AUTOMATIC TRANSMISSION

U151E Automatic Transmission - Sienna

PRECAUTION

NOTE:
- Perform the RESET MEMORY (AT initialization) when replacing the automatic transaxle assembly, engine assembly or ECM (See INITIALIZATION).
- Perform the REGISTRATION (VIN registration) when replacing the ECM (See REGISTRATION).

HINT:

RESET MEMORY can not be completed by only disconnecting the battery cable.

1. The automatic transaxle is composed of highly precision-finished parts which need careful inspection before reassembly. Even a small nick could cause fluid leakage or affect the performance. The instructions here are organized so that you work on only one component group at a time. This will help avoid confusion caused by similar-looking parts of different sub-assemblies being on your workbench at the same time. The component groups are inspected and repaired from the converter housing side. Complete the inspection, repair and reassembly before proceeding to the next component group as much as possible. If a defect is found in a certain component group during reassembly, inspect and repair this group immediately. If a component group cannot be assembled because some parts are being ordered, be sure to keep all parts of the group in a separate container while proceeding with disassembly, inspection, repair and reassembly of other component groups. Recommended: Toyota Genuine ATF WS

2. All disassembled parts should be washed clean and any fluid passages and holes should be blown through with compressed air.

3. Dry all parts with compressed air. Never use a shop rag or a piece of cloth to dry them.

4. When using compressed air, always aim away from yourself to prevent accidentally spraying ATF or kerosene in your face.

5. Only recommended automatic transaxle fluid or kerosene should be used for cleaning.

6. After cleaning, the parts should be arranged in the correct order for efficient inspection, repair, and reassembly.

7. When disassembling a valve body, be sure to match each valve together with the corresponding spring.

8. New discs for the brakes and clutches that are to be used for replacement must be soaked in ATF for at least 15 minutes before reassembly.

9. All oil seal rings, clutch discs, clutch plates, rotating parts, and sliding surfaces should be coated with ATF prior to reassembly.

10. All gaskets and rubber O-rings should be replaced with new ones.
11. Do not apply adhesive cements to gaskets and similar parts.
12. Make sure that the ends of a snap ring are not aligned with one of the cutouts and are installed in the groove correctly.
13. When replacing a worn bushing, the sub-assembly containing the bushing must also be replaced.
14. Check thrust bearings and races for wear or damage. Replace them as necessary.
15. When working with FIPG material, you must observe the following:
   - Using a razor blade and a gasket scraper, remove all the old packing (FIPG) material from the gasket surface.
   - Thoroughly clean all components to remove any loose material.
   - Clean both sealing surfaces with a non-residue solvent.
   - Parts must be reassembled within 10 minutes of application. Otherwise, the packing (FIPG) material must be removed and reapplied.

**DEFINITION OF TERMS**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor description</td>
<td>Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).</td>
</tr>
<tr>
<td>Related DTCs</td>
<td>Diagnostic code</td>
</tr>
<tr>
<td>Typical enabling condition</td>
<td>Preconditions that allow the ECM to detect malfunctions. With all preconditions satisfied, the ECM sets the DTC when the monitored value(s) exceeds the malfunction threshold(s).</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>The priority order that is applied to monitoring, if multiple sensors and components are used to detect the malfunction. While another sensor is being monitored, the next sensor or component will not be monitored until the previous monitoring has concluded.</td>
</tr>
<tr>
<td>Required sensor/components</td>
<td>The sensors and components that are used by the ECM to detect malfunctions.</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>The number of times that the ECM checks for malfunctions per driving cycle. &quot;Once per driving cycle&quot; means that the ECM detects malfunction only one time during a single driving cycle. &quot;Continuous&quot; means that the ECM detects malfunction every time when enabling condition is met.</td>
</tr>
<tr>
<td>Duration</td>
<td>The minimum time that the ECM must sense a continuous deviation in the monitored value(s)</td>
</tr>
</tbody>
</table>
before setting a DTC. This timing begins after the "typical enabling conditions" are met.

<table>
<thead>
<tr>
<th>Malfunction thresholds</th>
<th>Beyond this value, the ECM will conclude that there is a malfunction and set a DTC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL operation</td>
<td>MIL illumination timing after a defect is detected. &quot;Immediately&quot; means that the ECM illuminates MIL the instant the ECM determines that there is a malfunction. &quot;2 driving cycle&quot; means that the ECM illuminates MIL if the same malfunction is detected again in the 2nd driving cycle.</td>
</tr>
<tr>
<td>Component operating range</td>
<td>Normal operation range of sensors and solenoids under normal driving conditions. Use these ranges as a reference. They cannot be used to judge if a sensor or solenoid is defective or not.</td>
</tr>
</tbody>
</table>

**PARTS LOCATION**
SYSTEM DIAGRAM

The configuration of the electronic control system in the U151E automatic transaxles is as shown in the following chart.
Fig. 2: Automatic Transmission System Diagram  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYSTEM DESCRIPTION

1. SYSTEM DESCRIPTION  
   a. The ECT (Electronic controlled automatic transmission/transaxle) is an automatic  
      transmission/transaxle that electronically controls shift timing using the ECM. The ECM detects  
      electrical signals that indicate engine and driving conditions, and controls the shift point, based on
driver habits and road conditions. As a result, fuel efficiency and power transmission performance are improved.

Shift shock has been reduced by controlling the engine and transmission simultaneously. In addition, the ECT has features such as follows:

- Diagnostic function.
- Fail-safe function when a malfunction occurs.

**HOW TO PROCEED WITH TROUBLESHOOTING**

**HINT:**

- The ECM of this system is connected to the CAN and multiplex communication system. Therefore, before starting troubleshooting, make sure to check that there is no trouble in the CAN and multiplex communication systems.
- Techstream can be used at steps 3, 4, 6, and 9.

1. **Vehicle Brought to Workshop**
2. **Customer Problem Analysis**
3. **Connect Techstream to DLC3**
4. **Check and Clear DTCs and Freeze Frame Data**

**HINT:**

*See **DTC CHECK / CLEAR**.*

5. **Visual Inspection**
6. **Setting the Check Mode Diagnosis**

**HINT:**

(See **CHECK MODE PROCEDURE**).

7. **Problem Symptom Confirmation**

**HINT:**

(See **HOW TO PROCEED WITH TROUBLESHOOTING**).

Symptom does not occur: Go to step 8

Symptom occurs: Go to step 9

8. **Symptom Simulation**
HINT:
(See **HOW TO PROCEED WITH TROUBLESHOOTING**).

9. **DTC Check**

HINT:
(See **DTC CHECK / CLEAR**).

DTC is not output: Go to step 10
DTC is output: Go to step 17

10. **Basic Inspection**

HINT:
(See **INSPECTION, ON-VEHICLE INSPECTION** and **ADJUSTMENT**).

NG: Go to step 19
OK: Go to Next Step

11. **Mechanical System Test**

HINT:
(See **MECHANICAL SYSTEM TESTS**).

NG: Go to step 16
OK: Go to Next Step

12. **Hydraulic Test**

HINT:
(See **HYDRAULIC TEST**).

NG: Go to step 16
OK: Go to Next Step

13. **Manual Shifting Test**
HINT:

(See MANUAL SHIFTING TEST).

NG: Go to step 15

OK: Go to Next Step

14. Problem Symptoms Table Chapter 1

HINT:

(See PROBLEM SYMPTOMS TABLE).

NG: Go to step 18

OK: Go to Next Step

15. Problem Symptoms Table Chapter 2

HINT:

(See PROBLEM SYMPTOMS TABLE).

16. Part Inspection

Go to step 19

17. DTC Chart

HINT:

(See DIAGNOSTIC TROUBLE CODE CHART).

18. Circuit Inspection
19. Repair or Replace
20. Confirmation Test

NEXT: End

ROAD TEST

1. PROBLEM SYMPTOM CONFIRMATION
   a. Based on the result of the customer problem analysis, try to reproduce the symptoms. If the problem is that the transaxle does not shift up, shift down, or the shift point is too high or too low, conduct the following road test referring to the automatic shift schedule and simulate the problem
symptoms.

2. **ROAD TEST**

**NOTE:** Perform the test at the ATF temperature 50 to 80°C (122 to 176°F) in the normal operation.

a. D position test:

Shift into the D position and fully depress the accelerator pedal and check the following points.

1. Check up-shift operation.

   Check that 1 --> 2, 2 --> 3, 3 --> 4 and 4 --> 5th upshifts take place, and that the shift points conform to the automatic shift schedule (See [SERVICE DATA](#)).

   **HINT:**

   5th Gear Up-shift Prohibition Control

   - Engine coolant temperature is 55°C (131°F) or less and vehicle speed is at 80 km/h (176 mph) or less.
   - ATF temperature is -2°C (28°F) or less.

   4th Gear Up-shift Prohibition Control

   - Coolant temperature is 47°C (117°F) or less and vehicle speed is at 55 km/h (34 mph) or less.

   5th and 4th Gear Lock-up Prohibition Control

   - Brake pedal is depressed.
   - Accelerator pedal is released.
   - Coolant temperature is 60°C (140°F) or less.

2. Check for shift shock and slip.

   Check for shock and slip at the 1 --> 2, 2 --> 3, 3 --> 4 and 4 --> 5th up-shifts.

3. Check for abnormal noise and vibration.

   Drive in the D position lock-up or 5th gear, and check for abnormal noises and vibration.

   **HINT:**

   The check for the cause of abnormal noise and vibration must be done very thoroughly as it could also be due to loss of balance in the differential, torque converter clutch, etc.
4. Check kick-down operation.

Check that the possible kick-down vehicle speed limits for 2nd to 1st, 3rd to 2nd, 4th to 3rd, 5th to 4th kick-downs conform to those indicated on the automatic shift schedule while driving through all gears with the shift lever in the D position (See SERVICE DATA).

5. Check for abnormal shock and slip at kick-down.

6. Check the lock-up mechanism.
   - Drive in D position (5th gear), at a steady speed (lock-up ON).
   - Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

   HINT:
   - There is no lock-up in the 1st and 2nd gear.
   - 4th lock-up operates while uphill-downhill control is active in D position.
   - 3rd lock-up operates while uphill-downhill control is active in D position.
   - ATF temperature is 120°C (248°F) or more.
   - If there is a big jump in engine speed, there is no lock-up.

b. 4 (O/D OFF) position test:

Shift into the 4 position and fully depress the accelerator pedal and check the following points.

1. Check up-shift operation.

Check that the 1 --> 2, 2 --> 3 and 3 --> 4 up-shift take place and that the shift point conforms to the automatic shift schedule (See SERVICE DATA).

   HINT:

   There is no 5th up-shift in the 4 position.

2. Check engine braking.

While driving in the 4 position and 4th gear, release the accelerator pedal and check the engine braking effect.

3. Check for abnormal noise during acceleration and deceleration, and for shock at up-shift and down-shift.

c. 3 position test:

Shift into the 3 position and fully depress the accelerator pedal and check the following points.

1. Check up-shift operation.
Check that the 1 --> 2 and 2 --> 3 up-shift take place and that the shift point conforms to the automatic shift schedule (See SERVICE DATA).

HINT:

There is no 4th up-shift and lock-up in the 3 position.

2. Check engine braking.

While running in the 3 position and 3rd gear, release the accelerator pedal and check the engine braking effect.

3. Check for abnormal noise during acceleration and deceleration, and for shock at up-shift and down-shift.

d. 2 position test:

Shift into the 2 position and fully depress the accelerator pedal and check the following points.

1. Check up-shift operation.

Check that the 1 --> 2 up-shift takes place and that the shift point conforms to the automatic shift schedule (See SERVICE DATA).

HINT:

There is no 3rd up-shift and lock-up in the 2 position.

2. Check engine braking.

While running in the 2 position and 2nd gear, release the accelerator pedal and check the engine braking effect.

3. Check for abnormal noise during acceleration and deceleration, and for shock at up-shift and down-shift.

e. L position test:

Shift into the L position and fully depress the accelerator pedal and check the following points.

1. Check no up-shift.

While running in the L position, check that there is no up-shift to 2nd gear.

HINT:

There is no lock-up in the L position.
2. Check engine braking.

While running in the L position, release the accelerator pedal and check the engine braking effect.

3. Check for abnormal noise during acceleration and deceleration.
f. R position test:

Shift into the R position and fully depress the accelerator pedal and check for slipping.

**CAUTION: Before conducting this test ensure that the test area is free from people and obstruction.**

g. P position test:

Stop the vehicle on the grade (more than 5°) and after shifting into the P position, release the parking brake. Then, check that the parking lock pawl holds the vehicle in place.

h. Uphill/downhill control function test:
   1. Check that the gear does not up-shift to the 4th or 5th gear while the vehicle is driving uphill.
   2. Check that the gear automatically down-shifts from 5th to 4th or from the 4th to 3rd gear when brake is applied while the vehicle is driving downhill.

**MECHANICAL SYSTEM TESTS**

1. **PERFORM MECHANICAL SYSTEM TESTS**
   
a. Measure the stall speed.

The object of this test is to check the overall performance of the transaxle and engine by measuring the stall speeds in the D position.

**NOTE:**

- Driving test should be done on a paved road (a nonskid road).
- Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature 50 to 80°C (122 to 176°F).
- Do not continuously run this test for longer than 10 seconds.
- To ensure safety, do this test in a wide, clear level area which provides good traction.
- The stall test should always be carried out in pairs. One technician should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is doing the test.

1. Chock the 4 wheels.
2. Connect Techstream to the DLC3.
3. Fully apply the parking brake.
4. Keep your left foot pressed firmly on the brake pedal.
5. Start the engine.
6. Shift into the D position. Press all the way down on the accelerator pedal with your right foot.
7. Quickly read the stall speed at this time.

**Stall speed:** 2,300+-150 rpm

**Evaluation:**

**EVALUATION CHART**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Stall engine speed is low in D position</td>
<td>• Engine power output may be insufficient</td>
</tr>
<tr>
<td></td>
<td>• Stator one-way clutch not operating properly</td>
</tr>
<tr>
<td></td>
<td><strong>HINT:</strong></td>
</tr>
<tr>
<td></td>
<td>If the value is less than the specified value by 600</td>
</tr>
<tr>
<td></td>
<td>rpm or more, the torque converter could be</td>
</tr>
<tr>
<td></td>
<td>faulty.</td>
</tr>
<tr>
<td>(b) Stall engine speed is high in D position</td>
<td>• Line pressure is too low</td>
</tr>
<tr>
<td></td>
<td>• Forward clutch slipping</td>
</tr>
<tr>
<td></td>
<td>• U/D (Underdrive) brake slipping</td>
</tr>
<tr>
<td></td>
<td>• U/D (Underdrive) one-way clutch is not</td>
</tr>
<tr>
<td></td>
<td>operating properly</td>
</tr>
<tr>
<td></td>
<td>• No.1 one-way clutch not operating properly</td>
</tr>
<tr>
<td></td>
<td>• Improper fluid level</td>
</tr>
</tbody>
</table>

b. Measure the time lag.

1. When the shift lever is shifted while the engine is idling, there will be a certain time lapse or lag before the shock can be felt. This is used for checking the condition of the clutch and brake.

**NOTE:**

- Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature: 50 to 80°C (122 to 176°F).
- Be sure to allow 1 minute interval between tests.
- Perform the test three times, and measure the time lags. Calculate the average value of the three time lags.
2. Connect Techstream to the DLC3.
3. Fully apply the parking brake.
4. Start and warm up the engine and check idle speed.

**Idle speed: approx. 700 rpm (In N position and A/C OFF)**

5. Shift the lever from N to D position. Using a stop watch, measure the time from when the lever is shifted until the shock is felt.

**Time lag: N --> D less than 1.2 seconds**

6. In the same way, measure the time lag for N --> R.

**Time lag: N --> R less than 1.5 seconds**

**Evaluation (If N --> D or N --> R time lag is longer than the specified):**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>N --&gt; D time lag is longer</td>
<td>• Line pressure is too low</td>
</tr>
<tr>
<td></td>
<td>• Forward clutch worn</td>
</tr>
<tr>
<td></td>
<td>• No.1 one-way clutch is not operating properly</td>
</tr>
<tr>
<td></td>
<td>• U/D (Underdrive) one-way clutch is not operating</td>
</tr>
<tr>
<td></td>
<td>• U/D (Underdrive) brake worn</td>
</tr>
<tr>
<td>N --&gt; R time lag is longer</td>
<td>• Line pressure is too low</td>
</tr>
<tr>
<td></td>
<td>• Reverse clutch worn</td>
</tr>
<tr>
<td></td>
<td>• 1st and reverse brake worn</td>
</tr>
<tr>
<td></td>
<td>• U/D (Underdrive) brake worn</td>
</tr>
</tbody>
</table>

**HYDRAULIC TEST**

1. **PERFORM HYDRAULIC TEST**
   a. Measure the line pressure.

**NOTE:**
- Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature: 50 to 80°C (122 to 176°F).
- The line pressure test should always be carried out in pairs.
One technician should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is performing the test.

- Be careful to prevent SST hose from interfering with the exhaust pipe.
- This Check must be conducted after checking and adjusting engine.
- Perform under condition that A/C is OFF.
- When conducting stall test, do not continue more than 10 seconds.

**Fig. 3: Measuring Line Pressure**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

1. Warm up the ATF (Automatic Transmission Fluid).
2. Lift the vehicle up.
3. Remove the engine under cover.
4. Connect Techstream to the DLC3.
5. Remove the test plug A on the transaxle case front left side and install the SST.
SST 09992-00095 (09992-00231, 09992-00271)

NOTE: There is a difference in installation point between D position and R position.

6. Start the engine.
7. Using Techstream, shift to D position and hold 3rd gear by active test, and measure the line pressure in idling.

Specified line pressure:

**LINE PRESSURE SPECIFICATION**

<table>
<thead>
<tr>
<th>Condition</th>
<th>D position kPa (kgf/cm², psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idling</td>
<td>372 to 412 kPa (3.8 to 4.2 kgf/cm², 54 to 60 psi)</td>
</tr>
</tbody>
</table>

8. Turn the ignition switch off.
9. Disconnect the connector of the transmission wire.

HINT:

Disconnect the connector only when performing the D position stall test.

10. Start the engine.
11. Firmly depress the brake pedal, shift to the D position, depress the accelerator pedal all the way down and check the line pressure while the stall test is performed.

Specified line pressure:

**LINE PRESSURE SPECIFICATION**

<table>
<thead>
<tr>
<th>Condition</th>
<th>D position kPa (kgf/cm², psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stall test</td>
<td>931 to 1,031 kPa (9.5 to 10.5 kgf/cm², 135 to 150 psi)</td>
</tr>
</tbody>
</table>

12. Turn the ignition switch off.
13. Remove the SST, install the test plug A.
14. Remove the test plug B, install the SST and start engine.
Fig. 4: Locating Transmission Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09992-00095 (09992-00231, 09992-00271)

15. Connect the transmission wire connector, depress the brake pedal firmly, shift to the R position and check that the line pressure while the engine is idling and during the stall test.

Specified line pressure:

LINE PRESSURE SPECIFICATION

<table>
<thead>
<tr>
<th>Condition</th>
<th>R position kPa (kgf / cm², psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idling</td>
<td>672 to 742 kPa (6.9 to 7.6 kgf/cm², 97 to 108 psi)</td>
</tr>
<tr>
<td>Stall test</td>
<td>1,768 to 1,968 kPa (18.0 to 20.1 kgf/cm², 256 to 285 psi)</td>
</tr>
</tbody>
</table>

16. Remove the SST, install the test plug B.
17. Clear the DTC.

Evaluation:

EVALUATION CHART

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
</tr>
</thead>
</table>

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MANUAL SHIFTING TEST

1. PERFORM MANUAL SHIFTING TEST

HINT:

- With this test, it can be determined whether the trouble occurs in the electrical circuit or is a mechanical problem in the transaxle.
- If any abnormalities are found in the following test, the problem is in the transaxle itself.
  a. Disconnect the connector of the transmission wire.
  b. Drive with the transmission wire disconnected. Shifting the shift lever in the order of L, 2, 3, 4 and D position to check whether the shifting condition changes the table below.

<table>
<thead>
<tr>
<th>Shift Position</th>
<th>Shifting Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>L &lt;----&gt; 2</td>
<td>No Shift (Not Change)</td>
</tr>
<tr>
<td>2 &lt;----&gt; 3</td>
<td>Down Shift &lt;--&gt; Up Shift</td>
</tr>
<tr>
<td>3 &lt;----&gt; 4 D</td>
<td>No Shift (Not Change)</td>
</tr>
</tbody>
</table>

HINT:

When driving with the transmission wire disconnected, the shift lever position is in L or 2, the gear position is held in 3rd and the shift lever position is in 3, 4 or D, the gear position is held in 4th. However, when the shift position is in R or P, the operation is same as usual.

c. Connect the connector of the transmission wire.
d. Clear the DTC (See DTC CHECK / CLEAR).
INITIALIZATION

1. RESET MEMORY

NOTE:

- Perform the RESET MEMORY (AT initialization) when replacing the automatic transaxle assembly, engine assembly or ECM.
- The RESET MEMORY can be performed only with Techstream.

HINT:

The ECM memorizes the condition that the ECT controls the automatic transaxle assembly and engine assembly according to those characteristics. Therefore, when the automatic transaxle assembly, engine assembly, or ECM has been replaced, it is necessary to reset the memory so that the ECM can memorize the new information. Reset procedure is as follows.

a. Turn the engine switch off.
b. Connect Techstream to the DLC3.
c. Turn the ignition switch to the ON position and push the Techstream main switch on.
d. Enter the following menus: Powertrain / Engine and ECT / Utility / Reset Memory. Then, press "Next".
e. Perform the reset memory procedure from the main menu.
CAUTION: After performing the RESET MEMORY, be sure to perform the ROAD TEST described earlier.

HINT:

The ECM is learned by performing the ROAD TEST.

MONITOR DRIVE PATTERN

1. MONITOR DRIVE PATTERN FOR ECT TEST
   a. Perform this drive pattern as one method to simulate the detection conditions of the ECT malfunctions. (The DTCs may not be detected due to the actual driving conditions. And some codes may not be detected through this drive pattern.)

   HINT:

   Preparation for driving

   - Warm up the engine sufficiently. (Engine coolant temperature is 60°C (140°F) or higher)
   - Drive the vehicle when the atmospheric temperature is -10°C (14°F) or higher. (Malfunction is not detected when the atmospheric temperature is less than -10°C

   Driving note

   - Drive the vehicle through all gears.

   Stop --> 1st --> 2nd --> 3rd --> 4th --> 5th --> 5th (lock-up ON).

   - Repeat the above driving pattern three times or more.

NOTE:

- The monitor status can be checked using Techstream. When using Techstream, monitor status can be found in the "Powertrain / Engine or ECT / Data List".
- In the event that the drive pattern must be interrupted (possibly due to traffic conditions or other factors), the drive pattern can be resumed in most cases, the monitor can be completed.
- Perform this drive pattern on a level road as much as possible and strictly observe the posted speed limits and traffic laws while driving.
HINT:

*1: Drive at such a speed in the uppermost gear, to engage lock-up. The vehicle can be driven at a speed lower than that in the above diagram under the lock-up condition.

NOTE: If necessary to drive the vehicle for approximately 30 minutes to detect DTC P0711 (ATF temperature sensor malfunction).

PROBLEM SYMPTOMS TABLE

HINT:

- If a normal code is displayed during the diagnostic trouble code check although the trouble still occurs, check the electrical circuits for each symptom in the order given in the following charts.
- The Matrix Chart is divided into 2 chapters.
- When the circuit on which mark *1 is attached is a malfunction, DTC could be output.

Refer to the table below when the trouble cause is considered to be electrical. If the instruction PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE is given in the flowchart of each circuit, inspect the suspected areas in descending order for each symptom. If the trouble still occurs even though there are no abnormalities in the inspections listed for the symptoms, check and replace the ECM.
# Chapter 1: Electronic Circuit Matrix Chart

## Problem Symptoms Table

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Suspected Area</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>No down-shift (A particular gear, from 1st to 4th gear, is not down-shifted)</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td></td>
<td>Transmission control switch (D &lt;---&gt; 4 position) circuit</td>
<td>DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)</td>
</tr>
<tr>
<td>No down-shift (5th -&gt; 4th)</td>
<td>Shift solenoid valve S4 circuit *1</td>
<td>DTC P0982 SHIFT SOLENOID &quot;D&quot; CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S4); DTC P0983 SHIFT SOLENOID &quot;D&quot; CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S4)</td>
</tr>
<tr>
<td></td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td>No up-shift (A particular gear, from 1st to 4th gear, is not up-shifted)</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td></td>
<td>Transmission control switch (D &lt;---&gt; 4 position) circuit</td>
<td>DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)</td>
</tr>
<tr>
<td>No up-shift (4th -&gt; 5th)</td>
<td>Shift solenoid valve S4 circuit *1</td>
<td>DTC P0982 SHIFT SOLENOID &quot;D&quot; CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S4); DTC P0983 SHIFT SOLENOID &quot;D&quot; CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S4)</td>
</tr>
<tr>
<td></td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td>No lock-up</td>
<td>Stop light switch circuit *1</td>
<td>DTC P0724 BRAKE SWITCH &quot;B&quot; CIRCUIT HIGH</td>
</tr>
<tr>
<td></td>
<td>Engine coolant temp, sensor circuit *1</td>
<td>DIAGNOSTIC TROUBLE CODE CHART</td>
</tr>
<tr>
<td></td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td>No lock-up off</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td></td>
<td>Throttle position sensor circuit *1</td>
<td>DIAGNOSTIC TROUBLE CODE</td>
</tr>
<tr>
<td>Shift point too high or too low</td>
<td>ECM</td>
<td>CHART</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Transmission control switch (D (\rightarrow) 4 position) circuit</td>
<td>DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Up-shift to 5th from 4th while shift lever is in 4 position</th>
<th>ECM</th>
<th>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine coolant temp, sensor circuit *1</td>
<td>DIAGNOSTIC TROUBLE CODE CHART</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Up-shift to 5th from 4th while engine is cold</th>
<th>ECM</th>
<th>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission control switch (L (\rightarrow) 2 position) circuit *1</td>
<td>DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Up-shift to 2nd from 1st while shift lever is in L position</th>
<th>ECM</th>
<th>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve SL1 circuit *1</td>
<td>DTC P0748 PRESSURE CONTROL SOLENOID &quot;A&quot; ELECTRICAL (SHIFT SOLENOID VALVE SL1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Harsh engagement (N (\rightarrow) D)</th>
<th>ECM</th>
<th>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harsh engagement (Lock-up)</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td>Harsh engagement (Any driving position)</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td>Poor acceleration</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td>No kick-down</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
<tr>
<td>Engine stalls when starting off or stopping</td>
<td>ECM</td>
<td>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Malfunction in shifting</th>
<th>ECM</th>
<th>HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Park/neutral position switch circuit *1</td>
<td>DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)</td>
<td></td>
</tr>
<tr>
<td>Transmission control switch (D (\rightarrow) 4 position) circuit</td>
<td>DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)</td>
<td></td>
</tr>
</tbody>
</table>
## Chapter 2: On-Vehicle Repair and Off-Vehicle Repair

### PROBLEM SYMPTOMS TABLE - ON-VEHICLE REPAIR AND OFF-VEHICLE REPAIR

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Suspected Area</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle does not move in any forward position and in reverse positions</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td></td>
<td>U/D brake (B3)</td>
<td><strong>AUTOMATIC TRANSAXLE UNIT</strong></td>
</tr>
<tr>
<td></td>
<td>Torque converter clutch</td>
<td><strong>TORQUE CONVERTER CLUTCH AND DRIVE PLATE</strong></td>
</tr>
<tr>
<td>Vehicle does not move in R position</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td></td>
<td>Reverse clutch (C2)</td>
<td><strong>AUTOMATIC TRANSAXLE UNIT</strong></td>
</tr>
<tr>
<td></td>
<td>1st and reverse brake (B2)</td>
<td><strong>AUTOMATIC TRANSAXLE UNIT</strong></td>
</tr>
<tr>
<td>No up-shift (1st -&gt; 2nd)</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td></td>
<td>2nd and O/D brake (B1)</td>
<td><strong>AUTOMATIC TRANSAXLE UNIT</strong></td>
</tr>
<tr>
<td>No up-shift (2nd -&gt; 3rd)</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td></td>
<td>Direct and O/D clutch (CO)</td>
<td><strong>AUTOMATIC TRANSAXLE UNIT</strong></td>
</tr>
<tr>
<td>No up-shift (3rd -&gt; 4th)</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td></td>
<td>2nd and O/D brake (B1)</td>
<td><strong>AUTOMATIC TRANSAXLE UNIT</strong></td>
</tr>
<tr>
<td>No up-shift (4th -&gt; 5th)</td>
<td>Shift solenoid valve S4</td>
<td><strong>DTC P0766 SHIFT SOLENOID &quot;D&quot; PERFORMANCE (SHIFT SOLENOID VALVE S4)</strong></td>
</tr>
<tr>
<td></td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td></td>
<td>U/D clutch (C3)</td>
<td><strong>AUTOMATIC TRANSAXLE UNIT</strong></td>
</tr>
<tr>
<td>No down-shift (5th -&gt; 4th)</td>
<td>Shift solenoid valve S4</td>
<td><strong>DTC P0766 SHIFT SOLENOID &quot;D&quot; PERFORMANCE (SHIFT SOLENOID VALVE S4)</strong></td>
</tr>
<tr>
<td>No down-shift (4th -&gt; 3rd)</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td>No down-shift (3rd -&gt; 2nd)</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td>No down-shift (2nd -&gt; 1st)</td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td>No lock-up or No lock-up off</td>
<td>Shift solenoid valve DSL</td>
<td><strong>DTC P0741 TORQUE CONVERTER CLUTCH SOLENOID PERFORMANCE (SHIFT SOLENOID VALVE DSL)</strong></td>
</tr>
<tr>
<td></td>
<td>Valve body assembly</td>
<td><strong>VALVE BODY ASSEMBLY</strong></td>
</tr>
<tr>
<td></td>
<td>Torque converter clutch</td>
<td><strong>TORQUE CONVERTER</strong></td>
</tr>
<tr>
<td>Condition</td>
<td>Component Details</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (N -&gt; D)</td>
<td>Shift solenoid valve SL1, DTC P0746 PRESSURE CONTROL SOLENOID &quot;A&quot; PERFORMANCE (SHIFT SOLENOID VALVE SL1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valve body assembly, VALVE BODY ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C1 accumulator, AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forward clutch (C1), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 1 one-way clutch (F1), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U/D one-way clutch (F2), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (Lock-up)</td>
<td>Shift solenoid valve SL2, DTC P0776 PRESSURE CONTROL SOLENOID &quot;B&quot; PERFORMANCE (SHIFT SOLENOID VALVE SL2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valve body assembly, VALVE BODY ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Torque converter clutch, TORQUE CONVERTER CLUTCH AND DRIVE PLATE</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (N -&gt; R)</td>
<td>Shift solenoid valve SLT, DTC P2716 PRESSURE CONTROL SOLENOID &quot;D&quot; ELECTRICAL (SHIFT SOLENOID VALVE SLT)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valve body assembly, VALVE BODY ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C2 accumulator, AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reverse clutch (C2), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1st and reverse brake (B2), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (1st -&gt; 2nd -&gt; 3rd -&gt; 4th -&gt; 5th)</td>
<td>Shift solenoid valve SLT, DTC P2716 PRESSURE CONTROL SOLENOID &quot;D&quot; ELECTRICAL (SHIFT SOLENOID VALVE SLT)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valve body assembly, VALVE BODY ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (1st -&gt; 2nd)</td>
<td>Valve body assembly, VALVE BODY ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd and O/D brake (B1), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (2nd -&gt; 3rd)</td>
<td>Valve body assembly, VALVE BODY ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO accumulator, AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Direct and O/D clutch (CO), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (3rd -&gt; 4th)</td>
<td>Valve body assembly, VALVE BODY ASSEMBLY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd and O/D brake (B1), AUTOMATIC TRANSMAXLE UNIT</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Component Details</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (4th -&gt; 5th)</td>
<td>Valve body assembly, C3 accumulator, U/D clutch (B3)</td>
<td></td>
</tr>
<tr>
<td>Harsh engagement (5th -&gt; 4th)</td>
<td>Valve body assembly, B3 accumulator</td>
<td></td>
</tr>
<tr>
<td>Slip or shudder (Forward and reverse: After warm-up)</td>
<td>Valve body assembly, Oil strainer, Direct and O/D clutch (CO), Forward clutch (C1), U/D clutch (C3), 2nd and brake (B1), U/D brake (B3), No. 1 one-way clutch (F1), U/D one-way clutch (F2), Torque converter clutch</td>
<td></td>
</tr>
<tr>
<td>Slip or shudder (Particular position: Just after engine starts)</td>
<td>Torque converter clutch, Reverse clutch (C2), 1st and reverse brake (B2)</td>
<td></td>
</tr>
<tr>
<td>Slip or shudder (R position)</td>
<td>Forward clutch (C1), No. 1 one-way clutch (F1), U/D one-way clutch (F2)</td>
<td></td>
</tr>
<tr>
<td>Slip or shudder (1st)</td>
<td>Forward clutch (C1), No. 1 one-way clutch (F1), U/D one-way clutch (F2)</td>
<td></td>
</tr>
<tr>
<td>Slip or shudder (2nd)</td>
<td>2nd and O/D brake (B1)</td>
<td></td>
</tr>
<tr>
<td>Slip or shudder (3rd)</td>
<td>Direct and O/D clutch (CO)</td>
<td></td>
</tr>
<tr>
<td>Slip or shudder (4th)</td>
<td>2nd and O/D brake (B1)</td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>Component</td>
<td>Code/Message</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Slip or shudder (5th)</td>
<td>U/D clutch (C3)</td>
<td>AUTOMATIC TRANSAXLE UNIT</td>
</tr>
<tr>
<td>Shift position too high or too low</td>
<td>Shift solenoid valve SLT</td>
<td>DTC P2716 PRESSURE CONTROL SOLENOID &quot;D&quot; ELECTRICAL (SHIFT SOLENOID VALVE SLT)</td>
</tr>
<tr>
<td>No engine braking (1st +- 4th: D position)</td>
<td>U/D brake (B3)</td>
<td>AUTOMATIC TRANSAXLE UNIT</td>
</tr>
<tr>
<td>No engine braking (1st: L (1) position)</td>
<td>Valve body assembly</td>
<td>VALVE BODY ASSEMBLY</td>
</tr>
<tr>
<td>No engine braking (2nd: 2 position)</td>
<td>Valve body assembly</td>
<td>AUTOMATIC TRANSAXLE UNIT</td>
</tr>
<tr>
<td>No engine braking (3rd: 3 position)</td>
<td>Valve body assembly</td>
<td>AUTOMATIC TRANSAXLE UNIT</td>
</tr>
<tr>
<td>No kick-down</td>
<td>Valve body assembly</td>
<td>AUTO TOMATIC TRANSAXLE UNIT</td>
</tr>
<tr>
<td>Poor acceleration (All positions)</td>
<td>Shift solenoid valve SLT</td>
<td>DTC P2716 PRESSURE CONTROL SOLENOID &quot;D&quot; ELECTRICAL (SHIFT SOLENOID VALVE SLT)</td>
</tr>
<tr>
<td>Poor acceleration (5th)</td>
<td>U/D clutch (C3)</td>
<td>AUTOMATIC TRANSAXLE UNIT</td>
</tr>
<tr>
<td>Poor acceleration (5th)</td>
<td>U/D planetary gear unit</td>
<td>AUTOMATIC TRANSAXLE UNIT</td>
</tr>
<tr>
<td>Engine stalls when starting off or stopping</td>
<td>Shift solenoid valve DSL</td>
<td>DTC P0741 TORQUE CONVERTER CLUTCH SOLENOID PERFORMANCE (SHIFT SOLENOID VALVE DSL)</td>
</tr>
</tbody>
</table>

**TERMINALS OF ECM**

1. **ECM**
HINT:

Each ECM terminal's standard voltage is shown in the table below.

In the table, first follow the information under "Condition". Look under "Symbols (Terminal No.)" for the terminals to inspected. The standard voltage between the terminals is shown under "Specific Condition".

Use the illustration above as a reference for the ECM terminals.

### ECM TERMINALS VOLTAGE SPECIFICATION

<table>
<thead>
<tr>
<th>Symbols (Terminals No.)</th>
<th>Wiring Color</th>
<th>Terminal Description</th>
<th>Condition</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>L(E5-9)-E1(E11-1)</td>
<td>L-BR</td>
<td>L shift position switch signal</td>
<td>IG switch ON and shift lever L position</td>
<td>11 to 14 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IG switch ON and shift lever other than L position</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>2(E5-10)-E1 (E11-1)</td>
<td>Y-G - BR</td>
<td>2 shift position switch signal</td>
<td>IG switch ON and shift lever 2 and L position</td>
<td>11 to 14 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IG switch ON and shift lever other than 2 and L position</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>D(E5-21)-E1(E11-1)</td>
<td>L-W - BR</td>
<td>D shift position switch signal</td>
<td>IG switch ON and shift lever D and 4 position</td>
<td>11 to 14 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IG switch ON and shift lever other than D and 4 position</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>R(E5-11)-E1(E11-1)</td>
<td>R-B - BR</td>
<td>R shift position switch signal</td>
<td>IG switch ON and shift lever R position</td>
<td>11 to 14 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IG switch ON and shift lever other than R position</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>SPD(E5-8)-E1</td>
<td>V-W - BR</td>
<td>Speed signal</td>
<td>Vehicle speed 20</td>
<td>Pulse generation</td>
</tr>
</tbody>
</table>

Fig. 7: Identifying ECM Terminals

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
<table>
<thead>
<tr>
<th>Part Number</th>
<th>Function</th>
<th>Signal Details</th>
</tr>
</thead>
</table>
| STP(E4-15)-E1 (E11-1) | G-W - BR  Stop light switch signal | Brake pedal is depressed: 7.5 to 14 V  
Brake pedal is released: Below 1.5 V |
| 3(E5-19)-E1 (E11-1) | G-BR  3 shift position switch signal | IG switch ON and shift lever 3 position: 11 to 14 V  
IG switch ON and shift lever other than 3 position: Below 1 V |
| 4(E5-20)-E1 (E11-1) | B-W - BR  4 shift position switch signal | IG switch ON and shift lever 4 position: 11 to 14 V  
IG switch ON and shift lever other than 4 position: Below 1 V |
| NSW (STAR) (E10-8) - E1 (E11-1) | B-Y - BR  Park neutral switch signal | IG switch ON and shift lever P and N position: Below 1 V  
IG switch ON and shift lever other than P and N position: 11 to 14 V |
| P(E5-23)-E1 (E11-1) | L-Y - BR  Park position switch signal | IG switch ON and shift lever P position: 11 to 14 V  
IG switch ON and shift lever other than P position: Below 1 V |
| N(E5-22)-E1 (E11-1) | Y-R - BR  Neutral position switch signal | IG switch ON and shift lever N position: 11 to 14 V  
IG switch ON and shift lever other than N position: Below 1 V |
| DSL(E10-11)-E1 (E11-1) | Y-G - BR  DSL solenoid signal | Vehicle speed 65 km/h (40 mph), lock-up (ON to OFF): Pulse generation  
(See waveform 2) |
| SR(E10-9)-E1 (E11-1) | L-B - BR  SR solenoid signal | IG switch ON: Below 1 V  
3rd, 4th or 5th gear: 11 to 14 V  
1st or 2nd gear: Below 1 V |
| S4(E10-10)-E1 (E11-1) | L-W - BR  S4 solenoid signal | IG switch ON: Below 1 V  
5th gear: 11 to 14 V  
Except 5th gear: Below 1 V |
| SL3+ (E10-17) - SL3- (E10-16) | G-B - G-R  SL3 solenoid signal | Engine idle speed: Pulse generation  
(See waveform 3) |
### Waveform 1

<table>
<thead>
<tr>
<th>Reference</th>
<th>WAVEFORM REFERENCE (WAVEFORM 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal</td>
<td>SLT+ - SLT-</td>
</tr>
<tr>
<td>Tool setting</td>
<td>5 V/DIV, 1 ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Engine idle speed</td>
</tr>
</tbody>
</table>

#### Fig. 8: Waveform Graph (Waveform 1)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### Waveform 2

<table>
<thead>
<tr>
<th>Reference</th>
<th>WAVEFORM REFERENCE (WAVEFORM 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal</td>
<td>DSL-E1</td>
</tr>
<tr>
<td>Tool setting</td>
<td>10 V/DIV, 100ms./DIV</td>
</tr>
</tbody>
</table>
### Waveform 2

<table>
<thead>
<tr>
<th>Vehicle condition</th>
<th>Vehicle speed 65 km/h (40 mph), lock-up (ON to OFF)</th>
</tr>
</thead>
</table>

![Waveform Graph (Waveform 2)](image1)

**Fig. 9: Waveform Graph (Waveform 2)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Waveform 3

**Reference:**

**WAVEFORM REFERENCE (WAVEFORM 3)**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>SL3+ - SL3-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>5 V/DIV, 1 ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Engine idle speed</td>
</tr>
</tbody>
</table>

![Waveform Graph (Waveform 3)](image2)

**Fig. 10: Waveform Graph (Waveform 3)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Waveform 4

**Reference:**

**WAVEFORM REFERENCE (WAVEFORM 4)**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>SL2+ - SL2-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>5 V/DIV, 1 ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Engine idle speed</td>
</tr>
</tbody>
</table>
Fig. 11: Waveform Graph (Waveform 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Waveform 5

Reference:

**WAVEFORM REFERENCE (WAVEFORM 5)**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>SL1+-SL1-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>5 V/DIV, 1 ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Engine idle speed</td>
</tr>
</tbody>
</table>

Fig. 12: Waveform Graph (Waveform 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Waveform 6

Reference:

**WAVEFORM REFERENCE (WAVEFORM 6)**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>NC+-NC-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>1 V/DIV, 1 ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Vehicle speed 30 km/h (19 mph): (3rd gear)</td>
</tr>
<tr>
<td></td>
<td>Engine speed 1.400 rpm</td>
</tr>
</tbody>
</table>
g. Waveform 7

Reference:

<table>
<thead>
<tr>
<th>Terminal</th>
<th>NT+ - NT-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>5 V/DIV, 0.5ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Vehicle speed 20 km/h (12 mph)</td>
</tr>
</tbody>
</table>

h. Waveform 8

Reference:

<table>
<thead>
<tr>
<th>Terminal</th>
<th>SPD-E1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>5 V/DIV, 20ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Vehicle speed 20 km/h (12 mph)</td>
</tr>
</tbody>
</table>
DIAGNOSIS SYSTEM

1. DESCRIPTION
   a. When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is to connect Techstream to the vehicle, and read off various data output from the vehicle's ECM.
   b. OBD II regulations require that the vehicle's onboard computer illuminate the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in the computer itself or in the drive system components which affect the vehicle emissions. In addition to illuminating the MIL when a malfunction is detected, the applicable DTCs prescribed by SAE J2012 are recorded in the ECM memory (See DIAGNOSTIC TROUBLE CODE CHART).

