circuit at the Fuel Injector while actuating the driver circuit. There should be Battery voltage present when the driver is off and no voltage on the control circuit when the driver is on. This should be checked after the rest Battery supply and control circuits both check good. If the circuits tested good, and the voltage is not cycling on and off with the driver actuation, the PCM is most likely faulty.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P0205-FUEL INJECTOR 5 CIRCUIT/OPEN

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

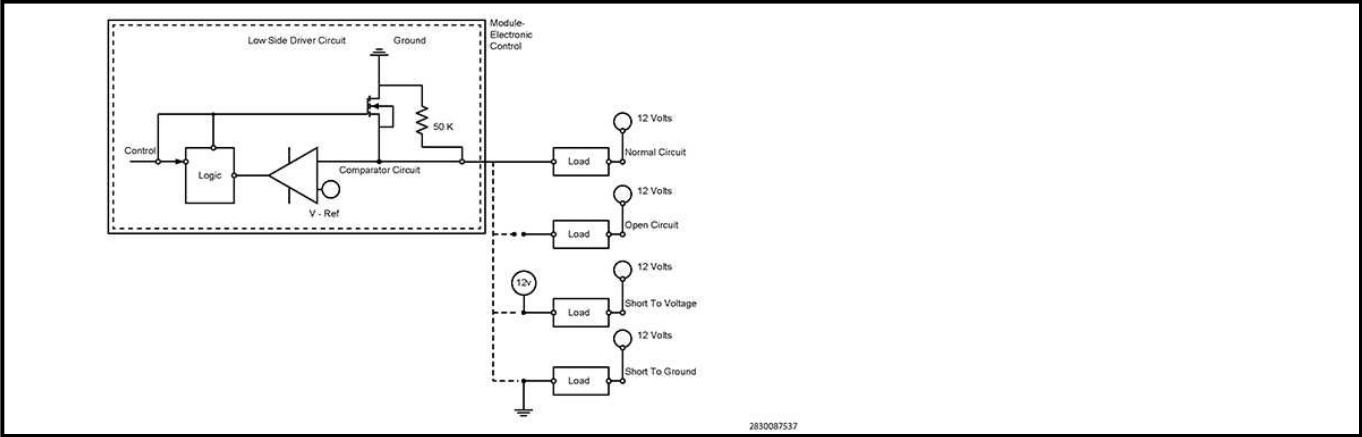
COMPONENT FUNCTIONAL DESCRIPTION-FUEL INJECTORS

The Fuel Injector is a solenoid that is supplied Battery voltage, typically from the Automatic Shut Down (ASD) Relay, and a ground path through a Pulse Width Modulated (PWM) Low Side Driver (LSD) controlled by the Powertrain Control Module (PCM). Each injector receives a unique pulse width based on that cylinder's fuel requirements. The PCM determines this fuel requirement by monitoring engine operating parameters through various sensors and calculating the appropriate amount of fuel to inject. The optimum amount of injected fuel depends on conditions such as engine and ambient temperatures, engine speed and workload, and exhaust gas composition.

Typical Low Side Driver Operation and Fault Detection: This type of driver circuit is generally used for relay control, solenoid control or a similar type of driver device. The PCM provides a ground to operate the device when switched on. The ground could be constant or Pulse Width Modulated (PWM). The PCM also provides fault detection for the device, wiring and internal driver. Fault detection can be done by monitoring voltage on the circuit, current draw, or a combination of both. For diagnostic purposes the PCM uses an internal pull down diagnostic resistor connected in series and a voltage reference (V-Ref) comparator for fault detection:

- **Circuit Open and Circuit Low Detection:** The PCM monitors for an **open circuit** and **short to ground** when the driver is switched off. When switched off, the available voltage passes through the device and the **internal pull down resistor** connected in series. The voltage at the **comparator circuit** should be close to Battery voltage since the majority of the voltage drop occurs through the diagnostic resistor. If the available voltage is less than the V-Ref, a fault is set. In this scenario the V-Ref would be slightly below Battery voltage. **An alternative method of fault detection for an open or short to ground** that is used is to monitor current draw when the internal driver is switched on. If the module does not detect any current draw it determines that the component or circuitry is open. Excessive current draw detected would indicate a short to ground.
- **Circuit High Detection:** The PCM monitors for a **short to voltage** when the driver is switched on. When the driver is switched on providing a path to ground through the transistor, the available voltage should be pulled low, near zero volts since the **comparator circuit** is monitoring the ground side of the device. If the voltage is greater than V-Ref, a fault is detected. In this scenario V-Ref would be slightly above zero volts.

NOTE: A load that has a resistance that is below manufacturer specification, or a second load device shorted to the low side driver circuit can cause excessive current draw on the internal driver. The driver will be switched off to protect against overheating and damaging the driver. In this instance the Circuit High fault may be detected because the available voltage on the comparator circuit is above V-Ref.



TECHNICAL DATA-FUEL INJECTORS

The specifications listed below are for typical Fuel Injectors used on low pressure fuel systems:

FUEL INJECTOR TECHNICAL SPECIFICATIONS	
Fuel Injector resistance	Typically between 9.0 and 18.0 Ohms. The resistance in a winding will vary with temperature. When checking a Fuel Injector coil it is good practice to compare the resistance of the suspect injector with the other known good injectors. Typically, the difference should be less than 10% between the injectors.
Fuel Injector current draw	Peak amperage draw will typically be around 1.0 amp when energized

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage is above 10.9 volts.
- Engine speed is below 3000 rpm.
- The ASD/Main relay is energized supplying power to the Fuel Injector.

SET CONDITION

- The PCM monitors the continuity of the Fuel Injector circuitry as well as the inductive voltage spike created by the collapse of the magnetic field in the coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
OPEN OR HIGH RESISTANCE IN THE 12 VOLT SUPPLY TO THE FUEL INJECTOR
OPEN OR HIGH RESISTANCE IN THE FUEL INJECTOR CONTROL CIRCUIT
SHORT TO GROUND IN THE FUEL INJECTOR CONTROL CIRCUIT

Possible Causes

FUEL INJECTOR COIL OPEN OR SHORT ACROSS THE COIL (RESISTANCE TOO HIGH OR TOO LOW)
FUEL INJECTOR PINTLE STICKING MECHANICALLY
FAULTY DRIVER INSIDE THE PCM

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC OVERVIEW-FUEL INJECTOR

PCM DIAGNOSTIC OVERVIEW: The Powertrain Control Module (PCM) monitors the inductive voltage spike, or fly back voltage created by the collapse of the magnetic field in the injector coil. This allows the Battery supply circuit, injector coil and control circuit to be monitored for electrical faults.

The wiring and components can be tested individually, or the entire system can be tested using a multi-channel scope. Regardless of the chosen test method, the following checks should be performed during diagnostics:

1. Verify that the Battery supply to the Fuel Injector is present and is capable of operating a load.
2. Verify the control circuit is not open or shorted to ground.
3. Verify that the Fuel Injector coil is not open or shorted across the coil. Low resistance in the Fuel Injector coil will cause excessive current draw causing the PCM to turn off the driver for self-protection.
4. Verify that the PCM internal Low Side Driver (LSD) is functioning properly.

COMPONENT RATIONALITY DIAGNOSTIC OVERVIEW: A circuit fault against a component, or a sensor being used to monitor the system should be diagnosed before a rationality fault. Component and system rationality diagnostics are typically designed to detect a mechanical failure in a solenoid, motor, actuator or an overall system performance issue. However, do not assume that the wiring or circuits to the component are always good if you do not have a circuit fault. For example, a few Ohms of resistance in the power supply, control or ground circuit in a harness connector to a component could cause the component not to energize when commanded on and set a rationality or performance fault instead of a circuit fault. Rationality faults are often designed as a catch all for any failure that could be missed in other diagnostics. It is always a good practice to learn and understand how the rationality diagnostics are performed and the faults are detected by the ECU. Then check the connectors and circuits for any wiring issues (opens, resistance or shorted circuits) that could have caused the rationality failure, like a stuck on or stuck off solenoid, before replacing any components.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. The DTC may be stored because the diagnostic has not run during the current ignition cycle. Review the scan tool Freeze Frame Data, along with the When Monitored and Set Conditions, and attempt to operate the vehicle or system in the similar conditions to allow the diagnostic to run. Some diagnostics may not be easily duplicate, such as some temperature sensor rationality diagnostics which require extended cold soaks. Other diagnostics may require several environmental conditions or extensive enable conditions difficult to duplicate. For these cases it may be best to simply check for proper operation of the components or systems to verify if failure mode is present before attempting to diagnose the system.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an

intermittent condition.

3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply check for connection issues by wiggle testing any wiring harness the circuitry passes through. A good practice is too watch for a DTC to become active or scan tool data to change. An even better method is to attach the Mopar Scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor Battery system voltage or poor ground connections can affect systems in different or odd ways. Check the Battery or Batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.
4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving.

Intermittent testing for a sensor circuit low/high fault with the Mopar Scope:

1. Back probe and connect the scope lead to the sensor signal circuit.
2. Monitor the circuit voltage while wiggle testing the wiring harness.
3. If you are not able to monitor the scope signal voltage during wiggle testing, set up a trigger to catch an intermittent condition. Set the trigger for voltage above 4.9 volts for an intermittent circuit high fault or below 0.1 volts for a circuit low fault.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

DIAGNOSTIC TEST-TESTING THE ENTIRE FUEL INJECTOR CIRCUITRY USING A LAB SCOPE (PREFERRED METHOD):

Testing fuel injectors with a lab scope can effectively test the entire electrical path for opens or high resistance. It can also help in determining if the fuel injectors pintle is mechanically sticking and not moving.

CONNECTING THE LAB SCOPE:

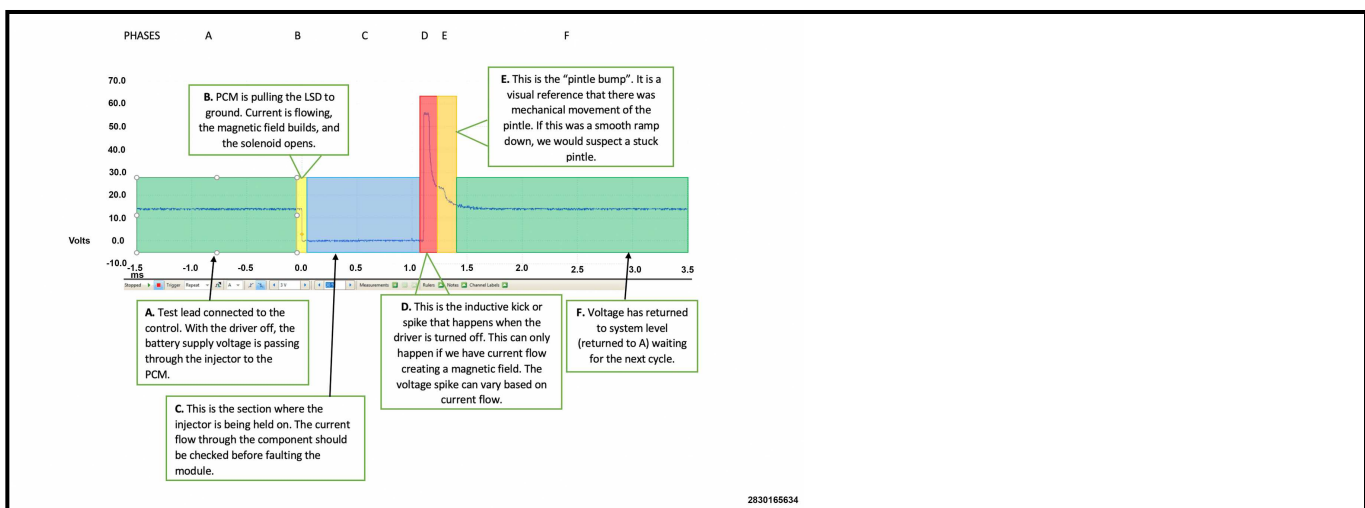
To effectively check the entire path, the scope should be connected to monitor the battery supply circuit voltage, fuel injector control circuit voltage, and current draw.

1. Connect the scope lead from channel A to the battery supply voltage circuit.
2. Connect the scope lead from channel B to the fuel injector control circuit.
3. Connect the amp clamp from channel C to the battery supply voltage circuit.

Shown below is a typical fuel injector cycle broken into phases. It may be helpful to perform the same checks on another fuel injector and record for comparison. This can give a good reference for the expected current draw and inductive spike (kick) voltage range when analyzing the fuel injector being tested.

Below is a description of possible failure modes that can be detected during each phase:

- **PHASE A** - If battery voltage **is not present** on the fuel injector control circuit (channel B) with the fuel injector off it shows that there is a blatant open in the path. If battery voltage **is present** on the battery supply circuit (channel A), it would indicate an open fuel injector coil.
- **PHASE B/C** - This is where the driver is pulled and held low, energizing the fuel injector. If the voltage reading on the control circuit is not pulled near zero it would indicate resistance in the control circuit path (all of the voltage should be used up by the fuel injector). If the voltage drops low and then quickly ramps back toward battery voltage it could indicate that there is too much current flow and the driver was turned off for protection, or the LSD is failing. During phase C the current should build to peak amperage of approximately 1.0 amp if the circuitry is good.
 - The voltage at the battery supply circuit (channel A) should remain constant throughout. If the supply voltage drops when the fuel injector is energized it would indicate resistance in the battery supply circuit.
- **PHASE D** - If resistance is detected in either of the circuits during the previous phases it can impact the inductive voltage spike when the fuel injector is turned off. This can also be seen in the amperage draw on the circuit. Higher resistance will reduce the amperage draw and inductive kick.
- **PHASE E** - If the voltage ramps down smoothly without the pintle bump it would indicate a stuck pintle inside the fuel injector.
- **PHASE F** - This is the same as Phase A. Fuel injector is off waiting for next actuation.



DIAGNOSTIC TEST-TESTING A FUEL INJECTOR USING A DVOM

1. Test methods for checking the Battery supply to the Fuel Injector:

1. (Recommended method) The voltage supply to the Fuel Injector can be checked by load testing the circuit using the recommended circuit load test tool or equivalent. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **STANDARD PROCEDURE**.
2. Probe the battery supply circuit using 12-volt test light connected to ground.
3. Back probe and monitor the voltage on the supply circuit at the Fuel Injector. The meter should read constant battery voltage when the Fuel Injector is being commanded on and off. If there is resistance in the circuit the voltage will drop when the Fuel Injector is energized.

2. Test methods for checking the Fuel Injector Control circuit:

1. The control circuit should be isolated and checked for an open and a short to ground. The circuit can be checked using an Ohmmeter to check continuity in the circuit and checking for continuity to ground.
2. The circuit can be isolated and checked for resistance or short to ground using the recommended load test tool. Refer to **STANDARD PROCEDURE**.

3. Test method for checking the Fuel Injector:

1. The Fuel Injector coil resistance can be measured and compared to the other Fuel Injectors if the technical data is not available. The resistance value should be within 10% of the other Fuel Injector coil resistance values. This only checks the Fuel Injector electrically. It does not verify that the injector is operating mechanically. That can only be checked with the lab scope.

4. Test method for checking the PCM driver:

1. If there is an actuator function for the driver circuit on the scan tool, back probe and measure the voltage on the control circuit at the Fuel Injector while actuating the driver circuit. There should be Battery voltage present when the driver is off and no voltage on the control circuit when the driver is on. This should be checked after the rest Battery supply and control circuits both check good. If the circuits tested good, and the voltage is not cycling on and off with the driver actuation, the PCM is most likely faulty.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P0206-FUEL INJECTOR 6 CIRCUIT/OPEN

NO TITLE

For a complete FUEL CONTROL SYSTEM wiring diagram, .

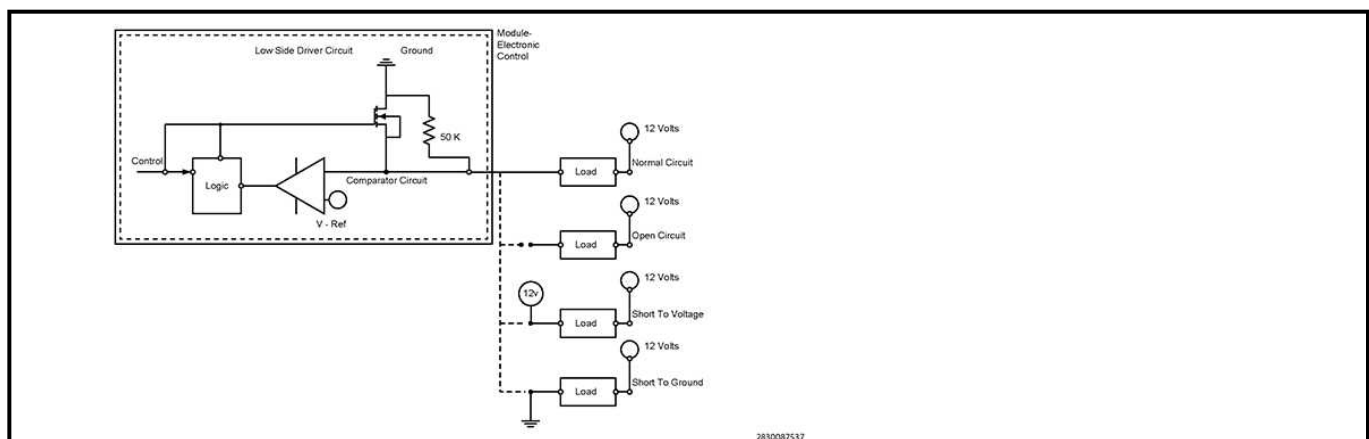
COMPONENT FUNCTIONAL DESCRIPTION-FUEL INJECTORS

The Fuel Injector is a solenoid that is supplied Battery voltage, typically from the Automatic Shut Down (ASD) Relay, and a ground path through a Pulse Width Modulated (PWM) Low Side Driver (LSD) controlled by the Powertrain Control Module (PCM). Each injector receives a unique pulse width based on that cylinder's fuel requirements. The PCM determines this fuel requirement by monitoring engine operating parameters through various sensors and calculating the appropriate amount of fuel to inject. The optimum amount of injected fuel depends on conditions such as engine and ambient temperatures, engine speed and workload, and exhaust gas composition.

Typical Low Side Driver Operation and Fault Detection: This type of driver circuit is generally used for relay control, solenoid control or a similar type of driver device. The PCM provides a ground to operate the device when switched on. The ground could be constant or Pulse Width Modulated (PWM). The PCM also provides fault detection for the device, wiring and internal driver. Fault detection can be done by monitoring voltage on the circuit, current draw, or a combination of both. For diagnostic purposes the PCM uses an internal pull down diagnostic resistor connected in series and a voltage reference (V-Ref) comparator for fault detection:

- **Circuit Open and Circuit Low Detection:** The PCM monitors for an **open circuit** and **short to ground** when the driver is switched off. When switched off, the available voltage passes through the device and the **internal pull down resistor** connected in series. The voltage at the **comparator circuit** should be close to Battery voltage since the majority of the voltage drop occurs through the diagnostic resistor. If the available voltage is less than the V-Ref, a fault is set. In this scenario the V-Ref would be slightly below Battery voltage. **An alternative method of fault detection for an open or short to ground** that is used is to monitor current draw when the internal driver is switched on. If the module does not detect any current draw it determines that the component or circuitry is open. Excessive current draw detected would indicate a short to ground.
- **Circuit High Detection:** The PCM monitors for a **short to voltage** when the driver is switched on. When the driver is switched on providing a path to ground through the transistor, the available voltage should be pulled low, near zero volts since the **comparator circuit** is monitoring the ground side of the device. If the voltage is greater than V-Ref, a fault is detected. In this scenario V-Ref would be slightly above zero volts.

NOTE: A load that has a resistance that is below manufacturer specification, or a second load device shorted to the low side driver circuit can cause excessive current draw on the internal driver. The driver will be switched off to protect against overheating and damaging the driver. In this instance the Circuit High fault may be detected because the available voltage on the comparator circuit is above V-Ref.



TECHNICAL DATA-FUEL INJECTORS

The specifications listed below are for typical Fuel Injectors used on low pressure fuel systems:

FUEL INJECTOR TECHNICAL SPECIFICATIONS	
Fuel Injector resistance	Typically between 9.0 and 18.0 Ohms. The resistance in a winding will vary with temperature. When checking a Fuel Injector coil it is good practice to compare the resistance of the suspect injector with the other known good injectors. Typically, the difference should be less than 10% between the injectors.
Fuel Injector current draw	Peak amperage draw will typically be around 1.0 amp when energized

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage is above 10.9 volts.
- Engine speed is below 3000 rpm.
- The ASD/Main relay is energized supplying power to the Fuel Injector.

SET CONDITION

- The PCM monitors the continuity of the Fuel Injector circuitry as well as the inductive voltage spike created by the collapse of the magnetic field in the coil. Any condition that reduces the maximum current flow or the magnitude of the voltage spike can cause this DTC.

DEFAULT ACTION

- The MIL will illuminate.

POSSIBLE CAUSES

Possible Causes
OPEN OR HIGH RESISTANCE IN THE 12 VOLT SUPPLY TO THE FUEL INJECTOR OPEN OR HIGH RESISTANCE IN THE FUEL INJECTOR CONTROL CIRCUIT SHORT TO GROUND IN THE FUEL INJECTOR CONTROL CIRCUIT FUEL INJECTOR COIL OPEN OR SHORT ACROSS THE COIL (RESISTANCE TOO HIGH OR TOO LOW) FUEL INJECTOR PINTLE STICKING MECHANICALLY FAULTY DRIVER INSIDE THE PCM

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC OVERVIEW-FUEL INJECTOR

PCM DIAGNOSTIC OVERVIEW: The Powertrain Control Module (PCM) monitors the inductive voltage spike, or fly back voltage created by the collapse of the magnetic field in the injector coil. This allows the Battery supply circuit, injector coil and control circuit to be monitored for electrical faults.

The wiring and components can be tested individually, or the entire system can be tested using a multi-channel scope. Regardless of the chosen test method, the following checks should be performed during diagnostics:

1. Verify that the Battery supply to the Fuel Injector is present and is capable of operating a load.
2. Verify the control circuit is not open or shorted to ground.
3. Verify that the Fuel Injector coil is not open or shorted across the coil. Low resistance in the Fuel Injector coil will cause excessive current draw causing the PCM to turn off the driver for self-protection.

4. Verify that the PCM internal Low Side Driver (LSD) is functioning properly.

COMPONENT RATIONALITY DIAGNOSTIC OVERVIEW: A circuit fault against a component, or a sensor being used to monitor the system should be diagnosed before a rationality fault. Component and system rationality diagnostics are typically designed to detect a mechanical failure in a solenoid, motor, actuator or an overall system performance issue. However, do not assume that the wiring or circuits to the component are always good if you do not have a circuit fault. For example, a few Ohms of resistance in the power supply, control or ground circuit in a harness connector to a component could cause the component not to energize when commanded on and set a rationality or performance fault instead of a circuit fault. Rationality faults are often designed as a catch all for any failure that could be missed in other diagnostics. It is always a good practice to learn and understand how the rationality diagnostics are performed and the faults are detected by the ECU. Then check the connectors and circuits for any wiring issues (opens, resistance or shorted circuits) that could have caused the rationality failure, like a stuck on or stuck off solenoid, before replacing any components.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. The DTC may be stored because the diagnostic has not run during the current ignition cycle. Review the scan tool Freeze Frame Data, along with the When Monitored and Set Conditions, and attempt to operate the vehicle or system in the similar conditions to allow the diagnostic to run. Some diagnostics may not be easily duplicated, such as some temperature sensor rationality diagnostics which require extended cold soaks. Other diagnostics may require several environmental conditions or extensive enable conditions difficult to duplicate. For these cases it may be best to simply check for proper operation of the components or systems to verify if failure mode is present before attempting to diagnose the system.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply check for connection issues by wiggle testing any wiring harness the circuitry passes through. A good practice is to watch for a DTC to become active or scan tool data to change. An even better method is to attach the Mopar Scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor Battery system voltage or poor ground connections can affect systems in different or odd ways. Check the Battery or Batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.
4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving.

Intermittent testing for a sensor circuit low/high fault with the Mopar Scope:

1. Back probe and connect the scope lead to the sensor signal circuit.
2. Monitor the circuit voltage while wiggle testing the wiring harness.
3. If you are not able to monitor the scope signal voltage during wiggle testing, set up a trigger to catch an intermittent condition. Set the trigger for voltage above 4.9 volts for an intermittent circuit high fault or

below 0.1 volts for a circuit low fault.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

DIAGNOSTIC TEST-TESTING THE ENTIRE FUEL INJECTOR CIRCUITRY USING A LAB SCOPE (PREFERRED METHOD):

Testing fuel injectors with a lab scope can effectively test the entire electrical path for opens or high resistance. It can also help in determining if the fuel injectors pintle is mechanically sticking and not moving.

CONNECTING THE LAB SCOPE:

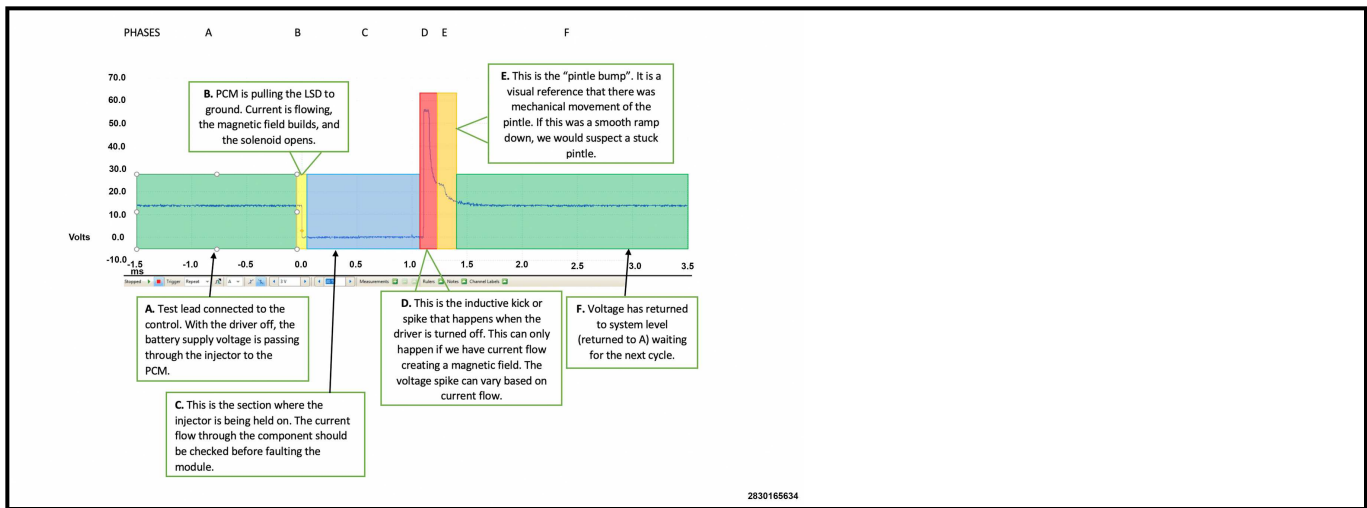
To effectively check the entire path, the scope should be connected to monitor the battery supply circuit voltage, fuel injector control circuit voltage, and current draw.

1. Connect the scope lead from channel A to the battery supply voltage circuit.
2. Connect the scope lead from channel B to the fuel injector control circuit.
3. Connect the amp clamp from channel C to the battery supply voltage circuit.

Shown below is a typical fuel injector cycle broken into phases. It may be helpful to perform the same checks on another fuel injector and record for comparison. This can give a good reference for the expected current draw and inductive spike (kick) voltage range when analyzing the fuel injector being tested.

Below is a description of possible failure modes that can be detected during each phase:

- **PHASE A** - If battery voltage **is not present** on the fuel injector control circuit (channel B) with the fuel injector off it shows that there is a blatant open in the path. If battery voltage **is present** on the battery supply circuit (channel A), it would indicate an open fuel injector coil.
- **PHASE B/C** - This is where the driver is pulled and held low, energizing the fuel injector. If the voltage reading on the control circuit is not pulled near zero it would indicate resistance in the control circuit path (all of the voltage should be used up by the fuel injector). If the voltage drops low and then quickly ramps back toward battery voltage it could indicate that there is too much current flow and the driver was turned off for protection, or the LSD is failing. During phase C the current should build to peak amperage of approximately 1.0 amp if the circuitry is good.
 - The voltage at the battery supply circuit (channel A) should remain constant throughout. If the supply voltage drops when the fuel injector is energized it would indicate resistance in the battery supply circuit.
- **PHASE D** - If resistance is detected in either of the circuits during the previous phases it can impact the inductive voltage spike when the fuel injector is turned off. This can also be seen in the amperage draw on the circuit. Higher resistance will reduce the amperage draw and inductive kick.
- **PHASE E** - If the voltage ramps down smoothly without the pintle bump it would indicate a stuck pintle inside the fuel injector.
- **PHASE F** - This is the same as Phase A. Fuel injector is off waiting for next actuation.



DIAGNOSTIC TEST-TESTING A FUEL INJECTOR USING A DVOM

1. Test methods for checking the Battery supply to the Fuel Injector:

- (Recommended method) The voltage supply to the Fuel Injector can be checked by load testing the circuit using the recommended circuit load test tool or equivalent. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to **STANDARD PROCEDURE**.
- Probe the battery supply circuit using 12-volt test light connected to ground.
- Back probe and monitor the voltage on the supply circuit at the Fuel Injector. The meter should read constant battery voltage when the Fuel Injector is being commanded on and off. If there is resistance in the circuit the voltage will drop when the Fuel Injector is energized.

2. Test methods for checking the Fuel Injector Control circuit:

- The control circuit should be isolated and checked for an open and a short to ground. The circuit can be checked using an Ohmmeter to check continuity in the circuit and checking for continuity to ground.
- The circuit can be isolated and checked for resistance or short to ground using the recommended load test tool. Refer to **STANDARD PROCEDURE**.

3. Test method for checking the Fuel Injector:

- The Fuel Injector coil resistance can be measured and compared to the other Fuel Injectors if the technical data is not available. The resistance value should be within 10% of the other Fuel Injector coil resistance values. This only checks the Fuel Injector electrically. It does not verify that the injector is operating mechanically. That can only be checked with the lab scope.

4. Test method for checking the PCM driver:

- If there is an actuator function for the driver circuit on the scan tool, back probe and measure the voltage on the control circuit at the Fuel Injector while actuating the driver circuit. There should be Battery voltage present when the driver is off and no voltage on the control circuit when the driver is on. This should be checked after the rest Battery supply and control circuits both check good. If the circuits tested good, and the voltage is not cycling on and off with the driver actuation, the PCM is most likely faulty.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

- Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
- After repairs are complete, erase all DTCs with the scan tool.
- Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in

the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE

NO TITLE

For a complete THROTTLE CONTROL SYSTEM wiring diagram, .

THEORY OF OPERATION

The Electronic Throttle Control (ETC) system uses two Throttle Position Sensors (TPS) to monitor the throttle blade position. TPS 1 and TPS 2 are located within the Throttle Body assembly. Each sensor has its own Signal circuit (TPS 1 or TPS 2). Both sensors share a common 5-Volt Reference circuit (Supply) and a common Sensor Ground. Each Signal circuit provides the Powertrain Control Module (PCM) with a signal voltage proportionate to throttle blade movement. Normally operating sensor signals are opposing to each other in the following manner:

- **TPS 1** voltage starts low, approximately 0.5 volts at **closed throttle**, and increases to approximately 4.5 volts at **wide open throttle** .
- **TPS 2** voltage starts high, approximately 4.3 volts at **closed throttle**, and decreases to approximately 0.7 volts at **wide open throttle** .

WHEN MONITORED

This diagnostic runs continuously when the following condition is met:

- Engine running and DTC P2135 is active.

- When fault P2135 becomes active, the Powertrain Control Module (PCM) compares the difference between calculated MAP based on TPS 1 input signal and sensed MAP.

SET CONDITION

- If the PCM determines that the TPS 2 error is larger than the TPS 1 error, this fault is set.

DEFAULT ACTION

- The MIL will illuminate.
- The ETC light will illuminate.
- The Throttle input and vehicle speed are limited.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
TPS 2 SIGNAL CIRCUIT OPEN/HIGH RESISTANCE
THROTTLE POSITION SENSOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to .

DIAGNOSTIC TEST

1. CHECK FOR ANY SERVICE BULLETINS OR PCM SOFTWARE UPDATES

1. Check for any applicable Service Bulletins or Flash updates related to the DTC.

Are there any applicable Service Bulletins or Flash updates?

Yes

- Perform the applicable repair.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR THE DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

3. CHECK THE THROTTLE BODY CONNECTOR AND TERMINALS

1. Turn the ignition off.
2. Check the Throttle Body harness connector for proper connection at the Throttle Body.
3. Verify that the connector is completely plugged in and properly locked prior to disconnecting.
4. Disconnect the Throttle Body harness connector and check for any pushed out, damaged or spread terminals.

Were any issues found with the connector or terminals?

Yes

- Repair the damaged terminal or properly connect and lock the Throttle Body harness connector and retest for DTCs.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any Throttle Body circuit, system voltage or 5-Volt Reference DTCs present?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [5](#)

5. CHECK FOR HIGH RESISTANCE IN THE THROTTLE BODY (K122) POSITION SIGNAL 2 CIRCUIT

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION:

Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

NOTE:

IMPORTANT - The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

Is the resistance below 3.0 Ohms?

Yes

- Go To [6](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

6. CHECK THE ABILITY OF THE PCM TO READ THE THROTTLE POSITION SENSOR SIGNAL

1. Reconnect the PCM C2 harness connector.
2. Turn the ignition on.
3. With the scan tool, monitor read DTCs.

NOTE: **The P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW DTC should be active or pending with the connector unplugged.**

4. Connect a jumper between the Throttle Body (K122) Position Signal 2 circuit and the (F855) 5-Volt Supply circuit.

NOTE: **The P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH DTC should be active or pending with the jumper in place.**

Does the scan tool read as described above?

Yes

- Verify that there is good pin to terminal contact in the Throttle Body and Powertrain Control Module connectors. If no problems are found, replace the Throttle Body Assembly. Refer to [THROTTLE BODY, REMOVAL AND INSTALLATION](#) . Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, with a scan tool, perform the ETC RELEARN function.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

NOTE: **Remove the jumper before continuing.**

- Go To [7](#)

7. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.

- Other signs of water intrusion.
- Weather seal damage (if equipped).
- Bent terminals.
- Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
- Terminals that have been pushed back into the connector cavity.
- Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW

NO TITLE

For a complete THROTTLE CONTROL SYSTEM wiring diagram, .

THEORY OF OPERATION

The Electronic Throttle Control (ETC) system uses two Throttle Position Sensors (TPS) to monitor the throttle blade position. TPS 1 and TPS 2 are located within the Throttle Body assembly. Each sensor has its own Signal circuit (TPS 1 or TPS 2). Both sensors share a common 5-Volt Reference circuit (Supply) and a common Sensor Ground. Each Signal circuit provides the Powertrain Control Module (PCM) with a signal voltage proportionate to throttle blade movement. Normally operating sensor signals are opposing to each other in the following manner:

- **TPS 1** voltage starts low, approximately 0.5 volts at **closed throttle**, and increases to approximately 4.5 volts at **wide open throttle** .
- **TPS 2** voltage starts high, approximately 4.3 volts at **closed throttle**, and decreases to approximately 0.7 volts at **wide open throttle** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage greater than 10.4 volts.