   If the malfunction does not occur in 3 consecutive trips, the MIL goes off but the DTCs remain in the ECM memory.

c. To check the DTCs, connect Techstream to the DLC3 of the vehicle. Techstream also enables you to erase the DTCs and check freeze frame data and various forms of engine data (For operating instructions, see the instruction book).

d. The DTCs include SAE controlled codes and Manufacturer controlled codes. SAE controlled codes must be set as prescribed by the SAE, while Manufacturer controlled codes can be set freely by a manufacturer within the prescribed limits (See DIAGNOSTIC TROUBLE CODE CHART).

e. The diagnosis system operates in "normal mode" during the normal vehicle use. In normal mode,
"2-trip detection logic" is used to ensure accurate detection of malfunction. "Check mode" is also available to technicians as an option. In check mode, "1 -trip detection logic" is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent malfunction.

f. *2 trip detection logic: When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned off and then turned to the ON position again, and same malfunction is detected again, the MIL will illuminate.

g. Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air/fuel ratio was Lean or Rich, and other data from the time the malfunction occurred.

h. Techstream records freeze frame data in five different instances: 1) 3 times before the DTC is set, 2) once when the DTC is set, and 3) once after the DTC is set. These data can be used to simulate the vehicle's condition around the time when the malfunction occurred. The data may help find the cause of the malfunction, or judge if the DTC is being caused by temporary malfunction or not.

![DTC Timing Chart](image1)

Fig. 17: DTC Timing Chart
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT THE DLC3**

   a. The vehicle's ECM uses ISO 15765-4 for communication. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 15765-4 format.

   ![DLC3 Connector Terminals](image2)

Fig. 18: Identifying DLC3 Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
DLC3 CONNECTOR TERMINALS RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Terminal No.</th>
<th>Name</th>
<th>Reference Terminal</th>
<th>Result</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIL</td>
<td>7</td>
<td>Bus &quot;+&quot; line</td>
<td>5 - Signal ground</td>
<td>Pulse generation</td>
<td>During transmission</td>
</tr>
<tr>
<td>CG</td>
<td>4</td>
<td>Chassis ground</td>
<td>Body ground</td>
<td>Below 1 ohms</td>
<td>Always</td>
</tr>
<tr>
<td>SG</td>
<td>5</td>
<td>Signal ground</td>
<td>Body ground</td>
<td>Below 1 ohms</td>
<td>Always</td>
</tr>
<tr>
<td>BAT</td>
<td>16</td>
<td>Battery positive</td>
<td>Body ground</td>
<td>11 to 14 V</td>
<td>Always</td>
</tr>
<tr>
<td>CANH</td>
<td>6</td>
<td>HIGH-level CAN bus line</td>
<td>CANL</td>
<td>54 to 69 ohms</td>
<td>IG switch OFF</td>
</tr>
<tr>
<td>CANH</td>
<td>6</td>
<td>HIGH-level CAN bus line</td>
<td>Battery positive</td>
<td>6 kohms or higher</td>
<td>IG switch OFF</td>
</tr>
<tr>
<td>CANH</td>
<td>6</td>
<td>HIGH-level CAN bus line</td>
<td>CG</td>
<td>200 ohms or higher</td>
<td>IG switch OFF</td>
</tr>
<tr>
<td>CANL</td>
<td>14</td>
<td>LOW-level CAN bus line</td>
<td>Battery positive</td>
<td>6 kohms or higher</td>
<td>IG switch OFF</td>
</tr>
<tr>
<td>CANL</td>
<td>14</td>
<td>LOW-level CAN bus line</td>
<td>CG</td>
<td>200 ohms or higher</td>
<td>IG switch OFF</td>
</tr>
</tbody>
</table>

**CAUTION:** *: Before measuring the resistance, leave the vehicle as is for at least 1 minute and do not operate the ignition switch, any other switches or the doors.

**HINT:**

If your display shows UNABLE TO CONNECT TO VEHICLE when you have connected the cable of Techstream to the DLC3, turned the ignition switch to the ON position and operated the scan tool, there is a problem on the vehicle side or tool side.

- If the communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If the communication is still impossible when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Department listed in the tool's instruction manual.

3. **CHECK BATTERY VOLTAGE**
   a. Measure the battery voltage.

   **Battery voltage: 11 to 14 V**

   If voltage is below 11 V, replace the battery before proceeding.

4. **CHECK MIL**
a. The MIL comes on when the ignition switch is turned to the ON position and the engine is not running.

HINT:

If the MIL does not light up, troubleshoot the combination meter.

b. When the engine is started, the MIL should go off. If the lamp remains on, it means that the diagnosis system has detected a malfunction or abnormality in the system.

DTC CHECK / CLEAR

1. DTC CHECK (NORMAL MODE)

   NOTE: When the diagnostic system is switched from the normal mode to the check mode, all the DTCs and freeze frame data recorded in the normal mode will be erased. So before switching modes, always check the DTCs and freeze frame data, and note them down.

a. Checking DTCs using Techstream.
   1. Turn the ignition switch off.
   2. Connect Techstream to the DLC3.
   3. Turn the ignition switch to the ON position and turn Techstream main switch on.
   4. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
   5. Use Techstream to check the DTCs and freeze frame data and note them down (For operating instructions, see the Techstream's instruction book).

   NOTE: When simulating symptoms with Techstream to check the DTCs, use the normal mode. For codes on the DTCs chart which are subject to "2 trip detection logic",

   Turn the ignition switch off after the symptom is simulated once. Then repeat the simulation process again. When the problem has been simulated twice, the MIL illuminates and the DTCs are recorded in the ECM.

2. DTC CLEAR

   a. When using Techstream: Clearing the DTCs.
      1. Connect Techstream to the DLC3.
      2. Turn the ignition switch to the ON position and turn the Techstream main switch on.
      3. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Clear.

      HINT:

      When operating Techstream to erase the codes, the DTCs and freeze frame data will be
erased. (See the Techstream's instruction book for operating instructions.)

b. When not using Techstream: Clearing the DTCs.
   1. Disconnect the battery terminal or remove the EFI and ETCS fuses from the engine room J/B for 60 seconds or more. However, if you disconnect the battery terminal, perform the "INITIALIZE" procedure.

CHECK MODE PROCEDURE

HINT:

Check mode has a higher sensitivity to malfunctions and can detect malfunction that normal mode cannot detect. Check mode can also detect all the malfunctions that normal mode can detect. In check mode, DTCs are detected with 1-trip detection logic.

1. DTC CHECK (CHECK MODE)

HINT:

Techstream only: Compared to the normal mode, the check mode is more sensitive for detecting malfunctions. Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check mode.

   a. Procedure for Check Mode using Techstream.
      1. Check the initial conditions.
         • Battery positive voltage 11 V or more
         • Throttle valve fully closed
         • Transaxle in the P or N position
         • A/C switch is off
      2. Turn the ignition switch off.
      3. Connect Techstream to the DLC3.
      4. Turn the ignition switch to ON position and turn the Techstream main switch on.
      5. Enter the following menus: Powertrain / Engine and ECT / Utility / Check Mode.

NOTE: All DTCs and freeze frame data recorded will be erased if: 1) Techstream is used to change the ECM from normal mode to check mode or vice-versa; or 2) during check mode, the ignition switch is turned from the ON to ACC position or turned OFF.
6. Start the engine (the MIL goes off after the engine starts).
7. Perform "MONITOR DRIVE PATTERN" for the ECT test. (Or, simulate the conditions of the malfunction described by the customer).

**NOTE:** Leave the ignition switch in the ON position until you have checked the DTCs, etc.

8. After simulating malfunction conditions, use the Techstream diagnosis selector to check the DTCs and freeze frame data, etc.
9. When you use Techstream: Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. After checking the DTC, inspect the applicable circuit.
11. See [DIAGNOSTIC TROUBLE CODE CHART](#) to confirm the details of the DTCs.

2. **DTC CLEAR**
   a. When using Techstream: Clearing the DTCs.
      1. Connect Techstream to the DLC3.
      2. Turn the ignition switch to the ON position and turn the Techstream main switch on.
      3. When you use Techstream: Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Clear.

      **HINT:**
      When operating Techstream to erase the codes, the DTCs and freeze frame data will be erased. (See the Techstream's instruction book for operating instructions.)

   b. When not using Techstream: Clearing the DTCs.
      1. Disconnect the battery cable or remove the EFI and ETCS fuses from the engine room J/B for 60 seconds or more. However, if you disconnect the battery cable, perform the "INITIALIZE" procedure.

**FAIL-SAFE CHART**
1. **FAIL-SAFE**

This function minimizes the loss of the ECT functions when any malfunction occurs in a sensor or solenoid.

a. ATF (Automatic Transmission Fluid) temperature sensor:

When the ATF temperature sensor has a malfunction, 5th upshift is prohibited.

b. Counter gear speed sensor NC (Speed sensor NC): When the counter gear speed sensor has a malfunction, 5th upshift is prohibited.

c. Shift solenoid valve DSL:

When the solenoid valve DSL has a malfunction, the current to the solenoid valve is stopped. This stops lock-up control, then fuel economy decreases.

d. Shift solenoid valve SL1, SL2, SL3 and S4:

Fail safe function:

If either of the shift solenoid valve circuits develops an open or short, the ECM turns the other shift solenoid "ON" and "OFF" in order to shift into the gear positions shown in the table below.

Manual shifting as shown in the following table must be done (In case of a short circuit, the ECM stops sending the current to the short circuited solenoid).

Even if starting the engine in the fail-safe mode, the gear position remains in the same position.

**HINT:**

FL: Flex Lock-up

### FAIL-SAFE CHART

<table>
<thead>
<tr>
<th>Normal Solenoid Valve</th>
<th>SL1</th>
<th>ON</th>
<th>OFF</th>
<th>ON</th>
<th>OFF</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL1</td>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SL2</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>FL</td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>SL3</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gear Position</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL1 Malfunction (During driving at 1st or 2nd) Solenoid Valve</td>
<td>SL1</td>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SL2</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>FL to ON</td>
</tr>
<tr>
<td></td>
<td>SL3</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON to OFF</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON to OFF</td>
</tr>
<tr>
<td>Gear Position</td>
<td>1st to 2nd</td>
<td>2nd</td>
<td>3rd to 2nd</td>
<td>4th to 2nd</td>
<td>5th to 2nd</td>
</tr>
<tr>
<td>SL1</td>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTE: In the table below, the values listed under "Normal Condition" are
reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

a. Warm up the engine.
b. Turn the ignition switch off.
c. Connect Techstream to the DLC3.
d. Turn the ignition switch to the ON position.
e. Turn on the tester.
f. Select the item: Powertrain / Engine and ECT / Data List.
g. According to the display on the tester, read the "Data List".

### DATA LIST

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Measurement Item/Range</th>
<th>Normal Condition</th>
<th>Diagnostic Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop Light Switch</td>
<td>Stop light switch Status/ ON or OFF</td>
<td>- Brake Pedal is depressed: ON</td>
<td>-</td>
</tr>
<tr>
<td>Neutral Position SW signal</td>
<td>PNP switch Status/ ON or OFF</td>
<td>Shift lever position is; P and N: ON Except P and N: OFF</td>
<td>When the shift lever position displayed on the Intelligent tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect. HINT: When the failure still occurs even after adjusting these parts, See DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)</td>
</tr>
<tr>
<td>Shift SW Status (P Range)</td>
<td>PNP switch Status/ ON or OFF</td>
<td>Shift lever position is: P: ON Except P: OFF</td>
<td>?</td>
</tr>
<tr>
<td>Shift SW Status (N Range)</td>
<td>PNP switch Status/ ON or OFF</td>
<td>Shift lever position is: N:ON Except N: OFF</td>
<td>?</td>
</tr>
<tr>
<td>Shift SW Status (R Range)</td>
<td>PNP switch Status/ ON or OFF</td>
<td>Shift lever position is; R: ON Except R: OFF</td>
<td>?</td>
</tr>
<tr>
<td>Shift SW Status (D Range)</td>
<td>PNP switch Status/ ON or OFF</td>
<td>Shift lever position is; D and 4: ON Except D and 4: OFF</td>
<td>?</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Shift SW Status (2 Range)</td>
<td>PNP SW Status/ON or OFF</td>
<td>Shift lever position is; 2 and L: ON Except 2 and L: OFF</td>
<td>?</td>
</tr>
<tr>
<td>Shift SW Status (L Range)</td>
<td>PNP SW Status/ ON or OFF</td>
<td>Shift lever position is; L: ON Except L: OFF</td>
<td>?</td>
</tr>
<tr>
<td>Shift SW Status (4 or D)</td>
<td>PNP SW Status/ ON or OFF</td>
<td>Shift lever position is; 4: ON Except 4: OFF</td>
<td>?</td>
</tr>
<tr>
<td>Shift SW Status (3 Range)</td>
<td>PNP SW Status/ ON or OFF</td>
<td>Shift lever position is; 3: ON Except 3: OFF</td>
<td>?</td>
</tr>
<tr>
<td>Shift SW Status (L Range)</td>
<td>Actual Gear Position/ 1st, 2nd, 3rd, 4th or 5th (O/D)</td>
<td>Shift lever position is;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Lock Up</td>
<td>Lock Up Status/ ON or OFF</td>
<td>Lock Up: ON Except Lock Up: OFF</td>
<td>-</td>
</tr>
<tr>
<td>Lock Up Solenoid Status</td>
<td>Lock Up Solenoid Status/ ON or OFF</td>
<td>Lock Up: ON Except Lock Up: OFF</td>
<td>-</td>
</tr>
<tr>
<td>SLT Solenoid Status</td>
<td>Shift Solenoid SLT Status/ ON or OFF</td>
<td>Accelerator pedal is depressed: OFF Accelerator pedal is released: ON</td>
<td>-</td>
</tr>
<tr>
<td>A/T Oil Temperature 1</td>
<td>ATF Temp. Sensor Value/ min.: -40°C (-40°F) max.: 215°C (419°F)</td>
<td>After Stall Test; Approx. 80°C (176°F) Equal to ambient temperature when cold soak If the value is &quot;-40°C (-40°F)&quot; or &quot;215°C (419°F)&quot;n, ATF temp, sensor circuit is opened or shorted.</td>
<td>-</td>
</tr>
</tbody>
</table>

**HINT:**
2. **ACTIVE TEST**

**HINT:**

Using Techstream to perform Active Test allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Test early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Test.

a. Warm up the engine.

b. Turn the ignition switch off.

c. Connect Techstream to the DLC3.

d. Turn the ignition switch to the ON position.

e. Push the "ON" button of Techstream.

f. Select the item "Powertrain / Engine and ECT / Active Test".

<table>
<thead>
<tr>
<th>SPD (NC)</th>
<th>Counter Gear Speed/display: 50 r/min</th>
<th>3rd when shift lever position is D position (After warming up the engine);</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Intermediate shaft speed (NC) becomes close to the engine speed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPD (NT)</th>
<th>Input Turbine Speed/display: 50 r/min</th>
<th>HINT:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Lock-up ON (After warming up the engine):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lock-up OFF (Idling at N position):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Input Turbine speed (NT) equal to the engine speed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Input Turbine speed (NT) nearly equal to the engine speed.</td>
</tr>
</tbody>
</table>
g. According to the display on tester, perform the "active Test".

### ACTIVE TEST DETAIL

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Test Part</th>
<th>Control Range</th>
<th>Diagnostic Note</th>
</tr>
</thead>
</table>
| Control the Shift Position | [Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition]  
- IDL: ON  
- Less than 50 km/h (31 mph) | 1st/2nd/3rd/4th/5th | Possible to check the operation of the shift solenoid valves. |
| [Others]  
- Press "-->" button: Shift up  
- Press "<--" button: Shift down | | |
| Activate the Lock Up | [Test Details] Control the shift solenoid DSL to set the automatic transaxle to the lock-up condition. [Vehicle Condition]  
- Throttle valve opening angle: Less than 35 %  
- Vehicle Speed: 60 km/h (37 mph) or more, and 5th gear | ON/OFF | Possible to check the DSL operation. |
| Activate the Solenoid (SL1) | [Test Details] Operate the shift solenoid SL1 [Vehicle Condition]  
- Vehicle Stopped.  
- Shift lever P or N position | ON/OFF | - |

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| Activate the Solenoid (SL2) | Operate the shift solenoid SL2  
[Vehicle Condition]  
- Vehicle Stopped.  
- Shift lever P or N position | ON/OFF | - |
| Activate the Solenoid (SL3) | [Test Details]  
Operate the shift solenoid SL3  
[Vehicle Condition]  
- Vehicle Stopped.  
- Shift lever P or N position | ON/OFF | - |
| Activate the Solenoid (S4) | [Test Details]  
Operate the shift solenoid S4  
[Vehicle Condition]  
- Vehicle Stopped.  
- Shift lever P or N position | ON/OFF | - |
| Activate the Solenoid (SR) | [Test Details]  
Operate the shift solenoid SR  
[Vehicle Condition]  
- Vehicle Stopped.  
- Shift lever P or N position | ON/OFF | - |
| Activate the Solenoid (DSL) | [Test Details]  
Operate the shift solenoid DSL  
[Vehicle Condition]  
- Vehicle Stopped.  
- Shift lever P or N position | ON/OFF | - |
| | [Test Details]  
Operate the shift solenoid SLT and raise the line pressure.  
[Vehicle Condition] | | |
### HINT:

The pressure values in Active Test and HYDRAULIC TEST are different from each other.

### DIAGNOSTIC TROUBLE CODE CHART

If a DTC is displayed during the DTC check, check the parts listed in the table below and proceed to the information given.

**HINT:**

- *1: Comes on MIL (Malfunction Indicator Lamp) light up
- *2: "DTC stored" mark means ECM memorizes the malfunction code if the ECM detects the DTC detection condition.

This DTC may be output when the clutch, brake and gear components etc. inside the automatic transmission are damaged.

### AUTOMATIC TRANSAXLE SYSTEM:

#### DIAGNOSTIC TROUBLE CODE CHART

<table>
<thead>
<tr>
<th>DTC Code</th>
<th>Detection Item</th>
<th>Trouble Area</th>
<th>MIL*1</th>
<th>Memory *2</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0705</td>
<td>Transmission Range Sensor Circuit</td>
<td>1. Open or short in park/neutral</td>
<td>Comes on</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td>Malfunction (PRNDL Input)</td>
<td>position switch circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Park/neutral position switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) "Activate the Solenoid (SLT)" in the Active Test is performed to check the line pressure changes by connecting the SST to the automatic transaxle, which is used in the HYDRAULIC TEST (See HYDRAULIC TEST) as well.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0710</td>
<td>Transmission Fluid Temperature Sensor</td>
<td>1. Open or short in ATF temperature sensor circuit</td>
<td>Comes on</td>
</tr>
<tr>
<td></td>
<td>&quot;A&quot; Circuit</td>
<td>2. Transmission wire (ATF temperature sensor)</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. ECM</td>
<td></td>
</tr>
<tr>
<td>P0711</td>
<td>Transmission Fluid Temperature Sensor</td>
<td>Transmission wire (ATF temperature sensor)</td>
<td>Comes on</td>
</tr>
<tr>
<td></td>
<td>&quot;A&quot; Performance</td>
<td></td>
<td>DTC stored</td>
</tr>
<tr>
<td>P0712</td>
<td>Transmission Fluid Temperature Sensor</td>
<td>1. Short in ATF temperature sensor circuit</td>
<td>Comes on</td>
</tr>
<tr>
<td></td>
<td>&quot;A&quot; Circuit Low Input</td>
<td>2. Transmission wire (ATF temperature sensor)</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. ECM</td>
<td></td>
</tr>
<tr>
<td>P0713</td>
<td>Transmission Fluid Temperature Sensor</td>
<td>1. Open in ATF temperature sensor circuit</td>
<td>Comes on</td>
</tr>
<tr>
<td></td>
<td>&quot;A&quot; Circuit High Input</td>
<td>2. Transmission wire (ATF temperature sensor)</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. ECM</td>
<td></td>
</tr>
<tr>
<td>P0717</td>
<td>Turbine Speed Sensor Circuit No Signal</td>
<td>1. Open or short in transmission revolution sensor NT (speed sensor NT)</td>
<td>Comes on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Transmission revolution sensor NT (speed sensor NT)</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. ECM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Automatic transaxle</td>
<td></td>
</tr>
<tr>
<td>DTC</td>
<td>Description</td>
<td>Symptoms</td>
<td>Status</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| P0724 | Brake Switch "B" Circuit High                                               | 1. Short in stop light switch circuit  
2. Stop light switch  
3. ECM                                             | Comes on         |
|       |                                                                             |                                                                          | DTC stored      |
| P0741 | Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve DSL)     | 1. Shift solenoid valve DSL remains open or closed  
2. Valve body is blocked  
3. Torque converter clutch  
4. Automatic transaxle (clutch, brake or gear etc.)  
5. Line pressure is too low | Comes on         |
|       |                                                                             |                                                                          | DTC stored      |
| P0746 | Pressure Control Solenoid "A" Performance (Shift Solenoid Valve SL1)        | 1. Shift solenoid valve SL1 remains open or closed  
2. Valve body is blocked  
3. Automatic transaxle (clutch, brake or gear etc.) | Comes on         |
|       |                                                                             |                                                                          | DTC stored      |
| P0748 | Pressure Control Solenoid "A" Electrical (Shift Solenoid Valve SL1)         | 1. Open or short in shift solenoid valve SL1 circuit  
2. Shift solenoid valve SL1  
3. ECM                                             | Comes on         |
|       |                                                                             |                                                                          | DTC stored      |
|       | Shift Solenoid "D"                                                          | 1. Shift solenoid valve S4 remains open or closed  
2. Valve body is                                           |                                                                      |
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Conditions</th>
<th>Diagnosis</th>
<th>DTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0766</td>
<td>Performance (Shift Solenoid Valve S4) blocked (Brake control valve)</td>
<td>3. Automatic transaxle (clutch, brake or gear, etc.)</td>
<td>Comes on</td>
<td>DTC stored</td>
</tr>
<tr>
<td>P0771</td>
<td>Shift Solenoid &quot;E&quot; Performance (Shift Solenoid Valve SR)</td>
<td>1. Shift solenoid valve SR remains open or closed</td>
<td>Comes on</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Valve body is blocked</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Automatic transaxle (clutch, brake or gear etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0776</td>
<td>Pressure Control Solenoid &quot;B&quot; Performance (Shift Solenoid Valve SL2)</td>
<td>1. Shift solenoid valve SL2 remains open or closed</td>
<td>Comes on</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Valve body is blocked</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Automatic transaxle (clutch, brake or gear etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0778</td>
<td>Pressure Control Solenoid &quot;B&quot; Electrical (Shift Solenoid Valve SL2)</td>
<td>1. Open or short in shift solenoid valve SL2 circuit</td>
<td>Comes on</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Shift solenoid valve SL2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. ECM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0793</td>
<td>Intermediate Shaft Speed Sensor &quot;A&quot;</td>
<td>1. Open or short in transmission revolution sensor NC (speed sensor NC)</td>
<td>Comes on</td>
<td>DTC stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Transmission revolution sensor NC (speed sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>1.</td>
<td>2.</td>
<td>3.</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>P0796</td>
<td>Pressure Control Solenoid &quot;C&quot; Performance (SL3)</td>
<td>Shift solenoid</td>
<td>Valve body is</td>
<td>Automatic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>valve SL3 remains</td>
<td>blocked</td>
<td>transaxle (clutch,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>open or closed</td>
<td></td>
<td>brake or gear etc.)</td>
</tr>
<tr>
<td>P0798</td>
<td>Pressure Control Solenoid &quot;C&quot; Electrical (SL3)</td>
<td>Open or short in</td>
<td>Shift solenoid</td>
<td>ECM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>shift solenoid valve</td>
<td>valve SL3 circuit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SL3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0982</td>
<td>Shift Solenoid &quot;D&quot; Control Circuit Low (S4)</td>
<td>Short in shift</td>
<td>Shift solenoid</td>
<td>ECM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solenoid valve S4</td>
<td>valve S4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0983</td>
<td>Shift Solenoid &quot;D&quot; Control Circuit High (S4)</td>
<td>Open in shift</td>
<td>Shift solenoid</td>
<td>ECM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solenoid valve S4</td>
<td>valve S4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0985</td>
<td>Shift Solenoid &quot;E&quot; Control Circuit Low (SR)</td>
<td>Short in shift</td>
<td>Shift solenoid</td>
<td>ECM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solenoid valve SR</td>
<td>valve SR</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0986</td>
<td>Shift Solenoid &quot;E&quot; Control Circuit High (S4)</td>
<td>Open in shift</td>
<td>Shift solenoid</td>
<td>ECM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>solenoid valve SR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>circuit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)

### DESCRIPTION

The park/neutral position switch detects the shift lever position and sends signals to the ECM.

### DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2714</td>
<td>Pressure Control Solenoid &quot;D&quot; Performance (Shift Solenoid Valve SLT)</td>
<td>Valve SR, 1. Shift solenoid valve SLT remains closed, 2. Valve body is blocked, 3. Automatic transaxle (clutch, brake or gear etc.), Comes on, DTC stored</td>
</tr>
<tr>
<td>P2716</td>
<td>Pressure Control Solenoid &quot;D&quot; Electrical (Shift Solenoid Valve SLT)</td>
<td>1. Open or short in shift solenoid valve SLT circuit, 2. Shift solenoid valve SLT, 3. ECM, Comes on, DTC stored</td>
</tr>
<tr>
<td>P2769</td>
<td>Torque Converter Clutch Solenoid Circuit Low (Shift Solenoid Valve DSL)</td>
<td>1. Short in shift solenoid valve DSL circuit, 2. Shift solenoid valve DSL, 3. ECM, Comes on, DTC stored</td>
</tr>
<tr>
<td>P2770</td>
<td>Torque Converter Clutch Solenoid Circuit High (Shift Solenoid Valve DSL)</td>
<td>1. Open in shift solenoid valve DSL circuit, 2. Shift solenoid valve DSL, 3. ECM, Comes on, DTC stored</td>
</tr>
</tbody>
</table>

DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)

DESCRIPTION

The park/neutral position switch detects the shift lever position and sends signals to the ECM.

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A. Any 2 or more signals of the following are ON simultaneously (2-trip)</td>
<td></td>
</tr>
</tbody>
</table>
P0705	
detection logic)
- P input signal is ON.
- N input signal is ON.
- R input signal is ON.
- D input signal is ON.
- 3 input signal is ON.
- 2 input signal is ON.

B. Any 2 or more signals of the following are ON simultaneously (2-trip detection logic)
- NSW (STAR) input signal is ON.
- R input signal is ON.
- D input signal is ON.
- 3 input signal is ON.
- 2 input signal is ON.

C. All switches are OFF simultaneously for NSW (STAR), P, R, N, D, 3, 2 positions (2-trip detection logic).

D. Both 1 and 2 conditions are met (2-trip detection logic)
1. One of the following conditions are met
   a. NSW (STAR) input signal is ON.
   b. P input signal is ON.
   c. N input signal is ON.
   d. R input signal is ON.
2. One of the following conditions are met
   a. 4 input signal is ON.
   b. L input signal is ON.

- Short in park/neutral position switch circuit
- Park/neutral position switch
- ECM
MONITOR DESCRIPTION

These DTCs indicate a problem with the park/neutral position switch and the wire harness in the park/neutral position switch circuit.

The park/neutral position switch detects the shift lever position and sends a signal to the ECM.

For security, the park/neutral position switch detects the shift lever position so that engine can be started only when the shift lever is in the P or N position.

The park/neutral position switch sends a signal to the ECM according to the shift position (P, R, N or D).

The ECM determines that there is a problem with the switch or related parts if it receives more than 1 position signal simultaneously. The ECM will turn on the MIL and store the DTC.

MONITOR STRATEGY

Related DTCs | P0705: Park/neutral position switch/Verify switch input
---|---
Required sensors/Components | Park/neutral position switch
Frequency of operation | Continuous
Duration | Condition (A), (B), (D)
2 sec.
Condition (C)
60 sec.
MIL operation | 2 driving cycles
Sequence of operation | None

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever this DTC is not present. None

Ignition switch | ON
Battery voltage | 10.5 V or more

TYPICAL MALFUNCTION THRESHOLDS

1. One of the following conditions are met: Condition (A), (B), (C) and (D)

   **Condition (A):**
Condition (B):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Number of the following signal input at the same time</th>
<th>2 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>P switch</td>
<td>ON</td>
</tr>
<tr>
<td>N switch</td>
<td>ON</td>
</tr>
<tr>
<td>R switch</td>
<td>ON</td>
</tr>
<tr>
<td>D switch</td>
<td>ON</td>
</tr>
<tr>
<td>3 switch</td>
<td>OFF</td>
</tr>
<tr>
<td>2 switch</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Condition (C):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Number of the following signal input at the same time</th>
<th>2 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW (STAR) switch</td>
<td>OFF</td>
</tr>
<tr>
<td>P switch</td>
<td>OFF</td>
</tr>
<tr>
<td>N switch</td>
<td>OFF</td>
</tr>
<tr>
<td>R switch</td>
<td>OFF</td>
</tr>
<tr>
<td>D switch</td>
<td>OFF</td>
</tr>
<tr>
<td>3 switch</td>
<td>OFF</td>
</tr>
<tr>
<td>2 switch</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Condition (D):

Both of the following conditions (1) or (2) are met:

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>(1) One of the following conditions are met</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW (STAR) switch</td>
<td>OFF</td>
</tr>
<tr>
<td>P switch</td>
<td>ON</td>
</tr>
<tr>
<td>R switch</td>
<td>ON</td>
</tr>
<tr>
<td>N switch</td>
<td>ON</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2) One of the following conditions are met</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPONENT OPERATING RANGE</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td></td>
</tr>
</tbody>
</table>

| Park/neutral Position switch | The park/neutral position switch sends only one signal to the ECM. |

| WIRING DIAGRAM |
INSPECTION PROCEDURE

1. **INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
   
   a. Disconnect the park/neutral position switch connector.
   
   b. Measure resistance according to the value(s) in the table below when the shift lever is moved to each position.
Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Shift Position</th>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>2 - 6 and 4 - 5</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except P</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>R</td>
<td>2-1</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except R</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>N</td>
<td>2 - 9 and 4 - 5</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except N</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>D and 4</td>
<td>2-7</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except D and 4</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>3</td>
<td>2-3</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except 3</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>2 and L</td>
<td>2-8</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except 2 and L</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
</tbody>
</table>

Switch Side:

(Connector Front View):

Fig. 21: Identifying Park/Neutral Position Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE PARK/NEUTRAL POSITION SWITCH ASSEMBLY

OK: Go to Next Step

2. INSPECT SHIFT LOCK CONTROL UNIT ASSEMBLY
   a. Connect the park/neutral position switch connector.
   b. Disconnect the transmission control switch connector of shift lock control unit assembly.
   c. Measure resistance according to the value(s) in the table below when the shift lever is moved to each position.
Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Shift Position</th>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>2-9</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>4</td>
<td>?</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>D</td>
<td>3-9</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>4</td>
<td>?</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>2</td>
<td>5-10</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>L</td>
<td>?</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>2</td>
<td>4-10</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>L</td>
<td>?</td>
<td>Below 1 ohms</td>
</tr>
</tbody>
</table>

Switch Side:
(Connector Front View):

Fig. 22: Identifying Shift Lock Control Unit Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE SHIFT LOCK CONTROL UNIT ASSEMBLY

OK: Go to Next Step

3. CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ECM)
   a. Connect the transmission control switch connector of shift lock control unit assembly.
   b. Turn the ignition switch to the ON position, and measure the voltage according to the value(s) in the table below when the shift lever is moved to each position.
Fig. 23: Identifying ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard voltage

VOLTAGE SPECIFICATION

<table>
<thead>
<tr>
<th>Shift Position</th>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>P and N</td>
<td>E10-8 (NSW (STAR)) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except P and N</td>
<td></td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>P</td>
<td>E5-23 (P) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except P</td>
<td></td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>N</td>
<td>E5-22 (N) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except N</td>
<td></td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>R</td>
<td>E5-11 (R) - Body ground</td>
<td>11 to 14 V*</td>
</tr>
<tr>
<td>Except R</td>
<td></td>
<td>Below 1 V</td>
</tr>
<tr>
<td>D and 4</td>
<td>E5-21 (D) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except D and 4</td>
<td></td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>4</td>
<td>E5-20 (4) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except 4</td>
<td></td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>3</td>
<td>E5-19 (3) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except 3</td>
<td></td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>2 and L</td>
<td>E5-10 (2) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except 2 and L</td>
<td></td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>L</td>
<td>E5-9 (L) - Body ground</td>
<td>Below 1 V</td>
</tr>
<tr>
<td>Except L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HINT:*
*: The voltage will drop slightly due to lighting up of the back up light.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

DTC P0710 TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT; DTC P0712 TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT; DTC P0713 TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT

DESCRIPTION

The ATF (Automatic Transmission Fluid) temperature sensor converts the fluid temperature into a resistance value which is input into the ECM.

The ECM applies a voltage to the temperature sensor through ECM terminal THO1.

The sensor resistance changes with the transmission fluid temperature. As the temperature becomes higher, the
sensor resistance decreases.

One terminal of the sensor is grounded so that the sensor resistance decreases and the voltage goes down as the temperature becomes higher.

The ECM calculates the fluid temperature based on the voltage signal.

![Resistance vs Temperature Graph](image)

**Fig. 24: ATF Temperature Sensor Resistance Graph**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0710   | (a) and (b) are detected momentarily within 0.5 sec. when neither P0712 nor P0713 is detected (1-trip detection logic) | • Open or short in ATF temperature sensor circuit  
• Transmission wire (ATF temperature sensor)  
• ECM |
|         | a. ATF temperature sensor resistance is less than 79 ohms.  
|         | b. ATF temperature sensor resistance is more than 156 kohms. |     |
|         | HINT: Within 0.5 sec, the malfunction |     |
**MONITOR DESCRIPTION**

These DTCs indicate an open or short in the automatic transmission fluid (ATF) temperature sensor (TFT sensor) circuit. The automatic transmission fluid (ATF) temperature sensor converts ATF temperature to an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature, and the ECM detects an opens or shorts in the ATF temperature circuit. If the resistance value of the ATF temperature is less than 79 ohms \(^*1\) or more than 156 kohms \(^*2\), the ECM interprets this as a fault in the ATF sensor or wiring. The ECM will turn on the MIL and store the DTC.

\(^*1\): 150°C (302°F) or more is indicated regardless of the actual ATF temperature.

\(^*2\): -40°C (-40°F) is indicated regardless of the actual ATF temperature.

**HINT:**

The ATF temperature can be checked on the Techstream display.

**MONITOR STRATEGY**

**Related DTCs**

- P0712: ATF temperature sensor/Range check (Low resistance)
- P0713: ATF temperature sensor/Range check (High resistance)

**Required sensors/Components**

- ATF temperature sensor (TFT sensor)

**Frequency of operation**

- Continuous

**Duration**

- 0.5 sec.

**MIL operation**

- Immediate

**Sequence of operation**

- None
TYPICAL ENABLING CONDITIONS

P0710: Range check (Chattering)

P0712: Range check (Low resistance)

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>The monitor will run whenever these DTCs are not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>The typical enabling condition is not available.</td>
<td>-</td>
</tr>
</tbody>
</table>

P0713: Range check (High resistance)

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time after engine start</td>
<td>15 min. or more</td>
</tr>
</tbody>
</table>

TYPICAL MALFUNCTION THRESHOLDS

P0710: Range check (Chattering)

TYPICAL MALFUNCTION THRESHOLDS

| TFT (Transmission fluid temperature) sensor resistance | Less than 79 ohms or More than 156 kohms |

P0712: Range check (Low resistance)

TYPICAL MALFUNCTION THRESHOLDS

| TFT sensor resistance | Less than 79 ohms |

P0713: Range check (High resistance)

TYPICAL MALFUNCTION THRESHOLDS

| TFT sensor resistance | More than 156 kohms |

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

| TFT sensor. | Atmospheric temperature to approx. 130°C (266°F) |

WIRING DIAGRAM
Fig. 25: Electronically Controlled Transmission Solenoid - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

Using Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTE: In the table below, the value listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether apart is faulty or not.

1. READ DATA LIST
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Data List".
   g. According to the display on the tester, read the "Data List".

DATA LIST

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Measurement Item/Range</th>
<th>Normal Condition</th>
<th>Diagnostic Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• After Stall Test; If the value is &quot;-40°C (-40°F)&quot; or &quot;215°C&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Microsoft

Microsoft

Microsoft
When DTC P0712 is output and Techstream output is 150°C (302°F), there is a short circuit.

When DTC P0713 is output and Techstream output is -40°C (-40°F), there is an open circuit.

Measure the resistance between terminal THO1 (THO) and body ground.

**TEMPERATURE SPECIFICATION**

<table>
<thead>
<tr>
<th>Temperature Displayed</th>
<th>Malfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40°C (-40°F)</td>
<td>Open circuit</td>
</tr>
<tr>
<td>150°C (302°F) or more</td>
<td>Short circuit</td>
</tr>
</tbody>
</table>

**HINT:**

If a circuit related to the ATF temperature sensor become open, P0713 is immediately set (in 0.5 second).

When P0713 is set, P0711 cannot be detected.

It is not necessary to inspect the circuit when P0711 is set.

1. **INSPECT TRANSMISSION WIRE (ATF TEMPERATURE SENSOR)**
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (THO) - 7 (E2)</td>
<td>79 ohms to 156 kohms</td>
</tr>
<tr>
<td>1 (THO) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>7 (E2) - Body ground</td>
<td>?</td>
</tr>
</tbody>
</table>

**HINT:**

If the resistance is out of the specified range with either the ATF temperature shown in the table below, the driveability of the vehicle may decrease.
Transmission Wire Side:

(Connector Front View):

![Diagram of transmission wire connector terminals]

Fig. 26: Identifying Transmission Wire Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ATF TEMPERATURE AND RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>ATF Temperature</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°C (50°F)</td>
<td>5 to 8 kohms</td>
</tr>
<tr>
<td>25°C (77°F)</td>
<td>2.5 to 4.5 kohms</td>
</tr>
<tr>
<td>110°C (230°F)</td>
<td>0.22 to 0.28 kohms</td>
</tr>
</tbody>
</table>

NG: REPAIR OR REPLACE TRANSMISSION WIRE

OK: Go to Next Step

2. CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)
   a. Connect the transmission wire connector to the transaxle.
   b. Disconnect the ECM connectors.
   c. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-24 (THO1) - E9-28 (E2)</td>
<td>79 ohms to 156kohms</td>
</tr>
</tbody>
</table>

   d. Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for short)

<table>
<thead>
<tr>
<th>RESISTANCE SPECIFICATION</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tester Connection</td>
<td>Specified Condition</td>
</tr>
<tr>
<td>E10-24 (THO1) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>E9-2S (E2) - Body ground</td>
<td></td>
</tr>
</tbody>
</table>

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

DTC P0711 TRANSMISSION FLUID TEMPERATURE SENSOR "A" PERFORMANCE

DESCRIPTION

The ATF (Automatic Transmission Fluid) temperature sensor converts the fluid temperature into a resistance value which is input into the ECM.

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0711</td>
<td>A. Both (a) and (b) are detected: (2-trip detection logic)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Intake air and engine coolant temperatures are more than -10°C (14°F) at engine start</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. After normal driving for over 19 min. and 9 km (6 mile) or more, ATF temp, is less than 20°C (68°F)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. When engine coolant temp, is</td>
<td></td>
</tr>
</tbody>
</table>

Transmission wire (ATF temperature sensor)
MONITOR DESCRIPTION

The ATF temperature sensor converts the ATF temperature to an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature and detects an open or short in the ATF temperature circuit or a fault in the ATF temperature sensor.

After running the vehicle for a certain period, the ATF temperature should increase. If the ATF temperature is below 20°C (68°F) after running the vehicle for a certain period, the ECM interprets this as a fault, and turns on the MIL.

When the ATF temperature is 110°C (230°F) or more after 17 minutes of engine cold start, the ECM also determines this as a fault, turns on the MIL, and stores the DTC.

MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0711: ATF temperature sensor/Rationality check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>ATF temperature sensor (TFT sensor)</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>3 sec.: Condition (A), (B), (C) Continuous.: Condition (D)</td>
</tr>
<tr>
<td>MIL operation</td>
<td>2 driving cycles</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever this DTC is not present.

<table>
<thead>
<tr>
<th>Condition (A):</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFT sensor circuit</td>
</tr>
<tr>
<td>ECT sensor circuit</td>
</tr>
<tr>
<td>IAT sensor circuit</td>
</tr>
<tr>
<td>ETCS</td>
</tr>
</tbody>
</table>

Condition (A):
### Condition (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Time after engine start</th>
<th>18 min. and 20 sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulated driving time</td>
<td>4 min. and 10 sec.</td>
</tr>
<tr>
<td>Driving distance after engine start</td>
<td>9 km (5.6 mile) or more</td>
</tr>
<tr>
<td>IAT (Intake air temperature) (12 sec. after starting engine)</td>
<td>-10°C (14°F) or more</td>
</tr>
<tr>
<td>ECT (12 sec. after starting engine)</td>
<td>-10°C (14°F) or more</td>
</tr>
</tbody>
</table>

### Condition (C):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Time after engine start</th>
<th>30 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulated driving time</td>
<td>6 min. and 40 sec.</td>
</tr>
<tr>
<td>Driving distance after engine start</td>
<td>15 km (9.3 mile) or more</td>
</tr>
<tr>
<td>IAT (Intake air temperature) (12 sec. after starting engine)</td>
<td>-15°C (5°F) or more</td>
</tr>
<tr>
<td>ECT (12 sec. after starting engine)</td>
<td>-15°C (5°F) or more</td>
</tr>
</tbody>
</table>

### Condition (D):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Time after engine start</th>
<th>40 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulated driving time</td>
<td>9 min. and 10 sec.</td>
</tr>
<tr>
<td>Driving distance after engine start</td>
<td>20 km (124 mile) or more</td>
</tr>
</tbody>
</table>

### Condition (E):

**TYPICAL ENABLING CONDITIONS**

| ECT (12 sec. after engine start) | Less than 35°C (95°F) |

**TYPICAL MALFUNCTION THRESHOLDS**

- Time after engine start: 18 min. and 20 sec.
- Accumulated driving time: 4 min. and 10 sec.
- Driving distance after engine start: 9 km (5.6 mile) or more
- IAT (Intake air temperature) (12 sec. after starting engine): -10°C (14°F) or more
- ECT (12 sec. after starting engine): -10°C (14°F) or more

- Time after engine start: 30 min.
- Accumulated driving time: 6 min. and 40 sec.
- Driving distance after engine start: 15 km (9.3 mile) or more
- IAT (Intake air temperature) (12 sec. after starting engine): -15°C (5°F) or more
- ECT (12 sec. after starting engine): -15°C (5°F) or more

- Time after engine start: 40 min.
- Accumulated driving time: 9 min. and 10 sec.
- Driving distance after engine start: 20 km (124 mile) or more

- ECT (12 sec. after engine start): Less than 35°C (95°F)
Condition (A), (B), (C), (D):

**TYPICAL MALFUNCTION THRESHOLDS**

<table>
<thead>
<tr>
<th>Component</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATF temperature sensor</td>
<td>Less than 20°C (68°F)</td>
</tr>
</tbody>
</table>

Condition (E):

**TYPICAL MALFUNCTION THRESHOLDS**

<table>
<thead>
<tr>
<th>Component</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATF temperature sensor</td>
<td>110°C (230°F) or more</td>
</tr>
</tbody>
</table>

**COMPONENT OPERATING RANGE**

**COMPONENT OPERATING RANGE**

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATF temperature sensor</td>
<td>Atmospheric temperature to approx. 130°C (266°F)</td>
</tr>
</tbody>
</table>

**WIRING DIAGRAM**

![Wiring Diagram](image)

*Fig. 28: Electronically Controlled Transmission Solenoid - Wiring Diagram

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

**INSPECTION PROCEDURE**

**HINT:**

Using Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

**NOTE:** In the table below, the value listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether
apart is faulty or not.

1. **READ DATA LIST**
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Data List".
   g. According to the display on the tester, read the "Data List".

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Measurement Item/Range</th>
<th>Normal Condition</th>
<th>Diagnostic Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/T Oil Temperature 1</td>
<td>ATF Temp. Sensor Value/ min.: -40°C (-40°F) max.: 215°C (419°F)</td>
<td>• After Stall Test; Approx. 80°C (176°F) • Equal to ambient temperature when cold soak</td>
<td>If the value is &quot;-40°C (-40°F)&quot; or &quot;215°C (419°F)&quot;, ATF temp, sensor circuit is opened or shorted.</td>
</tr>
</tbody>
</table>

**DATA LIST**

**HINT.**

When DTC P0712 is output and Techstream output is 150°C (302°F), there is a short circuit.

When DTC P0713 is output and Techstream output is -40°C (-40°F), there is an open circuit.

Measure the resistance between terminal THO1 (THO) and body ground.

**TEMPERATURE SPECIFICATION**

<table>
<thead>
<tr>
<th>Temperature Displayed</th>
<th>Malfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40°C (-40°F)</td>
<td>Open circuit</td>
</tr>
<tr>
<td>150°C (302°F) or more</td>
<td>Short circuit</td>
</tr>
</tbody>
</table>

**HINT:**

If a circuit related to the ATF temperature sensor becomes open, P0713 is immediately set (in 0.5 second).

When P0713 is set, P0711 cannot be detected.

It is not necessary to inspect the circuit when P0711 is set.
1. CHECK OTHER DTCs OUTPUT (IN ADDITION TO DTC P0711)
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and push the Techstream main switch ON.
   c. When you use Techstream:
      
      Select the item "Powertrain / Engine and ECT / Trouble Codes".
      
   d. Read the DTCs using Techstream.

Result

RESULT REFERENCE

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0711</td>
<td>A</td>
</tr>
<tr>
<td>P0711 and other DTCs</td>
<td>B</td>
</tr>
</tbody>
</table>

HINT:

If any other codes besides "P0711" are output, perform troubleshooting for those DTCs first.

B: Go to DTC CHART
A: Go to Next Step

2. CHECK TRANSMISSION FLUID LEVEL

OK: Automatic transmission fluid level is correct.

NG: ADD FLUID

OK: REPLACE TRANSMISSION WIRE (ATF TEMPERATURE SENSOR)

DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL

DESCRIPTION

This sensor detects the rotation speed of the input turbine. By comparing the input turbine speed signal (NT) with the counter gear speed sensor signal (NC), the ECM detects the shift timing of the gears and appropriately controls the engine torque and hydraulic pressure according to various conditions. Thus, providing smooth gear shift.

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECM detects conditions (a), (b) and (c) continuously for 5 sec. or more:</td>
<td>• Open or short in transmission</td>
</tr>
</tbody>
</table>
Reference (Using an oscilloscope):

Check the waveform between terminals NT+ and NT- of the ECM connector.

![Waveform Graph](image)

**Fig. 29: Waveform Graph**

*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

**Standard:** Refer to the illustration.

**WAVEFORM REFERENCE**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>NT+ - NT-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>5 V/DIV., 0.5 ms./DIV.</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Vehicle speed 20 km/h (12 mph)</td>
</tr>
</tbody>
</table>

**MONITOR DESCRIPTION**

The NT terminal of the ECM detects a revolution signal from the speed sensor (NT) (input RPM). The ECM calculates a gearshift comparing the speed sensor (NT) with the speed sensor (NC).

While the vehicle is operating in 2nd, 3rd, 4th or 5th gear in the shift position of D, if the input shaft revolution is less than 300 rpm *1 although the output shaft revolution is more than 1,000 rpm *2, the ECM detects the trouble, illuminates the MIL and stores the DTC.

*1: Pulse is not output or is irregularly output.

*2: The vehicle speed is 50 km/h (31 mph) or more.
MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0717: Speed sensor (NT)/Verify pulse input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Speed sensor (NT), Speed sensor (NC)</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>5 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

The monitor will run whenever this DTC is not present.

<table>
<thead>
<tr>
<th>DTCs</th>
<th>P0500 (VSS) P0748, P0778, P0798 (Shift solenoid valve (range))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift change</td>
<td>Shift change is completed and before starting next shift change operation</td>
</tr>
<tr>
<td>ECM selected gear</td>
<td>3rd, 4th</td>
</tr>
<tr>
<td>Output shaft rpm</td>
<td>1,000 rpm or more</td>
</tr>
<tr>
<td>NSW (STAR) switch</td>
<td>OFF</td>
</tr>
<tr>
<td>R switch</td>
<td>OFF</td>
</tr>
<tr>
<td>L switch</td>
<td>OFF</td>
</tr>
<tr>
<td>Engine</td>
<td>Running</td>
</tr>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
</tbody>
</table>

TYPICAL MALFUNCTION THRESHOLDS

| Sensor signal rpm             | Less than 300 rpm                                           |

COMPONENT OPERATING RANGE

| Speed sensor (NT)             | Turbine speed is equal to engine speed with lock-up ON       |

WIRING DIAGRAM
INSPECTION PROCEDURE

1. INSPECT SPEED SENSOR INSTALLATION
   a. Check the speed sensor installation.

   **OK**: The installation bolt is tightened properly and there is no clearance between the sensor and transaxle case.

   ![Diagram showing proper speed sensor installation](image)

   **NG**: REPLACE SPEED SENSOR (NT)

2. INSPECT SPEED SENSOR (NT)
   a. Disconnect the speed sensor connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. CHECK HARNESS AND CONNECTOR (SPEED SENSOR - ECM)
   a. Connect the speed sensor connector.
   b. Disconnect the ECM connector.
   c. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-35 (NT+) - E10-27 (NT-)</td>
<td>560 to 680 ohms</td>
</tr>
</tbody>
</table>

   d. Measure the resistance according to the value(s) in the table below.
Fig. 33: Disconnecting ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard resistance (Check for short)

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-35 (NT+) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>E10-27 (NT-) - Body ground</td>
<td></td>
</tr>
</tbody>
</table>

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

DTC P0724 BRAKE SWITCH "B" CIRCUIT HIGH

DESCRIPTION

The purpose of this circuit is to prevent the engine from stalling while driving in lock-up condition when brakes are suddenly applied.

When the brake pedal is depressed, this switch sends a signals to the ECM. Then the ECM cancels the operation of the lock-up clutch while braking is in progress.

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0724   | The stop light switch remains ON even when the vehicle is driven in a STOP (less than 3 km/h (2 mph) and GO (30 km/h (19 mph) or more) fashion 5 times. (2-trip detection logic). | • Short in stop light switch circuit  
• Stop light switch  
• ECM |

MONITOR DESCRIPTION

This DTC indicates that the stop light switch remains on. When the stop light switch remains ON during "stop
and go" driving, the ECM interprets this as a fault in the stop light switch and the MIL comes on and the ECM stores the DTC. The vehicle must stop (less than 3 km/h (2 mph)) and go (30 km/h (19 mph) or more) 5 times for two driving cycles in order to detect a malfunction.

**MONITOR STRATEGY**

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0724: Stop light switch/Rationality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Stop light switch, Vehicle speed sensor</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>GO and STOP 5 times</td>
</tr>
<tr>
<td>MIL operation</td>
<td>2 driving cycles</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
<tr>
<td>Battery voltage</td>
<td>8 V or more</td>
</tr>
<tr>
<td>GO (Vehicle speed is 30 km/h (18.63 mph) or more)</td>
<td>Once</td>
</tr>
<tr>
<td>STOP (Vehicle speed is less than 3 km/h (1.86 mph))</td>
<td>Once</td>
</tr>
</tbody>
</table>

**TYPICAL MALFUNCTION THRESHOLDS**

| Brake switch | Remain ON during GO and STOP 5 times |

**WIRING DIAGRAM**
INSPECTION PROCEDURE

1. READ VALUE OF DATA LIST

HINT:

Using Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Data List".
   g. According to the display on the tester, read the "Data List".

<table>
<thead>
<tr>
<th>DATA LIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tester Display</td>
</tr>
<tr>
<td>Microsoft</td>
</tr>
</tbody>
</table>

Microsoft
Wednesday, August 12, 2009 2:03:24 PM | Page 79 | © 2005 Mitchell Repair Information Company, LLC.
RESULT REFERENCE

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG</td>
<td>A</td>
</tr>
<tr>
<td>OK</td>
<td>B</td>
</tr>
</tbody>
</table>

B: Go to step 3

A: Go to Next Step

2. **INSPECT STOP LIGHT SWITCH ASSEMBLY**
   a. Remove the stop light switch assembly.
   b. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Switch position</th>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch pin free</td>
<td>1-2</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Switch pin pushed in</td>
<td>?</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>Switch pin free</td>
<td>3-4</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>Switch pin pushed in</td>
<td>?</td>
<td>Below 1 ohms</td>
</tr>
</tbody>
</table>
NG: REPLACE STOP LIGHT SWITCH ASSEMBLY

OK: Go to Next Step

3. CHECK HARNESS AND CONNECTOR (STOP LIGHT SWITCH ASSEMBLY - ECM)
   a. Install the stop light switch assembly.
   b. Measure the voltage according to the value(s) in the table below when the brake pedal is depressed and released.

Standard voltage

<table>
<thead>
<tr>
<th>Condition</th>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake pedal is depressed</td>
<td>E4-15(STP)-Body ground</td>
<td>11 to 14 V</td>
</tr>
<tr>
<td>Brake pedal is released</td>
<td></td>
<td>Below 1 V</td>
</tr>
</tbody>
</table>

Fig. 36: Identifying ECM Connector

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

DTC P0741 TORQUE CONVERTER CLUTCH SOLENOID PERFORMANCE (SHIFT SOLENOID VALVE DSL)

SYSTEM DESCRIPTION

The ECM uses the signals from the throttle position sensor, air-flow meter, turbine (input) speed sensor, intermediate (counter) shaft speed sensor and crankshaft position sensor to monitor the engagement condition of the lock-up clutch.

Then the ECM compares the engagement condition of the lock-up clutch with the lock-up schedule in the ECM memory to detect a mechanical problems of the shift solenoid valve DSL, valve body and torque converter.
DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0741</td>
<td>Lock-up does not occur when driving in the lock-up range (normal driving at 80 km/h [50 mph]), or lock up remains ON in the lock-up OFF range. (2-trip detection logic)</td>
<td>• Shift solenoid valve DSL remains open or closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Valve body is blocked</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Torque converter clutch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Automatic transaxle (clutch, brake or gear etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Line pressure is too low</td>
</tr>
</tbody>
</table>

MONITOR DESCRIPTION

Torque converter lock-up is controlled by the ECM based on the speed sensor (NT), speed sensor (NC), engine rpm, engine load, engine temperature, vehicle speed, transmission temperature, and gear selection. The ECM determines the lock-up status of the torque converter by comparing the engine rpm (NE) to the input turbine rpm (NT). The ECM calculates the actual transmission gear by comparing input turbine rpm (NT) to counter gear rpm (NC). When conditions are appropriate, the ECM requests "lock-up" by applying control voltage to the shift solenoid DSL. When the DSL is turned on, it applies pressure to the lock-up relay valve and locks the torque converter clutch.

If the ECM detects no lock-up after lock-up has been requested or if it detects lock-up when it is not requested, the ECM interprets this as a fault in the shift solenoid valve DSL or lock-up system performance. The ECM will turn on the MIL and store the DTC.

HINT:

Example:

When any of the following is met, the system judges it as a malfunction.

- There is a difference in rotation between the input side (engine speed) and output side (input turbine speed) of the torque converter when the ECM commands lock-up.

  (Engine speed is at least 100 rpm greater than input turbine speed.)

- There is no difference in rotation between the input side (engine speed) and output side (input turbine speed) of the torque converter when the ECM commands lock-up off.

  (The difference between engine speed and input turbine speed is less than 35 rpm.)

MONITOR STRATEGY

MONITOR STRATEGY
### Related DTCs

<table>
<thead>
<tr>
<th>DTC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0741</td>
<td>Shift solenoid valve DSL/OFF malfunction</td>
</tr>
<tr>
<td></td>
<td>Shift solenoid valve DSL/ON malfunction</td>
</tr>
</tbody>
</table>

### Required sensors/Components

- Shift solenoid valve DSL
- Speed sensor (NT)
- Speed sensor (NC)
- Crankshaft position sensor (NE)
- Throttle position sensor (VPA1)
- Mass air flow sensor (MAF)
- Transmission temperature sensor (THO1)
- Engine coolant temperature sensor (ECT)

### Frequency of operation

Continuous

### Duration

- OFF malfunction (A) Continuous.
- OFF malfunction (B) 1 sec.
- OFF malfunction (C) 3.5 sec.
- ON malfunction 1.8 sec.

### MIL operation

2 driving cycles

### Sequence of operation

None

### TYPICAL ENABLING CONDITIONS

All:

**TYPICAL ENABLING CONDITIONS**

The monitor will run whenever this DTC is not present.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECT (Engine coolant temperature)</td>
<td>10°C (50°F) or more</td>
</tr>
<tr>
<td>Transmission range</td>
<td>&quot;D&quot;</td>
</tr>
<tr>
<td>TFT (Transmission fluid temperature)</td>
<td>-20°C (-4°F) or more</td>
</tr>
<tr>
<td>TFT sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>ECT sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Turbine speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Intermediate shaft speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Output speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve SL1 circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve SL2 circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve SL3 circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve S4 circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve SR circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve DSL circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Electronic throttle system</td>
<td>Not circuit malfunction</td>
</tr>
</tbody>
</table>

**OFF malfunction (A):**
TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed gear 1,900 rpm (varies with engine speed)</td>
</tr>
</tbody>
</table>

OFF malfunction (B):

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle speed</td>
<td>10 km/h (6.2 mph) or more</td>
</tr>
</tbody>
</table>

OFF malfunction (C):

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>ECM lock-up command</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>3rd, 4th or 5th</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>25 km/h (15.5 mph) or more</td>
</tr>
</tbody>
</table>

ON malfunction:

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>ECM lock-up command</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>3rd, 4th or 5th</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>7% or more</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>25 to 60 km/h (15.5 to 37.3 mph)</td>
</tr>
</tbody>
</table>

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met: OFF malfunction or ON malfunction

OFF malfunction:

TYPICAL MALFUNCTION THRESHOLDS

| Engine Speed - Input (turbine) speed | 100 rpm or more |

ON malfunction:

TYPICAL MALFUNCTION THRESHOLDS

| Difference between engine speed and input (turbine) speed | Less than 35 rpm |

INSPECTION PROCEDURE

HINT:

Using Techstream to perform Active Test allows relays, VSVs, actuators and other items to be operated without
removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Test early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Test.

1. **PERFORM ACTIVE TEST**
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Active Test".
   g. According to the display on the tester, perform the "Active Test".

### ACTIVE TEST DETAIL

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Test Part</th>
<th>Control Range</th>
<th>Diagnostic Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Test Details] Control the shift solenoid DSL to set the automatic transaxle to the lock-up condition.</td>
<td>ON/OFF</td>
<td>Possible to check the DSL operation.</td>
</tr>
<tr>
<td></td>
<td>[Vehicle Condition]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Throttle valve opening angle: Less than 35 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vehicle Speed: 60 km/h (37 mph) or more, and 5th gear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HINT:**

- This test can be conducted when the vehicle speed is 60 km/h (37 mph) or more.
- This test can be conducted in the 5th gear.

**Activity: Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.**

**HINT:**

- When changing the accelerator pedal opening angle while driving, if the engine speed does not change, lock-up is on.
- Slowly release, but not fully, the accelerator pedal in order to decelerate. (Fully releasing the pedal will close the throttle valve and lock-up may be turned off.)
1. **CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0741)**
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and turn the Techstream main switch ON.
   c. When you use Techstream:
      
      Select the item "Powertrain / Engine and ECT / Trouble Codes".
      
   d. Read the DTCs using Techstream.
   
   **Result**

   **RESULT REFERENCE**

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0741</td>
<td>A</td>
</tr>
<tr>
<td>P0741 and other DTCs</td>
<td>B</td>
</tr>
</tbody>
</table>

   **HINT:**

   If any other codes besides "P0741" are output, perform the troubleshooting for those DTCs first.

   **B:** Go to **DTC CHART**

   **A:** Go to Next Step

2. **INSPECT TRANSMISSION WIRE (DSL)**
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Transmission Wire Side:

(Connector Front View):

<table>
<thead>
<tr>
<th>Standard resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESISTANCE SPECIFICATION</td>
</tr>
<tr>
<td>Tester Connection</td>
</tr>
<tr>
<td>E10-11 (DSL) - Body ground</td>
</tr>
</tbody>
</table>

NG: Go to step 4

OK: Go to step

3. CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)
   a. Connect the transmission wire connector.
   b. Disconnect the ECM connector.
   c. Measure the resistance according to the value(s) in the table below.

Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-11 (DSL) - Body ground</td>
<td>11 to 13 ohms</td>
</tr>
</tbody>
</table>
NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to Next Step

4. INSPECT SHIFT SOLENOID VALVE DSL
   a. Remove the shift solenoid valve DSL.
   b. Measure the resistance according to the value(s) in the table below.

Standard resistance

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solenoid Connector (DSL) - Solenoid Body (DSL)</td>
<td>11 to 13 ohms</td>
</tr>
</tbody>
</table>

   c. Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

OK: The solenoid valve makes an operating sound.

**Shift Solenoid Valve DSL:**

![Solenoid Valve Diagram]

NG: REPLACE SHIFT SOLENOID VALVE DSL

OK: Go to Next Step
5. **CHECK TRANSMISSION WIRE**

   **OK:** The connectors and pins are securely installed. There is no open or short on the wire harness.

   **NG:** REPAIR OR REPLACE TRANSMISSION WIRE

   **OK:** Go to Next Step

6. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**

   **OK:** There are no foreign objects on each valve and they operate smoothly.

   **NG:** REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

   **OK:** Go to Next Step

7. **INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY**

   **OK:** The torque converter clutch operates normally.

   **NG:** REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

   **OK:** REPAIR AUTOMATIC TRANSAXLE ASSEMBLY

**DTC P0746 PRESSURE CONTROL SOLENOID "A" PERFORMANCE (SHIFT SOLENOID VALVE SL1)**

**SYSTEM DESCRIPTION**

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th or 5th gear).

Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

**DTC DETECTION CONDITION AND TROUBLE AREA**

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0746   | The gear required by the ECM does not match the actual gear when driving (2-trip detection logic) | - Shift solenoid valve SL1 remains open or closed  
- Valve body is blocked  
- Automatic transaxle (clutch, brake or gear etc.) |

**MONITOR DESCRIPTION**
The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd, 4th or 5th gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL.

HINT:

Example:

When either condition (a) or (b) is met, the ECM detects a malfunction.

a. The ECM commands the 1st gear, but the actual gear is 2nd.

b. The ECM commands the 2nd gear, but the actual gear is 1st.

MONITOR STRATEGY

### Related DTCs

| P0746: Shift solenoid valve SL1/OFF malfunction |
| Shift solenoid valve SL1/ON malfunction |

| Required sensors/Components |
| Shift solenoid valve SL1, Speed sensor (NT), Speed sensor (NC), Crankshaft position sensor (NE) |

| Frequency of operation |
| Continuous |

| Duration |
| 0.8 sec. |

| MIL operation |
| 2 driving cycles |

| Sequence of operation |
| None |

TYPICAL ENABLING CONDITIONS

**ALL:**

| The monitor will run whenever this DTC is not present. |
| P0115 - P0118 (ECT sensor) P0125 (Insufficient ECT for closed loop) P0500 (VSS) P0748, P0778, P0798 (Shift solenoid valve (range)) |

| ECT (Engine coolant temperature) |
| 10°C (50°F) or more |

| Transmission range |
| "D" |

| TFT (Transmission fluid temperature) |
| -20°C (-4°F) or more |

| TFT sensor circuit |
| Not circuit malfunction |

| ECT sensor circuit |
| Not circuit malfunction |

| Turbine speed sensor circuit |
| Not circuit malfunction |

| Intermediate shaft speed sensor circuit |
| Not circuit malfunction |

| Output speed sensor circuit |
| Not circuit malfunction |
OFF malfunction:

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>1st</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle speed</td>
<td>Less than 40 km/h (24.9 mph)</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

ON malfunction:

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>2nd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met: OFF malfunction or ON malfunction

OFF malfunction:

2 detections are necessary per driving cycle:

1st detection; temporary flag ON

2nd detection; pending fault code ON

TYPICAL MALFUNCTION THRESHOLDS

Input (turbine) speed/Intermediate shaft speed | 1.49 to 1.63

ON malfunction:

TYPICAL MALFUNCTION THRESHOLDS

Input (turbine) speed/Intermediate shaft speed | 2.72 to 2.86

INSPECTION PROCEDURE
HINT:

Using Techstream to perform Active Test allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Test early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Test.

1. **PERFORM ACTIVE TEST**
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Active Test".
   g. According to the display on the tester, perform the "Active Test".

HINT:

While driving, the shift position can be forcibly changed with Techstream.

Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (See DATA LIST / ACTIVE TEST).

### ACTIVE TEST DETAIL

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Test Part</th>
<th>Control Range</th>
<th>Diagnostic Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control the Shift Position</td>
<td>[Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition]</td>
<td>1st/2nd/3rd/4th/5th</td>
<td>Possible to check the operation of the shift solenoid valves.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• IDL: ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less than 50 km/h (31 mph)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Others]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Press &quot;--&gt;&quot; button: Shift up</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Press &quot;&lt;--&quot; button: Shift down</td>
<td></td>
</tr>
</tbody>
</table>
HINT:

- This test can be conducted when the vehicle speed is 50 km/h (31 mph) or less.
- The shift position commanded by the ECM is shown in the Data List/Shift Status display on Techstream.

1. **CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0746)**
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and turn the Techstream main switch ON.
   c. When you use Techstream:
      - Select the item "Powertrain / Engine and ECT / Trouble Codes".
   d. Read the DTCs using Techstream.

Result

**RESULT REFERENCE**

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0746</td>
<td>A</td>
</tr>
<tr>
<td>P0746 and other DTCS</td>
<td>B</td>
</tr>
</tbody>
</table>

HINT:

If any other codes besides "P0746" are output, perform the troubleshooting for those DTCs first.

B: Go to **DTC CHART**

A: Go to Next Step

2. **INSPECT SHIFT SOLENOID VALVE SL1**
   a. Remove the shift solenoid valve SL1.
   b. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 -2</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

c. Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK: The solenoid makes an operating sound.
NG: REPLACE SHIFT SOLENOID VALVE SL1

OK: Go to Next Step

3. INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK: There are no foreign objects on each valve and they operate smoothly.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

OK: Go to Next Step

4. INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK: The torque converter clutch operates normally.

NG: REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK: REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL (SHIFT SOLENOID VALVE SL1)
DESCRIPTION

Shifting from 1st to 5th is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1, SL2, SL3, S4 and SR which are controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated smoothly (Fail safe function).

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0748   | The ECM checks for an open or short in the shift solenoid valve SL1 circuit while driving and shift gears. {1 -trip detection logic}    | • Open or short in shift solenoid valve SL1 circuit
|         | • Output signal duty equals to 100 %. (NOTE: SL1 output signal duty is less than 100 % under normal condition.)                     | • Shift solenoid valve SL1
|         |                                                                       | • ECM |

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (See DATA LIST / ACTIVE TEST).

MONITOR STRATEGY

<table>
<thead>
<tr>
<th></th>
<th>P0748: Shift solenoid valve SL1/Range check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related DTCs</td>
<td></td>
</tr>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve SL1</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>1 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th></th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>The monitor will run whenever this DTC is not present.</td>
<td></td>
</tr>
<tr>
<td>Battery voltage</td>
<td>10 V or more</td>
</tr>
</tbody>
</table>

Microsoft

Wednesday, August 12, 2009 2:03:24 PM  Page 95  © 2005 Mitchell Repair Information Company, LLC.
TYPICAL MALFUNCTION THRESHOLDS

TYPICAL MALFUNCTION THRESHOLDS
Output signal duty | 100%

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE
Output signal duty | Less than 100%

WIRING DIAGRAM

![Wiring Diagram](image)

Fig. 42: Shift Solenoid Valve SL1 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. INSPECT TRANSMISSION WIRE (SL1)
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6(SL1+)-13(SL1-)</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

   c. Measure the resistance according to the value(s) in the table below.
Standard resistance (Check for short)

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (SL1+) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>13 (SL1-) - Body ground</td>
<td></td>
</tr>
</tbody>
</table>

**Transmission Wire Side:**

(Connector Front View):

![Connector Diagram]

**Fig. 43: Identifying Transmission Wire Connector Terminals**

*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

NG: Go to step 3

OK: Go to Next Step

2. **CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)**
   a. Connect the transmission wire connector to the transaxle.
   b. Disconnect the connector from the ECM.
   c. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-19 (SL1+) - E10-18 (SL1-)</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

   d. Measure the resistance according to the value(s) in the table below.

**Standard resistance (Check for short)**

**RESISTANCE SPECIFICATION**
NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

3. INSPECT SHIFT SOLENOID VALVE SL1
   a. Remove the shift solenoid valve SL1.
   b. Measure the resistance according to the value(s) in the table below.

   Standard resistance
   RESISTANCE SPECIFICATION
<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>
   c. Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

   OK: The solenoid makes an operating sound.
NG: REPLACE SHIFT SOLENOID VALVE SL1

OK: REPAIR OR REPLACE TRANSMISSION WIRE

DTC P0766 SHIFT SOLENOID "D" PERFORMANCE (SHIFT SOLENOID VALVE S4)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th or 5th gear).

Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0766   | The gear required by the ECM does not match the actual gear when driving (2-trip detection logic) | • Shift solenoid valve S4 remains open or closed  
• Valve body is blocked  
• Automatic transaxle (clutch, brake or gear etc.) |
MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd, 4th or 5th gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL and stores the DTC.

MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0766: Shift solenoid valve S4/OFF malfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shift solenoid valve S4/ON malfunction</td>
</tr>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve S4, Speed sensor (NT),</td>
</tr>
<tr>
<td></td>
<td>Speed sensor (NC), Crankshaft position sensor</td>
</tr>
<tr>
<td></td>
<td>(NE)</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>OFF malfunction (A) and ON malfunction (B)</td>
</tr>
<tr>
<td></td>
<td>1 sec.</td>
</tr>
<tr>
<td></td>
<td>OFF malfunction (B)</td>
</tr>
<tr>
<td></td>
<td>1.2 sec.</td>
</tr>
<tr>
<td></td>
<td>ON malfunction (A)</td>
</tr>
<tr>
<td></td>
<td>0.8 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>2 driving cycles</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

All:

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>P0115 - P0118 (ECT sensor) P0125 (Insufficient ECT for closed loop) P0500 (VSS) P0748, P0778, P0798 (Shift solenoid valve (range))</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECT (Engine coolant temperature)</td>
<td>10°C (50°F) or more</td>
</tr>
<tr>
<td>Transmission range</td>
<td>&quot;D&quot;</td>
</tr>
<tr>
<td>TFT (Transmission fluid temperature)</td>
<td>-20°C (-4°F) or more</td>
</tr>
<tr>
<td>TFT sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>ECT sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Turbine speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Intermediate shaft speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Output speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve SL1 circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve SL2 circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Shift solenoid valve SL3 circuit</td>
<td>Not circuit malfunction</td>
</tr>
</tbody>
</table>
### Shift solenoid valve S4 circuit
- Not circuit malfunction

### Shift solenoid valve SR circuit
- Not circuit malfunction

### Shift solenoid valve DSL circuit
- Not circuit malfunction

### Electronic throttle system
- Not circuit malfunction

### OFF malfunction (A):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>5th</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>5% or more</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>10 km/h (6.2 mph) or more</td>
</tr>
</tbody>
</table>

### OFF malfunction (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM lock-up command</td>
<td>ON</td>
</tr>
<tr>
<td>ECM selected gear</td>
<td>3rd, 4th or 5th</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>10% or more</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>25 to 100 km/h (15.5 to 62.1 mph)</td>
</tr>
</tbody>
</table>

### ON malfunction (A):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>4th or 5th</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

### ON malfunction (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>4th</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>5% or more</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>10 km/h (6.2 mph) or more</td>
</tr>
</tbody>
</table>

### TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met: OFF malfunction (A) and (B), or ON malfunction (A) and (B)

2 detections are necessary per driving cycle:

1st detection; temporary flag ON

2nd detection; pending fault code ON
OFF malfunction (A):

**TYPICAL MALFUNCTION THRESHOLDS**

| Intermediate shaft speed/Output speed | 1.44 to 1.58 |

OFF malfunction (B):

**TYPICAL MALFUNCTION THRESHOLDS**

| Difference between engine speed and input (turbine) speed | Less than 35 rpm |

ON malfunction (A):

**TYPICAL MALFUNCTION THRESHOLDS**

| Input (turbine) speed/Intermediate shaft speed | 0.64 to 0.74 |

ON malfunction (B):

**TYPICAL MALFUNCTION THRESHOLDS**

| Intermediate shaft speed/Output speed | 1.02 to 1.16 |

**INSPECTION PROCEDURE**

**HINT:**

Using Techstream to perform Active Test allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Test early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Test.

1. **PERFORM ACTIVE TEST**
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Active Test".
   g. According to the display on the tester, perform the "Active Test".

   **HINT:**

   While driving, the shift position can be forcibly changed with Techstream.

   Comparing the shift position commanded by the Active Test with the actual shift position enables
you to confirm the problem (See DATA LIST / ACTIVE TEST).

**ACTIVE TEST DETAIL**

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Test Part</th>
<th>Control Range</th>
<th>Diagnostic Note</th>
</tr>
</thead>
</table>
| Control the Shift position | [Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition]  
  • IDL: ON  
  • Less than 50 km/h (31 mph) | 1st/2nd/3rd/4th/5th | Possible to check the operation of the shift solenoid valves. |
|                        | [Others]  
  • Press "-->" button: Shift up  
  • Press "<--" button: Shift down |               |                 |

**HINT:**

- This test can be conducted when the vehicle speed is 50 km/h (31 mph) or less.
- The shift position commanded by the ECM is shown in the Data List/Shift Status display on Techstream.

1. **CHECK OTHER DTCs OUTPUT (IN ADDITION TO DTC P0766)**
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and turn the Techstream main switch ON.
   c. Select the item "Powertrain / Engine and ECT / Trouble Codes".
   d. Read the DTCs using Techstream.

**Result**

**RESULT REFERENCE**

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0766</td>
<td>A</td>
</tr>
<tr>
<td>P0766 and other DTCs</td>
<td>B</td>
</tr>
</tbody>
</table>

**HINT:**
If any other codes besides "P0766" are output, perform the troubleshooting for those DTCs first.

**B: Go to DTC CHART**

**A: Go to Next Step**

2. **INSPECT SHIFT SOLENOID VALVE S4**
   
   a. Remove the shift solenoid valve S4.
   
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solenoid Connector (S4) - Solenoid Body (S4)</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>

   c. Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

   **OK: The solenoid makes an operating sound.**

   **Shift Solenoid Valve S4:**

   ![Diagram of Shift Solenoid Valve S4](image)

   **Fig. 46: Measuring Resistance Between Shift Solenoid Valve S4 Terminals And Solenoid Body**

   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   **NG: REPLACE SHIFT SOLENOID VALVE S4**

   **OK: Go to Next Step**

3. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**
OK: There are no foreign objects on each valve and they operate smoothly.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

OK: Go to Next Step

4. INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK: The torque converter clutch operates normally.

NG: REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK: REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC P0771 SHIFT SOLENOID "E" PERFORMANCE (SHIFT SOLENOID VALVE SR)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th or 5th gear).

Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0771   | The gear required by the ECM does not match the actual gear when driving (2-trip detection logic) | • Shift solenoid valve SR remains open or closed  
• Valve body is blocked  
• Automatic transaxle (clutch, brake or gear etc.) |

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd, 4th or 5th gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL and stores the DTC.

MONITOR STRATEGY

MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0771: Shift solenoid valve SR/Rationality check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve SR, Speed sensor (NT), Speed</td>
</tr>
</tbody>
</table>
TYPICAL ENABLING CONDITIONS

All:

<table>
<thead>
<tr>
<th>Frequency of operation</th>
<th>sensor (NC), Crankshaft position sensor (NE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>OFF malfunction (A) 1 sec.</td>
</tr>
<tr>
<td></td>
<td>OFF malfunction (B) 3.5 sec.</td>
</tr>
<tr>
<td></td>
<td>ON malfunction (A) Continuous ON malfunction (B) and (C) 0.8 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>2 driving cycles</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

The monitor will run whenever this DTC is not present

P0115-P0118 (ECT sensor) P0125 (Insufficient ECT for closed loop) P0500 (VSS) P0748, P0778, P0798 (Shift solenoid valve (range))

ECT (Engine coolant temperature) 10°C (50°F) or more
Transmission range "D"
TFT (Transmission fluid temperature) -20°C (-4°F) or more
TFT sensor circuit Not circuit malfunction
ECT sensor circuit Not circuit malfunction
Turbine speed sensor circuit Not circuit malfunction
Intermediate shaft speed sensor circuit Not circuit malfunction
Output speed sensor circuit Not circuit malfunction
Shift solenoid valve SL1 circuit Not circuit malfunction
Shift solenoid valve SL2 circuit Not circuit malfunction
Shift solenoid valve SL3 circuit Not circuit malfunction
Shift solenoid valve S4 circuit Not circuit malfunction
Shift solenoid valve SR circuit Not circuit malfunction
Shift solenoid valve DSL circuit Not circuit malfunction
Electronic throttle system Not circuit malfunction

OFF malfunction (A):

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle valve opening angle</td>
<td>5% or more</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>10 km/h (6.2 mph) or more</td>
</tr>
</tbody>
</table>
OFF malfunction (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM lock-up command</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>3rd, 4th or 5th</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>25 km/h (15.5 mph) or more</td>
</tr>
</tbody>
</table>

ON malfunction (A):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM lock-up command</th>
<th>OFF</th>
</tr>
</thead>
</table>

ON malfunction (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>1st</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle speed</td>
<td>Less than 40 km/h (24.9 mph)</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

ON malfunction (C):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

ON malfunction (D):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Duration time from shift command of ECM</th>
<th>15 sec. or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>4th or 5th</td>
</tr>
</tbody>
</table>

**TYPICAL MALFUNCTION THRESHOLDS**

Either of the following conditions is met: OFF malfunction (A) and (B), or ON malfunction (A), (B), (C) and (D)

OFF malfunction (A):

**TYPICAL MALFUNCTION THRESHOLDS**

<table>
<thead>
<tr>
<th>Intermediate shaft speed/Output speed</th>
<th>1.44 to 1.58</th>
</tr>
</thead>
</table>

OFF malfunction (B):
TYPICAL MALFUNCTION THRESHOLDS

| Engine speed - Input (turbine) speed | 75 rpm or more |

ON malfunction (A):

TYPICAL MALFUNCTION THRESHOLDS

| Difference between engine speed and input (turbine) speed | 150 rpm or more |

ON malfunction (B):

TYPICAL MALFUNCTION THRESHOLDS

| Input (turbine) speed/Intermediate shaft speed | 0.93 to 1.07 |

ON malfunction (C):

TYPICAL MALFUNCTION THRESHOLDS

| Input (turbine) speed/Intermediate shaft speed | 0.93 to 1.07 |

ON malfunction (D):

TYPICAL MALFUNCTION THRESHOLDS

| Input (turbine) speed/Intermediate shaft speed | 0.64 to 0.74 |

INSPECTION PROCEDURE

HINT:

Using Techstream to perform Active Test allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Test early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Test.

1. **PERFORM ACTIVE TEST**
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Active Test".
   g. According to the display on the tester, perform the "Active Test".

   HINT:
While driving, the shift position can be forcibly changed with Techstream.

Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (See **DATA LIST / ACTIVE TEST**).

**ACTIVE TEST DETAIL**

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Test Part</th>
<th>Control Range</th>
<th>Diagnostic Note</th>
</tr>
</thead>
</table>
| Control the Shift Position | [Test Details]
Operate the shift solenoid valve and set the each shift position by yourself.
[Vehicle Condition] | • IDL: ON
• Less than 50 km/h (31 mph) | 1st/2nd/3rd/4th/5th | Possible to check the operation of the shift solenoid valves. |
| [Others] | • Press "-->" button: Shift up
• Press "<--" button: Shift down | |

**HINT:**

- This test can be conducted when the vehicle speed is 50 km/h (31 mph) or less.
- The shift position commanded by the ECM is shown in the Data List/Shift Status display on Techstream.

1. **CHECK OTHER DTCs OUTPUT (IN ADDITION TO DTC P0771)**
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and turn the Techstream main switch ON.
   c. When you use Techstream:
      Select the item "Powertrain / Engine and ECT / Trouble Codes".
   d. Read the DTCs using Techstream.

**Result**
HINT:

If any other codes besides "P0771" are output, perform the troubleshooting for those DTCs first.

**B:** Go to DTC CHART

**A:** Go to Next Step

2. **INSPECT SHIFT SOLENOID VALVE SR**
   a. Remove the shift solenoid valve SR.
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solenoid Connector (SR) - Solenoid Body (SR)</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>

   c. Connect positive (+) lead to the terminal of solenoid connector, negative (-) lead to the solenoid body.

   **OK:** The solenoid makes an operating sound.

   **Shift Solenoid Valve SR:**

   ![Fig. 47: Measuring Resistance Between Shift Solenoid Valve SR Terminals And Solenoid Body](image-url)
NG: REPLACE SHIFT SOLENOID VALVE SR

OK: Go to Next Step

3. INSPECT TRANSMISSION VALVE BODY ASSEMBLY

OK: There are no foreign objects on each valve and they operate smoothly.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

OK: Go to Next Step

4. INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK: The torque converter clutch operates normally.

NG: REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK: REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC P0776 PRESSURE CONTROL SOLENOID "B" PERFORMANCE (SHIFT SOLENOID VALVE SL2)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th or 5th gear).

Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves, valve body or automatic transaxle (clutch, brake or gear etc.).

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0776   | The gear required by the ECM does not match the actual gear when driving (2-trip detection logic) | • Shift solenoid valve SL2 remains open or closed  
 • Valve body is blocked  
 • Automatic transaxle (clutch, brake or gear etc.) |

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd, 4th or 5th gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL and stores the DTC.
## MONITOR STRATEGY

### Related DTCs
- P0776: Shift solenoid valve SL2/OFF malfunction
- Shift solenoid valve SL2/ON malfunction

### Required sensors/Components
- Shift solenoid valve SL2, Speed sensor (NT), Speed sensor (NC), Crankshaft position sensor (NE)

### Frequency of operation
- Continuous

### Duration
- OFF malfunction (A) 1.8 sec.
- OFF malfunction (B) and (C) 0.8 sec.
- ON malfunction (A) and (B) 0.8 sec.
- ON malfunction (C) 0.4 sec.