SET CONDITION

- TPS 2 voltage is less than 0.16 volts for 0.07 seconds.

DEFAULT ACTION

- The ETC light will illuminate.
- The MIL will illuminate.
- The Throttle input and vehicle speed are limited.

POSSIBLE CAUSES

Possible Causes
5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND
TPS 2 SIGNAL CIRCUIT SHORTED TO GROUND
TPS 2 SIGNAL CIRCUIT SHORTED TO THE TPS RETURN CIRCUIT
TPS 2 SIGNAL CIRCUIT OPEN
TPS RETURN CIRCUIT OPEN
THROTTLE POSITION SENSOR/THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to .

DIAGNOSTIC TEST

1. CHECK FOR ANY SERVICE BULLETINS OR PCM SOFTWARE UPDATES

1. Check for any applicable Service Bulletins or Flash updates related to the DTC.

Are there any applicable Service Bulletins or Flash updates?

Yes

- Perform the applicable repair.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read and record DTCs in all Electronic Control Units (ECUs) on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

3. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any system voltage or 5-Volt Reference DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [4](#)

4. CHECK THE THROTTLE BODY CONNECTOR AND TERMINALS

1. Turn the ignition off.
2. Check the Throttle Body harness connector for proper connection at the Throttle Body.
3. Verify that the connector is completely plugged in and properly locked prior to disconnecting.
4. Disconnect the Throttle Body harness connector and check for any pushed out, damaged or spread terminals.

Were any issues found with the connector or terminals?

Yes

- Repair the damaged terminal or properly connect and lock the Throttle Body harness connector and retest for DTCs.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE (F855) 5-VOLT SUPPLY CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. Disconnect the harness connector at the component of the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Turn the ignition on.
4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

NOTE: The voltage on a 5.0 volt signal or reference circuit should be between approximately 4.8 and 5.2 volts.

Is the voltage above 5.2 volts?

Yes

- Go To [6](#)

No

- Repair the (F855) 5-Volt Supply circuit for an open or short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

6. ISOLATE AND CHECK THE (K122) TPS 2 SIGNAL CIRCUIT FOR A SHORT TO GROUND

1. The ignition must be off when checking a circuit for continuity to ground.
2. Isolate the circuit by disconnecting the Powertrain Control Module (PCM) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the negative lead of the DVOM to a known good ground.
4. With the positive lead of the DVOM, probe the circuit being tested at the component harness connector and check for continuity between the circuit and ground.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: There should be no continuity between ground and the circuit being tested.

Is there continuity between ground and the circuit being tested?

Yes

- Repair the circuit for a short to ground. Use the wiring diagram as a guide to trace the circuit and look for any in-line connectors to help isolate the location of the short.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. ISOLATE AND CHECK THE (K122) TPS 2 SIGNAL CIRCUIT FOR A SHORT TO THE (K922) TPS RETURN CIRCUIT

1. The ignition must be off when checking for a short between circuits.
2. Isolate the circuit by disconnecting the Powertrain Control Module (PCM) and every component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect the test leads of the DVOM and check for continuity between the circuits being tested at the component harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: There should be no continuity between the circuits being tested.

Is there continuity between the circuits?

Yes

- Repair the short between the circuits.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

8. ISOLATE AND CHECK THE (K122) TPS 2 SIGNAL CIRCUIT FOR AN OPEN/HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Powertrain Control Module (PCM) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

NOTE: **IMPORTANT - The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.**

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

Is the resistance below 3.0 Ohms?

Yes

- Go To [9](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

9. CONNECT A FUSED JUMPER BETWEEN THE (K122) TPS 2 SIGNAL CIRCUIT AND THE (F855) 5-VOLT SUPPLY CIRCUIT AT THE THROTTLE BODY SENSOR HARNESS CONNECTOR - VERIFY ABILITY OF THE PCM TO DETECT THE SENSOR SIGNAL CIRCUIT HIGH DTC

1. The Powertrain Control Module (PCM) harness connectors must be connected to the PCM during this test step.
2. Disconnect the sensor harness connector.
3. With the ignition in the off position, connect a fused jumper between the sensor signal circuit and the 5-Volt Supply circuit at the sensor harness connector.
4. Turn the ignition on.
5. With the scan tool, read DTCs.

Does the scan tool display the SENSOR SIGNAL CIRCUIT HIGH DTC with the jumper in place?

Yes

- Replace the faulty sensor in accordance with the Service Information. Refer to **THROTTLE BODY, REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [10](#)

10. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the Powertrain Control Module in accordance with the Service information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .
- Test complete.

P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH

NO TITLE

For a complete THROTTLE CONTROL SYSTEM wiring diagram, .

THEORY OF OPERATION

The Electronic Throttle Control (ETC) system uses two Throttle Position Sensors (TPS) to monitor the throttle blade position. TPS 1 and TPS 2 are located within the Throttle Body assembly. Each sensor has its own Signal circuit (TPS 1 or TPS 2). Both sensors share a common 5-Volt Reference circuit (Supply) and a common Sensor Ground. Each Signal circuit provides the Powertrain Control Module (PCM) with a signal voltage proportionate to throttle blade movement. Normally operating sensor signals are opposing to each other in the following manner:

- **TPS 1** voltage starts low, approximately 0.5 volts at **closed throttle**, and increases to approximately 4.5 volts at **wide open throttle** .
- **TPS 2** voltage starts high, approximately 4.3 volts at **closed throttle**, and decreases to approximately 0.7 volts at **wide open throttle** .

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- With the ignition on.
- Battery voltage greater than 10.4 volts.

SET CONDITION

- TPS Signal 2 circuit voltage is above 4.595 volts for 0.07 seconds.

DEFAULT ACTION

- The ETC light will illuminate.
- The MIL will illuminate.
- The Throttle input and vehicle speed are limited.

POSSIBLE CAUSES

Possible Causes
TPS 2 SIGNAL CIRCUIT SHORTED TO ANOTHER VOLTAGE SUPPLY CIRCUIT
TPS 2 SIGNAL CIRCUIT SHORTED TO THE 5-VOLT SUPPLY CIRCUIT
THROTTLE BODY
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC TEST

1. CHECK FOR ANY SERVICE BULLETINS OR PCM SOFTWARE UPDATES

1. Check for any applicable Service Bulletins or Flash updates related to the DTC.

Are there any applicable Service Bulletins or Flash updates?

Yes

- Perform the applicable repair.

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [2](#)

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [3](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

3. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any system voltage or 5-Volt Reference DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [4](#)

4. CHECK THE THROTTLE BODY CONNECTOR AND TERMINALS

1. Turn the ignition off.
2. Check the Throttle Body harness connector for proper connection at the Throttle Body.
3. Verify that the connector is completely plugged in and properly locked prior to disconnecting.
4. Disconnect the Throttle Body harness connector and check for any pushed out, damaged or spread terminals.

Were any issues found with the connector or terminals?

Yes

- Repair the damaged terminal or properly connect and lock the Throttle Body harness connector and retest for DTCs.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE THROTTLE BODY (K122) POSITION SIGNAL 2 CIRCUIT FOR A SHORT TO VOLTAGE

1. Turn the ignition off.
2. Disconnect the harness connector at the component of the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Turn the ignition on.
4. Using a DVOM, measure the voltage of the circuit being tested at the component harness connector.

NOTE: The voltage on a 5.0 volt signal or reference circuit should be between approximately 4.8 and 5.2 volts.

Is the voltage above 5.2 volts?

Yes

- Repair the Throttle Body (K122) Position Signal 2 circuit for a short to voltage.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. CHECK FOR THE THROTTLE BODY (K122) POSITION SIGNAL 2 CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

1. The ignition must be off when performing a resistance check to find a short between circuits.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and every component harness connector containing the circuit being tested. At this time leave all in-line connectors connected. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Connect one lead of the DVOM to the circuit being tested at the ECU harness connector.
4. With the other lead of the DVOM probe all other circuits at the ECU harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adaptor, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: With the circuit isolated there should be no continuity between the circuit being tested and any other circuit.

Is there continuity between the circuit being tested and any other circuit?

Yes

- Repair the short between the circuits that have continuity. Use the wiring diagram as a guide to trace the circuits and look for any in-line connectors to help isolate the location of the short.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CONNECT A FUSED JUMPER BETWEEN THE THROTTLE BODY (K122) POSITION SIGNAL 2 CIRCUIT AND THE (K922) SENSOR GROUND CIRCUIT AT THE THROTTLE BODY HARNESS CONNECTOR - VERIFY ABILITY OF THE PCM TO DETECT THE SENSOR SIGNAL CIRCUIT LOW DTC

1. The Electronic Control Module (ECU) harness connectors must be connected to the ECU during this test step.
2. Disconnect the sensor harness connector.
3. With the ignition in the off position, connect a fused jumper between the sensor signal circuit and the sensor ground circuit at the sensor harness connector.
4. Turn the ignition on.
5. With the scan tool, read DTCs.

Does the scan tool display the SENSOR SIGNAL CIRCUIT LOW DTC with the jumper in place?

Yes

- Replace the faulty sensor in accordance with the Service Information. Refer to **THROTTLE BODY, REMOVAL AND INSTALLATION**.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

8. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.

11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace the Powertrain Control Module in accordance with the Service information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .
- Test complete.

P025A-FUEL PUMP MODULE CONTROL CIRCUIT OPEN

NO TITLE

For a complete FUEL DELIVERY SYSTEM wiring diagram, .

KNOWN ISSUES - FPCM SYSTEM

While the FPCM has the capability of detected failure modes, the faults are not always reported out as intended. Some vehicles have incorrect calibrations that will read the FPCM messages incorrectly and set the DTCs incorrectly. On these vehicles it is best not to rely on the DTC, or DTC Description when deciding which portion of the system to diagnose. In these cases it is best to read and understand how the system operates, then diagnose the entire system to determine where the failure lies by performing the **Complete Fuel Pump Control Module System Diagnostics (Not DTC Specific)** procedure when diagnosing this system. This diagnostic can also be used to diagnose the FPCM command, feedback and fuel pump control circuits on vehicles with the correct calibration software.

The vehicles listed below will set faults incorrectly for the model years listed and should always be diagnosed using the Not DTC specific system approach.

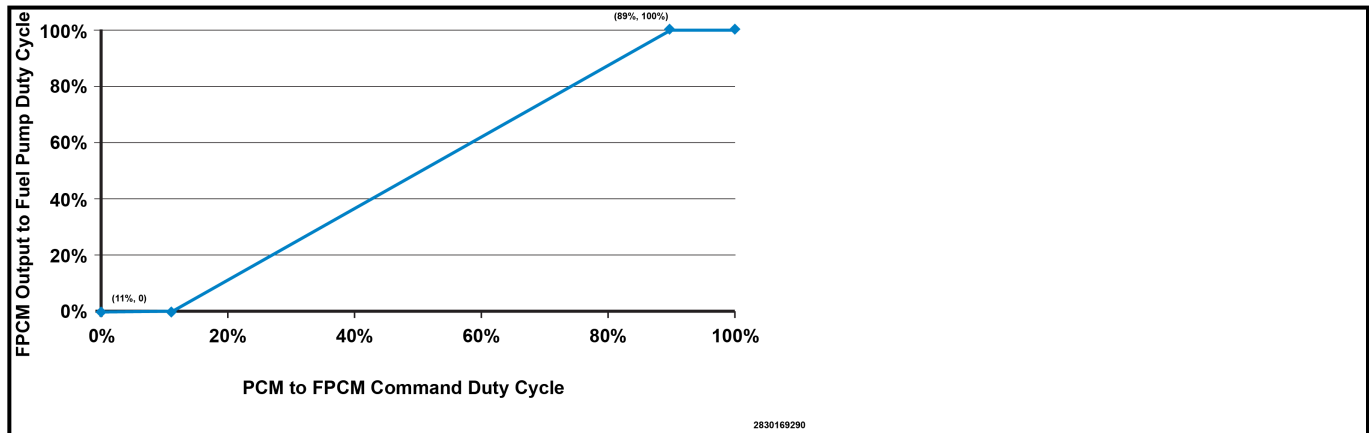
- DS - model years 2016-2019
- RU - model years 2017-2018
- JL - model year 2018
- JT - model year 2020

The exceptions to the information above are the Loss of Communication, Fuel Rail Pressure Sensor and Fuel Pump Relay Control circuit faults. These faults will typically set correctly since they are detected by the PCM directly, not the FPCM.

FPCM SYSTEM DESCRIPTION AND OPERATION

SYSTEM DESCRIPTION: When the Powertrain Control Module (PCM) requires Fuel Pump operation it energizes the Fuel Pump Relay. The Battery voltage output from the relay does not connect directly to the Fuel Pump like traditional systems. Instead, the Battery voltage is supplied to the Fuel Pump Control Module (FPCM). When the ignition is switched on, the Battery voltage is present for approximately five seconds. Battery voltage should always be present during cranking or when the engine is running. The purpose of FPCM is to operate the Fuel Pump at a reduced voltage output to reduce electrical load on the system. Most vehicle/engine combinations operate as a **fixed pressure system** . Vehicles with the 6.2L engine operate as a **variable pressure system** . It is necessary on some vehicles with the 6.2L engine to have a second Fuel Pump and FPCM to meet engine needs. The second FPCM performs the same diagnostics as the primary module but uses different DTCs.

SYSTEM OPERATION: To maintain the desired fuel pressure, the PCM sends a Pulse Width Modulated (PWM) duty cycle signal to the FPCM. If there are no system faults present, the Fuel Pump Control output to the Fuel Pump is based on the duty cycle sent by the PCM. The graph below shows the FPCM output to the Fuel Pump in proportion to the PCM command signal. **The FPCM output to the fuel pump will not read as a duty cycle when monitoring with a Mopar Scope. It will be a consistent voltage output that is a percentage of battery voltage.**



COMPONENT FUNCTIONAL DESCRIPTION- FUEL PUMP CONTROL MODULE (FPCM) AND FUEL PUMP

The FPCM performs fault detection and reports faults to the PCM through the PWM Feedback circuit. The feedback circuit can be monitored using the Mopar Scope and functions as follows:

- The feedback circuit is a 5.0 volt duty cycle.
- The PCM supplies the 5.0 volts for the feedback circuit.
- The FPCM pulses the low side of the circuit to communicate with the PCM.
- The normal duty cycle operating range is between 3% and 97%.
- When the system is operating normally, the FPCM will send a 50% duty cycle on the feedback circuit to the PCM.
- When the FPCM detects a fault it will send a duty cycle that aligns with the failure mode detected.
- If the duty cycle is 0% or 100% the PCM will set the Loss of Communication fault against the FPCM.

NOTE: Monitoring the FPCM internal driver with an open feedback circuit using the Mopar Scope will show a pulse width signal with a very low voltage (.025v - 0.5v). This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the PCM. This can be useful when performing diagnostics on the feedback circuitry.

Depending on the failure mode detected by the PCM and FPCM, the FPCM can react by either reducing the PWM output duty cycle, or defaulting to an 80% duty cycle for the fuel pump operation. The FPCM reactions are explained further in the PCM/FPCM Reaction column of the Enable Conditions and Failure Modes section.

Fuel Pump: The Fuel Pump operates in the same manner as a typical Brushed DC motor. The only difference is that the speed is reduced due to the PWM output voltage from the FPCM being less than 100%. The voltage supplied is based on the command received from the PCM.

Vehicles with Dual Pump Systems: The fuel pumps operate independently, but may be serviced as an assembly on some vehicles. During normal operation both Fuel Pumps are used to provide the system pressure and volume needed during most engine operating conditions. **The exception is at idle, or idle and purging where there is extremely low fuel demand.** During this mode Fuel Pump 2 is typically turned off. When more fuel demand is needed (typically off idle) Fuel Pump 2 is turned on and both pumps are operated at the same duty cycle. If either pump is failing the vehicle may still operate normally during most driving conditions but would have performance issues under heavy engine load when both pumps are needed. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. **However, if Fuel Pump 2 is**

defaulted to 80%, the primary pump will continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump assembly reservoir.

COMPONENT FUNCTIONAL DESCRIPTION - POWERTRAIN CONTROL MODULE (PCM)

The PCM monitors the input signal from the Fuel Rail Pressure Sensor to determine the commanded duty cycle to the FPCM. On a fixed pressure system the PCM varies the commanded duty cycle to maintain a constant pressure. On variable pressure systems the commanded duty cycle is varied to adjust fuel pressure based on engine needs. Ambient temperature and fuel temperature can also contribute to fuel pressure changes. The pressure is raised during high ambient temperatures to prevent boiling of the fuel.

NOTE: On vehicles with diesel engines or high pressure gas fuel systems, the PCM monitors the Fuel Pressure Sensor on the low pressure side of the system to determine the commanded duty cycle, not the Fuel Rail Pressure Sensor on the high pressure side.

The command circuit can be monitored using the Mopar Scope and functions as follows:

- The command circuit is a 12.0 volt duty cycle.
- The FPCM supplies the 12.0 volts for the command circuit.
- The PCM pulses the low side of the circuit to communicate with the DTCM.
- The normal duty cycle operating range is between 11% and 89%.
- If the FPCM does not receive a valid command signal from the PCM it will send a fault message on the feedback circuit and operates the fuel pump at a defaulted value (typically 80%).

With an open command circuit, the PCM internal driver will show a pulse width signal of approximately 2.5v if checking at the PCM connector with the Mopar Scope. This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the FPCM. This can be useful when performing diagnostics on the command circuitry.

When the PCM loses communication with the FPCM it will default to the highest duty cycle. This will cause the FPCM to provide maximum voltage output to the fuel pump.

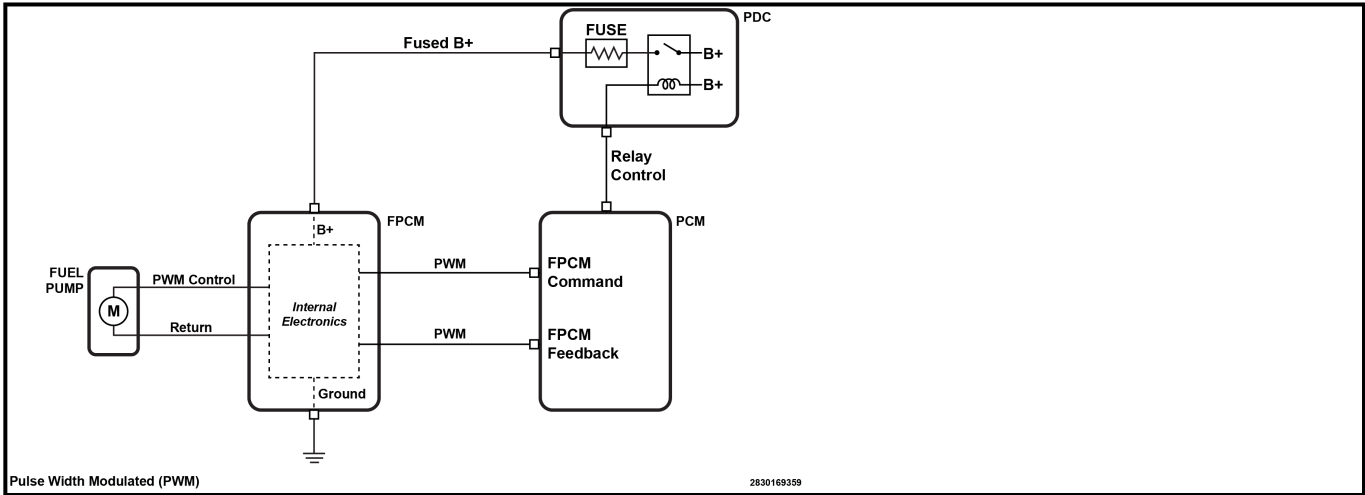
TECHNICAL DATA-FUEL SYSTEM PRESSURE SPECIFICATIONS

The table below shows the fuel system pressure specifications.

VARIABLE FUEL PRESSURE SYSTEM SPECIFICATIONS (6.2L ENGINES)		
CRANKING	520 kPa (75.4 psi)	System operates in open loop during cranking
IDLE	340 - 400 kPa (49 - 58 psi)	Normal operating range at idle - Pressure is dependant on ambient and fuel temp. Pressure is raised during high temp to prevent boiling
NORMAL RANGE OF OPERATION	340 - 550 kPa (49 - 80 psi)	Normal operating range between idle and high engine demand
100% DUTY CYCLE	600 - 700 kPa (87 - 101.5 psi)	This is regulated by the pressure relief valve in the Fuel Pump. The pressure can vary from pump to pump.
B		
4 CYLINDER (1.0L/1.3L GSET / 2.0L GMET ENGINES)		
CRANKING	580 kPa (84.1 psi)	System operates in open loop during cranking
ALL OTHER OPERATING CONDITIONS	520 kPa (75.4 psi)	The fixed pressure systems should maintain approximately 75.0 psi during normal operation
B		
FIXED PRESSURE SYSTEM SPECIFICATIONS (ALL OTHER ENGINES)		

The fixed pressure systems should maintain approximately 400 kPa (58.0) psi during normal operation

GENERIC SYSTEM SCHEMATIC:



WHEN MONITORED

SET CONDITION

- The Powertrain Control Module (PCM) detects a fault in the Fuel Pump Control System.

DEFAULT ACTION

- The MIL will illuminate.

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

The table below shows the FPCM DTCs and the correlating INTENDED failure modes. **NOTE: On some vehicles the faults may not always set as expected which may lead to a misdiagnosis (See the know issue section). Therefore, it is usually best to perform the "Complete Fuel Pump Control Module System Testing (Not DTC Specific)" in the diagnostic section.**

POSSIBLE CAUSES

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
P025A	P027A	Missing or invalid PWM Command signal from PCM	1. PCM to FPCM Command Signal open 2. PCM to FPCM Command Signal shorted low or high 3. Invalid PWM signal - frequency out of range 4. FPCM 5. PCM	FPCM defaults the output to the Fuel Pump to 80% duty cycle NOTE: It is not uncommon for the P025A DTC to set erroneously for several other failure modes
P025B	P027B	Output driver over temp	1. FPCM Output partially shorted to ground	PCM sets fault, waits a calibrated period

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
			2. Faulty Fuel Pump (high mechanical resistance) 3. Faulty FPCM internal driver	and commands a safe duty cycle FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If over temp continues, shut down output driver.
P025C	P027C	System under voltage - Fuel Pump Relay output voltage to FPCM is below a calibrated threshold (approximately 6.0 volts)	1. High resistance in the Fuel Pump Relay output circuit 2. FPCM	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P025D	P027D	System over voltage - Fuel Pump Relay output voltage to FPCM is above a calibrated threshold (approximately 16.0 volts)	1. Charging system issue	- PCM applies over voltage strategy - FPCM reacts to PCM input command
P0628	P2633	FPCM output to Fuel Pump shorted to ground	1. Fuel Pump PWM Control circuit shorted to ground	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
P0629	P2634	FPCM output to Fuel Pump shorted to voltage	1. Fuel Pump PWM Control circuit shorted to voltage	FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If condition continues, shut down output driver.
P062A	P062A	Actual fuel pressure is above or below the desired fuel pressure by more than a calibrated threshold. - Fixed pressure system - 5.8 psi above or 14.5 psi below - Variable pressure system - 10.9 psi above or below	1. No fuel in the Fuel Tank 2. Fuel supply tube broken/leaking 3. Fuel supply tube pinched/restricted 4. FPCM defaulted to 80% due to another failure detected 5. FPCM duty cycle output reduced due to another failure detected 6. Faulty Fuel Pump	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P064A	P26EA	Current draw exceeds calibrated threshold	1. Fuel Pump PWM Control circuit shorted to voltage	PCM reduces PWM duty cycle until issue

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
			2. Faulty Fuel Pump - internal short or high mechanical resistance	clears FPCM reacts to PCM input command
P1205	P120A	FPCM Micro internal fault	1. Fuel Pump Control Module	FPCM continues to run in normal mode - run Fuel Pump according to PCM command signal
P1206	P120B	FPCM output to Fuel Pump open circuit	1. Fuel Pump PWM Control circuit open 2. Fuel Pump Return/Ground circuit open 3. FPCM Ground circuit open 4. FPCM	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
U0109	U016C	PCM Loss of Communication with FPCM	1. FPCM PWM Feedback circuit open 2. FPCM PWM Feedback shorted low or high 3. Fuel Pump Relay output circuit to FPCM open or shorted to ground 4. FPCM Ground circuit open 5. Fuel Pump PWM Control circuit shorted to ground 6. FPCM 7. PCM	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle

DIAGNOSTIC OVERVIEW-FUEL PUMP CONTROL MODULE

GENERAL DIAGNOSTIC INFORMATION: There are several faults associated with this system. The failure modes being monitored for are Loss of Communication, internal FPCM faults, system voltage faults, Thermal Protection, circuit faults, and system performance. **On several vehicles, multiple or incorrect faults** can set which can mislead diagnosing the vehicle. For this reason, it is a good practice to perform a total system diagnosis regardless of the DTC present for most faults. The communication faults are detected directly by the PCM and will typically set correctly. See Communication Diagnostics explanation below.

PCM DIAGNOSTICS: The PCM directly monitors the Fuel Pump Relay Control circuit, FPCM Feedback circuit and the Fuel Pressure Sensor circuits for faults. The Fuel Pressure Sensor signal must be rationalized since the signal is monitored to perform fuel system pressure performance diagnostics. This is done by watching the signal at initial engine start up for both types of systems. **On the fixed pressure system** the normally stable fuel pressure is dynamic for the first few seconds. The pressure will spike above the set point approximately 40-50 kPa (5.8-7.25 psi), then drop below the set point approximately 60-70 kPa (8.7-10.2 psi), and quickly dampen and settle at the set point 400kPa (58.0 psi). At initial engine start up, when the engine speed reaches approximately 500 rpm, the Powertrain Control Module (PCM) measures the delta pressure change between the highest pressure reading and lowest pressure reading and make determinations about sensor rationality. The diagnostic works the same **on the variable pressure system** as the fixed pressure

system except that the system is in open loop at start up and the pressure is commanded to a preset known value to perform the diagnostic.

SYSTEM VOLTAGE DIAGNOSTICS: The FPCM monitors the Battery voltage supply coming from the Fuel Pump Relay to the module. A fault will set if the voltage is too high or too low. Typically a voltage high fault would indicate a charging system issue. The voltage low fault could also be a charging system issue, but may also be caused by resistance in the Battery supply or ground circuit.

COMMUNICATION DIAGNOSTICS: Unlike other system faults, the Loss of Communication fault will typically set correctly. The PCM will set this fault when the FPCM PWM Feedback duty cycle is below 3% or above 97%. This can occur if the FPCM Battery voltage supply or ground circuits are open, or the FPCM PWM Feedback circuit is open or shorted.

FUEL PUMP PERFORMANCE DIAGNOSTICS: The PCM fails the **P062A Fuel System Performance** diagnostic when the actual fuel pressure is approximately **100 kPa (14.5 psi) below or 40 kPa (5.8 psi) above the desired fuel pressure**. This fault usually sets along with other faults since the FPCM will default to 80% duty cycle for many failure modes which causes the actual pressure to be higher than the desired set point. The entire system should be examined when this fault is set, including the Fuel Pressure Sensor and circuits. A sensor drifted out of range, or high resistance in the signal or sensor ground circuit can cause a false reading on a normally operating system.

- **The dual pump variable pressure systems can be tricky when diagnosing a performance fault.** The fuel pressure may be good with one failed pump during most normal operating conditions. The condition may only be present under very heavy engine load conditions when both pumps are needed to produce the pressure and volume needed. If available on the scan tool, monitoring duty cycle for both pumps can help diagnosing the issue. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. However, if Fuel Pump 2 is defaulted to 80%, the primary pump will continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump reservoir.

The FPCM fails the **P064A Fuel Pump Control Module Performance** when excessive current draw is detected on the fuel pump circuitry. The FPCM will default and reduce the duty cycle to the fuel pump to the lowest possible duty cycle while the issue is present.

For most vehicles the fuel pressure desired and actual values, as well as the Fuel Pump output duty cycle data can be viewed on the scan tool. These readings can be very useful during the diagnosis of the system.

TECH TIP: A vehicle will typically have one of two issues;

1. The vehicle has no fuel pressure/pump is not operating.
 - The first thing to check for is a Loss of Communication fault. The reason is that the same Battery supply and ground circuit that are used to power up the FPCM are also used for the Fuel Pump motor to operate. A loss of Battery supply, or a poor chassis ground for the module will cause both issues.
 - The next thing to look for is an output from the FPCM to the pump. This can be done with the scan tool or by checking the duty cycle output from the FPCM. If there is any output from the FPCM to the Fuel Pump, the pump should be operating and creating fuel pressure. If the pump is not running then the Fuel Pump and circuits between the FPCM and Fuel Pump should be focused on during diagnostics. If the Loss of Communication fault is not present the Battery supply and chassis ground are most likely good.
2. The vehicle runs normally, has a DTC or DTCs present, and the output duty cycle to the Fuel Pump is defaulted. In most cases, the output is defaulted to 80% and the actual pressure is greater than the desired pressure.
 - The first thing to check is for a Loss of Communication fault. If the vehicle is running with a Loss of Communication fault, and an 80% output duty cycle, it would typically point to an issue with

the FPCM PWM Feedback circuit. A loss of Battery supply or a poor chassis ground would usually cause no Fuel Pump operation and a no start condition.

- If there is no Loss of Communication fault then this condition is most likely present due to an issue with the command circuit, an over current draw or over temp condition with the Fuel Pump.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns, or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. **Since the FPCM monitors the Fuel Pump circuits and motor for excessive current draw and over temperature conditions,** it is possible that the pump may need to run for an extended period for the condition to be present.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply, check for connection issues by wiggle testing any wiring harnesses and in-line connectors the circuitry passes through. A good practice is to watch for a DTC to become active or scan tool data to change. An even better method is to attach a lab scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor battery system voltage or poor ground connections can affect systems in different or odd ways. Check the battery or batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.
4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving. Operate the components through a full range of operation while monitoring functionality.

DIAGNOSTIC TEST - FPCM SYSTEM COMMAND CIRCUIT FAULTS (P025A, P027A)

TECH TIP: The FPCM DTCs will set incorrectly for some vehicles/model years due to incorrect calibrations. For those vehicles it is best to perform the "COMPLETE FUEL PUMP CONTROL MODULE SYSTEM TESTING (NOT DTC SPECIFIC)" diagnostic procedure. Refer to the "KNOW ISSUES" section above for a list of the vehicles with incorrect calibrations.

COMMAND CIRCUIT OPEN/LOW/HIGH (P025A, P027A):

The FPCM PWM Command circuit is a 12 volt PWM signal. This fault will set when it is detected that the command circuit between the PCM and FPCM is open, stuck low (shorted to ground) or stuck high (shorted to voltage). For a detailed description on the functionality of the command circuit, read the PCM component functional description section above.

NOTE: With an open command circuit, the PCM internal driver will show a pulse width signal of approximately 2.5v if checking at the PCM connector with the Mopar Scope. This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the FPCM. This can be useful when performing diagnostics on the command circuitry.

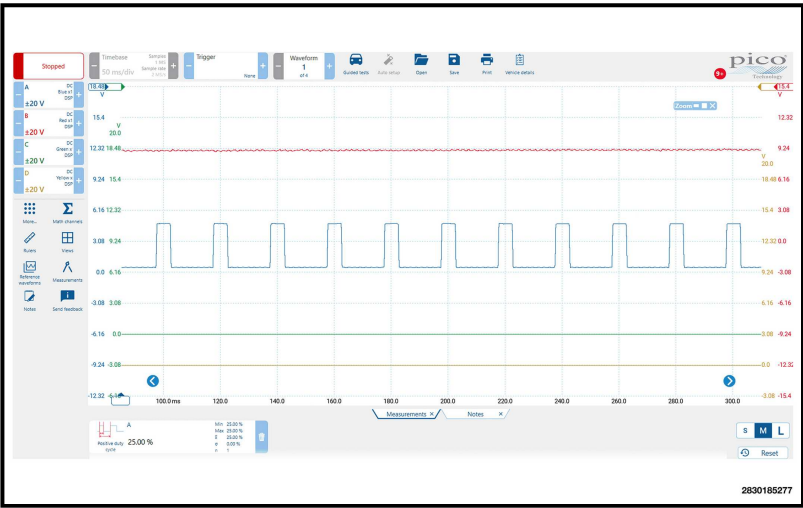
Listed below are test methods using the Mopar Scope and traditional testing with a meter.

TESTING THE COMMAND CIRCUIT USING THE MOPAR SCOPE (PREFERRED METHOD):

Using the Mopar Scope is the preferred and best method for diagnosing the FPCM and circuits. The circuits can be monitored one at a time or all together using all four channels of the scope. Crank or start the engine while monitoring the following command circuit. The command circuit can be tested at the FPCM or at the PCM using the GPEC Adaptor connected in-line. Both results are described below.

SCOPE LEAD CONNECTED AT THE FPCM

1. If the PWM Command circuit is functioning normally the signal should have a 12v duty cycle between 11% and 89%.
 - If the command circuit is functioning as described above the command circuit is not the cause of the issue.
2. If the PWM Command circuit is reading a constant 0 volts, it would indicate that the control circuit is shorted to ground.



Blue Channel - Feedback circuit
Red Channel - Fuel pump output circuit
Green Channel - Command circuit

- Test and repair the short to ground in the command circuit.
3. If the PWM Command circuit is a reading a constant battery voltage, it would indicate an open in the command circuit or the PCM internal driver is faulty.



Blue Channel - Feedback circuit

Yellow Channel - Command circuit on the FPCM side of the open

Green Channel - Command circuit on the PCM side of the open

- Isolate and measure the resistance of the command circuit. If the circuit is open or has high resistance repair the circuit. If the circuit has less than 5.0 Ohms of resistance, the PCM driver is faulty. Replace the powertrain control module in accordance with the service information.
4. If the PWM Command circuit is duty cycling, but the voltage is approximately 2.5v instead of the normal 12v duty cycle, it indicates that the command circuit and PCM internal driver are good. The FPCM is not producing the 12v output on the command circuit.



Blue Channel - Feedback circuit

Yellow Channel - Command circuit on the FPCM side of the open

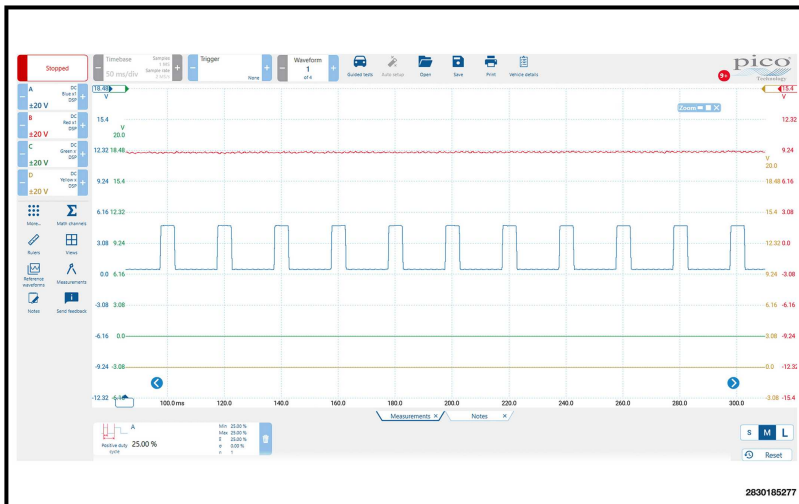
Green Channel - Command circuit on the PCM side of the open

- Verify that the relay output battery supply to the FPCM is constant and the FPCM ground circuit is good. If both circuits test good replace the fuel pump control module in accordance with the service information.

SCOPE LEAD CONNECTED AT THE GPEC ADAPTOR IN-LINE WITH THE PCM

- If the PWM Command circuit is functioning normally the signal should have a 12v duty cycle between 11% and 89%.
 - If the command circuit is functioning as described above the command circuit is not the cause of the issue.

- If the PWM Command circuit is reading a constant 0 volts, it would indicate that the command circuit is shorted to ground.



Blue Channel - Feedback circuit
Red Channel - Fuel pump output circuit
Green Channel - Command circuit

- Test and repair the short to ground in the command circuit.
- If the PWM Command circuit is a reading a constant battery voltage, it indicates the command circuit and FPCM output are good. The PCM internal driver is faulty.



Blue Channel - Feedback circuit
Yellow Channel - Command circuit on the FPCM side of the open
Green Channel - Command circuit on the PCM side of the open

- Replace the powertrain control module in accordance with the service information.
- If the PWM Command circuit is duty cycling, but the voltage is approximately 2.5v instead of the normal 12v duty cycle, it indicates that the PCM internal driver is good. There is an open in the command circuit or the FPCM is not producing the 12v output on the command circuit.



Blue Channel - Feedback circuit
Yellow Channel - Command circuit on the FPCM side of the open
Green Channel - Command circuit on the PCM side of the open

- Isolate and measure the resistance of the command circuit. If the circuit is open or has high resistance repair the circuit. If the circuit has less than 5.0 Ohms of resistance, the FPCM output is faulty. Replace the fuel pump control module in accordance with the service information.

TESTING THE COMMAND CIRCUIT USING A METER:

- Check for continuity between ground and the FPCM PWM command circuit. There should be no continuity between ground and the FPCM PWM command circuit
 - If the FPCM PWM command circuit shows continuity to ground, repair the FPCM PWM command circuit for a short to ground.
 - If the FPCM PWM command circuit does not show continuity to ground, **continue to step 2.**
- Disconnect the PCM and FPCM harness connectors. Check for continuity between the FPCM PWM command circuit and all other circuits at the PCM harness connector. There should be no continuity between the FPCM PWM command circuit and any other circuit.
 - If the FPCM PWM command circuit shows continuity with another circuit, repair the FPCM PWM command circuit for a short to the other circuit.
 - If the FPCM PWM command circuit does not show continuity to any other circuit, **continue to step 3.**
- Measure the resistance of the FPCM PWM command circuit between the FPCM harness connector and PCM harness connector. The resistance should typically be below 3.0 Ohms.
 - If the resistance is above 3.0 Ohms, repair the FPCM PWM command circuit for high resistance.
 - If the FPCM PWM command circuit tests good, the issue could be either an intermittent condition, poor pin fit at a connector, or a calibration issue setting the incorrect DTC.
 - If the terminals appear good and an intermittent issue isn't found perform the "DIAGNOSTIC TEST - COMPLETE FUEL PUMP CONTROL MODULE SYSTEM TESTING (NOT DTC SPECIFIC)" diagnostic to check the entire system operation.

DIAGNOSTIC TEST - COMPLETE FUEL PUMP CONTROL MODULE SYSTEM TESTING (NOT DTC SPECIFIC)

TECH TIP: The FPCM DTCs will set incorrectly for some vehicles/model years due to incorrect calibrations. For those vehicles it is best to perform the "COMPLETE FUEL PUMP CONTROL MODULE SYSTEM TESTING (NOT DTC SPECIFIC)" diagnostic procedure. Refer to the "KNOW ISSUES" section above for a list of the vehicles with incorrect calibrations.

COMPLETE FUEL PUMP CONTROL MODULE SYSTEM DIAGNOSTICS:

Using the Mopar Scope is the preferred and best method for diagnosing the FPCM and circuits. The circuits can be monitored one at a time or all together using all four channels of the scope.

This test is written with the leads back probed and connected at the FPCM connector unless otherwise specified

. Crank or start the engine while monitoring each of the following circuits:

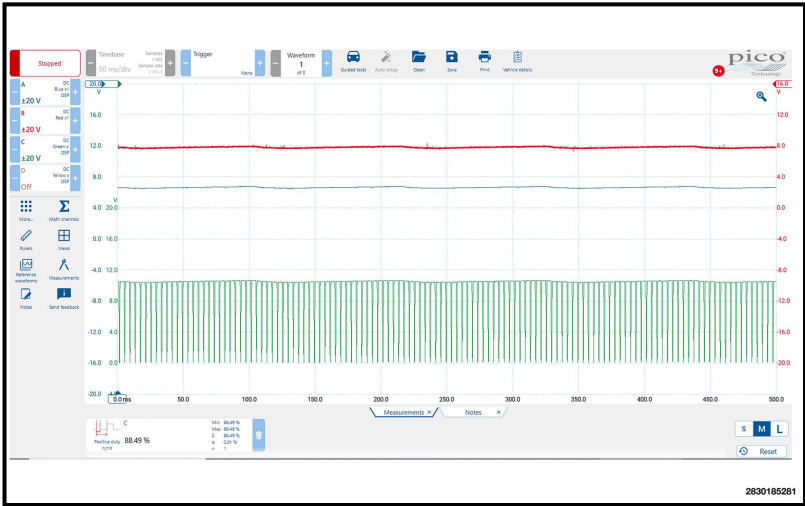
- PWM Command circuit
- PWM Feedback circuit
- Fuel Pump Control circuit
- Relay output to FPCM (Battery supply)

Below are the expected results along with failure modes for each of the circuits:

1. BATTERY SUPPLY CIRCUIT:

1. The relay output voltage to the FPCM should remain constant and equal to battery voltage during operation.
 - If the voltage is constant battery voltage during cranking, the relay output is not the cause of the issue.
2. If no voltage is present during cranking there is an open in the relay output circuit.
 - Check the fuse for the circuit. If the fuse is open, check the Fuel Pump Relay Output circuit for a short to ground before replacing the fuse. If the fuse is good check the relay output circuit for an open.
3. Voltage is present but below battery voltage.
 - Check for resistance in the relay output and FPCM ground circuits.

NOTE: An open ground circuit can cause the feedback circuit voltage to change from a 5v duty cycle to a constant voltage or approximately 6.5v as seen in the figure below.



Blue Channel - Feedback circuit
Red Channel - Fuel pump output circuit
Green Channel - Command circuit

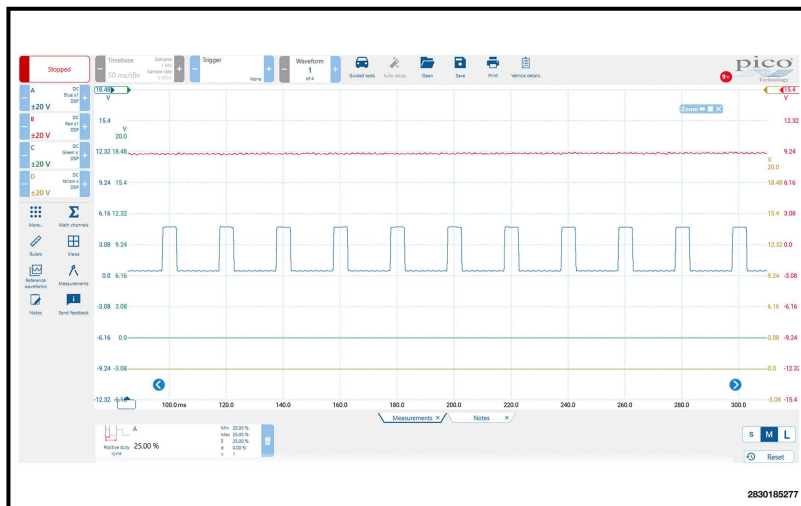
2. FUEL PUMP PWM COMMAND CIRCUIT:

For a detailed description on the functionality of the command circuit, read the PCM component functional description section above. The FPCM will still operate the fuel pump when there is an issue with the command circuit. Typically the output voltage to the fuel pump will be higher than during

normal operation. The command circuit can be tested at the FPCM or at the PCM using the GPEC Adaptor connected in-line. Both results are described below.

SCOPE LEAD CONNECTED AT THE FPCM

1. If the PWM Command circuit is functioning normally the signal should have a 12v duty cycle between 11% and 89%.
 - If the command circuit is functioning as described above the command circuit is not the cause of the issue.
2. If the PWM Command circuit is reading a constant 0 volts, it would indicate that the control circuit is shorted to ground.



Blue Channel - Feedback circuit

Red Channel - Fuel pump output circuit

Green Channel - Command circuit

- Test and repair the short to ground in the command circuit.
3. If the PWM Command circuit is a reading a constant battery voltage, it would indicate an open in the command circuit or the PCM internal driver is faulty.



Blue Channel - Feedback circuit

Yellow Channel - Command circuit on the FPCM side of the open

Green Channel - Command circuit on the PCM side of the open

- Isolate and measure the resistance of the command circuit. If the circuit is open or has high resistance repair the circuit. If the circuit has less than 5.0 Ohms of resistance, the PCM

driver is faulty. Replace the powertrain control module in accordance with the service information.

- If the PWM Command circuit is duty cycling, but the voltage is approximately 2.5v instead of the normal 12v duty cycle, it indicates that the command circuit and PCM internal driver are good. The FPCM is not producing the 12v output on the command circuit.



Blue Channel - Feedback circuit

Yellow Channel - Command circuit on the FPCM side of the open

Green Channel - Command circuit on the PCM side of the open

- Verify that the relay output battery supply to the FPCM is constant and the FPCM ground circuit is good. If both circuits test good replace the fuel pump control module in accordance with the service information.

SCOPE LEAD CONNECTED AT THE GPEC ADAPTOR IN-LINE WITH THE PCM

- If the PWM Command circuit is functioning normally the signal should have a 12v duty cycle between 11% and 89%.
 - If the command circuit is functioning as described above the command circuit is not the cause of the issue.
- If the PWM Command circuit is reading a constant 0 volts, it would indicate that the command circuit is shorted to ground.



Blue Channel - Feedback circuit

Red Channel - Fuel pump output circuit

Green Channel - Command circuit

- Test and repair the short to ground in the command circuit.
3. If the PWM Command circuit is a reading a constant battery voltage, it indicates the command circuit and FPCM output are good. The PCM internal driver is faulty.



Blue Channel - Feedback circuit

Yellow Channel - Command circuit on the FPCM side of the open

Green Channel - Command circuit on the PCM side of the open

- Replace the powertrain control module in accordance with the service information.
4. If the PWM Command circuit is duty cycling, but the voltage is approximately 2.5v instead of the normal 12v duty cycle, it indicates that the PCM internal driver is good. There is an open in the command circuit or the FPCM is not producing the 12v output on the command circuit.



Blue Channel - Feedback circuit

Yellow Channel - Command circuit on the FPCM side of the open

Green Channel - Command circuit on the PCM side of the open

- Isolate and measure the resistance of the command circuit. If the circuit is open or has high resistance repair the circuit. If the circuit has less than 5.0 Ohms of resistance, the FPCM output is faulty. Replace the fuel pump control module in accordance with the service information.

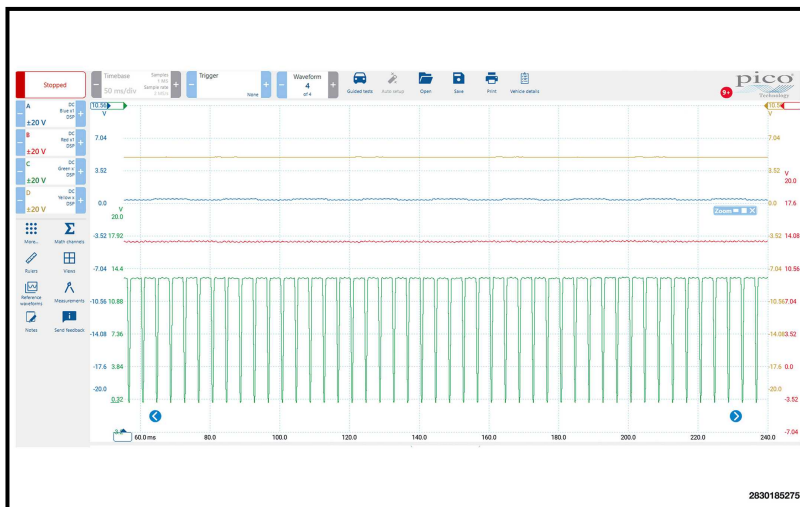
3. FPCM PWM FEEDBACK CIRCUIT:

For a detailed description on the functionality of the feedback circuit, read the FPCM component functional description section above. The PCM will command the highest command duty cycle when it cannot receive feedback from the FPCM due to an issue with the feedback circuit. The fuel pump should

still operate when the communication is lost between the FPCM and PCM due to a feedback signal circuit issue. Typically the output voltage to the fuel pump will be higher than during normal operation. The feedback circuit can be tested at the FPCM or at the PCM using the GPEC Adaptor connected in-line. Both results are described below.

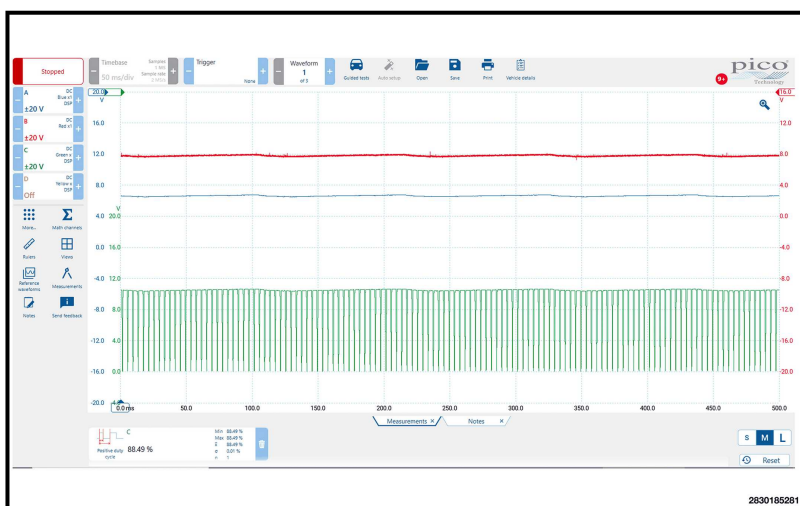
SCOPE LEAD CONNECTED AT THE FPCM

1. If the FPCM PWM Feedback circuit is functioning normally the signal should have a 5v duty cycle between 3% and 97%.
 - If the feedback circuit is functioning as described above the feedback circuit is not the cause of the issue.
2. If the PWM feedback circuit is reading a constant 0 volts, it would indicate that the control circuit is shorted to ground.
 - Test and repair the short to ground in the feedback circuit.
3. If the PWM feedback circuit is reading a constant 5.0 volts, it would indicate that FPCM internal driver is faulty.



Blue Channel - Feedback circuit on the FPCM side of the open
Yellow Channel - Feedback circuit on the PCM side of the open
Green Channel - Command circuit
Red Channel - Fuel pump output circuit

- Replace the fuel pump control module in accordance with the service information.
4. An open or partially open ground circuit can effect the feedback pattern in different ways. The PWM feedback circuit may read a constant voltage approximately 6.5 volts, or it could be a pulsed voltage between 5.0 volts and 8.0 volts when the FPCM ground circuit is open.

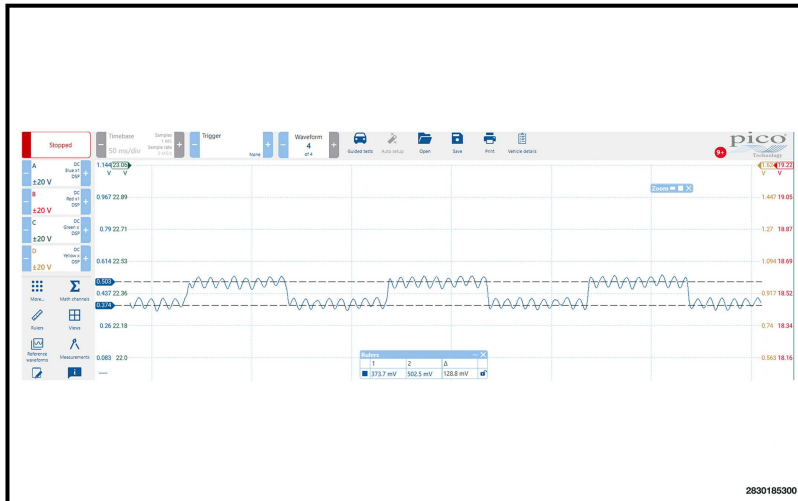


Blue Channel - Feedback circuit

Red Channel - Fuel pump output circuit

Green Channel - Command circuit

- Test and repair the FPCM ground circuit for an open or high resistance.
5. If the PWM feedback circuit is duty cycling between approximately 0.3v and 0.6v instead of the normal 5v duty cycle, it indicates that the FPCM internal driver is good. Either the feedback circuit is open or the PCM is not producing the 5v output on the feedback circuit.



Blue Channel - Feedback circuit on the FPCM side of the open

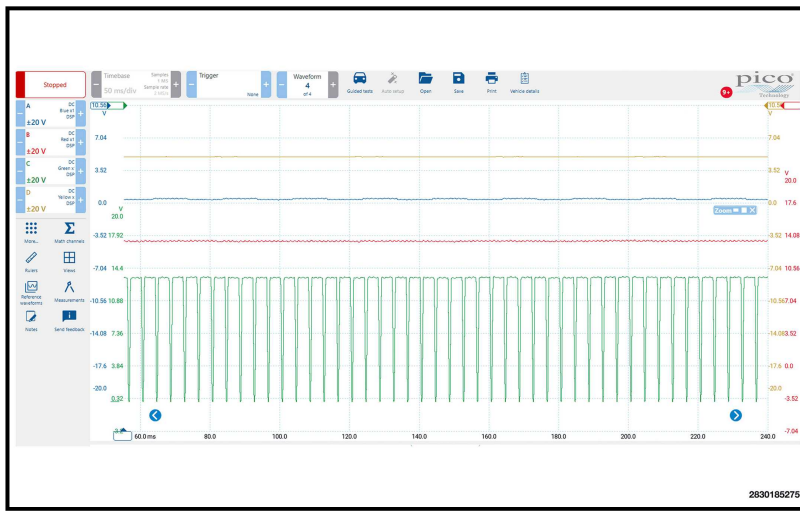
- If the circuit is open or has high resistance repair the circuit. If the circuit has less than 5.0 Ohms of resistance, the PCM output driver is faulty. Replace the powertrain control module in accordance with the service information.

NOTE:

Another way to test the output and circuit is to connect a scope lead to the PCM connector using the GPEC Adaptor tool. If the 5v output is present at the PCM connector, but not at the FPCM, the PCM is good and the feedback circuit is open.

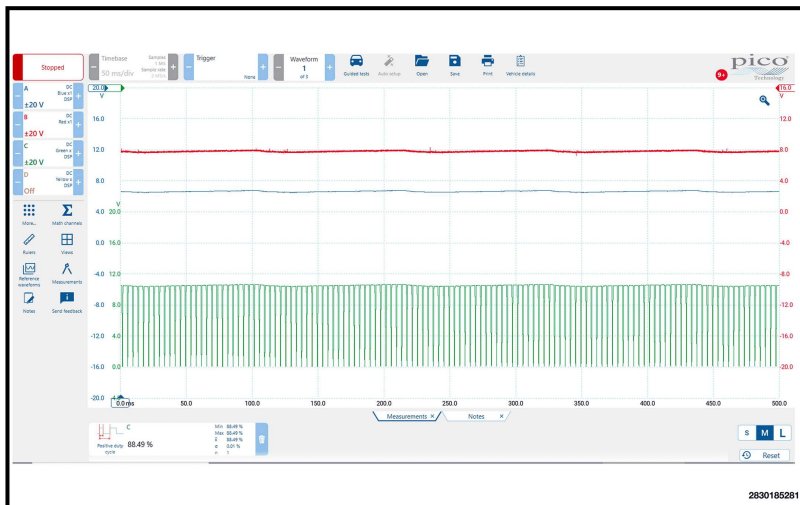
SCOPE LEAD CONNECTED AT THE GPEC ADAPTOR CONNECTED IN-LINE WITH THE PCM

1. If the FPCM PWM Feedback circuit is functioning normally the signal should have a 5v duty cycle between 3% and 97%.
 - If the feedback circuit is functioning as described above the feedback circuit is not the cause of the issue.
2. If the PWM feedback circuit is reading a constant 0 volts, it would indicate that the control circuit is shorted to ground.
 - Test and repair the short to ground in the feedback circuit.
3. If the PWM feedback circuit is reading a constant 5.0 volts, it would indicate that the feedback circuit is open or the FPCM internal driver is faulty.



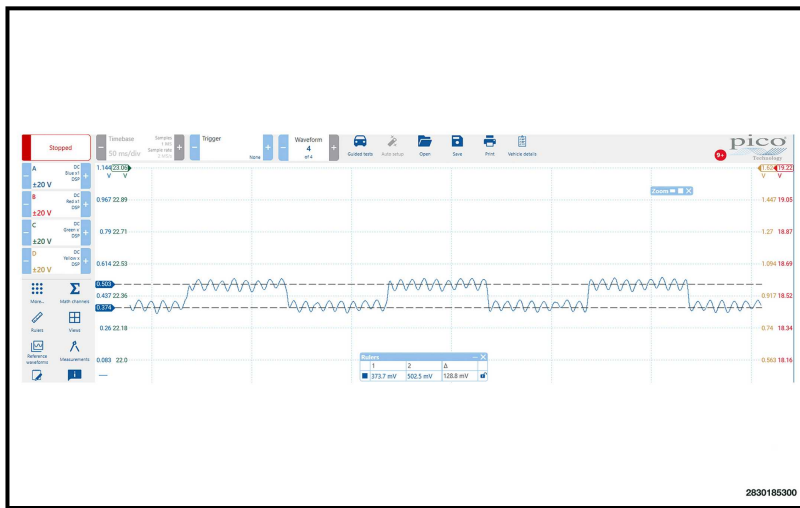
Blue Channel - Feedback circuit on the FPCM side of the open
Yellow Channel - Feedback circuit on the PCM side of the open
Green Channel - Command circuit
Red Channel - Fuel pump output circuit

- If the circuit is open or has high resistance repair the circuit. If the circuit has less than 5.0 Ohms of resistance, the FPCM driver is faulty. Replace the fuel pump control module in accordance with the service information.
4. If the PWM feedback circuit is reading a constant voltage approximately 6.5 volts, it would indicate that the FPCM ground circuit is open.



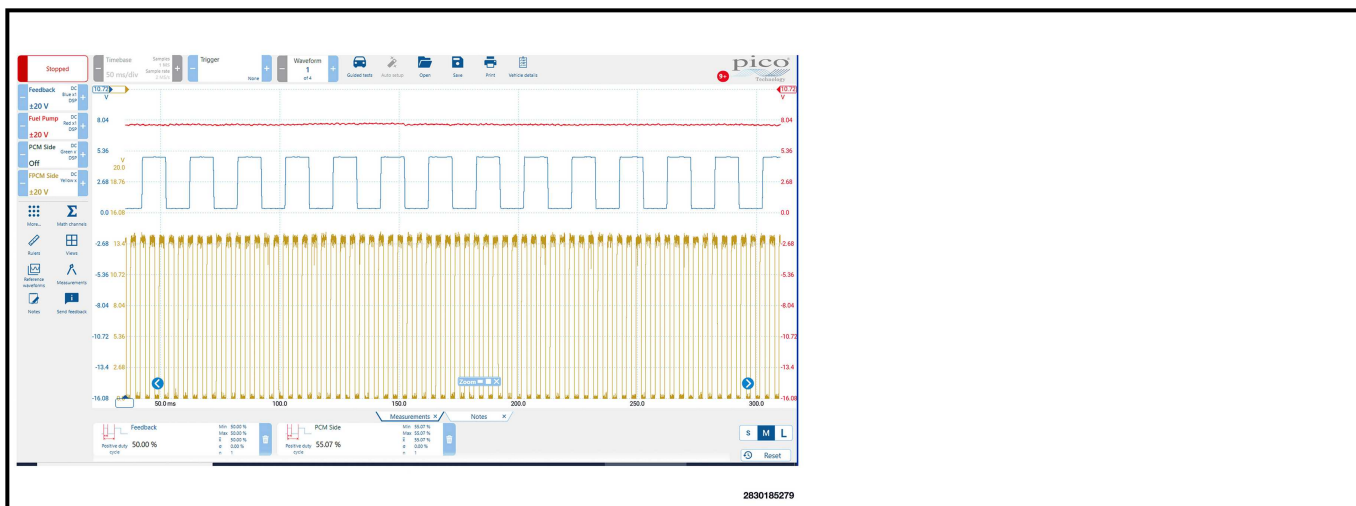
Blue Channel - Feedback circuit
Red Channel - Fuel pump output circuit
Green Channel - Command circuit

- Test and repair the FPCM ground circuit for an open or high resistance.
5. If the PWM feedback circuit is duty cycling between approximately 0.3v and 0.6v instead of the normal 5v duty cycle, it indicates that the feedback circuit and FPCM internal driver is good. The PCM is not producing the 5v output on the feedback circuit.



Blue Channel - Feedback circuit on the FPCM side of the open

- Replace the powertrain control module in accordance with the service information.
4. **FUEL PUMP AND CONTROL CIRCUITS:** There should be a relatively constant voltage on the fuel pump control circuit. When the system is operating normally without any faults the output voltage is typically around 7.0 - 9.0 volts. When there is a fault in the system the output is typically higher due to the FPCM defaulting to a higher output (between 10.5 volts and battery voltage). For this reason the fuel pump output voltage may be high near battery voltage due to an issue in the Fuel Pump circuits or one of the other FPCM circuits (Command or Feedback). If one of those circuits indicates an issue, diagnose that circuit before continuing with the diagnosis of the fuel pump circuits.
1. If the Fuel Pump Control circuit voltage is functioning normally it should be less than battery voltage (between approximately 7.0 - 9.0 volts).
 - If the voltage on the Fuel Pump Control circuit reads as described above, the output from the FPCM is normal.
 - If the voltage on the Fuel Pump Control circuit is reading 0v or near battery voltage, **continue to step b.**
 2. Gain access to the Fuel Pump harness connector. Using the Mopar Scope, back probe the Fuel Pump Control circuit and Fuel Pump Return circuit. Crank or start the engine while monitor the voltage on each circuit.
 - If the Fuel Pump Control circuit voltage is 0 at the Fuel Pump harness connector, the Fuel Pump Control circuit is open or shorted to ground. Repair the circuit. **NOTE: A short to ground in the Fuel Pump PWM Control circuit may open the fuse for the FPCM Battery voltage supply from the relay, which can cause a Loss of Communication fault also.**
 - If the Fuel Pump Control circuit voltage is the same as the output from the FPCM, the Fuel Pump Return circuit is 0v, and the Fuel Pump does not operate, the Fuel Pump is faulty.
 - If the Fuel Pump Return circuit voltage matches the Fuel Pump Control circuit at the Fuel Pump harness connector, the Fuel Pump Return circuit is open to ground. **NOTE: The return circuit grounds through the FPCM chassis ground circuit. This will likely lead to a no start with no fuel pump operation.**



Blue Channel - Feedback circuit
Red Channel - Fuel Pump Control circuit
Yellow Channel - Command circuit

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.

1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
2. If the DTC or condition did not return, repair is complete.

P025B-FUEL PUMP MODULE CONTROL CIRCUIT PERFORMANCE

NO TITLE

For a complete FUEL DELIVERY SYSTEM wiring diagram, .

KNOWN ISSUES - FPCM SYSTEM

While the FPCM has the capability of detected failure modes, the faults are not always reported out as intended. Some vehicles have incorrect calibrations that will read the FPCM messages incorrectly and set the DTCs incorrectly. On these vehicles it is best not to rely on the DTC, or DTC Description when deciding which portion of the system to diagnose. In these cases it is best to read and understand how the system operates, then diagnose the entire system to determine where the failure lies by performing the **Complete Fuel Pump Control Module System Diagnostics (Not DTC Specific)** procedure when diagnosing this system. This diagnostic can also be used to diagnose the FPCM command, feedback and fuel pump control circuits on vehicles with the correct calibration software.

The vehicles listed below will set faults incorrectly for the model years listed and should always be diagnosed using the Not DTC specific system approach.

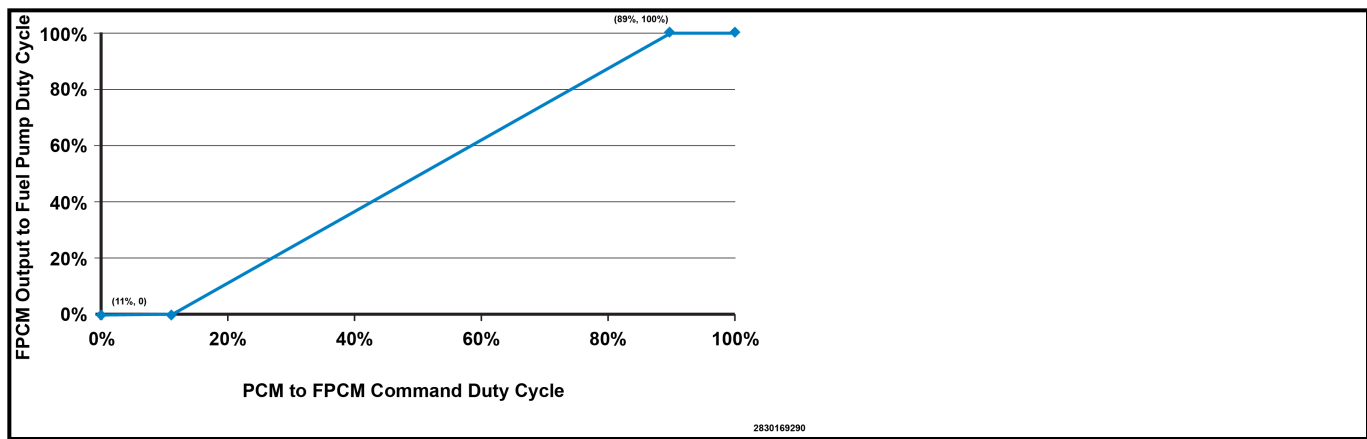
- DS - model years 2016-2019
- RU - model years 2017-2018
- JL - model year 2018
- JT - model year 2020

The exceptions to the information above are the Loss of Communication, Fuel Rail Pressure Sensor and Fuel Pump Relay Control circuit faults. These faults will typically set correctly since they are detected by the PCM directly, not the FPCM.

FPCM SYSTEM DESCRIPTION AND OPERATION

SYSTEM DESCRIPTION: When the Powertrain Control Module (PCM) requires Fuel Pump operation it energizes the Fuel Pump Relay. The Battery voltage output from the relay does not connect directly to the Fuel Pump like traditional systems. Instead, the Battery voltage is supplied to the Fuel Pump Control Module (FPCM). When the ignition is switched on, the Battery voltage is present for approximately five seconds. Battery voltage should always be present during cranking or when the engine is running. The purpose of FPCM is to operate the Fuel Pump at a reduced voltage output to reduce electrical load on the system. Most vehicle/engine combinations operate as a **fixed pressure system** . Vehicles with the 6.2L engine operate as a **variable pressure system** . It is necessary on some vehicles with the 6.2L engine to have a second Fuel Pump and FPCM to meet engine needs. The second FPCM performs the same diagnostics as the primary module but uses different DTCs.

SYSTEM OPERATION: To maintain the desired fuel pressure, the PCM sends a Pulse Width Modulated (PWM) duty cycle signal to the FPCM. If there are no system faults present, the Fuel Pump Control output to the Fuel Pump is based on the duty cycle sent by the PCM. The graph below shows the FPCM output to the Fuel Pump in proportion to the PCM command signal. **The FPCM output to the fuel pump will not read as a duty cycle when monitoring with a Mopar Scope. It will be a consistent voltage output that is a percentage of battery voltage.**



COMPONENT FUNCTIONAL DESCRIPTION- FUEL PUMP CONTROL MODULE (FPCM) AND FUEL PUMP

The FPCM performs fault detection and reports faults to the PCM through the PWM Feedback circuit. The feedback circuit can be monitored using the Mopar Scope and functions as follows:

- The feedback circuit is a 5.0 volt duty cycle.
- The PCM supplies the 5.0 volts for the feedback circuit.
- The FPCM pulses the low side of the circuit to communicate with the PCM.
- The normal duty cycle operating range is between 3% and 97%.
- When the system is operating normally, the FPCM will send a 50% duty cycle on the feedback circuit to the PCM.
- When the FPCM detects a fault it will send a duty cycle that aligns with the failure mode detected.
- If the duty cycle is 0% or 100% the PCM will set the Loss of Communication fault against the FPCM.

NOTE: Monitoring the FPCM internal driver with an open feedback circuit using the Mopar Scope will show a pulse width signal with a very low voltage (.025v - 0.5v). This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the PCM. This can be useful when performing diagnostics on the feedback circuitry.

Depending on the failure mode detected by the PCM and FPCM, the FPCM can react by either reducing the PWM output duty cycle, or defaulting to an 80% duty cycle for the fuel pump operation. The FPCM reactions are explained further in the PCM/FPCM Reaction column of the Enable Conditions and Failure Modes section.

Fuel Pump: The Fuel Pump operates in the same manner as a typical Brushed DC motor. The only difference is that the speed is reduced due to the PWM output voltage from the FPCM being less than 100%. The voltage supplied is based on the command received from the PCM.

Vehicles with Dual Pump Systems: The fuel pumps operate independently, but may be serviced as an assembly on some vehicles. During normal operation both Fuel Pumps are used to provide the system pressure and volume needed during most engine operating conditions. **The exception is at idle, or idle and purging where there is extremely low fuel demand.** During this mode Fuel Pump 2 is typically turned off. When more fuel demand is needed (typically off idle) Fuel Pump 2 is turned on and both pumps are operated at the same duty cycle. If either pump is failing the vehicle may still operate normally during most driving conditions but would have performance issues under heavy engine load when both pumps are needed. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. **However, if Fuel Pump 2 is defaulted to 80%, the primary pump will continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump assembly reservoir.**

COMPONENT FUNCTIONAL DESCRIPTION - POWERTRAIN CONTROL MODULE (PCM)

The PCM monitors the input signal from the Fuel Rail Pressure Sensor to determine the commanded duty cycle to the FPCM. On a fixed pressure system the PCM varies the commanded duty cycle to maintain a constant pressure. On variable pressure systems the commanded duty cycle is varied to adjust fuel pressure based on engine needs. Ambient temperature and fuel temperature can also contribute to fuel pressure changes. The pressure is raised during high ambient temperatures to prevent boiling of the fuel.