### MIL operation
- 2 driving cycles

### Sequence of operation
- None

## TYPICAL ENABLING CONDITIONS

### All:

### The monitor will run whenever this DTC is not present.

| ECT (Engine coolant temperature) | 10°C (50°F) or more |
| Transmission range | "D"
| TFT (Transmission fluid temperature) | -20°C (-4°F) or more |

### Not circuit malfunction
- ECT sensor circuit
- Turbine speed sensor circuit
- Intermediate shaft speed sensor circuit
- Output speed sensor circuit
- Shift solenoid valve SL1 circuit
- Shift solenoid valve SL2 circuit
- Shift solenoid valve SL3 circuit
- Shift solenoid valve S4 circuit
- Shift solenoid valve SR circuit
- Shift solenoid valve DSL circuit
- Electronic throttle system
OFF malfunction (A):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM lock-up command</td>
<td>OFF</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>Less than 60 km/h (37.3 mph)</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>10% or more</td>
</tr>
</tbody>
</table>

OFF malfunction (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>1st</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>Less than 40 km/h (24.9 mph)</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

OFF malfunction (C):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>3rd</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

OFF malfunction (D):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>4th or 5th</td>
</tr>
<tr>
<td>Duration time from shift command of ECM</td>
<td>15 sec. or more</td>
</tr>
</tbody>
</table>

ON malfunction (A):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>1st</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>Less than 40 km/h (24.9 mph)</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>4.5% or more at engine speed 1,900 rpm (Varies with engine speed)</td>
</tr>
</tbody>
</table>

ON malfunction (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Condition Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>3rd</td>
</tr>
<tr>
<td>Throttle valve opening angle</td>
<td>5.0% or more at output speed 1,400 rpm (Varies with engine speed)</td>
</tr>
<tr>
<td>Malfunction of pressure control solenoid &quot;B&quot; (SL2)</td>
<td>Not detected</td>
</tr>
</tbody>
</table>
and "C" (SL3)

ON malfunction (C):

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle valve opening angle</td>
<td>7.0% or more at output speed 1,050 rpm (Varies with engine speed)</td>
</tr>
<tr>
<td>Malfunction of pressure control solenoid &quot;B&quot; (SL2)</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met: OFF malfunction (A), (B), (C) and (D), or ON malfunction (A), (B) and (C)

OFF malfunction (A):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference between engine speed and input (turbine) speed</td>
<td>Less than 35 rpm</td>
</tr>
</tbody>
</table>

OFF malfunction (B) and (C):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input (turbine) speed/Intermediate shaft speed</td>
<td>0.93 to 1.07</td>
</tr>
</tbody>
</table>

OFF malfunction (D):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input (turbine) speed/Intermediate shaft speed</td>
<td>0.64 to 0.74</td>
</tr>
</tbody>
</table>

ON malfunction (A):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input (turbine) speed/Intermediate shaft speed</td>
<td>2.72 to 2.86</td>
</tr>
</tbody>
</table>

ON malfunction (B):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input (turbine) speed - Intermediate shaft speed</td>
<td>700 rpm or more</td>
</tr>
</tbody>
</table>

ON malfunction (C):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input (turbine) speed - Intermediate shaft speed</td>
<td>Less than -500 rpm or 700 rpm or more</td>
</tr>
</tbody>
</table>
INSPECTION PROCEDURE

HINT:

Using Techstream to perform Active Test allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Test early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Test.

1. PERFORM ACTIVE TEST
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECt / Active Test".
   g. According to the display on the tester, perform the "Active Test".

HINT:

While driving, the shift position can be forcibly changed with Techstream.

Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (See DATA LIST / ACTIVE TEST).

ACTIVE TEST DETAIL

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Test Part</th>
<th>Control Range</th>
<th>Diagnostic Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control the Shift Position</td>
<td>[Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition] • IDL: ON • Less than 50 km/h (31 mph)</td>
<td>1st/2nd/3rd/4th/5th</td>
<td>Possible to check the operation of the shift solenoid valves.</td>
</tr>
<tr>
<td></td>
<td>[Others] • Press &quot;--&gt;&quot; button: Shift up • Press &quot;&lt;--&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Microsoft

Wednesday, August 12, 2009 2:03:24 PM

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HINT:

- This test can be conducted when the vehicle speed is 50 km/h (31 mph) or less.
- The shift position commanded by the ECM is shown in the Data List/Shift Status display on Techstream.

1. **CHECK OTHER DTCs OUTPUT (IN ADDITION TO DTC P0776)**
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and turn the Techstream main switch ON.
   c. When you use Techstream:
      Select the item "Powertrain / Engine and ECT / Trouble Codes".
   d. Read the DTCs using Techstream.

   **Result**

   **RESULT REFERENCE**

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0776</td>
<td>A</td>
</tr>
<tr>
<td>P0776 and other DTCs</td>
<td>B</td>
</tr>
</tbody>
</table>

   **HINT:**

   If any other codes besides "P0776" are output, perform the troubleshooting for those DTCs first.

   **B: Go to** [DTC CHART](#)

   **A: Go to Next Step**

2. **INSPECT SHIFT SOLENOID VALVE SL2**
   a. Remove the shift solenoid valve SL2.
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

   c. Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1.
of the solenoid valve connector, then check the movement of the valve.

**OK:** The solenoid makes an operating sound.

**Shift Solenoid Valve SL2:**

![Diagram of Shift Solenoid Valve SL2]

**Fig. 48: Measuring Resistance Between Shift Solenoid Valve SL2 Terminals**

**NG:** REPLACE SHIFT SOLENOID VALVE SL2

**OK:** Go to Next Step

3. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**

**OK:** There are no foreign objects on each valve and they operate smoothly.

**NG:** REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

**OK:** Go to Next Step

4. **INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY**

**OK:** The torque converter clutch operates normally.

**NG:** REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

**OK:** REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY
DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL (SHIFT SOLENOID VALVE SL2)

DESCRIPTION

Shifting from 1st to 5th is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1, SL2, SL3, S4 and SR which are controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated smoothly (Fail safe function).

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0778   | ECM checks for an open or short circuit in shift solenoid valves SL2 (1-trip detection logic) Hybrid IC for solenoid indicates fail. | • Open or short in shift solenoid valve SL2 circuit  
• Shift solenoid valve SL2  
• ECM |

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (See DATA LIST / ACTIVE TEST).

MONITOR STRATEGY

MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0778: Shift solenoid valve SL2/Range check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve SL2</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>1 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

TYPICAL ENABLING CONDITIONS

| The monitor will run whenever this DTC is not present. | None |
| Solenoid current cut status | Not cut |
| Battery voltage | 11 V or more |
| Ignition switch | ON |
| Starter | OFF |
TYPICAL MALFUNCTION_THRESHOLDS

TYPICAL MALFUNCTION_THRESHOLDS
Solenoid status from IC | Fail (Open or short)

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE
Output signal duty | Less than 100%

WIRING DIAGRAM

Fig. 49: Shift Solenoid Valve SL2 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. INSPECT TRANSMISSION WIRE (SL2)
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

   Standard resistance

   RESISTANCE SPECIFICATION
   Tester Connection | Specified Condition 20°C (68°F)
   5(SL2+)-12(SL2-) | 5.0 to 5.6 ohms

   c. Measure the resistance according to the value(s) in the table below.

   OK: Standard resistance (Check for short)
RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (SL2+) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>12 (SL2-) - Body ground</td>
<td>?</td>
</tr>
</tbody>
</table>

Transmission Wire Side:

(Connector Front View):

Fig. 50: Identifying Transmission Wire Connector Terminals (SL2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to Next Step

2. CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)
   a. Connect the transmission wire connector to the transaxle.
   b. Disconnect the connector from the ECM.
   c. Measure the resistance according to the value(s) in the table below.

   Standard resistance

   RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-15 (SL2+) - E10-14 (SL2-)</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

d. Measure the resistance according to the value(s) in the table below.
Fig. 51: Identifying ECM Connector  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Standard resistance (Check for short)

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-15 (SL2+) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>E10-14 (SL2-) - Body ground</td>
<td></td>
</tr>
</tbody>
</table>

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

3. INSPECT SHIFT SOLENOID VALVE SL2
   a. Remove the shift solenoid valve SL2.
   b. Measure the resistance according to the value(s) in the table below.

Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

OK: The solenoid makes an operating sound.
NG: REPLACE SHIFT SOLENOID VALVE SL2

OK: REPAIR OR REPLACE TRANSMISSION WIRE

DTC P0793 INTERMEDIATE SHAFT SPEED SENSOR "A"

DESCRIPTION

This sensor detects the rotation speed of the counter gear. By comparing the counter gear speed signal (NC) with the direct clutch speed sensor signal (NT), the ECM detects the shift timing of the gears and appropriately controls the engine torque and hydraulic pressure according to various conditions. Thus smooth gear shifting is performed.

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0793  | ECM detects conditions (a), (b) and (c) continuously for 5 sec. or more: (1-trip detection logic) | • Open or short in transmission revolution sensor NC (speed sensor NC) circuit  
• Transmission revolution sensor NC (speed sensor NC)  
• ECM |
|         | a. Vehicle speed: 50 km/h (31 mph) or more | |
|         | b. Park/neutral position switch (NSW (STAR)) is OFF | |
Reference (Using an oscilloscope):

Check the waveform between terminals NC+ and NC- of the ECM connector.

Fig. 53: Waveform Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard: Refer to the illustration.

**WAVEFORM REFERENCE**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>NC+-NC-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool setting</td>
<td>1 V/DIV, 1ms./DIV</td>
</tr>
<tr>
<td>Vehicle condition</td>
<td>Vehicle speed 30 km/h (19 mph): (3rd gear) Engine speed 1,400 rpm</td>
</tr>
</tbody>
</table>

**MONITOR DESCRIPTION**

The NC terminal of the ECM detects a revolution signal from the speed sensor (NC) (counter gear rpm). The ECM calculates a gearshift comparing the speed sensor (NT) with the speed sensor (NC). While the vehicle is operating in 2nd, 3rd, 4th or 5th gear in the shift position of D, if the counter gear revolution is less than 300 rpm *1 although the output shaft revolution is more than 1,000 rpm *2, the ECM detects the trouble, illuminates the MIL and stores the DTC.

*1: Pulse is not output or is irregularly output.

*2: The vehicle speed is 50 km/h (31 mph) or more.

**MONITOR STRATEGY**

**Related DTCs**

P0793: Speed sensor (NC)/Verify pulse input

**Required sensors/Components**

Speed sensor (NC), Speed sensor (NT), Park/neutral position switch
<table>
<thead>
<tr>
<th>Frequency of operation</th>
<th>Continuous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>5 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine</td>
<td>Running</td>
</tr>
<tr>
<td>NSW (STAR) switch</td>
<td>OFF</td>
</tr>
<tr>
<td>Output shaft rpm</td>
<td>1,000 rpm or more</td>
</tr>
<tr>
<td>Battery voltage</td>
<td>8 V or more</td>
</tr>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**TYPICAL MALFUNCTION THRESHOLDS**

| Sensor signal rpm | Less than 300 rpm |

**COMPONENT OPERATING RANGE**

**HINT:**
- 3rd when shift lever position is D position (After warming up the engine);
- Intermediate shaft speed (NC) becomes close to the engine speed.

**WIRING DIAGRAM**

![Wiring Diagram](image)
INSPECTION PROCEDURE

HINT:

Using Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

1. READ DATA LIST
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Data List".
   g. According to the display on the tester, read the "Data List".

DATA LIST

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Measurement Item/Range</th>
<th>Normal Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPD (NC)</td>
<td>Counter Gear Speed/ display: 50 r/min</td>
<td>HINT: 3rd when shift lever position is D position (After warming up the engine); Intermediate shaft speed (NC) becomes close to the engine speed.</td>
</tr>
</tbody>
</table>

HINT:

- SPD (NC) is always 0 while driving:
  
  Open or short in the sensor or circuit.

- SPD (NC) is always more than 0 and less than 300 rpm while driving the vehicle at 50 km/h (31 mph) or more:
  
  Sensor trouble, improper installation, or intermittent connection trouble of the circuit.

1. INSPECT SPEED SENSOR INSTALLATION
a. Check the speed sensor installation.

OK: The installation bolt is tightened properly and there is no clearance between the sensor and transaxle case.

NG: REPLACE SPEED SENSOR (NC)

OK: Go to Next Step

2. INSPECT SPEED SENSOR (NC)
   a. Disconnect the speed sensor connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 -2</td>
<td>560 to 680 ohms</td>
</tr>
</tbody>
</table>

Sensor Side:

(Connector Front View):
Fig. 56: Identifying Speed Sensor Connector Terminals (NC)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE SPEED SENSOR (NC)

OK: Go to Next Step

3. CHECK HARNESS AND CONNECTOR (SPEED SENSOR - ECM)
   a. Connect the speed sensor connector.
   b. Disconnect the ECM connector.
   c. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-34 (NC+) - E10-26 (NC-)</td>
<td>560 to 680 ohms</td>
</tr>
</tbody>
</table>

   d. Measure the resistance according to the value(s) in the table below.

   ![ECM Connector Diagram](image)

   **Fig. 57: Identifying ECM Connector**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   **Standard resistance (Check for short)**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-34 (NC+) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>E10-26 (NC-) - Body ground</td>
<td></td>
</tr>
</tbody>
</table>

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

DTC P0796 PRESSURE CONTROL SOLENOID "C" PERFORMANCE (SHIFT SOLENOID VALVE)
SL3)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th or 5th gear).

Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical troubles of the shift solenoid valves and valve body.

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0796   | The gear required by the ECM does not match the actual gear when driving (2-trip detection logic) | • Shift solenoid valve SL3 remains open or closed  
• Valve body is blocked  
• Automatic transaxle (clutch, brake or gear etc.) |

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd, 4th or 5th gear position). When the gear position commanded by the ECM and the actual gear position are not the same, the ECM illuminates the MIL and stores the DTC.

MONITOR STRATEGY

### Related DTCs

P0796:  
Shift solenoid valve SL3/OFF malfunction  
Shift solenoid valve SL3/ON malfunction

### Required sensors/Components

Shift solenoid valve SL3, Speed sensor (NT), Speed sensor (NC), Crankshaft position sensor (NE)

### Frequency of operation

Continuous

### Duration

- OFF malfunction (A)  
  0.8 sec.  
- OFF malfunction (B)  
  1 sec.  
- ON malfunction (A) and (B)  
  0.8 sec.  
- ON malfunction (C)  
  0.4 sec.

### MIL operation

2 driving cycles

### Sequence of operation

None
TYPICAL ENABLING CONDITIONS

All:

| TYPICAL ENABLING CONDITIONS                                                                 |                                                                 |
|-------------------------------------------------------------------------------------------|--|---|---|---|---|
| The monitor will run whenever this DTC is not present.                                      | P0115-P0118 (ECT sensor) P0125 (Insufficient ECT for closed loop) P0500 (VSS) P0748, P0778, P0798 (Shift solenoid valve (range)) |
| ECT (Engine coolant temperature)                                                           | 10°C (50°F) or more |
| Transmission range                                                                         | "D" |
| TFT (Transmission fluid temperature)                                                       | -20°C (-4°F) or more |
| TFT sensor circuit                                                                         | Not circuit malfunction |
| ECT sensor circuit                                                                         | Not circuit malfunction |
| Turbine speed sensor circuit                                                               | Not circuit malfunction |
| Intermediate shaft speed sensor circuit                                                    | Not circuit malfunction |
| Output speed sensor circuit                                                                | Not circuit malfunction |
| Shift solenoid valve SL1 circuit                                                           | Not circuit malfunction |
| Shift solenoid valve SL2 circuit                                                           | Not circuit malfunction |
| Shift solenoid valve SL3 circuit                                                           | Not circuit malfunction |
| Shift solenoid valve S4 circuit                                                           | Not circuit malfunction |
| Shift solenoid valve SR circuit                                                            | Not circuit malfunction |
| Shift solenoid valve DSL circuit                                                           | Not circuit malfunction |
| Electronic throttle system                                                                 | Not circuit malfunction |

OFF malfunction (A):

TYPICAL ENABLING CONDITIONS

| TYPICAL ENABLING CONDITIONS                                                                 | 4th or 5th |
|-------------------------------------------------------------------------------------------|--|---|---|---|---|
| ECM selected gear                                                                         | 4.5% or more at engine speed 1,900 rpm (Varies with engine speed) |
| Throttle valve opening angle                                                               | |

OFF malfunction (B):

TYPICAL ENABLING CONDITIONS

| TYPICAL ENABLING CONDITIONS                                                                 | 4th |
|-------------------------------------------------------------------------------------------|--|---|---|---|---|
| ECM selected gear                                                                         | 4th |
| Throttle valve opening angle                                                               | 5% or more |
| Vehicle speed                                                                             | 10 km/h (6.2 mph) or more |

ON malfunction (A):

TYPICAL ENABLING CONDITIONS

| TYPICAL ENABLING CONDITIONS                                                                 | 1st |
|-------------------------------------------------------------------------------------------|--|---|---|---|---|
| ECM selected gear                                                                         | 1st |
| Vehicle speed                                                                             | Less than 40 km/h (24.9 mph) |
ON malfunction (B):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle valve opening angle</td>
<td>5.0% or more at output speed 1,400 rpm (Varies with engine speed)</td>
</tr>
<tr>
<td>Malfunction of pressure control solenoid &quot;B&quot; (SL2) and &quot;C&quot; (SL3)</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

ON malfunction (C):

**TYPICAL ENABLING CONDITIONS**

| Throttle valve opening angle | 7.0% or more at output speed 1,050 rpm (Varies with engine speed) |
| Malfunction of pressure control solenoid "B" (SL2) | Not detected |

**TYPICAL MALFUNCTION THRESHOLDS**

Either of the following conditions is met: OFF malfunction (A) and (B), or ON malfunctions (A), (B) and (C)

2 detections are necessary per driving cycle:

1st detection; temporary flag ON

2nd detection; pending fault code ON

**OFF malfunction (A):**

**TYPICAL MALFUNCTION THRESHOLDS**

| Input (turbine) speed/Intermediate shaft speed | 0.93 to 1.07 |

**OFF malfunction (B):**

**TYPICAL MALFUNCTION THRESHOLDS**

| Intermediate shaft speed/Output speed | 1.02 to 1.16 |

**ON malfunction (A):**

**TYPICAL MALFUNCTION THRESHOLDS**

| Input (turbine) speed/Intermediate shaft speed | 0.93 to 1.07 |
ON malfunction (B):

TYPICAL MALFUNCTION THRESHOLDS

| Input (turbine) speed - Intermediate shaft speed | 700 rpm or more |

ON malfunction (C):

TYPICAL MALFUNCTION THRESHOLDS

| Input (turbine) speed - Intermediate shaft speed | Less than -500 rpm or 700 rpm or more |

INSPECTION PROCEDURE

HINT:

Using Techstream to perform Active Test allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Test early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Test.

1. **PERFORM ACTIVE TEST**
   a. Warm up the engine.
   b. Turn the ignition switch off.
   c. Connect Techstream to the DLC3.
   d. Turn the ignition switch to the ON position.
   e. Turn on the tester.
   f. Select the item "Powertrain / Engine and ECT / Active Test".
   g. According to the display on the tester, perform the "Active Test".

   HINT:

   While driving, the shift position can be forcibly changed with Techstream.

Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (See DATA LIST / ACTIVE TEST).

**ACTIVE TEST DETAIL**

<table>
<thead>
<tr>
<th>Tester Display</th>
<th>Test Part</th>
<th>Control Range</th>
<th>Diagnostic Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. **CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0796)**
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and turn the Techstream main switch ON.
   c. When you use Techstream:
      
      Select the item "DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES".
   d. Read the DTCs using Techstream.

   **Result**

   **RESULT REFERENCE**

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0796</td>
<td>A</td>
</tr>
<tr>
<td>P0796 and other DTCs</td>
<td>B</td>
</tr>
</tbody>
</table>

   **HINT:**

   If any other codes besides "P0796" are output, perform the troubleshooting for those DTCs first.

   **B: Go to DTC CHART**

   **A: Go to Next Step**

2. **INSPECT SHIFT SOLENOID VALVE SL3**
a. Remove the shift solenoid valve SL3.
b. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

c. Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

**OK:** The solenoid makes an operating sound.

**Shift Solenoid Valve SL3:**

Fig. 58: Measuring Resistance Between Shift Solenoid Valve SL3 Terminals

**NG:** REPLACE SHIFT SOLENOID VALVE SL3

**OK:** Go to Next Step

3. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**

**OK:** There are no foreign objects on each valve and they operate smoothly.
NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY

OK: Go to Next Step

4. INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK: The torque converter clutch operates normally.

NG: REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK: REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC P0798 PRESSURE CONTROL SOLENOID "C" ELECTRICAL (SHIFT SOLENOID VALVE SL3)

DESCRIPTION

Shifting from 1st to 5th is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1, SL2, SL3, S4 and SR which are controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated smoothly (Fail safe function).

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0798   | The ECM checks for an open or short in the shift solenoid valve SL3 circuit while driving and shifting gears. (1-trip detection logic) | • Open or short in shift solenoid valve SL3 circuit  
• Shift solenoid valve SL3  
• ECM |
|         | • Output signal duty equals to 100 %.  
(NO TEE: SL3 output signal duty is less than 100 % under normal condition.) | |

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (See DATA LIST / ACTIVE TEST).

MONITOR STRATEGY
MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0798: Shift solenoid valve SL3/Range check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve SL3</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>1 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery voltage</td>
<td>10 V or more</td>
</tr>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
</tbody>
</table>

TYPICAL MALFUNCTION THRESHOLDS

| Output signal duty | 100% |

COMPONENT OPERATING RANGE

| Output signal duty | Less than 100% |

WIRING DIAGRAM

Fig. 59: Shift Solenoid Valve SL3 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE
1. **INSPECT TRANSMISSION WIRE (SL3)**
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4(SL3+)-11(SL3-)</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

   c. Measure the resistance according to the value(s) in the table below.

   **Standard resistance (Check for short)**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 (SL3+) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>11 (SL3-) - Body ground</td>
<td>?</td>
</tr>
</tbody>
</table>

   **Transmission Wire Side:**

   **(Connector Front View):**

   ![Connector Diagram]

   **Fig. 60: Identifying Transmission Wire Connector Terminals**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   **NG:** Go to step 3
   **OK:** Go to Next Step

2. **CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)**
   a. Connect the transmission wire connector to the transaxle.
   b. Disconnect the connector from the ECM.
c. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

<table>
<thead>
<tr>
<th>RESISTANCE SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tester Connection</td>
</tr>
<tr>
<td>E10-17 (SL3+) - E10-16 (SL3-)</td>
</tr>
</tbody>
</table>


d. Measure the resistance according to the value(s) in the table below.

**Standard resistance (Check for short)**

<table>
<thead>
<tr>
<th>RESISTANCE SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tester Connection</td>
</tr>
<tr>
<td>E10-17 (SL3+) - Body ground</td>
</tr>
<tr>
<td>E10-16 (SL3-) - Body ground</td>
</tr>
</tbody>
</table>

---

**Fig. 61: Identifying ECM Connector**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NG: REPAIR OR REPLACE HARNESS OR CONNECTOR**

**OK: REPLACE ECM**

3. **INSPECT SHIFT SOLENOID VALVE SL3**
   a. Remove the shift solenoid valve SL3.
   b. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

<table>
<thead>
<tr>
<th>RESISTANCE SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tester Connection</td>
</tr>
<tr>
<td>1-2</td>
</tr>
</tbody>
</table>
c. Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK: The solenoid makes an operating sound.

Fig. 62: Measuring Resistance Between Shift Solenoid Valve SL3 Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE SHIFT SOLENOID VALVE SL3

OK: REPAIR OR REPLACE TRANSMISSION WIRE

DTC P0982 SHIFT SOLENOID "D" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S4);
DTC P0983 SHIFT SOLENOID "D" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S4)

DESCRIPTION

Shifting from 1st to 5th is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1, SL2, SL3, S4 and SR which are controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated smoothly (Fail safe function).

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECM detects short in solenoid valve S4 circuit 2 times when</td>
<td>• Short in shift solenoid valve S4 circuit</td>
</tr>
</tbody>
</table>
MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (See DATA LIST / ACTIVE TEST).

MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0982: Shift solenoid valve S4/Range check (Low resistance)</th>
<th>P0983: Shift solenoid valve S4/Range check (High resistance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve S4</td>
<td></td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>0.064 sec.</td>
<td></td>
</tr>
<tr>
<td>MIL operation</td>
<td>Immediate</td>
<td></td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

P0982: Range check (Low resistance):

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve S4</td>
<td>ON</td>
</tr>
<tr>
<td>Battery voltage</td>
<td>8 V or more</td>
</tr>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
</tbody>
</table>

P0983: Range check (High resistance):

<table>
<thead>
<tr>
<th>TYPICAL ENABLING CONDITIONS</th>
</tr>
</thead>
</table>
TYPICAL MALFUNCTION THRESHOLDS

**P0982: Range check (Low resistance):**

<table>
<thead>
<tr>
<th>COMPONENT OPERATING RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve S4 resistance</td>
</tr>
</tbody>
</table>

**P0983: Range check (High resistance):**

<table>
<thead>
<tr>
<th>COMPONENT OPERATING RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve S4 resistance</td>
</tr>
</tbody>
</table>

**COMPONENT OPERATING RANGE**

<table>
<thead>
<tr>
<th>COMPONENT OPERATING RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve S4</td>
</tr>
</tbody>
</table>

WIRING DIAGRAM

Fig. 63: Shift Solenoid Valve S4 - Wiring Diagram

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**INSPECTION PROCEDURE**

1. **INSPECT TRANSMISSION WIRE (S4)**
   a. Disconnect the transmission wire connector from the transaxle.
b. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (S4) - Body ground</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>

**Transmission Wire Side:**

(Connector Front View):

![Connector Diagram]

---

**Fig. 64: Identifying Transmission Wire Connector Terminals**

*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

NG: Go to step 3

OK: Go to Next Step

2. CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)
   a. Connect the transmission wire connector to the transaxle.
   b. Disconnect the connector from the ECM.
   c. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-10 (S4) - Body ground</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>
NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

3. INSPECT SHIFT SOLENOID VALVE S4
   a. Remove the shift solenoid valve S4.
   b. Measure the resistance according to the value(s) in the table below.

   Standard resistance

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solenoid Connector (S4) - Solenoid Body (S4)</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>

   c. Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

   OK: The solenoid makes an operating sound.
Shift Solenoid Valve S4:

![Diagram of Shift Solenoid Valve S4](image)

**Fig. 66: Measuring Resistance Between Shift Solenoid Valve S4 Terminals And Solenoid Body**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NG: REPLACE SHIFT SOLENOID VALVE S4**

**OK: REPAIR OR REPLACE TRANSMISSION WIRE**

**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR);**
**DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**

**DESCRIPTION**
Shifting from 1st to 5th is performed in combination with "ON" and "OFF" operation of the shift solenoid valves SL1, SL2, SL3, S4, and SR which are controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated smoothly (Fail safe function).

**DTC DETECTION CONDITION AND TROUBLE AREA**

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P0985   | ECM detects short in solenoid valve SR circuit 2 times when solenoid valve SR is operated (1-trip detection logic) | • Short in shift solenoid valve SR circuit  
• Shift solenoid valve SR  
• ECM |
| P0986   | ECM detects open in solenoid valve SR circuit 2 times when solenoid valve SR is not operated (1-trip detection logic) | • Open in shift solenoid valve SR circuit  
• Shift solenoid valve SR  
• ECM |

**MONITOR DESCRIPTION**
The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail-safe function and turns the other normal shift solenoid valves "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (See DATA LIST / ACTIVE TEST.).

**MONITOR STRATEGY**

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P0985: Shift solenoid valve SR/Range check (Low resistance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve SR</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Duration</td>
<td>0.064 sec.</td>
</tr>
<tr>
<td>MIL operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
</tr>
</tbody>
</table>

**TYPICAL ENABLING CONDITIONS**

**P0985: Range check (Low resistance):**

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve SR</td>
<td>ON</td>
</tr>
<tr>
<td>Battery voltage</td>
<td>8 V or more</td>
</tr>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**P0986: Range check (High resistance):**

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve SR</td>
<td>OFF</td>
</tr>
<tr>
<td>Battery voltage</td>
<td>8 V or more</td>
</tr>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**TYPICAL MALFUNCTION THRESHOLDS**

**P0985: Range check (Low resistance):**
TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Component</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve SR</td>
<td>8 ohms or less</td>
</tr>
</tbody>
</table>

P0986: Range check (High resistance):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Component</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve SR</td>
<td>100 kohms or more</td>
</tr>
</tbody>
</table>

COMPONENT OPERATING RANGE

<table>
<thead>
<tr>
<th>Component</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve SR</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>

WIRING DIAGRAM

![Wiring Diagram](image)

Fig. 67: Shift Solenoid Valve SR - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **INSPECT TRANSMISSION WIRE (SR)**
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 (SR) - Body ground</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>
**Transmission Wire Side:**

*(Connector Front View):*

![Diagram](image)

**Fig. 68: Identifying Transmission Wire Connector Terminals (SR)**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to Next Step

2. **CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)**
   a. Connect the transmission wire connector to the transaxle.
   b. Disconnect the connector from the ECM.
   c. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-9 (SR) - Body ground</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>

![Diagram](image)

**Fig. 69: Identifying ECM Connector**
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

3. INSPECT SHIFT SOLENOID VALVE SR
   a. Remove the shift solenoid valve SR.
   b. Measure the resistance according to the value(s) in the table below.

   **Standard resistance**

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solenoid Connector (SR) - Solenoid Body (SR)</td>
<td>11 to 15 ohms</td>
</tr>
</tbody>
</table>

   c. Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

   OK: The solenoid makes an operating sound.

   **Shift Solenoid Valve SR:**

   ![Shift Solenoid Valve SR Diagram]

   **Fig. 70: Measuring Resistance Between Shift Solenoid Valve SR Terminals And Solenoid Body**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE SHIFT SOLENOID VALVE SR

OK: REPAIR OR REPLACE TRANSMISSION WIRE

DTC P2714 PRESSURE CONTROL SOLENOID "D" PERFORMANCE (SHIFT SOLENOID VALVE SLT)

**SYSTEM DESCRIPTION**
The linear solenoid valve (SLT) controls the transmission line pressure for smooth transmission operation based on signals from the throttle position sensor and the vehicle speed sensor. The ECM adjusts the duty ratio (*) of the SLT solenoid valve to control hydraulic line pressure coming from the primary regulator valve. Appropriate line pressure assures smooth shifting with varying engine outputs.

(*): Duty Ratio

The duty ratio is the ratio of the period of continuity in one cycle. For example, if A is the period of continuity in one cycle, and B is the period of non-continuity, then Duty Ratio = A/(A+B) x 100(%) 

---

**Fig. 71: Line Pressure Graph**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECM detects a malfunction on</td>
<td></td>
</tr>
</tbody>
</table>

---
MONITOR DESCRIPTION

In any forward position, when the difference between the revolutions of the turbine, Intermediate and output shaft exceeds the specified value (varies with Intermediate, output speed) determined by the ECM, the ECM illuminates the MIL and store the DTC.

When shift solenoid valve SLT remains on, the oil pressure goes down and the clutch engagement force decreases.

NOTE: If you continue driving under these conditions, the clutch will burn out and the vehicle will no longer be drivable.

MONITOR STRATEGY

TYPICAL ENABLING CONDITIONS

ON malfunction:

The monitor will run whenever this DTC is not present.

<table>
<thead>
<tr>
<th>Transmission range</th>
<th>&quot;D&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFT (Transmission fluid temperature)</td>
<td>-20°C (-4°F) or more</td>
</tr>
<tr>
<td>TFT sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Turbine speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Intermediate shaft speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
<tr>
<td>Output speed sensor circuit</td>
<td>Not circuit malfunction</td>
</tr>
</tbody>
</table>

Related DTCs: P2714: Shift solenoid valve SLT/ON malfunction

Required sensors/Components:
- Shift solenoid valve SLT
- Speed sensor (NT)
- Speed sensor (NC)
- Crankshaft position sensor (NE)

Frequency of operation: Continuous

Duration: 0.5 sec.

MIL operation: 2 driving cycles

Sequence of operation: None

Transmission range: "D"

TFT (Transmission fluid temperature): -20°C (-4°F) or more

TFT sensor circuit: Not circuit malfunction

Turbine speed sensor circuit: Not circuit malfunction

Intermediate shaft speed sensor circuit: Not circuit malfunction

Output speed sensor circuit: Not circuit malfunction

NOTE: If you continue driving under these conditions, the clutch will burn out and the vehicle will no longer be drivable.
### ON malfunction (A):

#### TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>1st</td>
</tr>
<tr>
<td>Temporary MAIN gear</td>
<td>1st or 2nd or 3rd or 4th</td>
</tr>
<tr>
<td>NT - NC x Temporary MAIN gear ratio</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NT: Input (turbine) speed</td>
<td></td>
</tr>
<tr>
<td>NC: Intermediate shaft speed</td>
<td></td>
</tr>
<tr>
<td>Temporary U/D gear</td>
<td>Low</td>
</tr>
<tr>
<td>NC - NO x Temporary U/D gear ratio</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>NO: Output speed</td>
<td></td>
</tr>
<tr>
<td>TT</td>
<td>900 Nm or more</td>
</tr>
<tr>
<td>TT: Turbine Torque</td>
<td></td>
</tr>
<tr>
<td>NT</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NC</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NO</td>
<td>250 rpm or more</td>
</tr>
</tbody>
</table>

### ON malfunction (B):

#### TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM selected gear</td>
<td>2nd</td>
</tr>
<tr>
<td>Temporary MAIN gear</td>
<td>1st or 2nd or 3rd or 4th</td>
</tr>
<tr>
<td>NT - NC x Temporary MAIN gear ratio</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NT: Input (turbine) speed</td>
<td></td>
</tr>
<tr>
<td>NC: Intermediate shaft speed</td>
<td></td>
</tr>
<tr>
<td>Temporary U/D gear</td>
<td>Low</td>
</tr>
<tr>
<td>NC - NO x Temporary U/D gear ratio</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>NO: Output speed</td>
<td></td>
</tr>
<tr>
<td>TT</td>
<td>192 Nm or more</td>
</tr>
<tr>
<td>TT: Turbine Torque</td>
<td></td>
</tr>
<tr>
<td>NT</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NC</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NO</td>
<td>250 rpm or more</td>
</tr>
</tbody>
</table>
ON malfunction (C):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary MAIN gear</td>
<td>1st or 2nd or 3rd or 4th</td>
</tr>
<tr>
<td>NT - NC x Temporary MAIN gear ratio</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NT: Input (turbine) speed</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NC: Intermediate shaft speed</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>Temporary U/D gear</td>
<td>Low</td>
</tr>
<tr>
<td>NC - NO x Temporary U/D gear ratio</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>NO: Output speed</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>TT</td>
<td>900 Nm or more</td>
</tr>
<tr>
<td>TT: Turbine Torque</td>
<td>900 Nm or more</td>
</tr>
<tr>
<td>NT</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NC</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NO</td>
<td>250 rpm or more</td>
</tr>
</tbody>
</table>

ON malfunction (D):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary MAIN gear</td>
<td>1st or 2nd or 3rd or 4th</td>
</tr>
<tr>
<td>NT - NC x Temporary MAIN gear ratio</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NT: Input (turbine) speed</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NC: Intermediate shaft speed</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>Temporary U/D gear</td>
<td>Low</td>
</tr>
<tr>
<td>NC - NO x Temporary U/D gear ratio</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>NO: Output speed</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>TT</td>
<td>189 Nm or more</td>
</tr>
<tr>
<td>TT: Turbine Torque</td>
<td>189 Nm or more</td>
</tr>
<tr>
<td>NT</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NC</td>
<td>250 rpm or more</td>
</tr>
<tr>
<td>NO</td>
<td>250 rpm or more</td>
</tr>
</tbody>
</table>

ON malfunction (E):

**TYPICAL ENABLING CONDITIONS**

<table>
<thead>
<tr>
<th>ECM selected gear</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary MAIN gear</td>
<td>1st or 2nd or 3rd or 4th</td>
</tr>
<tr>
<td>NT - NC x Temporary MAIN gear ratio</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NT: Input (turbine) speed</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>NC: Intermediate shaft speed</td>
<td>100 rpm or more at Intermediate shaft speed 1,000 rpm</td>
</tr>
<tr>
<td>Temporary U/D gear</td>
<td>Low</td>
</tr>
</tbody>
</table>
**TYPICAL MALFUNCTION THRESHOLDS**

[ON malfunction]

Detection condition: Total accumulated time of ON malfunctions (a), (b), (c), (d) and (e) is 0.5 second or more

**ON malfunction (A):**

<table>
<thead>
<tr>
<th>NC - NO x Temporary U/D gear ratio</th>
<th>NO: Output speed</th>
<th>300 rpm or more at Output speed 1,000 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TT</strong></td>
<td>TT: Turbine Torque</td>
<td>189 Nm or more</td>
</tr>
<tr>
<td><strong>NT</strong></td>
<td></td>
<td>250 rpm or more</td>
</tr>
<tr>
<td><strong>NC</strong></td>
<td></td>
<td>250 rpm or more</td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td></td>
<td>250 rpm or more</td>
</tr>
</tbody>
</table>

**TYPICAL MALFUNCTION THRESHOLDS**

<table>
<thead>
<tr>
<th>NT - NC x 1st gear ratio</th>
<th>100 rpm or more at Intermediate shaft speed 1,000 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC - NO x Low gear ratio</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>Duration</td>
<td>1 sec. or more</td>
</tr>
<tr>
<td>Shift Solenoid valve SL1 Performance</td>
<td>Not performance malfunction</td>
</tr>
</tbody>
</table>

**ON malfunction (B):**

<table>
<thead>
<tr>
<th>NT - NC x 2nd gear ratio</th>
<th>100 rpm or more at Intermediate shaft speed 1,000 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC - NO x Low gear ratio</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>Duration</td>
<td>1 sec. or more</td>
</tr>
<tr>
<td>Shift Solenoid valve SL1 Performance</td>
<td>Not performance malfunction</td>
</tr>
</tbody>
</table>

**ON malfunction (C):**

<table>
<thead>
<tr>
<th>NT - NC x 3rd gear ratio</th>
<th>100 rpm or more at Intermediate shaft speed 1,000 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC - NO x Low gear ratio</td>
<td>300 rpm or more at Output speed 1,000 rpm</td>
</tr>
<tr>
<td>Duration</td>
<td>1 sec. or more</td>
</tr>
<tr>
<td>Shift Solenoid valve SL1 Performance</td>
<td>Not performance malfunction</td>
</tr>
</tbody>
</table>

**ON malfunction (D):**

<table>
<thead>
<tr>
<th>NC - NO x Temporary U/D gear ratio</th>
<th>NO: Output speed</th>
<th>300 rpm or more at Output speed 1,000 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TT</strong></td>
<td>TT: Turbine Torque</td>
<td>189 Nm or more</td>
</tr>
<tr>
<td><strong>NT</strong></td>
<td></td>
<td>250 rpm or more</td>
</tr>
<tr>
<td><strong>NC</strong></td>
<td></td>
<td>250 rpm or more</td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td></td>
<td>250 rpm or more</td>
</tr>
</tbody>
</table>
ON malfunction (E):

TYPICAL MALFUNCTION THRESHOLDS

<table>
<thead>
<tr>
<th>Shift Solenoid valve SL1 Performance</th>
<th>Not performance malfunction</th>
</tr>
</thead>
</table>

| NT - NC x 4th gear ratio            | 100 rpm or more at Intermediate shaft speed 1,000 rpm |
| NC - NO x Low gear ratio            | 300 rpm or more at Output speed 1,000 rpm            |
| Duration                            | 1 sec. or more                                             |

INSPECTION PROCEDURE

1. CHECK OTHER DTCS OUT PUT (IN ADDITION TO DTC P2714)
   a. Connect Techstream to the DLC3.
   b. Turn the ignition switch to the ON position and turn the Techstream main switch ON.
   c. When you use Techstream:

   Select the item "Powertrain / Engine and ECT / Trouble Codes".

   d. Read the DTCs using Techstream.

   Result

   RESULT REFERENCE

<table>
<thead>
<tr>
<th>Result</th>
<th>Proceed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2714</td>
<td>A</td>
</tr>
<tr>
<td>P2714 and other DTCs</td>
<td>B</td>
</tr>
</tbody>
</table>

   HINT:

   If any other codes besides "P2714" are output, perform the troubleshooting for those DTCs first.

   B: Go to DTC CHART

   A: Go to Next Step

2. INSPECT SHIFT SOLENOID VALVE SLT
   a. Remove the shift solenoid valve SLT.
b. Measure the resistance according to the value(s) in the table below.

**Standard resistance**

**RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

c. Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

**OK:** The solenoid makes an operating sound.

![Shift Solenoid Valve SLT:](image)

**Fig. 72: Measuring Resistance Between Shift Solenoid Valve SLT Terminals**  
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

**NG:** REPLACE SHIFT SOLENOID VALVE SLT

**OK:** Go to Next Step

3. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**

**OK:** There are no foreign objects on each valve.

**NG:** REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY
OK: Go to Next Step

4. INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

OK: The torque converter clutch operates normally.

NG: REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY

OK: REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSEMBLY

DTC P2716 PRESSURE CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)

DESCRIPTION

The linear solenoid valve (SLT) controls the transmission line pressure for smooth transmission operation based on signals from the throttle position sensor and the vehicle speed sensor. The ECM adjusts the duty cycle of the SLT solenoid valve to control hydraulic line pressure coming from the primary regulator valve. Appropriate line pressure assures smooth shifting with varying engine outputs.

(*): Duty Ratio

The duty ratio is the ratio of the period of continuity in one cycle.

For example, if A is the period of continuity in one cycle, and B is the period of non-continuity, then Duty Ratio = A/(A + B) x 100(%)  

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P2716   | Open or short is detected in shift solenoid valve SLT circuit for 1 second or more while driving (1-trip detecting logic). | • Open or short in shift solenoid valve SLT circuit  
• Shift solenoid valve SLT  
• ECM |
MONITOR DESCRIPTION

When an open or short in the linear solenoid valve (SLT) circuit is detected, the ECM interprets this as a fault. The ECM will turn on the MIL and store the DTC.

MONITOR STRATEGY

<table>
<thead>
<tr>
<th>MONITOR STRATEGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related DTCs</td>
</tr>
<tr>
<td>Required sensors/Components</td>
</tr>
<tr>
<td>Frequency of operation</td>
</tr>
<tr>
<td>Duration</td>
</tr>
<tr>
<td>MIL operation</td>
</tr>
<tr>
<td>Sequence of operation</td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS

<table>
<thead>
<tr>
<th>TYPICAL ENABLING CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The monitor will run whenever this DTC is not present.</td>
</tr>
<tr>
<td>Solenoid current cut status</td>
</tr>
<tr>
<td>Battery voltage</td>
</tr>
<tr>
<td>Ignition switch</td>
</tr>
</tbody>
</table>
TYPICAL MALFUNCTION THRESHOLDS

COMPONENT OPERATING RANGE

WIRING DIAGRAM

Fig. 74: Shift Solenoid Valve SLT - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. INSPECT TRANSMISSION WIRE (SLT)
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

   Standard resistance

   RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (SLT+) - 8 (SLT-)</td>
<td>5.0 to 5.6 ohms at 20°C (68°F)</td>
</tr>
</tbody>
</table>

   c. Measure the resistance according to the value(s) in the table below.

   Standard resistance (Check for short)
RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (SLT+) - Body ground</td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>8 (SLT-) - Body ground</td>
<td>?</td>
</tr>
</tbody>
</table>

Transmission Wire Side:

(Connector Front View):

Fig. 75: Identifying Transmission Wire Connector Terminals (SLT)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to Next Step

2. CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)
   a. Connect the transmission wire connector to the transaxle.
   b. Disconnect the ECM connector.
   c. Measure the resistance according to the value(s) in the table below.

Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-13 (SLT+) - E10-12 (SLT-)</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

   d. Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for short)

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-13 (SLT+) - Body ground</td>
<td></td>
</tr>
</tbody>
</table>
NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

3. INSPECT SHIFT SOLENOID VALVE SLT
   a. Remove the shift solenoid valve (SLT).
   b. Measure the resistance according to the value(s) in the table below.

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>5.0 to 5.6 ohms</td>
</tr>
</tbody>
</table>

   c. Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

   OK: The solenoid makes an operating sound.
NG: REPLACE SHIFT SOLENOID VALVE SLT

OK: REPAIR OR REPLACE TRANSMISSION WIRE

DTC P2769 TORQUE CONVERTER CLUTCH SOLENOID CIRCUIT LOW (SHIFT SOLENOID VALVE DSL); DTC P2770 TORQUE CONVERTER CLUTCH SOLENOID CIRCUIT HIGH (SHIFT SOLENOID VALVE DSL)

DESCRIPTION

The shift solenoid valve DSL is turned "ON" and "OFF" by signals from the ECM in order to control the hydraulic pressure operation, the lock-up relay valve, which then controls operation of the lock-up clutch.

DTC DETECTION CONDITION AND TROUBLE AREA

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
</table>
| P2769   | ECM detects short in solenoid valve DSL circuit (0.1 sec.) when solenoid valve DSL is operated (2-trip detection logic) | • Short in shift solenoid valve DSL circuit  
• Shift solenoid valve DSL  
• ECM |
| P2770   | ECM detects open in solenoid valve DSL circuit (0.1 sec.) when solenoid valve DSL is not | • Open in shift solenoid valve DSL circuit  
• Shift solenoid valve DSL |
MONITOR DESCRIPTION

Torque converter lock-up is controlled by the ECM based on engine rpm, engine load, engine temperature, vehicle speed, transmission temperature, and shift range selection. The ECM determines the lock-up status of the torque converter by comparing the engine rpm (NE) to the input turbine rpm (NT). The ECM calculates the actual transmission gear by comparing input turbine rpm (NT) to counter gear rpm (NC). When conditions are appropriate, the ECM requests "lock-up" by applying control voltage to the shift solenoid DSL. When the DSL is opened, it applies pressure to the lock-up relay valve and locks the torque converter clutch. If the ECM detects an open or short in the DSL solenoid circuit, the ECM interprets this as a fault in the DSL solenoid or circuit. The ECM will turn on the MIL and store the DTC.

MONITOR STRATEGY

<table>
<thead>
<tr>
<th>Related DTCs</th>
<th>P2769: Shift solenoid valve DSL/Range check (Low resistance)</th>
<th>P2770: Shift solenoid valve DSL/Range check (High resistance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/Components</td>
<td>Shift solenoid valve DSL</td>
<td></td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>0.064 sec. or more</td>
<td></td>
</tr>
<tr>
<td>MIL operation</td>
<td>2 driving cycles</td>
<td></td>
</tr>
<tr>
<td>Sequence of operation</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

TYPICAL ENABLING CONDITIONS P2769

Range check (Low resistance):

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift solenoid valve DSL</td>
<td>ON</td>
</tr>
<tr>
<td>Solenoid current cut status</td>
<td>Not cut</td>
</tr>
<tr>
<td>Battery voltage</td>
<td>8 V or more</td>
</tr>
<tr>
<td>Ignition switch</td>
<td>ON</td>
</tr>
<tr>
<td>Starter</td>
<td>OFF</td>
</tr>
</tbody>
</table>

P2770: Range check (High resistance):

<table>
<thead>
<tr>
<th>The monitor will run whenever this DTC is not present.</th>
<th>None</th>
</tr>
</thead>
</table>
TYPICAL MALFUNCTION THRESHOLDS

P2769: Range check (Low resistance):

TYPICAL MALFUNCTION THRESHOLDS

| Shift solenoid valve DSL resistance | 8 ohms or less |

P2770: Range check (High resistance):

TYPICAL MALFUNCTION THRESHOLDS

| Shift solenoid valve DSL resistance | 100 kohms or more |

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

| Shift solenoid valve DSL | Resistance: 11 to 13 ohms at 20°C (68°F) |

WIRING DIAGRAM

Fig. 78: Shift Solenoid Valve DSL - Wiring Diagram

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. INSPECT TRANSMISSION WIRE (DSL)
   a. Disconnect the transmission wire connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.
Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 (DSL) - Body ground</td>
<td>11 to 13 ohms</td>
</tr>
</tbody>
</table>

Transmission Wire Side:

(Connector Front View):

Fig. 79: Identifying Transmission Wire Connector Terminals (DSL)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to Next Step

2. CHECK HARNESS AND CONNECTOR (TRANSMISSION WIRE - ECM)
   a. Connect the transmission wire connector.
   b. Disconnect the ECM connector.
   c. Measure the resistance according to the value(s) in the table below.

Standard resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E10-11 (DSL) - Body ground</td>
<td>11 to 13 ohms</td>
</tr>
</tbody>
</table>
NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM

3. INSPECT SHIFT SOLENOID VALVE DSL
   a. Remove the shift solenoid valve DSL.
   b. Measure the resistance according to the value(s) in the table below.

   Standard resistance

   **RESISTANCE SPECIFICATION**

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solenoid Connector (DSL) - Solenoid Body (DSL)</td>
<td>11 to 13 ohms</td>
</tr>
</tbody>
</table>

   c. Connect the positive (+) lead to the terminal of the solenoid connector, and the negative (-) lead to the solenoid body.

   **OK: The solenoid valve makes an operating sound.**
Fig. 81: Measuring Resistance Between Shift Solenoid Valve DSL Terminals And Solenoid Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE SHIFT SOLENOID VALVE DSL

OK: REPAIR OR REPLACE TRANSMISSION WIRE

AUTOMATIC TRANSAKLE FLUID

ON-VEHICLE INSPECTION

1. CHECK FLUID LEVEL

HINT:

Drive the vehicle so that the engine and transaxle are at normal operating temperature.

Fluid temperature: 70 to 80°C (158 to 176°F)

a. Park the vehicle on a level surface and set the parking brake.

b. With the engine idling and the brake pedal depressed, move the shift lever to all positions from P to L and return to the P position.

c. Take out the dipstick and wipe it clean.

d. Put the dipstick back all the way.

e. Take out the dipstick again and check that the fluid level is within the HOT range.

If the fluid level is below the HOT range, add new fluid and recheck the fluid level.

If the fluid level exceeds the HOT range, drain the fluid once, add the proper amount of new fluid
and recheck the fluid level.

If there are leaks, it is necessary to repair or replace O-rings, FIPGs, oil seals, plugs and/or other parts.

![Diagram of dipstick levels](image)

**Fig. 82: Identifying Fluid Level On Dipstick**  
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

**PARK / NEUTRAL POSITION SWITCH**

**COMPONENTS**
REMOVAL

1. REMOVE BATTERY

2. REMOVE AIR CLEANER ASSEMBLY

HINT:

(See REMOVAL)

3. SEPARATE TRANSMISSION CONTROL CABLE ASSEMBLY
   a. Remove the nut from the control shaft lever.
   b. Disconnect the control cable from the control shaft lever.
c. Remove the clip and disconnect the control cable from the control cable bracket.

**NOTE:** Do not hold the resin guide pipe.

4. **REMOVE PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
   a. Disconnect the park/neutral position switch connector.
   
   b. Remove the nut, washer and control shaft lever.

---

**Fig. 84: Locating Control Shaft Lever Nut**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Fig. 85: Locating Control Cable Clip**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Fig. 86: Locating Park/Neutral Position Switch Connector**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
c. Using a screwdriver, pry up the lock plate.

d. Remove the lock nut and the lock plate.

e. Remove the 2 bolts and pull out the park/neutral position switch.
INSPECTION

1. INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY OPERATION
   a. Apply the parking brake and turn the ignition switch to the ON position.
   b. Depress the brake pedal and check that the engine starts only when the shift lever is in the N or P
      position and the engine does not start when the shift lever is in other positions.
   c. Check that the back up light comes on and the reverse warning buzzer sounds only when the shift
      lever is in the R position and the light and buzzer do not operate when the shift lever is in other
      positions.
   d. If a failure is found, check the park/neutral position switch for continuity.

2. INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY
   a. Jack up the vehicle.
   b. Disconnect the park/neutral position switch connector.
   c. Measure the resistance according to the value(s) in the table below when the shift lever is moved to
      each position.

Resistance

<table>
<thead>
<tr>
<th>Shift Position</th>
<th>Tester Connection</th>
<th>Specified Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>2 - 6 and 4 - 5</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except P</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>R</td>
<td>2-1</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except R</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>N</td>
<td>2 - 9 and 4 - 5</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except N</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>D and 4</td>
<td>2-7</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except D and 4</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
<tr>
<td>3</td>
<td>2-3</td>
<td>Below 1 ohms</td>
</tr>
<tr>
<td>Except 3</td>
<td></td>
<td>10 kohms or higher</td>
</tr>
</tbody>
</table>
ADJUSTMENT

1. ADJUST PARK/NEUTRAL POSITION SWITCH ASSEMBLY
   a. Loosen the 2 bolts of the park/neutral position switch and move the shift lever to the N position.
   b. Align the groove with the neutral basic line.
   c. Hold the switch in position and tighten the 2 bolts.

   Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

   d. After adjustment, perform the inspection described in park/neutral position switch assembly operation.
INSTALLATION

1. INSTALL PARK/NEUTRAL POSITION SWITCH ASSEMBLY
   a. Install the park/neutral position switch to the manual valve shaft.
   b. Temporarily install the 2 bolts.

   ![Fig. 93: Locating Park/Neutral Position Switch Bolts](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

   c. Place a new lock plate and tighten the nut.

   **Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)**

   d. Temporarily install the control shaft lever.

   ![Fig. 94: Locating Lock Plate Nut](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

   e. Turn the lever counterclockwise until it stops, then turn it clockwise 2 notches.
   f. Remove the control shaft lever.
g. Align the groove with the neutral basic line.

h. Hold the switch in position and tighten the 2 bolts.

**Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)**

i. Using a screwdriver, bend the tabs of the lock plate.
j. Install the control shaft lever, washer and the nut.

**Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)**

Fig. 98: Locating Control Shaft Lever Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

k. Connect the park/neutral position switch connector.

Fig. 99: Locating Park/Neutral Position Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
   a. Connect the control cable to the control shaft lever with the nut.

**Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)**

Microsoft
Page 174  © 2005 Mitchell Repair Information Company, LLC.
Fig. 100: Locating Control Shaft Lever Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the control cable with a new clip to the bracket.

Fig. 101: Locating Control Cable Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. ADJUST PARK/NEUTRAL POSITION SWITCH ASSEMBLY (See ADJUSTMENT)
4. INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY OPERATION (See INSPECTION)
5. INSPECT SHIFT LEVER POSITION (See ADJUSTMENT)
6. ADJUST SHIFT LEVER POSITION (See ADJUSTMENT)
7. INSTALL AIR CLEANER ASSEMBLY

HINT:

(See INSTALLATION)

8. INSTALL BATTERY

TRANSMISSION WIRE

COMPONENTS
Fig. 102: Identifying Transmission Wire Components With Torque Specification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
2. REMOVE ENGINE UNDER COVER NO.1
3. DRAIN AUTOMATIC TRANSAXLE FLUID
   a. Remove the drain plug and gasket, and drain the ATF.
   b. Install a new gasket and the drain plug.
Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)

4. REMOVE AUTOMATIC TRANSAXLE OIL PAN SUB-ASSEMBLY
   
   a. Remove the 18 bolts, oil pan and gasket.

   **NOTE:** Some fluid will remain in the oil pan. Carefully remove the oil pan so that fluid remaining in the pan does not spill out.

   ![Fig. 103: Locating Oil Pan Bolts](image)
   Fig. 103: Locating Oil Pan Bolts
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Remove the 2 magnets from the oil pan.

   ![Fig. 104: Identifying Magnets](image)
   Fig. 104: Identifying Magnets
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Examine particles in the pan.

   1. Collect any steel chips using the removed magnets. Look carefully at the chips and particles in the pan and on the magnets to see the type of wear which might be found in the transaxle.

   **Result:**

   **Steel (magnetic):**

   Wear of the bearing, gear or plate
Brass (non-magnetic):

Wear of the bearing

Fig. 105: Collecting Steel Chips Using Magnet
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. DISCONNECT TRANSMISSION WIRE
   a. Disconnect the 7 shift solenoid valve connectors.
   b. Remove the bolt and lock plate, and disconnect the ATF temperature sensor.

Fig. 106: Locating Shift Solenoid Valve Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE TRANSMISSION WIRE
   a. Disconnect the transmission wire connector.
   b. Remove the bolt and transmission wire.
   c. Remove the O-ring from the transmission wire.
INSTALLATION

1. INSTALL TRANSMISSION WIRE
   a. Coat the O-ring of the transmission wire connector with ATF and install it.

   Torque: 5.4 N*m (55 kgf*cm, 48 ft.*lbf)

2. CONNECT TRANSMISSION WIRE
a. Coat the O-ring of the ATF temperature sensor with ATF.
b. Install the ATF temperature sensor with the lock plate and bolt.

   Torque: 6.6 N*m (67 kgf*cm, 58 ft.*lbf)

c. Connect the 7 shift solenoid valve connectors.

![Fig. 110: Locating Shift Solenoid Valve Connectors](image1)

3. INSTALL AUTOMATIC TRANSAXLE OIL PAN SUB-ASSEMBLY
   a. Install the 2 magnets in the oil pan.
   b. Apply seal packing to the 18 bolts.

   Seal packing:

   THREE BOND 2430 or equivalent

![Fig. 111: Identifying Magnets](image2)

   c. Using a new gasket, install the oil pan to the transaxle case with the 18 bolts.

   Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)

   **NOTE:** Apply seal packing to the bolts and tighten them within 10 minutes of installation.
Fig. 112: Locating Oil Pan Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL
5. ADD AUTOMATIC TRANSAXLE FLUID
6. INSPECT AUTOMATIC TRANSAXLE FLUID (See ON-VEHICLE INSPECTION)
7. INSTALL ENGINE UNDER COVER NO.1
8. RESET MEMORY

HINT:

(See INITIALIZATION)

VALVE BODY ASSEMBLY

COMPONENTS
Fig. 113: Identifying Valve Body Assembly Components With Torque Specification (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
Fig. 114: Identifying Valve Body Assembly Components With Torque Specification (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE ENGINE UNDER COVER NO.1
2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
3. DRAIN AUTOMATIC TRANSAXLE FLUID (See REMOVAL)
4. **REMOVE AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY**
   a. Remove the 18 bolts, oil pan and gasket.

   **NOTE:** Some fluid will remain in the oil pan. Carefully remove the oil pan so that the fluid remaining in the pan does not spill out.

   ![Fig. 115: Locating Oil Pan Bolts](image)

   **Fig. 115: Locating Oil Pan Bolts**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Remove the 2 magnets from the oil pan.

   ![Fig. 116: Identifying Magnets](image)

   **Fig. 116: Identifying Magnets**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Examine particles in the pan.

   1. Collect any steel chips using the removed magnets. Look carefully at the chips and particles in the pan and on the magnets to see the type of wear which might be found in the transaxle.

   **Result:**

   **Steel (magnetic):**

   Wear of the bearing, gear or plate

   **Brass (non-magnetic):**
Wear of the bearing

![Image of a hand touching a gear]

**Fig. 117: Collecting Steel Chips Using Magnet**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **DISCONNECT TRANSMISSION WIRE**
   a. Disconnect the 7 shift solenoid valve connectors.
   b. Remove the bolt and lock plate, and disconnect the ATF temperature sensor.

![Diagram of disconnecting transmission wire]

**Fig. 118: Locating Shift Solenoid Valve Connectors**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE VALVE BODY OIL STRAINER ASSEMBLY**
   a. Remove the 3 bolts and oil strainer.

   **NOTE:** Be careful when removing the oil strainer as fluid will come out.
b. Remove the O-ring from the valve body oil strainer assembly.

Fig. 120: Locating Valve Body Oil Strainer O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE TRANSMISSION VALVE BODY ASSEMBLY
   a. Support the valve body assembly and remove the 17 bolts and the transmission valve body assembly.

Fig. 121: Locating Valve Body Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the check ball body and the spring.
c. Remove the bolt and lock plate from the valve body assembly.

d. Remove the shift solenoid valve SL3 and SLT from the valve body assembly.

e. Remove the bolt and shift solenoid valve S4 from the valve body assembly.

f. Remove the shift solenoid valve SR from the valve body assembly.
g. Remove the bolt and shift solenoid valve DSL from the valve body assembly.

h. Remove the bolt and shift solenoid valve SL2 from the valve body assembly.

i. Remove the bolt and shift solenoid valve SL1 from the valve body assembly.
Installation

1. Install Transmission Valve Body Assembly
   a. Install the shift solenoid valve SL1 to the valve body assembly with the bolt.

      Torque: 6.6 N*m (67 kgf*cm, 58 in.*lbf)

   b. Install the shift solenoid valve SL2 to the valve body assembly with the bolt.

      Torque: 11 N*m (110 kgf*cm, 8 ft.*lbf)
c. Install the shift solenoid valve DSL to the valve body assembly with the bolt.

Torque: 11 N*m (110 kgf*cm, 8 ft.*lbf)

![Fig. 131: Locating Shift Solenoid Valve DSL Bolt](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Install the shift solenoid valve SR to the valve body assembly.

![Fig. 132: Identifying Shift Solenoid Valve SR](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Install the shift solenoid valve S4 to the valve body assembly with the bolt.

Torque: 11 N*m (110 kgf*cm, 8 ft.*lbf)
f. Install the shift solenoid valve SL3 and SLT to the valve body assembly.

g. Install the lock plate to the valve body assembly with the bolt.

Torque: 6.6 N*m (67 kgf*cm, 58 in.*lbf)

h. Install the spring and check ball body.

i. Align the groove of the manual valve with the pin of the lever.
j. Install the 17 bolts.

Torque: 11 N*m (110 kgf*cm, 8 ft.*lbf)

**NOTE:**
- Push the valve body against the accumulator piston springs and check ball body to install the valve body.
- First, temporarily tighten the bolts marked with (1) in the illustration because they are positioning bolts.

Bolt length:

Bolt A:
41 mm (1.614 in.)

Bolt B:
57 mm (2.244 in.)

Bolt C:
25 mm (0.984 in.)

![Fig. 136: Locating Transmission Valve Body Assembly Bolts](image)

---

2. **INSTALL VALVE BODY OIL STRAINER ASSEMBLY**
   
   a. Coat a new O-ring with ATF.
   
   b. Install the O-ring to the oil strainer.
c. Install the oil strainer with the 3 bolts.

**Torque: 11 N\*m (110 kgf\*cm, 8 ft.*lbf)**

3. **INSTALL TRANSMISSION WIRE**
   a. Coat the O-ring with ATF.
   b. Install the ATF temperature sensor with the lock plate and bolt.

   **Torque: 6.6 N\*m (67 kgf\*cm, 58 in.*lbf)**

   c. Connect the 7 shift solenoid valve connectors.
4. INSTALL AUTOMATIC TRANSAXLE OIL PAN SUB-ASSEMBLY
   a. Install the 2 magnets in the oil pan.
   b. Apply seal packing or equivalent to the 18 bolts.

   Seal packing:

   THREE BOND 2430 or equivalent

   c. Install the oil pan and new gasket with the 18 bolts to the transaxle case.

   Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)

   NOTE: Tighten the bolts within 10 minutes of sealant application.

5. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL
6. ADD AUTOMATIC TRANSAXLE FLUID
7. CHECK FLUID LEVEL IN AUTOMATIC TRANSAXLE (See ON-VEHICLE INSPECTION)
8. INSTALL ENGINE UNDER COVER NO.1
9. RESET MEMORY
SHIFT LOCK SYSTEM

ON-VEHICLE INSPECTION

1. CHECK SHIFT LOCK OPERATION
   a. Move the shift lever to the P position.
   b. Turn the ignition switch to the LOCK position.
   c. Check that the shift lever cannot be moved to any position other than P.
   d. Turn the ignition switch to the on position, depress the brake pedal and check that the shift lever can be moved to another position. If operation cannot be done as specified, inspect the shift lock control unit.

2. CHECK SHIFT LOCK RELEASE BUTTON OPERATION
   a. Using a small screwdriver, remove the shift lock release cover.
   b. When operating the shift lever with the shift lock release button pressed, check that the lever can be moved to any position other than P.

      If operation cannot be done as specified, check the shift lever assembly installation condition.

3. CHECK KEY INTERLOCK OPERATION
   a. Turn the ignition switch to the ON position.
   b. Depress the brake pedal and move the shift lever to any position other than P.
   c. Check that the ignition key cannot be turned to the LOCK position.
   d. Move the shift lever to the P position, turn the ignition key to the LOCK position and check that the key can be removed.

      If operation cannot be done as specified, inspect the shift lock control unit.
4. **INSPECT SHIFT LOCK CONTROL UNIT ASSEMBLY**
   
a. Measure the voltage according to the value(s) in the table below.

   **HINT:**
   
   Do not disconnect the shift lock control unit assembly connector.

   ![Shift Lock Control Unit Connector Terminals](image.png)

   **Fig. 142: Identifying Shift Lock Control Unit Connector Terminals**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   **Voltage**

   **VOLTAGE SPECIFICATION**

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Measuring Condition</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 (ACC) - 8 (E)</td>
<td>Ignition switch ACC</td>
<td>10 to 14</td>
</tr>
<tr>
<td>6 (ACC) - 8 (E)</td>
<td>Ignition switch OFF</td>
<td>Below 1</td>
</tr>
<tr>
<td>7 (STP) - 8 (E)</td>
<td>Depress brake pedal</td>
<td>10 to 14</td>
</tr>
<tr>
<td>7 (STP) - 8 (E)</td>
<td>Release brake pedal</td>
<td>Below 1</td>
</tr>
</tbody>
</table>
   | 12 (KLS+) - 8 (E) | 1. Ignition switch ACC and shift lever P position  
   |                | 2. Ignition switch ACC and shift lever except P position |
   |                | 3. Ignition switch ACC and shift lever except P position (After approx. 1 second) | Below 1 7.5 to 11 6 to 9 |
   | 1 (IG) - 8 (E)  | Ignition switch ON                                       | 10 to 14    |
   | 1 (IG) - 8 (E)  | Ignition switch OFF                                      | Below 1     |

b. Measure the resistance according to the value(s) in the table below.

   **HINT:**
   
   Do not disconnect the shift lock control unit assembly connector.
If operation cannot be done as specified, replace the shift lever assembly.

![Shift Lever Assembly Diagram]

Fig. 143: Identifying Shift Lock Control Unit Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Resistance

RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Measuring Condition</th>
<th>Specified Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (E) - Body ground</td>
<td>Always</td>
<td>Below 1 ohms</td>
</tr>
</tbody>
</table>

5. INSPECT KEY INTER LOCK SOLENOID

a. Disconnect the solenoid connector.
b. Connect KLS+ (4) terminal to the batteries' positive (+) terminal and KLS (3) terminal to the battery negative (-) terminal, and apply about 12 V between KLS+ - KLS- terminals.
c. Check that operation noise can be heard from the solenoid.

If the solenoid does not operate, replace the solenoid.

![Key Inter Lock Solenoid Connector Terminals Diagram]

Fig. 144: Identifying Key Inter Lock Solenoid Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSPECT SHIFT LOCK SOLENOID

a. Disconnect the solenoid connector.
b. Connect SSL+ (2) terminal to the batteries' positive (+) terminal, and SLS- (1) terminal to the battery negative (-) terminal, and apply about 12 V between SLL+ - SLS- terminals.
c. Check that operation noise can be heard from the solenoid.
If the solenoid does not operate, replace the solenoid.

Fig. 145: Identifying Shift Lock Solenoid Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SHIFT LEVER

COMPONENTS
Fig. 146: Identifying Shift Lever Components With Torque Specification (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
REMOVAL

1. DISCONNECT BATTERY NEGATIVE TERMINAL
2. REMOVE FRONT DOOR SCUFF PLATE LH

HINT:

(See REMOVAL)

3. REMOVE FRONT DOOR SCUFF PLATE RH
4. REMOVE COWL SIDE TRIM BOARD LH
   HINT:
   (See REMOVAL )

5. REMOVE COWL SIDE TRIM BOARD RH
   HINT:
   (See REMOVAL )

6. REMOVE INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LOWER LH
   HINT:
   (See REMOVAL )

7. REMOVE GLOVE COMPARTMENT DOOR STOPPER SUB-ASSEMBLY
   HINT:
   (See REMOVAL )

8. REMOVE GLOVE COMPARTMENT DOOR ASSEMBLY
   HINT:
   (See REMOVAL )

9. REMOVE FLOOR CARPET COVER CENTER LH
   HINT:
   (See REMOVAL )

10. REMOVE FLOOR CARPET COVER CENTER RH
    HINT:
    (See REMOVAL )
11. REMOVE INSTRUMENT CLUSTER FINISH PANEL CENTER NO.1

HINT:

(See REMOVAL)

12. REMOVE INSTRUMENT CLUSTER FINISH PANEL CENTER NO.2

HINT:

(See REMOVAL)

13. REMOVE SHIFT LEVER KNOB SUB-ASSEMBLY

a. Remove the floor shift lever knob sub-assembly.

![](image1)

Fig. 148: Locating Floor Shift Lever Knob Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE POSITION INDICATOR HOUSING ASSEMBLY

a. Using a screwdriver, remove the position indicator housing assembly from the instrument cluster finish panel assembly center.

![](image2)

Fig. 149: Identifying Position Indicator Housing Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE INSTRUMENT CLUSTER FINISH PANEL ASSEMBLY CENTER
16. REMOVE SHIFT LEVER CAP
   a. Using a small screwdriver, remove the shift lever cap from the position indicator housing assembly.

   ![Fig. 150: Identifying Shift Lever Cap](image)
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. REMOVE INSTRUMENT CLUSTER FINISH PANEL SUB-ASSEMBLY LOWER CENTER

   HINT:

   (See REMOVAL )

18. DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY
   a. Using a screwdriver, disconnect the cable end from the shift lever assembly.
   b. Using a small screwdriver, disconnect the outer of transmission control cable assembly from the shift lever assembly.
19. **REMOVE SHIFT LEVER ASSEMBLY**
   a. Disconnect the 2 connectors.
   b. Remove the 4 bolts and disconnect the shift lever assembly from the vehicle.

**DISASSEMBLY**

1. **REMOVE INDICATOR LIGHT WIRE SUB-ASSEMBLY**
   a. Remove the indicator light wire sub assembly from the position indicator light guide.
2. **REMOVE POSITION INDICATOR LIGHT BULB**
   a. Remove the shift position indicator light bulb from the indicator light wire sub-assembly

3. **REMOVE POSITION INDICATOR SLIDE COVER**
   a. Remove the shift lever slide cover guide from the shift lever assembly.
   
      b. Remove the position indicator slide cover from the shift lever assembly.
4. REMOVE POSITION INDICATOR SLIDE COVER
   a. Remove the position indicator slide cover No.2 from the position indicator slide cover.

ADJUSTMENT

1. INSPECT SHIFT LEVER POSITION
   a. When shifting from P to R position only with ignition switch ON and brake pedal, make sure that the shifting lever moves smoothly and can be moderately operated.
   b. When starting engine, make sure that the vehicle moves forward when shifting from N to D position and moves rearward when shifting to R position.

2. ADJUST SHIFT LEVER POSITION
   a. Loosen the nut on the control shaft lever.
b. Push the control shaft fully downward.

c. Return the control shaft lever 2 notches to the N position.

d. While pushing the control cable end up with the shift lever in the N position, install it to the control shaft lever with the nut.

**Torque:** 13 N*m (132.6 kgf*cm, 9.5 ft.*lbf)

**NOTE:**
- If the control cable end is excessively pushed up, the shift lever can not be adjusted.
- When tightening the nut, confirm that the control cable is properly stretched.

e. Start the engine and make sure that the vehicle moves forward when shifting the lever from the N to D position and moves rearward when shifting it to the R position.
Fig. 159: Adjusting Transmission Control Cable
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. INSTALL POSITION INDICATOR SLIDE COVER
   a. Install the position indicator slide cover No.2 to the position indicator slide cover.

Fig. 160: Locating Position Indicator Slide Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL POSITION INDICATOR SLIDE COVER
   a. Install the position indicator slide cover to the shift lever assembly.
   b. Install the shift lever slide cover guide to the shift lever assembly.
3. INSTALL POSITION INDICATOR LIGHT BULB  
   a. Install the shift position indicator light bulb to the indicator light wire sub-assembly.

4. INSTALL INDICATOR LIGHT WIRE SUB-ASSEMBLY  
   a. Install the indicator light wire sub-assembly to the shift lever assembly.

INSTALLATION

1. INSTALL SHIFT LEVER ASSEMBLY  
   a. Install shift lever assembly to the vehicle with the 4 bolts.
Torque: 21 N*m (214 kgf*cm, 15 ft.*lbf)

NOTE: Into datum hole of shift lever into datum pin of instrument lower.

b. Connect the 2 connectors to the shift lever assembly.

Fig. 163: Locating Shift Lever Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY
a. Install the cable outer to the shift lever plate

b. When installing the transmission control cable assembly on the shift lever plate, place the projection to the shift lever plate (Fig. 165). Confirm that the spring in the shift cable outer has
moved to the position (Fig. 165) shown in the illustration.

Confirm that the shift cable is installed on the shift lever plate properly.

![Fig. 165: Identifying Shift Cable Outer Spring Position](image)

**Fig. 165: Identifying Shift Cable Outer Spring Position**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**
- To prevent torsion of the inner cable, the projection on the eye end should face rear.
- Push the cable end to the bottom of the pin.

3. INSTALL INSTRUMENT CLUSTER FINISH PANEL SUB-ASSEMBLY LOWER CENTER

HINT:

(See INSTALLATION)

4. INSTALL SHIFT LEVER CAP
   a. Install the shift lever cap to the floor shift position indicator housing assembly.

![Fig. 166: Identifying Shift Lever Cap](image)

**Fig. 166: Identifying Shift Lever Cap**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL POSITION INDICATOR HOUSING ASSEMBLY
   a. install the position indicator housing assembly to the instrument cluster finish panel assembly center.
6. **INSTALL SHIFT LEVER KNOB SUB-ASSEMBLY**
   a. install the shift lever knob sub-assembly.

7. **ADJUST SHIFT LEVER POSITION**
   HINT:
   (See **ADJUSTMENT**)

8. **INSPECT SHIFT LEVER POSITION**
   HINT:
   (See **ADJUSTMENT**)

9. **INSPECT KEY INTER LOCK OPERATION**
   HINT:
   (See **ON-VEHICLE INSPECTION**)

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Fig. 167: Identifying Position Indicator Housing Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Fig. 168: Locating Shift Lever Knob Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
10. **INSPECT SHIFT LOCK OPERATION**

HINT:

(See **ON-VEHICLE INSPECTION**)

11. **INSPECT SHIFT LOCK RELEASE BUTTON OPERATION**

HINT:

(See **ON-VEHICLE INSPECTION**)

**TRANSMISSION CONTROL CABLE ASSEMBLY COMPONENTS**

![Diagram of Transmission Control Cable Assembly Components]

- CLIP

Non-reusable part

- N"m (kgf"cm, ft."lbf): Specified torque

**Fig. 169: Identifying Transmission Control Cable Assembly Components With Torque Specification**
REMOVAL

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**

2. **REMOVE INSTRUMENT CLUSTER FINISH PANEL SUB-ASSEMBLY CENTER**

HINT:

(See **REMOVAL**)

3. **REMOVE TRANSMISSION CONTROL CABLE ASSEMBLY**
   a. Remove the nut from the control shaft lever.
   b. Disconnect the transmission control cable assembly from the control shaft lever.
   c. Remove the clip and disconnect the transmission control cable assembly from the control cable bracket.
   d. Disconnect the transmission control cable assembly from the transmission control cable bracket No.2.
e. Remove the 2 nuts and disconnect the transmission control cable assembly from the vehicle.

f. Using a screwdriver, disconnect the cable end from the shift lever assembly.

g. Using a small screwdriver, disconnect the cable outer of transmission control cable assembly from the shift lever assembly.

h. Pull out the control cable from the vehicle.
ADJUSTMENT

1. INSPECT SHIFT LEVER POSITION
   a. When shifting from P to R position only with ignition switch ON and brake pedal, make sure that the shifting lever moves smoothly and can be moderately operated.
   b. When starting engine, make sure that the vehicle moves forward when shifting from N to D position and moves rearward when shifting to R position.

2. ADJUST SHIFT LEVER POSITION
   a. Loosen the nut on the control shaft lever.
b. Push the control shaft fully downward.

c. Return the control shaft lever 2 notches to the N position.

![Diagram of control shaft lever](image)

**Fig. 176: Returning Control Shaft Lever 2 Notches To N Position**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. While pushing the control cable end up with the shift lever in the N position, install it to the control shaft lever with the nut.

**Torque**: 13 N·m (132.6 kgf·cm, 9.5 ft·lbf)

**NOTE:**
- If the control cable end is excessively pushed up, the shift lever can not be adjusted.
- When tightening the nut, confirm that the control cable is properly stretched.

e. Start the engine and make sure that the vehicle moves forward when shifting the lever from the N to D position and moves rearward when shifting it to the R position.
INSTALLATION

1. INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY
   a. Pull in the control cable to the body.
   b. Install the cable end, as shown in the illustration.
c. When installing the transmission control cable assembly on the shift lever plate, place the projection of the shift cable downward to fit in the groove of the shift lever plate (Fig. 179). Confirm that the spring in the shift cable outer has moved to the position (Fig. 179) shown in the illustration.

Confirm that the shift cable is installed on the shift lever plate properly.

![Fig. 179: Identifying Spring In Shift Cable Outer](image)

**NOTE:**
- To prevent torsion of the inner cable, the projection on the eye end should face rear.
- Push the cable end to the bottom of the pin.

d. Install the transmission control cable assembly and 2 nuts.

**Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)**

![Fig. 180: Locating Transmission Control Cable Assembly Bolts](image)

e. Connect the transmission control cable assembly to the transmission control cable bracket No.2.
f. Temporarily install the transmission control cable assembly to the control shaft lever with the nut.

g. Install the transmission control cable assembly and clip to the bracket.
(See **INSTALLATION**) 

3. **ADJUST SHIFT LEVER POSITION**

   HINT:

   (See **ADJUSTMENT**) 

4. **INSPECT SHIFT LEVER POSITION**

   HINT:

   (See **ADJUSTMENT**) 

**DIFFERENTIAL OIL SEAL**

**COMPONENTS**

![Diagram of Differential Oil Seal Components]

- **DIFFERENTIAL SIDE BEARING RETAINER OIL SEAL**
- **TRANSAXLE HOUSING OIL SEAL**

☐ Apply MP grease

• Non-reusable part

---

Fig. 184: Identifying Differential Side Bearing Retainer Oil Seal And Transaxle Housing Oil Seal
REMOVAL

1. REMOVE FRONT WHEELS
2. REMOVE ENGINE UNDER COVER NO. 1
3. DRAIN AUTOMATIC TRANSAXLE FLUID
   a. Remove the drain plug, gasket and drain ATF.
   b. Install a new gasket and the drain plug.

   Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)

4. REMOVE FRONT DRIVE SHAFT ASSEMBLY LH

   HINT:

   (See REMOVAL )

   SST 09520-01010, 09520-24010 (09520-32040)

5. REMOVE FRONT DRIVE SHAFT ASSEMBLY RH (for 2WD)

   HINT:

   (See REMOVAL )

6. REMOVE TRANSAXLE HOUSING OIL SEAL
   a. Using SST, pull out the oil seal.

   SST 09308-00010

   Fig. 185: Removing Transaxle Housing Oil Seal
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE DIFFERENTIAL SIDE BEARING RETAINER OIL SEAL
   a. Using SST, pull out the oil seal.
SST 09308-00010

INSTALLATION

1. INSTALL TRANSAXLE HOUSING OIL SEAL
   a. Using SST and a hammer, install a new oil seal.

   SST 09316-60011 (09316-00011)

   Oil seal installation depth:

   -0.5 to 0.5 mm (-0.020 to 0.020 in.)

   b. Coat the lip of the oil seal with MP grease.

2. INSTALL DIFFERENTIAL SIDE BEARING RETAINER OIL SEAL
   a. Using SST and a hammer, install a new oil seal.

   SST 09223-15020, 09950-70010 (09951 - 07150)
Oil seal installation depth:

-0.5 to 0.5 mm (-0.020 to 0.020 in.)

b. Coat the lip of the oil seal with MP grease.

3. INSTALL FRONT DRIVE SHAFT ASSEMBLY LH

   HINT:

   (See INSTALLATION )

4. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH (for 2WD)

   HINT:

   (See INSTALLATION )

5. INSTALL FRONT WHEELS

   Torque: 103 N·m (1,050 kgf·cm, 76 ft·lbf)

6. ADD AUTOMATIC TRANSAXLE FLUID

7. INSPECT AUTOMATIC TRANSAXLE FLUID (See ON-VEHICLE INSPECTION )

8. INSTALL ENGINE UNDER COVER NO.1

9. CHECK ABS SPEED SENSOR SIGNAL

   HINT:

   (See DTC CHECK / CLEAR )

**AUTOMATIC TRANSAXLE ASSEMBLY**

**COMPONENTS**
Fig. 189: Identifying Automatic Transaxle Assembly Components With Torque Specification (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
REMOVAL

1. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

(See REMOVAL )
2. REMOVE FRONT DRIVE SHAFT ASSEMBLY LH

   HINT:

   (See REMOVAL.)

3. REMOVE FRONT DRIVE SHAFT ASSEMBLY RH

   HINT:

   (See REMOVAL.)

4. REMOVE TRANSMISSION CONTROL CABLE CLAMP
   a. Remove the bolt and the transmission control cable clamp.

   ![Fig. 191: Locating Transmission Control Cable Clamp Bolt](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

5. REMOVE WIRE HARNESS CLAMP
   a. Disconnect the wire harnesses from the clamp.
   b. Remove the 3 bolts and 2 clamps.

   ![Fig. 192: Locating Wire Harness Clamps Bolts](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

6. DISCONNECT WIRE HARNESS
a. Remove the bolt and disconnect the wire harness.

![Fig. 193: Locating Wire Harness Bolt](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE STARTER ASSEMBLY
   a. Disconnect the connector (1).
   b. Remove the nut (2) and disconnect the starter wire.
   c. Remove the 2 bolts (3) and starter assembly.

![Fig. 194: Locating Starter Assembly Bolts](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. DISCONNECT CONNECTORS
   a. Disconnect the transmission wire connector.
   b. Disconnect the park/neutral position switch connector.
   c. Disconnect the 2 speed sensor connectors.
9. REMOVE TRANSMISSION CONTROL CABLE BRACKET NO.1
   a. Remove the bolt and automatic transmission oil cooler tube clamp.
   b. Remove the 2 bolts and transmission control cable bracket No. 1.

10. REMOVE TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY
    a. Remove the ATF level gauge.
    b. Disconnect the wire harnesses 2 clamps from the oil filler tube.
    c. Remove the 2 bolts and oil filler tube.
    d. Remove the O-ring from the oil filler tube.
11. REMOVE OIL COOLER INLET TUBE NO.1
   a. Using SST and a wrench, disconnect the oil cooler inlet tube No.1.

   SST 09023-12701

12. REMOVE OIL COOLER OUTLET TUBE NO.1
   a. Using SST and a wrench, disconnect the oil cooler outlet tube No.1.

   SST 09023-12701

13. REMOVE ENGINE MOUNTING BRACKET FRONT
   a. Remove the 3 bolts and engine mounting bracket front.
14. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY
   a. Remove the 2 bolts and flywheel housing under cover.

   b. Turn the crankshaft to gain access and remove the 6 bolts while holding the crankshaft pulley bolt with a wrench.