NOTE: On vehicles with diesel engines or high pressure gas fuel systems, the PCM monitors the Fuel Pressure Sensor on the low pressure side of the system to determine the commanded duty cycle, not the Fuel Rail Pressure Sensor on the high pressure side.

The command circuit can be monitored using the Mopar Scope and functions as follows:

- The command circuit is a 12.0 volt duty cycle.
- The FPCM supplies the 12.0 volts for the command circuit.
- The PCM pulses the low side of the circuit to communicate with the DTCM.
- The normal duty cycle operating range is between 11% and 89%.
- If the FPCM does not receive a valid command signal from the PCM it will send a fault message on the feedback circuit and operates the fuel pump at a defaulted value (typically 80%).

With an open command circuit, the PCM internal driver will show a pulse width signal of approximately 2.5v if checking at the PCM connector with the Mopar Scope. This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the FPCM. This can be useful when performing diagnostics on the command circuitry.

When the PCM loses communication with the FPCM it will default to the highest duty cycle. This will cause the FPCM to provide maximum voltage output to the fuel pump.

TECHNICAL DATA-FUEL SYSTEM PRESSURE SPECIFICATIONS

The table below shows the fuel system pressure specifications.

VARIABLE FUEL PRESSURE SYSTEM SPECIFICATIONS (6.2L ENGINES)		
CRANKING	520 kPa (75.4 psi)	System operates in open loop during cranking
IDLE	340 - 400 kPa (49 - 58 psi)	Normal operating range at idle - Pressure is dependant on ambient and fuel temp. Pressure is raised during high temp to prevent boiling
NORMAL RANGE OF OPERATION	340 - 550 kPa (49 - 80 psi)	Normal operating range between idle and high engine demand
100% DUTY CYCLE	600 - 700 kPa (87 - 101.5 psi)	This is regulated by the pressure relief valve in the Fuel Pump. The pressure can vary from pump to pump.
B		
4 CYLINDER (1.0L/1.3L GSET / 2.0L GMET ENGINES)		
CRANKING	580 kPa (84.1 psi)	System operates in open loop during cranking
ALL OTHER OPERATING CONDITIONS	520 kPa (75.4 psi)	The fixed pressure systems should maintain approximately 75.0 psi during normal operation
B		
FIXED PRESSURE SYSTEM SPECIFICATIONS (ALL OTHER ENGINES)		
The fixed pressure systems should maintain approximately 400 kPa (58.0) psi during normal operation		

GENERIC SYSTEM SCHEMATIC:

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
P025A	P027A	Missing or invalid PWM Command signal from PCM	1. PCM to FPCM Command Signal open 2. PCM to FPCM Command Signal shorted low or high 3. Invalid PWM signal - frequency out of range 4. FPCM 5. PCM	FPCM defaults the output to the Fuel Pump to 80% duty cycle NOTE: It is not uncommon for the P025A DTC to set erroneously for several other failure modes
P025B	P027B	Output driver over temp	1. FPCM Output partially shorted to ground 2. Faulty Fuel Pump (high mechanical resistance) 3. Faulty FPCM internal driver	- PCM sets fault, waits a calibrated period and commands a safe duty cycle - FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If over temp continues, shut down output driver.
P025C	P027C	System under voltage - Fuel Pump Relay output voltage to FPCM is below a calibrated threshold (approximately 6.0 volts)	1. High resistance in the Fuel Pump Relay output circuit 2. FPCM	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P025D	P027D	System over voltage - Fuel Pump Relay output voltage to FPCM is above a calibrated threshold (approximately 16.0 volts)	1. Charging system issue	- PCM applies over voltage strategy - FPCM reacts to PCM input command
P0628	P2633	FPCM output to Fuel Pump shorted to ground	1. Fuel Pump PWM Control circuit shorted to ground	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
P0629	P2634	FPCM output to Fuel Pump shorted to voltage	1. Fuel Pump PWM Control circuit shorted to voltage	FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If condition continues, shut down output driver.

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
P062A	P062A	Actual fuel pressure is above or below the desired fuel pressure by more than a calibrated threshold. - Fixed pressure system - 5.8 psi above or 14.5 psi below - Variable pressure system - 10.9 psi above or below	- No fuel in the Fuel Tank - Fuel supply tube broken/leaking - Fuel supply tube pinched/restricted - FPCM defaulted to 80% due to another failure detected - FPCM duty cycle output reduced due to another failure detected - Faulty Fuel Pump	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P064A	P26EA	Current draw exceeds calibrated threshold	- Fuel Pump PWM Control circuit shorted to voltage - Faulty Fuel Pump - internal short or high mechanical resistance	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
P1205	P120A	FPCM Micro internal fault	Fuel Pump Control Module	FPCM continues to run in normal mode - run Fuel Pump according to PCM command signal
P1206	P120B	FPCM output to Fuel Pump open circuit	- Fuel Pump PWM Control circuit open - Fuel Pump Return/Ground circuit open - FPCM Ground circuit open - FPCM	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
U0109	U016C	PCM Loss of Communication with FPCM	- FPCM PWM Feedback circuit open - FPCM PWM Feedback shorted low or high - Fuel Pump Relay output circuit to FPCM open or shorted to ground - FPCM Ground circuit open - Fuel Pump PWM Control circuit shorted to ground - FPCM - PCM	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle

DIAGNOSTIC OVERVIEW-FUEL PUMP CONTROL MODULE

GENERAL DIAGNOSTIC INFORMATION: There are several faults associated with this system. The failure modes being monitored for are Loss of Communication, internal FPCM faults, system voltage faults,

Thermal Protection, circuit faults, and system performance. **On several vehicles, multiple or incorrect faults** can set which can mislead diagnosing the vehicle. For this reason, it is a good practice to perform a total system diagnosis regardless of the DTC present for most faults. The communication faults are detected directly by the PCM and will typically set correctly. See Communication Diagnostics explanation below.

PCM DIAGNOSTICS: The PCM directly monitors the Fuel Pump Relay Control circuit, FPCM Feedback circuit and the Fuel Pressure Sensor circuits for faults. The Fuel Pressure Sensor signal must be rationalized since the signal is monitored to perform fuel system pressure performance diagnostics. This is done by watching the signal at initial engine start up for both types of systems. **On the fixed pressure system** the normally stable fuel pressure is dynamic for the first few seconds. The pressure will spike above the set point approximately 40-50 kPa (5.8-7.25 psi), then drop below the set point approximately 60-70 kPa (8.7-10.2 psi), and quickly dampen and settle at the set point 400kPa (58.0 psi). At initial engine start up, when the engine speed reaches approximately 500 rpm, the Powertrain Control Module (PCM) measures the delta pressure change between the highest pressure reading and lowest pressure reading and make determinations about sensor rationality. The diagnostic works the same **on the variable pressure system** as the fixed pressure system except that the system is in open loop at start up and the pressure is commanded to a preset known value to perform the diagnostic.

SYSTEM VOLTAGE DIAGNOSTICS: The FPCM monitors the Battery voltage supply coming from the Fuel Pump Relay to the module. A fault will set if the voltage is too high or too low. Typically a voltage high fault would indicate a charging system issue. The voltage low fault could also be a charging system issue, but may also be caused by resistance in the Battery supply or ground circuit.

COMMUNICATION DIAGNOSTICS: Unlike other system faults, the Loss of Communication fault will typically set correctly. The PCM will set this fault when the FPCM PWM Feedback duty cycle is below 3% or above 97%. This can occur if the FPCM Battery voltage supply or ground circuits are open, or the FPCM PWM Feedback circuit is open or shorted.

FUEL PUMP PERFORMANCE DIAGNOSTICS: The PCM fails the **P062A** Fuel System Performance diagnostic when the actual fuel pressure is approximately **100 kPa (14.5 psi) below or 40 kPa (5.8 psi) above the desired fuel pressure**. This fault usually sets along with other faults since the FPCM will default to 80% duty cycle for many failure modes which causes the actual pressure to be higher than the desired set point. The entire system should be examined when this fault is set, including the Fuel Pressure Sensor and circuits. A sensor drifted out of range, or high resistance in the signal or sensor ground circuit can cause a false reading on a normally operating system.

- **The dual pump variable pressure systems can be tricky when diagnosing a performance fault.** The fuel pressure may be good with one failed pump during most normal operating conditions. The condition may only be present under very heavy engine load conditions when both pumps are needed to produce the pressure and volume needed. If available on the scan tool, monitoring duty cycle for both pumps can help diagnosing the issue. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. However, if Fuel Pump 2 is defaulted to 80%, the primary pump will continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump reservoir.

The FPCM fails the **P064A** Fuel Pump Control Module Performance when excessive current draw is detected on the fuel pump circuitry. The FPCM will default and reduce the duty cycle to the fuel pump to the lowest possible duty cycle while the issue is present.

For most vehicles the fuel pressure desired and actual values, as well as the Fuel Pump output duty cycle data can be viewed on the scan tool. These readings can be very useful during the diagnosis of the system.

TECH TIP: A vehicle will typically have one of two issues;

1. The vehicle has no fuel pressure/pump is not operating.
 - The first thing to check for is a Loss of Communication fault. The reason is that the same Battery supply and ground circuit that are used to power up the FPCM are also used for the Fuel Pump

motor to operate. A loss of Battery supply, or a poor chassis ground for the module will cause both issues.

- The next thing to look for is an output from the FPCM to the pump. This can be done with the scan tool or by checking the duty cycle output from the FPCM. If there is any output from the FPCM to the Fuel Pump, the pump should be operating and creating fuel pressure. If the pump is not running then the Fuel Pump and circuits between the FPCM and Fuel Pump should be focused on during diagnostics. If the Loss of Communication fault is not present the Battery supply and chassis ground are most likely good.
2. The vehicle runs normally, has a DTC or DTCs present, and the output duty cycle to the Fuel Pump is defaulted. In most cases, the output is defaulted to 80% and the actual pressure is greater than the desired pressure.
 - The first thing to check is for a Loss of Communication fault. If the vehicle is running with a Loss of Communication fault, and an 80% output duty cycle, it would typically point to an issue with the FPCM PWM Feedback circuit. A loss of Battery supply or a poor chassis ground would usually cause no Fuel Pump operation and a no start condition.
 - If there is no Loss of Communication fault then this condition is most likely present due to an issue with the command circuit, an over current draw or over temp condition with the Fuel Pump.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns, or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. **Since the FPCM monitors the Fuel Pump circuits and motor for excessive current draw and over temperature conditions,** it is possible that the pump may need to run for an extended period for the condition to be present.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply, check for connection issues by wiggle testing any wiring harnesses and in-line connectors the circuitry passes through. A good practice is to watch for a DTC to become active or scan tool data to change. An even better method is to attach a lab scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor battery system voltage or poor ground connections can affect systems in different or odd ways. Check the battery or batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components,

modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.

4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving. Operate the components through a full range of operation while monitoring functionality.

DIAGNOSTIC TEST - FUEL PUMP CONTROL PERFORMANCE FAULTS (P025B, P027B, P062A, P064A, P26EA)

TECH TIP: The FPCM DTCs will set incorrectly for some vehicles/model years due to incorrect calibrations. For those vehicles it is best to perform the "COMPLETE FUEL PUMP CONTROL MODULE SYSTEM TESTING (NOT DTC SPECIFIC)" diagnostic procedure. Refer to the "KNOW ISSUES" section above for a list of the vehicles with incorrect calibrations.

FUEL PUMP CONTROL MODULE OUTPUT OVERTEMP (P025B, P027B): This fault will set when the FPCM detects an internal overtemp condition for the fuel pump output circuitry. Anything that can cause excessive current draw can cause the FPCM to eventually overheat and shut down.

1. Check the wiring and connectors at the FPCM and PCM for signs of spread terminal or corrosion that can cause an excessive electrical load on the FPCM. Check for a high mechanical draw due to a faulty Fuel Pump Assembly or severely restricted filter. Any of these conditions can cause an overtemp condition on the FPCM internal driver circuitry and should be confirmed good before condemning the module.
 - If any connection or mechanical issues are found with the module or fuel pump, repair the issue and retest the system.
 - If no other issues are found, replace the FPCM in accordance with the service information.

FUEL PUMP CONTROL PERFORMANCE (P062A): This fault usually sets along with other faults since the FPCM will either default to 80% duty cycle, or reduce the duty cycle PWM Output to the Fuel Pump when another fault is present. Either condition can cause the delta between the actual fuel pressure and the desired fuel pressure to be greater than the calibrated thresholds. If this fault is present with any other FPCM related faults, perform the other appropriate diagnostic procedure to find the failure. If **only this fault** is set, perform this diagnostic procedure.

NOTE: **The Fuel Rail Pressure Sensor is used to detect this failure (Low Fuel Pressure Sensor on the fuel high pressure system engines). A drifted Fuel Rail Pressure Sensor reading due to a faulty sensor or high circuit resistance can cause this DTC to set. The Fuel Rail Pressure Sensor rationality is checked by the PCM at each engine start up event. If it fails it will set a Fuel Rail Pressure Sensor Performance fault. If the Fuel Rail Pressure Sensor Performance fault is present, perform that test procedure before continuing.**

1. If available on the scan tool, check the Fuel Pump duty cycle, the actual and desired fuel pressure data readings.
 1. If the duty cycle is 80%, and the actual pressure is approximately 64 - 65 psi, **continue testing in step 2.**
 2. If the actual pressure is lower than the desired pressure, there is likely a fuel pressure issue.
 - Verify that the vehicle is not out of fuel.
 - Check the fuel lines for leaks or restrictions.
 - Before condemning the Fuel Pump, the Fuel Pump PWM Control and return circuits should be checked for high resistance causing low Fuel Pump output. If both circuits check good, the Fuel Pump is most likely faulty.
2. It is possible to have resistance in Fuel Rail Pressure Sensor signal or sensor ground circuit causing the signal to read off. Check the actual fuel system pressure with a pressure gauge and compare it to the Fuel Rail Pressure Sensor reading on the scan tool. Refer to the CHECKING THE FUEL DELIVERY SYSTEM test procedure in section 29 for checking fuel pressure. Refer to **DIAGNOSIS AND TESTING**.

1. If the actual fuel pressure and the Fuel Rail Pressure Sensor reading is the same, replace the Fuel Pump. The Fuel Pump Assembly can be failing and still produce high fuel pressure in the system when the FPCM is defaulted to 80% duty cycle.

- If the actual fuel pressure and the Fuel Rail Pressure Sensor reading is different, **continue testing in step 3.**

3. Isolate and check the Fuel Rail Pressure Sensor circuit for high resistance.

1. If any of the circuits measure above 5.0 Ohms of resistance, repair the high resistance.
2. If the circuits check good, replace the Fuel Rail Pressure Sensor.

FUEL PUMP CONTROL MODULE PERFORMANCE (P064A, P26EA): This DTC sets due to an over current condition in the fuel pump circuitry. This can occur from high mechanical resistance in the fuel pump or an electrical issue with the fuel pump PWM control circuit. Typically the FPCM will reduce the duty cycle output to the fuel when this failure is occurring to reduce the load on the circuit.

1. Disconnect the fuel pump control module and fuel pump harness connectors. Check the fuel pump PWM control circuit for continuity to ground.

1. If there is continuity between ground and the fuel pump PWM control circuit, repair the circuit for a short to ground.

2. If the circuit checks good, **continue testing in step 2.**

2. Check the fuel pump PWM control circuit for a short to all other circuits at the FPCM harness connector.

1. If there is continuity between the fuel pump PWM control circuit and any other circuit, repair the short between the circuits.

2. If the circuit checks good replace the fuel pump in accordance with the service information.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced** , perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P025C-FUEL PUMP MODULE CONTROL CIRCUIT LOW

NO TITLE

For a complete FUEL DELIVERY SYSTEM wiring diagram, .

KNOWN ISSUES - FPCM SYSTEM

While the FPCM has the capability of detected failure modes, the faults are not always reported out as intended. Some vehicles have incorrect calibrations that will read the FPCM messages incorrectly and set the DTCs incorrectly. On these vehicles it is best not to rely on the DTC, or DTC Description when deciding which portion of the system to diagnose. In these cases it is best to read and understand how the system operates, then diagnose the entire system to determine where the failure lies by performing the **Complete Fuel Pump Control Module System Diagnostics (Not DTC Specific)** procedure when diagnosing this system. This diagnostic can also be used to diagnose the FPCM command, feedback and fuel pump control circuits on vehicles with the correct calibration software.

The vehicles listed below will set faults incorrectly for the model years listed and should always be diagnosed using the Not DTC specific system approach.

- DS - model years 2016-2019
- RU - model years 2017-2018
- JL - model year 2018
- JT - model year 2020

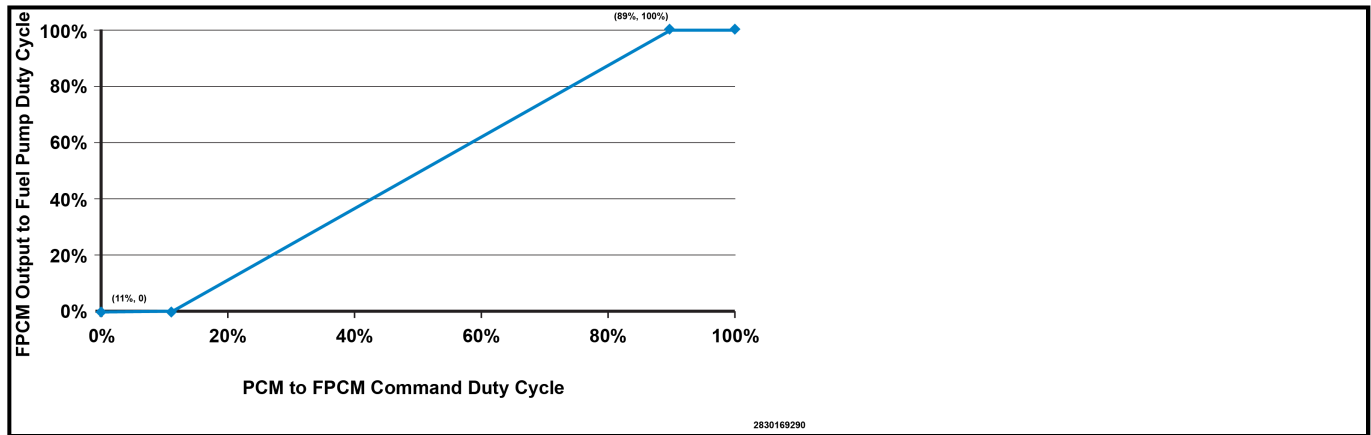
The exceptions to the information above are the Loss of Communication, Fuel Rail Pressure Sensor and Fuel Pump Relay Control circuit faults. These faults will typically set correctly since they are detected by the PCM directly, not the FPCM.

FPCM SYSTEM DESCRIPTION AND OPERATION

SYSTEM DESCRIPTION: When the Powertrain Control Module (PCM) requires Fuel Pump operation it energizes the Fuel Pump Relay. The Battery voltage output from the relay does not connect directly to the Fuel Pump like traditional systems. Instead, the Battery voltage is supplied to the Fuel Pump Control Module (FPCM). When the ignition is switched on, the Battery voltage is present for approximately five seconds. Battery voltage should always be present during cranking or when the engine is running. The purpose of FPCM is to operate the Fuel Pump at a reduced voltage output to reduce electrical load on the system. Most vehicle/engine combinations operate as a **fixed pressure system** . Vehicles with the 6.2L engine operate as a **variable pressure system** . It is necessary on some vehicles with the 6.2L engine to have a second Fuel Pump and FPCM to meet engine needs. The second FPCM performs the same diagnostics as the primary module but uses different DTCs.

SYSTEM OPERATION: To maintain the desired fuel pressure, the PCM sends a Pulse Width Modulated (PWM) duty cycle signal to the FPCM. If there are no system faults present, the Fuel Pump Control output to the Fuel Pump is based on the duty cycle sent by the PCM. The graph below shows the FPCM output to the Fuel Pump in proportion to the PCM command signal. **The FPCM output to the fuel pump will not read as a**

duty cycle when monitoring with a Mopar Scope. It will be a consistent voltage output that is a percentage of battery voltage.



COMPONENT FUNCTIONAL DESCRIPTION- FUEL PUMP CONTROL MODULE (FPCM) AND FUEL PUMP

The FPCM performs fault detection and reports faults to the PCM through the PWM Feedback circuit. The feedback circuit can be monitored using the Mopar Scope and functions as follows:

- The feedback circuit is a 5.0 volt duty cycle.
- The PCM supplies the 5.0 volts for the feedback circuit.
- The FPCM pulses the low side of the circuit to communicate with the PCM.
- The normal duty cycle operating range is between 3% and 97%.
- When the system is operating normally, the FPCM will send a 50% duty cycle on the feedback circuit to the PCM.
- When the FPCM detects a fault it will send a duty cycle that aligns with the failure mode detected.
- If the duty cycle is 0% or 100% the PCM will set the Loss of Communication fault against the FPCM.

NOTE: Monitoring the FPCM internal driver with an open feedback circuit using the Mopar Scope will show a pulse width signal with a very low voltage (.025v - 0.5v). This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the PCM. This can be useful when performing diagnostics on the feedback circuitry.

Depending on the failure mode detected by the PCM and FPCM, the FPCM can react by either reducing the PWM output duty cycle, or defaulting to an 80% duty cycle for the fuel pump operation. The FPCM reactions are explained further in the PCM/FPCM Reaction column of the Enable Conditions and Failure Modes section.

Fuel Pump: The Fuel Pump operates in the same manner as a typical Brushed DC motor. The only difference is that the speed is reduced due to the PWM output voltage from the FPCM being less than 100%. The voltage supplied is based on the command received from the PCM.

Vehicles with Dual Pump Systems: The fuel pumps operate independently, but may be serviced as an assembly on some vehicles. During normal operation both Fuel Pumps are used to provide the system pressure and volume needed during most engine operating conditions. **The exception is at idle, or idle and purging where there is extremely low fuel demand.** During this mode Fuel Pump 2 is typically turned off. When more fuel demand is needed (typically off idle) Fuel Pump 2 is turned on and both pumps are operated at the same duty cycle. If either pump is failing the vehicle may still operate normally during most driving conditions but would have performance issues under heavy engine load when both pumps are needed. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. **However, if Fuel Pump 2 is defaulted to 80%, the primary pump will continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump assembly reservoir.**

COMPONENT FUNCTIONAL DESCRIPTION - POWERTRAIN CONTROL MODULE (PCM)

The PCM monitors the input signal from the Fuel Rail Pressure Sensor to determine the commanded duty cycle to the FPCM. On a fixed pressure system the PCM varies the commanded duty cycle to maintain a constant pressure. On variable pressure systems the commanded duty cycle is varied to adjust fuel pressure based on engine needs. Ambient temperature and fuel temperature can also contribute to fuel pressure changes. The pressure is raised during high ambient temperatures to prevent boiling of the fuel.

NOTE: On vehicles with diesel engines or high pressure gas fuel systems, the PCM monitors the Fuel Pressure Sensor on the low pressure side of the system to determine the commanded duty cycle, not the Fuel Rail Pressure Sensor on the high pressure side.

The command circuit can be monitored using the Mopar Scope and functions as follows:

- The command circuit is a 12.0 volt duty cycle.
- The FPCM supplies the 12.0 volts for the command circuit.
- The PCM pulses the low side of the circuit to communicate with the DTCM.
- The normal duty cycle operating range is between 11% and 89%.
- If the FPCM does not receive a valid command signal from the PCM it will send a fault message on the feedback circuit and operates the fuel pump at a defaulted value (typically 80%).

With an open command circuit, the PCM internal driver will show a pulse width signal of approximately 2.5v if checking at the PCM connector with the Mopar Scope. This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the FPCM. This can be useful when performing diagnostics on the command circuitry.

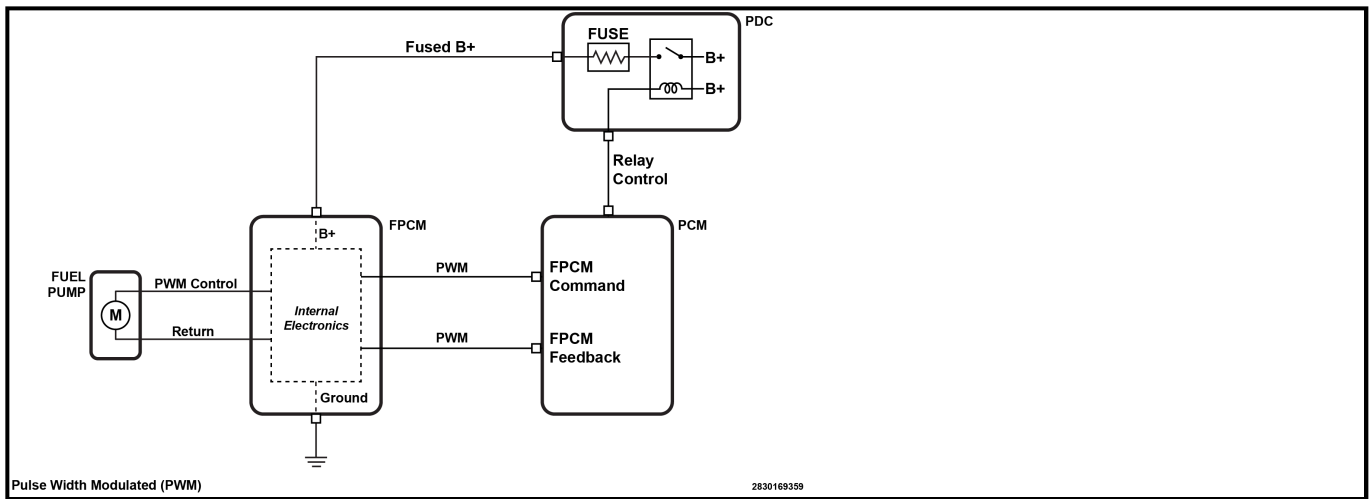
When the PCM loses communication with the FPCM it will default to the highest duty cycle. This will cause the FPCM to provide maximum voltage output to the fuel pump.

TECHNICAL DATA-FUEL SYSTEM PRESSURE SPECIFICATIONS

The table below shows the fuel system pressure specifications.

VARIABLE FUEL PRESSURE SYSTEM SPECIFICATIONS (6.2L ENGINES)		
CRANKING	520 kPa (75.4 psi)	System operates in open loop during cranking
IDLE	340 - 400 kPa (49 - 58 psi)	Normal operating range at idle - Pressure is dependant on ambient and fuel temp. Pressure is raised during high temp to prevent boiling
NORMAL RANGE OF OPERATION	340 - 550 kPa (49 - 80 psi)	Normal operating range between idle and high engine demand
100% DUTY CYCLE	600 - 700 kPa (87 - 101.5 psi)	This is regulated by the pressure relief valve in the Fuel Pump. The pressure can vary from pump to pump.
B		
4 CYLINDER (1.0L/1.3L GSET / 2.0L GMET ENGINES)		
CRANKING	580 kPa (84.1 psi)	System operates in open loop during cranking
ALL OTHER OPERATING CONDITIONS	520 kPa (75.4 psi)	The fixed pressure systems should maintain approximately 75.0 psi during normal operation
B		
FIXED PRESSURE SYSTEM SPECIFICATIONS (ALL OTHER ENGINES)		
The fixed pressure systems should maintain approximately 400 kPa (58.0) psi during normal operation		

GENERIC SYSTEM SCHEMATIC:



WHEN MONITORED

SET CONDITION

- The Powertrain Control Module (PCM) detects a fault in the Fuel Pump Control System.

DEFAULT ACTION

- The MIL will illuminate.

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

The table below shows the FPCM DTCs and the correlating INTENDED failure modes. **NOTE: On some vehicles the faults may not always set as expected which may lead to a misdiagnosis (See the know issue section). Therefore, it is usually best to perform the "Complete Fuel Pump Control Module System Testing (Not DTC Specific)" in the diagnostic section.**

POSSIBLE CAUSES

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
P025A	P027A	Missing or invalid PWM Command signal from PCM	1. PCM to FPCM Command Signal open 2. PCM to FPCM Command Signal shorted low or high 3. Invalid PWM signal - frequency out of range 4. FPCM 5. PCM	FPCM defaults the output to the Fuel Pump to 80% duty cycle NOTE: It is not uncommon for the P025A DTC to set erroneously for several other failure modes
P025B	P027B	Output driver over temp	1. FPCM Output partially shorted to ground 2. Faulty Fuel Pump (high mechanical resistance) 3. Faulty FPCM internal driver	- PCM sets fault, waits a calibrated period and commands a safe duty cycle - FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If over temp continues, shut down output driver.
P025C	P027C	System under voltage - Fuel Pump Relay output voltage to FPCM is below a calibrated threshold (approximately 6.0 volts)	1. High resistance in the Fuel Pump Relay output circuit 2. FPCM	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P025D	P027D	System over voltage - Fuel Pump Relay output voltage to FPCM is above a calibrated threshold (approximately 16.0 volts)	1. Charging system issue	- PCM applies over voltage strategy - FPCM reacts to PCM input command
P0628	P2633	FPCM output to Fuel Pump shorted to ground	1. Fuel Pump PWM Control circuit shorted to ground	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
P0629	P2634	FPCM output to Fuel Pump shorted to voltage	1. Fuel Pump PWM Control circuit shorted to voltage	FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If condition continues, shut down output driver.

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
P062A	P062A	Actual fuel pressure is above or below the desired fuel pressure by more than a calibrated threshold. - Fixed pressure system - 5.8 psi above or 14.5 psi below - Variable pressure system - 10.9 psi above or below	- No fuel in the Fuel Tank - Fuel supply tube broken/leaking - Fuel supply tube pinched/restricted - FPCM defaulted to 80% due to another failure detected - FPCM duty cycle output reduced due to another failure detected - Faulty Fuel Pump	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P064A	P26EA	Current draw exceeds calibrated threshold	- Fuel Pump PWM Control circuit shorted to voltage - Faulty Fuel Pump - internal short or high mechanical resistance	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
P1205	P120A	FPCM Micro internal fault	Fuel Pump Control Module	FPCM continues to run in normal mode - run Fuel Pump according to PCM command signal
P1206	P120B	FPCM output to Fuel Pump open circuit	- Fuel Pump PWM Control circuit open - Fuel Pump Return/Ground circuit open - FPCM Ground circuit open - FPCM	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
U0109	U016C	PCM Loss of Communication with FPCM	- FPCM PWM Feedback circuit open - FPCM PWM Feedback shorted low or high - Fuel Pump Relay output circuit to FPCM open or shorted to ground - FPCM Ground circuit open - Fuel Pump PWM Control circuit shorted to ground - FPCM - PCM	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle

DIAGNOSTIC OVERVIEW-FUEL PUMP CONTROL MODULE

GENERAL DIAGNOSTIC INFORMATION: There are several faults associated with this system. The failure modes being monitored for are Loss of Communication, internal FPCM faults, system voltage faults,

Thermal Protection, circuit faults, and system performance. **On several vehicles, multiple or incorrect faults** can set which can mislead diagnosing the vehicle. For this reason, it is a good practice to perform a total system diagnosis regardless of the DTC present for most faults. The communication faults are detected directly by the PCM and will typically set correctly. See Communication Diagnostics explanation below.

PCM DIAGNOSTICS: The PCM directly monitors the Fuel Pump Relay Control circuit, FPCM Feedback circuit and the Fuel Pressure Sensor circuits for faults. The Fuel Pressure Sensor signal must be rationalized since the signal is monitored to perform fuel system pressure performance diagnostics. This is done by watching the signal at initial engine start up for both types of systems. **On the fixed pressure system** the normally stable fuel pressure is dynamic for the first few seconds. The pressure will spike above the set point approximately 40-50 kPa (5.8-7.25 psi), then drop below the set point approximately 60-70 kPa (8.7-10.2 psi), and quickly dampen and settle at the set point 400kPa (58.0 psi). At initial engine start up, when the engine speed reaches approximately 500 rpm, the Powertrain Control Module (PCM) measures the delta pressure change between the highest pressure reading and lowest pressure reading and make determinations about sensor rationality. The diagnostic works the same **on the variable pressure system** as the fixed pressure system except that the system is in open loop at start up and the pressure is commanded to a preset known value to perform the diagnostic.

SYSTEM VOLTAGE DIAGNOSTICS: The FPCM monitors the Battery voltage supply coming from the Fuel Pump Relay to the module. A fault will set if the voltage is too high or too low. Typically a voltage high fault would indicate a charging system issue. The voltage low fault could also be a charging system issue, but may also be caused by resistance in the Battery supply or ground circuit.

COMMUNICATION DIAGNOSTICS: Unlike other system faults, the Loss of Communication fault will typically set correctly. The PCM will set this fault when the FPCM PWM Feedback duty cycle is below 3% or above 97%. This can occur if the FPCM Battery voltage supply or ground circuits are open, or the FPCM PWM Feedback circuit is open or shorted.

FUEL PUMP PERFORMANCE DIAGNOSTICS: The PCM fails the **P062A** Fuel System Performance diagnostic when the actual fuel pressure is approximately **100 kPa (14.5 psi) below or 40 kPa (5.8 psi) above the desired fuel pressure**. This fault usually sets along with other faults since the FPCM will default to 80% duty cycle for many failure modes which causes the actual pressure to be higher than the desired set point. The entire system should be examined when this fault is set, including the Fuel Pressure Sensor and circuits. A sensor drifted out of range, or high resistance in the signal or sensor ground circuit can cause a false reading on a normally operating system.

- **The dual pump variable pressure systems can be tricky when diagnosing a performance fault.** The fuel pressure may be good with one failed pump during most normal operating conditions. The condition may only be present under very heavy engine load conditions when both pumps are needed to produce the pressure and volume needed. If available on the scan tool, monitoring duty cycle for both pumps can help diagnosing the issue. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. However, if Fuel Pump 2 is defaulted to 80%, the primary pump will continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump reservoir.

The FPCM fails the **P064A** Fuel Pump Control Module Performance when excessive current draw is detected on the fuel pump circuitry. The FPCM will default and reduce the duty cycle to the fuel pump to the lowest possible duty cycle while the issue is present.

For most vehicles the fuel pressure desired and actual values, as well as the Fuel Pump output duty cycle data can be viewed on the scan tool. These readings can be very useful during the diagnosis of the system.

TECH TIP: A vehicle will typically have one of two issues;

1. The vehicle has no fuel pressure/pump is not operating.
 - The first thing to check for is a Loss of Communication fault. The reason is that the same Battery supply and ground circuit that are used to power up the FPCM are also used for the Fuel Pump

motor to operate. A loss of Battery supply, or a poor chassis ground for the module will cause both issues.

- The next thing to look for is an output from the FPCM to the pump. This can be done with the scan tool or by checking the duty cycle output from the FPCM. If there is any output from the FPCM to the Fuel Pump, the pump should be operating and creating fuel pressure. If the pump is not running then the Fuel Pump and circuits between the FPCM and Fuel Pump should be focused on during diagnostics. If the Loss of Communication fault is not present the Battery supply and chassis ground are most likely good.
2. The vehicle runs normally, has a DTC or DTCs present, and the output duty cycle to the Fuel Pump is defaulted. In most cases, the output is defaulted to 80% and the actual pressure is greater than the desired pressure.
 - The first thing to check is for a Loss of Communication fault. If the vehicle is running with a Loss of Communication fault, and an 80% output duty cycle, it would typically point to an issue with the FPCM PWM Feedback circuit. A loss of Battery supply or a poor chassis ground would usually cause no Fuel Pump operation and a no start condition.
 - If there is no Loss of Communication fault then this condition is most likely present due to an issue with the command circuit, an over current draw or over temp condition with the Fuel Pump.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns, or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. **Since the FPCM monitors the Fuel Pump circuits and motor for excessive current draw and over temperature conditions,** it is possible that the pump may need to run for an extended period for the condition to be present.
2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply, check for connection issues by wiggle testing any wiring harnesses and in-line connectors the circuitry passes through. A good practice is to watch for a DTC to become active or scan tool data to change. An even better method is to attach a lab scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor battery system voltage or poor ground connections can affect systems in different or odd ways. Check the battery or batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components,

modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.

4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving. Operate the components through a full range of operation while monitoring functionality.

DIAGNOSTIC TEST - FPCM SYSTEM VOLTAGE LOW AND HIGH (P025C, P025D, P027C, P027D)

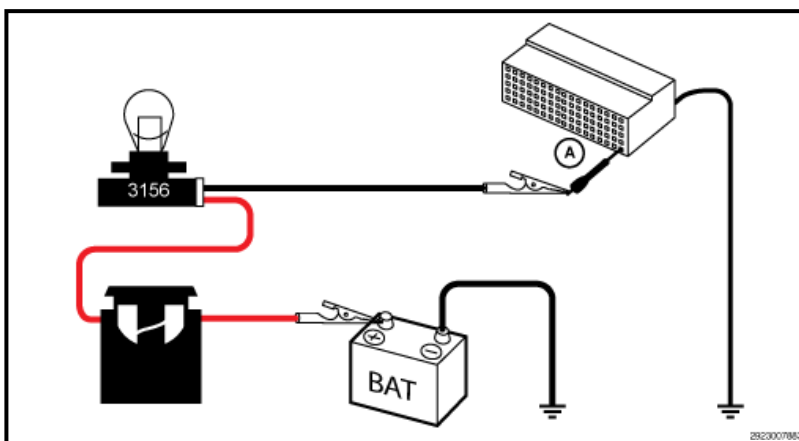
TECH TIP: The FPCM DTCs will set incorrectly for some vehicles/model years due to incorrect calibrations. For those vehicles it is best to perform the "COMPLETE FUEL PUMP CONTROL MODULE SYSTEM TESTING (NOT DTC SPECIFIC)" diagnostic procedure. Refer to the "KNOW ISSUES" section above for a list of the vehicles with incorrect calibrations.

SYSTEM VOLTAGE HIGH (P025D, P027D): The system voltage high DTCs indicate a charging system issue. Refer to the charging system service and diagnostic information.

SYSTEM VOLTAGE LOW (P025C, P027C):

The system voltage low fault indicates that the voltage supply to the module is below a calibrated threshold (approximately 6.0 volts). This typically is due to high resistance in the Battery voltage supply or ground circuits for the FPCM.

1. Disconnect the FPCM harness connector and load test the FPCM Ground circuit. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit, . Refer to **STANDARD PROCEDURE** .



1. A way to verify that there is no resistance in the circuit being tested is to perform a simple voltage drop test across the 3156 bulb of the load test tool. The voltage drop across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.
 - If the ground circuit fails load testing, repair the FPCM chassis ground.
 - If the ground circuit tests good, **continue testing in step 2.**

NOTE: Keep in mind when performing this step that when the ignition is switched on, and the engine is not cranking, the Fuel Pump Relay is energized for approximately 5.0 seconds and then powered down. It will be powered continuously when the engine is cranking or running.

2. Load test the battery supply to the FPCM harness connector.
 1. If the battery supply circuit fails load testing, repair the fuel pump relay output circuit for an open or high resistance. If the fuse is open, test the circuit for a short to ground.
 2. If both the Battery supply and ground circuits pass the load test and the DTC is active, replace the Fuel Pump Control Module in accordance with the service information.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced**, perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P025D-FUEL PUMP MODULE CONTROL CIRCUIT HIGH

NO TITLE

For a complete FUEL DELIVERY SYSTEM wiring diagram, .

KNOWN ISSUES - FPCM SYSTEM

While the FPCM has the capability of detected failure modes, the faults are not always reported out as intended. Some vehicles have incorrect calibrations that will read the FPCM messages incorrectly and set the DTCs incorrectly. On these vehicles it is best not to rely on the DTC, or DTC Description when deciding which portion of the system to diagnose. In these cases it is best to read and understand how the system operates, then diagnose the entire system to determine where the failure lies by performing the **Complete Fuel Pump Control Module System Diagnostics (Not DTC Specific)** procedure when diagnosing this system. This

diagnostic can also be used to diagnose the FPCM command, feedback and fuel pump control circuits on vehicles with the correct calibration software.

The vehicles listed below will set faults incorrectly for the model years listed and should always be diagnosed using the Not DTC specific system approach.

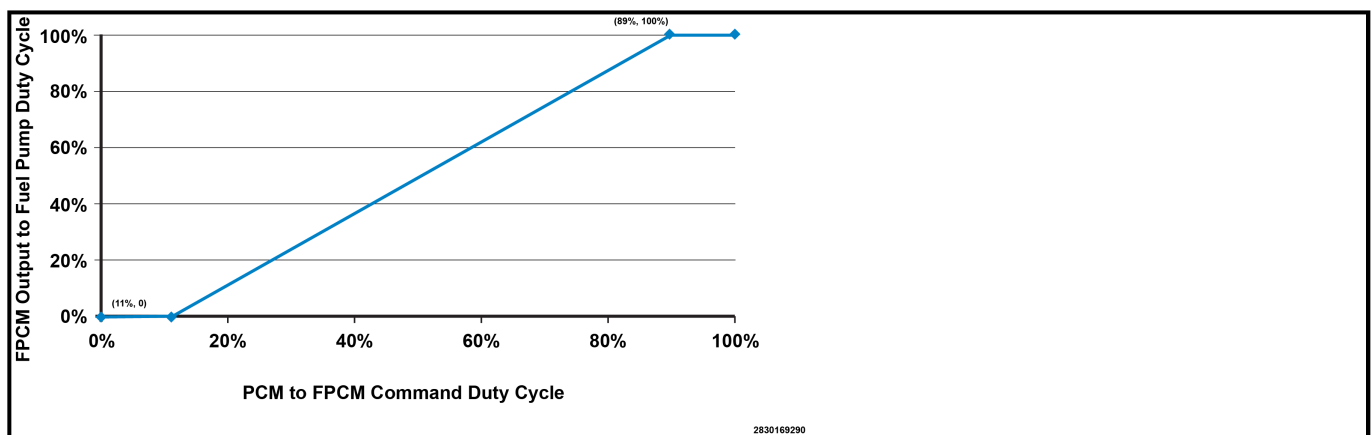
- DS - model years 2016-2019
- RU - model years 2017-2018
- JL - model year 2018
- JT - model year 2020

The exceptions to the information above are the Loss of Communication, Fuel Rail Pressure Sensor and Fuel Pump Relay Control circuit faults. These faults will typically set correctly since they are detected by the PCM directly, not the FPCM.

FPCM SYSTEM DESCRIPTION AND OPERATION

SYSTEM DESCRIPTION: When the Powertrain Control Module (PCM) requires Fuel Pump operation it energizes the Fuel Pump Relay. The Battery voltage output from the relay does not connect directly to the Fuel Pump like traditional systems. Instead, the Battery voltage is supplied to the Fuel Pump Control Module (FPCM). When the ignition is switched on, the Battery voltage is present for approximately five seconds. Battery voltage should always be present during cranking or when the engine is running. The purpose of FPCM is to operate the Fuel Pump at a reduced voltage output to reduce electrical load on the system. Most vehicle/engine combinations operate as a **fixed pressure system**. Vehicles with the 6.2L engine operate as a **variable pressure system**. It is necessary on some vehicles with the 6.2L engine to have a second Fuel Pump and FPCM to meet engine needs. The second FPCM performs the same diagnostics as the primary module but uses different DTCs.

SYSTEM OPERATION: To maintain the desired fuel pressure, the PCM sends a Pulse Width Modulated (PWM) duty cycle signal to the FPCM. If there are no system faults present, the Fuel Pump Control output to the Fuel Pump is based on the duty cycle sent by the PCM. The graph below shows the FPCM output to the Fuel Pump in proportion to the PCM command signal. **The FPCM output to the fuel pump will not read as a duty cycle when monitoring with a Mopar Scope. It will be a consistent voltage output that is a percentage of battery voltage.**



COMPONENT FUNCTIONAL DESCRIPTION- FUEL PUMP CONTROL MODULE (FPCM) AND FUEL PUMP

The FPCM performs fault detection and reports faults to the PCM through the PWM Feedback circuit. The feedback circuit can be monitored using the Mopar Scope and functions as follows:

- The feedback circuit is a 5.0 volt duty cycle.
- The PCM supplies the 5.0 volts for the feedback circuit.
- The FPCM pulses the low side of the circuit to communicate with the PCM.
- The normal duty cycle operating range is between 3% and 97%.

- When the system is operating normally, the FPCM will send a 50% duty cycle on the feedback circuit to the PCM.
- When the FPCM detects a fault it will send a duty cycle that aligns with the failure mode detected.
- If the duty cycle is 0% or 100% the PCM will set the Loss of Communication fault against the FPCM.

NOTE: **Monitoring the FPCM internal driver with an open feedback circuit using the Mopar Scope will show a pulse width signal with a very low voltage (.025v - 0.5v). This is picking up voltage from the internal driver device that is still trying to pulse the duty cycle to the PCM. This can be useful when performing diagnostics on the feedback circuitry.**

Depending on the failure mode detected by the PCM and FPCM, the FPCM can react by either reducing the PWM output duty cycle, or defaulting to an 80% duty cycle for the fuel pump operation. The FPCM reactions are explained further in the PCM/FPCM Reaction column of the Enable Conditions and Failure Modes section.

Fuel Pump: The Fuel Pump operates in the same manner as a typical Brushed DC motor. The only difference is that the speed is reduced due to the PWM output voltage from the FPCM being less than 100%. The voltage supplied is based on the command received from the PCM.

Vehicles with Dual Pump Systems: The fuel pumps operate independently, but may be serviced as an assembly on some vehicles. During normal operation both Fuel Pumps are used to provide the system pressure and volume needed during most engine operating conditions. **The exception is at idle, or idle and purging where there is extremely low fuel demand.** During this mode Fuel Pump 2 is typically turned off. When more fuel demand is needed (typically off idle) Fuel Pump 2 is turned on and both pumps are operated at the same duty cycle. If either pump is failing the vehicle may still operate normally during most driving conditions but would have performance issues under heavy engine load when both pumps are needed. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. **However, if Fuel Pump 2 is defaulted to 80%, the primary pump will continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump assembly reservoir.**

COMPONENT FUNCTIONAL DESCRIPTION - POWERTRAIN CONTROL MODULE (PCM)

The PCM monitors the input signal from the Fuel Rail Pressure Sensor to determine the commanded duty cycle to the FPCM. On a fixed pressure system the PCM varies the commanded duty cycle to maintain a constant pressure. On variable pressure systems the commanded duty cycle is varied to adjust fuel pressure based on engine needs. Ambient temperature and fuel temperature can also contribute to fuel pressure changes. The pressure is raised during high ambient temperatures to prevent boiling of the fuel.

NOTE: **On vehicles with diesel engines or high pressure gas fuel systems, the PCM monitors the Fuel Pressure Sensor on the low pressure side of the system to determine the commanded duty cycle, not the Fuel Rail Pressure Sensor on the high pressure side.**

The command circuit can be monitored using the Mopar Scope and functions as follows:

- The command circuit is a 12.0 volt duty cycle.
- The FPCM supplies the 12.0 volts for the command circuit.
- The PCM pulses the low side of the circuit to communicate with the DTCM.
- The normal duty cycle operating range is between 11% and 89%.
- If the FPCM does not receive a valid command signal from the PCM it will send a fault message on the feedback circuit and operates the fuel pump at a defaulted value (typically 80%).

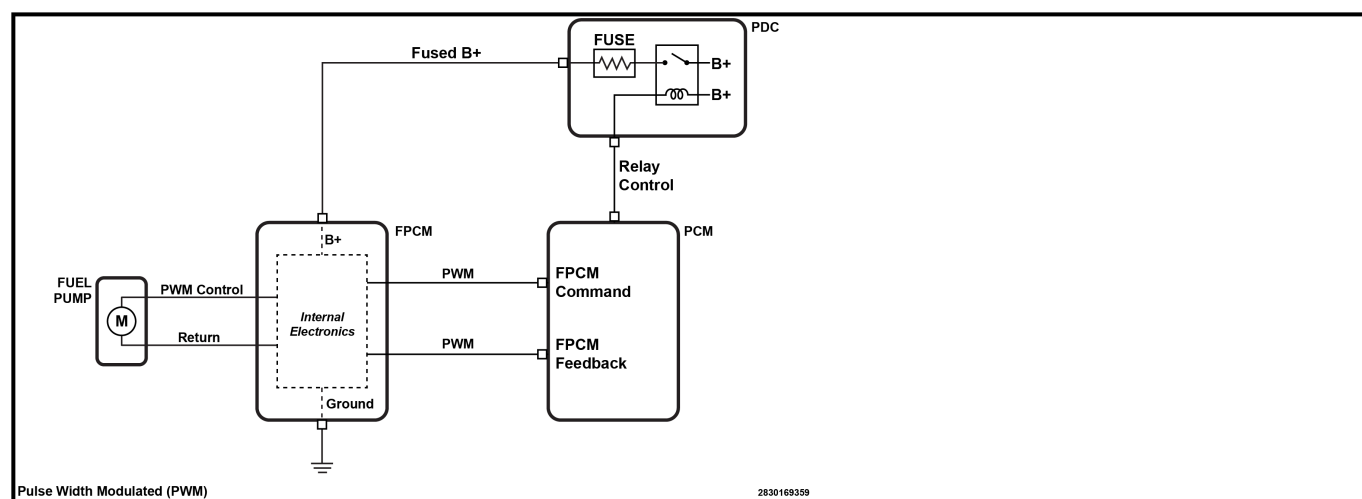
With an open command circuit, the PCM internal driver will show a pulse width signal of approximately 2.5v if checking at the PCM connector with the Mopar Scope. This is picking up voltage from the

When the PCM loses communication with the FPCM it will default to the highest duty cycle. This will cause the FPCM to provide maximum voltage output to the fuel pump.

The table below shows the fuel system pressure specifications.

VARIABLE FUEL PRESSURE SYSTEM SPECIFICATIONS (6.2L ENGINES)		
CRANKING	520 kPa (75.4 psi)	System operates in open loop during cranking
IDLE	340 - 400 kPa (49 - 58 psi)	Normal operating range at idle - Pressure is dependant on ambient and fuel temp. Pressure is raised during high temp to prevent boiling
NORMAL RANGE OF OPERATION	340 - 550 kPa (49 - 80 psi)	Normal operating range between idle and high engine demand
100% DUTY CYCLE	600 - 700 kPa (87 - 101.5 psi)	This is regulated by the pressure relief valve in the Fuel Pump. The pressure can vary from pump to pump.
B		
4 CYLINDER (1.0L/1.3L GSET / 2.0L GMET ENGINES)		
CRANKING	580 kPa (84.1 psi)	System operates in open loop during cranking
ALL OTHER OPERATING CONDITIONS	520 kPa (75.4 psi)	The fixed pressure systems should maintain approximately 75.0 psi during normal operation
B		
FIXED PRESSURE SYSTEM SPECIFICATIONS (ALL OTHER ENGINES)		
The fixed pressure systems should maintain approximately 400 kPa (58.0) psi during normal operation		

GENERIC SYSTEM SCHEMATIC:



SET CONDITION

- The Powertrain Control Module (PCM) detects a fault in the Fuel Pump Control System.

DEFAULT ACTION

- The MIL will illuminate.

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

The table below shows the FPCM DTCs and the correlating INTENDED failure modes. **NOTE: On some vehicles the faults may not always set as expected which may lead to a misdiagnosis (See the know issue section). Therefore, it is usually best to perform the "Complete Fuel Pump Control Module System Testing (Not DTC Specific)" in the diagnostic section.**

POSSIBLE CAUSES

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
P025A	P027A	Missing or invalid PWM Command signal from PCM	1. PCM to FPCM Command Signal open 2. PCM to FPCM Command Signal shorted low or high 3. Invalid PWM signal - frequency out of range 4. FPCM 5. PCM	FPCM defaults the output to the Fuel Pump to 80% duty cycle NOTE: It is not uncommon for the P025A DTC to set erroneously for several other failure modes
P025B	P027B	Output driver over temp	1. FPCM Output partially shorted to ground 2. Faulty Fuel Pump (high mechanical resistance) 3. Faulty FPCM internal driver	- PCM sets fault, waits a calibrated period and commands a safe duty cycle - FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If over temp continues, shut down output driver.
P025C	P027C	System under voltage - Fuel Pump Relay output voltage to FPCM is below a calibrated threshold (approximately 6.0 volts)	1. High resistance in the Fuel Pump Relay output circuit 2. FPCM	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P025D	P027D	System over voltage - Fuel Pump Relay output voltage to FPCM is above a calibrated threshold (approximately 16.0 volts)	1. Charging system issue	- PCM applies over voltage strategy - FPCM reacts to PCM input command
P0628	P2633	FPCM output to Fuel Pump shorted to ground	1. Fuel Pump PWM Control circuit shorted to ground	PCM reduces PWM duty cycle until issue clears

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
				FPCM reacts to PCM input command
P0629	P2634	FPCM output to Fuel Pump shorted to voltage	1. Fuel Pump PWM Control circuit shorted to voltage	FPCM output to Fuel Pump to 50% duty cycle for a calibrated period. If condition continues, shut down output driver.
P062A	P062A	Actual fuel pressure is above or below the desired fuel pressure by more than a calibrated threshold. - Fixed pressure system - 5.8 psi above or 14.5 psi below - Variable pressure system - 10.9 psi above or below	- No fuel in the Fuel Tank - Fuel supply tube broken/leaking - Fuel supply tube pinched/restricted - FPCM defaulted to 80% due to another failure detected - FPCM duty cycle output reduced due to another failure detected - Faulty Fuel Pump	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle
P064A	P26EA	Current draw exceeds calibrated threshold	- Fuel Pump PWM Control circuit shorted to voltage - Faulty Fuel Pump - internal short or high mechanical resistance	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
P1205	P120A	FPCM Micro internal fault	1. Fuel Pump Control Module	FPCM continues to run in normal mode - run Fuel Pump according to PCM command signal
P1206	P120B	FPCM output to Fuel Pump open circuit	- Fuel Pump PWM Control circuit open - Fuel Pump Return/Ground circuit open - FPCM Ground circuit open - FPCM	- PCM reduces PWM duty cycle until issue clears - FPCM reacts to PCM input command
U0109	U016C	PCM Loss of Communication with FPCM	- FPCM PWM Feedback circuit open - FPCM PWM Feedback shorted low or high - Fuel Pump Relay output circuit to FPCM open or shorted to ground	- PCM requests 100% Fuel Pump operation - FPCM defaults the output to the Fuel Pump to 80% duty cycle

FPCM 1 DTC	FPCM 2 DTC	FAILURE MODES	POSSIBLE CAUSES	PCM/FPCM REACTION
			4. FPCM Ground circuit open 5. Fuel Pump PWM Control circuit shorted to ground 6. FPCM 7. PCM	

DIAGNOSTIC OVERVIEW-FUEL PUMP CONTROL MODULE

GENERAL DIAGNOSTIC INFORMATION: There are several faults associated with this system. The failure modes being monitored for are Loss of Communication, internal FPCM faults, system voltage faults, Thermal Protection, circuit faults, and system performance. **On several vehicles, multiple or incorrect faults** can set which can mislead diagnosing the vehicle. For this reason, it is a good practice to perform a total system diagnosis regardless of the DTC present for most faults. The communication faults are detected directly by the PCM and will typically set correctly. See Communication Diagnostics explanation below.

PCM DIAGNOSTICS: The PCM directly monitors the Fuel Pump Relay Control circuit, FPCM Feedback circuit and the Fuel Pressure Sensor circuits for faults. The Fuel Pressure Sensor signal must be rationalized since the signal is monitored to perform fuel system pressure performance diagnostics. This is done by watching the signal at initial engine start up for both types of systems. **On the fixed pressure system** the normally stable fuel pressure is dynamic for the first few seconds. The pressure will spike above the set point approximately 40-50 kPa (5.8-7.25 psi), then drop below the set point approximately 60-70 kPa (8.7-10.2 psi), and quickly dampen and settle at the set point 400kPa (58.0 psi). At initial engine start up, when the engine speed reaches approximately 500 rpm, the Powertrain Control Module (PCM) measures the delta pressure change between the highest pressure reading and lowest pressure reading and make determinations about sensor rationality. The diagnostic works the same **on the variable pressure system** as the fixed pressure system except that the system is in open loop at start up and the pressure is commanded to a preset known value to perform the diagnostic.

SYSTEM VOLTAGE DIAGNOSTICS: The FPCM monitors the Battery voltage supply coming from the Fuel Pump Relay to the module. A fault will set if the voltage is too high or too low. Typically a voltage high fault would indicate a charging system issue. The voltage low fault could also be a charging system issue, but may also be caused by resistance in the Battery supply or ground circuit.

COMMUNICATION DIAGNOSTICS: Unlike other system faults, the Loss of Communication fault will typically set correctly. The PCM will set this fault when the FPCM PWM Feedback duty cycle is below 3% or above 97%. This can occur if the FPCM Battery voltage supply or ground circuits are open, or the FPCM PWM Feedback circuit is open or shorted.

FUEL PUMP PERFORMANCE DIAGNOSTICS: The PCM fails the **P062A** Fuel System Performance diagnostic when the actual fuel pressure is approximately **100 kPa (14.5 psi) below or 40 kPa (5.8 psi) above the desired fuel pressure**. This fault usually sets along with other faults since the FPCM will default to 80% duty cycle for many failure modes which causes the actual pressure to be higher than the desired set point. The entire system should be examined when this fault is set, including the Fuel Pressure Sensor and circuits. A sensor drifted out of range, or high resistance in the signal or sensor ground circuit can cause a false reading on a normally operating system.

- **The dual pump variable pressure systems can be tricky when diagnosing a performance fault.** The fuel pressure may be good with one failed pump during most normal operating conditions. The condition may only be present under very heavy engine load conditions when both pumps are needed to produce the pressure and volume needed. If available on the scan tool, monitoring duty cycle for both pumps can help diagnosing the issue. If a failure is detected for either Fuel Pump or circuitry, the duty cycle will typically default to 80%. If Fuel Pump 1 (primary) is defaulted to 80%, Fuel Pump 2 may remain off during most operating conditions. However, if Fuel Pump 2 is defaulted to 80%, the primary pump will

continue to operate at the lower duty cycle range. The reason for this is that the primary pump operates the jet pump to pull fuel from the secondary side of the Fuel Tank and also fills the Fuel Pump reservoir.

The FPCM fails the **P064A** Fuel Pump Control Module Performance when excessive current draw is detected on the fuel pump circuitry. The FPCM will default and reduce the duty cycle to the fuel pump to the lowest possible duty cycle while the issue is present.

For most vehicles the fuel pressure desired and actual values, as well as the Fuel Pump output duty cycle data can be viewed on the scan tool. These readings can be very useful during the diagnosis of the system.

TECH TIP: A vehicle will typically have one of two issues;

1. The vehicle has no fuel pressure/pump is not operating.
 - The first thing to check for is a Loss of Communication fault. The reason is that the same Battery supply and ground circuit that are used to power up the FPCM are also used for the Fuel Pump motor to operate. A loss of Battery supply, or a poor chassis ground for the module will cause both issues.
 - The next thing to look for is an output from the FPCM to the pump. This can be done with the scan tool or by checking the duty cycle output from the FPCM. If there is any output from the FPCM to the Fuel Pump, the pump should be operating and creating fuel pressure. If the pump is not running then the Fuel Pump and circuits between the FPCM and Fuel Pump should be focused on during diagnostics. If the Loss of Communication fault is not present the Battery supply and chassis ground are most likely good.
2. The vehicle runs normally, has a DTC or DTCs present, and the output duty cycle to the Fuel Pump is defaulted. In most cases, the output is defaulted to 80% and the actual pressure is greater than the desired pressure.
 - The first thing to check is for a Loss of Communication fault. If the vehicle is running with a Loss of Communication fault, and an 80% output duty cycle, it would typically point to an issue with the FPCM PWM Feedback circuit. A loss of Battery supply or a poor chassis ground would usually cause no Fuel Pump operation and a no start condition.
 - If there is no Loss of Communication fault then this condition is most likely present due to an issue with the command circuit, an over current draw or over temp condition with the Fuel Pump.

PRELIMINARY DIAGNOSTIC CHECKS

1. Check for any Service Bulletins, Star On-line Cases or ECU flash updates that apply for the DTC or symptom.
2. Check for any Battery voltage DTCs in the ECU. Low Battery voltage can cause a DTC.
3. Circuit faults should typically be diagnosed before rationality/performance faults.
4. Check the component harness connector(s) for proper connection at the component. Verify that the connector is completely plugged in and properly locked prior to disconnecting for testing. Disconnect the component harness connector and check for water intrusion and any pushed out, damaged, corroded, burnt, or spread terminals.

CHECK FOR AN ACTIVE OR INTERMITTENT CONDITION

Checking for an active DTC or condition: Read and record all DTCs and Freeze Frame Data. Run and save a vehicle scan report for later use if needed. Review the Freeze Frame data, When Monitored and Set Conditions. Erase all DTCs and operate the vehicle or system in accordance with these conditions attempting to duplicate the DTC or condition. If a DTC returns, or the condition is present continue with the diagnostic procedure. If the DTC or condition is not present, review the Intermittent Condition Testing information.

Intermittent Condition Testing: A DTC can be stored for any number of reasons. If a DTC is not active review and check the following items below;

1. **Since the FPCM monitors the Fuel Pump circuits and motor for excessive current draw and over temperature conditions,** it is possible that the pump may need to run for an extended period for the

condition to be present.

2. Electronic Control Modules can be affected by temperature or software issues. Always check for any flash updates that may be related to the DTC or failure mode before continuing to diagnose an intermittent condition.
3. Poor wiring harness connections are a big contributor to intermittent electrical connections. Always check for any Service Bulletins that may apply to the DTC or failure mode before continuing to diagnose an intermittent condition. If no bulletins apply, check for connection issues by wiggle testing any wiring harnesses and in-line connectors the circuitry passes through. A good practice is too watch for a DTC to become active or scan tool data to change. An even better method is to attach a lab scope to the circuitry and wiggle test the wiring. Review the scope pattern looking for intermittent opens in the circuitry during the wiggle test. Poor battery system voltage or poor ground connections can affect systems in different or odd ways. Check the battery or batteries for proper charge and operation along with proper connections. Use the wiring information to identify and check any chassis ground connections related to the systems or components being diagnosed. Verify that connectors are locked in properly at the components, modules and any in-line connectors in the system. Look for pushed out, corroded, spread, burnt, or broken terminals at each connector.
4. Mechanical and electrical components can fail intermittently due to temperature changes or vibration during driving. Operate the components through a full range of operation while monitoring functionality.

DIAGNOSTIC TEST - FPCM SYSTEM VOLTAGE LOW AND HIGH (P025C, P025D, P027C, P027D)

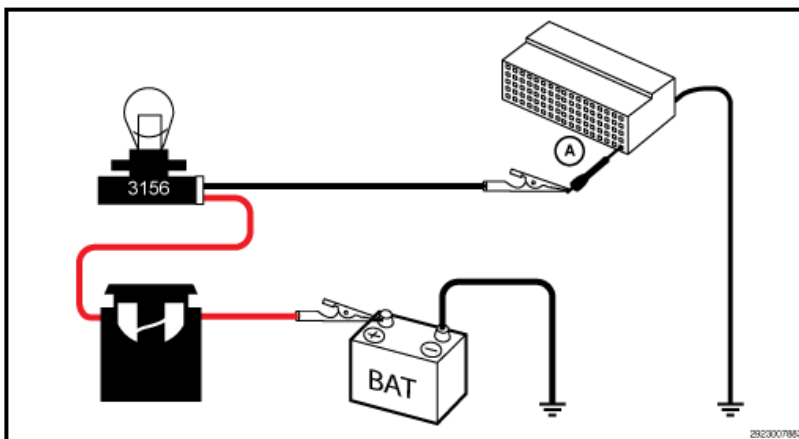
TECH TIP: The FPCM DTCs will set incorrectly for some vehicles/model years due to incorrect calibrations. For those vehicles it is best to perform the "COMPLETE FUEL PUMP CONTROL MODULE SYSTEM TESTING (NOT DTC SPECIFIC)" diagnostic procedure. Refer to the "KNOW ISSUES" section above for a list of the vehicles with incorrect calibrations.

SYSTEM VOLTAGE HIGH (P025D, P027D): The system voltage high DTCs indicate a charging system issue. Refer to the charging system service and diagnostic information.

SYSTEM VOLTAGE LOW (P025C, P027C):

The system voltage low fault indicates that the voltage supply to the module is below a calibrated threshold (approximately 6.0 volts). This typically is due to high resistance in the Battery voltage supply or ground circuits for the FPCM.

1. Disconnect the FPCM harness connector and load test the FPCM Ground circuit. Read the **CIRCUIT LOAD TESTING PROCEDURE** for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit, . Refer to [STANDARD PROCEDURE](#) .



1. A way to verify that there is no resistance in the circuit being tested is to perform a simple voltage drop test across the 3156 bulb of the load test tool. The voltage drop across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.

- If the ground circuit fails load testing, repair the FPCM chassis ground.
- If the ground circuit tests good, **continue testing in step 2.**

NOTE: Keep in mind when performing this step that when the ignition is switched on, and the engine is not cranking, the Fuel Pump Relay is energized for approximately 5.0 seconds and then powered down. It will be powered continuously when the engine is cranking or running.

2. Load test the battery supply to the FPCM harness connector.
 1. If the battery supply circuit fails load testing, repair the fuel pump relay output circuit for an open or high resistance. If the fuse is open, test the circuit for a short to ground.
 2. If both the Battery supply and ground circuits pass the load test and the DTC is active, replace the Fuel Pump Control Module in accordance with the service information.

POWERTRAIN VERIFICATION TEST

VERIFICATION OF REPAIR:

1. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
2. After repairs are complete, erase all DTCs with the scan tool.
3. Refer to the table below to determine if a learn procedure should be performed for the component that was removed or replaced. Not all learn procedures are available for all vehicles. If a component listed in the table is replaced and the correlating learn procedure is present in the scan tool, navigate to "Miscellaneous Functions" and perform the learn procedure before verifying repair. Failure to do so may cause the same, or another DTC to set.

Scan Tool Learn Procedures	Component replaced or removed: Note: (All available Learn procedures should be performed when a PCM is replaced)
Brake Pedal Learn	Brake Pedal Position Sensor, Brake Pedal Assembly
Cam Crank Relearn (NGC/GPEC Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clear Misfire TLC (Magneti Marelli Controllers)	CKP Sensor, CMP Sensor, Flywheel, Valvetrain components (timing chain, gears, tensioners), Cam Phasers
Clutch Pedal Learn	Clutch Pedal Position Sensor, Clutch Pedal, Clutch Assembly (pressure plate and disc)
EGR Valve Replaced	EGR Valve
Learn ETC	Throttle Body
Check PCM Odometer	PCM Replaced
Check PCM VIN	PCM Replaced
PCM Replaced Routine	PCM Replaced
Learn Gear Shift Sensor	Gear Shift Position Sensor, Transmission Shifter components

4. **If the PCM has been replaced**, perform the Module Programming procedure. The PCM Reprogramming procedure is either in Section - 8E Electronic Control Modules/PCM Programming Folder or Section 28 - PCM Standard Procedure Folder depending on the vehicle application. Be certain that the secret key code, VIN and odometer mileage are programmed after programming the PCM.
5. Operate the vehicle in accordance with the parameters and specific information found in the Monitoring Conditions and Theory of Operation of the DTC that was repaired.
6. With the scan tool, verify that no DTCs have returned.
 1. If the DTC returned check for any service bulletins or star online cases that may apply. If no bulletins exist, return to and perform the DTC procedure.
 2. If the DTC or condition did not return, repair is complete.

P0298-ENGINE OIL TEMPERATURE TOO HIGH

NO TITLE

For a complete INTAKE AIR SYSTEM wiring diagram, .

THEORY OF OPERATION

Once the Ambient Air Temperature (AAT), Intake Air Temperature (IAT), and Engine Coolant Temperature (ECT) Sensors have been evaluated the Engine Oil Temperature (EOT) Sensor can be checked. If the ambient, engine coolant, and general temperature sensor rationalities indicate valid sensor readings then the engine oil temperature rationality will assume the AAT and ECT Sensors are correct and therefore can be used to evaluate the EOT Sensor.

To determine failing status, the difference between the starting EOT and starting ECT is compared to a threshold. If the calculated difference is above the threshold, then starting EOT is compared to starting AAT. The diagnostic will check to see if a block heater is being used to determine if larger threshold values are needed. If this rationality test fails, then it is tested again using the updated value of AAT. A failure here will result in a fault being set for EOT sensor.

WHEN MONITORED

This diagnostic runs when the following conditions are met:

- With the engine running in fuel delivery mode.
- Battery voltage above 7.5 volts.
- The difference between the engine coolant temperature and the actual engine oil temperature is less than 255B°C (491B°F) at engine start-up.
- To initiate the monitor, the model predicted engine oil temperature at engine start must be less than approximately 58B°C (136.4B°F). The monitor will stop running when the model predicted engine oil temperature becomes greater than 88B°C (190.4B°F).

SET CONDITION

- If the actual engine oil temperature is above the model predicted temperature by more than 40B°C (104B°F) for three minutes.

DEFAULT ACTION

- The ETC light will illuminate.

POSSIBLE CAUSES

Possible Causes
ENGINE OIL
COOLING SYSTEM NOT OPERATING TO SPECIFICATION
HIGH RESISTANCE IN THE EOT SENSOR TEMP SIGNAL CIRCUIT
HIGH RESISTANCE IN THE SENSOR GROUND CIRCUIT
ENGINE OIL TEMPERATURE (EOT) SENSOR
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to .

DIAGNOSTIC TEST

1. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, with the scan tool, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any Engine Oil Temperature Sensor DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK THE ENGINE OILING AND COOLING SYSTEMS FOR PROPER CONDITIONS AND DAMAGE

NOTE: The following items should be considered before determining the cause of this DTC. Failure to do so may lead to misdiagnosis.