   HINT:

   There will be one green colored bolt.
c. Remove the 10 bolts.

d. Separate and remove the automatic transaxle.

Fig. 202: Locating Automatic Transaxle Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE TORQUE CONVERTER CLUTCH ASSEMBLY
16. INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY

HINT:

(See **INSPECTION** )

INSTALLATION

1. INSTALL TORQUE CONVERTER CLUTCH ASSEMBLY
   a. Install the torque converter clutch to the automatic transaxle.
   b. Using vernier calipers and a straight edge, measure the dimension "A" between the transaxle fitting part of the engine and the converter fitting part of the drive plate (*1).

Fig. 203: Measuring Dimension A Between Transaxle Fitting Part Of Engine And Converter Fitting Part Of Drive Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
c. Using vernier calipers and a straight edge, measure the dimension "B" shown in the illustration and check that "B" is greater than "A" (measured in step (*1)).

**Standard:**

A + 1 mm (0.03937 in.) or more

**NOTE:** Remember to minus the thickness of the straight edge.

![Image of dimension B measurement]

**Fig. 204: Measuring Dimension B**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY**

a. Install the automatic transaxle to the engine with the 10 bolts.

**Torque: Bolt A**

64 N*m (650 kgf*cm, 47 ft.*lbf)

**Bolt B**

46 N*m (470 kgf*cm, 34 ft.*lbf)

**Bolt C**

43 N*m (439 kgf*cm, 32 ft.*lbf)
b. Apply a few drops of adhesive to each of 2 threads on the tip of the 6 torque converter clutch mounting bolts.

**Adhesive:**

Part No. 08833-00070, THREE BOND 1324 or equivalent

c. Install the 6 torque converter clutch mounting bolts.

**Torque: 41 N*m (413 kgf*cm, 30 ft.*lbf)**

**NOTE:** First install the black colored bolt, and then the remaining 5 bolts.

d. Install the flywheel housing under cover to the automatic transaxle with the 2 bolt.

**Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)**
3. INSTALL ENGINE MOUNTING BRACKET FRONT
   a. Install the engine mounting bracket front to the automatic transaxle with the 3 bolts.

   Torque: 64 N*m (653 kgf*cm, 47 ft.*lbfc)

4. INSTALL TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY
   a. Coat a new O-ring with ATF, and install it to the transmission oil filler tube sub-assembly.
   b. Install the transmission oil filler tube sub-assembly and bolt to the automatic transaxle.

   Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbfc)
c. Connect the 2 clamps to the oil filler tube.
d. Install the ATF level gauge.

5. INSTALL OIL COOLER INLET TUBE NO.1
a. Temporarily install the oil cooler outlet tube No.1.
b. Temporarily install the oil cooler inlet tube No.1.
c. Install the oil cooler tube clamp and bolt.

Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

d. Using SST and a wrench, tighten the oil cooler inlet tube No.1.

SST 09023-12701

Torque: 34 N*m (347 kgf*cm, 25 ft.*lbf)
6. INSTALL OIL COOLER OUTLET TUBE NO.1
   a. Using SST and a wrench, tighten the oil cooler outlet tube No.1.

   **SST 09023-12701**

   Torque: 34 N*m (347 kgf*cm, 25 ft.*lbf)

7. INSTALL TRANSMISSION CONTROL CABLE BRACKET NO.1
   a. Install the control cable bracket No.1 with the 2 bolts.

   Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)

8. CONNECT CONNECTORS
   a. Connect the transmission wire connector.
   b. Connect the park/neutral position switch connector.
   c. Connect the 2 speed sensor connectors.
9. INSTALL STARTER ASSEMBLY

   a. Install the starter assembly with the 2 bolts (1).

      **Torque: 37 N*m (377 kgf*cm, 27 ft.*lbf)**

   b. Connect the connector (2).

   c. Connect the starter wire with the nut (3).

      **Torque: 9.8 N*m (100 kgf*cm, 87 in.*lbf)**
10. CONNECT WIRE HARNESS  
   a. Connect the wire harness with the bolt.
   
   Torque: 13 N\(\times\)m (133 kgf\(\times\)cm, 10 ft.*lbf)

   Fig. 215: Locating Wire Harness Bolt  
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSTALL WIRE HARNESS CLAMP  
   a. Install the 2 clamps and 3 bolts.
   
   Torque: 8.4 N\(\times\)m (86 kgf\(\times\)cm, 74 in.*lbf)
   
   b. Connect the wire harnesses to the clamps.

   Fig. 216: Locating Wire Harness Clamps Bolts  
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL TRANSMISSION CONTROL CABLE CLAMP  
   a. Install the transmission control cable clamp with the bolt.
   
   Torque: 12 N\(\times\)m (122 kgf\(\times\)cm, 9 ft.*lbf)
Fig. 217: Locating Transmission Control Cable Bracket Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSTALL FRONT DRIVE SHAFT ASSEMBLY LH

HINT:

(See INSTALLATION )

14. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH

HINT:

(See INSTALLATION )

15. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

(See INSTALLATION )

16. RESET MEMORY

HINT:

(See INITIALIZATION )

TORQUE CONVERTER CLUTCH AND DRIVE PLATE

INSPECTION

1. INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY
   a. Inspect the one-way clutch.
      1. Set SST into the inner race of the one-way clutch.

SST 09350-32014 (09351 -32010)
2. Install SST so that it fits in the notch of the converter hub and outer race of the one-way clutch.

SST 09350-32014 (09351 - 32010, 09351 - 32020)

3. Stand the torque converter up and turn the SST.

**Standard:**

If the one-way clutch is turned clockwise, it rotates freely and if turned counterclockwise, it locks.

---

b. Determine the condition of the torque converter clutch assembly.

1. If the inspection result of the torque converter clutch assembly satisfies the following conditions, replace the torque converter clutch assembly.

**Malfunction item:**

A metallic sound is emitted from the torque converter clutch assembly during the stall test or when the shift lever is moved to the N position.
The one-way clutch is free or locked in both directions.

The amount of powder in the ATF is greater than the sample shown on the illustration (see Fig. 220).

HINT:

The illustration shows the auto fluid of approximately 0.25 liters (0.26 US qts, 0.22 Imp. qts) that is taken out from the removed torque converter clutch.

Sample showing minimum amount of powders in ATF

Fig. 220: Identifying Minimum Amount Of Powders In ATF
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Exchange the ATF in the torque converter clutch.
   
   1. If the ATF is discolored and/or has a foul odor, completely stir the ATF in the torque converter clutch and drain it with the torque converter facing up.

d. Clean and check the oil cooler and oil pipe line.
   
   1. If the torque converter clutch is inspected or the ATF is exchanged, clean the oil cooler and oil pipe line.

HINT:

- Spray compressed air of 196 kPa (2 kgf/cm², 28 psi) from the inlet hose.
- If plenty of fine powders are identified in the ATF, add new ATF using a bucket pump and clean it again.
2. If the ATF is cloudy, inspect the oil cooler (radiator).

![Image: Checking Oil Cooler And Oil Pipe Line](https://example.com/image1)

**Fig. 221: Checking Oil Cooler And Oil Pipe Line**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Prevent deformation of the torque converter clutch and damage to the oil pump gear.

1. When there is any damage on the end of the bolt for the torque converter clutch and on the bottom of the bolt hole, replace the bolt and the torque converter clutch.
2. All of the bolts must be same length.
3. Bolts with washers must be used.

![Image: Identifying Proper Installation Position Of Bolt](https://example.com/image2)

**Fig. 222: Identifying Proper Installation Position Of Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT DRIVE PLATE & RING GEAR SUB-ASSEMBLY**

   a. Set up a dial indicator with a roller instrument and measure the drive plate runout.
   b. Check for damage of the ring gear.

   **Maximum runout:**

   0.20 mm (0.0079 in.)

   If runout is not within specification or ring gear is damaged, replace the drive plate.
Fig. 223: Measuring Drive Plate Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

AUTOMATIC TRANSAXLE UNIT

COMPONENTS

Fig. 224: Identifying Automatic Transaxle Unit Components With Torque Specification (1 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
Fig. 225: Identifying Automatic Transaxle Unit Components With Torque Specification (2 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
Fig. 226: Identifying Automatic Transaxle Unit Components With Torque Specification (3 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
Fig. 227: Identifying Automatic Transaxle Unit Components (4 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
Fig. 228: Identifying Automatic Transaxle Unit Components With Torque Specification (5 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY
1. **REMOVE PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
   
a. Remove the nut, washer and control shaft lever.

   ![Control Shaft Lever Nut](image1)

   **Fig. 229: Locating Control Shaft Lever Nut**  
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a screwdriver, unstake the nut stopper, and remove the lock nut and nut stopper.

   ![Nut Stopper](image2)

   **Fig. 230: Unstaking Nut Stopper**  
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 2 bolts and pull out the park/neutral position switch.

   ![Park/Neutral Position Switch](image3)

   **Fig. 231: Locating Park/Neutral Position Switch Bolts**  
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE BREATHER PLUG HOSE**
a. Remove the breather plug hose from the transaxle case.

3. REMOVE OIL COOLER TUBE UNION (INLET OIL COOLER UNION)
   a. Remove the union.
   b. Remove the O-ring from the union.

   ![Fig. 232: Identifying Oil Cooler Tube Union (Inlet Oil Cooler Union) And O-Ring
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.](image)

4. REMOVE OIL COOLER TUBE UNION (OUTLET OIL COOLER UNION)
   a. Remove the elbow.
   b. Remove the O-ring from the elbow.

   ![Fig. 233: Identifying Elbow And O-Ring
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.](image)

5. REMOVE SPEED SENSOR
   a. Remove the 2 bolts and the 2 speed sensors from the transaxle assembly.
6. **REMOVE TRANSAXLE CASE NO.1 PLUG**
   a. Remove the 4 transaxle case No.1 plugs from the transaxle case.
   b. Remove the 4 O-rings from the 4 transaxle case No.1 plugs.

7. **FIX AUTOMATIC TRANSAXLE ASSEMBLY**
   a. Fix the transaxle assembly.

8. **REMOVE AUTOMATIC TRANSAXLE OIL PAN SUB-ASSEMBLY**
a. Remove the 18 bolts, oil pan and gasket.

![Fig. 237: Locating Oil Pan Bolts](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 2 magnets from the oil pan.

![Fig. 238: Locating Magnets In Oil Pan](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSPECT TRANSMISSION OIL CLEANER MAGNET**

a. Remove the magnets and use them to collect any steel chips. Examine the chips and particles in the pan and on the magnet to determine what type of wear has occurred in the transaxle:

**Result:**

**Steel (magnetic):**

Wear of the bearing, gear and plate

**Brass (non-magnetic):**

Wear of the bushing
10. **DISCONNECT TRANSMISSION WIRE**
   a. Remove the 7 connectors from the shift solenoid valves.
   b. Remove the bolt, lock plate and temperature sensor.

11. **REMOVE TRANSMISSION WIRE**
   a. Remove the bolt and transmission wire from the transaxle case.

12. **REMOVE VALVE BODY OIL STRAINER ASSEMBLY**
a. Remove the 3 bolts and oil strainer.

Fig. 242: Locating Oil Strainer Bolts  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the O-ring from the oil strainer.

Fig. 243: Locating Oil Strainer O-Ring  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE TRANSMISSION VALVE BODY ASSEMBLY
   a. Support the valve body assembly and remove the 17 bolts and valve body assembly.

Fig. 244: Locating Valve Body Assembly Bolts  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
14. **REMOVE GOVERNOR APPLY GASKET NO.1**
   a. Remove the governor apply gasket No.1 from the transaxle case.

   ![Fig. 245: Locating Governor Apply Gasket](Image)
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **REMOVE TRANSAXLE CASE 2ND BRAKE GASKET**
   a. Remove the transaxle case 2nd brake gasket from the transaxle case.

   ![Fig. 246: Locating Transaxle Case 2nd Brake Gasket](Image)
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **REMOVE BRAKE DRUM GASKET**
   a. Remove the brake drum gasket from the transaxle case.

   ![Fig. 247: Locating Brake Drum Gasket](Image)
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
17. REMOVE CHECK BALL BODY
   a. Remove the check ball body and spring from the transaxle case.

Fig. 248: Identifying Check Ball Body And Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. REMOVE C-3 ACCUMULATOR PISTON
   a. Remove the spring from the C-3 accumulator piston.

b. Apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the oil hole and remove the C-3 accumulator piston.

   NOTE:
   • Applying compressed air may cause the piston to jump-out. When removing the piston, hold it using a waste cloth.
   • Take care not to splash ATF when applying compressed air.
c. Remove the O-ring from the C-3 accumulator piston.

![Locating C-3 Accumulator Piston O-Ring](image)

**Fig. 250: Locating C-3 Accumulator Piston**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

19. **REMOVE REVERSE CLUTCH ACCUMULATOR PISTON**

a. Apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the oil hole and remove the reverse accumulator piston and spring.

**NOTE:**
- Applying compressed air may cause the piston to jump-out. When removing the piston, hold it using a waste cloth.
- Take care not to splash ATF when applying compressed air.
b. Remove the 2 O-rings from the reverse clutch accumulator piston.

![Diagram of Reverse Clutch Accumulator Piston with O-rings](image)

**Fig. 253: Locating Reverse Clutch Accumulator Piston O-Rings**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE B-3 ACCUMULATOR PISTON**
   a. Apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the oil hole and remove the B-3 accumulator piston and 2 springs.

**NOTE:**
- Applying compressed air may cause the piston to jump-out. When removing the piston, hold it using a waste cloth.
- Take care not to splash ATF when applying compressed air.

![Diagram of B-3 Accumulator Piston](image)

**Fig. 254: Locating B-3 Accumulator Piston**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the O-ring from the B-3 accumulator piston.
21. **REMOVE MANUAL VALVE LEVER SHAFT RETAINER SPRING**
   a. Using needle-nose pliers, remove the manual valve lever shaft retainer spring.

22. **REMOVE MANUAL DETENT SPRING SUB-ASSEMBLY**
   a. Remove the 2 bolts, the manual detent spring sub-assembly and cover.

23. **REMOVE PARKING LOCK PAWL BRACKET**
a. Remove the 2 bolts and parking lock pawl bracket.

Fig. 258: Locating Parking Lock Pawl Bracket Bolts  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **REMOVE MANUAL VALVE LEVER SUB-ASSEMBLY**

a. Using a chisel and hammer, cut off and remove the spacer.

Fig. 259: Removing Spacer Using Chisel And Hammer  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a pin punch (Ø35 mm) and hammer, drive out the pin.

**HINT:**

Slowly drive out the pin so that it will not fall into the transaxle case.
c. Remove the manual valve lever shaft and manual valve lever.

Fig. 261: Identifying Manual Valve Lever Shaft And Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. REMOVE PARKING LOCK ROD SUB-ASSEMBLY
   a. Remove the parking lock rod from the manual valve lever.

Fig. 262: Identifying Parking Lock Rod Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE MANUAL VALVE LEVER SHAFT OIL SEAL
   a. Using a screwdriver, remove the oil seal from the transaxle case.

   NOTE: Do not apply excessive force when removing the oil seal.
27. **FIX AUTOMATIC TRANSAXLE ASSEMBLY**
   a. Fix the transaxle case with the oil pump side facing up.

28. **INSPECT INPUT SHAFT ENDPLAY**

   **HINT:**
   
   (See **INSPECTION**
   )

29. **REMOVE TRANSAXLE HOUSING**
   a. Remove the 16 bolts.
   b. Tap on the circumference of the transaxle housing with a plastic hammer to remove the transaxle housing from the transaxle case.

   **NOTE:** The differential may be accidentally removed when the transaxle housing is removed.

30. **REMOVE OIL PUMP ASSEMBLY**
   a. Remove the 7 bolts and oil pump from the transaxle case.
31. **REMOVE THRUST NEEDLE ROLLER BEARING**
   a. Remove the thrust needle roller bearing from the underdrive planetary gear assembly.

32. **REMOVE THRUST BEARING UNDERDRIVE RACE NO.2**
   a. Remove the thrust bearing underdrive race No.2 from the underdrive planetary gear assembly.

33. **REMOVE DIFFERENTIAL GEAR ASSEMBLY**
a. Remove the differential gear assembly from the transaxle case.

Fig. 268: Identifying Differential Gear Assembly And Transaxle Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. REMOVE OVERDRIVE BRAKE GASKET
   a. Remove the 2 overdrive brake gaskets from the transaxle case.

Fig. 269: Identifying Overdrive Brake Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. REMOVE FORWARD CLUTCH ASSEMBLY
   a. Remove the forward clutch assembly from the transaxle case.

Fig. 270: Identifying Forward Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
b. Remove the thrust needle roller bearing from the forward clutch.

![Thrust Needle Roller Bearing](image)

**Fig. 271: Identifying Thrust Needle Roller Bearing**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

36. **REMOVE MULTIPLE DISC CLUTCH HUB**
   a. Remove the thrust needle roller bearing, multiple disc clutch hub, thrust needle roller bearing and thrust bearing race No.1 from the transaxle case.

![Multiple Disc Clutch Hub and Thrust Bearing](image)

**Fig. 272: Identifying Thrust Needle Roller Bearing, Multiple Disc Clutch Hub And Thrust Bearing Race**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

37. **INSPECT MULTIPLE DISC CLUTCH HUB**

   **HINT:**

   (See **INSPECTION**)

38. **REMOVE UNDERDRIVE PLANETARY GEAR ASSEMBLY**
   a. Remove the bolt and pawl shaft clamp.
b. Remove the parking lock pawl shaft.

c. Push the parking lock pawl.

**HINT:**

Failure to do so will cause interference when the underdrive planetary gear is removed.
d. Remove the underdrive planetary gear assembly from the transaxle case.

**NOTE:** Be careful so that the underdrive planetary gear assembly will not fall out.

![Fig. 276: Identifying Underdrive Planetary Gear Assembly](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

39. **REMOVE PARKING LOCK PAWL**
   a. Remove the spring, pawl pin and parking lock pawl.

![Fig. 277: Identifying Spring And Parking Lock Pawl](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

40. **REMOVE UNDERDRIVE CLUTCH ASSEMBLY**
   a. Remove the underdrive clutch assembly, thrust bearing and bearing race from the transaxle case.
41. **REMOVE UNDERDRIVE 1-WAY CLUTCH ASSEMBLY**
   a. Using a screwdriver, remove the snap ring from the transaxle case.

   **NOTE:** Do not apply excessive force when removing the snap ring.

   b. Remove the underdrive 1-way clutch from the transaxle case.
c. Remove the outer race retainer from the 1-way clutch.

![Outer Race Retainer](image)

**Fig. 281: Identifying Outer Race Retainer**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. REMOVE UNDERDRIVE CLUTCH DISC NO.2
   a. Using a screwdriver, remove the snap ring.

   **NOTE:** Do not apply excessive force when removing the snap ring.

![Snap Ring](image)

**Fig. 282: Identifying Snap Ring**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Remove the flange, 4 discs and 4 plates from the transaxle case.

43. INSPECT UNDERDRIVE CLUTCH DISC NO.2

   **HINT:**

   (See [INSPECTION](#))
44. REMOVE TRANSAXLE REAR COVER SUB-ASSEMBLY
   a. Remove the 11 bolts.
   b. Tap on the circumference of the rear cover with a plastic hammer to remove the transaxle rear cover from the transaxle case.

45. REMOVE TRANSAXLE CASE NO.1 PLUG
   a. Remove the 4 transaxle case No.1 plugs from the transaxle rear cover.
   b. Remove the 4 O-rings from the 4 transaxle case No.1 plugs.
46. REMOVE REAR CLUTCH OIL SEAL RING OUTER
   a. Remove the 3 rear clutch oil seal rings from the transaxle rear cover.

![Rear Clutch Oil Seal Ring Outer](image)

**Fig. 286: Identifying Rear Clutch Oil Seal Ring Outer**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

47. REMOVE NEEDLE-ROLLER BEARING
   a. Using SST, remove the needle-roller bearing from the transaxle rear cover.

   **SST 09387-00041 (09387-01021, 09387-01030, 09387-01040)**

![Needle-Roller Bearing and SST](image)

**Fig. 287: Identifying Needle-Roller Bearing And SST**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

48. REMOVE GOVERNOR APPLY GASKET NO.1
   a. Using a screwdriver, remove the 3 apply gaskets.

![Governor Apply Gasket](image)
49. **REMOVE BRAKE APPLY TUBE**
   
   a. Remove the bolt, clamp and brake apply tube.
   
   b. Remove the clutch apply tube.
   
   c. Remove the brake apply tube from the clamp.

   **NOTE:** Do not bend the tubes.

50. **REMOVE DIRECT CLUTCH ASSEMBLY**

   a. Remove the thrust bearing and the direct clutch assembly from the transaxle case.

51. **REMOVE OVERDRIVE DIRECT CLUTCH HUB SUB-ASSEMBLY**

   a. Remove the thrust bearing race, thrust bearing and overdrive direct clutch hub from the planetary gear assembly.
52. INSPECT OVERDRIVE DIRECT CLUTCH DRUM SUB-ASSEMBLY

HINT:

(See INSPECTION )

53. REMOVE REAR PLANETARY SUN GEAR ASSEMBLY
   a. Remove the rear planetary sun gear assembly from the transaxle case.

   Rear Planetary Sun Gear Assembly

   b. Remove the thrust needle roller bearing and thrust bearing race from the rear planetary sun gear assembly.
c. Remove the planetary carrier thrust washer No.2 from the rear planetary sun gear assembly.

54. **REMOVE 1-WAY CLUTCH ASSEMBLY**
   a. Remove the 1-way clutch assembly and the thrust needle roller bearing from the transaxle case.
   b. Remove the 1-way clutch inner race from the 1-way clutch assembly.
55. REMOVE 1-WAY CLUTCH SLEEVE OUTER
   a. Remove the 1-way clutch sleeve outer from the transaxle case.

56. REMOVE PLANETARY CARRIER THRUST WASHER NO.1
   a. Remove the planetary carrier thrust washer No.1 from the planetary gear assembly.

57. REMOVE 2ND BRAKE CLUTCH DISC
a. Using a screwdriver, remove the snap ring.
b. Remove the flange, 4 discs and 4 plates from the transaxle case.

Fig. 299: Identifying Snap Ring, Discs, And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. INSPECT 2ND BRAKE CLUTCH DISC

HINT:

(See INSPECTION )

59. REMOVE 2ND BRAKE PISTON ASSEMBLY
a. Using a screwdriver, remove the snap ring.

b. Remove the 2ND brake piston assembly from the transaxle case.

Fig. 300: Identifying Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
60. REMOVE REAR PLANETARY GEAR ASSEMBLY
   a. Using a screwdriver, remove the snap ring.
   b. Remove the rear planetary gear assembly from the transaxle case.

61. REMOVE INPUT SUN GEAR
   a. Remove the 2 thrust needle roller bearings, thrust bearing race No.2 and the input sun gear from the
transaxle case.

Fig. 304: Identifying Thrust Needle Roller Bearings, Thrust Bearing Race And Input Sun Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. REMOVE 1ST AND REVERSE BRAKE CLUTCH DISC
   a. Remove the flange, 6 discs and 6 plates from the transaxle case.

Fig. 305: Identifying Flange, Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. INSPECT 1ST AND REVERSE BRAKE CLUTCH DISC

   HINT:
   (See INSPECTION )

64. REMOVE FRONT PLANETARY GEAR ASSEMBLY
   a. Using a chisel and hammer, unstake the lock washer.

   NOTE: Push down all claws of the washer. Otherwise the SST cannot be fully pressed against the nut, and cannot loosen the nut.
b. Using SST, remove the nut.

SST 09387-00030, 09387-00080

Fig. 307: Removing/Installing Front Planetary Gear Nut With SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using SST and a press, remove the front planetary gear assembly from the counter drive gear.

SST 09950-60010 (09951-00450), 09950-70010 (09951-07100)

Fig. 308: Identifying Front Planetary Gear Assembly, Counter Drive Gear, And SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Remove the front planetary gear assembly from the brake hub.
65. REMOVE FRONT PLANETARY RING GEAR
   a. Using a screwdriver, remove the snap ring and front planetary ring gear from the brake hub.

66. REMOVE 1ST AND REVERSE BRAKE RETURN SPRING SUB-ASSEMBLY
   a. Place SST on the return spring, and compress the return spring with a press.

   SST 09387-00070

   b. Using a snap ring expander, remove the snap ring.

   NOTE:
   - Stop the press when the spring seat is lowered 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove, to prevent the spring seat from being deformed.
   - Do not expand the snap ring excessively.
67. INSPECT 1ST AND REVERSE BRAKE RETURN SPRING SUB-ASSEMBLY

HINT:
(See INSPECTION )

68. REMOVE 1ST AND REVERSE BRAKE PISTON
   a. Apply compressed air (392 kPa, 40 kgf/cm², 57 psi) to the transaxle case to remove the 1st and reverse brake piston.

   NOTE:
   • Applying compressed air may cause the piston to jump-out. When removing the piston, hold it using a waste cloth.
   • Take care not to splash ATF when applying compressed air.

   b. Remove the 2 O-rings from the 1st and reverse brake piston.
69. REMOVE COUNTER DRIVE GEAR
   a. Using SST and a press, remove the counter drive gear from the transaxle case.

   **SST 09950-60010 (09951-00590), 09950-70010 (09951-07100)**

   **Fig. 314: Identifying Counter Drive Gear And SST**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. As shown in the illustration, tighten the 2 bolts evenly and make clearance of approx. 20.0 mm (0.787 in.) between the counter drive gear and the inner race.

   **Fig. 315: Identifying Clearance Between Counter Drive Gear And Inner Race**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Using SST, remove the tapered roller bearing.
70. REMOVE TRANSFER DRIVEN PINION FRONT BEARING
   a. Using a snap ring expander, remove the snap ring.
   b. Using SST and a press, remove the bearing outer race.

   SST 09950-60010 (09951-00590), 09950-00020, 09950-00030, 09950-40011 (09957-04010)
71. **REMOVE BREATHER PLUG NO.2 (ATM)**

72. **REMOVE UNDERDRIVE BRAKE RETURN SPRING SUB-ASSEMBLY**
   a. Place SST on the return spring, and compress the return spring with a press.

   **SST 09387-00020**

   b. Using a snap ring expander, remove the snap ring.

   **NOTE:**
   
   - Stop the press when the spring seat is lowered 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove, to prevent the spring seat from being deformed.
   - Do not expand the snap ring excessively.

![Fig. 319: Compressing Return Spring With SST To Access Snap Ring](image)

73. **INSPECT UNDERDRIVE BRAKE RETURN SPRING SUB-ASSEMBLY**

   **HINT:**

   (See **INSPECTION**)

74. **REMOVE UNDERDRIVE BRAKE PISTON**
   a. Apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the transaxle case to remove the underdrive brake piston.
b. Remove the 2 O-rings from the underdrive brake piston.

75. REMOVE NEEDLE ROLLER BEARING
   a. Using SST, remove the needle roller bearing from the transaxle case.

   SST 09387-00041 (09387-01010,09387-01030, 09387-01040)

76. REMOVE UNDERDRIVE CLUTCH DRUM OIL SEAL RING
a. Remove the 2 oil seal rings from the transaxle case.

![Fig. 323: Identifying Underdrive Clutch Drum Oil Seal Ring](Image)

**Fig. 323: Identifying Underdrive Clutch Drum Oil Seal Ring**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

77. **REMOVE TRANSAXLE CASE NO.1 PLUG**

   a. Remove the 2 transaxle case No.1 plugs.
   
   b. Remove the 2 O-rings from the 2 transaxle case No.1 plugs.

![Fig. 324: Identifying Transaxle Case Plugs And O-Rings](Image)

**Fig. 324: Identifying Transaxle Case Plugs And O-Rings**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

78. **REMOVE UNDERDRIVE CYLINDRICAL ROLLER BEARING**

   a. Using SST, remove the underdrive cylindrical roller bearing from the transaxle case.

   **SST 09514-35011**
79. REMOVE UNDERDRIVE OUTPUT SHAFT OIL SEAL RING
   a. Remove the oil seal ring from the transaxle housing.

80. REMOVE DIFFERENTIAL GEAR LUBE APPLY TUBE
   a. Remove the bolt, transaxle apply tube clamp and differential gear lube apply tube from the transaxle housing.

   NOTE: Do not bend the tubes.

INSPECTION

1. INSPECT MULTIPLE DISC CLUTCH HUB
   a. Using a dial indicator, measure the inside diameter of the forward clutch hub bushing

   Standard inside diameter:

   23.025 to 23.046 mm (0.9065 to 0.9073 in.)
Maximum inside diameter:

23.09 mm (0.9091 in.)

NOTE: Check the contact surface of the bushing in the direct clutch shaft. If any scratch or discoloration is found, replace the direct clutch sub-assembly with a new one.

If the inside diameter is greater than the maximum, replace the forward clutch hub with a new one.

2. INSPECT UNDERDRIVE CLUTCH DISC NO.2
   a. Check if the sliding surfaces of the disc, plate and flange are worn or burnt.

      If necessary, replace them.

      NOTE:
      • If the lining of the disc comes off or discolors, or if a part of the groove is worn, replace all discs.
      • Before installing new discs, immerse them in ATF for at least 15 minutes.

3. INSPECT OVERDRIVE DIRECT CLUTCH DRUM SUB-ASSEMBLY
a. Using a dial indicator, measure the inside diameter of the forward clutch hub bushing.

**Standard inside diameter:**

23.025 to 23.046 mm (0.9065 to 0.9073 in.)

**Maximum inside diameter:**

23.09 mm (0.9091 in.)

**NOTE:** Check the contact surface of the bushing in the direct clutch shaft. If any scratch or discoloration is found, replace the direct clutch sub-assembly with a new one.

If the inside diameter is greater than the maximum, replace the forward clutch hub with a new one.

![Image: Measuring Inside Diameter Of Forward Clutch Hub Bushing](Fig. 330: Measuring Inside Diameter Of Forward Clutch Hub Bushing)

**Fig. 330: Measuring Inside Diameter Of Forward Clutch Hub Bushing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSPECT 2ND BRAKE CLUTCH DISC**

   a. Check if the sliding surface of the disc, plate and flange are worn or burnt.

   If necessary, replace them.

   **NOTE:**

   - If the lining of the disc comes off or discolors, or if a part of the groove is worn, replace all discs.
   - Before installing new discs, immerse them in ATF for at least 15 minutes.
5. INSPECT 1ST AND REVERSE BRAKE CLUTCH DISC
   a. Check if the sliding surface of the disc, plate and flange are worn or burnt.

If necessary, replace them.

**NOTE:**
- If the lining of the disc comes off or discolors, or if a part of the groove is worn, replace all discs.
- Before installing new discs, immerse them in ATF for at least 15 minutes.

6. INSPECT 1ST AND REVERSE BRAKE RETURN SPRING SUB-ASSEMBLY
   a. Using a vernier calipers, measure the free length of the spring together with the spring seat.

   **Standard free length:**

   17.61 mm (0.6933 in.)

   **HINT:**

   If the result is not as specified, replace the spring.
7. **INSPECT UNDERDRIVE BRAKE RETURN SPRING SUB-ASSEMBLY**
   a. Using a vernier calipers, measure the free length of the spring together with the spring seat.

   **Standard free length:**

   13.24 mm (0.5213 in.)

   **HINT:**

   If the result is not as specified, replace the spring.

8. **INSPECT PACK CLEARANCE OF 1ST AND REVERSE BRAKE**
   a. Using vernier calipers, measure the distance between the disc surface and the contact surface of the 2nd brake cylinder and transaxle case (Dimension A).
   b. Select an appropriate flange so that the pack clearance will meet the specified value.

   **Pack clearance:**

   1.16 to 1.35 mm (0.0457 to 0.0531 in.)
Fig. 335: Measuring Distance Between Disc/Contact Surface Of 2nd Brake Cylinder And Transaxle Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Piston stroke = Dimension A - Flange thickness

Flange thickness: mm (in.)

<table>
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<th>FLANGE THICKNESS SPECIFICATION</th>
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c. Install the flange.

9. INSPECT PACK CLEARANCE OF 2ND BRAKE
   a. Using a vernier calipers, measure the distance between the disc surface and snap ring surface (Dimension B).
   b. Select an appropriate flange so that the pack clearance will meet the specified value.

   Pack clearance:

   0.62 to 0.91 mm (0.0244 to 0.0358 in.)
Fig. 336: Measuring Distance Between Disc Surface And Snap Ring Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Piston stroke = Dimension B - Flange thickness - Snap ring thickness 1.6 mm (0.063 in.)

Flange thickness: mm (in.)

FLANGE THICKNESS SPECIFICATION

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<td>3.3(0.130)</td>
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10. INSPECT PACK CLEARANCE OF UNDERDRIVE BRAKE

a. Using a dial indicator, measure the underdrive brake pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).

Pack clearance:

1.81 to 2.20 mm (0.0713 to 0.0866 in.)

HINT:

Select an appropriate flange from the table below so that it will meet the specified value.
b. Temporarily remove the snap ring and attach it to the flange.

c. Reinstall the snap ring.

11. **INSPECT UNDERDRIVE 1-WAY CLUTCH ASSEMBLY**

   a. Install the underdrive clutch assembly to the 1-way clutch.

   b. Rotate the underdrive 1-way clutch assembly to check the rotating direction for the lock or free operation.

   **HINT:**

   If the result is not as specified, replace the underdrive 1-way clutch.

---

**FLANGE THICKNESS SPECIFICATION**

<table>
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<th>Thickness</th>
<th>Mark</th>
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<tr>
<td>3</td>
<td>3.4(0.134)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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**Fig. 338: Inspecting Underdrive 1-Way Clutch Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
a. Using a dial indicator, measure the input shaft end play.

**End play:**

0.262 to 1.244 mm (0.01 to 0.049 in.)

**HINT:**

If the result is not as specified, replace the input shaft or thrust needle roller bearing.

![Fig. 339: Measuring Input Shaft End Play](https://example.com/fig_339.jpg)

**Fig. 339: Measuring Input Shaft End Play**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**REASSEMBLY**

1. **BEARING POSITION**
**Fig. 340: Exploded View Of Bearing Position**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### FRONT/REAR RACE AND THRUST BEARING DIAMETER SPECIFICATION

<table>
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<tr>
<th>Mark</th>
<th>Front Race Diameter Inside / Outside mm (in.)</th>
<th>Thrust Bearing Diameter Inside / Outside mm (in.)</th>
<th>Rear Race Diameter Inside / Outside mm (in.)</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td>57.2 (2.252) / 84.96 (3.3449)</td>
<td>56.4 (2.220) / 83.0 (3.268)</td>
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</tbody>
</table>
2. INSTALL DIFFERENTIAL GEAR LUBE APPLY TUBE
   a. Install the differential gear lube apply tube and transaxle apply tube clamp with the bolt to the transaxle housing.

   Torque: 9.8 N*m (100 kgf*cm, 87 in.*lbf)

   **NOTE:** Make sure to insert the pipe to the stopper.

   ![Diagram](image)

   **Fig. 341: Identifying Differential Gear Lube Apply Tube And Transaxle Apply Tube Clamp**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL TRANSAXLE CASE NO.1 PLUG
   a. Install 2 new O-rings to the 2 transaxle case No.1 plugs.
   b. Install the 2 transaxle case No.1 plugs to the transaxle rear cover.
Torque: 7.4 N\*m (75 kgf\*cm, 65 in.\*lb)

**Fig. 342: Identifying Transaxle Case Plugs And O-Rings**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

4. **INSTALL UNDERDRIVE OUTPUT SHAFT OIL SEAL RING**
   a. Coat a new oil seal ring with ATF and install it to the transaxle housing.

**Fig. 343: Identifying Underdrive Output Shaft Oil Seal Ring**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

5. **INSTALL UNDERDRIVE CYLINDRICAL ROLLER BEARING**
   a. Coat the underdrive cylindrical roller bearing with ATF.
   b. Using SST and a press, install the underdrive cylindrical roller bearing.

   **SST 09950-60020 (09951-00810), 09950-70010 (09951-07100)**

   **NOTE:** Do not apply excessive pressure to the bearing.
6. INSTALL UNDERDRIVE CLUTCH DRUM OIL SEAL RING
   a. Coat 2 new oil seal rings with ATF, and install them to the transaxle rear cover.

   **NOTE:**
   - Do not expand the end gap of the oil seal ring too much.
   - Fix the hooks firmly. Confirm that the oil seal ring rotates freely in its groove.

7. INSTALL NEEDLE ROLLER BEARING
   a. Wrap vinyl tape around the SST 4.0 mm (0.157 in.) from the bottom of the SST until the thickness of the tape is about 5.0 mm (0.197 in.).

   **NOTE:** Clean SST to remove deposited oil, before wrapping vinyl tape.

   b. Coat the needle roller bearing with ATF.
c. Using SST and a press, install the needle-roller bearing to the transaxle case.

SST 09950-60010 (09951-00320), 09950-70010 (09951-07100)

NOTE: When the wrapped vinyl tape contacts the transaxle case, stop press-fitting.

8. INSTALL UNDERDRIVE BRAKE PISTON
   a. Coat 2 new O-rings with ATF, and install them to the underdrive brake piston.

   NOTE:  
   - Make sure that the O-rings are not twisted or pinched when they are installed.  
   - Apply sufficient ATF to the O-ring before installing.
b. Coat the underdrive brake piston with ATF.
c. Install the underdrive brake piston to the transaxle case.

**NOTE:** Be careful not to damage the O-ring.

![Diagram of O-ring]

**Fig. 348: Locating Underdrive Brake Piston O-Rings**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL UNDERDRIVE BRAKE RETURN SPRING SUB-ASSEMBLY**
   a. Place SST on the return spring and compress the return spring with a press.

   **SST 09387-00020**

   b. Using a snap ring expander, install the snap ring to the transaxle case.

![Diagram of SST and Snap Ring]

**Fig. 349: Identifying Underdrive Brake Piston**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.
10. INSTALL BREATHER PLUG NO.2 (ATM)

11. INSTALL COUNTER DRIVE GEAR BEARING
   a. Coat the counterdrive gear bearing with ATF.
   b. Using SST and a press, install the bearing outer race.

   SST 09950-60020 (09951-01030), 09950-70010 (09951-07150), 09649-17010

   NOTE:
   - Do not apply excessive pressure to the bearing.
   - Press-fit the bearing outer race until it contacts the transaxle case.

   Fig. 351: Using SST And Press To Install Bearing Outer Race
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Using a snap ring expander, install the snap ring.

   NOTE: The white mark side of the snap ring should face upward.
12. INSTALL COUNTER DRIVE GEAR
   a. Coat the counterdrive gear with ATF.
   b. Using SST and a press, install the tapered roller bearing to the counter drive gear.

   SST 09950-70010 (09951-07150), 09649-17010

   **NOTE:** Do not apply excessive pressure to the bearing.

   c. Using SST and a press, install the counter drive gear and bearing to the transaxle case.

   SST 09950-70010 (09951-07150), 09223-15030, 09527-17011, 09950-60020 (09951-00750)

   **NOTE:** Do not apply excessive pressure to the counter drive gear.
13. INSTALL 1ST AND REVERSE BRAKE PISTON
   a. Coat 2 new O-rings with ATF.
   b. Install the 2 O-rings to the 1st and reverse brake piston.

   NOTE:
   - Make sure that the O-rings are not twisted or pinched when they are installed.
   - Apply sufficient ATF to the O-ring prior to assembling.

   c. Coat the 1st and reverse brake piston with ATF, and install it to the transaxle case.
14. INSTALL 1ST AND REVERSE BRAKE RETURN SPRING SUB-ASSEMBLY
   a. Place SST on the return spring and compress the return spring with a press.

      SST 09387-00070

   b. Using a snap ring expander, install the snap ring to the transaxle case.

      NOTE: Be careful not to damage the O-ring.

      • Stop the press when the spring seat is lowered to the place 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove, preventing the spring seat from being deformed.
      • Do not expand the snap ring excessively.
      • Installing the spring sub-assembly, check that all of the springs are fit in the piston correctly.
      • The snap ring should be fully engaged in the groove of the cylinder.
      • Fix the snap ring to the inside of the claw of the spring seat firmly.
15. **INSTALL FRONT PLANETARY RING GEAR**
   a. Using a screwdriver, install the front planetary ring gear and snap ring to the brake hub.

   **NOTE:** Confirm that the snap ring is engaged in the groove of the brake hub correctly.

   ![Diagram of Front Planetary Ring Gear](image)

   *Fig. 358: Identifying Snap Ring, Brake Hub And Front Planetary Ring Gear*
   *Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

16. **INSTALL FRONT PLANETARY GEAR ASSEMBLY**
   a. Install the front planetary gear assembly to the brake hub.

   ![Diagram of Front Planetary Gear Assembly](image)

   *Fig. 359: View Of Front Planetary Gear Assembly And Brake Hub*
   *Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*


   **SST 09950-60010 (09951-00500), 09950-70010 (09951-07100)**

   **NOTE:**
   - Do not apply excessive pressure to the planetary gear assembly.
   - Press the inner race of LH tapered roller bearing, counter gear and front planetary gear assembly to the position where no preload should be applied to one pair of tapered roller bearings (left and right).
c. Install a new washer as shown in the illustration.

![Fig. 361: Identifying Washer](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Fig. 361: Identifying Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using SST, install the nut.

SST 09387-00030, 09387-00080

Torque: 280 N\*m (3,355 kgf\*cm, 207 ft.\*lbf)

**NOTE:** Assemble the washer after pressing each part, then tighten the nut to the minimum tightening torque.
e. Using SST and a torque wrench, measure the turning torque of the bearing while rotating SST at 60 rpm. When the measured value is not as specified, gradually tighten the nut until it reaches the specified value.

f. Tighten the nut gradually until the specified turning torque of tapered roller bearing is measured.  

Torque: 350 N*m (3,569 kgf*cm, 258 ft.*lbf)

g. Using a chisel and hammer, stake the front lock washer.
17. INSTALL INPUT SUN GEAR
   a. Coat the 2 thrust bearings with ATF.
   b. Install the 2 thrust bearings, the bearing race and the input sun gear to the front planetary gear assembly.

   **NOTE:**
   - Install the bearing race on the side of the front planetary carrier. Be careful about the direction of the race.
   - Installing thrust bearing and front sun gears, be careful about the direction of the parts.
   - Install the bearing race on the side of the front sun gear. Be careful about the direction of the race.
   - Install the thrust bearing and the race after holding the parts on the input sun gear by applying grease. Make sure that the assembling order is correct.

   Thrust bearing and bearing race diameter: mm (in.)

   **THRUST BEARING AND BEARING RACE DIAMETER SPECIFICATION**

<table>
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<th>Inside</th>
<th>Outside</th>
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</table>
18. INSTALL REAR PLANETARY GEAR ASSEMBLY
   a. Install the rear planetary gear assembly to the rear planetary ring gear.

   ![Rear Planetary Gear Assembly]

   Fig. 366: Identifying Rear Planetary Gear Assembly
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a screwdriver, install the snap ring.

   **NOTE:** Confirm that the snap ring is fixed in the groove of the 1st and reverse brake hub correctly.

   ![Snap Ring]

   Fig. 367: Identifying Snap Ring
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL 1ST AND REVERSE BRAKE CLUTCH DISC
   a. Coat the 6 discs with ATF.
   b. Install the 7 plates and 6 discs.

   **NOTE:** Make sure that the plates, discs, and flange are installed as shown in the illustration.
20. **INSPECT PACK CLEARANCE OF FIRST AND REVERSE BRAKE**

a. Using vernier calipers, measure the distance between the disc surface and the contact surface of the 2nd brake cylinder and transaxle case (Dimension A).

b. Select an appropriate flange so that the pack clearance will meet the specified value.

Pack clearance: 1.16 to 1.35 mm (0.0457 to 0.0531 in.)

**Flange thickness: mm (in.)**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Thickness</th>
<th>Mark</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.8 (0.071)</td>
<td>5</td>
<td>2.2 (0.087)</td>
</tr>
<tr>
<td>2</td>
<td>1.9 (0.075)</td>
<td>6</td>
<td>2.3 (0.091)</td>
</tr>
<tr>
<td>3</td>
<td>2.0 (0.079)</td>
<td>7</td>
<td>2.4 (0.094)</td>
</tr>
<tr>
<td>4</td>
<td>2.1 (0.083)</td>
<td>8</td>
<td>2.5 (0.098)</td>
</tr>
</tbody>
</table>

**HINT:**

Piston stroke = Dimension A - Flange thickness
c. Install the flange.

Fig. 370: Identifying Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSTALL SECOND BRAKE PISTON ASSEMBLY
   a. Install the second brake piston assembly to the transaxle case.

Fig. 371: Identifying Second Brake Piston Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the snap ring and measure the inside diameter.

   Inside diameter: Greater than 167 mm (6.57 in.)

   NOTE:
   - Make sure that the taper snap ring is installed in the correct direction.
   - When the diameter does not meet the specified value, replace the snap ring with a new one.
   - After installing, confirm that there is no clearance between the 2nd brake cylinder and the fitting surface of the cylinder in the transaxle case.
22. **INSTALL 1-WAY CLUTCH SLEEVE OUTER**
   a. Install the 1-way clutch sleeve outer to the 2nd brake cylinder assembly.

   **NOTE:** Make sure that the outer sleeve is installed in the correct direction.

23. **INSTALL 1-WAY CLUTCH ASSEMBLY**
   a. Install the 1-way clutch inner race to the 1-way clutch.

   **NOTE:**
   - Make sure that the inner race is installed in the correct direction.
   - Confirm that the discrimination mark is visible.
b. Check the rotating direction of 1-way clutch for the lock or free operation as shown in the illustration.

![Fig. 375: Checking Rotating Direction Of 1-Way Clutch](image)

COURTESY OF TOYOTA MOTOR SALES, U.S.A., INC.

![Fig. 374: Identifying 1-Way Clutch Inner Race](image)

COURTESY OF TOYOTA MOTOR SALES, U.S.A., INC.

![Diagram of 1-Way Clutch](image)

c. Install the 1-way clutch and thrust needle roller bearing to the 1-way clutch sleeve outer.

**Bearing diameter: mm (in.)**

**BEARING DIAMETER SPECIFICATION**

<table>
<thead>
<tr>
<th></th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing</td>
<td>53.6 (2.110)</td>
<td>69.4 (2.732)</td>
</tr>
</tbody>
</table>

**NOTE:** Install the thrust bearing properly so that no-colored race will be visible.
24. INSTALL PLANETARY CARRIER THRUST WASHER NO.1
   a. Coat the planetary carrier thrust washer No.1 with yellow petrolatum, and install the washer onto the planetary sun gear assembly.

   **NOTE:** After installing, confirm that the projection should be fixed firmly in the hole of the planetary sun gear assembly.

25. REMOVE REAR PLANETARY SUN GEAR ASSEMBLY
   a. Coat the planetary carrier thrust washer No.2 with yellow petrolatum, and install the washer onto the rear planetary sun gear.
b. Coat the bearing with yellow petrolatum, and install the bearing onto the rear planetary sun gear.

**Bearing diameter: mm (in.)**

**BEARING DIAMETER SPECIFICATION**

<table>
<thead>
<tr>
<th></th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race, A</td>
<td>33.0 (1.299)</td>
<td>45.4 (1.787)</td>
</tr>
<tr>
<td>Bearing, B</td>
<td>31.85 (1.254)</td>
<td>45.2 (1.78)</td>
</tr>
</tbody>
</table>

c. Install the rear planetary sun gear assembly to the rear planetary gear.

**NOTE:** Installing the rear planetary sun gear assembly, make sure that the B1 discs are engaged.
26. **INSTALL 2ND BRAKE CLUTCH DISC**
   a. Coat the 4 discs with ATF.
   b. Install the 4 discs and 5 plates to the transaxle case.
   c. Temporarily install the snap ring.

27. **INSPECT PACK CLEARANCE OF 2ND BRAKE**
   a. Using a vernier calipers, measure the distance between the disc surface and snap ring surface (Dimension B).
   b. Select an appropriate flange so that the pack clearance will meet the specified value.

   **Clearance: 0.62 to 0.91 mm (0.0244 to 0.0358 in.)**

   **HINT:**
   
   Piston stroke = Dimension B - Flange thickness - Snap ring thickness 1.6 mm (0.063 in.)
Flange thickness: mm (in.)

<table>
<thead>
<tr>
<th>Mark</th>
<th>Thickness</th>
<th>Mark</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0 (0.118)</td>
<td>5</td>
<td>3.4 (0.134)</td>
</tr>
<tr>
<td>2</td>
<td>3.1 (0.122)</td>
<td>6</td>
<td>3.5 (0.138)</td>
</tr>
<tr>
<td>3</td>
<td>3.2 (0.126)</td>
<td>7</td>
<td>3.6 (0.142)</td>
</tr>
<tr>
<td>4</td>
<td>3.3 (0.130)</td>
<td>8</td>
<td>-</td>
</tr>
</tbody>
</table>

28. INSTALL OVERDRIVE DIRECT CLUTCH HUB SUB-ASSEMBLY
   a. Install the direct clutch hub to the planetary gear assembly.

   NOTE: Be careful not to damage the bushing inside the overdrive clutch hub during installation.
b. Coat the thrust bearing with ATF.
c. Install the bearing race and the thrust bearing to the direct clutch hub.

![Diagram of Overdrive Direct Clutch Hub]

**Fig. 384: Identifying Overdrive Direct Clutch Hub And Planetary Gear Assembly**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to drop the bearing when it is installed.

Bearing and race diameter: mm (in.)

<table>
<thead>
<tr>
<th>BEARING AND RACE DIAMETER SPECIFICATION</th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing, A</td>
<td>24.7 (0.972)</td>
<td>39.5 (1.555)</td>
</tr>
<tr>
<td>Race, B</td>
<td>23.6 (0.929)</td>
<td>38.0 (1.496)</td>
</tr>
</tbody>
</table>

29. **INSTALL DIRECT CLUTCH ASSEMBLY**
   a. Coat the thrust bearing with ATF.
   b. Install the direct clutch assembly and thrust bearing to the rear planetary sun gear assembly.

![Diagram of Direct Clutch Assembly and Thrust Bearing]

**Fig. 385: Identifying Thrust Bearing And Direct Clutch Assembly**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** The disc in the direct clutch should completely match with the hub attached outside the rear planetary sun gear. Otherwise, the rear
c. Clean the connecting part of the transaxle case and the rear cover.

d. As shown in the illustration, place a straightedge on the direct clutch drum and measure the distance between the transaxle case and the straightedge using vernier calipers (Dimension C).

![Figure 386: Measuring Distance Between Transaxle Case And Straightedge](image1)

**Fig. 386: Measuring Distance Between Transaxle Case And Straightedge**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

e. Using vernier calipers and a straightedge, measure the dimension shown in the illustration.

f. Calculate the end play value using the following formula. Select a thrust bearing which satisfies the end play value and install the selected bearing.

![Figure 387: Measuring Dimension](image2)

**Fig. 387: Measuring Dimension**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

End play: 0.244 to 0.901 mm (0.0096 to 0.0355 in.)

**NOTE:** Make sure that the no-colored race side is facing the direct clutch assembly.

**HINT:**

End play = Dimension D - Dimension C

**Bearing thickness and diameter: mm (in.)**
BEARING THICKNESS AND DIAMETER SPECIFICATION

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.6 (0.1417)</td>
<td>56.3 (2.217)</td>
<td>75.7 (2.980)</td>
</tr>
<tr>
<td>3.8 (0.1496)</td>
<td>56.3 (2.217)</td>
<td>75.7 (2.980)</td>
</tr>
</tbody>
</table>

30. INSTALL GOVERNOR APPLY GASKET NO.1
   a. Install 3 new governor apply gaskets No.1 to the transaxle case.

![Fig. 388: Locating Governor Apply Gaskets](image)

31. INSTALL BRAKE APPLY TUBE
   a. Install the clamp to the brake apply tube.

   **NOTE:** Make sure to install the clamp to the apply tube before installing the apply tube to the transaxle case. This prevents the apply tube from being deformed or damaged.

   b. Install the clutch apply tube.

   ![Fig. 389: Identifying Brake Apply Tube](image)

   c. Install the brake apply tube and a bolt to the transaxle case.

   **Torque:** 5.4 N*m (55 kgf*cm, 48 in.*lbf)
NOTE: The tube should be securely inserted until it reaches the stopper.

![Diagram of Brake Apply Tube and Clutch Apply Tube](image)

**Fig. 390: Identifying Brake Apply Tube And Clutch Apply Tube**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL NEEDLE ROLLER BEARING  
   a. Using SST and a press, press the needle roller bearing into the transaxle rear cover.

   **SST 09950-60010 (09951-00230, 09952-06010)**

   Press fit depth: 20.55 to 21.25 mm (0.8091 to 0.8366 in.)

![Diagram of Needle Roller Bearing Installation](image)

**Fig. 391: Using SST And Press To Install Needle Roller Bearing To Transaxle Rear Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:  
- The engraved mark side of the bearing should face upward.
- Repeat the press fit until the specified value is obtained.

   b. Coat a needle roller bearing with ATF.

33. INSTALL REAR CLUTCH OIL SEAL RING OUTER  
   a. Coat 3 new rear clutch oil seal rings with ATF, install them to the transaxle rear cover.

   **NOTE:** The snap ring should be fully engaged in the groove of the drum.
34. **INSTALL TRANSAXLE CASE NO.1 PLUG**
   a. Coat 4 new O-rings with ATF.
   b. Install the 4 O-rings to the 4 transaxle case No.1 plugs.
   c. Install the 4 transaxle case No.1 plugs to the transaxle rear cover.
   
   **Torque: 7.4 N*m (75 kgf*cm, 65 in.*lbf)**

35. **INSTALL TRANSAXLE REAR COVER SUB-ASSEMBLY**
   a. Remove any packing material and be careful not to spill oil on the contact surfaces of the transaxle rear cover or the transaxle case.
   b. Apply FIPG to the cover.
   
   **FIPG: Part No. 08826-00090, THREE BOND 1281 or equivalent.**
Fig. 394: Identifying FIPG Applying Area On Transaxle Rear Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Make sure that the FIPG is applied in a bead (section diameter: ø1.2) so that the entire sealing surface will be evenly sealed. The FIPG should also protrude slightly from the flange after the assembly of the parts has been completed.

c. Apply liquid sealer to the "A" bolt threads.

Sealant: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent.

d. Install the 11 bolts.

Torque: Bolt A 19 N*m (190 kgf*cm, 14 ft.*lbf)

Other bolts: 25 N*m (250 kgf*cm, 18 ft.*lbf)

Fig. 395: Locating Transaxle Rear Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. INSTALL UNDERDRIVE CLUTCH DISC NO.2
   a. Coat the 4 discs with ATF.
   b. Install the 4 discs, 4 plates and flange to the transaxle case.

NOTE: Be careful about the order of discs, plate and flange assembly.
c. Using a screwdriver, install the snap ring.

**NOTE:** The snap ring should be fully engaged in the groove of the drum.

37. **INSPECT PACK CLEARANCE OF UNDERDRIVE BRAKE**
   a. Using a dial indicator, measure the underdrive brake pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).
Pack clearance: 1.81 to 2.20 mm (0.0713 to 0.0866 in.)

HINT:

Select an appropriate flange from the table below so that it will meet the specified value.

Flange thickness: mm (in.)

<table>
<thead>
<tr>
<th>Mark</th>
<th>Thickness</th>
<th>Mark</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0 (0.118)</td>
<td>4</td>
<td>3.1 (0.122)</td>
</tr>
<tr>
<td>2</td>
<td>3.2 (0.126)</td>
<td>5</td>
<td>3.3 (0.130)</td>
</tr>
<tr>
<td>3</td>
<td>3.4 (0.134)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

b. Temporarily remove the snap ring and attach it to the flange.

c. Reinstall the snap ring.

38. **INSPECT UNDERDRIVE 1-WAY CLUTCH ASSEMBLY**

a. Install the underdrive clutch assembly to the 1-way clutch.

b. Rotate the underdrive clutch assembly to check the rotating direction for the lock or free operation.

![Free](Fig. 399: Inspecting Underdrive 1-Way Clutch Assembly)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. **INSTALL UNDERDRIVE 1-WAY CLUTCH ASSEMBLY**

a. Install the outer race retainer to the 1-way clutch.

**NOTE:** Fix the outer race retainer to the external tooth of the 1-way clutch firmly.
b. Install the 1-way clutch to the transaxle case.

**NOTE:** Make sure that the mark on the 1-way clutch outer race is visible.

c. Using a screwdriver, install the snap ring to the transaxle case.

**NOTE:** The snap ring should be fixed fully engaged in the groove of the transaxle case.
40. INSTALL UNDERDRIVE CLUTCH ASSEMBLY
   a. Coat the bearing and bearing race with petroleum jelly, install them onto the underdrive clutch.

   Bearing and bearing race diameter: mm (in.)

   BEARING AND BEARING RACE DIAMETER SPECIFICATION

<table>
<thead>
<tr>
<th></th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing</td>
<td>37.73 (1.4854)</td>
<td>58.0 (2.2835)</td>
</tr>
<tr>
<td>Race</td>
<td>29.9 (1.1772)</td>
<td>55.5 (2.185)</td>
</tr>
</tbody>
</table>

   Fig. 403: Identifying Underdrive Clutch Assembly
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Install the underdrive clutch assembly to the transaxle case.

   NOTE: Do not damage the oil seal when installing the underdrive clutch drum sub-assembly.

41. INSTALL PARKING LOCK PAWL
   a. Install the pawl pin and spring to the parking lock pawl.

   Fig. 404: Identifying Pawl Pin, Spring And Parking Lock Pawl
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Temporarily install the parking lock pawl, shaft and spring to the transaxle case, as shown in the
42. INSTALL UNDERDRIVE PLANETARY GEAR ASSEMBLY
   a. Install the underdrive planetary gear assembly to the transaxle case.

   **NOTE:** Fully engage all the discs of underdrive clutch and hub splines of the underdrive planetary gear assembly and install them securely.

   b. Install the parking lock pawl shaft.

Fig. 405: Identifying Spring And Parking Lock Pawl
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Fig. 406: Identifying Underdrive Planetary Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Fig. 407: Locating Parking Lock Pawl Shaft
c. Install the pawl shaft clamp with the bolt.

**Torque:** 9.8 N\(\cdot\)m (100 kgf\(\cdot\)cm, 87 in.\(\cdot\)lbf)

![Pawl Shaft Clamp](image)

**Fig. 408: Identifying Bolt And Pawl Shaft Clamp**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using a straightedge and vernier calipers as shown in the illustration, measure the gap between the top of the differential drive pinion in the underdrive planetary gear and the contact surface of the transaxle case and housing (Dimension E).

**NOTE:** Record dimension E for the following process.

![Dimension E](image)

**Fig. 409: Measuring Gap Between Top Of Differential Drive Pinion And Contact Surface Of Transaxle Case**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. As shown in the illustration, measure the 2 places of the transaxle housing, and calculate dimension F using the formula below.

**NOTE:** Record dimension F for the following process.

**HINT:**
Dimension F = Dimension (1) - Dimension (2)

Fig. 410: Identifying Dimension (1) And Dimension (2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. INSTALL MULTIPLE DISC CLUTCH HUB
   a. Install the thrust bearing race No.1 to the transaxle case while checking its direction.

   Bearing race diameter: mm (in.)

   BEARING RACE DIAMETER SPECIFICATION
<table>
<thead>
<tr>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing race</td>
<td>39.5 (1.555)</td>
</tr>
</tbody>
</table>

   Thrust Bearing Race No.1

   Fig. 411: Identifying Thrust Bearing Race
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Coat the thrust needle roller bearing and race with yellow petrolatum, install them onto the multiple disc clutch hub.

   Thrust bearing and race diameter: mm (in.)

   THRUST BEARING AND RACE DIAMETER SPECIFICATION
<table>
<thead>
<tr>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrust Bearing</td>
<td>36.4 (1.433)</td>
</tr>
</tbody>
</table>
c. Coat the needle roller bearing with ATF.
d. Install the needle roller bearing to the multiple clutch hub.

**Bearing diameter: mm (in.)**

**BEARING DIAMETER SPECIFICATION**

<table>
<thead>
<tr>
<th></th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing</td>
<td>23.6 (0.929)</td>
<td>44 (1.732)</td>
</tr>
</tbody>
</table>

**THRUST BEARING DIAMETER SPECIFICATION**

<table>
<thead>
<tr>
<th></th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrust Bearing</td>
<td>33.58 (1.3220)</td>
<td>51.9 (2.043)</td>
</tr>
</tbody>
</table>
c. Install the forward clutch to the forward clutch assembly.

NOTE:

- Align the splines of all discs in the forward clutch with those of multiple clutch hub to install them securely.
- Be careful not to damage the bushing inside of the forward clutch hub during installation.

45. INSTALL OVERDRIVE BRAKE GASKET
   a. Install 2 new overdrive brake gaskets.
46. INSTALL DIFFERENTIAL GEAR ASSEMBLY
   a. Install the differential gear assembly to the transaxle case.

47. INSTALL THRUST BEARING UNDERDRIVE RACE NO.2
   a. Install the thrust bearing underdrive race No.2 to the underdrive planetary gear assembly.

48. INSTALL THRUST NEEDLE ROLLER BEARING
a. Coat the thrust needle roller bearing with ATF.
b. Calculate the end play value using the following formula and values of Dimension E and F that are measured when installing the cylindrical roller bearing and underdrive planetary gear. Select an appropriate underdrive planetary gear thrust bearing race No.2 which satisfies the specified end play value, and install the selected bearing race.

**End play: 0.498 to 0.993 mm (0.01961 to 0.03909 in.)**

**HINT:**

![Diagram of thrust needle roller bearing, differential gear, and forward clutch assembly](image)

**Fig. 419: Identifying Thrust Needle Roller Bearing, Differential Gear And Forward Clutch Assembly**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

End play = Dimension F - Dimension E - thrust bearing thickness 2.5 mm (0.0984 in.) - underdrive thrust bearing race No.2 thickness.

**Race thickness: mm (in.)**

<table>
<thead>
<tr>
<th>F-E</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 7.72 (0.3039)</td>
<td>3.5(0.138)</td>
</tr>
<tr>
<td>7.72 (0.3039)</td>
<td>3.8(0.150)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bearing</th>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing</td>
<td>57.2 (2.252)</td>
<td>84.96 (3.345)</td>
</tr>
<tr>
<td>Bearing race</td>
<td>56.4 (2.22)</td>
<td>83 (3.268)</td>
</tr>
</tbody>
</table>

49. **INSTALL OIL PUMP ASSEMBLY**
   a. Install the oil pump to the transaxle case with the 7 bolts.

**Torque: 22 N*m (226 kgf*cm, 16 ft.*lbf)**
b. Coat the O-ring of oil pump with ATF.

NOTE: Confirm that the input shaft rotates smoothly with the manual operation after installing the oil pump.

50. INSTALL TRANSAXLE HOUSING
   a. Remove any packing material and be careful not to spill oil on the contact surface of the transaxle case or transaxle housing.
   b. Apply FIPG to the transaxle case.

   FIPG: Part No. 08826-00090, THREE BOND 1281 or equivalent
c. Install the transaxle housing and 16 bolts to the transaxle case.

Torque: Bolt A 22 N·m (225 kgf·cm, 16 ft·lbf)
Bolt B 29 N·m (300 kgf·cm, 22 ft·lbf)
Bolt C 29 N·m (295 kgf·cm, 21 ft·lbf)
Bolt D 22 N·m (226 kgf·cm, 16 ft·lbf)

HINT:

Apply seal packing or equivalent to bolts A and D.

Seal packing: THREE BOND 2403 or equivalent

Bolt length

Bolt A: 50 mm (1.969 in.)
Bolt B: 50 mm (1.969 in.)
Bolt C: 42 mm (1.654 in.)
Bolt D: 72 mm (2.835 in.)

NOTE: Tighten the bolts within 10 minutes of sealant application.

51. **INSPECT INPUT SHAFT END PLAY**
   a. Using a dial indicator, measure the input shaft end play.

   **End play:** 0.262 to 1.249 mm (0.0100 to 0.0494 in.)

![Fig. 424: Measuring Input Shaft End Play](image)

**Fig. 424: Measuring Input Shaft End Play**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. **FIX AUTOMATIC TRANSAXLE ASSEMBLY**
   a. Fix the transaxle assembly.

![Fig. 425: Fixing Automatic Transaxle Assembly](image)

**Fig. 425: Fixing Automatic Transaxle Assembly**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. **INSTALL MANUAL VALVE LEVER SHAFT OIL SEAL**
   a. Coat a new oil seal with MP grease.
   b. Install the oil seal to the transaxle case.

   **SST 09950-60010 (09951-00230), 09950-70010 (09951-07100)**
Oil seal installation depth: 0 ± 0.5 mm (0 ± 0.197 in.)

Fig. 426: Tapping Oil Seal To Transaxle Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. INSTALL PARKING LOCK ROD SUB-ASSEMBLY
   a. Install the parking lock rod to the manual valve lever.

Fig. 427: Identifying Parking Lock Rod Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. INSTALL MANUAL VALVE LEVER SUB-ASSEMBLY
   a. Install a new spacer and manual valve lever shaft to the transaxle case.

NOTE: Do not damage the oil seal when installing the shaft to the transaxle case.
b. Using a pin punch and hammer, drive in a new pin.

![Fig. 428: Identifying Spacer And Manual Valve Lever Shaft](image1)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Turn the spacer and the lever shaft to align the small hole for locating the staking position in the spacer with the staking position mark on the lever shaft.

d. Using a pin punch, stake the spacer through the small hole.

e. Check that the spacer does not turn.

![Fig. 429: Locating Pin Using Pin Punch And Hammer](image2)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. **INSTALL MANUAL VALVE LEVER SHAFT RETAINER SPRING**

a. Using needle-nose pliers, install the retainer spring.

**NOTE:** Hang the spring on the shaft firmly.
57. INSTALL PARKING LOCK PAWL BRACKET  
   a. Install the parking lock pawl bracket with the 2 bolts.

   **Torque:** 20 N*\(m\) (205 kgf*cm, 15 ft.*lbf)

   **Bolt length:** 25 mm (0.984 in.)

   **NOTE:** Make sure that the parking rod is placed between the parking pawl and the guide of the parking bracket when the parking bracket is installed.

58. INSTALL MANUAL DETENT SPRING SUB-ASSEMBLY  
   a. Install the manual detent spring and cover with the 2 bolts.

   **NOTE:** Make sure to install the manual detent spring and cover in this order.

   **HINT:**

   Tighten bolt A first, and then bolt B.
Torque: Bolt A 20 N*m (205 kgf*cm, 15 ft.*lbf)

![Fig. 433: Locating Manual Detent Spring Sub-Assembly Bolts](image)

Bolt B 12 N*m (120 kgf*cm, 9 ft.*lbf)

Bolt length:

Bolt A: 27 mm (1.063 in.)

Bolt B: 16 mm (0.630 in.)

59. INSTALL B-3 ACCUMULATOR PISTON
   a. Coat a new O-ring with ATF, install it to the B-3 accumulator piston.

   **NOTE:** Make sure that the O-ring is not twisted and that it does not protrude abnormally from the accumulator piston. Apply sufficient ATF before installing the O-ring. The O-ring must be installed in the correct position.

   ![Fig. 434: Locating B-3 Accumulator Piston O-Ring](image)

   b. Coat the piston with ATF, install it to the transaxle case.
NOTE: Install the springs to each accumulator piston, checking the identification color or each spring.

Accumulator spring:

ACCUMULATOR SPRING FREE LENGTH OUTER DIAMETER SPECIFICATION

<table>
<thead>
<tr>
<th>Free length Outer diameter mm (in.)</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner 62.00 (2.4409) / 15.50(0.610)</td>
<td>Purple</td>
</tr>
<tr>
<td>Outer 74.23 (2.9224) / 21.70(0.854)</td>
<td>Purple</td>
</tr>
</tbody>
</table>

Fig. 435: Locating ATF Applying Area Of B-3 Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. INSTALL REVERSE CLUTCH ACCUMULATOR PISTON
   a. Coat 2 new O-rings with ATF, install them to the reverse accumulator piston.

NOTE: Make sure that the O-ring is not twisted and that it does not protrude abnormally from the accumulator piston. Apply sufficient ATF before installing the O-ring. The O-ring must be installed in the correct position.

Fig. 436: Locating Reverse Clutch Accumulator Piston O-Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Coat the piston with ATF, install it to the transaxle case.
NOTE: Install the springs to each accumulator piston, checking the identification color or each spring.

Accumulator spring:

ACCUMULATOR SPRING FREE LENGTH OUTER DIAMETER SPECIFICATION

<table>
<thead>
<tr>
<th>Free length Outer diameter mm (in.)</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.96 (2.3999) / 14.10 (0.555)</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

Fig. 437: Locating Reverse Clutch Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. INSTALL C-3 ACCUMULATOR PISTON
   a. Coat a new O-ring with ATF, install it to the C-3 accumulator piston.

   NOTE: Make sure that the O-ring is not twisted and that it does not protrude abnormally from the accumulator piston. Apply sufficient ATF before installing the O-ring. The O-ring must be installed in the correct position.

   Fig. 438: Locating C-3 Accumulator Piston O-Ring
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Coat the piston with ATF, install it to the transaxle case.

   NOTE: Install the springs to each accumulator piston, checking the
identification color or each spring.

Accumulator spring:

**ACCUMULATOR SPRING FREE LENGTH OUTER DIAMETER SPECIFICATION**

<table>
<thead>
<tr>
<th>Free length Outer diameter mm (in.)</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>72.20 (2.8425) / 19.0(0.748)</td>
<td>Colorless</td>
</tr>
</tbody>
</table>

NOTE: Be sure to place the spring in the hole in the check ball body. Be careful about the direction of the parts.

62. INSTALL CHECK BALL BODY

a. Coat the check ball body with ATF.

b. Install the check ball body and spring.

**NOTE:** Be sure to place the spring in the hole in the check ball body. Be careful about the direction of the parts.
63. INSTALL BRAKE DRUM GASKET  
   a. Coat a new brake drum gasket with ATF, install it to the transaxle case.

   **NOTE:** Be sure not to damage the lip of the transaxle case brake gasket when inserting the gasket to the case. Apply sufficient ATF to the gasket before installation. Be careful about the direction of parts.

64. INSTALL TRANSAXLE CASE 2ND BRAKE GASKET  
   a. Coat a new transaxle case 2nd brake gasket with ATF, and install it to the transaxle case.

   **NOTE:** Be sure not to damage the lip of the transaxle case brake gasket when inserting the gasket to the case. Apply sufficient ATF to the gasket before installation. Be careful about the direction of parts.
65. **INSTALL GOVERNOR APPLY GASKET NO.1**
   a. Coat a new governor apply gasket No.1 with ATF, and install it to the transaxle case.

   **NOTE:** Be sure not to damage the lip of the transaxle case brake gasket when inserting the gasket to the case. Apply sufficient ATF to the gasket before installation. Be careful about the direction of parts.

66. **INSTALL TRANSMISSION WIRE**
   a. Coat a new O-ring with ATF, and install it to the transmission wire.

   **NOTE:** Make sure that the O-ring is not twisted, protruded, or pinched when installing the wire transmission to the transaxle case. Apply sufficient ATF to the O-ring before installation.
b. Install the transmission wire retaining bolt.

**Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)**

---

67. **CONNECT TRANSMISSION WIRE**

a. Coat an O-ring of the ATF temperature sensor with ATF.

b. Install the ATF temperature sensor with the lock plate and bolt.

**Torque: 6.6 N*m (67 kgf*cm, 58 in.*lbf)**

c. Connect the 7 solenoid connectors.

**NOTE:**

- Connect the connectors A, B, C, D, E, F, G, in the order from shortest to longest.
- Apply ATF to the bolt.
68. INSTALL TRANSMISSION VALVE BODY ASSEMBLY
   a. While positioning the manual valve lever position, install the valve body to the transaxle case with
      the 17 bolts.

      Torque: 11 N*m (110 kgf*cm, 8 ft.*lbf)

      Bolt length:

      Bolt A: 41 mm (1.614 in.)

      Bolt B: 57 mm (2.244 in.)

      Bolt C: 25 mm (0.984 in.)

      NOTE:
      - Push the valve body against the accumulator piston spring and
        the check ball body to install the valve body.
      - When installing the valve body to the transaxle case, do not
        hold the solenoids.
      - Temporarily tighten the bolts marked with (1) in the illustration
69. INSTALL VALVE BODY OIL STRAINER ASSEMBLY
   a. Coat a new O-ring with ATF and install it to the oil strainer.

   **NOTE:** Make sure that the O-ring is not twisted or pinched. Apply sufficient
   ATF to the O-ring before installation.

   ![Fig. 449: Locating Valve Body Oil Strainer O-Ring](image)
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Install the oil strainer and 3 bolts to the valve body.

   **Torque:** 11 N*m (110 kgf*cm, 8 ft.*lbf)

   **NOTE:** Apply ATF to the bolts.

   ![Fig. 450: Locating Oil Strainer Bolts](image)
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

70. INSTALL AUTOMATIC TRANSAXLE OIL PAN SUB-ASSEMBLY
   a. Install the 2 magnets to the oil pan.
   b. Apply seal packing or equivalent to new 18 bolts.

   **Seal packing:** THREE BOND 2430 or equivalent
c. Install the oil pan and new oil pan gasket to the transaxle case with the 18 bolts.

**Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)**

**NOTE:**
- Tighten the bolts within 10 minutes of sealant application.
- Completely remove any oil or grease from the contact surface of the transaxle case and the oil pan with the gasket before installing the oil pan to the case.

71. **INSTALL TRANSAXLE CASE NO.1 PLUG**
   a. Coat 4 new O-rings with ATF, and install them to the 4 transaxle case No.1 plugs.
   b. Install the 4 transaxle case No.1 plugs to the transaxle case.

   **Torque: 7.4 N*m (75 kgf*cm, 65 in.*lbf)**
72. INSTALL SPEED SENSOR  
   a. Coat 2 new O-rings with ATF and install them to the 2 sensors.  
   b. Install the 2 sensors to the transaxle case with the 2 bolts.  

   **Torque:** 11.0 N*m (115 kgf*cm, 8 ft.*lbf)**

73. INSTALL OIL COOLER TUBE UNION (OUTLET OIL COOLER UNION)  
   a. Coat a new O-ring with ATF, and install it to the elbow.  
   b. Install the elbow to the transaxle case.  

   **Torque:** 27 N*m (276 kgf*cm, 20 ft.*lbf)**
74. **INSTALL OIL COOLER TUBE UNION (INLET OIL COOLER UNION)**
   a. Coat a new O-ring with ATF, and install it to the union.
   b. Install the union to the transaxle case.

   **Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)**

75. **INSTALL BREATHER PLUG HOSE**
   a. Install the breather plug hose to the transaxle case firmly.

76. **INSTALL PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
   a. Install the park/neutral position switch onto the manual valve lever shaft, and temporarily install the 2 adjusting bolts.
   b. Install a new nut stopper and nut.

   **Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)**
c. Temporarily install the control shaft lever.

d. Turn the lever counterclockwise until it stops, and then turn it clockwise 2 notches.
e. Remove the control shaft lever.

f. Align the groove with the neutral basic line.
g. Tighten the 2 bolts.
Torque: 5.4 N\*m (55 kgf\*cm, 48 in.\*lbf)

Fig. 460: Identifying Park/Neutral Position Switch Bolts Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Using a screwdriver, stake the nut with the nut stopper.

Fig. 461: Staking Nut With Nut Stopper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Install the control shaft lever, washer and nut.

Torque: 13 N\*m (130 kgf\*cm, 9 ft.\*lbf)

77. INSTALL SPEEDOMETER DRIVEN HOLE (ATM) COVER SUB-ASSEMBLY
   a. Coat a new O-ring with ATF and install it to the speedometer driven hole cover.
   b. Install the bolt and speedometer driven hole cover sub assembly to the transaxle assembly.

Torque: 6.9 N\*m (70 kgf\*cm, 61 in.\*lbf)
Fig. 462: Locating Control Shaft Lever Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OIL PUMP

COMPONENTS

- FRONT OIL PUMP BODY
- O-RING
- FRONT OIL PUMP DRIVE GEAR
- FRONT OIL PUMP OIL SEAL
- CLUTCH DRUM OIL SEAL RING
- 9.5 (106.07 in.*lb/ft)
- x 11
- STATOR SHAFT ASSEMBLY

N*m (kg*cm, ft.*lb/ft) - Specified torque

- Non-reusable part
- Apply petroleum jelly
DISASSEMBLY

1. INSPECT OIL PUMP ASSEMBLY

HINT:

(See INSPECTION )

2. REMOVE CLUTCH DRUM OIL SEAL RING
   a. Remove the 2 clutch drum oil seal rings.

3. REMOVE STATOR SHAFT ASSEMBLY
   a. Using a "torx" socket (T30), remove the 11 bolts and stator shaft.

4. INSPECT CLEARANCE OF OIL PUMP ASSEMBLY

HINT:

(See INSPECTION )
5. **REMOVE FRONT OIL PUMP DRIVE GEAR**  
   a. Remove the front oil pump drive gear.

![Fig. 466: Locating Front Oil Pump Drive Gear](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE FRONT OIL PUMP DRIVEN GEAR**  
   a. Remove the front oil pump driven gear.

![Fig. 467: Locating Front Oil Pump Driven Gear](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **REMOVE FRONT OIL PUMP BODY O-RING**  
   a. Using a screwdriver, remove the O-ring.

**HINT:**

Tape the screwdriver before use.
8. REMOVE FRONT OIL PUMP OIL SEAL
   a. Mount the oil pump in a soft jaw vise.
   b. Using SST, remove the oil seal from the oil pump body.

   **SST 09308-00010**

INSPECTION

1. INSPECT OIL PUMP ASSEMBLY
   a. Turn the drive gear with the 2 screwdrivers and make sure that it rotates smoothly.

   **NOTE:** Be careful not to damage the oil seal lip.
2. **INSPECT CLEARANCE OF OIL PUMP ASSEMBLY**
   
a. Push the driven gear to one side of the body.
   
b. Using a feeler gauge, measure the clearance.
   
   **Standard body clearance:** 0.10 to 0.17 mm (0.0039 to 0.0067 in.)
   
   **Side clearance:** 0.02 to 0.05 mm (0.001 to 0.002 in.)
   
   **Maximum body clearance:** 0.17 mm (0.0067 in.)
   
   If the body clearance is greater than the maximum, replace the oil pump body sub-assembly.
   
   ![Diagram of Oil Pump Drive Gear]
   
   **Fig. 471: Measuring Clearance Between Oil Pump Body And Oil Pump Driven Gear**
   
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Using a feeler gauge, measure the tip clearance between the driven gear teeth and drive gear teeth.
   
   **Standard tip clearance:** 0.07 to 0.15 mm (0.0028 to 0.0059 in.)
   
   **Maximum tip clearance:** 0.15 mm (0.0059 in.)
   
   If the tip clearance is greater than the maximum, replace the oil pump body sub-assembly.
d. Using a straightedge and feeler gauge, measure the side clearance of both gears.

**Standard side clearance: 0.02 to 0.05 mm (0.0008 to 0.0020 in.)**

**Maximum side clearance: 0.05 mm (0.0020 in.)**

**Drive gear thickness: mm (in.)**

**DRIVE GEAR THICKNESS SPECIFICATION**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>11.690 to 11.699 (0.4602 to 0.4606)</td>
</tr>
<tr>
<td>B</td>
<td>11.700 to 11.709 (0.4606 to 0.4610)</td>
</tr>
<tr>
<td>C</td>
<td>11.710 to 11.720 (0.4610 to 0.4614)</td>
</tr>
<tr>
<td>D</td>
<td>11.721 to 11.730 (0.4615 to 0.4618)</td>
</tr>
<tr>
<td>E</td>
<td>11.731 to 11.740 (0.4619 to 0.4622)</td>
</tr>
</tbody>
</table>

**Driven gear thickness: mm (in.)**

**DRIVE GEAR THICKNESS SPECIFICATION**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>11.690 to 11.699 (0.4602 to 0.4606)</td>
</tr>
</tbody>
</table>
3. **INSPECT FRONT OIL PUMP AND GEAR BODY SUB-ASSEMBLY**
   a. Using a dial indicator, measure the inside diameter of the oil pump body bushing.

   **Standard inside diameter:** 38.113 to 38.138 mm (1.50051 to 1.50149 in.)

   **Maximum inside diameter:** 38.188 mm (1.50346 in.)

   If the inside diameter is greater than the maximum, replace the oil pump body sub-assembly.

   ![Diagram](image1)

   **Fig. 474: Measuring Inside Diameter Of Oil Pump Body Bushing**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSPECT STATOR SHAFT ASSEMBLY**
   a. Using a dial indicator, measure the inside diameter of the stator shaft.

   **Standard inside diameter:** 21.500 to 21.526 mm (0.84646 to 0.84748 in.)

   **Maximum inside diameter:** 21.57 mm (0.8492 in.)

   If the inside diameter is greater than the maximum, replace the stator shaft.

   ![Diagram](image2)

   **Fig. 475: Measuring Inside Diameter Of Stator Shaft**
REASSEMBLY

1. INSTALL FRONT OIL PUMP OIL SEAL
   a. Using SST and a hammer, install a new oil seal to the oil pump body.
      
      SST 09350-32014(09351-32140)
      
      HINT:
      The seal end should be flat with the outer edge of the oil pump.
   b. Coat the lip of the oil seal with MP grease.

   ![Fig. 476: Tapping Oil Seal To Oil Pump Body Using SST](image)

2. INSTALL FRONT OIL PUMP BODY O-RING
   a. Coat new O-ring with ATF, and install it to the oil pump body.

   ![Fig. 477: Identifying Front Oil Pump Body O-Ring](image)

   NOTE: Make sure that the O-ring is not twisted or pinched. Moreover, apply enough ATF to the O-ring before installation.
3. INSTALL FRONT OIL PUMP DRIVEN GEAR
   a. Coat the front oil pump driven gear with ATF, and install it to the oil pump body with the marked side facing upward.

![Fig. 478: Identifying Marks On Oil Pump Driven Gear](image)

4. INSTALL FRONT OIL PUMP DRIVE GEAR
   a. Coat the front oil pump drive gear with ATF, and install it to the oil pump body with the marked side facing upward.

![Fig. 479: Identifying Marks On Oil Pump Drive Gear](image)

5. INSTALL STATOR SHAFT ASSEMBLY
   a. Set the stator shaft and align it with each bolt hole.
   b. Using a "torx" socket (T30), install the 11 bolts.

   **Torque: 9.8 N*m (100 kgf*cm, 87 in.*lbf)**
6. **INSTALL CLUTCH DRUM OIL SEAL RING**
   a. Coat 2 new clutch drum oil seal rings with ATF.
   b. Install 2 new clutch drum oil seal rings.

   **NOTE:** Do not expand the ring ends excessively.

7. **INSPECT OIL PUMP ASSEMBLY**

   **HINT:**

   (See **INSPECTION**)

---

**SECOND BRAKE PISTON**

**COMPONENTS**
DISASSEMBLY

1. REMOVE 2ND BRAKE PISTON RETURN SPRING SUB-ASSEMBLY
   a. Place SST on the return spring and compress the return spring with a press.

   SST 09387-00060

   b. Using a screwdriver, remove the snap ring.
c. Remove the 2nd brake piston return spring.

2. REMOVE 2ND BRAKE PISTON

a. Hold the 2nd brake piston and apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the 2nd brake cylinder to remove the 2nd brake piston.

**NOTE:** Hold the piston with a shop rag or a piece of cloth when removing the piston. Failure to do so may result in the piston jumping out from the cylinder.
3. **REMOVE 2ND BRAKE PISTON O-RING**
   a. Remove the 2 O-rings from the 2nd brake piston.

![Diagram of O-rings](image)

**Fig. 486: Locating 2nd Brake Piston O-Rings**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

**INSPECTION**

1. **INSPECT 2ND BRAKE PISTON RETURN SPRING SUB-ASSEMBLY**
   a. Using vernier calipers, measure the free length of the spring together with the spring seat.