- **LOW ENGINE OIL**
- **ENGINE MECHANICAL TOLERANCES OUT OF SPECIFICATION**
- **ENGINE OIL PRESSURE OUT OF SPECIFICATION**
- **ENGINE OIL MEETS OEM SPECIFICATION**
- **DETERIORATED OR DIRTY OIL**
- **ENGINE OIL CONTAMINATED (i.e., coolant and/or fuel)**
- **COOLING SYSTEM NOT OPERATING TO SPECIFICATION**

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. ISOLATE AND CHECK THE EOT SENSOR (G24) TEMP SIGNAL CIRCUIT FOR HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the
(special tool #10436, Adapter, GPEC Diagnostic)
to the appropriate PCM harness connector.

NOTE: The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [5](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

5. ISOLATE AND CHECK THE (K900) SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE

1. The ignition must be off when checking the continuity of a circuit.
2. Isolate the circuit by disconnecting the Electronic Control Unit (ECU) and the component harness connector containing the circuit being tested. **Note:** Use the wiring diagram as a guide to follow the path of the circuit.
3. Before measuring the resistance of any circuit, first measure the resistance between the two leads of the DVOM. **Note:** The meter leads can add resistance to the measurement value.
4. Connect one lead of the DVOM to the circuit being tested at the component harness connector.
5. Connect the other lead to the circuit being tested at the GPEC Adaptor and measure the resistance of the circuit.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

1. If it is necessary to probe a terminal at a PCM harness connector, connect the

(special tool #10436, Adapter, GPEC Diagnostic)

to the appropriate PCM harness connector.

NOTE: The GPEC Diagnostic Adaptor can add up to 1.5 Ohms of resistance to the circuit.

Is the resistance below 3.0 Ohms?

Yes

- Go To [6](#)

No

- Repair the circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

6. CHECK THE ABILITY OF THE PCM TO READ THE EOT SENSOR SIGNAL

1. Turn the ignition off.
2. Reconnect the PCM C2 harness connector.
3. Turn the ignition on.
4. With the scan tool, read the Engine Oil Temperature Sensor voltage.

NOTE: The P0198-ENGINE OIL TEMPERATURE SENSOR CIRCUIT HIGH DTC should display as active or pending with the harness connector disconnected.

5. Connect a jumper between the EOT (G224) Temp Signal circuit and the Sensor Ground circuit at the Engine Oil Temperature Sensor harness connector.

NOTE: The P0197-ENGINE OIL TEMPERATURE SENSOR CIRCUIT LOW DTC should display as active or pending with the jumper in place.

Does the scan tool display as described above?

Yes

- Verify that there is good pin to terminal contact in the EOT Sensor and Control Module connectors. Replace the Engine Oil Temperature Sensor if no problems were found with the connectors. Refer to [ENGINE SENSORS , REMOVAL AND INSTALLATION ENGINE SENSORS , REMOVAL AND INSTALLATION](#) .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.

- Damaged connector locks.
- Corrosion.
- Other signs of water intrusion.
- Weather seal damage (if equipped).
- Bent terminals.
- Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
- Terminals that have been pushed back into the connector cavity.
- Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0300-MULTIPLE CYLINDER MISFIRE

THEORY OF OPERATION

The PCM uses the Crankshaft Position (CKP) Sensor to detect and monitor the Crankshaft rotational speed. Normally, the Crankshaft rotational speed is fairly stable from cylinder to cylinder. When a misfire occurs in a cylinder, the Crankshaft speed changes abruptly for that cylinder. Therefore, anything that causes a sudden change in Crankshaft speed detected for a single cylinder is determined to be an engine misfire event. A misfire fault will usually occur due to poor fuel quality or metering, lack of spark, engine timing, low engine compression due to engine mechanical or valvetrain issues, a vacuum leak or coolant leak entering the engine intake air system. Though not as common, other factors such as severe wheel balance or braking vibration, a worn serpentine belt or belt driven accessory binding should also be considered when diagnosing a misfire fault.

Depending on the engine involved, there can be several systems and components that can contribute to a misfire. **In many cases, but not always, there will be other DTCs set related to these systems. If that is the case, the focus should be on following the diagnostics for the system that has DTCs set against it.** The different components or systems will affect misfire in different ways. Factors to consider when diagnosing a misfire are whether the misfire is a single cylinder or multiple cylinder misfire, and when does the misfire occur (idle, vehicle and engine speed, heavy engine load conditions, etc.). These factors can help in

determining what components or systems should be focused on during diagnostics. **Typically a multiple cylinder misfire is an indication of timing, oil or coolant consumption, air handling, fuel supply or poor fuel quality issue that can affect multiple cylinders and not a single cylinder component such as a Fuel Injector, Ignition Coil or Spark Plug.**

NOTE: **The effects that the components and systems have on misfire detection are described in more detail in the individual test steps below.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Fuel level above 12%.
- Battery voltage above 10.9 volts.
- The adaptive numerator has been successfully learned.
- Ambient temperature above -23B°C (-9.4B°F).
- Coolant temperature at engine start is above -7B°C (19.4B°F). If start engine temperature is below threshold, enable monitor when engine temperature reaches 21B°C (69.8B°F).
- Engine speed between approximately 400 rpm and 6200 rpm.
 - Misfire monitor is disabled during a Decel Fuel Shutoff Event (DFSO).

SET CONDITION

- The variation in crankshaft speed between cylinders exceeds a calibrated value, based on engine speed and load.

DEFAULT ACTION

- The MIL will illuminate or flash depending on severity of the misfire.
- During a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. When the engine rev counter has reached the calculated threshold the Fuel Injector is turned back on. If a misfire is still occurring, the injector is disabled again. This cycle will continue until the misfire has stopped.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
ENGINE OIL LEVEL LOW/AERATED OR CONTAMINATED
INCORRECT ENGINE OIL FILTER
INSUFFICIENT OIL PRESSURE DUE TO A MECHANICAL FAILURE IN THE OILING SYSTEM
ENGINE VACUUM LEAK OR INTAKE RESTRICTION
EXHAUST RESTRICTION
FUEL SYSTEM ISSUES (POOR QUALITY OR FUEL PRESSURE ISSUE)
EXCESSIVE CARBON BUILD-UP OR VALVETRAIN ISSUE
CRANKSHAFT POSITION SENSOR (CKP) OR TONE WHEEL ISSUES
VARIABLE VALVE TIMING (VVT) SYSTEM ISSUES
VARIABLE VALVE LIFT (VVL) SYSTEM ISSUES (IF EQUIPPED)
INTERNAL EGR VALVE LEAK
COOLANT LEAKING INTO A CYLINDER
FAULTY FUEL INJECTOR
FAULTY IGNITION COIL OR SPARK PLUG
ENGINE MECHANICAL/LOW COMPRESSION

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, read and record all DTCs and Freeze Frame information.
3. Operate the vehicle under conditions recorded in the Freeze Frame information when the DTC was set.

NOTE: During the test drive of the vehicle, note when the misfire condition is present for use later in this diagnostic test. Also monitor the Downstream O2 Sensor(s) when the misfire is occurring. O2 Sensor voltage readings that are consistently on the low side of the scale would indicate a lean condition. This could indicate a lack of fuel due to a plugged Fuel Injector or fuel system issue. O2 Sensor voltage readings that are consistently on the high side of the scale indicates that the Catalytic Converter is burden with too much fuel. This could be caused by a lack of spark or a possible leaky Fuel Injector.

NOTE: Keep in mind that during a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. This can cause a misfire that occurs only at high engine speed or heavy engine load to appear to continue when returning to idle. However this could be due to the Fuel Injector being disabled until the rev counter resets.

4. With the scan tool, view the Misfire Monitor to see which cylinders are effected.

Are there excessive misfires occurring at this time?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCs

1. Refer to the recorded DTCs.

Are there any fuel, ignition system component, air handling component, VVT system, or VVL system DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK FOR MECHANICAL CONDITIONS THAT COULD CAUSE A MISFIRE

NOTE: Each of the following conditions can cause a misfire during most operating conditions with the exception of the out of balance tires or warped brake rotors.

1. Visually inspect the engine for any of the following conditions:

- Worn, loose or slipping serpentine belt. Refer to [**BELT, SERPENTINE , REMOVAL AND INSTALLATION**](#) [**BELT, SERPENTINE , REMOVAL AND INSTALLATION**](#) .
- Binding or misaligned engine driven accessories: Examples: A/C Compressor, P/S Pump, Water pump, etc.
- Improper mounting of the CKP Sensor or damaged target wheel.
- Harmonic Balancer out of balance.
- Extremely out of balance tires or warped brake rotors.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE ENGINE OIL AND OILING SYSTEM

NOTE: The VVT or VVL systems depend on sufficient oil pressure to operate normally. An oiling system or oil pressure issue can cause the VVT or VVL systems to operate erratically which can effect Camshaft timing or valve lift and cause a misfire during any operating condition.

1. Turn the ignition off.
2. The following items should be checked before continuing with this procedure. Failure to do so may lead to misdiagnosis.
 - LOW ENGINE OIL LEVEL
 - AERATED ENGINE OIL
 - INCORRECT ENGINE OIL FILTER (DOES NOT MEET OEM SPECIFICATIONS)
 - DETERIORATED OR DIRTY OIL
 - CONTAMINATED ENGINE OIL
 - INCORRECT ENGINE OIL VISCOSITY

Were any of the above conditions present?

Yes

- Repair the engine oiling or mechanical condition (i.e. improper oil drain back, oil sludge, damaged oil pump, pick-up tube or seal, etc.).
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE ENGINE OIL PRESSURE AND OIL PUMP OPERATION

1. Install the applicable adaptor to the oil filter cap and install an oil pressure gauge to the adaptor. If the adaptor is not available, monitor the oil pressure reading with the scan tool.

2. Start the engine and allow it to idle.
3. Monitor the engine oil pressure reading on the gauge or scan tool.

NOTE: If the oil pressure is below 14.0 psi or oscillating excessively, it can cause a delay in Cam Phaser movement sufficient enough to cause a misfire during any operating condition.

Is the oil pressure reading stable and above 14.0 psi?

Yes

- Go To [6](#)

No

- Repair the engine oiling or mechanical condition (i.e. improper oil drain back, oil sludge, damaged oil pump, pick-up tube or seal, etc.).
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

6. CHECK THE VVT SYSTEM AND CAM PHASER POSITIONS

NOTE: A VVT system issue from a lack of oil pressure will generally effect all of the cylinders for both banks. If a Cam Phaser or Oil Control Valve is stuck, it will generally effect the cylinders on the bank where that Camshaft is located. This may be accompanied by a Crankshaft/Camshaft Timing Misalignment and/or Camshaft Position Slow Response DTC.

1. If the multiple cylinder misfire is coming from the cylinders on the same bank and the VVT system is suspected to be the issue, check the VVT operation as follows:

- With the scan tool, monitor and compare the suspect Intake and Exhaust Camshaft **desired** position values with the Camshaft **actual** position values with the engine running at idle. After comparing the two values at idle, check and compare the values at several different engine speeds. The best way to do this is to raise the engine speed quickly and hold steady for up to 30 seconds and monitor the actual and desired values. Then lower the engine speed and hold steady at a level above idle (off of lock pin) for up to 30 seconds and monitor the actual and desired values. Repeat this a few times up and down, monitoring the values and then allow the engine to come back to idle and monitor the actual position to verify that the phaser is coming back to lock pin. There are a few things to monitor during testing:
- One is for the phaser not coming back to lock pin at idle (this could indicate a faulty phaser or oil control valve that is permanently stuck off lock pin or a VVT Solenoid that is electrically stuck on). For the **standard 3.6L application** , lock pin position for the Intake Camshaft is 127.0 degrees and lock pin position for the Exhaust Camshaft is 117.0 degrees. For the **3.6L Upgrade application** , lock pin position for the Intake Camshaft is 146.0 degrees and lock pin position for the Exhaust Camshaft is 123.0 degrees.
- A second is for the actual position lagging or moving slowly toward the desired position (this could indicate a faulty phaser or tarnished oil control valve that is dragging). The third thing to monitor for would be the actual position lagging and then overshooting the desired position (this could indicate a faulty phaser, oil control valve or VVT Solenoid that is intermittently sticking or binding and then overshoot when the condition goes away).
- The third thing to monitor for would be the actual position lagging and then overshooting the desired position (this could indicate a faulty phaser, oil control valve or VVT Solenoid that is intermittently sticking or binding and then overshoot when the condition goes away).

Is the difference between the actual value and the desired value readings more than 6.0 degrees at idle or is the actual value lagging behind or overshooting the desired value?

Yes

- If the difference is greater than 6.0 degrees at idle, it is indicating that the camshaft will not return to lock pin. If the actual reading is lagging or overshooting when changing the engine speeds, it is indicating a binding or sticking. Diagnose and repair the issue with the VVT system. Performing the appropriate Camshaft Position Slow Response DTC diagnostic procedure (P000A - P000D) may aid in further diagnosing the system.

No

- Go To [7](#)

7. CHECK THE INTAKE SYSTEM FOR LEAKS OR RESTRICTIONS

1. Visually inspect the intake plumbing for restriction. Check the Air Filter for excessive debris causing a restriction.
2. Check the engine components and vacuum hoses for vacuum leaks.

NOTE: **A vacuum leak can affect one or more cylinders depending on the location of the leak.**

Were any issues found with the intake system?

Yes

- Repair the leak or restriction in the intake system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [8](#)

8. CHECK THE EXHAUST SYSTEM FOR RESTRICTIONS

1. Visually inspect the exhaust system for any physical damage that may cause a restriction and excessive exhaust back flow.
2. Start the engine and allow it to idle.
3. Check the exhaust flow at the tail pipe.

Were any issues found with the exhaust system?

Yes

- Repair the restriction in the exhaust system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [9](#)

9. CHECK THE FUEL QUALITY AND ETHANOL LEVEL

1. Check the fuel for the following:
 - Water in fuel
 - Correct type of fuel
 - Old or contaminated fuel
 - Low fuel
 - Perform the CHECK FOR PROPER ETHANOL LEVEL IN THE GASOLINE procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found with the fuel?

Yes

- Replace the fuel and, if necessary, flush and clean the fuel system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [10](#)

10. CHECK THE FUEL DELIVERY SYSTEM

NOTE: Fuel pressure that is too high or too low will affect multiple cylinders and generally cause a misfire during most operating conditions.

1. Perform the CHECKING THE FUEL DELIVERY SYSTEM test procedure. Refer to [DIAGNOSIS AND TESTING](#) .

Were any problems found?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [11](#)

11. CHECK FOR A FUEL INJECTOR ISSUE

NOTE: A Fuel Injector that is plugged and spraying too little fuel, or fouled and spraying too much fuel or has an uneven pattern will generally cause a misfire during any operating condition. One faulty Fuel Injector will usually cause a single cylinder misfire. However if the injector is spraying an excessive amount of fuel, the excess fuel could also affect the adjoining cylinders. In most cases there will be far more misfire counts on the cylinder with the faulty Fuel Injector than on the other affected cylinders.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

1. Turn the ignition on and allow the fuel pressure to reach maximum pressure.

NOTE: The ignition may need to be cycled on and off a couple times to reach maximum fuel pressure in the rail.

2. Turn the ignition on.
3. With the scan tool, actuate the Fuel Injector for the cylinders that indicated a misfire.
4. Monitor the fuel pressure gauge.
5. Restore the fuel pressure in the rail and repeat this step with two or three Fuel Injectors on cylinders that do not have a misfire. Compare the fuel pressure drop readings of the known good cylinders to the cylinders with the misfire condition.

Did the fuel pressure gauge indicate a drop in fuel pressure equal to the pressure drop in the known good injectors?

Yes

- Go To [12](#)

NOTE: Turn the ignition off, remove the Fuel Pressure Decay Tester and connect the fuel lines before continuing.

No

- If the pressure drop is too little, check for debris in the Fuel Rail or Fuel Injector and repair as necessary. If the pressure drop is too large, suspect a faulty or fouled Fuel Injector as the issue.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

12. CHECK THE VARIABLE VALVE LIFT (VVL) SYSTEM (IF EQUIPPED)

NOTE: The 3.6L Upgrade engine is equipped with the VVL System. The classic engine is not. If this vehicle is not equipped with the VVL system skip this test step.

NOTE: A Rocker Arm or arms can get stuck due to an oil pressure issue, or a mechanical failure of a VVL Solenoid (including O-rings) or Rocker Arm. A single Rocker Arm that is stuck in low lift will not be detected and the system will continue to operate normally, however some misfire and engine roughness may be felt. One Rocker Arm stuck in Low Lift mode will cause a misfire at higher engine speeds (above approximately 4000 rpm). Two or more Rocker Arms stuck in Low Lift mode can cause a misfire at any engine speed, including idle. A Rocker Arm stuck in high lift mode typically misfires at idle.

NOTE: The two rear cylinders are controlled by the rear solenoid on each bank. Therefore, a VVL issue that affects both rear cylinders on a bank is most likely a common issue for both cylinders. These would include a damaged or missing O-ring, faulty solenoid, oil supply or control circuit issue. A VVL issue that only affects one of the rear cylinders is more likely going to be a failure of a Rocker Arm or pin for that cylinder.

NOTE: The front VVL Solenoids control the operation of the Rocker Arms for the front cylinder only on each bank. The rear VVL Solenoids control the operation of the Rocker Arms for the back two cylinders on each bank.

1. Turn the ignition on.
2. With the scan tool, navigate to Systems Tests, perform the VVL System Diagnostic test and follow the on screen directions. for further VVL system functionality and scan tool routine information.

NOTE: Do not erase the DTC before running the routine.

3. When the test is complete, compare the results to the table below for the probable failure conditions.

Does the scan tool results show that the misfire is being caused by the VVL system?

Yes

- Compare the results from the routine to the table below

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
Low misfire percentage on (1) Rocker Stuck Low test, (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire
High misfire percentage on (1) Rocker Stuck Low test , (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 1	• VVL Solenoid 1/1 stuck on/open • VVL Solenoid 1/1 control circuit shorted to 12 volts • VVL Solenoid 1/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 1 rocker arm lash adjuster issue (stuck or broken) • Cylinder 1 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	• Verify that the VVL Solenoid 1/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 1/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 1 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 2	• VVL Solenoid 2/1 stuck on/open • VVL Solenoid 2/1 control circuit shorted to 12 volts • VVL Solenoid 2/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 2 rocker arm lash adjuster issue (stuck or broken)	• Verify that the VVL Solenoid 2/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 2/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 2 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	• Cylinder 2 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 13 .
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 3	• Cylinder 3 rocker arm lash adjuster issue (stuck or broken) • Cylinder 3 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 3 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 4	• Cylinder 4 rocker arm lash adjuster issue (stuck or broken) • Cylinder 4 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 4 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 5	• Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 5 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 6	• Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 6 rocker arms or lock pins
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck on/open • VVL Solenoid 1/2 control circuit shorted to 12 volts • VVL Solenoid 1/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but	• Check the VVL Solenoid 1/2 control circuit for a short to 12 volts condition • Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 3 and Cylinder 5	
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 4 and Cylinder 6	• VVL Solenoid 2/2 stuck on/open • VVL Solenoid 2/2 control circuit shorted to 12 volts • VVL Solenoid 2/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 4 and Cylinder 6	• Check the VVL Solenoid 2/2 control circuit for a short to 12 volts condition • Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 13.
(1) Rocker Stuck Low test - high misfire percentage Cylinder 1, Cylinder 3, and Cylinder 5	• Both bank 1 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control	• Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	oil passage for both bank 1 solenoids Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 13.
(1) Rocker Stuck Low test - high misfire percentage Cylinder 2, Cylinder 4, and Cylinder 6	- Both bank 2 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage for both bank 2 solenoids - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	- Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 13.
(1) Rocker Stuck Low test - high misfire percentage for all Cylinders (1 - 6)	- Missing or damaged supply O-rings causing oil pressure leakage from the supply oil passage to the control oil passage for front and rear solenoids on bank 1 and bank 2 - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in both Cylinder Heads.	- Check operation of all VVL Solenoids for a stuck on/open condition, damaged or missing supply O-rings - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace both Cylinder Heads.
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1	- VVL Solenoid 1/1 control circuit open or shorted to ground - VVL Solenoid 1/1 stuck closed/off - VVL Solenoid 1/1 has missing or damaged control O-ring causing	- Check the VVL Solenoid 1/1 control circuit for an open or shorted to ground condition - Check the VVL Solenoid 1/1 for a missing or damaged control O-ring

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	- oil pressure leakage from the control oil passage to the exhaust oil passage - Control oil passage pressure restricted - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm lash adjuster issue (stuck or broken) - Cylinder 1 rocker arm lock pin stuck extended	- Actuate and check the VVL Solenoid 1/1 operation. Check for debris on screen - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2	- VVL Solenoid 2/1 stuck closed/off - VVL Solenoid 2/1 control circuit open or shorted to ground - VVL Solenoid 2/1 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage - Control oil passage pressure restricted - Cylinder 2 lash adjuster plugged - Cylinder 2 rocker arm lash adjuster issue (stuck or broken) - Cylinder 2 rocker arm lock pin stuck extended	- Check the VVL Solenoid 2/1 control circuit for an open or shorted to ground condition - Check the VVL Solenoid 2/1 for a missing or damaged control O-ring - Actuate and check the VVL Solenoid 2/1 operation. Check for debris on screen - Cylinder 2 lash adjuster plugged - Cylinder 2 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3	- Cylinder 3 lash adjuster plugged - Cylinder 3 rocker arm lash adjuster issue (stuck or broken) - Cylinder 3 rocker arm lock pin stuck extended	- Cylinder 3 lash adjuster plugged - Cylinder 3 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4	- Cylinder 4 lash adjuster plugged - Cylinder 4 rocker arm lash adjuster issue (stuck or broken) - Cylinder 4 rocker arm lock pin stuck extended	- Cylinder 4 lash adjuster plugged - Cylinder 4 rocker arm stuck failure or lock pin stuck extended

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 5	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck extended	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 6	• Cylinder 6 lash adjuster plugged • Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck extended	• Cylinder 6 lash adjuster plugged • Cylinder 6 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck closed/off • VVL Solenoid 1/2 control circuit open or shorted to ground • VVL Solenoid 1/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted NOTE: It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 3 and Cylinder 5	• Check the VVL Solenoid 1/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 1/2 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 1/2 operation. Check for debris on screen • Cylinder 3 or 5 lash adjuster plugged • Cylinder 3 or 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4 and Cylinder 6	• VVL Solenoid 2/2 stuck closed/off • VVL Solenoid 2/2 control circuit open or shorted to ground	• Check the VVL Solenoid 2/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 2/2 for a missing or damaged control O-ring

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	- VVL Solenoid 2/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage - Control oil passage pressure restricted NOTE: It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 4 and Cylinder 6	- Actuate and check the VVL Solenoid 2/2 operation. Check for debris on screen - Cylinder 4 or 6 lash adjuster plugged - Cylinder 4 or 6 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1, Cylinder 3 and Cylinder 5	- VVL Solenoid 1/1 and 1/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage - Bank 1 oil supply passage blockage or restriction to front and rear oil feeds in the bank 1 Cylinder Head - Large internal leakage in bank 1 Cylinder Head affecting the front and rear oil feeds	- Check the control O-rings on the front and rear bank 1 VVL Solenoids for damage - Check for proper oil pressure at the front and rear bank 1 VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 13. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
		cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2, Cylinder 4 and Cylinder 6	- VVL Solenoid 2/1 and 2/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage - Bank 2 oil supply passage blockage or restriction to front and rear oil feeds in the bank 2 Cylinder Head - Large internal leakage in bank 2 Cylinder Head affecting the front and rear oil feeds	- Check the control O-rings on the front and rear bank 2 VVL Solenoids for damage - Check for proper oil pressure at the front and rear bank VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 13. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage for all Cylinders (1 - 6)	Engine oil pressure too low to both Cylinder Heads due to: - Oil level low - Wrong viscosity oil - Oil Filter restriction - Engine mechanical failure (damaged bearings, pick-up tube or seal, engine block, etc.) - Faulty Oil Pump	- Check for proper oil level, filter and viscosity before checking engine oil pressure - If the engine oil pressure is low check for any mechanical issue that could cause low oil pressure. If there are no issues with the bearings, pick-up tube and engine block replace the Engine Oil Pump Assembly NOTE:

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
		Low engine oil pressure will likely also cause issues/faults for the VVT system

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [14](#)

13. CHECK THE ACTUAL OIL PRESSURE TO THE VVL SOLENOID IN THE CYLINDER HEAD

1. Turn the ignition off.
2. Remove the appropriate VVL Solenoid called out by the scan tool.
3. Install the (special tool #2027300090, Kit, VVL Adapters) in place of the VVL Solenoid.
4. Start the engine and allow it to idle.
5. With the scan tool, monitor the Dual Oil Pump mode.

NOTE: Let the engine run long enough for the pump to switch to low pump mode.

6. Read and record the oil pressure reading on the oil pressure gauge. Compare the reading to the main engine oil pressure reading from the Engine Oil Pressure Sensor reading on the scan tool.

NOTE: The Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure reading.

Is the Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure?

Yes

- Remove and inspect the screen on the VVL Solenoid for debris that can block oil flow through the solenoid. Check the seals on the VVL Solenoid for damage and proper installation. If no debris is found, and the seals appear good replace the VVL Solenoid in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Diagnose and repair the lack of oil pressure to the VVL Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

14. CHECK FOR PROPER SPARK AT THE IGNITION COILS

NOTE: A faulty Ignition Coil or Spark Plug can cause a misfire at idle but could also misfire only under a heavy load on the engine. One faulty Ignition Coil or Spark Plug will usually cause a single cylinder misfire, not a multiple cylinder misfire.

1. Remove the Ignition Coil from the cylinders that are misfiring.
2. Connect the Ignition Coil harness connector.

3. Disconnect the Fuel Injector harness connector of the cylinder being tested.
4. Install a spark tester on the Ignition Coil.
5. While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated from the Ignition Coil.

Is good spark present?

Yes

- Go To [15](#)

No

- Go To [21](#)

15. INSPECT THE SPARK PLUG

1. Turn the ignition off.
2. Remove the Spark Plug(s) in accordance with the Service Information. Refer to [SPARK PLUG, REMOVAL AND INSTALLATION](#).
3. Inspect the Spark Plug(s) for the following conditions:
 - Cracks
 - Carbon Tracking
 - Fouling due to oil, coolant or excess fuel in the cylinder
 - Gap size out of specifications
 - Loose or broken electrode

Check for signs of oil or coolant in the cylinder.

Were any of the above conditions present?

Yes

- Replace the Spark Plug in accordance with the Service Information. If oil or coolant were found in the cylinder, diagnose and repair the cause.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [16](#)

16. CHECK THE ENGINE COMPRESSION TO CHECK FOR VALVETRAIN OR COMBUSTION CHAMBER ISSUES

NOTE: A cylinder compression or valvetrain issue will cause a misfire during all operating conditions. These types of failures will normally affect a single cylinder. However, depending on the type of failure incurred, other cylinders can also be affected and show misfires. In most cases there will be far more misfire counts on the cylinder with the issue than on the other affected cylinders.

NOTE: If you suspect that the VVT system is causing the issue, it may be helpful to perform the Camshaft Position Slow Response diagnostic procedures for the bank that the misfires are occurring on.

1. Perform a cylinder compression test on all of the cylinders and compare the known good cylinders to the cylinders that are misfiring. Refer to .

Is the cylinder compression within specification?

Yes

- Go To [17](#)

No

- Perform a Cylinder Leak Down Test to determine if the cause is from the valvetrain or combustion chambers and repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

17. EXCHANGE SPARK PLUG(S) AND CHECK FOR MISFIRE TO FOLLOW THE SPARK PLUG

1. Turn the ignition off.
2. Exchange the Spark Plug(s) with a known good cylinder that was not indicating a misfire or replace the Spark Plugs if they are difficult to access.
3. Start the engine and monitor the misfire monitor screen.

Did the misfire switch to the previously good cylinder or go away if the Spark Plug(s) was replaced?

Yes

- Replace the Spark Plugs in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [18](#)

18. CHECK THE EGR SYSTEM

NOTE: The EGR Valve should only allow flow during light to normal acceleration and steady speed states. There should be no EGR flow at idle. If the EGR Valve is stuck open or leaking, it will cause the engine to run rough and misfire at idle and hesitation on initial throttle tip in. The misfire should go away or decrease greatly when driving since EGR gas flow is normally allowed under those conditions.

1. If the EGR Valve is suspected of leaking it can be checked as follows:
 - If the engine has a tube coming off of the EGR Valve, allow the vehicle to sit and cool to ambient temperature or until the EGR Tube is cooled to ambient temperature. Start the engine and allow it to idle in park. The EGR Valve should be closed at this time so there should be no flow of exhaust gases through the tube. If the EGR Valve is stuck open or leaking the tube will begin to heat up quickly from the exhaust gases leaking passed the valve.
 - If there is no tube coming off of the EGR Valve, or it is not easily accessible, block off the EGR Valve to stop flow into the engine. The most effective way of doing this is to loosen the bolts connecting the EGR Valve to the engine and slide a piece of metal or cardboard between the valve to block the opening. Tighten the bolts enough to form a good seal and start the engine to see if the misfire/rough running at idle is gone.

Were any issue found with the EGR Valve?

Yes

- Replace the EGR Valve in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [19](#)

19. CLEAN THE CARBON FROM THE VALVETRAIN AND COMBUSTION CHAMBERS

NOTE: Carbon build up on the engine valves and guides can cause a misfire during all operating conditions but is usually more noticeable during cruising speeds or heavy engine load conditions. If carbon build up is becoming an issue it could set only a single cylinder misfire but usually will affect more than one cylinder and set multiple cylinder misfire as well.

1. Using the Mopar Combustion cleaner, de-carbon the valves and combustion chambers.
2. After driving and clearing the combustion cleaner from the engine, erase any DTCs with the scan tool.
3. Test drive the vehicle in accordance with the Freeze Frame data.
4. With the scan tool, view the Misfire Monitor.

Did the misfire return?

Yes

- Go To [20](#)

No

- Cleaning the valves and combustion chambers repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

20. CHECK THE CAMSHAFT LOBES, ROCKER ARMS AND SPRINGS

NOTE: Worn Camshaft Lobes, worn or broken Rocker Arms or springs may sometimes but not always be detected during a compression test. The misfire can occur at different operating conditions depending on which component is worn and the severity of the wear on the component.

1. Visually inspect the Camshaft, Rocker Arms or springs for excessive wear or broken parts.

Were any issues found with the Camshaft, Rocker Arms or springs?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [25](#)

21. CHECK THE ASD RELAY OUTPUT CIRCUIT

1. Turn the ignition off.
2. Disconnect the Ignition Coil harness connector.
3. Turn the ignition on.
4. With a scan tool, actuate the ASD Relay.

5. Using a 12-volt test light connected to ground, probe the ASD Relay Output circuit at the Ignition Coil harness connector.

Does the test light illuminate brightly?

Yes

- Go To [22](#)

No

- Repair the open or short to ground in the ASD Relay Output circuit between the PDC and Ignition Coil harness connector.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

NOTE: Stop All Actuations.

•

22. CHECK THE IGNITION COIL DRIVER CIRCUIT OPERATION

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

1. Using a 12-volt test light connected to a 12 volt source, probe the Coil Control circuit at the Ignition Coil harness connector.
2. Crank the engine for 5.0 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking

- Replace the Ignition Coil in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

ON constantly

- Go To [23](#)

OFF constantly

- Go To [24](#)

23. CHECK THE COIL CONTROL CIRCUIT FOR A SHORT TO GROUND

1. Turn the ignition off.
2. Disconnect the PCM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic).
4. Check for continuity between ground and the Coil Control circuit at the Ignition Coil harness connector.

Is there continuity between ground and the Coil Control circuit?

Yes

- Repair the Coil Control circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [25](#)

24. CHECK THE COIL CONTROL CIRCUIT FOR AN OPEN

1. Turn the ignition off.
2. Disconnect the PCM C2 harness connector.
3. Measure the resistance of the Coil Control circuit between the Ignition Coil harness connector and the GPEC Adaptor.

Is the resistance below 3.0 Ohms?

Yes

- Go To [25](#)

No

- Repair the Coil Control circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

25. CHECK RELATED PCM AND COMPONENT CONNECTIONS

1. Perform any Service Bulletins that apply.
2. Disconnect all PCM harness connectors.
3. Disconnect all related in-line harness connections (if equipped).
4. Disconnect the related component harness connectors.
5. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

6. Reconnect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
7. Reconnect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. Reconnect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
9. With the scan tool, erase DTCs.
10. Test drive or operate the vehicle in accordance with the when monitored and set conditions.

11. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0301-CYLINDER 1 MISFIRE

THEORY OF OPERATION

The PCM uses the Crankshaft Position (CKP) Sensor to detect and monitor the Crankshaft rotational speed. Normally, the Crankshaft rotational speed is fairly stable from cylinder to cylinder. When a misfire occurs in a cylinder, the Crankshaft speed changes abruptly for that cylinder. Therefore, anything that causes a sudden change in Crankshaft speed detected for a single cylinder is determined to be an engine misfire event. A misfire fault will usually occur due to poor fuel quality or metering, lack of spark, engine timing, low engine compression due to engine mechanical or valvetrain issues, a vacuum leak or coolant leak entering the engine intake air system. Though not as common, other factors such as severe wheel balance or braking vibration, a worn serpentine belt or belt driven accessory binding should also be considered when diagnosing a misfire fault.

Depending on the engine involved, there can be several systems and components that can contribute to a misfire. **In many cases, but not always, there will be other DTCs set related to these systems. If that is the case, the focus should be on following the diagnostics for the system that has DTCs set against it.** The different components or systems will affect misfire in different ways. Factors to consider when diagnosing a misfire are whether the misfire is a single cylinder or multiple cylinder misfire, and when does the misfire occur (idle, vehicle and engine speed, heavy engine load conditions, etc.). These factors can help in determining what components or systems should be focused on during diagnostics. **Typically a multiple cylinder misfire is an indication of timing, oil or coolant consumption, air handling, fuel supply or poor fuel quality issue that can affect multiple cylinders and not a single cylinder component such as a Fuel Injector, Ignition Coil or Spark Plug.**

NOTE: **The effects that the components and systems have on misfire detection are described in more detail in the individual test steps below.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Fuel level above 12%.
- Battery voltage above 10.9 volts.
- The adaptive numerator has been successfully learned.
- Ambient temperature above -23B°C (-9.4B°F).
- Coolant temperature at engine start is above -7B°C (19.4B°F). If start engine temperature is below threshold, enable monitor when engine temperature reaches 21B°C (69.8B°F).
- Engine speed between approximately 400 rpm and 6200 rpm.
 - Misfire monitor is disabled during a Decel Fuel Shutoff Event (DFSO).

SET CONDITION

- The misfire threshold to set the fault is application specific; it is tied to the level of misfire that will cause emissions to increase to 1.5 times the standard.

DEFAULT ACTION

- The MIL light will illuminate or flash depending on severity of the misfire.
- During a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. When the engine rev counter has reached the calculated threshold the Fuel Injector is turned back on. If a misfire is still occurring, the injector is disabled again. This cycle will continue until the misfire has stopped.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
ENGINE VACUUM LEAK EXCESSIVE CARBON BUILD-UP IN CYLINDER HEAD OR COMBUSTION CHAMBER FAULTY FUEL INJECTOR CRANKSHAFT POSITION SENSOR (CKP) OR TONE WHEEL ISSUES FAULTY IGNITION COIL OR SPARK PLUG VARIABLE VALVE LIFT (VVL) SYSTEM ISSUES COOLANT LEAKING INTO A CYLINDER FAULTY CYLINDER HEAD GASKET ENGINE MECHANICAL/LOW COMPRESSION WORN CAMSHAFT LOBES, SPRINGS OR ROCKER ARMS POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, read and record all DTCs and Freeze Frame information.
3. Operate the vehicle under conditions recorded in the Freeze Frame information when the DTC was set.

NOTE: During the test drive of the vehicle, note when the misfire condition is present for use later in this diagnostic test. Also monitor the Downstream O2 Sensor(s) when the misfire is occurring. O2 Sensor voltage readings that are consistently on the low side of the scale would indicate a lean condition. This could indicate a lack of fuel due to a plugged Fuel Injector or fuel system issue. O2 Sensor voltage readings that are consistently on the high side of the scale would indicate a rich condition. This could be caused by a lack of spark or a possible leaky Fuel Injector.

NOTE: Keep in mind that during a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. This can cause a misfire that occurs only at high engine speed or heavy engine load to appear to continue when

returning to idle. However this could be due to the Fuel Injector being disabled until the rev counter resets.

4. With the scan tool, view the Misfire Monitor to see which cylinders are effected.

Are there excessive misfires shown for this cylinder at this time?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any Service Bulletins or fuel system, ignition system component, air handling component, VVL system (if equipped), or VVT system DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK FOR MECHANICAL CONDITIONS THAT COULD CAUSE A MISFIRE

NOTE: Each of the following conditions can cause a misfire during most operating conditions with the exception of the out of balance tires or warped brake rotors.

1. Visually inspect the engine for any of the following conditions:

- Worn, loose or slipping serpentine belt.
- Binding or misaligned engine driven accessories: A/C Compressor, P/S Pump, Water pump, etc.
- Improper mounting of the CKP Sensor or damaged target wheel.
- Harmonic Balancer out of balance.
- Extremely out of balance tires or warped brake rotors.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE ENGINE OIL LEVEL AND CONDITION

NOTE: The oil level being low or the wrong oil filter or viscosity being used can cause Variable Valve Timing system operating issues. This could lead to a misfire condition.

NOTE: The following items should be checked before continuing with this procedure. Failure to do so may lead to misdiagnosis.

- **ENGINE MECHANICAL TOLERANCES OUT OF SPECIFICATION**
- **ENGINE OIL PRESSURE OUT OF SPECIFICATION**
- **LOW ENGINE OIL LEVEL**
- **INCORRECT ENGINE OIL FILTER (DOES NOT MEET OEM SPECIFICATIONS)**
- **DETERIORATED OR DIRTY OIL**
- **CONTAMINATED ENGINE OIL**
- **INCORRECT ENGINE OIL VISCOSITY**
- **AERATED ENGINE OIL**

1. If any of the above conditions are found, repair as necessary.

Were any of the above conditions present?

Yes

- Repair the engine oiling or mechanical condition (i.e. improper oil drain back, oil sludge, damaged oil pump, pick-up tube or seal, etc.).
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE INTAKE SYSTEM FOR LEAKS

1. Check the engine and Intake Manifold for vacuum leaks.

NOTE: A vacuum leak can affect one or more cylinders depending on the location of the leak.

Were any leaks found with the intake system?

Yes

- Repair the leak in the intake system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. CHECK THE FUEL QUALITY

1. Check the fuel for the following:

- Water in fuel
- Correct type of fuel
- Old or contaminated fuel
- Low fuel
- Perform the CHECK FOR PROPER ETHANOL LEVEL IN THE GASOLINE procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found with the fuel?

Yes

- Replace the fuel and, if necessary, flush and clean the fuel system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK FOR A CLOGGED OR LEAKING FUEL INJECTOR

NOTE: A Fuel Injector that is plugged and spraying too little fuel, or fouled and spraying too much fuel, will generally cause a misfire during any operating condition. One faulty Fuel Injector will usually cause a single cylinder misfire. However if the injector is spraying an excessive amount of fuel, the excess fuel could also affect the adjoining cylinders. In most cases there will be far more misfire counts on the cylinder with the faulty Fuel Injector than on the other affected cylinders.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.

1. Install the Fuel Pressure Decay Tester (special tool #8978A, Decay Tool, Fuel) to the fuel rail.
2. Turn the ignition on and allow the fuel pressure to reach maximum pressure and stabilize.

NOTE: The ignition may need to be cycled off and on a couple times to reach maximum fuel pressure in the rail.

3. Once the pressure reading has stabilized, record the fuel pressure. This is known as the "starting pressure".
4. With the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire while monitoring the fuel pressure gauge.
5. Record the fuel pressure. This is known as the "ending pressure."

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

6. Repeat sub-steps two through five with several other Fuel Injectors on cylinders that do not have a misfire. Make sure to start the Fuel Injector actuation at the same starting pressure for each injector. Compare the ending pressures of the known good cylinders to the cylinder with the misfire condition.

Are the ending pressures about the same for all of the tested injectors?

Yes

- Go To [8](#)

No, the injector from the cylinder with the misfire stood out from the rest.

- If the pressure drop is too small, check for debris in the Fuel Rail or Fuel Injector and repair as necessary. If the pressure drop is too large, suspect a faulty or fouled Fuel Injector as the issue.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

8. CHECK THE VARIABLE VALVE LIFT (VVL) SYSTEM (IF EQUIPPED)

NOTE: The 3.6L Upgrade engine is equipped with the VVL System. The classic engine is not. If this vehicle is not equipped with the VVL system skip this test step.

NOTE: A Rocker Arm or arms can get stuck due to an oil pressure issue, or a mechanical failure of a VVL Solenoid (including O-rings) or Rocker Arm. A single Rocker Arm that is stuck in low lift will not be detected and the system will continue to operate normally, however some misfire and engine roughness may be felt. One Rocker Arm stuck in Low Lift mode will cause a misfire at higher engine speeds (above approximately 4000 rpm). Two or more Rocker Arms stuck in Low Lift mode can cause a misfire at any engine speed, including idle. A Rocker Arm stuck in high lift mode typically misfires at idle.

NOTE: The two rear cylinders are controlled by the rear solenoid on each bank. Therefore, a VVL issue that affects both rear cylinders on a bank is most likely a common issue for both cylinders. These would include a damaged or missing O-ring, faulty solenoid, oil supply or control circuit issue. A VVL issue that only affects one of the rear cylinders is more likely going to be a failure of a Rocker Arm or pin for that cylinder.

NOTE: The front VVL Solenoids control the operation of the Rocker Arms for the front cylinder only on each bank. The rear VVL Solenoids control the operation of the Rocker Arms for the back two cylinders on each bank.

1. Turn the ignition on.
2. With the scan tool, navigate to Systems Tests, perform the VVL System Diagnostic test and follow the on screen directions. for further VVL system functionality and scan tool routine information.

NOTE: Do not erase the DTC before running the routine.

3. When the test is complete, compare the results to the table below for the probable failure conditions.

Does the scan tool results show that the misfire is being caused by the VVL system?

Yes

- Compare the results from the routine to the table below

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
Low misfire percentage on (1) Rocker Stuck Low test, (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire
High misfire percentage on (1) Rocker Stuck Low test , (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 1	• VVL Solenoid 1/1 stuck on/open • VVL Solenoid 1/1 control circuit shorted to 12 volts • VVL Solenoid 1/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 1 rocker arm lash adjuster issue (stuck or broken) • Cylinder 1 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	• Verify that the VVL Solenoid 1/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 1/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 1 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 2	• VVL Solenoid 2/1 stuck on/open • VVL Solenoid 2/1 control circuit shorted to 12 volts • VVL Solenoid 2/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 2 rocker arm lash adjuster issue (stuck or broken) • Cylinder 2 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	• Verify that the VVL Solenoid 2/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 2/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 2 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 3	• Cylinder 3 rocker arm lash adjuster issue (stuck or broken)	• Check for broken or stuck Cylinder 3 rocker arms or lock pins

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	• Cylinder 3 rocker arm lock pin stuck retracted	
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 4	• Cylinder 4 rocker arm lash adjuster issue (stuck or broken) • Cylinder 4 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 4 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 5	• Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 5 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 6	• Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 6 rocker arms or lock pins
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck on/open • VVL Solenoid 1/2 control circuit shorted to 12 volts • VVL Solenoid 1/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 3 and Cylinder 5	• Check the VVL Solenoid 1/2 control circuit for a short to 12 volts condition • Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 4 and Cylinder 6	• VVL Solenoid 2/2 stuck on/open • VVL Solenoid 2/2 control circuit shorted to 12 volts • VVL Solenoid 2/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 4 and Cylinder 6	• Check the VVL Solenoid 2/2 control circuit for a short to 12 volts condition • Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - high misfire percentage Cylinder 1, Cylinder 3, and Cylinder 5	• Both bank 1 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage for both bank 1 solenoids • Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	• Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - high misfire percentage Cylinder 2, Cylinder 4, and Cylinder 6	- Both bank 2 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage for both bank 2 solenoids - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	- Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - high misfire percentage for all Cylinders (1 - 6)	- Missing or damaged supply O-rings causing oil pressure leakage from the supply oil passage to the control oil passage for front and rear solenoids on bank 1 and bank 2 - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in both Cylinder Heads.	- Check operation of all VVL Solenoids for a stuck on/open condition, damaged or missing supply O-rings - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace both Cylinder Heads.
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1	- VVL Solenoid 1/1 control circuit open or shorted to ground - VVL Solenoid 1/1 stuck closed/off - VVL Solenoid 1/1 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage - Control oil passage pressure restricted - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm lash adjuster issue (stuck or broken)	- Check the VVL Solenoid 1/1 control circuit for an open or shorted to ground condition - Check the VVL Solenoid 1/1 for a missing or damaged control O-ring - Actuate and check the VVL Solenoid 1/1 operation. Check for debris on screen - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm stuck failure or lock pin stuck extended

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	• Cylinder 1 rocker arm lock pin stuck extended	
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2	• VVL Solenoid 2/1 stuck closed/off • VVL Solenoid 2/1 control circuit open or shorted to ground • VVL Solenoid 2/1 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted • Cylinder 2 lash adjuster plugged • Cylinder 2 rocker arm lash adjuster issue (stuck or broken) • Cylinder 2 rocker arm lock pin stuck extended	• Check the VVL Solenoid 2/1 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 2/1 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 2/1 operation. Check for debris on screen • Cylinder 2 lash adjuster plugged • Cylinder 2 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3	• Cylinder 3 lash adjuster plugged • Cylinder 3 rocker arm lash adjuster issue (stuck or broken) • Cylinder 3 rocker arm lock pin stuck extended	• Cylinder 3 lash adjuster plugged • Cylinder 3 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4	• Cylinder 4 lash adjuster plugged • Cylinder 4 rocker arm lash adjuster issue (stuck or broken) • Cylinder 4 rocker arm lock pin stuck extended	• Cylinder 4 lash adjuster plugged • Cylinder 4 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 5	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck extended	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 6	• Cylinder 6 lash adjuster plugged	• Cylinder 6 lash adjuster plugged

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
RPM test - high misfire percentage Cylinder 6	• Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck extended	• Cylinder 6 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck closed/off • VVL Solenoid 1/2 control circuit open or shorted to ground • VVL Solenoid 1/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted NOTE: It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 3 and Cylinder 5	• Check the VVL Solenoid 1/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 1/2 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 1/2 operation. Check for debris on screen • Cylinder 3 or 5 lash adjuster plugged • Cylinder 3 or 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4 and Cylinder 6	• VVL Solenoid 2/2 stuck closed/off • VVL Solenoid 2/2 control circuit open or shorted to ground • VVL Solenoid 2/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted NOTE:	• Check the VVL Solenoid 2/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 2/2 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 2/2 operation. Check for debris on screen • Cylinder 4 or 6 lash adjuster plugged • Cylinder 4 or 6 rocker arm stuck failure or lock pin stuck extended

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 4 and Cylinder 6	
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1, Cylinder 3 and Cylinder 5	- VVL Solenoid 1/1 and 1/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage - Bank 1 oil supply passage blockage or restriction to front and rear oil feeds in the bank 1 Cylinder Head - Large internal leakage in bank 1 Cylinder Head affecting the front and rear oil feeds	- Check the control O-rings on the front and rear bank 1 VVL Solenoids for damage - Check for proper oil pressure at the front and rear bank 1 VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 2. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2, Cylinder 4 and Cylinder 6	VVL Solenoid 2/1 and 2/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage	- Check the control O-rings on the front and rear bank 2 VVL Solenoids for damage - Check for proper oil pressure at the front and

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	- Bank 2 oil supply passage blockage or restriction to front and rear oil feeds in the bank 2 Cylinder Head - Large internal leakage in bank 2 Cylinder Head affecting the front and rear oil feeds	rear bank VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage for all Cylinders (1 - 6)	Engine oil pressure too low to both Cylinder Heads due to: - Oil level low - Wrong viscosity oil - Oil Filter restriction - Engine mechanical failure (damaged bearings, pick-up tube or seal, engine block, etc.) - Faulty Oil Pump	- Check for proper oil level, filter and viscosity before checking engine oil pressure - If the engine oil pressure is low check for any mechanical issue that could cause low oil pressure. If there are no issues with the bearings, pick-up tube and engine block replace the Engine Oil Pump Assembly NOTE: Low engine oil pressure will likely also cause issues/faults for the VVT system

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

- Go To [10](#)

9. CHECK THE ACTUAL OIL PRESSURE TO THE VVL SOLENOID IN THE CYLINDER HEAD

1. Turn the ignition off.
2. Remove the appropriate VVL Solenoid called out by the scan tool.
3. Install the (special tool #2027300090, Kit, VVL Adapters) in place of the VVL Solenoid.
4. Start the engine and allow it to idle.
5. With the scan tool, monitor the Dual Oil Pump mode.

NOTE: Let the engine run long enough for the pump to switch to low pump mode.

6. Read and record the oil pressure reading on the oil pressure gauge. Compare the reading to the main engine oil pressure reading from the Engine Oil Pressure Sensor reading on the scan tool.

NOTE: The Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure reading.

Is the Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure?

Yes

- Remove and inspect the screen on the VVL Solenoid for debris that can block oil flow through the solenoid. Check the seals on the VVL Solenoid for damage and proper installation. If no debris is found, and the seals appear good replace the VVL Solenoid in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Diagnose and repair the lack of oil pressure to the VVL Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

10. CHECK FOR PROPER SPARK AT THE IGNITION COIL

1. Turn the ignition off and remove the Fuel Pressure Decay Tester and connect the fuel lines before continuing.

NOTE: A faulty Ignition Coil or Spark Plug can cause a misfire at idle but could also misfire only under a heavy load on the engine. One faulty Ignition Coil or Spark Plug will usually cause a single cylinder misfire.

2. Remove the Ignition Coil from the cylinder that is misfiring.
3. Connect the Ignition Coil harness connector.
4. Disconnect the Fuel Injector harness connector of the cylinder being tested.
5. Install a spark tester on the Ignition Coil.
6. While cranking the engine observe the spark coming from the spark tester.

Is a crisp blue spark present?

Yes

- Go To [11](#)

No

- Go To [16](#)

11. INSPECT THE SPARK PLUG AND CYLINDER

1. Turn the ignition off.
2. Remove the Spark Plug in accordance with the Service Information.
3. Inspect the Spark Plug for the following conditions:
 - Cracks
 - Carbon Tracking
 - Fouling due to oil, coolant or excess fuel in the cylinder
 - Gap size out of specifications
 - Loose or broken electrode
4. Check for signs of oil or coolant in the cylinder.

Were any of the above conditions present?

Yes

- Replace the Spark Plug. If oil or coolant were found in the cylinder or on the Spark Plug, diagnose and repair the cause.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [12](#)

12. CHECK THE ENGINE COMPRESSION TO CHECK FOR VALVETRAIN OR COMBUSTION CHAMBER ISSUES

NOTE: A cylinder compression or valvetrain issue will cause a misfire during all operating conditions. These types of failures will normally affect a single cylinder. However, depending on the type of failure incurred, other cylinders can also be affected and show misfires. In most cases there will be far more misfire counts on the cylinder with the issue than on the other affected cylinders.

1. Perform a cylinder compression test on several cylinders and compare the known good cylinders to the cylinder that was misfiring. Refer to .

Is the cylinder compression within specification?

Yes

- Go To [13](#)

No

- Perform a Cylinder Leak Down Test to determine if the cause is from the valvetrain or combustion chamber and repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

13. EXCHANGE SPARK PLUG AND CHECK FOR MISFIRE TO FOLLOW THE SPARK PLUG

1. Exchange the Spark Plug with a known good cylinder that was not indicating a misfire or replace the Spark Plug if it is difficult to access.
2. Start the engine and monitor the misfire monitor screen.

Did the misfire switch to the previously good cylinder or go away if the Spark Plug was replaced?

Yes

- Repair is complete if Spark Plug was replaced and misfire is gone, or replace the Spark Plug if it moved to the known good cylinder.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [14](#)

14. CLEAN THE CARBON FROM THE VALVETRAIN AND COMBUSTION CHAMBERS

NOTE: Carbon build up on the engine valves and guides can cause a misfire during all operating conditions but is usually more noticeable during cruising speeds or heavy engine load conditions. If carbon build up is becoming an issue it could set only a single cylinder misfire but usually will affect more than one cylinder and set multiple cylinder misfire as well.

1. Using Mopar Combustion cleaner, de-carbon the engine.
2. After driving and clearing the combustion cleaner from the engine, erase DTCs with the scan tool.
3. Test drive the vehicle in accordance with the Freeze Frame data.
4. With the scan tool, view the Misfire Monitor.

Did the misfire return?

Yes

- Go To [15](#)

No

- Cleaning the valves and combustion chambers repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

15. CHECK THE CAMSHAFT LOBES, ROCKER ARMS AND SPRINGS

NOTE: Worn Camshaft Lobes, worn or broken Rocker Arms or springs may sometimes but not always be detected during a compression test. The misfire can occur at different operating conditions depending on which component is worn and the severity of the wear on the component.

1. Visually inspect the Camshaft, Rocker Arms or springs for excessive wear or broken parts.

Were any issues found with the Camshaft, Rocker Arms or springs?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [20](#)

16. CHECK THE ASD RELAY OUTPUT CIRCUIT

1. Turn the ignition off.
2. Disconnect the Ignition Coil harness connector.
3. Turn the ignition on.

4. With a scan tool, actuate the ASD Relay.
5. Using a 12-volt test light connected to ground, probe the ASD Relay Output circuit at the Ignition Coil harness connector.

Does the test light illuminate brightly?

Yes

- Go To [17](#)

No

- Stop all scan tool actuations and repair the open or short to ground in the ASD Relay Output circuit between the PDC and Ignition Coil harness connector.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

17. CHECK THE IGNITION COIL CONTROL CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

1. Using a 12-volt test light connected to a 12 volt source, back probe the Coil Control circuit at the Ignition Coil harness connector.
2. Crank the engine for 5 seconds while observing the test light.

What was the condition of the test light while cranking the engine?

Blinking brightly

- Replace the Ignition Coil in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

ON constantly

- Go To [18](#)

OFF constantly

- Go To [19](#)

18. CHECK THE COIL CONTROL CIRCUIT FOR A SHORT TO GROUND

1. Turn the ignition off.
2. Disconnect the PCM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic) to the engine harness side of the PCM C2 harness connector.
4. Check for continuity between ground and the Coil Control circuit at the Ignition Coil harness connector.

Is there continuity between ground and the Coil Control circuit?

Yes

- Repair the Coil Control circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [20](#)

19. CHECK THE COIL CONTROL CIRCUIT FOR AN OPEN

1. Turn the ignition off.
2. Measure the resistance of the Coil Control circuit between the Ignition Coil harness connector and the GPEC Adaptor.

Is the resistance below 3.0 Ohms?

Yes

- Go To [20](#)

No

- Repair the Coil Control circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

20. CHECK RELATED PCM AND COMPONENT HARNESS CONNECTIONS

1. Disconnect all PCM harness connectors.
2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

5. Connect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
10. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION**.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0302-CYLINDER 2 MISFIRE

THEORY OF OPERATION

The PCM uses the Crankshaft Position (CKP) Sensor to detect and monitor the Crankshaft rotational speed. Normally, the Crankshaft rotational speed is fairly stable from cylinder to cylinder. When a misfire occurs in a cylinder, the Crankshaft speed changes abruptly for that cylinder. Therefore, anything that causes a sudden change in Crankshaft speed detected for a single cylinder is determined to be an engine misfire event. A misfire fault will usually occur due to poor fuel quality or metering, lack of spark, engine timing, low engine compression due to engine mechanical or valvetrain issues, a vacuum leak or coolant leak entering the engine intake air system. Though not as common, other factors such as severe wheel balance or braking vibration, a worn serpentine belt or belt driven accessory binding should also be considered when diagnosing a misfire fault.

Depending on the engine involved, there can be several systems and components that can contribute to a misfire. **In many cases, but not always, there will be other DTCs set related to these systems. If that is the case, the focus should be on following the diagnostics for the system that has DTCs set against it.** The different components or systems will affect misfire in different ways. Factors to consider when diagnosing a misfire are whether the misfire is a single cylinder or multiple cylinder misfire, and when does the misfire occur (idle, vehicle and engine speed, heavy engine load conditions, etc.). These factors can help in determining what components or systems should be focused on during diagnostics. **Typically a multiple cylinder misfire is an indication of timing, oil or coolant consumption, air handling, fuel supply or poor fuel quality issue that can affect multiple cylinders and not a single cylinder component such as a Fuel Injector, Ignition Coil or Spark Plug.**

NOTE: **The effects that the components and systems have on misfire detection are described in more detail in the individual test steps below.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Fuel level above 12%.
- Battery voltage above 10.9 volts.
- The adaptive numerator has been successfully learned.
- Ambient temperature above -23B°C (-9.4B°F).
- Coolant temperature at engine start is above -7B°C (19.4B°F). If start engine temperature is below threshold, enable monitor when engine temperature reaches 21B°C (69.8B°F).
- Engine speed between approximately 400 rpm and 6200 rpm.
 - Misfire monitor is disabled during a Decel Fuel Shutoff Event (DFSO).

SET CONDITION

- The variation in crankshaft speed between cylinders exceeds a calibrated value, based on engine speed and load.

DEFAULT ACTION

- The MIL light will illuminate or flash depending on severity of the misfire.
- During a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. When the engine rev counter has reached the calculated threshold the Fuel Injector is turned back on. If a misfire is still occurring, the injector is disabled again. This cycle will continue until the misfire has stopped.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
ENGINE VACUUM LEAK EXCESSIVE CARBON BUILD-UP IN CYLINDER HEAD OR COMBUSTION CHAMBER FAULTY FUEL INJECTOR POOR FUEL QUALITY OR HIGH ETHANOL LEVEL CRANKSHAFT POSITION SENSOR (CKP) OR TONE WHEEL ISSUES FAULTY IGNITION COIL OR SPARK PLUG VARIABLE VALVE LIFT (VVL) SYSTEM ISSUES (IF EQUIPPED) COOLANT LEAKING INTO A CYLINDER FAULTY CYLINDER HEAD GASKET ENGINE MECHANICAL/LOW COMPRESSION WORN CAMSHAFT LOBES, SPRINGS OR ROCKER ARMS POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding.
Refer to .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, read and record all DTCs and Freeze Frame information.
3. Operate the vehicle under conditions recorded in the Freeze Frame information when the DTC was set.

NOTE: During the test drive of the vehicle, note when the misfire condition is present for use later in this diagnostic test. Also monitor the Downstream O2 Sensor(s) when the misfire is occurring. O2 Sensor voltage readings that are consistently on the low side of the scale would indicate a lean condition. This could indicate a lack of fuel due to a plugged Fuel Injector or fuel system issue. O2 Sensor voltage readings that are consistently on the high side of the scale would indicate a rich condition. This could be caused by a lack of spark or a possible leaky Fuel Injector.

NOTE: Keep in mind that during a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. This can cause a misfire that occurs only at high engine speed or heavy engine load to appear to continue when

returning to idle. However this could be due to the Fuel Injector being disabled until the rev counter resets.

4. With the scan tool, view the Misfire Monitor to see which cylinders are effected.

Are there excessive misfires shown for this cylinder at this time?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any Service Bulletins or fuel system, ignition system component, air handling component, VVL system (if equipped), or VVT system DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK FOR MECHANICAL CONDITIONS THAT COULD CAUSE A MISFIRE

NOTE: Each of the following conditions can cause a misfire during most operating conditions with the exception of the out of balance tires or warped brake rotors.

1. Visually inspect the engine for any of the following conditions:

- Worn, loose or slipping serpentine belt.
- Binding or misaligned engine driven accessories: A/C Compressor, P/S Pump, Water pump, etc.
- Improper mounting of the CKP Sensor or damaged target wheel.
- Harmonic Balancer out of balance.
- Extremely out of balance tires or warped brake rotors.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE ENGINE OIL LEVEL AND CONDITION

NOTE: The oil level being low or the wrong oil filter or viscosity being used can cause Variable Valve Timing system operating issues. This could lead to a misfire condition.

NOTE: The following items should be checked before continuing with this procedure. Failure to do so may lead to misdiagnosis.

- **ENGINE MECHANICAL TOLERANCES OUT OF SPECIFICATION**
- **ENGINE OIL PRESSURE OUT OF SPECIFICATION**
- **LOW ENGINE OIL LEVEL**
- **INCORRECT ENGINE OIL FILTER (DOES NOT MEET OEM SPECIFICATIONS)**
- **DETERIORATED OR DIRTY OIL**
- **CONTAMINATED ENGINE OIL**
- **INCORRECT ENGINE OIL VISCOSITY**
- **AERATED ENGINE OIL**

1. If any of the above conditions are found, repair as necessary.

Were any of the above conditions present?

Yes

- Repair the engine oiling or mechanical condition (i.e. improper oil drain back, oil sludge, damaged oil pump, pick-up tube or seal, etc.).
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE INTAKE SYSTEM FOR LEAKS

1. Check the engine and Intake Manifold for vacuum leaks.

NOTE: A vacuum leak can affect one or more cylinders depending on the location of the leak.

Were any leaks found with the intake system?

Yes

- Repair the leak in the intake system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. CHECK THE FUEL QUALITY

1. Check the fuel for the following:

- Water in fuel
- Correct type of fuel
- Old or contaminated fuel
- Low fuel
- Perform the CHECK FOR PROPER ETHANOL LEVEL IN THE GASOLINE procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found with the fuel?

Yes

- Replace the fuel and, if necessary, flush and clean the fuel system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK FOR A CLOGGED OR LEAKING FUEL INJECTOR

NOTE: A Fuel Injector that is plugged and spraying too little fuel, or fouled and spraying too much fuel, will generally cause a misfire during any operating condition. One faulty Fuel Injector will usually cause a single cylinder misfire. However if the injector is spraying an excessive amount of fuel, the excess fuel could also affect the adjoining cylinders. In most cases there will be far more misfire counts on the cylinder with the faulty Fuel Injector than on the other affected cylinders.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.

1. Install the Fuel Pressure Decay Tester (special tool #8978A, Decay Tool, Fuel) to the fuel rail.
2. Turn the ignition on and allow the fuel pressure to reach maximum pressure and stabilize.

NOTE: The ignition may need to be cycled off and on a couple times to reach maximum fuel pressure in the rail.

3. Once the pressure reading has stabilized, record the fuel pressure. This is known as the "starting pressure".
4. With the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire while monitoring the fuel pressure gauge.
5. Record the fuel pressure. This is known as the "ending pressure."

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

6. Repeat sub-steps two through five with several other Fuel Injectors on cylinders that do not have a misfire. Make sure to start the Fuel Injector actuation at the same starting pressure for each injector. Compare the ending pressures of the known good cylinders to the cylinder with the misfire condition.

Are the ending pressures about the same for all of the tested injectors?

Yes

- Go To [8](#)

No, the injector from the cylinder with the misfire stood out from the rest.

- If the pressure drop is too small, check for debris in the Fuel Rail or Fuel Injector and repair as necessary. If the pressure drop is too large, suspect a faulty or fouled Fuel Injector as the issue.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

8. CHECK THE VARIABLE VALVE LIFT (VVL) SYSTEM (IF EQUIPPED)

NOTE: The 3.6L Upgrade engine is equipped with the VVL System. The classic engine is not. If this vehicle is not equipped with the VVL system skip this test step.

NOTE: A Rocker Arm or arms can get stuck due to an oil pressure issue, or a mechanical failure of a VVL Solenoid (including O-rings) or Rocker Arm. A single Rocker Arm that is stuck in low lift will not be detected and the system will continue to operate normally, however some misfire and engine roughness may be felt. One Rocker Arm stuck in Low Lift mode will cause a misfire at higher engine speeds (above approximately 4000 rpm). Two or more Rocker Arms stuck in Low Lift mode can cause a misfire at any engine speed, including idle. A Rocker Arm stuck in high lift mode typically misfires at idle.

NOTE: The two rear cylinders are controlled by the rear solenoid on each bank. Therefore, a VVL issue that affects both rear cylinders on a bank is most likely a common issue for both cylinders. These would include a damaged or missing O-ring, faulty solenoid, oil supply or control circuit issue. A VVL issue that only affects one of the rear cylinders is more likely going to be a failure of a Rocker Arm or pin for that cylinder.

NOTE: The front VVL Solenoids control the operation of the Rocker Arms for the front cylinder only on each bank. The rear VVL Solenoids control the operation of the Rocker Arms for the back two cylinders on each bank.

1. Turn the ignition on.
2. With the scan tool, navigate to Systems Tests, perform the VVL System Diagnostic test and follow the on screen directions. for further VVL system functionality and scan tool routine information. Refer to [VALVE TIMING , DESCRIPTION AND OPERATION](#) .

NOTE: Do not erase the DTC before running the routine.

3. When the test is complete, compare the results to the table below for the probable failure conditions.

Does the scan tool results show that the misfire is being caused by the VVL system?

Yes

- Compare the results from the routine to the table below

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
Low misfire percentage on (1) Rocker Stuck Low test, (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire
High misfire percentage on (1) Rocker Stuck Low test , (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 1	• VVL Solenoid 1/1 stuck on/open • VVL Solenoid 1/1 control circuit shorted to 12 volts • VVL Solenoid 1/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 1 rocker arm lash adjuster issue (stuck or broken) • Cylinder 1 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	• Verify that the VVL Solenoid 1/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 1/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 1 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 2	• VVL Solenoid 2/1 stuck on/open • VVL Solenoid 2/1 control circuit shorted to 12 volts • VVL Solenoid 2/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 2 rocker arm lash adjuster issue (stuck or broken) • Cylinder 2 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	• Verify that the VVL Solenoid 2/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 2/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 2 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 3	• Cylinder 3 rocker arm lash adjuster issue (stuck or broken)	• Check for broken or stuck Cylinder 3 rocker arms or lock pins

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	• Cylinder 3 rocker arm lock pin stuck retracted	
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 4	• Cylinder 4 rocker arm lash adjuster issue (stuck or broken) • Cylinder 4 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 4 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 5	• Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 5 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 6	• Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 6 rocker arms or lock pins
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck on/open • VVL Solenoid 1/2 control circuit shorted to 12 volts • VVL Solenoid 1/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 3 and Cylinder 5	• Check the VVL Solenoid 1/2 control circuit for a short to 12 volts condition • Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 4 and Cylinder 6	- VVL Solenoid 2/2 stuck on/open - VVL Solenoid 2/2 control circuit shorted to 12 volts - VVL Solenoid 2/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage - Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 4 and Cylinder 6	- Check the VVL Solenoid 2/2 control circuit for a short to 12 volts condition - Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - high misfire percentage Cylinder 1, Cylinder 3, and Cylinder 5	- Both bank 1 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage for both bank 1 solenoids - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	- Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - high misfire percentage Cylinder 2, Cylinder 4, and Cylinder 6	- Both bank 2 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage for both bank 2 solenoids - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	- Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - high misfire percentage for all Cylinders (1 - 6)	- Missing or damaged supply O-rings causing oil pressure leakage from the supply oil passage to the control oil passage for front and rear solenoids on bank 1 and bank 2 - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in both Cylinder Heads.	- Check operation of all VVL Solenoids for a stuck on/open condition, damaged or missing supply O-rings - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace both Cylinder Heads.
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1	- VVL Solenoid 1/1 control circuit open or shorted to ground - VVL Solenoid 1/1 stuck closed/off - VVL Solenoid 1/1 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage - Control oil passage pressure restricted - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm lash adjuster issue (stuck or broken)	- Check the VVL Solenoid 1/1 control circuit for an open or shorted to ground condition - Check the VVL Solenoid 1/1 for a missing or damaged control O-ring - Actuate and check the VVL Solenoid 1/1 operation. Check for debris on screen - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm stuck failure or lock pin stuck extended

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	• Cylinder 1 rocker arm lock pin stuck extended	
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2	• VVL Solenoid 2/1 stuck closed/off • VVL Solenoid 2/1 control circuit open or shorted to ground • VVL Solenoid 2/1 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted • Cylinder 2 lash adjuster plugged • Cylinder 2 rocker arm lash adjuster issue (stuck or broken) • Cylinder 2 rocker arm lock pin stuck extended	• Check the VVL Solenoid 2/1 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 2/1 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 2/1 operation. Check for debris on screen • Cylinder 2 lash adjuster plugged • Cylinder 2 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3	• Cylinder 3 lash adjuster plugged • Cylinder 3 rocker arm lash adjuster issue (stuck or broken) • Cylinder 3 rocker arm lock pin stuck extended	• Cylinder 3 lash adjuster plugged • Cylinder 3 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4	• Cylinder 4 lash adjuster plugged • Cylinder 4 rocker arm lash adjuster issue (stuck or broken) • Cylinder 4 rocker arm lock pin stuck extended	• Cylinder 4 lash adjuster plugged • Cylinder 4 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 5	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck extended	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 6	• Cylinder 6 lash adjuster plugged	• Cylinder 6 lash adjuster plugged

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
RPM test - high misfire percentage Cylinder 6	• Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck extended	• Cylinder 6 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck closed/off • VVL Solenoid 1/2 control circuit open or shorted to ground • VVL Solenoid 1/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted NOTE: It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 3 and Cylinder 5	• Check the VVL Solenoid 1/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 1/2 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 1/2 operation. Check for debris on screen • Cylinder 3 or 5 lash adjuster plugged • Cylinder 3 or 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4 and Cylinder 6	• VVL Solenoid 2/2 stuck closed/off • VVL Solenoid 2/2 control circuit open or shorted to ground • VVL Solenoid 2/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted NOTE:	• Check the VVL Solenoid 2/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 2/2 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 2/2 operation. Check for debris on screen • Cylinder 4 or 6 lash adjuster plugged • Cylinder 4 or 6 rocker arm stuck failure or lock pin stuck extended

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 4 and Cylinder 6	
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1, Cylinder 3 and Cylinder 5	- VVL Solenoid 1/1 and 1/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage - Bank 1 oil supply passage blockage or restriction to front and rear oil feeds in the bank 1 Cylinder Head - Large internal leakage in bank 1 Cylinder Head affecting the front and rear oil feeds	- Check the control O-rings on the front and rear bank 1 VVL Solenoids for damage - Check for proper oil pressure at the front and rear bank 1 VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 2. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2, Cylinder 4 and Cylinder 6	VVL Solenoid 2/1 and 2/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage	- Check the control O-rings on the front and rear bank 2 VVL Solenoids for damage - Check for proper oil pressure at the front and

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	- Bank 2 oil supply passage blockage or restriction to front and rear oil feeds in the bank 2 Cylinder Head - Large internal leakage in bank 2 Cylinder Head affecting the front and rear oil feeds	rear bank VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage for all Cylinders (1 - 6)	Engine oil pressure too low to both Cylinder Heads due to: - Oil level low - Wrong viscosity oil - Oil Filter restriction - Engine mechanical failure (damaged bearings, pick-up tube or seal, engine block, etc.) - Faulty Oil Pump	- Check for proper oil level, filter and viscosity before checking engine oil pressure - If the engine oil pressure is low check for any mechanical issue that could cause low oil pressure. If there are no issues with the bearings, pick-up tube and engine block replace the Engine Oil Pump Assembly NOTE: Low engine oil pressure will likely also cause issues/faults for the VVT system

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

- Go To [10](#)

9. CHECK THE ACTUAL OIL PRESSURE TO THE VVL SOLENOID IN THE CYLINDER HEAD

1. Turn the ignition off.
2. Remove the appropriate VVL Solenoid called out by the scan tool.
3. Install the (special tool #2027300090, Kit, VVL Adapters) in place of the VVL Solenoid.
4. Start the engine and allow it to idle.
5. With the scan tool, monitor the Dual Oil Pump mode.