   **Standard free length:** 16.61 mm (0.6539 in.)

![Diagram of brake piston and spring](image)

**Fig. 487: Measuring Free Length Of 2nd Brake Piston Return Spring**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

**REASSEMBLY**

1. **INSTALL 2ND BRAKE PISTON O-RING**
   a. Coat 2 new O-rings with ATF, and install them in the 2nd brake piston.

   **NOTE:** Make sure that the O-ring is not twisted or pinched.
2. **INSTALL 2ND BRAKE PISTON**
   a. Coat the 2nd brake piston with ATF, and install it to the 2nd brake cylinder.

   **NOTE:** Be careful not to damage the O-ring.

3. **INSTALL 2ND BRAKE PISTON RETURN SPRING SUB-ASSEMBLY**
   a. Install the 2nd brake piston return spring.

   **NOTE:** Installing the spring sub-assembly, check that all of the springs are fit in the piston correctly.
b. Place SST on the piston return spring, and compress the piston return spring with a press.

SST 09387-00060

c. Using a screwdriver, install the snap ring.
d. Be sure that the end gap of the snap ring is not aligned with the spring retainer claw.

NOTE:

- Stop the press when the spring seat is lowered to the place 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove.
- This prevents the spring seat from being deformed.

Fig. 491: Compressing 2nd Brake Piston Return Spring And Locating Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

FORWARD CLUTCH

COMPONENTS
Fig. 492: Identifying Forward Clutch Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. INSPECT PACK CLEARANCE OF FORWARD CLUTCH

HINT:
2. **REMOVE FORWARD MULTIPLE DISC CLUTCH DISC**
   a. Using a screwdriver, remove the snap ring.

   ![Snap Ring](Fig. 493: Identifying Snap Ring)

   Fig. 493: Identifying Snap Ring
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Remove the flange, 5 discs and 5 plates from the input shaft assembly.

   ![Flange, Discs And Plates](Fig. 494: Identifying Flange, Discs And Plates)

   Fig. 494: Identifying Flange, Discs And Plates
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE FORWARD CLUTCH RETURN SPRING SUB-ASSEMBLY**
   a. Place SST on the spring retainer and compress the return spring with a press.
   b. Using a snap ring expander, remove the snap ring.

   **NOTE:**
   - Stop the press when the spring seat is lowered 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove, preventing the spring seat from being deformed.
   - Do not expand the snap ring excessively.
c. Remove the clutch balancer from the input shaft.

![Fig. 496: Identifying Clutch Balancer And Input Shaft](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

\[\text{Clutch Balancer}\]
\[\text{Input Shaft}\]

d. Remove the forward clutch return spring from the input shaft.

![Fig. 497: Identifying Forward Clutch Return Spring And Input Shaft](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

\[\text{Forward Clutch Return Spring}\]
\[\text{Input Shaft}\]

4. **REMOVE FORWARD CLUTCH RETURN SPRING SUB-ASSEMBLY**
   a. Place the forward clutch drum onto the oil pump.
   b. Holding the forward clutch piston by hand, apply compressed air (392 kPa, 4.0 kgf/cm\(^2\), 57 psi) to
the oil pump to remove the forward clutch piston.

HINT:

When the piston cannot be removed as it is slanted, blow air again with the protruding side pushed, or remove the piston using the needle nose pliers with vinyl tape on the tip.

---

5. **REMOVE INPUT SHAFT OIL SEAL RING**
   
   a. Remove the input shaft oil seal ring from the input shaft.

---

**INSPECTION**

1. **INSPECT PACK CLEARANCE OF FORWARD CLUTCH**
   
   a. Install the forward clutch on the oil pump.

   **NOTE:** Be careful not to damage the oil seal ring of oil pump.

   b. Using a dial indicator, measure the forward clutch pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).
Pack clearance: 1.00 to 1.25 mm (0.0394 to 0.4921 in.)

If the clearance is not as specified, inspect the discs, plates and flange.

HINT:

If the opening is large, cover it with a shop rug or a piece of cloth to prevent the compressed air from being released.

Fig. 500: Measuring Forward Clutch Pack Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT FORWARD MULTIPLE DISC CLUTCH DISC**
   a. Check if the sliding surface of the disc, plate and flange are worn or burnt.

   If necessary, replace them.

   HINT:

   - If the lining of the disc comes off or discolors, or if a part of the groove is worn, replace all discs.
   - Before installing new discs, immerse them in ATF for at least 15 minutes.
3. **INSPECT FORWARD CLUTCH RETURN SPRING SUB-ASSEMBLY**
   a. Using vernier calipers, measure the free length of the spring together with the spring seat.

   **Standard free length: 26.74 mm (1.0528 in.)**

4. **INSPECT PACK CLEARANCE OF FORWARD CLUTCH**
   a. Using a dial indicator, measure the forward clutch pack clearance while applying and releasing compressed air (392 kgf/cm², 4.0 kPa, 57 psi).

   **Pack clearance: 1.00 to 1.25 mm (0.0394 to 0.4921 in.)**

   If the piston stroke is less than the minimum, parts may be assembled incorrectly. Check and reassemble the parts again.

   If the clearance is not as specified, select another flange.

   **HINT:**

   There are 5 different thicknesses of flanges available.

   **Flange thickness: mm (in.)**
**FLANGE THICKNESS SPECIFICATION**

<table>
<thead>
<tr>
<th>No.</th>
<th>Thickness</th>
<th>No.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.00(0.1181)</td>
<td>4</td>
<td>3.45(0.1358)</td>
</tr>
<tr>
<td>2</td>
<td>3.15(0.1240)</td>
<td>5</td>
<td>3.60(0.1417)</td>
</tr>
<tr>
<td>3</td>
<td>3.30(0.1299)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Fig. 503: Measuring Forward Clutch Pack Clearance**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSPECT FORWARD MULTIPLE DISC CLUTCH DISC**
   a. Check if the disc lightly rotates when rotating the forward clutch assembly after inserting the multiple disc clutch into it.

    **NOTE:** Do not place the forward clutch assembly in a vise.

**Fig. 504: Inspecting Forward Multiple Disc Clutch Disc**
REASSEMBLY

1. INSTALL INPUT SHAFT OIL SEAL RING
   a. Compress a new input shaft oil seal ring from both sides to reduce dimension A.
      
      Dimension A: 5 mm (0.197 in.)
   b. Coat the oil seal ring with ATF and install it to the input shaft.

   NOTE: Do not expand the end gap of the oil seal ring too much. Fix the hooks firmly.

   ![Fig. 505: Compressing New Input Shaft Oil Seal Ring From Both Sides To Reduce Dimension A](image)

2. INSTALL FORWARD CLUTCH PISTON SUB-ASSEMBLY
   a. Coat the forward clutch piston with ATF, and install it to the input shaft.

   NOTE: Be careful not to damage the lip of the forward clutch piston.

   ![Fig. 506: Identifying Forward Clutch Piston Sub-Assembly](image)
3. INSTALL FORWARD CLUTCH RETURN SPRING SUB-ASSEMBLY
   
a. Install the return spring to the input shaft.

   **NOTE:** Installing the spring sub-assembly, check that all of the springs are fit in the piston correctly.

b. Coat the clutch balancer with ATF.

   ![Forward Clutch Return Spring and Input Shaft](image1)

   **Fig. 507: Identifying Forward Clutch Return Spring And Input Shaft**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the clutch balancer to the input shaft.

   **NOTE:**
   - Be careful not to damage the lip of the forward clutch balancer.
   - Make sure that the clutch balancer is not pinched and that there are no other defects at the lip.
   - Apply sufficient ATF to the sealing lip before installation.

   ![Clutch Balancer and Input Shaft](image2)

   **Fig. 508: Identifying Clutch Balancer And Input Shaft**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   SST 09387-00020

d. Place SST on the clutch balancer, and compress the clutch balancer with a press.

   SST 09387-00020
e. Install the snap ring with a snap ring expander.
f. Be sure that the end gap of the snap ring is not aligned with the spring retainer claw.

**NOTE:**
- Stop the press when the spring seat is lowered to the place 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove.
- This prevents the spring seat from being deformed.
- Do not expand the snap ring excessively.

![Fig. 509: Installing Snap Ring](image)

Fig. 509: Installing Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: The end gap of the snap ring should not align with any of the stoppers.

g. Set the end gap of the snap ring in the piston as shown in the illustration.

4. INSTALL FORWARD MULTIPLE DISC CLUTCH DISC

a. Coat the 5 discs with ATF.

![Fig. 510: Identifying Stoppers](image)

Fig. 510: Identifying Stoppers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the 5 plates, 5 discs and flange input shaft.

**NOTE:** Make sure that the plates, discs, and flange are installed as shown in
c. Using a screwdriver, install the snap ring.
d. Check that the end gap of the snap ring is not aligned with one of the cutouts.

**NOTE:** The snap ring should be fully engaged in the groove of the drum.

5. **INSPECT PACK CLEARANCE OF FORWARD CLUTCH**

**HINT:**

(See [INSPECTION](#))

6. **INSPECT FORWARD MULTIPLE DISC CLUTCH DISC**

**HINT:**

(See [INSPECTION](#))

**DIRECT CLUTCH**
COMPONENTS

Fig. 513: Identifying Direct Clutch Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. INSPECT PACK CLEARANCE OF REVERSE CLUTCH
HINT:
(See **INSPECTION** )

2. **INSPECT PACK CLEARANCE OF DIRECT CLUTCH AND OVERDRIVE CLUTCH**

HINT:
(See **INSPECTION** )

3. **REMOVE DIRECT MULTIPLE DISC CLUTCH DISC**
   a. Using a screwdriver, remove the snap ring from the intermediate shaft.

![Fig. 514: Identifying Snap Ring](https://example.com/fig514)
*Fig. 514: Identifying Snap Ring*
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

   b. Remove the flange, 3 discs, 3 plates and cushion plate from the intermediate shaft.

![Fig. 515: Identifying Flange, Discs, Plates And Cushion Plate From Intermediate Shaft](https://example.com/fig515)
*Fig. 515: Identifying Flange, Discs, Plates And Cushion Plate From Intermediate Shaft*
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

4. **REMOVE OVERDRIVE DIRECT CLUTCH DISC**
   a. Using a screwdriver, remove the snap ring from the intermediate shaft.
   b. Remove the flange, 4 discs and 4 plates from the intermediate shaft.
5. REMOVE OVERDRIVE CLUTCH RETURN SPRING SUB-ASSEMBLY
   a. Place SST on the clutch balancer and compress the spring with a press.

   **SST 09387-00020**

   b. Using a snap ring expander, remove the snap ring from the direct clutch drum.

   **NOTE:**
   - Stop the press when the spring seat is lowered to the place 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove.

   - This prevents the spring seat from being deformed.
   - Do not expand the snap ring excessively.

   c. Remove the clutch balancer from the direct clutch drum.
d. Remove the overdrive clutch return spring from the direct clutch drum.

6. REMOVE OVERDRIVE DIRECT CLUTCH PISTON
   a. Install the intermediate shaft on the transaxle rear cover.
   b. Holding the direct clutch piston with your hand, apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the transaxle rear cover to remove the direct clutch piston.

7. REMOVE OVERDRIVE DIRECT CLUTCH DRUM SUB-ASSEMBLY
a. Holding the direct clutch drum by hand, apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the transaxle rear cover to remove the direct clutch drum.

![Fig. 521: Applying Compressed Air To Transaxle Rear Cover](image)

8. REMOVE OVERDRIVE DIRECT CLUTCH O-RING
   a. Using a screwdriver, remove the O-ring from the direct clutch drum.

![Fig. 522: Locating Overdrive Direct Clutch O-Ring](image)

INSPECTION

1. INSPECT PACK CLEARANCE OF REVERSE CLUTCH
   a. Install the intermediate shaft and needle roller bearing onto the transaxle rear cover.
   b. Using a dial indicator, measure the reverse clutch pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).

   Pack clearance: 0.60 to 0.82 mm (0.02362 to 0.03228 in.)

   If the pack clearance is not as specified, inspect the discs, plates and flange.
2. INSPECT PACK CLEARANCE OF DIRECT CLUTCH AND OVERDRIVE CLUTCH
   a. Using a dial indicator, measure the direct clutch and overdrive clutch pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).

   Pack clearance: 0.61 to 0.83 mm (0.02401 to 0.03268 in.)

   If the pack clearance is not as specified, inspect the discs, plates and flange.
3. **INSPECT DIRECT MULTIPLE DISC CLUTCH DISC**
   
   a. Check if the sliding surfaces of the disc, plate and flange are worn or burnt.

   If necessary, replace them.

   **HINT:**

   - If the lining of the disc comes off or discolors, or if a part of the groove is worn, replace all discs.
   - Before installing new discs, immerse them in ATF for at least 15 minutes.
4. **INSPECT OVERDRIVE DIRECT CLUTCH DISC**
   a. Check if the sliding surface of the disc, plate and flange are worn or burnt. If necessary, replace them.

   **HINT:**
   - If the lining of the disc comes off or discolors, or if a part of the groove is worn, replace all discs.
   - Before installing new discs, immerse them in ATF for at least 15 minutes.

   ![Identifying Overdrive Direct Clutch Disc](image)

   **Fig. 526: Identifying Overdrive Direct Clutch Disc**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSPECT OVERDRIVE CLUTCH RETURN SPRING SUB-ASSEMBLY**
   a. Using vernier calipers, measure the free length of the spring together with the spring seat.

   **Standard free length: 25.91 mm (1.0201 in.)**

   ![Measuring Free Length Of Overdrive Clutch Return Spring](image)

   **Fig. 527: Measuring Free Length Of Overdrive Clutch Return Spring**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSPECT PACK CLEARANCE OF REVERSE CLUTCH**
   a. Install the intermediate shaft onto the transaxle rear cover.
   b. Using a dial indicator, measure the direct clutch pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).
Clearance: 0.60 to 0.82 mm (0.02362 to 0.03228 in.)

If the pack clearance is less than the minimum, parts may have been assembled incorrectly, so check and reassemble again. If the clearance is not as specified, select another flange.

HINT:

There are 7 flanges of different thickness.

Flange thickness: mm (in.)

<table>
<thead>
<tr>
<th>No.</th>
<th>Thickness</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>6</td>
<td>3.5 (0.138)</td>
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</table>

Fig. 528: Measuring Reverse Clutch Pack Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSPECT PACK CLEARANCE OF DIRECT CLUTCH AND OVERDRIVE CLUTCH**
   a. Using a dial indicator, measure the direct clutch & overdrive clutch pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).

   Clearance: 0.61 to 0.83 mm (0.02401 to 0.03268 in.)
If the pack clearance is less than the minimum, parts may have been assembled incorrectly, so check and reassemble again. If the clearance is not as specified, select another flange.

HINT:

There are 7 different thicknesses of flanges available.

**Flange thickness: mm (in.)**

**FLANGE THICKNESS SPECIFICATION**

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<thead>
<tr>
<th>No.</th>
<th>Thickness</th>
<th>No.</th>
<th>Thickness</th>
</tr>
</thead>
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<tr>
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<td>2</td>
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<td>3.1 (0.122)</td>
</tr>
<tr>
<td>3</td>
<td>2.8 (0.110)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

b. Check that the disc rotates when rotating the disc after inserting the rear planetary sun gear.

**NOTE:** Do not place the rear planetary sun gear in a vise.

![Fig. 529: Checking Disc Rotation](Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.)

**REASSEMBLY**

1. **INSTALL OVERDRIVE DIRECT CLUTCH O-RING**
   a. Coat an O-ring with ATF, and install it to the direct clutch drum.

   **NOTE:** Make sure that the O-ring is not twisted or pinched when it is installed.
2. INSTALL OVERDRIVE DIRECT CLUTCH DRUM SUB-ASSEMBLY
   a. Coat the direct clutch drum with ATF, and install it to the intermediate shaft.

   **NOTE:**
   - Be careful not to damage the O-ring.
   - Be careful not to damage the lip of the direct clutch drum.

3. INSTALL OVERDRIVE DIRECT CLUTCH PISTON
   a. Coat the overdrive direct clutch piston with ATF, and install it to the direct clutch drum.
4. INSTALL OVERDRIVE CLUTCH RETURN SPRING SUB-ASSEMBLY
   a. Install the overdrive clutch return spring to the direct clutch drum.

      NOTE: Installing the spring sub-assembly, check that all of the springs are fit in piston correctly.

   b. Coat the clutch balancer with ATF.

   c. Install the clutch balancer to the direct clutch drum.

      NOTE:
      - Be careful not to damage the lip of the direct clutch balancer.
      - Make sure that the lip of the seal is not pinched and that it has no other defects.
      - Apply sufficient ATF to the sealing lip before installing the clutch balancer.

   d. Place SST on the clutch balancer and compress the overdrive clutch return spring with a press.

      SST 09387-00020
e. Using a snap ring expander, install the snap ring to the direct clutch drum.
f. Be sure that the end gap of the snap ring is not aligned with the spring retainer claw.

**NOTE:**
- Stop the press when the spring seat is lowered to the place 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove.
- This prevents the spring seat from being deformed.
- Do not expand the snap ring excessively.

![Fig. 535: Placing SST On Clutch Balancer And Compress Overdrive Clutch Return Spring](image)

**NOTE:** The end gap of the snap ring should not align with any of the stops.

![Fig. 536: Identifying Stoppers](image)

5. **INSTALL OVERDRIVE DIRECT CLUTCH DISC**
   a. Coat the 4 discs with ATF.
   b. Install the 4 plates, 4 discs and flange to the intermediate shaft.

**NOTE:** Make sure that the plates, discs, and flange are installed as shown in
6. INSTALL DIRECT MULTIPLE DISC CLUTCH DISC
   a. Coat the 3 disc with ATF.
   b. Install the cushion plate, 3 plates, 3 disc and flange to the intermediate shaft.

   **NOTE:**
   - Install the cushion plate with the mark on the white surface facing to plate.
   - Be careful about the order of discs, plate and flange assembly.
c. Using a screwdriver, install the snap ring.

d. Check that the end gap of the snap ring is not aligned with one of the cutouts.

**NOTE:** The snap ring should be fixed certainly in the groove of the drum.
DISASSEMBLY

1. INSPECT UNDERDRIVE PLANETARY GEAR PRELOAD

HINT:

(See INSPECTION )

2. REMOVE FRONT PLANETARY GEAR NUT
a. Using SST, loosen the staked part of the lock nut.

SST 09930-00010 (09931 -00010, 09931 -00020), 09387-00050

![Fig. 542: Loosening Staked Part Of Lock Nut](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Place the underdrive planetary gear in a soft jaw vise.

**NOTE:** Be careful not to damage the differential drive pinion.

![Fig. 543: Placing Underdrive Planetary Gear In Soft Jaw Vise](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a socket wrench, remove the lock nut.

![Fig. 544: Locating Lock Nut](image)
3. **REMOVE CYLINDRICAL ROLLER BEARING RACE INNER**
   a. Using SST, remove the cylindrical roller bearing race inner.

   SST 09950-00020, 09950-00030, 09950-60010 (09951-00320, 09957-04010)

![Fig. 545: Using SST On Cylindrical Roller Bearing Race Inner](image)

4. **REMOVE UNDERDRIVE PLANETARY GEAR ASSEMBLY**
   a. Using SST and a press, remove the differential drive pinion, parking lock gear, counter driven gear with underdrive planetary ring gear and radial ball bearing front.

   SST 09950-60010 (09951-00320), 09387-00050, 09950-00020, 09950-00030, 09950-40011 (09957-04010)

![Fig. 546: Pressing Differential Drive Pinion, Parking Lock Gear And Counter Driven Gear With SST](image)

   b. Place the underdrive planetary gear in a soft jaw vise.
   c. Using SST, remove the radial ball bearing rear from the underdrive planetary gear.

   SST 09950-60010 (09951-00320), 09950-00030, 09950-40011 (09957-04010)
5. REMOVE UNDERDRIVE PLANETARY RING GEAR
   a. Using a snap ring pliers, remove the snap ring.
   b. Remove the underdrive planetary ring gear from the counter driven gear.

**Fig. 547: Using SST To Remove Rear Bearing Form Underdrive Planetary Gear**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Fig. 548: Locating Snap Ring**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Fig. 549: Identifying Underdrive Planetary Ring Gear And Counter Driven Gear**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**INSPECTION**

1. **INSPECT UNDERDRIVE PLANETARY GEAR PRELOAD**
a. Using SST, fix the underdrive planetary gear assembly.

**SST 09387-00050**

![Image of Underdrive Planetary Gear Assembly]

**Fig. 550: Identifying Underdrive Planetary Gear Assembly**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

b. Using SST and a torque wrench, measure the turning torque of the underdrive planetary gear assembly while rotating the torque wrench at 60 rpm.

**SST 09387-00050**

*Turning torque at 60 rpm.*: 0.50 to 1.42 N*m (5.1 to 14.5 kgf*cm, 4.4 to 12.6 in.*lbf)*

**HINT:**

Use a torque wrench with a fulcrum length of 160 mm (6.3 in.).

![Image of Measuring Turning Torque Of Underdrive Planetary Gear]

**Fig. 551: Measuring Turning Torque Of Underdrive Planetary Gear**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

**REASSEMBLY**

1. **INSTALL UNDERDRIVE PLANETARY RING GEAR**
   a. Install a new snap ring to the outer race of the radial ball bearing rear.
HINT:

When replacing the bearing, also replace the counter driven gear with a new one.

Fig. 552: Identifying Snap Ring On Outer Race Of Radial Ball Bearing Rear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a piston ring compressor, squeeze the snap ring.

Fig. 553: Using Piston Ring Compressor To Squeeze Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using SST and a press, press in the outer race of the radial ball bearing rear.

SST 09950-60020 (09951-00890), 09950-70010 (09951-07100)

NOTE: Be sure not to damage the snap ring during outer race installation.

Fig. 554: Pressing In Outer Race Of Radial Ball Bearing Rear
d. Install the underdrive planetary ring gear to the counter driven gear.

![Underdrive Planetary Ring Gear and Counter Driven Gear](Fig. 555: Identifying Underdrive Planetary Ring Gear And Counter Driven Gear)

e. Using a snap ring pliers, install the snap ring.

![Snap Ring](Fig. 556: Identifying Snap Ring)

2. INSTALL UNDERDRIVE PLANETARY GEAR ASSEMBLY
   a. Using SST and a press, press the radial ball bearing rear in the underdrive planetary gear.

   **SST 09502-12010, 09950-60010 (09951-00260), 09950-70010 (09951-07100)**

   **NOTE:** Press the bearing until it becomes flat at the bottom.
b. Install the counter driven gear with planetary ring gear to the underdrive planetary gear.

c. Using SST and a press, press in the radial ball bearing front.

**NOTE:** Press the counter driven gear while rotating it.
d. Using SST and a press, press in the parking lock gear.

SST 09502-12010, 09950-60010 (09951-00260), 09950-70010 (09951-07100)

**NOTE:** Press the counter driven gear while rotating it.

![Fig. 560: Pressing Parking Lock Gear](Image)

*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

3. **INSTALL DIFFERENTIAL DRIVE PINION**

SST 09726-40010, 09950-60010 (09951-00260), 09950-70010 (09951-07100)

**NOTE:** Press the counter driven gear while rotating it.

![Fig. 561: Pressing Differential Drive Pinion](Image)

*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

4. **INSTALL CYLINDRICAL ROLLER BEARING RACE INNER**
   a. Using SST and a press, press the cylindrical roller bearing race inner.

SST 09506-35010, 09950-60010 (09951-00260), 09950-70010 (09951-07100)

**NOTE:** Press the counter driven gear while rotating it.
5. **INSTALL FRONT PLANETARY GEAR NUT**
   
a. Place the underdrive planetary gear in a soft jaw vise.

   **NOTE:** Be careful not to damage the differential drive pinion.

b. Using a socket wrench, install a new lock nut.

   **Torque:** 280 N*m (2,885 kgf*cm, 207 ft.*lbf)

   **HINT:**

   Use a torque wrench with a fulcrum length of 750 mm (29.53 in.).

c. Using a pin punch and hammer, stake the lock nut.

   **CAUTION:** Be sure that there are no cracks on the nut.
6. INSPECT UNDERDRIVE PLANETARY GEAR PRELOAD

HINT:

(See INSPECTION)

UNDERDRIVE CLUTCH

COMPONENTS
Fig. 565: Identifying Underdrive Clutch Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **INSPECT UNDERDRIVE PACK CLEARANCE**

   HINT:

   (See **INSPECTION**)  

2. **REMOVE UNDERDRIVE CLUTCH FLANGE NO.2 HOLE SNAP RING**
a. Using a screwdriver, remove the underdrive clutch flange No.2 snap ring.

![Snap Ring](image)

**Fig. 566: Identifying Underdrive Clutch Flange Hole Snap Ring**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

3. **REMOVE UNDERDRIVE CLUTCH DISC NO.1**
   a. Remove the flange, 4 discs and 4 plates from the underdrive clutch drum.

![Underdrive Clutch Drum](image)

**Fig. 567: Identifying Discs, Plates, And Underdrive Clutch Drum**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

4. **REMOVE UNDERDRIVE CLUTCH RETURN SPRING SUB-ASSEMBLY**
   a. Place SST on the clutch balancer and compress the spring with a press.

   **SST 09350-32014**

   b. Using a snap ring expander, remove the snap ring.

**NOTE:**
- Stop the press when the spring seat is lowered to the place 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove.
- This prevents the spring seat from being deformed.
- Do not expand the snap ring excessively.
c. Remove the clutch balancer from the underdrive clutch drum.

![Clutch Balancer and Underdrive Clutch Drum](image1)

**Fig. 569: View Of Clutch Balancer And Underdrive Clutch Drum**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

d. Remove the return spring from the underdrive clutch drum.

![Underdrive Clutch Return Spring and Underdrive Clutch Drum](image2)

**Fig. 570: View Of Underdrive Clutch Return Spring And Underdrive Clutch Drum**
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

5. **REMOVE UNDERDRIVE CLUTCH PISTON SET**
   a. Install the underdrive clutch to the transaxle case.
NOTE:  Be careful not to damage the oil seal ring.

b. Holding the underdrive clutch piston by hand, apply compressed air (392 kPa, 4.0 kgf/cm², 57 psi) to the transaxle case to remove the underdrive clutch piston.

Fig. 571: Applying Compressed Air To Transaxle Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE UNDERDRIVE CLUTCH DRUM O-RING
   a. Using a screwdriver, remove the O-ring from the underdrive clutch drum.

Fig. 572: Locating Underdrive Clutch Drum O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT UNDERDRIVE PACK CLEARANCE
   a. Install the underdrive clutch to the transaxle case.

   NOTE:  Be careful not to damage the oil seal rings.

b. Install a dial indicator as shown in the illustration.

c. Measure the underdrive clutch pack clearance while applying and releasing compressed air (392 kPa, 4.0 kgf/cm², 57 psi).

   Pack clearance: 1.51 to 1.71 mm (0.0594 to 0.0673 in.)
If the pack clearance is not as specified, inspect the discs, plates and flange.

HINT:

There are 5 flanges in different thickness.

Flange thickness: mm (in.)

**FLANGE THICKNESS SPECIFICATION**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Thickness</th>
<th>Mark</th>
<th>Thickness</th>
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<td>3</td>
<td>3.4 (0.134)</td>
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</table>

2. **INSPECT UNDERDRIVE CLUTCH DISC NO.1**
   
a. Check if the sliding surface of the disc, plate and flange are worn or burnt. If necessary, replace them.

HINT:

- If the lining of the disc comes off or discolors, or if a part of the groove is worn, replace all discs.
- Before installing new discs, immerse them in ATF for at least 15 minutes.
3. **INSPECT UNDERDRIVE CLUTCH DRUM SUB-ASSEMBLY**
   a. Using a dial indicator, measure the inside diameter of the underdrive clutch drum bushing.

   **Standard drum bushing:** 37.06 to 37.08 mm (1.4591 to 1.4598 in.)
   
   **Maximum drum bushing:** 37.13 mm (1.4618 in.)

   If the inside diameter is greater than the maximum, replace the underdrive clutch drum.

4. **INSPECT UNDERDRIVE CLUTCH RETURN SPRING SUB-ASSEMBLY**
   a. Using a vernier calipers, measure the free length of the spring together with the spring seat.

   **Standard free length:** 17.14 mm (0.6752 in.)
REASSEMBLY

1. INSTALL UNDERDRIVE CLUTCH DRUM O-RING
   a. Coat a new O-ring with ATF, and install it to the underdrive clutch drum.

   **NOTE:** Make sure that the O-ring is not twisted or pinched.

2. INSTALL UNDERDRIVE CLUTCH PISTON SET
   a. Coat the underdrive clutch piston with ATF, and install it to the underdrive clutch piston drum.

   **NOTE:**
   - Be careful not to damage the O-ring.
   - Be careful not to damage the lip of the piston.
3. **INSTALL UNDERDRIVE CLUTCH RETURN SPRING SUB-ASSEMBLY**
   a. Install the return spring to the underdrive clutch drum.

   **NOTE:** Installing the spring sub-assembly, check that all of the springs are fit in the piston correctly.

   b. Coat the clutch balancer with ATF.

   **Fig. 578: Locating Underdrive Clutch Piston**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   **Fig. 579: View Of Underdrive Clutch Return Spring And Underdrive Clutch Drum**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Install the clutch balancer to the underdrive clutch drum.

   **NOTE:** Be careful not to damage the lip of the clutch balancer.
d. Place SST on the clutch balancer and compress the piston return spring with a press.

**SST 09350-32014(09351-32070)**

e. Using a snap ring expander, install the snap ring to the underdrive clutch drum.

f. Be sure that the end gap of the snap ring is not aligned with the spring retainer claw.

**NOTE:**

- Stop the press when the spring seat is lowered to the place 1 to 2 mm (0.039 to 0.078 in.) from the snap ring groove.
- This prevents the spring seat from being deformed.
- Do not expand the snap ring excessively.

g. Set the end gap of the snap ring in the underdrive clutch drum as shown in the illustration.

**NOTE:** The end gap of the snap ring should not align with any of the stoppers.
4. INSTALL UNDERDRIVE CLUTCH DISC NO.1
   a. Coat the 4 discs with ATF.
   b. Install the 4 plates, 4 discs and flange to the underdrive clutch drum.

   **NOTE:** Make sure that the plates, discs, and flange are installed as shown in the illustration.

5. INSTALL 1ST & REVERSE BRAKE RETURN SPRING SHAFT SNAP RING
   a. Using a screwdriver, install the underdrive clutch flange No.2 hole snap ring.
   b. Check that the end gap of snap ring is not aligned with one of the cutouts.

   **NOTE:** The snap ring should be fully engaged in the groove of the drum.

6. INSPECT UNDERDRIVE PACK CLEARANCE

   **HINT:**

   (See **INSPECTION** )
Fig. 584: Identifying Underdrive Clutch Flange Hole Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DIFFERENTIAL CASE

COMPONENTS
Fig. 585: Identifying Differential Case Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **REMOVE FRONT DIFFERENTIAL RING GEAR**
   a. Place matchmarks on the front differential ring gear and differential case.
b. Remove the 14 bolts.

c. Using a plastic hammer, tap on the front differential ring gear to remove it from the case.

2. REMOVE FRONT DIFFERENTIAL CASE FRONT TAPERED ROLLER BEARING
   a. Using SST, remove the front differential case front differential tapered roller bearing from the differential case.
b. Using SST, remove the front differential case front tapered roller bearing outer race.

**SST 09308-00010**

3. **REMOVE FRONT DIFFERENTIAL CASE REAR TAPERED ROLLER BEARING**
   a. Using SST, remove the front differential case rear tapered roller bearing from the differential case.

   **SST 09950-00020, 09950-00030, 09950-60010 (09951-00490), 09950-40011 (09957-04010), 09308-00010**
b. Using SST, remove the front differential case rear tapered roller bearing outer race.

**SST 09308-00010**

4. **REMOVE FRONT DIFFERENTIAL PINION SHAFT STRAIGHT PIN**
   a. Using a pin punch and hammer, install the straight pin.

   **NOTE:** Before removing the straight pin, unstake it with a pin punch.
5. REMOVE FRONT DIFFERENTIAL PINION SHAFT NO.1  
   a. Remove the front differential pinion shaft No.1 from the differential case.

![Diagram showing the front differential pinion shaft No.1](image1)

**Fig. 594: Identifying Front Differential Pinion Shaft No. 1**  
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

6. REMOVE FRONT DIFFERENTIAL SIDE GEAR  
   a. Remove the 2 front differential pinions, 2 pinion thrust washers, 2 front differential side gears and 2 side gear thrust washers from the differential case.

![Diagram showing front differential side gears](image2)

**Fig. 595: Identifying Front Differential Pinions And Front Differential Side Gears**  
*Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.*

7. REMOVE TRANSAXLE HOUSING OIL SEAL  
   a. Using SST and a hammer, remove the oil seal.

   SST 09950-70010 (09951-07100), 09215-00013 (09215-00471)
8. **REMOVE DIFFERENTIAL SIDE BEARING RETAINER OIL SEAL**
   a. Using SST, remove the oil seal.

   **SST 09950-70010 (09951 -07100), 09608-10010**

**INSPECTION**

1. **INSPECT BACKLASH**
   a. Using a dial indicator, inspect the backlash of the side gear.

   **Standard backlash: 0.05 to 0.20 mm (0.0020 to 0.0079 in.)**

   **Thrust washer thickness**

**THRUST WASHER THICKNESS SPECIFICATION**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.625 mm (0.0640 in.)</td>
</tr>
<tr>
<td>-</td>
<td>1.725 mm (0.0679 in.)</td>
</tr>
<tr>
<td>-</td>
<td>1.825 mm (0.0719 in.)</td>
</tr>
</tbody>
</table>
Fig. 598: Inspecting Backlash Of Side Gear  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. INSTALL FRONT DIFFERENTIAL SIDE GEAR  
   a. Apply ATF to the 2 front differential side gears, 2 side gear thrust washers, 2 front differential pinions and 2 pinion thrust washers and install them to the differential case.

Fig. 599: Identifying Front Differential Side Gears And Front Differential Pinions  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL FRONT DIFFERENTIAL PINION SHAFT NO.1  
   a. Coat the front differential pinion shaft No.1 with ATF, and install it to the differential case.

3. INSPECT BACKLASH

   HINT:

   (See INSPECTION )
4. **INSTALL FRONT DIFFERENTIAL PINION SHAFT STRAIGHT PIN**
   
a. Using a pin punch and a hammer, install the pinion shaft straight pin.

   ![Fig. 601: Using Pin Punch And Hammer To Install Pinion Shaft Straight Pin](image)

   **Fig. 601: Using Pin Punch And Hammer To Install Pinion Shaft Straight Pin**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a chisel and a hammer, stake the differential case.

   ![Fig. 602: Staking Differential Case](image)

   **Fig. 602: Staking Differential Case**
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   **NOTE:** Stake the differential case after adjusting the backlash.

5. **INSTALL FRONT DIFFERENTIAL CASE FRONT TAPERED ROLLER BEARING**
a. Using SST and a press, install the front differential case front tapered roller bearing to the differential case.

SST 09316-12010, 09550-60010 (09951-00490), 09950-70010 (09951-07100)

**NOTE:** Do not damage the bearing cage when installing the bearing inner race.

![Fig. 603: Pressing Front Differential Case Front Tapered Roller Bearing](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using SST and a hammer, install the front differential case tapered roller bearing front outer race to the transaxle housing.

SST 09550-60010 (09951-00490), 09950-60020 (09951-00910)

![Fig. 604: Tapping Front Differential Case Tapered Roller Bearing Front Outer Race To Transaxle Housing](image)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL FRONT DIFFERENTIAL CASE REAR TAPERED ROLLER BEARING**
   
a. Using SST and a press, install the front differential case front tapered roller bearing to the differential case.

SST 09316-12010, 09550-60010 (09951-00490), 09950-70010 (09951-07100, 09951-07150)
b. Using SST and a hammer, install the front differential case tapered roller bearing rear outer race to the transaxle housing.

SST 09950-70010 (09951-07100, 09951-07150), 09950-60020 (09951-00890)

NOTE: No clearance is allowed between the bearing and transaxle housing.

7. ADJUST DIFFERENTIAL SIDE BEARING PRELOAD
   a. Install the differential assembly to the transaxle case.
b. Clean the mating surfaces of the transaxle case and transaxle housing.
c. Install the transaxle housing to the transaxle case and tighten them with the 16 bolts.

**Torque:**
- Bolt A 25 N·m (255 kgf·cm, 18 ft.*lbf)
- Bolt B 33 N·m (337 kgf·cm, 24 ft.*lbf)
- Bolt C 29 N·m (295 kgf·cm, 21 ft.*lbf)
- Bolt D 22 N·m (226 kgf·cm, 16.0 ft.*lbf)

**HINT:**
Apply seal packing or equivalent to bolts A and D.

**Seal packing:** THREE BOND 2403 or equivalent

**Bolt length:**
- Bolt A: 50 mm (1.969 in.)
Bolt B: 50 mm (1.969 in.)

Bolt C:
42 mm (1.654 in.)

Bolt D: 72 mm (2.835 in.)

HINT:
Usually, bolt A is non-reusable. In this case, however, the bolt can be used after cleaning it.

d. Using SST, turn the differential assembly to the right and left 2 or 3 times to settle the bearing.

SST 09564-32011
e. Using SST and a torque wrench, measure the turning torque of the differential.

SST 09564-32011

Turning torque at 60 rpm:

New bearing: 0.20 to 0.69 N*m (2.0 to 7.0 kgf*cm, 1.8 to 6.1 in.*lbf)

Used bearing: 0.10 to 0.35 N*m (1.0 to 3.6 kgf*cm, 0.9 to 3.1 in.*lbf)

HINT:
If the turning torque is not as specified, refer to the table below to select a thrust washer so that the specified value is achieved.

Flange thickness: mm (in.)

<table>
<thead>
<tr>
<th>FLANGE THICKNESS SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark</td>
</tr>
<tr>
<td>------</td>
</tr>
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<td>0</td>
</tr>
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<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>
f. Remove the 16 bolts and the transaxle housing.

g. Remove the differential assembly.
8. **INSTALL FRONT DIFFERENTIAL RING GEAR**
   
   a. Using ATF and heater, heat the front differential ring gear to 90 to 110°C (194.0 to 230.0°F).

   **NOTE:**  
   Do not heat the ring gear to more than 110°C (230.0°F).

   b. Clean the contact surface of the front differential case.

   c. Align the matchmarks, and install the front differential ring gear case quickly.

   **NOTE:**  
   Do not install the bolts while the ring gear is hot.
d. Tighten the 14 bolts.

Torque: 95.0 N\(\cdot\)m (970 kgf\(\cdot\)cm, 70 ft.\(\cdot\)lbf)

**NOTE:** Tighten the bolts a little at a time in a diagonal pattern.

9. **INSTALL TRANSAXLE HOUSING OIL SEAL**
   
a. Using SST and a hammer, install a new oil seal.

   SST 09223-15020, 09950-70010 (09951 -07150)

b. Coat the lip of oil seal with a little MP grease.

   Oil seal installation depth: 0 ± 0.5 mm (0± 0.0197 in.)
10. INSTALL DIFFERENTIAL SIDE BEARING RETAINER OIL SEAL
   a. Using SST and a hammer, install a new oil seal.

   **SST 09710-30050, 09950-70010 (09951-07150)**

   b. Coat the lip of the oil seal with a little MP grease.

   **Oil seal installation depth: 0 ± 0.5 mm (0± 0.0197 in.)**

**SPEED SENSOR**

**COMPONENTS**
Fig. 617: Identifying Speed Sensor Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE BATTERY
2. REMOVE AIR CLEANER ASSEMBLY

HINT:

(See REMOVAL.)

3. REMOVE SPEED SENSOR (NT SENSOR)
   a. Disconnect the speed sensor connector.
   b. Remove the bolt and speed sensor.
4. REMOVE SPEED SENSOR (NC SENSOR)
   a. Disconnect the speed sensor connector.
   b. Remove the bolt and speed sensor.

INSPECTION

1. INSPECT SPEED SENSOR (NT SENSOR)
   a. Disconnect the speed sensor connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

   AISIN made:

   Resistance:

   RESISTANCE SPECIFICATION
<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>560 to 680 ohms</td>
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</tbody>
</table>

   TOYOTA made:
Resistance:

### RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>500 to 620 ohms</td>
</tr>
</tbody>
</table>

**Sensor Side:**

(Connector Front View):

![Connector Diagram]

**Fig. 620: Identifying Speed Sensor Connector Terminals (NT)**
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT SPEED SENSOR (NC SENSOR)**
   a. Disconnect the speed sensor connector from the transaxle.
   b. Measure the resistance according to the value(s) in the table below.

**AISIN made:**

Resistance:

### RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>560 to 680 ohms</td>
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**TOYATA made:**

Resistance:

### RESISTANCE SPECIFICATION

<table>
<thead>
<tr>
<th>Tester Connection</th>
<th>Specified Condition 20°C (68°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>500 to 620 ohms</td>
</tr>
</tbody>
</table>
INSTALLATION

1. INSTALL SPEED SENSOR (NC SENSOR)
   a. Coat the O-ring with ATF.
   b. Install the speed sensor with the bolt.

   **Torque: 11 N*m (115 kgf*cm, 8 ft.*lbf)**

   **HINT:**

   Make sure to install the same manufacturer's sensor.

   c. Connect the speed sensor connector.

2. INSTALL SPEED SENSOR (NT SENSOR)
a. Coat the O-ring with ATF.
b. Install the speed sensor with the bolt.

   Torque: 11 N*m (115 kgf*cm, 8 ft.*lbf)

   HINT:

   Make sure to install the same manufacturer's sensor.

c. Connect the speed sensor connector.

   ![Fig. 623: Locating Speed Sensor Connector And Speed Sensor Bolt (NT)]
   Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL AIR CLEANER ASSEMBLY

   HINT:

   (See INSTALLATION )

4. INSTALL BATTERY