NOTE: Let the engine run long enough for the pump to switch to low pump mode.

6. Read and record the oil pressure reading on the oil pressure gauge. Compare the reading to the main engine oil pressure reading from the Engine Oil Pressure Sensor reading on the scan tool.

NOTE: The Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure reading.

Is the Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure?

Yes

- Remove and inspect the screen on the VVL Solenoid for debris that can block oil flow through the solenoid. Check the seals on the VVL Solenoid for damage and proper installation. If no debris is found, and the seals appear good replace the VVL Solenoid in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Diagnose and repair the lack of oil pressure to the VVL Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

10. CHECK FOR PROPER SPARK AT THE IGNITION COIL

1. Turn the ignition off and remove the Fuel Pressure Decay Tester and connect the fuel lines before continuing.

NOTE: A faulty Ignition Coil or Spark Plug can cause a misfire at idle but could also misfire only under a heavy load on the engine. One faulty Ignition Coil or Spark Plug will usually cause a single cylinder misfire.

2. Remove the Ignition Coil from the cylinder that is misfiring.
3. Connect the Ignition Coil harness connector.
4. Disconnect the Fuel Injector harness connector of the cylinder being tested.
5. Install a spark tester on the Ignition Coil.
6. While cranking the engine observe the spark coming from the spark tester.

Is a crisp blue spark present?

Yes

- Go To [11](#)

No

- Go To [16](#)

11. INSPECT THE SPARK PLUG AND CYLINDER

1. Turn the ignition off.
2. Remove the Spark Plug in accordance with the Service Information.
3. Inspect the Spark Plug for the following conditions:
 - Cracks
 - Carbon Tracking
 - Fouling due to oil, coolant or excess fuel in the cylinder
 - Gap size out of specifications
 - Loose or broken electrode
4. Check for signs of oil or coolant in the cylinder.

Were any of the above conditions present?

Yes

- Replace the Spark Plug. If oil or coolant were found in the cylinder or on the Spark Plug, diagnose and repair the cause.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [12](#)

12. CHECK THE ENGINE COMPRESSION TO CHECK FOR VALVETRAIN OR COMBUSTION CHAMBER ISSUES

NOTE: A cylinder compression or valvetrain issue will cause a misfire during all operating conditions. These types of failures will normally affect a single cylinder. However, depending on the type of failure incurred, other cylinders can also be affected and show misfires. In most cases there will be far more misfire counts on the cylinder with the issue than on the other affected cylinders.

1. Perform a cylinder compression test on several cylinders and compare the known good cylinders to the cylinder that was misfiring. Refer to .

Is the cylinder compression within specification?

Yes

- Go To [13](#)

No

- Perform a Cylinder Leak Down Test to determine if the cause is from the valvetrain or combustion chamber and repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

13. EXCHANGE SPARK PLUG AND CHECK FOR MISFIRE TO FOLLOW THE SPARK PLUG

1. Exchange the Spark Plug with a known good cylinder that was not indicating a misfire or replace the Spark Plug if it is difficult to access.
2. Start the engine and monitor the misfire monitor screen.

Did the misfire switch to the previously good cylinder or go away if the Spark Plug was replaced?

Yes

- Repair is complete if Spark Plug was replaced and misfire is gone, or replace the Spark Plug if it moved to the known good cylinder.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [14](#)

14. CLEAN THE CARBON FROM THE VALVETRAIN AND COMBUSTION CHAMBERS

NOTE: Carbon build up on the engine valves and guides can cause a misfire during all operating conditions but is usually more noticeable during cruising speeds or heavy engine load conditions. If carbon build up is becoming an issue it could set only a single cylinder misfire but usually will affect more than one cylinder and set multiple cylinder misfire as well.

1. Using Mopar Combustion cleaner, de-carbon the engine.
2. After driving and clearing the combustion cleaner from the engine, erase DTCs with the scan tool.
3. Test drive the vehicle in accordance with the Freeze Frame data.
4. With the scan tool, view the Misfire Monitor.

Did the misfire return?

Yes

- Go To [15](#)

No

- Cleaning the valves and combustion chambers repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

15. CHECK THE CAMSHAFT LOBES, ROCKER ARMS AND SPRINGS

NOTE: Worn Camshaft Lobes, worn or broken Rocker Arms or springs may sometimes but not always be detected during a compression test. The misfire can occur at different operating conditions depending on which component is worn and the severity of the wear on the component.

1. Visually inspect the Camshaft, Rocker Arms or springs for excessive wear or broken parts.

Were any issues found with the Camshaft, Rocker Arms or springs?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [20](#)

16. CHECK THE ASD RELAY OUTPUT CIRCUIT

1. Turn the ignition off.
2. Disconnect the Ignition Coil harness connector.
3. Turn the ignition on.

4. With a scan tool, actuate the ASD Relay.
5. Using a 12-volt test light connected to ground, probe the ASD Relay Output circuit at the Ignition Coil harness connector.

Does the test light illuminate brightly?

Yes

- Go To [17](#)

No

- Stop all scan tool actuations and repair the open or short to ground in the ASD Relay Output circuit between the PDC and Ignition Coil harness connector.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

17. CHECK THE IGNITION COIL CONTROL CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

1. Using a 12-volt test light connected to a 12 volt source, back probe the Coil Control circuit at the Ignition Coil harness connector.
2. Crank the engine for 5 seconds while observing the test light.

What was the condition of the test light while cranking the engine?

Blinking brightly

- Replace the Ignition Coil in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

ON constantly

- Go To [18](#)

OFF constantly

- Go To [19](#)

18. CHECK THE COIL CONTROL CIRCUIT FOR A SHORT TO GROUND

1. Turn the ignition off.
2. Disconnect the PCM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic) to the engine harness side of the PCM C2 harness connector.
4. Check for continuity between ground and the Coil Control circuit at the Ignition Coil harness connector.

Is there continuity between ground and the Coil Control circuit?

Yes

- Repair the Coil Control circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [20](#)

19. CHECK THE COIL CONTROL CIRCUIT FOR AN OPEN

1. Turn the ignition off.
2. Measure the resistance of the Coil Control circuit between the Ignition Coil harness connector and the GPEC Adaptor.

Is the resistance below 3.0 Ohms?

Yes

- Go To [20](#)

No

- Repair the Coil Control circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

20. CHECK RELATED PCM AND COMPONENT HARNESS CONNECTIONS

1. Disconnect all PCM harness connectors.
2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

5. Connect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
10. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION**.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

P0303-CYLINDER 3 MISFIRE

THEORY OF OPERATION

The PCM uses the Crankshaft Position (CKP) Sensor to detect and monitor the Crankshaft rotational speed. Normally, the Crankshaft rotational speed is fairly stable from cylinder to cylinder. When a misfire occurs in a cylinder, the Crankshaft speed changes abruptly for that cylinder. Therefore, anything that causes a sudden change in Crankshaft speed detected for a single cylinder is determined to be an engine misfire event. A misfire fault will usually occur due to poor fuel quality or metering, lack of spark, engine timing, low engine compression due to engine mechanical or valvetrain issues, a vacuum leak or coolant leak entering the engine intake air system. Though not as common, other factors such as severe wheel balance or braking vibration, a worn serpentine belt or belt driven accessory binding should also be considered when diagnosing a misfire fault.

Depending on the engine involved, there can be several systems and components that can contribute to a misfire. **In many cases, but not always, there will be other DTCs set related to these systems. If that is the case, the focus should be on following the diagnostics for the system that has DTCs set against it.** The different components or systems will affect misfire in different ways. Factors to consider when diagnosing a misfire are whether the misfire is a single cylinder or multiple cylinder misfire, and when does the misfire occur (idle, vehicle and engine speed, heavy engine load conditions, etc.). These factors can help in determining what components or systems should be focused on during diagnostics. **Typically a multiple cylinder misfire is an indication of timing, oil or coolant consumption, air handling, fuel supply or poor fuel quality issue that can affect multiple cylinders and not a single cylinder component such as a Fuel Injector, Ignition Coil or Spark Plug.**

NOTE: **The effects that the components and systems have on misfire detection are described in more detail in the individual test steps below.**

WHEN MONITORED

This diagnostic runs continuously when the following conditions are met:

- Fuel level above 12%.
- Battery voltage above 10.9 volts.
- The adaptive numerator has been successfully learned.
- Ambient temperature above -23B°C (-9.4B°F).
- Coolant temperature at engine start is above -7B°C (19.4B°F). If start engine temperature is below threshold, enable monitor when engine temperature reaches 21B°C (69.8B°F).
- Engine speed between approximately 400 rpm and 6200 rpm.
 - Misfire monitor is disabled during a Decel Fuel Shutoff Event (DFSO).

SET CONDITION

- The variation in crankshaft speed between cylinders exceeds a calibrated value, based on engine speed and load.

DEFAULT ACTION

- The MIL light will illuminate or flash depending on severity of the misfire.
- During a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. When the engine rev counter has reached the calculated threshold the Fuel Injector is turned back on. If a misfire is still occurring, the injector is disabled again. This cycle will continue until the misfire has stopped.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

POSSIBLE CAUSES

Possible Causes
ENGINE VACUUM LEAK EXCESSIVE CARBON BUILD-UP IN CYLINDER HEAD OR COMBUSTION CHAMBER FAULTY FUEL INJECTOR POOR FUEL QUALITY OR HIGH ETHANOL LEVEL CRANKSHAFT POSITION SENSOR (CKP) OR TONE WHEEL ISSUES FAULTY IGNITION COIL OR SPARK PLUG VARIABLE VALVE LIFT (VVL) SYSTEM ISSUES (IF EQUIPPED) COOLANT LEAKING INTO A CYLINDER FAULTY CYLINDER HEAD GASKET ENGINE MECHANICAL/LOW COMPRESSION WORN CAMSHAFT LOBES, SPRINGS OR ROCKER ARMS POWERTRAIN CONTROL MODULE (PCM)

Always perform the **PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE** before proceeding. Refer to .

DIAGNOSTIC TEST

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, read and record all DTCs and Freeze Frame information.
3. Operate the vehicle under conditions recorded in the Freeze Frame information when the DTC was set.

NOTE: During the test drive of the vehicle, note when the misfire condition is present for use later in this diagnostic test. Also monitor the Downstream O2 Sensor(s) when the misfire is occurring. O2 Sensor voltage readings that are consistently on the low side of the scale would indicate a lean condition. This could indicate a lack of fuel due to a plugged Fuel Injector or fuel system issue. O2 Sensor voltage readings that are consistently on the high side of the scale would indicate a rich condition. This could be caused by a lack of spark or a possible leaky Fuel Injector.

NOTE: Keep in mind that during a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. This can cause a misfire that occurs only at high engine speed or heavy engine load to appear to continue when

returning to idle. However this could be due to the Fuel Injector being disabled until the rev counter resets.

4. With the scan tool, view the Misfire Monitor to see which cylinders are effected.

Are there excessive misfires shown for this cylinder at this time?

Yes

- Go To [2](#)

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. Refer to .

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any Service Bulletins or fuel system, ignition system component, air handling component, VVL system (if equipped), or VVT system DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). Refer to .

No

- Go To [3](#)

3. CHECK FOR MECHANICAL CONDITIONS THAT COULD CAUSE A MISFIRE

NOTE: Each of the following conditions can cause a misfire during most operating conditions with the exception of the out of balance tires or warped brake rotors.

1. Visually inspect the engine for any of the following conditions:

- Worn, loose or slipping serpentine belt.
- Binding or misaligned engine driven accessories: A/C Compressor, P/S Pump, Water pump, etc.
- Improper mounting of the CKP Sensor or damaged target wheel.
- Harmonic Balancer out of balance.
- Extremely out of balance tires or warped brake rotors.

Were any of the above conditions present?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [4](#)

4. CHECK THE ENGINE OIL LEVEL AND CONDITION

NOTE: The oil level being low or the wrong oil filter or viscosity being used can cause Variable Valve Timing system operating issues. This could lead to a misfire condition.

NOTE: The following items should be checked before continuing with this procedure. Failure to do so may lead to misdiagnosis.

- **ENGINE MECHANICAL TOLERANCES OUT OF SPECIFICATION**
- **ENGINE OIL PRESSURE OUT OF SPECIFICATION**
- **LOW ENGINE OIL LEVEL**
- **INCORRECT ENGINE OIL FILTER (DOES NOT MEET OEM SPECIFICATIONS)**
- **DETERIORATED OR DIRTY OIL**
- **CONTAMINATED ENGINE OIL**
- **INCORRECT ENGINE OIL VISCOSITY**
- **AERATED ENGINE OIL**

1. If any of the above conditions are found, repair as necessary.

Were any of the above conditions present?

Yes

- Repair the engine oiling or mechanical condition (i.e. improper oil drain back, oil sludge, damaged oil pump, pick-up tube or seal, etc.).
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [5](#)

5. CHECK THE INTAKE SYSTEM FOR LEAKS

1. Check the engine and Intake Manifold for vacuum leaks.

NOTE: A vacuum leak can affect one or more cylinders depending on the location of the leak.

Were any leaks found with the intake system?

Yes

- Repair the leak in the intake system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [6](#)

6. CHECK THE FUEL QUALITY

1. Check the fuel for the following:

- Water in fuel
- Correct type of fuel
- Old or contaminated fuel
- Low fuel
- Perform the CHECK FOR PROPER ETHANOL LEVEL IN THE GASOLINE procedure. Refer to **DIAGNOSIS AND TESTING** .

Were any problems found with the fuel?

Yes

- Replace the fuel and, if necessary, flush and clean the fuel system.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [7](#)

7. CHECK FOR A CLOGGED OR LEAKING FUEL INJECTOR

NOTE: A Fuel Injector that is plugged and spraying too little fuel, or fouled and spraying too much fuel, will generally cause a misfire during any operating condition. One faulty Fuel Injector will usually cause a single cylinder misfire. However if the injector is spraying an excessive amount of fuel, the excess fuel could also affect the adjoining cylinders. In most cases there will be far more misfire counts on the cylinder with the faulty Fuel Injector than on the other affected cylinders.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.

1. Install the Fuel Pressure Decay Tester (special tool #8978A, Decay Tool, Fuel) to the fuel rail.
2. Turn the ignition on and allow the fuel pressure to reach maximum pressure and stabilize.

NOTE: The ignition may need to be cycled off and on a couple times to reach maximum fuel pressure in the rail.

3. Once the pressure reading has stabilized, record the fuel pressure. This is known as the "starting pressure".
4. With the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire while monitoring the fuel pressure gauge.
5. Record the fuel pressure. This is known as the "ending pressure."

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

6. Repeat sub-steps two through five with several other Fuel Injectors on cylinders that do not have a misfire. Make sure to start the Fuel Injector actuation at the same starting pressure for each injector. Compare the ending pressures of the known good cylinders to the cylinder with the misfire condition.

Are the ending pressures about the same for all of the tested injectors?

Yes

- Go To [8](#)

No, the injector from the cylinder with the misfire stood out from the rest.

- If the pressure drop is too small, check for debris in the Fuel Rail or Fuel Injector and repair as necessary. If the pressure drop is too large, suspect a faulty or fouled Fuel Injector as the issue.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

8. CHECK THE VARIABLE VALVE LIFT (VVL) SYSTEM (IF EQUIPPED)

NOTE: The 3.6L Upgrade engine is equipped with the VVL System. The classic engine is not. If this vehicle is not equipped with the VVL system skip this test step.

NOTE: A Rocker Arm or arms can get stuck due to an oil pressure issue, or a mechanical failure of a VVL Solenoid (including O-rings) or Rocker Arm. A single Rocker Arm that is stuck in low lift will not be detected and the system will continue to operate normally, however some misfire and engine roughness may be felt. One Rocker Arm stuck in Low Lift mode will cause a misfire at higher engine speeds (above approximately 4000 rpm). Two or more Rocker Arms stuck in Low Lift mode can cause a misfire at any engine speed, including idle. A Rocker Arm stuck in high lift mode typically misfires at idle.

NOTE: The two rear cylinders are controlled by the rear solenoid on each bank. Therefore, a VVL issue that affects both rear cylinders on a bank is most likely a common issue for both cylinders. These would include a damaged or missing O-ring, faulty solenoid, oil supply or control circuit issue. A VVL issue that only affects one of the rear cylinders is more likely going to be a failure of a Rocker Arm or pin for that cylinder.

NOTE: The front VVL Solenoids control the operation of the Rocker Arms for the front cylinder only on each bank. The rear VVL Solenoids control the operation of the Rocker Arms for the back two cylinders on each bank.

1. Turn the ignition on.
2. With the scan tool, navigate to Systems Tests, perform the VVL System Diagnostic test and follow the on screen directions. for further VVL system functionality and scan tool routine information. Refer to [VALVE TIMING , DESCRIPTION AND OPERATION](#) .

NOTE: Do not erase the DTC before running the routine.

3. When the test is complete, compare the results to the table below for the probable failure conditions.

Does the scan tool results show that the misfire is being caused by the VVL system?

Yes

- Compare the results from the routine to the table below

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
Low misfire percentage on (1) Rocker Stuck Low test, (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire
High misfire percentage on (1) Rocker Stuck Low test , (2) Rocker Stuck High, Low RPM test, and (3) Rocker Stuck High, High RPM test	No VVL issue detected	The misfire condition being detected is not caused by the VVL System. Another system is likely causing the misfire

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 1	• VVL Solenoid 1/1 stuck on/open • VVL Solenoid 1/1 control circuit shorted to 12 volts • VVL Solenoid 1/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 1 rocker arm lash adjuster issue (stuck or broken) • Cylinder 1 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	• Verify that the VVL Solenoid 1/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 1/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 1 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 2	• VVL Solenoid 2/1 stuck on/open • VVL Solenoid 2/1 control circuit shorted to 12 volts • VVL Solenoid 2/1 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Cylinder 2 rocker arm lash adjuster issue (stuck or broken) • Cylinder 2 rocker arm lock pin stuck retracted • Oil pressure leakage from the supply oil passage to the front control oil passage in the Cylinder Head.	• Verify that the VVL Solenoid 2/1 control circuit is not shorted to 12 volts • Check operation of VVL Solenoid 2/1 for a stuck on/open condition, damaged or missing supply O-ring • Check for broken or stuck Cylinder 2 rocker arms or lock pins • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 3	• Cylinder 3 rocker arm lash adjuster issue (stuck or broken)	• Check for broken or stuck Cylinder 3 rocker arms or lock pins

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	• Cylinder 3 rocker arm lock pin stuck retracted	
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 4	• Cylinder 4 rocker arm lash adjuster issue (stuck or broken) • Cylinder 4 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 4 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 5	• Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 5 rocker arms or lock pins
(1) Rocker Stuck Low test - has high misfire percentage on Cylinder 6	• Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck retracted	• Check for broken or stuck Cylinder 6 rocker arms or lock pins
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck on/open • VVL Solenoid 1/2 control circuit shorted to 12 volts • VVL Solenoid 1/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage • Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 3 and Cylinder 5	• Check the VVL Solenoid 1/2 control circuit for a short to 12 volts condition • Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring • It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - high misfire percentage on Cylinder 4 and Cylinder 6	- VVL Solenoid 2/2 stuck on/open - VVL Solenoid 2/2 control circuit shorted to 12 volts - VVL Solenoid 2/2 has missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage - Oil pressure leakage from the supply oil passage to the rear control oil passage in the Cylinder Head. NOTE: It's less likely but possible for a rocker arm lash adjuster failure (stuck or broken) or lock pin stuck retracted on both Cylinder 4 and Cylinder 6	- Check the VVL Solenoid 2/2 control circuit for a short to 12 volts condition - Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - high misfire percentage Cylinder 1, Cylinder 3, and Cylinder 5	- Both bank 1 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage for both bank 1 solenoids - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	- Check operation of VVL Solenoid 1/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
(1) Rocker Stuck Low test - high misfire percentage Cylinder 2, Cylinder 4, and Cylinder 6	- Both bank 2 solenoids have missing or damaged supply O-ring causing oil pressure leakage from the supply oil passage to the control oil passage for both bank 2 solenoids - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in the Cylinder Head.	- Check operation of VVL Solenoid 2/2 for a stuck on/open condition, damaged or missing supply O-ring - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace the Cylinder Head. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9.
(1) Rocker Stuck Low test - high misfire percentage for all Cylinders (1 - 6)	- Missing or damaged supply O-rings causing oil pressure leakage from the supply oil passage to the control oil passage for front and rear solenoids on bank 1 and bank 2 - Oil pressure leakage from the supply oil passage to the front and rear control oil passages in both Cylinder Heads.	- Check operation of all VVL Solenoids for a stuck on/open condition, damaged or missing supply O-rings - It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if all other possible causes are exhausted, replace both Cylinder Heads.
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1	- VVL Solenoid 1/1 control circuit open or shorted to ground - VVL Solenoid 1/1 stuck closed/off - VVL Solenoid 1/1 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage - Control oil passage pressure restricted - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm lash adjuster issue (stuck or broken)	- Check the VVL Solenoid 1/1 control circuit for an open or shorted to ground condition - Check the VVL Solenoid 1/1 for a missing or damaged control O-ring - Actuate and check the VVL Solenoid 1/1 operation. Check for debris on screen - Cylinder 1 lash adjuster plugged - Cylinder 1 rocker arm stuck failure or lock pin stuck extended

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	• Cylinder 1 rocker arm lock pin stuck extended	
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2	• VVL Solenoid 2/1 stuck closed/off • VVL Solenoid 2/1 control circuit open or shorted to ground • VVL Solenoid 2/1 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted • Cylinder 2 lash adjuster plugged • Cylinder 2 rocker arm lash adjuster issue (stuck or broken) • Cylinder 2 rocker arm lock pin stuck extended	• Check the VVL Solenoid 2/1 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 2/1 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 2/1 operation. Check for debris on screen • Cylinder 2 lash adjuster plugged • Cylinder 2 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3	• Cylinder 3 lash adjuster plugged • Cylinder 3 rocker arm lash adjuster issue (stuck or broken) • Cylinder 3 rocker arm lock pin stuck extended	• Cylinder 3 lash adjuster plugged • Cylinder 3 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4	• Cylinder 4 lash adjuster plugged • Cylinder 4 rocker arm lash adjuster issue (stuck or broken) • Cylinder 4 rocker arm lock pin stuck extended	• Cylinder 4 lash adjuster plugged • Cylinder 4 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 5	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm lash adjuster issue (stuck or broken) • Cylinder 5 rocker arm lock pin stuck extended	• Cylinder 5 lash adjuster plugged • Cylinder 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 6	• Cylinder 6 lash adjuster plugged	• Cylinder 6 lash adjuster plugged

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
RPM test - high misfire percentage Cylinder 6	• Cylinder 6 rocker arm lash adjuster issue (stuck or broken) • Cylinder 6 rocker arm lock pin stuck extended	• Cylinder 6 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 3 and Cylinder 5	• VVL Solenoid 1/2 stuck closed/off • VVL Solenoid 1/2 control circuit open or shorted to ground • VVL Solenoid 1/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted NOTE: It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 3 and Cylinder 5	• Check the VVL Solenoid 1/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 1/2 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 1/2 operation. Check for debris on screen • Cylinder 3 or 5 lash adjuster plugged • Cylinder 3 or 5 rocker arm stuck failure or lock pin stuck extended
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 4 and Cylinder 6	• VVL Solenoid 2/2 stuck closed/off • VVL Solenoid 2/2 control circuit open or shorted to ground • VVL Solenoid 2/2 has missing or damaged control O-ring causing oil pressure leakage from the control oil passage to the exhaust oil passage • Control oil passage pressure restricted NOTE:	• Check the VVL Solenoid 2/2 control circuit for an open or shorted to ground condition • Check the VVL Solenoid 2/2 for a missing or damaged control O-ring • Actuate and check the VVL Solenoid 2/2 operation. Check for debris on screen • Cylinder 4 or 6 lash adjuster plugged • Cylinder 4 or 6 rocker arm stuck failure or lock pin stuck extended

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	It's less likely but possible for a rocker arm lash adjuster issue (stuck or broken) or lock pin stuck retracted on Cylinder 4 and Cylinder 6	
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 1, Cylinder 3 and Cylinder 5	- VVL Solenoid 1/1 and 1/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage - Bank 1 oil supply passage blockage or restriction to front and rear oil feeds in the bank 1 Cylinder Head - Large internal leakage in bank 1 Cylinder Head affecting the front and rear oil feeds	- Check the control O-rings on the front and rear bank 1 VVL Solenoids for damage - Check for proper oil pressure at the front and rear bank 1 VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 2. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage Cylinder 2, Cylinder 4 and Cylinder 6	VVL Solenoid 2/1 and 2/2 have missing or damaged control O-rings causing oil pressure leakage from the control oil passage to the exhaust oil passage	- Check the control O-rings on the front and rear bank 2 VVL Solenoids for damage - Check for proper oil pressure at the front and

SCAN TOOL INTRUSIVE VVL TEST RESULT	PROBABLE CAUSES	REPAIR ACTIONS
	- Bank 2 oil supply passage blockage or restriction to front and rear oil feeds in the bank 2 Cylinder Head - Large internal leakage in bank 2 Cylinder Head affecting the front and rear oil feeds	rear bank VVL Solenoids. Proceed to step below to check the oil pressure in the Cylinder Head. Refer to 9. It is a very low percentage of the time that an internal crack in a Cylinder Head would cause this issue. However if the oil pressure is low to both solenoids and all other possible causes are exhausted, replace the Cylinder Head NOTE: Low oil pressure in the Cylinder Head will likely also cause issues/faults for the VVT system
(2) Rocker Stuck High, Low RPM test, or (3) Rocker Stuck High, High RPM test - high misfire percentage for all Cylinders (1 - 6)	Engine oil pressure too low to both Cylinder Heads due to: - Oil level low - Wrong viscosity oil - Oil Filter restriction - Engine mechanical failure (damaged bearings, pick-up tube or seal, engine block, etc.) - Faulty Oil Pump	- Check for proper oil level, filter and viscosity before checking engine oil pressure - If the engine oil pressure is low check for any mechanical issue that could cause low oil pressure. If there are no issues with the bearings, pick-up tube and engine block replace the Engine Oil Pump Assembly NOTE: Low engine oil pressure will likely also cause issues/faults for the VVT system

- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

- Go To [10](#)

9. CHECK THE ACTUAL OIL PRESSURE TO THE VVL SOLENOID IN THE CYLINDER HEAD

1. Turn the ignition off.
2. Remove the appropriate VVL Solenoid called out by the scan tool.
3. Install the (special tool #2027300090, Kit, VVL Adapters) in place of the VVL Solenoid.
4. Start the engine and allow it to idle.
5. With the scan tool, monitor the Dual Oil Pump mode.

NOTE: Let the engine run long enough for the pump to switch to low pump mode.

6. Read and record the oil pressure reading on the oil pressure gauge. Compare the reading to the main engine oil pressure reading from the Engine Oil Pressure Sensor reading on the scan tool.

NOTE: The Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure reading.

Is the Cylinder Head oil pressure should be within 5.0 psi of main engine oil pressure?

Yes

- Remove and inspect the screen on the VVL Solenoid for debris that can block oil flow through the solenoid. Check the seals on the VVL Solenoid for damage and proper installation. If no debris is found, and the seals appear good replace the VVL Solenoid in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Diagnose and repair the lack of oil pressure to the VVL Solenoid.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

10. CHECK FOR PROPER SPARK AT THE IGNITION COIL

1. Turn the ignition off and remove the Fuel Pressure Decay Tester and connect the fuel lines before continuing.

NOTE: A faulty Ignition Coil or Spark Plug can cause a misfire at idle but could also misfire only under a heavy load on the engine. One faulty Ignition Coil or Spark Plug will usually cause a single cylinder misfire.

2. Remove the Ignition Coil from the cylinder that is misfiring.
3. Connect the Ignition Coil harness connector.
4. Disconnect the Fuel Injector harness connector of the cylinder being tested.
5. Install a spark tester on the Ignition Coil.
6. While cranking the engine observe the spark coming from the spark tester.

Is a crisp blue spark present?

Yes

- Go To [11](#)

No

- Go To [16](#)

11. INSPECT THE SPARK PLUG AND CYLINDER

1. Turn the ignition off.
2. Remove the Spark Plug in accordance with the Service Information.
3. Inspect the Spark Plug for the following conditions:
 - Cracks
 - Carbon Tracking
 - Fouling due to oil, coolant or excess fuel in the cylinder
 - Gap size out of specifications
 - Loose or broken electrode
4. Check for signs of oil or coolant in the cylinder.

Were any of the above conditions present?

Yes

- Replace the Spark Plug. If oil or coolant were found in the cylinder or on the Spark Plug, diagnose and repair the cause.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [12](#)

12. CHECK THE ENGINE COMPRESSION TO CHECK FOR VALVETRAIN OR COMBUSTION CHAMBER ISSUES

NOTE: A cylinder compression or valvetrain issue will cause a misfire during all operating conditions. These types of failures will normally affect a single cylinder. However, depending on the type of failure incurred, other cylinders can also be affected and show misfires. In most cases there will be far more misfire counts on the cylinder with the issue than on the other affected cylinders.

1. Perform a cylinder compression test on several cylinders and compare the known good cylinders to the cylinder that was misfiring. Refer to .

Is the cylinder compression within specification?

Yes

- Go To [13](#)

No

- Perform a Cylinder Leak Down Test to determine if the cause is from the valvetrain or combustion chamber and repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

13. EXCHANGE SPARK PLUG AND CHECK FOR MISFIRE TO FOLLOW THE SPARK PLUG

1. Exchange the Spark Plug with a known good cylinder that was not indicating a misfire or replace the Spark Plug if it is difficult to access.
2. Start the engine and monitor the misfire monitor screen.

Did the misfire switch to the previously good cylinder or go away if the Spark Plug was replaced?

Yes

- Repair is complete if Spark Plug was replaced and misfire is gone, or replace the Spark Plug if it moved to the known good cylinder.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [14](#)

14. CLEAN THE CARBON FROM THE VALVETRAIN AND COMBUSTION CHAMBERS

NOTE: Carbon build up on the engine valves and guides can cause a misfire during all operating conditions but is usually more noticeable during cruising speeds or heavy engine load conditions. If carbon build up is becoming an issue it could set only a single cylinder misfire but usually will affect more than one cylinder and set multiple cylinder misfire as well.

1. Using Mopar Combustion cleaner, de-carbon the engine.
2. After driving and clearing the combustion cleaner from the engine, erase DTCs with the scan tool.
3. Test drive the vehicle in accordance with the Freeze Frame data.
4. With the scan tool, view the Misfire Monitor.

Did the misfire return?

Yes

- Go To [15](#)

No

- Cleaning the valves and combustion chambers repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

15. CHECK THE CAMSHAFT LOBES, ROCKER ARMS AND SPRINGS

NOTE: Worn Camshaft Lobes, worn or broken Rocker Arms or springs may sometimes but not always be detected during a compression test. The misfire can occur at different operating conditions depending on which component is worn and the severity of the wear on the component.

1. Visually inspect the Camshaft, Rocker Arms or springs for excessive wear or broken parts.

Were any issues found with the Camshaft, Rocker Arms or springs?

Yes

- Perform the appropriate repair in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [20](#)

16. CHECK THE ASD RELAY OUTPUT CIRCUIT

1. Turn the ignition off.
2. Disconnect the Ignition Coil harness connector.
3. Turn the ignition on.

4. With a scan tool, actuate the ASD Relay.
5. Using a 12-volt test light connected to ground, probe the ASD Relay Output circuit at the Ignition Coil harness connector.

Does the test light illuminate brightly?

Yes

- Go To [17](#)

No

- Stop all scan tool actuations and repair the open or short to ground in the ASD Relay Output circuit between the PDC and Ignition Coil harness connector.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

17. CHECK THE IGNITION COIL CONTROL CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

1. Using a 12-volt test light connected to a 12 volt source, back probe the Coil Control circuit at the Ignition Coil harness connector.
2. Crank the engine for 5 seconds while observing the test light.

What was the condition of the test light while cranking the engine?

Blinking brightly

- Replace the Ignition Coil in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

ON constantly

- Go To [18](#)

OFF constantly

- Go To [19](#)

18. CHECK THE COIL CONTROL CIRCUIT FOR A SHORT TO GROUND

1. Turn the ignition off.
2. Disconnect the PCM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the (special tool #10436, Adapter, GPEC Diagnostic) to the engine harness side of the PCM C2 harness connector.
4. Check for continuity between ground and the Coil Control circuit at the Ignition Coil harness connector.

Is there continuity between ground and the Coil Control circuit?

Yes

- Repair the Coil Control circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- Go To [20](#)

19. CHECK THE COIL CONTROL CIRCUIT FOR AN OPEN

1. Turn the ignition off.
2. Measure the resistance of the Coil Control circuit between the Ignition Coil harness connector and the GPEC Adaptor.

Is the resistance below 3.0 Ohms?

Yes

- Go To [20](#)

No

- Repair the Coil Control circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

20. CHECK RELATED PCM AND COMPONENT HARNESS CONNECTIONS

1. Disconnect all PCM harness connectors.
2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:
 - Proper connector installation.
 - Damaged connector locks.
 - Corrosion.
 - Other signs of water intrusion.
 - Weather seal damage (if equipped).
 - Bent terminals.
 - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
 - Terminals that have been pushed back into the connector cavity.
 - Check for spread terminals and verify proper terminal tension.

Repair any conditions that are found.

5. Connect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
10. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
- Perform the POWERTRAIN VERIFICATION TEST. Refer to .

No

- The wiring or poor connection problem has been repaired.
 - Perform the POWERTRAIN VERIFICATION TEST. Refer to .
-